Department of Political and Economic Studies
University of Helsinki
Helsinki

FULL-RESERVE BANKING

SEPARATING MONEY CREATION FROM BANK LENDING

Patrizio Lainà

ACADEMIC DISSERTATION

To be presented, with the permission of the Faculty of Social Sciences of the University of Helsinki, for public examination in lecture room 5, University main building, on 20 October 2018, at 12 noon.

Helsinki 2018

Publications of the Faculty of Social Sciences 89 (2018)

© Patrizio Lainà

Supervised by: Heikki Patomäki and Pekka Sauramo
Reviewed by: Guido Montani and Jonathan Perraton
Opponent: Jesper Jespersen

Distribution and sales:
Unigrafia, Helsinki
https://shop.unigrafia.fi

ISBN 978-951-51-3333-5 (pbk.)
ISBN 978-951-51-3334-2 (PDF)

ISSN 2343-273X (pbk.)
ISSN 2343-2748 (web)

Unigrafia
Helsinki 2018

ABSTRACT

In this dissertation, I study full-reserve banking (FRB). Currently, most money is created by private banks in the form of bank deposits simultaneously with the making of loans. FRB means that the prerogative to create money is shifted from private banks to public responsibility, or money is fixed to a commodity. In other words, under FRB the money supply consists of government money (i.e. cash, central bank reserves and government securities) or commodity money (e.g. gold or silver).

FRB would prohibit private money creation, at least in the sense that the government would not guarantee repayment or par clearance of private monies or money-like assets. This would mean that there would be no more deposit insurance and the central bank would not act as the lender of last resort for private actors.

FRB is not a new idea. In fact, FRB was tried in the UK and the US in the 19th century. In the UK, the Bank Charter Act of 1844 prohibited private money creation by requiring that bank-issued notes (which were the prevailing means of payment at the time) should be fully backed by government money or gold. The National Acts of 1863 and 1864 implemented FRB in the US. According to the available statistics, the FRB experiments did not destabilize the economy. Instead, most macroeconomic indicators pointed upwards. Banks, however, were able to undermine FRB quite quickly as the FRB requirement did not include bank deposits. Consequently, bank deposits quickly became the dominant means of payment and continue to occupy that position today.

FRB proposals have been popular, particularly after serious financial crises. Following the Great Depression, the US came close to adopting FRB again, but the idea was watered down in the Banking Acts of 1933 (better known as the Glass-Steagall Act) and 1935, which separated deposit banks from investment banks. After the Global Financial Crisis in 2007–8, there was a new wave of FRB proposals, but none of them has been implemented.

Currently, there are no economies in which most money does not come into existence as a result of bank lending. Complete adoption of FRB seems unlikely in any country in the near future. Due to technological progress, however, partial adoption of FRB in the form of "digital cash" (deposited currency) seems very likely.

In this dissertation, I try to make a case for money creation being a public responsibility. I find that FRB has a positive impact on economic stability and it has the potential to foster democracy, while it is only slightly able to promote social equality. Whether it can advance ecological sustainability is more ambiguous.

FRB would secure the payment system and reduce moral hazard by eliminating the need to bail out banks and insure deposits. FRB would also generate significant seigniorage revenue for the government, for instance, 6

billion euros on average annually in Finland. Thus, it has the potential to expand the sphere of democratic decision-making, although this is not an automatic consequence of FRB. Moreover, according to some surveys, people would prefer that money creation became a public responsibility.

Probably the most convincing critique presented against FRB is that near-monies could emerge and undermine FRB, as happened in the 19th century. Fears that FRB would cause credit crunches or excessively volatile interest rates are not well justified, as most detailed proposals based on public money include flexible elements that would make it relatively easy to avoid them. The critique, however, does apply to FRB versions in which the money supply would consist solely of commodity money.

I also examine FRB in a theoretical stock-flow consistent model. The model builds on post-Keynesian economic theory – in particular, the Monetary Circuit Theory and the Modern Monetary Theory. I conduct an experiment with the model to study what happens when money is created through government spending in an FRB system. I compare the results to the current monetary system and to the case when government spending is increased under FRB but without money creation. I find that in all cases an increase in government spending increases output, employment and inflation in a very similar manner. Unlike in other cases, however, money creation under FRB leads to a permanent reduction in consolidated government debt, thus increasing the fiscal space of the government. Moreover, an increase in central bank reserves translates into an almost equal increase in demand deposits. A major change in the money supply leads to relatively smooth and small changes in interest rates.

In other experiments the findings are very similar when money is created in an FRB system through tax cuts or citizen's dividends. However, creating money through quantitative easing (repaying government debt) affects only monetary aggregates and interest rates, but not the real economy. Finally, I find that credit crunches under FRB seem possible but rare.

The overall findings of this PhD thesis are largely in line with the previous literature. This study is strictly in line with previous formal models of FRB as almost all of them find FRB a positive reform. Even though I find positive results on a more general level as well, the previous discussion on whether FRB would be beneficial for economic stability, democracy, social equality and ecological sustainability is mixed. The only way to obtain reliable results is to implement FRB and see.

TIIVISTELMÄ

Väitöskirjassa tarkastellaan täysreservipankkijärjestelmää. Nykyisin suurimman osan yhteiskunnan rahavarannosta luovat yksityiset pankit lainanannon yhteydessä. Täysreservipankkijärjestelmä tarkoittaa, että pankkien rahanluontioikeus siirretään julkisen vallan tehtäväksi tai raha kiinnitetään johonkin hyödykkeeseen. Toisin sanoen täysreservipankkijärjestelmässä yhteiskunnan rahavaranto koostuisi ainoastaan julkisesta rahasta (eli käteisestä, keskuspankkireserveistä tai valtion velkakirjoista) tai hyödykerahasta (esim. kullasta tai hopeasta).

Täysreservipankkijärjestelmä estäisi yksityisen rahan luonnin ainakin siinä mielessä, ettei julkinen valta takaa yksityisen rahan tai rahankaltaisten varallisuuserien takaisinmaksua taikka vaihdettavuutta kiinteällä vaihtokurssilla. Tämä tarkoittaa, että esimerkiksi pankkien talletussuojasta luovuttaisiin, eikä keskuspankki toimisi enää viimekätisenä lainoittajana yksityisille toimijoille.

Täysreservipankkijärjestelmä ei ole uusi idea. Sitä jopa kokeiltiin 1800-luvulla Britanniassa ja Yhdysvalloissa. Britanniassa vuonna 1844 ja Yhdysvalloissa vuosina 1863 ja 1864 säädettiin lait, jotka edellyttivät, että pankkien liikkeelle laskemat setelit, jotka toimivat vallitsevina maksuvälineinä siihen aikaan, täytyi taata täysimääräisesti julkisella rahalla tai kullalla. Saatavilla olevien tilastojen mukaan kokeilut eivät aiheuttaneet taloudellista epävakautta, vaan pikemminkin suurin osa makrotaloudellisista indikaattoreista osoitti ylöspäin. Pankit kuitenkin pystyivät melko lyhyessä ajassa kiertämään sääntelyä, sillä täysreservivelvoite ei ulottunut pankkitalletuksiin. Niinpä pankkitalletuksista tuli nopeasti pääasiallinen maksuväline ja ne ovat sitä yhä tänäkin päivänä.

Etenkin vakavien rahoituskriisien jälkeen esitykset täysreservipankkijärjestelmän puolesta ovat olleet suosittuja. 1930-luvun suuren laman jälkeen täysreservipankkijärjestelmä melkein otettiin käyttöön Yhdysvalloissa, mutta lainsäädäntö vesittyi matkalla ja tuotti tunnetun Glass—Steagall-lain, joka erotti talletuspankkitoiminnan investointipankkitoiminnasta. Vuosien 2007–08 globaalin finanssikriisin jälkeen tehtiin monia esityksiä täysreservipankkijärjestelmään siirtymiseksi, mutta yhtäkään ei ole toteutettu.

Nykyään ei ole yhtään valtiota, jossa suurin osa rahavarannosta ei syntyisi pankkien lainaustoiminnan yhteydessä. Täysreservipankkijärjestelmän toteuttaminen täysimääräisesti näyttää lähitulevaisuudessa epätodennäköiseltä missään maassa. Sen sijaan täysreservipankkijärjestelmän osittainen toteuttaminen ”sähköisen käteisen” muodossa vaikuttaa teknologisen kehityksen ansiosta hyvinkin mahdolliselta.

Tässä väitöskirjassa esitän argumentin, että rahan luonti pitäisi olla julkisen vallan tehtävä. Yleisemmän arvion mukaan

täysreservipankkijärjestelmällä olisi selvästi positiivinen vaikutus talouden vakauteen ja se edistäisi demokratiaa, mutta sillä olisi vain lievästi positiivinen vaikutus sosiaaliseen tasa-arvoon. Huomattavasti kyseenalaisempaa on, pystyisikö se edistämään ekologista kestävyyttä.

Argumentoin, että täysreservipankkijärjestelmä turvaisi yhteiskunnan maksujärjestelmää ja vähentäisi moraalikatoa poistamalla julkiselta sektorilta tarpeen pelastaa pankkeja ja taata talletuksia. Laskelmani mukaan se myös tuottaisi merkittävää seigniorage-tuloa valtiolle, esimerkiksi Suomessa keskimäärin 6 miljardia euroa vuosittain. Näin ollen se voisi laajentaa demokraattisen päätöksenteon aluetta, vaikkei se olekaan automaattinen seuraus. Useimpien kyselytutkimusten mukaan enemmistö ihmisistä kannattaa ajatusta, että rahan luonti kuuluu julkisen vallan tehtäväksi.

Ehkä vakuuttavin kritiikki täysreservipankkijärjestelmää kohtaan on, että yksityiset rahan korvikkeet syrjäyttäisivät julkisen rahan kuten kävi 1800-luvulla. Sen sijaan huolet siitä, että täysreservipankkijärjestelmä aiheuttaisi luottolamoja tai erittäin ailahtelevia korkotasoja eivät ole kovin perusteltuja, sillä useimmat yksityiskohtaiset ehdotukset julkiseen rahaan perustuvasta täysreservipankkijärjestelmästä sisältävät joustoja, joiden avulla ne voidaan välttää suhteellisen helposti. Kritiikki pätee selvästi paremmin täysreservipankkijärjestelmän versioihin, joissa rahavaranto koostuisi hyödykerahasta.

Lisäksi tutkin täysreservipankkijärjestelmää teoreettisen varanto—virta-konsistentin mallin avulla. Malli nojaa jälkikeynesiläiseen talousteoriaan, etenkin rahan kiertoteoriaan ja moderniin rahateoriaan. Kokeilen mallilla, mitä tapahtuu, kun rahaa luodaan täysreservipankkijärjestelmässä valtion menolisäyksen kautta. Vertaan tuloksia nykyiseen rahajärjestelmään ja tilanteeseen, jossa täysreservipankkijärjestelmässä valtio lisää menojaan ilman, että uutta rahaa luodaan. Kaikissa tapauksissa valtion menolisäys kasvattaa tuotantoa, työllisyyttä ja inflaatiota hyvin samankaltaisesti. Muista tapauksista poiketen rahan luonti täysreservipankkijärjestelmässä kuitenkin johtaa nettomääräisen valtionvelan pienenemiseen ja siten finanssipolitiikan liikkumavaran kasvuun. Keskuspankkireservien lisäys kasvattaa käyttötilien talletuksia lähes yhtä paljon. Suuri rahavarannon muutos johtaa suhteellisen sulaviin ja pieniin muutoksiin korkotasoissa.

Muissa kokeissa, kun rahaa luodaan veronalennusten tai kansalaisosingon kautta täysreservipankkijärjestelmässä, tulokset ovat hyvin samankaltaisia kuin, jos rahaa luodaan valtion menolisäyksen kautta. Sen sijaan rahan luonti määrällisen keventämisen kautta vaikuttaa ainoastaan raha-aggregaatteihin ja korkotasoihin, mutta ei juurikaan reaalitalouteen. Kyseisessä mallissa luottolamat täysreservipankkijärjestelmässä ovat mahdollisia, mutta melko harvinaisia.

Kokonaisuudessaan tämän väitöskirjan löydökset ovat suunnilleen linjassa aiemman kirjallisuuden kanssa. Taloustieteellinen malli on erittäin hyvin linjassa aiempien formaalien mallien kanssa, sillä lähes kaikissa niissä havaitaan täysreservipankkijärjestelmällä olevan lähinnä positiivisia

taloudellisia vaikutuksia. Vaikka yleisemmälläkin tasolla havaitsen täysreservipankkijärjestelmällä olevan pääasiassa positiivisia seurauksia, aiempi kirjallisuus on melko monenkirjavaa sen suhteen, edistäisikö täysreservipankkijärjestelmä talouden vakautta, demokratiaa, sosiaalista tasa-arvoa ja ekologista kestävyyttä. Ainoa tapa saada seurauksista kunnollinen varmuus on kokeilla täysreservipankkijärjestelmää.

ACKNOWLEDGEMENTS

I am most grateful to my supervisors Heikki Patomäki and Pekka Sauramo. I highly value your commitment to this project and all the time you put into reading and commenting my writings. I must admit that it was sometimes difficult to balance your conflicting views, which clearly reflected your different backgrounds in political science and economics, respectively. Nevertheless, perhaps because of this, your comments substantially enhanced the quality of this thesis and certainly forced me to think a lot more.

I thank both pre-examiners, Jonathan Perraton and Guido Montani, for carefully reading through the manuscript of my doctoral dissertation and for giving a detailed assessment of it. You were able to bring new and interesting aspects to my attention even at a late stage of this research project.

I also want to thank Kenneth Quek for editing the language of this dissertation and sticking to the tight schedule. Now, instead of numerous errors, the language of this thesis should look like proper English.

My opponent, Jesper Jespersen, deserves my sincere gratitude for travelling to Finland and publicly discussing my dissertation. Defending my arguments against a distinguished post-Keynesian scholar was truly an honour for me.

Special thanks go to Teivo Teivainen, who kindly read a draft of this thesis and provided constructive comments. I must also thank Teivo for being a key instigator when I was applying for a PhD student position at the University of Helsinki. Otherwise, I might have ended up on another path.

I would also like to thank Stefano Lucarelli for inviting me to be a visiting fellow at the University of Bergamo. Bergamo was an astonishing city and the university offered an excellent opportunity to meet and speak with several distinguished post-Keynesian scholars. I am looking forward to visiting Bergamo again.

I would also like to express my gratitude to Lars Österman for bringing the idea of full-reserve banking to Finland and, consequently, to my awareness. Otherwise, I might have taken another path in my academic and activist life. I am also grateful to Ville Iivarinen, Valtteri Aaltonen and all other persons actively involved in Economic Democracy Finland. You have kept me informed and highly motivated throughout this research project.

At various stages of this research project comments were kindly provided by Riccardo Bellofiore, Sheila Dow, Ben Dyson, Antoine Godin, Charles Goodhart, Lauri Holappa, Meinhard Jensen, Toma Kavonius, Marc Lavoie, Stefano Lucarelli, Johan Meriluoto, Ralph Musgrave, Ronnie Phillips, Roger Sandilands, Malcolm Sawyer, Govert Schuller, Jan Toporowski, Marco Veronese Passarella, Matti Ylönen and Gennaro Zezza. I apologize for any omission.

I would also like to thank the Left Forum Finland (Vasemmistofoorumi) for providing workspace with highly inspiring colleagues. Many thanks to Teppo Eskelinen, Lauri Finér, Lauri Holappa, Ruurik Holm, Kuutti Koski, Laura Kumpuniemi, Antti Kurko, Jaana Lähteenmaa, Janne Nurmi, Veera Nuutinen, Johanna Perkiö, Jukka Pietiläinen, Elina Vainikainen and Matti Ylönen. I enjoyed every discussion we had.

This PhD thesis would have never been completed without the generous funding offered by foundationsI would like to express my particular gratitude to the Finnish Cultural Foundation (Suomen Kulttuurirahasto), the Ryoichi Sasakawa Young Leaders Fellowship Fund (SYLFF) and Palkansaajasäätiö.

Some chapters of this PhD thesis were previously presented or published. Chapter 3 was presented under the title "Exogenous and Endogenous Theories of Money and Banking" at the World Politics Post-Graduate Seminar in Helsinki, Finland on 1 October 2015 (Lainà 2015d).

Chapter 4 was previously published as "Proposals for Full-Reserve Banking: A Historical Survey from David Ricardo to Martin Wolf" in *Economic Thought* volume 4 issue 2 on pages 1–19 in 2015 (Lainà 2015c). The paper was published with a commentary by Charles Goodhart and Meinhard Jensen (2015). The paper is reproduced courtesy of *Economic Thought*.

Section 5.1 was published under the title "Seignorage from Full-Reserve Banking" as SSRN Working Paper No. 3065319 (Lainà 2017).

Chapter 7 was previously presented under the title "Introduction to Stock-Flow Consistent Modeling" at the Sovereign Money Research Day in Hague, Netherlands on 24 November 2016 (Lainà 2016). The paper is coming out in a revised form in *Finnish Economic Journal* (Lainà 2018a).

Chapter 8 further develops my stock-flow consistent model of FRB, previously published under the title "Money Creation Under Full-Reserve Banking: A Stock-Flow Consistent Model", first as Levy Economics Institute Working Paper No. 851 in October 2015 (Lainà 2015b) and forthcoming in *Cambridge Journal of Economics* (Lainà 2018b).

All chapters have been rewritten for the purpose of this PhD thesis.

Finally, I would like to thank my family and friends for all the support they have given me. In particular, I want to thank my wife Emmi and son Mio who have been there for me at all times. I am also grateful to my father Biagio, mother Raija and brother Alessandro.

I dedicate this thesis to my wife Emmi and our son Mio.

Although this study is about money, there are much more important things in life.

Helsinki, September 2018
Patrizio Lainà

CONTENTS

Abstract 3

Tiivistelmä 5

Acknowledgements 8

Contents 10

List of Tables 13

List of Figures 14

Abbreviations 15

1 Introduction 17

1.1 Motivation 17

1.2 Meta-Theoretical Premises 19

1.3 Central Definitions 22

1.4 Research Setting 28

1.5 Findings 33

1.6 Structure 48

2 Development of Money Creation and Banking Regulation 50

2.1 United Kingdom 50

2.2 United States 52

2.3 International 56

2.4 Full-Reserve Banking Experiments 62

3 Theories of Money Creation and Banking 66

3.1 Exogenous Money 66

3.2 Endogenous Money 70

3.3 Monetary Circuit Theory 79

3.4 Modern Monetary Theory 84

3.5 Theorisation in Global Political Economy 90

4 History of Full-Reserve Banking Proposals 96

4.1 First Steps: David Ricardo and Others 98

4.2 Chicago Plan: On the Policy Agenda 99

4.3 Post-World War II: Academic Developments 104

4.4 Turn of the Millennium: More Creative Ideas 105

4.5 Aftermath of the Global Financial Crisis: Back to the Policy Agenda 107

5 Potential Benefits of Full-Reserve Banking 116

5.1 Political Inclusion 116

5.2 Economic Stability 132

5.3 Social Equality 139

5.4 Ecological Sustainability 144

6 Criticism of Full-Reserve Banking 150

6.1 Unreliable Government 150

6.2 Undemocratic 153

6.3 Inflationary 155

6.4 Deflationary 159

6.5 Shortage of Credit 162

6.6 Volatility of Interest Rates 166

6.7 End of Banking 168

6.8 Rise of Shadow Banking 170

6.9 Emergence of Near-Monies 172

6.10 Inefficient 177

6.11 Socially Disintegrating 179

6.12 Ecologically Irrelevant 180

7 Methodology of Stock-Flow Consistent Modelling 185

7.1 History 185
7.2 Method 187
7.3 Similarities and Differences 192
7.4 Strengths and Weaknesses 194
8 Stock-Flow Consistent Model of Full-Reserve Banking 199
8.1 Matrices 202
8.2 Equations 204
8.3 Calibration and Steady State 215
8.4 Money Creation through Government Spending 217
8.5 Other Options for Money Creation 226
8.6 Credit Crunch 228
9 Conclusions 230
9.1 Research Summary 230
9.2 Implications 243
9.3 Limitations 252
9.4 Further Research 253
References 257
Appendix: List of Variables of REFORM2 284

LIST OF TABLES

Table 1. Different types of full-reserve banking 97

Table 2. One-shot seigniorage revenue from transition to full-reserve banking 126

Table 3. Annual seigniorage revenue from full-reserve banking 130

Table 4. Balance sheet matrix 188

Table 5. Revaluation matrix 189

Table 6. Transaction-flow matrix 189

Table 7. Balance sheet matrix of REFORM2 202

Table 8. Revaluation matrix of REFORM2 203

Table 9. Transaction-flow matrix of REFORM2 204

Table 10. List of Endogenous Variables 284

Table 11. List of Exogenous Variables 286

Table 12. List of Parameters 286

Table 13. Reaction Parameters in Portfolio Equations 287

LIST OF FIGURES

Figure 1 Monetary Circuit Theory Illustrated..... 80

Figure 2 Demand deposits and reserves in the United States 125

Figure 3 Output, employment and inflation 218

Figure 4 Government deficit and debt 219

Figure 5 Central bank money 221

Figure 6 Bank deposits and loans 222

Figure 7 Interest rates on government bills, loans and time deposits 223

ABBREVIATIONS

BIS	Bank for International Settlements
DSGE	dynamic-stochastic general equilibrium
ECB	European Central Bank
EMU	Economic and Monetary Union (of the European Union)
EU	European Union
FRB	full-reserve banking
GDP	gross domestic product
GFC	Global Financial Crisis
GPE	Global Political Economy
IMF	International Monetary Fund
MCT	Monetary Circuit Theory
MMT	Modern Monetary Theory
PK-SFC	post-Keynesian stock-flow consistent
SDR	Special Drawing Right
SFC	stock-flow consistent
SME	small and medium-sized enterprise
UK	United Kingdom
US	United States
USD	United States dollar

1 INTRODUCTION

This introductory chapter gives a brief overview of this PhD thesis. Firstly, I discuss motivational issues and meta-theoretical premises. Then, I define central terms. After that, I present the main results. Finally, I briefly go through the structure of the study.

1.1 MOTIVATION

In the current monetary system most money is created by private banks. When banks make loans, they issue new deposits. That is, banks do not need prior deposits before they can grant loans. Bank deposits are simply accounting entries which are created simultaneously with bank loans (for a detailed description of how banks create money, see the Bank of England's publication McLeay et al 2014a; 2014b).

The current monetary system came into existence in the 17th century. According to Graeber (2012), instead of lending pre-existing assets, as they had been doing previously, banks began to issue more certificates of assets (e.g. gold) than they had assets backing the certificates. Fractional-reserve banking system was born. Instead of outlawing it, the fractional-reserve banking system was institutionalized, regulated and guaranteed.

In contrast, under FRB, private money creation is prohibited. Today, it would mean that banks could no longer create new money in the form of bank deposits in the process of bank lending. In other words, every deposit would be backed by either government money (i.e. cash, central bank reserves and government securities) or a commodity (e.g. gold). FRB aims at separating the payments system from the financing system, as well as separating monetary policy from credit policy.

I defend the position that money creation should be a public responsibility. Nevertheless, I do not mean that literally *all* private monies or money-like assets should be banned. On the contrary, many complementary currencies can make the economy more resilient, besides serving important social ends. What I am arguing is that government guarantees and par clearance of private monies and money-like assets should be lifted (e.g. deposit insurance and lender of last resort service to private actors). Moreover, the government should take a leading role in supplying the (only) risk-free medium of payment for the economy.

I argue that privatizing society's money is also destabilizing. Recently, the Global Financial Crisis (GFC) revealed the underlying instability involved in private money creation. By issuing new deposits, private banks were able to create a credit bubble, which fuelled asset prices – housing prices in particular. Eventually, the bubble burst and the whole financial system almost collapsed.

Saving the financial system involved huge bail-outs with taxpayers' funds. It is largely recognized that banks' ability to create money out of nothing was at least partly responsible for the crisis (see e.g. Schularick and Taylor 2012; Jordà et al 2014; 2015).

In the past, FRB has been proposed several times and even experimented with as a solution to financial instability. In the UK, the Bank Charter Act of 1844 prohibited private money creation through fractional-reserve banking by requiring that bank-issued notes (which were the prevailing means of payment) should be fully-backed by government money or gold. The National Acts of 1863 and 1864 implemented FRB in the US.

The FRB requirement, however, did not cover bank deposits, which quickly became the dominant means of payment (see e.g. Kindleberger 1984). In the 1930s, according to Phillips (1994a), the Chicago Plan[1] was almost adopted in the US, but the FRB idea was watered down in the Banking Acts of 1933 (better known as the Glass-Steagall Act) and 1935. Instead of preventing private money creation in the form of bank deposits, the Banking Acts separated commercial and investment banking, provided deposit insurance and improved the government's control over monetary policy and money supply. Currently, there are no examples of economies in which most money does not come into existence as a consequence of bank lending.

Now, in the aftermath of the GFC, preventing private money creation in order to ensure financial stability has once again become a topical issue. For instance, Martin Wolf (2014a; 2014b), the chief economics commentator at the *Financial Times*, openly supports FRB; the UK and Dutch parliaments debated on money creation; Green Party UK (2015) included FRB in its political agenda; Switzerland voted on FRB in a referendum (see Dawnay 2017); Iceland's Prime Minister commissioned two FRB reports (Sigurjonsson 2015 and KPMG 2016); and bills to implement FRB have been put forward in the US and the UK.

As with financial reform in general, FRB proposals have emerged especially after the onset of financial crises such as the Great Depression in the 1930s, the Savings and Loan Crisis in the late 1980s and, most recently, the GFC in 2007–8. Instead of reforming the foundations, that state has attempted to contain the inherent instability of the financial system with more regulation and guarantees to banks. For instance, in the US the Glass-Steagall Act of 1933 was a mere 37 pages long while the Dodd-Frank Act of 2012 included over 9000 pages of text. After the Great Depression, almost all developed countries guaranteed bank deposits through various deposit insurance schemes in order to prevent bank runs. However, more complex regulation and further guarantees to banks have not succeeded in preventing serious financial crises.

[1] The Chicago Plan was a FRB proposal developed at the University of Chicago. The first version was published in Knight et al (1933) and the second version in Simons et al (1933).

I will defend the argument that we need fundamental reform in order to fix the current monetary system. In my view, FRB seems to be the most promising candidate.

1.2 META-THEORETICAL PREMISES

This section presents my ontological and methodological commitments and discusses philosophical values which inevitably steer any social scientific research – including this PhD thesis (see e.g. Kuhn 1962; Lakatos 1970).

The premises of my doctoral thesis are as follows. Economies have a complex institutional structure covering households, firms, banks, central banks and governments. Economies evolve over historical time and their development depends on how these institutions make decisions and interact with each other. Money is not neutral as we live in a monetary economy and not in an exchange economy.

In addition, the banking system is at the heart of global (financial) capitalism. By separating money creation from bank lending, FRB could offer a mechanism to reduce the influence of banks and thus change the power relations within global capitalism. FRB could serve as a concrete utopia.

Critical Realism is a philosophical meta-theory of social sciences with no substantive claims or policy implications (see e.g. Bhaskar 1975; 1979). The starting point is that there is an objective reality although our capacity to know it is inevitably impeded. Critical Realism is often described as ontologically realist and epistemologically relativist although it also includes rational comparisons and judgements.

According to Bhaskar (1979), causality is not related to events and their conjunctions but rather to structures and mechanisms which are not directly observable. Bhaskar (1979) pointed out that empirical is embedded within actual which is again embedded within real. Instead of focusing on the narrowest conception of causality, we should concentrate on the broadest. However, since there is no one reliable way to acquire knowledge of reality, one has to weigh a number of issues against each other.

I fully share the Critical Realist view that analysis should be ontologically realist and epistemologically relativist. However, contrary to many Critical Realists, I am not ready to completely abandon mathematical methods (in this sense Critical Realists are, in fact, often epistemological absolutists rather than relativists).

For instance, Tony Lawson (1997; 2013) applied Critical Realism to economics and argued that economics should completely abandon mathematical methods because they are inconsistent with the social ontology of economics (Morgan and Patomäki 2017 have further developed Lawson's account of contrast explanation). I disagree with Lawson (1997; 2013) that mathematical modelling should be completely abandoned. Sometimes

mathematics proves to be an appropriate (but not, of course, the only) approach to study economic reality.[2]

I would argue that, although social sciences – including economics – are open systems, there can be local closures.[3] That is, the system as a whole can be open, but it can include demi-regularities. Sheila Dow (1985) made the same point and argued that scientists can establish regularities, but not laws.

I share Dow's (1985) position that we should not commit ourselves to a single methodological approach in social sciences. Instead, we need multiple methods to supplement the analysis from different angles.

Furthermore, as Steve Keen (2015) points out, mathematical methods do not have to presume an atomistic and closed reality, as Critical Realists often argue. According to Keen (2015), any non-linear system is, by definition, not atomistic as it cannot be reduced to its constituent parts (i.e. the system contains emergent properties). In fact, Keen (2015) argues that non-linear systems are normally open and non-ergodic, and thus consistent with Critical Realism.

Moreover, it should be recalled that mathematics in itself does not mean anything. What matters are the underlying theories, either described with mathematics or otherwise (although different presentation formats have, of course, their limitations). For instance, Chapter 8 presents a stock-flow consistent (SFC) model of FRB. Although the theoretical framework is expressed in mathematical terms, the theoretical features are discussed in textual form in Chapter 3 regarding money and banking specifically and in Sections 7.3 and 7.4 regarding post-Keynesian economic theory more broadly. Therefore, we should focus on the content of theories and not on the formulation of theories.[4]

Nevertheless, I share Lawson's (1997; 2013) view that neoclassical economics in particular is fixated with mathematical presentation. I would argue that one of the greatest shortcomings of neoclassical economics is the historical narrowing down of methodological tools. Currently, neoclassical economics is highly intolerant towards other methods than those based on constrained optimization. While constrained optimization might be a suitable

[2] For further discussion on the role of mathematics, see Lainà (2018c).

[3] According to Sayer (1992), a system can be said to be closed when there is no change or qualitative variation in the object possessing causal powers *and* the relationship between the causal mechanism and those of its external conditions are constant. A closed system produces regularities. However, if either condition is violated the system is open. Local closures mean that within an open system one mechanism can dominate in certain circumstances and produce temporary or superficial regularities known as demi-regularities.

[4] According to King (2003), by the end of the 1990s, the discussion on methodology among post-Keynesian economists became synonymous with Critical Realism. In 1999, there was also a special issue of *Journal of Post Keynesian Economics* discussing Critical Realism. King (2003), however, argued that the post-Keynesian focus on Critical Realism did not, in the end, lead to any significant development in post-Keynesian economic theory.

tool in some cases, it is highly unlikely that it would be the best method in all cases.

Neoclassical economics is also often associated with Positivism[5] (e.g. Milonakis and Fine 2009), although neoclassical economists themselves rarely examine their underlying philosophy of science. Neoclassical economists do follow the implication of Positivism that the social world – in addition to the natural world – operates according to general laws which are to be discovered and, therefore, they are happy to deduce propositions from axioms.

However, neoclassical economists often disregard the latter part of Positivism, which is to test derived assertions against empirical evidence. The problem is not testing but that many theoretical propositions are beyond testing, and thus falsification. To begin with, utility cannot be observed and thus it is impossible to know whether persons are really "rational" – particularly as any behaviour can be described as an outcome of utility maximization. In temporal terms, the long run is a pure theoretical construction that cannot be observed. Because of this, the assertion that money is neutral in the long run is more a statement of faith. Moreover, all "natural" phenomena are beyond falsification. The "natural" level of output, the "natural" level of employment and the "natural" rate of interest cannot be observed, but they are crucial for the whole neoclassical macroeconomic edifice.

According to Popper's (1959) falsification principle, theories should not be beyond falsification. In addition, neoclassical economics has not fared well in explaining a number of phenomena such as the Global Financial Crisis. In this sense neoclassical economics has become, following Lakatos (1970), a degenerative research program.

Paradoxically, neoclassical economics has been accused of relying too much on Positivistic philosophy of science, but following the idea of Positivism strictly could actually take neoclassical economics forward. At least neoclassical economists would be forced to develop falsifiable theories. Adopting another philosophy of science would most likely be even more productive. Currently, however, there are no signs of what Kuhn (1962) would describe as a scientific revolution in neoclassical economics.

Heterodox economics, in particular post-Keynesian economics, is more tolerant towards other methods and is often based on Critical Realism (see e.g. Lavoie 2015).[6] Because of this, in my opinion, post-Keynesian economics is

[5] Positivism is a philosophical meta-theory which holds that knowledge can be derived from sensory experience through reason and logic. It also holds that a sharp distinction between facts and values can be maintained.

[6] Due to methodological differences, I have suggested in Lainà (2018c) that instead of consolidating meta-theoretical premises within disciplines, bridges could rather be built between disciplines. For instance, neoclassical economics and American GPE are mostly built on Positivism, while heterodox economics and British GPE are largely based on Critical

able to provide more realistic and relevant analyses of economic reality. Of course, methodological pluralism and Critical Realist philosophy of science does not automatically guarantee better analysis, but at least it has great potential to do so as its theoretical propositions are generally falsifiable.

Following Cox's (1981) division between problem-solving theory and critical theory, this thesis clearly builds on critical theory. Instead of taking existing relations and institutions as a starting point, it investigates how relations and institutions emerged and how to change them. The focus will be on money and banking institutions.

Finally, I discuss the meaning of philosophical values for this research project. I hold that philosophical values are not simply endowed but rather they are socially constructed and shaped. I am no exception to the dictum that all social scientists are influenced by their values. I see the dichotomic distinction between facts and values as anachronistic (see e.g. Sayer 2011). Therefore, it is important for a researcher to explicate his or her values.

I broadly subscribe to liberal democratic values and peaceful conflict resolution. More specifically, my normative commitments are: democracy, economic stability, social equality and ecological sustainability. Particularly in Chapters 5 and 6, I will assess FRB from these normative points of view.

The issue is not, however, whether the evaluation of FRB as a useful reform depends on a particular set of values. Indeed, I believe my commitments to democracy, economic stability, social equality and ecological sustainability are relatively widely shared. The issue is whether FRB is able to achieve those values or if works against them instead. Interpretations differ due to different world views and theoretical traditions (which are also influenced by values).

Although I have aimed to conduct the analysis as objectively as possible, my judgement is hardly unbiased. Before I started this research project, my preconception was that FRB would be desirable. In addition, I was (and still am) an activist in Economic Democracy Finland, which is a non-profit organization promoting FRB in Finland. Thus, in this PhD thesis there are at least unconscious choices and usage of language that favour FRB.

1.3 CENTRAL DEFINITIONS

In this section I define and distinguish between the concepts of debt, credit and money. I also define banks and other financial institutions before, finally, defining full-reserve banking.

Realism. Thus, it could be more fruitful for these traditions to collaborate between disciplines rather than within disciplines. Patomäki (2003) argued more specifically that Critical Realism could offer a common framework for collaboration between neo-Gramscian GPE and post-Keynesian economics.

1.3.1 DEBT AND CREDIT

I define debt as a specific obligation owed by one party (debtor) to a second party (creditor). The Oxford English Dictionary (2015) defines debt very similarly:

> *1.) That which is owed or due; anything (as money, goods, or service) which one person is under obligation to pay or render to another. [...] 2.) A liability or obligation to pay or render something; the condition of being under such obligation. [...] 3.) Obligation to do something; duty.*

Credit is a more multi-dimensional and broader concept than debt. Credit includes debt but it also refers to issues which do not involve a specific obligation. That is, there is no necessary legal relationship between two or more parties. Credit is also specifically associated with trust. The Oxford English Dictionary (2015) defines credit as:

> *1.) The estimate in which the character of a person (or thing) is held; reputation. [...] 2.) Right to be believed; authority on which to be accepted as true, truthful, or authentic. [...] 3.) The mental action or state of accepting something as true. [...] 4.) The charge, trust, or care of a person (to which a thing is committed). [...] 5.) Personal influence based on the confidence or trust of others; power derived from character or reputation. [...] 9.) Trust or confidence in a customer's ability and intention to pay at some future time, shown by allowing money or goods to be taken or services to be used without immediate payment. [...] 10.) Money lent or borrowed with an agreement as to repayment; money placed at a person's disposal in the books of a bank, etc., which may be drawn on to the extent of the amount; (more widely) the value of goods or services available without immediate payment.*

1.3.2 MONEY

I define money as a unit of account and store of value which is generally accepted as payment for goods and services and repayment of debts in a particular country. The Oxford English Dictionary (2015) defines money along the same lines:

> *1.) Any generally accepted medium of exchange which enables a society to trade goods without the need for barter; any objects or tokens regarded as a store of value and used as a medium of exchange. [...] 2.) Means of payment considered as representing value or purchasing power; the power of purchase or means of exchange represented by coins, banknotes, cheques, etc. Hence: property, possessions, resources, etc., viewed as having exchangeable value or a value expressible in terms of monetary units.*

The first two definitions of money in the Oxford English Dictionary already include all the main functions of money regularly encountered in economics textbooks: medium of exchange, store of value, unit of account and means of payment. Means of payment means that it can clear debt relations while the ownership of any commodity is not necessarily transferred. Therefore, it could be argued that means of payment is a broader concept and includes also medium of exchange.

Basically, there are three types of money: cash, (central bank) reserves and (bank) deposits. Naturally, cash includes both notes and coins. Central bank reserves are in practice a non-tangible form of cash (nowadays electronic). Currency (known also as central bank money, base money and monetary base) includes both of these two types of money: cash and central bank reserves. Bank deposits include demand and time deposits. Demand deposits are held in current accounts (UK) or checking accounts (US). Time deposits are held in savings accounts.

In spoken language, money typically refers to cash and deposits as individual persons do not have access to reserves. Reserves can only be accessed through an account at the central bank. Generally, only banks and the government can have accounts at the central bank. Banks need reserves in order to satisfy reserve requirements (if applicable in the host country), and, more importantly, to make payments to each other.

Money can also be defined along the public–private axis. Government money (sometimes called state money or public money) refers to cash, reserves and government securities. In contrast, private money refers to demand deposits, time deposits and other short-term liquid debt.

Statistical definitions of money are used for measuring the money supply. In most statistical definitions money can only be held by the public, that is, by non-bank and non-government economic agents (M0–M3). M0 refers to cash in circulation. M1 includes M0 and banks' demand deposits. M2 includes M1 and banks' time deposits. M3 includes M2 and large liquid assets, such as institutional money market funds and short-term repos. Moreover, most central banks also report the monetary base, MB, which covers all cash (including that in bank vaults) and central bank reserves.

Commodity money refers to a commodity used as a medium of payment that has intrinsic value, such as gold or silver. Fiat money is inconvertible money in the sense that it does not include a promise to convert it following a fixed exchange rate to, for instance, gold or foreign currency. It can but does not have to be legal tender, that is, set as the official medium of payment by government regulation or law. Finally, fiduciary money refers to money which represents dual sides of a balance sheet.

1.3.3 MONEY AS DEBT?

Some post-Keynesian economists argue that money is inevitably debt. It is true that today most of the money stock is indeed debt. Bank deposits are banks'

promises to pay an equal amount in cash. Cash, however, does not entitle the holder to anything specific, for example, to any particular amount of gold. For this reason, for instance, ECB (2017) regards cash as debt-free money.

Although post-Keynesians almost always recognize this, they might argue that cash entitles the holder to receive real products and services in exchange and it is an obligation of the government to accept it as a payment for taxes. Building on this, for instance, Wray (2014) and Dixhoorn (2013) argue that there cannot be such a thing as debt-free money. If one is willing to accept their very broad definition of debt, the conclusion cannot be challenged. However, such a comprehensive definition of debt easily obscures the meaning and becomes analytically impractical. Therefore, as was presented in the first subsection above, I do not share this broad definition of debt.

I mean by debt-free money that its issuance does not involve repayment in the future (neither interest nor maturity) and it is inconvertible at a fixed exchange rate to something else, for instance, to other type of money, gold or foreign currency. Based on this definition, it could be argued that only coins are debt-free money.

Coins are the only type of money which can be said to be debt-free, as they are inconvertible and their issuance does not include future repayment. Notes, although they do not entitle their holders to anything else, are issued against a promise to repay in the future (i.e. they are borrowed into existence). Notes are issued by the central bank through lending or by buying financial assets, which are typically government bonds and, thus, require repayment in the future. Coins, in contrast, are issued by the government, which can spend their nominal value into circulation.[7] Normally, coins are created by the government, although the central bank often buys them at face value and handles their distribution. In this case, however, the government receives reserves which it can spend and the outcome does not differ from the case in which the government directly spends the coins it creates (for a more detailed description on how notes and coins are created, see Federal Reserve Bank of New York 2013; McLeay et al 2014a; 2014b).

Reserves are not debt-free either. Like notes, although they do not entitle the holder to anything else, reserves are issued against a promise to repay in

[7] More specifically, only the face value of coins minus their production cost (including the cost of metal, manufacturing and transportation) is completely added to the government budget (see US Mint 2011). Notes and reserves yield seigniorage revenue via the interest rate margin of assets against which they are issued. For instance, if central bank lends reserves for banks with a 4 % interest (in an overdraft banking system) and pays 1 % interest on them, the government receives 3 % of the outstanding amount of reserves as annual seigniorage revenue. Similarly, if central bank sells reserves for banks by buying government bonds with a 4 % yield (in an asset-based banking system) and pays 1 % interest on them, government receives 3 % of the outstanding amount of reserves as annual seigniorage revenue. Seigniorage on notes is similar to reserves except central bank does not, of course, pay any interest on them.

the future. That is, a central bank issues reserves when it lends, buys existing assets or makes payments (see McLeay et al 2014b).

Bank deposits are most obviously based on debt. They do entitle the holder to an equivalent amount of cash. Furthermore, deposits are issued against a promise to repay in the future as they are mostly created as a by-product of bank loans (McLeay et al 2014a; 2014b).

Although most money can be accurately described as debt, all money is not debt and it can, contrary to what many post-Keynesians argue, be something other than debt.

I would argue that credit is a more appropriate term for describing money. All money is inevitably credit as credit also refers to trust. As Iivarinen (2015) put it, money is trust in society and in its laws. Money is trust in other persons and in the fact that they will accept it as a valid means of payment today and in the future. Money is trust in its issuer and in the fact that it will maintain its value. I share Iivarinen's (2015) view that none of these is the same thing as debt.

Nevertheless, I do not wish to go further into this conceptual debate. As Dittmer (2015) points out, different interpretations derive from different definitions. I do not see any meaningful advantage in discussing whether money is debt, credit or something else and whether it can be otherwise when everybody seems to agree on the underlying issue – they only use different words. This is the reason why I did not include the words "debt" or "credit" in the title of this PhD thesis. Instead, I decided to go with "Separating Money Creation from Bank Lending" as the subtitle as it is easily comprehensible and does not readily lead to semantic debates. Before I can define the main title "Full-Reserve Banking", I will have to define banks and other financial institutions.

1.3.4 BANKS AND OTHER FINANCIAL INSTITUTIONS

A deposit bank, also known as a commercial bank or simply bank, is a financial institution which takes deposits, grants loans, provides cash and makes payments on behalf of its customers. This is in line with the Oxford English Dictionary (2015) definition:

> *[…] 2.) An institution that invests money deposited by customers or subscribers, typically pays interest on deposits, and usually offers a range of other financial services, including making payments when required by customers, making loans at interest, and exchanging currency; a building occupied by such an institution. […]*

In the spoken language generally and throughout this thesis in particular, the word "bank" refers exclusively to deposit banks. Banks can create deposits at the same time as they grant loans. This is the fundamental element that separates them from other financial institutions.

Central bank is a financial institution which has a monopoly over issuing notes and central bank reserves (as discussed above coins are issued by the government). Generally, it also acts as the lender of last resort to banks and the government. Banks and the government have accounts at the central bank, and thus have access to central bank reserves.

Investment banks can trade securities, assist in raising capital and advise on investments. The word "investment *bank*" is somewhat misleading as they do not take deposits, provide cash or make payments on behalf of its customers. Thus, they are actually classified as other financial institutions.

Other financial institutions are all financial institutions which are not deposit banks or central banks, including investment banks. For instance, pension funds, mutual funds, equity funds, hedge funds and insurance companies are other financial institutions.

1.3.5 FULL-RESERVE BANKING

Full-reserve banking (FRB) can be defined as an arrangement that makes the money supply of an economy consist of government money (i.e. cash, central bank reserves and government securities) or commodity money (e.g. gold or silver). [8] Under FRB, private money creation is prohibited in the sense that government does not guarantee repayment or par clearance of private monies or money-like assets (e.g. deposit insurance and lender of last resort service for private actors). In other words, the government would take a leading role in supplying the only risk-free medium of payment for the economy.

Today, FRB would mean that banks could no longer create new money in the form of bank deposits in the process of bank lending. FRB aims to separate the payment system from the financing system, as well as monetary policy from credit policy.

FRB can, however, refer to a variety of arrangements. Some versions allow only cash or central bank reserves to back banks' demand deposits. For instance, imposing 100% reserve requirements on demand deposits would accomplish this goal and effectively prevent money creation by banks.

Other versions of FRB allow all government money (i.e. cash, central bank reserves *and* government securities) to back demand deposits. Although in this case banks could create new money by buying government securities from other economic agents, they would only monetize government debt and not be able to create private money freely.

Yet other versions of FRB require full commodity backing of demand deposits (typically in gold or silver). In this case, banks could create new money by buying the commodity required for backing deposits from other

[8] It should be noted that the definition and measurement of the money supply is ambiguous (see Subsection 1.3.2). Under some definitions FRB would make all money either government or commodity money while in other cases private not-government-guaranteed money-like assets would still be counted as money. Here the relevant measure of the money supply is M1.

economic agents, but they would not be able to freely create private money. I will discuss various versions of FRB in detail in Chapter 4.

As established in the literature, I will use FRB as an umbrella term to capture all these different versions of monetary reform (see e.g. Musgrave 2014; Dixhoorn 2013). [9] For instance, FRB includes proposals labelled as sovereign money, 100 % money, full money, debt-free money, Chicago Plan, 100 % reserve banking, narrow banking, core banking, limited purpose banking, deposited currency and pure commodity standard.[10]

1.4 RESEARCH SETTING

This section gives an overview of the research setting. Firstly, I present my research questions and the scope of this study before going through the most notable previous research. Then, I discuss the study's theoretical and methodological frameworks.

1.4.1 RESEARCH QUESTIONS

The main research question is whether FRB would be a beneficial reform. As was stated in Section 1.2, the question is evaluated from the following normative perspectives: democracy, economic stability, social equality and ecological sustainability. The question is answered gradually throughout the PhD thesis.

To specify the analysis, the following research questions are presented:

- How have money creation and banking been regulated nationally and internationally?
- How have money creation and banking been theorized?
- Who h sproposed FRB and when?
- Has FRB been implemented in the past? If so, when, where and what were the consequences?
- Why does no country run a FRB system today?
- What are the advantages and shortcomings of FRB?
- How could the economic consequences of FRB be modelled?

Unfortunately, many economists and commentators judge FRB (either positively or negatively) based on their prejudices rather than systematic analysis. Many studies – especially critical ones – merely discuss the consequences of FRB without coherent analysis or, worse, base their

[9] Some authors (e.g. Jackson and Dyson 2012) define FRB more strictly as referring only to the Chicago Plan, in order to distinguish it from sovereign money.

[10] Social credit is a concept that comes close to FRB, but it is a broader political philosophy which emphasizes the control of money and credit (see Douglas 1933).

judgement on misconceptions. This thesis aims to be as profound, coherent and systematic as possible, but, of course, it cannot be exhaustive.

The scope of this thesis is limited both spatially and temporally. Geographically, I focus on the FRB proposals put forward in the US and the UK, although other countries are not entirely excluded. The reason for this is that the US and the UK are the only countries which have previously implemented FRB. Furthermore, the US and the UK are at the heart of global (financial) capitalism and, since World War II, have exercised key influence in setting global financial standards through international institutions – such as the International Monetary Fund (IMF) and the Bank for International Settlements (BIS). In addition, my linguistic skills naturally limit me to English-speaking countries (in addition to Finland) – although my knowledge of English can also be seen as a manifestation of the historical economic and cultural power of the US and the UK.

The nation-state often appears as the central unit of analysis in this thesis. For this, I could be accused of methodological nationalism. I do recognize that there are various actors, mechanisms and processes that do not take place chiefly in the context of a nation-state. I do not grant any principled primacy to methodological nationalism. However, I do take the nation-state as a central context of analysis for practical reasons. More specifically, record-keeping often happens at the level of nation-states. For example, GDP, employment and inflation[11] are measured for nation-states. More importantly, nation-states usually form currency areas and are the issuers and (more relevantly) regulators of money and banking. Thus, due to practical reasons I have conducted my analysis mainly in the context of nation-states, although cosmopolitan perspectives are not categorically excluded. I share Patomäki and Teivainen's (2004) view that our problems are increasingly global and therefore to solve them we need forms of cosmopolitan democracy.

Temporally, this thesis focuses from the 19th century until today although there are some references to events in the more distant past. This thesis does not aim to establish ahistorical "laws", but rather attempts to understand events in their historical context.

1.4.2 PREVIOUS RESEARCH

Until very recently, FRB was barely scrutinized at all. There were, of course, a number of proposals for FRB. However, these proposals focused on presenting a detailed version of FRB or, at most, discussed some limited aspects of the effects of FRB. However, systematic analyses of the consequences of FRB were missing. Finally, the GFC sparked a wave of research on the consequences of monetary reform.

[11] Throughout this dissertation, inflation refers to consumer price inflation. When I refer to wage or asset price inflation, they are specified.

I will go through the most important previous studies on FRB and establish my research niches. Phillips (1994a) produced the first comprehensive historical survey of FRB. He went through the history of FRB proposals, focusing on the US during the New Deal period. Phillips (1994a) was able to trace the first proposal for FRB back to David Ricardo. However, Phillips (1994a) did not analyse the consequences of FRB. Nevertheless, it is most likely the only comprehensive historical survey of FRB. In Chapter 4 the historical survey is supplemented and extended to the post-GFC period, which spawned a number of new FRB proposals.

Dixhoorn (2013) gave a good overview of different versions of FRB. She also provided a balanced evaluation of the consequences of FRB (perhaps too balanced, in my opinion, as pros are consistently matched with an equal number of cons). She found that FRB would be generally desirable, but the current monetary system could be fixed even without such a radical reform.

More critical reviews of FRB were provided by Bossone (2001; 2002), Dow et al (2015), Goodhart and Jensen (2015) and Fontana and Sawyer (2016). On the other hand, Huber and Robertson (2000), Jackson and Dyson (2012) and Musgrave (2014) evaluated the consequences of FRB as very positive. In 2016, there was a special issue of *Cambridge Journal of Economics* featuring a lively discussion on the advantages and shortcomings of FRB. Although there is a growing literature evaluating the consequences of FRB, they have not been evaluated from an explicitly normative position as is done in this study.

After the GFC, many formal models of FRB have emerged. As far as I know, the first formal model of FRB was built by Chung (1991). Benes and Kumhof (2012; 2013) modelled FRB in a dynamic-stochastic general equilibrium (DSGE) framework. Suntum and Neugebauer (2015) built an overlapping-generations model. Other neoclassical theoretical models were built by Singh (2009), Chari and Phelan (2014), Krainer (2015) and Prescott and Wessel (2016).

FRB has also been formally modelled in a more heterodox tradition. Flaschel et al (2010) and Chiarella et al (2011) studied FRB in a dynamic multiplier framework. Yamaguchi (2010; 2011; 2014) investigated it in a system dynamics framework. Correa (2012) used a sectoral balance framework. Egmond and Vries (2015) examined FRB in a dynamic simulation framework.

Regardless of whether the approach is neoclassical or heterodox, almost all of the models find FRB beneficial from an economic perspective. Although FRB has been modelled in a variety of frameworks with promising results, it has not been modelled in a stock-flow consistent framework, which has become particularly popular among post-Keynesian scholars. This thesis will fill this research gap in Chapter 8.

1.4.3 THEORETICAL FRAMEWORK

In a wider academic context, this thesis can be situated between post-Keynesian economics and Global Political Economy (GPE; also known as International Political Economy, IPE)[12].

The premises of post-Keynesian economics contrast with those of neoclassical economics (also known as mainstream or orthodox economics).[13] Post-Keynesian economics is based on fundamental uncertainty, while neoclassical economics builds on probabilistic risks. In post-Keynesian economics the behaviour of economic agents is steered by norms, procedural (or bounded) rationality and adaptive expectations. Contrastively, in neoclassical economics the behaviour of economic agents is often steered by optimization, perfect rationality and rational expectations (i.e. perfect foresight). Unlike in neoclassical economics, post-Keynesians maintain that the economy is not a self-adjusting system and demand is important also in the long run. Post-Keynesians hold that we live in a monetary economy and not in a real exchange economy as neoclassical economists think.

For post-Keynesians, money is endogenous, that is, its creation is determined endogenously by the banking system rather than exogenously by the central bank. This thesis builds on two post-Keynesian theories of endogenous money. The Monetary Circuit Theory (MCT; also known as the Monetary Theory of Production) focuses on private money creation while the Modern Monetary Theory (MMT; also called Neo-Chartalism or the State Theory of Money) focuses on government money creation. The two theories should be seen as complements rather than substitutes. Chapter 3 elaborates the post-Keynesian theories of endogenous money while Sections 7.3 and 7.4 describe the features of post-Keynesian economics more broadly in textual form before they are used in a mathematical form in Chapter 8.

Although post-Keynesian economists universally share the view that money is endogenous, money has not necessarily always been endogenous. Most post-Keynesians argue that money became endogenous because of a gradual process of development (e.g. Chick 1986)[14]. That is, money is endogenous today because of a particular institutional setting. I argue that FRB is an institutional reform that would make money exogenous again.

Moreover, I pore over GPE literature and assess FRB from various theoretical views on democracy. I follow Held's (2006) categorization of democratic theories under liberal and direct democracy. Liberal democracy is based on the idea that elected politicians represent the interests and views of

---

[12] GPE is distinguished here from Political Economy which sometimes refers to a subfield in neoclassical economics.

[13] For a comprehensive and coherent post-Keynesian textbook, see Lavoie (2015). For a detailed description of the history of post-Keynesian economic thought, see King (2003).

[14] Some post-Keynesians maintain that, instead of an institutional setting, money is endogenous because of a theoretical position, which is always true. For instance, Rochon and Rossi (2013) argue that money has always been and inevitably will be endogenous.

citizens within the framework of the rule of law. It maintains that the state is a free political space. In particular, the theory of deliberative democracy holds that discussion and argumentation is key in decision-making.

Direct democracy, on the other hand, emphasizes the need for people to decide on public affairs directly without representation. In particular, the Marxist tradition emphasizes class conflict. Therefore, the decisions of representative policy makers do not reflect reasoned arguments but class relations. As capitalists are seen as the more powerful class, the state is a repressive structure from the workers' perspective. For this reason, some Marxists are cautious of the state as it exercises influence through power structures or by directly intervening in the lives of individuals. Democratic theory is discussed in more detail in Section 3.5 while its implications on FRB are discussed in Sections 5.1, 6.1 and 6.2.

1.4.4 METHODOLOGY

As I argued in Section 1.2, relying solely on one method would not be able to provide sufficient insight. Thus, I use both qualitative and quantitative methods. Chapters 2–6 are based on qualitative analysis while Chapters 7 and 8 build on quantitative analysis.

More specifically, Chapters 2 and 3 depict what the current monetary system is – Chapter 2 from a historical perspective and Chapter 3 from a theoretical perspective. Chapter 4 carries out a historical survey of FRB proposals. Chapters 5 and 6 provide a review of the discussion on the benefits and shortcomings of FRB and evaluate it from a normative perspective.

Chapter 7 introduces the SFC modelling method. The method is based on the fact that every transaction by one sector implies an equivalent transaction by another sector (i.e. every purchase implies a sale). Flows (such as consumption and investment) interact with stocks (such as deposits and loans) and generate an interactive dynamic system which evolves through historic time. Such a system describes, with financial transactions fully integrated at the level of accounting, the processes which generate factor income, expenditure and production. Although the focus is on a quantitative tool, the chapter also discusses its historical development and theoretical underpinnings as well as qualitatively comparing its performance.

Finally, Chapter 8 presents an SFC model of FRB and conducts some experiments with it. Even though the analysis is strictly based on mathematics, the interpretation of the results inevitably involves some qualitative aspects too. The chapter contributes to the more specific discussion on the economic benefits and shortcomings of FRB. In particular, the chapter addresses the questions of whether FRB would increase the fiscal space of the government, cause excessively volatile interest rates or bring about credit crunches.

1.5 FINDINGS

This section presents the key findings of my PhD thesis and discusses their academic contribution. The findings are presented in the same order as the chapters of this thesis.

1.5.1 DEVELOPMENT OF REGULATION

Chapter 2 outlines the historical development of money creation and banking regulation. In addition, the two FRB experiments in 19th century UK and US are examined in their historical context.

The need to regulate money creation and banking emerged simultaneously with fractional-reserve banking. According to Graeber (2012), instead of lending pre-existing assets, as they had been doing previously, in the 17th century banks began to issue more certificates of assets (e.g. gold) than they had assets backing the certificates. Since then, bank failures have exposed the real economy[15] to serious systemic risks. Instead of outlawing the fractional-reserve banking system, it was regulated.

World's first central bank was established in Sweden in 1668. The UK followed in 1694 by founding the Bank of England. The US had two temporary central banks with 20-year charters in the 18th and 19th century before entering the "free banking era". In 1913, the current central bank of the US, the Federal Reserve Bank, was established. Today, almost all countries have a central bank.

Originally, central banks were established to raise funds for the government. The central banks gradually assumed all their modern functions. Today, central banks manipulate the value of currency, hold a monopoly over issuing notes, provide the means (notes and reserves) for banks to clear payments, act as lender of last resort to banks, and supervise and regulate banks.

In the past, FRB has been implemented as a solution to financial instability. In the UK, the Bank Charter Act of 1844 prohibited private money creation through fractional-reserve banking by requiring that bank-issued notes (which were the prevailing means of payment) should be fully backed by government money or gold. The National Acts of 1863 and 1864 implemented FRB in the US.

The FRB requirement, however, did not include bank deposits, which quickly became the dominant means of payment (see e.g. Kindleberger 1984). Thus, banks were able to undermine the FRB requirement relatively quickly. Currently, there are no examples of economies where the majority of money does not come into existence as a consequence of bank lending. Nevertheless,

[15] Real economy refers to the part of the economy that is concerned with production of goods and services.

as a result of the FRB experiments, central banks assumed monopolies over issuing notes that they still maintain today.

Examining the FRB experiments more closely reveals that there were no dramatic changes in macroeconomic indicators while or after FRB was implemented (see BIS 2016; Thomas and Dimsdale 2017; US Bureau of the Census 1975; Philippon 2015). Real GDP, inflation, money supply, bank loans and interest rates more or less continued on their previous paths. In fact, more macroeconomic indicators pointed towards positive developments rather than negative. This is the case even though FRB was implemented in the US during the Civil War. Perhaps one reason why FRB did not have a more significant economic impact was that, according to data in Thomas and Dimsdale (2017) and US Bureau of the Census (1975), banks had already substituted most bank notes (issued by private banks rather than the government) with bank deposits before FRB was imposed, although the rate of substitution clearly accelerated after the reform. This reduced the importance of the FRB experiment somewhat.

In the 1930s, there was a serious attempt to implement FRB in the US again. The Great Depression put forward a series of New Deal banking reforms. According to Phillips (1994a), the Chicago Plan came close to being adopted, but the FRB idea was watered down in the Banking Acts of 1933 (better known as the Glass-Steagall Act) and 1935. Instead of preventing private money creation in the form of bank deposits, the Banking Acts separated commercial and investment banking, improved the government's control over money and provided deposit insurance for banks.

The US was the first country to guarantee bank deposits. As deposit insurance proved to be successful in preventing bank runs, almost all countries have followed and introduced their own deposit insurance schemes.

Since the 1970s, money creation and banking have been deregulated. The UK completely abolished reserve requirements in 1981. In addition to the UK, today there are no reserve requirements at least in Canada, Australia, New Zealand, Hong Kong, Switzerland and Sweden.

Banking regulation has also been internationalized. After the World War II, the IMF was designated to coordinate international monetary arrangements. The international gold standard, known as the Bretton Woods system, worked from 1945 to 1971. Since then, most major currencies have floated against each other and the role of the IMF has been confined to facilitating the deregulation process.

Although it has no legislative power, the BIS – often referred as the central bank of central banks – is perhaps the most important institution for setting international standards for national banking systems. The power of the BIS is manifested most evidently through the Basel Accords.

The trend was to gradually reduce regulation – until the GFC. After that, the tide turned. The UK and the US have passed legislation to separate commercial and investment banking (Vickers Report proposals and the Dodd-Frank Act, respectively). The EU has also taken similar steps (see Liikanen et

al 2012) although the process is on hiatus and unlikely to proceed in the near future. Even though money creation and banking are regulated more tightly, the foundations of the monetary system remain unaltered.

1.5.2 MONEY AND BANKING THEORIES

Chapter 3 demonstrates that exogenous theories of money are not in line with the operational reality. Instead, as post-Keynesians have long maintained, money is endogenous, that is, its creation is determined endogenously by the banking system rather than exogenously by the central bank.

The chapter also shows that abandoning the exogenous money approach threatened the neutral money axiom, which is one of the cornerstones of neoclassical economics. As long as one accepted that money was exogenous, mainstream's equilibrium mechanisms – the interest rate mechanism (see e.g. Wicksell 1898; Robertson 1934; Ohlin 1937) and the real balance effect (see Pigou 1943; Patinkin 1965) – could theoretically justify the long-run neutrality of money.

However, after state-of-the-art neoclassical economics had accepted that money is endogenous (e.g. Svensson 1999; Taylor 1999; Woodford 2003), it became logically impossible to build on the interest rate mechanism and the real balance effect. According to Ahokas and Holappa (2014), instead of abandoning the neutral money axiom, neoclassical economists were able to invent new equilibrium "mechanisms". A monetary policy rule known as the Taylor rule replaced the interest rate mechanism and countercyclical fiscal policy replaced the real balance effect. Ahokas and Holappa (2014) emphasize that neither, however, is a market *mechanism*. Both are *policies* that require conscious action. Only by assuming that both monetary and fiscal policy are on autopilot is neoclassical economics able to hang on to the long-run neutrality of money.

It also turns out that GPE often relies, at least implicitly, on exogenous theories of money adopted from neoclassical economics textbooks. This can blur or even mislead the analysis of monetary institutions and monetary governance. For instance, many GPE scholars argue that the economic policy space of governments has shrunk in the post-Bretton Woods era (see e.g. Blyth 2013; Rodrik 2011; Patomäki 2009; Ruggie 1982). The basic idea is that free capital mobility has forced governments to pursue policies that satisfy investors.

Bell (2012) emphasizes that not only structures but also ideas matter in terms of the power of international capital. However, Holappa (2012; 2017a; 2017b) and Kotilainen (2016) argue specifically that the new monetary regime adopted after the Bretton Woods era actually expanded the economic policy space available to governments, but it does not mean that governments automatically exploit this space. They argue that instead of operational realities of the monetary system, the economic policy space of governments is

mainly limited by ideologies and practices manifested, for instance, in the constitution.

Moreover, because they have neglected the endogenous nature of money, GPE scholars have probably exaggerated the importance of central banks. The misconception that governments are ultimately in control of their money supplies has led many GPE scholars to consider the functioning of the commercial banking system to be merely technical or non-political. Thus many GPE scholars neglect the (un)democratic nature of money creation. As key monetary decisions are not made by central banks but rather by regular commercial banks (which can, of course, be indirectly influenced by central banks but to a lesser extent than usually depicted in the literature), there seems to be a need in GPE to focus more explicitly on the role of banks as creators of money (there are some recent exceptions, for instance, Teivainen 2017). Current research is too narrowly focused on the democratic accountability of central banks. This would also explain why FRB has not been investigated in the GPE literature.

I believe that a more progressive view of money and banking is expressed in post-Keynesian monetary theories, in particular the MCT and the MMT, which are based on endogenous money. I argue that the MCT and the MMT should be seen as complementary rather than competitive theories as the MCT focuses on private money creation, while the MMT concentrates on government money creation.

By adjusting the underlying theories, GPE could provide valuable insights on why money creation and banking regulation has converged globally even though no international institution formally regulates these policy areas. Furthermore, GPE could explain why no country runs a FRB system today even though there might be sound economic reasons to adopt such a system.

1.5.3 HISTORICAL PROPOSALS

Chapter 4 is a comprehensive mapping exercise of the history of FRB proposals. The specific contribution of the chapter is to complement the historical survey of FRB proposals previously published by Phillips (1994a). Although Phillips (1994a) laid much of the groundwork – especially for the New Deal period –a survey including contemporary proposals for FRB, especially the recent new wave sparked by the GFC, has not been conducted before. Unsurprisingly, FRB proposals have been particularly popular after serious financial crises.

Moreover, the chapter groups FRB proposals into six categories. In chronological order, first came the *pure commodity standard* (e.g. Ricardo 1824; Mises 1912; Hayek 1937; Rothbard 1962; Huerta de Soto 2009), which can be traced back to David Ricardo. It maintains that all money, including bank deposits, has to be backed by a commodity such as gold (in all other types

backed by government money).[16] It is associated with the Austrian school of economics.

Second, in a *sovereign money* system (e.g. Soddy 1926; 1934; Currie 1934; 2004; Daly 1980; 2013; Huber and Robertson 2000; Jackson and Dyson 2012; Wolf 2014a; 2014b) all demand deposits are held at central bank. Deposit banks can make loans only by attracting savings or using their own capital. Sovereign money is associated with Positive Money, New Economics Foundation and ecological economics.

Third, in the *Chicago Plan* (e.g. Knight et al 1933; Simons et al 1933; Fisher 1935; Douglas et al 1939; Friedman 1948; 1960; 1969; Benes and Kumhof 2012; 2013; Prescott and Wessel 2016), deposit banks provide only payments services and cannot make loans. It is associated with the 'old' Chicago school of economics and monetarism.

Fourth, *deposited currency* proposals (e.g. Tobin 1985; 1987; Jessup and Bochnak 1992; Gruen 2014; Lainà 2015a; Barrdear and Kumhof 2016) hold that the full-reserve requirement applies only to certain deposits. Other (not fully-backed) deposits are not guaranteed. Individuals can choose which type of deposits they prefer to hold. Postal saving systems or central bank accounts for the general public would be examples of deposited currency.

Fifth, *narrow banking* proposals (e.g. Kareken 1986; Litan 1987; Spong 1996; De Grauwe 2008a; Kay 2009; Phillips and Roselli 2009; King 2016; Stiglitz 2016) restrict banks' assets to 'safe' by some standards. The less restrictive proposals are not counted as FRB. These proposals thus allow assets that private banks can issue on their own (e.g. mortgages).

Sixth, in *limited purpose banking* (e.g. Pollock 1993; Kotlikoff 2010; Cochrane 2014) banks become unleveraged mutual funds. In other words, banks' liabilities are restricted to equity. It means that all risks are born by investors instead of the banks themselves.

The most iconic and detailed proposals for FRB are probably Fisher (1935) and Jackson and Dyson (2012). They represent the Chicago Plan and sovereign money versions of FRB, respectively. The Chicago Plan came close to being adopted during the Great Depression, but today sovereign money seems to be the most popular version of FRB.

Lately, FRB has become politically more acceptable. Political parties have added FRB to their political agenda (see e.g. Green Party UK 2015). Most importantly, the Icelandic government was actively advocating FRB and Iceland's Prime Minister even commissioned two FRB reports (Sigurjonsson 2015; KPMG 2016). Moreover, social movements are pressuring politicians to take action. For instance, in Switzerland, a citizens' initiative managed to obtain enough signatures in order to commit the Swiss government to arrange a referendum on FRB (see Dawnay 2017), but the reform did not pass (only 24 % supported it). Furthermore, the UK and Dutch parliaments debated money creation. In addition, bills to implement FRB have been put forward at least in

[16] For this reason, I use FRB instead of public money as the catch-all term.

the US and the UK. Thus, there are signs that FRB might actually be implemented somewhere in the near future.

1.5.4 NORMATIVE EVALUATION

Chapters 5 and 6 present the advantages and shortcomings of FRB, respectively. The costs and benefits are evaluated against four normative perspectives: democracy, economic stability, social equality and ecological sustainability.

Democracy

FRB could be beneficial in terms of democracy. Surveys reveal that the general public does not know who creates most of the money supply (e.g. Motivaction 2016; Niskanen 2016; Nietlisbach 2015; Dods 2014). Most people falsely think that either the government or the central bank is responsible for money creation. Only a small minority recognizes that banks create most of the money today.

Nevertheless, according to surveys (e.g. Motivaction 2016; Niskanen 2016; Nietlisbach 2015), most of the general public think that money creation should be the prerogative of the state (although Cobden Centre 2010 found dissimilar results). It seems that the principles of FRB are in line with the people's preferences. If FRB were implemented, the monetary system would work as most people falsely assume it works today and, more importantly, it would more accurately reflect the preferences of the electorate.

Not only would the monetary system function as people want it to function, under FRB the economic domain subjected to democratic decision making could also expand. This is because FRB would generate seigniorage revenue for the government. FRB could foster democracy as new money would not be allocated by banks, but through democratic processes of parliament instead. Of course, this presupposes that there are functioning democratic institutions in place and the country is not under totalitarian control. It is not self-evident that the seigniorage revenue generated by FRB would advance people's wellbeing. For instance, the seigniorage could be used for arms races or making war (although it is, in principle, possible that these decisions are reached through legitimate democratic processes).

Furthermore, I provide estimates of seigniorage revenue generated by FRB. Seigniorage is estimated both for the transition to FRB (only once) and for running an FRB system (annually). Most surprisingly, it turns out that, on the aggregate level, the US is already effectively running an FRB system. In other words, US banks have more reserves than demand deposits. Consequently, the transition to FRB would not yield any seigniorage revenue for the US government.

In other selected countries the transition seigniorage would be significant, ranging from 31% to 55% of GDP. It also turned out that in each selected country there is enough government debt outstanding to be "monetized" by the central bank. In fact, the transition seigniorage does not increase government budgets at all, but it does substantially reduce net government debt, that is, government debt held by private or foreign economic agents.

The annual seigniorage revenue ranges from 1% to 8% of GDP in selected countries, on average. The wide difference between countries is explained by relative sizes and historical growth rates of money supplies (M1). For instance, the money supply relative to GDP is over four times larger in the UK than in the US. The UK money supply has also grown almost twice as fast as the US money supply. Thus, FRB would increase the UK government budget by 8% while it would increase the US government budget only by 1%. Other studies have found similar results (e.g. Huber and Robertson 2000; Benes and Kumhof 2012; 2013).

The annual seigniorage revenue generated by FRB would be a very significant source of income for the government. For instance, the current monetary system generated an almost negligible annual seigniorage revenue of 180 million euros (0.3 % of central government budget) for the Finnish government in 2014. Under FRB I estimated the average annual seigniorage revenue for Finland as 6 billion euros (3 % of GDP or 11% of central government budget). That is, the annual seigniorage revenue would be over 30 times more in an FRB system than in the current monetary system. Put differently, the annual seigniorage would be roughly equal to the administrative fields of the Ministries of Defence, the Interior, Justice and Foreign Affairs *combined* (including e.g. army, police, courts and development aid). Thus, FRB has great potential to extend the fiscal capacity available to governments.

Although rarely pointed out by critics, whether FBR would advance democracy strongly depends on one's conception of democracy. Following Held's (2006) categorization, FRB would quite obviously advance the liberal conception of democracy, which emphasizes representation. However, it is less so if one adopts the conception of direct democracy as citizens would not directly decide the allocation of money. From this point of view, FRB could be argued to be undemocratic.

More commonly, critics think that FRB would be undemocratic if the decision of the amount of money to be created is delegated to an independent expert body instead of parliament (as in some FRB proposals such as Jackson and Dyson 2012). For instance, Pettifor (2014a; 2014b), Dow et al (2015) and Fontana and Sawyer (2016) criticize FRB from this perspective. This type of critique is not convincing as an independent expert body is already responsible for monetary policy in most countries and, more importantly, the decisions of banks are hardly democratic. Moreover, there is no reason why the amount of new money created could not be decided politically (in addition to the

allocation of new money). Indeed, this is exactly what some FRB proposals advocate (e.g. Currie 1934; Daly 2013).

Others fear that the government would abuse its power to create money (e.g. Angell 1935; Coppola 2012). However, Musgrave (2014) points out that there is no reason why governments could not abuse their power to create money already today (and some of them certainly have done so in the past). Thus, FRB does not make the situation any worse.

The institutional context in which FRB would be implemented is also very important. Adopting FRB in a monetary sovereign[17] state would probably be the safest option as it gives a lot of leeway to defend the currency against the animal spirits of international financial capital. Another option would be to allow the currency to float, but restrict capital mobility. This, however, does not seem viable in a globalised world.

Globalization is a comprehensive process. Deviating from the norm may risk damage to international political cooperation in other policy areas and adverse positioning decisions by international productive capital. Reactions to FRB are, however, highly contingent on the perceptions and attitudes of other actors.

Nevertheless, it is possible that successful implementation of FRB may require international coordination. The hegemonic position of the US is being threatened by China. The US, led by Donald Trump, is also withdrawing from international institutions that are not functioning fully in line with redefined US interests. Should China take up a leading role in international institutions, FRB could become a feasible option. As it is ruled by a communist party, China does not object to increasing the role of public money, at least on ideological grounds.

Economic Stability

Under FRB, economic stability would be strengthened in several ways. In the current monetary system bank bailouts and deposit insurance remove the incentives of bank owners and depositors to scrutinize the soundness of banks (e.g. Demirgüç-Kunt and Detragiache 2002). As profits are private but losses are socialized, banks are encouraged to take excessive risks. By creating new money out of thin air, banks can fuel credit booms (e.g. Schularick and Taylor 2012; Jordà et al 2014; 2015). Excessive risk-taking and credit booms tend to end as financial crises, which can bring down the whole payment system of an economy (for a review of studies, see e.g. Lainà et al 2015; Kauko 2014).

FRB would make the two causes of moral hazard – bank bailouts and deposit insurance – redundant. Under FRB, banks could be allowed to fail without serious repercussions and, logically, there could be no bank runs

[17] Monetary sovereignty means that the state issues its own currency, the exchange rate is flexible, and almost all government debt is denominated in domestic currency.

(Jackson and Dyson 2012; Chari and Phelan 2014).[18] Therefore, banks would not be incentivized to engage in high-risk activities. Furthermore, banks could not fund credit booms by creating new money. According to Jackson and Dyson (2012), this should reduce the occurrence of financial crises.

Even if a financial crisis were to occur in a FRB system, the payment system would remain secure (e.g. Dixhoorn 2013). Thus, not only would there be fewer financial crises under FRB, but those that occurred would also be less severe.

The real economy would also be more stable under FRB. As monetary policy would be separated from credit policy, the amount of money could move countercyclically rather than procyclically (e.g. Sigurjonsson 2015). Instead of the money supply expanding quickly in booms and shrinking in busts, following bank loans, the money supply could be increased in busts and decreased in booms – just what is needed to tame the business cycle.[19]

Moreover, monetary policy would be more effective under FRB. Monetary authorities could influence the money supply directly instead of trying to manipulate it indirectly through interest rates (Jackson 2014; Dyson et al 2016; Sigurjonsson 2015). Indeed, conducting monetary policy by manipulating interest rates has recently proved to be inefficient (see e.g. Sharpe and Suarez 2014). Most importantly, the financial markets face the same interest rates as the real economy, and thus interest rate manipulation is a blunt tool for simultaneously controlling consumer prices and asset prices (Musgrage 2014; Jackson and Dyson 2012).

The most convincing critique presented against FRB, in my view, is the potential emergence of near-monies (e.g. Schumpeter 1954; Goodhart and Jensen 2015; Dow et al 2015; Fontana and Sawyer 2016). Although bank deposit creation could be successfully prevented, it is possible that new forms of private money would emerge and ultimately replace most of the government money in regular transactions (or commodity money under a pure commodity standard). This is what happened in the UK and the US in the 19th century when FRB was implemented and, critics argue, there is no reason why it would not happen again. Although near-monies can be combated by outlawing them (Fisher 1935), by extending the FRB requirement to new forms of private money (Jackson and Dyson 2012) and by paying interest on FRB money (Friedman 1960), it is a valid concern.

Phillips (1994a), however, argued that near-monies need not be prevented completely. In fact, many proponents of FRB seem to support rather than object to parallel currencies –particularly local currencies. Dyson et al (2016)

[18] Goodhart and Jensen (2015) challenge this view and point out that there could still be a run on time deposits. It could, however, be argued that a run on time deposits does not risk the payment system more broadly.

[19] It has become conventional wisdom that the central bank should pursue countercyclical monetary policy. For the discussion on countercyclical monetary policy, see e.g. Kliesen (1993).

emphasize that it would be important to remove government guarantees for private monies or money-like assets (repayment and par clearance, e.g. deposits insurance and lender of last resort to private agents). If people are still willing to invest in risky private assets, they should be allowed to do so and bear the risks involved.

Other noteworthy critiques are that under FRB there would be a shortage of credit (e.g. Mitchell 2015b; Kregel 2012; Independent Commission on Banking 2011; Bossone 2001; 2002; Goodhart 1993) or interest rates would become excessively volatile (e.g. Dittmer 2015; Dow et al 2015). It is true that in certain circumstances there could be a credit crunch or interest rates could fluctuate wildly. However, I find in Chapter 8 that those circumstances seem rare and it is relatively straightforward to counteract those problems with appropriate monetary policy. Nevertheless, it is good to be aware of these potential problems as they need conscious and prompt action.

More surprisingly, part of the critique comes from diametrically opposite angles. While most rigorous neoclassical economists often criticize FRB for causing runaway inflation, post-Keynesian economists typically argue that it would be deflationary (e.g. Kregel 2012; Pettifor 2014a; 2014b). Jackson (2014) and Dyson et al (2016) address the critique by pointing out that the target of monetary policy would still be steady inflation. The only difference is that the money supply rather than the short-term interest rate would be the tool. Although concerns regarding both inflation and deflation are understandable, I would argue that it is very unlikely that FRB in itself would cause either. The inflationary or deflationary tendency under FRB depends mostly on "animal spirits" and the stance of monetary and fiscal policy – as is the case today.

Social Equality

Social equality could be advanced in several ways under FRB. Firstly, new money could be distributed more evenly. According to Hodgson (2013), only the highest income decile of the UK population are net recipients of interest related to bank deposits and loans. Huber and Robertson (2000) and Wolf (2014b, 211) argue that most likely the allocation of new money would contribute to a more equal distribution of income if the decision were to be made by parliament rather than by banks.

Secondly, banks could not fuel asset price inflation by creating money. According to Jackson and Dyson (2012), asset price inflation mostly benefits the rich.

Thirdly, bank loans would not be required to support the money supply. That is, the money supply would not have to be "rented" from banks anymore (Jackson and Dyson 2012). At least interest payments from money creation would not flow upwards, making the rich even richer (Wolf 2014b). This would also reduce the amount of debt throughout the economy (Sigurjonsson 2015).

Fourthly, bank bailouts using taxpayers' funds would be redundant. According to Jackson and Dyson (2012), the reason is that a failing bank would not impose a systemic risk on the payment system.

Fifthly, there is no economic or social justification why the government should guarantee risk-free private returns by providing deposit insurance schemes (Jackson and Dyson 2012). Thus, FRB would realign risk-return relations and put the monetary system more in line with market principles. If there is no risk, there should not be any private returns either.

Finally, if the occurrence and severity of financial crises were to be reduced, the negative social consequences of financial crises (see Reinhart and Rogoff 2009b; Dijk 2013), such as unemployment and detrimental impact on health, education, poverty and gender issues, would also be diminished.

FRB is also criticized for increasing rather than reducing social inequality. The point is that, as banks cannot create credit under FRB, interest rates on both loans and deposits would be somewhat higher (e.g. Dixhoorn 2013; Musgrave 2014). This would make the distribution of income more uneven. I agree that interest rates might be a bit higher under FRB, but if there would be less debt (e.g. because the money supply does not need to be supported by bank loans) interest flows to the rich could actually decrease.

More importantly, however, there is much more to social equality than interest flows. For instance, disposing bank subsidies and bail-outs as well as generating annual seigniorage revenue for the government would certainly be improvements in social equality – let alone the reduced frequency and severity of financial crises, during which the poor usually suffer the most. Thus, FRB might not have a very significant effect on direct income distribution, but it probably would advance social equality more broadly.

Ecological Sustainability

Green supporters of FRB argue that under FRB the composition of production might become more ecologically sustainable. Instead of banks dictating which projects are funded, (time) depositors would have more say in how their savings are invested (Jackson and Dyson 2012). Presumably, the public would stress ecological issues more than banks, which mainly focus on increasing their profits. In addition, by extending the sphere of political decision-making through higher seigniorage revenue, it is assumed that the government makes more environmentally friendly decisions than banks (Dittmer 2015; Farley et al 2013; Mellor 2010).

It is also possible that FRB is ecologically irrelevant. The critics argue that the composition of production would not change significantly under FRB. The decisions on what is produced, how it is produced and for whom it is produced are at most marginally affected by the monetary system (Musgrave 2014).

According to green supporters of FRB, FRB might also facilitate ecological sustainability by eliminating the growth imperative related to the current monetary system. First of all, economic growth is considered tightly related to

environmental degradation (see e.g. Boulding 1966; Kneese et al 1970; Georgescu-Roegen 1971; Meadows et al 1972; 2004) and it might even be socially undesirable (see e.g. Hirsch 1976; Easterlin 1974; Layard 2005).

This link between economic growth and environmental degradation has been challenged, particularly by neoclassical economists. It is possible to see economic growth and ecological sustainability as mutually reinforcing rather than mutually exclusive. In particular, the environmental Kuznets curve hypothesis maintains that the environmental impact indicator is an inverted U-shaped function of income per capita (for discussion, see Stern 2004). That is, when the economy grows, the (negative) environmental impact initially increases but then decreases.

Although the link between growth and the environment remains up for debate, green proponents of FRB associate the current monetary system with economic growth. The underlying idea is that – as bank loans are currently a precondition for the existence of the money supply – an increase in the money supply also implies growing the real economy. Contrary to the popular view, the problem does not arise from the fact that banks create only enough money to repay the principal of loans but not enough to cover interest payments (see e.g. Musgrave 2014; Parkkinen 2015).

Instead, the argument goes that banks do not recirculate interest payments in full, but rather hoard part of them as undistributed profits (Rowbotham 1998; Daly 1999; Douthwaite 2000; Binswanger 2009; Farley et al 2013). To balance this, the amount of loans has to increase. Furthermore, every borrower must return more money (loan principal *plus* interest) than originally received (deposits equal to loan principal). This means that borrowers must somehow "make the money grow". Green supporters of FRB interpret all this to mean that there exists a growth imperative in the current monetary system.

Green proponents of FRB argue that FRB could eliminate this growth imperative as the existence of money would be independent of bank loans (Lietaer et al 2012; Daly 2013). Even though banks and other economic agents could still hoard under FRB, an increase in the money supply would not require the economy to grow. Thus, FRB would advance ecological sustainability by allowing (but not automatically leading to) zero-growth or degrowth.

Even green supporters of FRB admit that there are also other sources pushing for economic growth. Nevertheless, they maintain that FRB would eliminate one of them. In my view, even if economic growth would inevitably have a detrimental effect on ecological sustainability, it remains ambiguous whether the current monetary system really imposes a growth imperative and, if it does, whether it could be remedied in another way. The critics are on the right track in pointing out that growth of the money supply does not necessarily indicate economic growth as well.

Neither is it obvious that FRB would eliminate any hypothetical growth imperative. Most likely, the drive for growth is more deeply rooted in our economic system. It seems that capitalism – rather than the monetary system

– encourages people to continuously increase profits and accumulate wealth.[20] This has little to do with the monetary system.

Generally, the criticism presented against FRB is better justified against pure commodity standard types of FRB proposals, while proposals based on public money involve more flexible elements that can avoid at least some of these caveats.

Taking into account all the claimed benefits and criticisms, FRB seems to be a progressive reform. Nevertheless, it seems that FRB is able to satisfy some normative premises better than others. FRB seems to have a particularly positive impact on economic stability and democracy, while it is only slightly able to promote social equality. Whether it is able to advance ecological sustainability is more dubious, but it is quite clear that FRB would not work against it either.

1.5.5 STOCK-FLOW CONSISTENT MODELLING

Chapter 7 traces the origins of SFC modelling to the late 1960s. At the time, James Tobin and his colleagues began to develop neoclassical SFC models in Yale. Shortly after, in the early 1970s, Wynne Godley and his partners started to develop a post-Keynesian alternative in Cambridge, UK. Godley and Cripps (1983) is one of the seminal works of the Cambridge Group while Backus et al (1980) is a good example of the Yale Group.

Neoclassical SFC models faded away in the mid-1980s, but post-Keynesian SFC models continue to thrive today. Regardless of their theoretical differences, both approaches shared the fundamental idea that each income (expenditure) flow must appear as an expenditure (income) flow in another sector and as an equivalent change in the financial balance of both sectors. Chapter 7 introduces the post-Keynesian SFC modelling method following the magnum opus of PK-SFC modelling by Godley and Lavoie (2012).

The chapter also compares PK-SFC models with other modelling techniques and discusses their strengths and weaknesses. Compared to neoclassical DSGE models[21], PK-SFC models share the starting point that an economy is in a steady state/general equilibrium which can be disturbed by shocks.

However, there are important differences. DSGE models do not systematically incorporate stocks and flows. Furthermore, PK-SFC models are typically deterministic rather than stochastic. In addition to other theoretical differences, in PK-SFC models the behaviour of economic agents is steered by norms instead of optimization as is the case with DSGE models. Recently, however, DSGE models have introduced many elements previously included

[20] Capitalism refers to the private ownership of the means of production and is thus a much broader concept than the monetary system, which refers to the control of money.

[21] DSGE models are macroeconomic models derived from microeconomic principles. In the neoclassical literature they are considered cutting-edge research.

only in PK-SFC models. For instance, adaptive expectations and a bigger role for money and financial markets have become part of cutting-edge DSGE models.

Obviously, there are fewer differences between PK-SFC and Tobin's SFC models. PK-SFC models are dynamic, that is, they focus on multiple periods and the adjustment process, while Tobin's SFC models are static, that is, they concentrate on one-period equilibrium. In addition, Tobin's SFC models build on neoclassical theory and, thus, the behaviour of economic agents is like DSGE models rather than PK-SFC models.

SFC models in general have many strengths. SFC models are fully tractable, parametric, coherent and complete macroeconomic models. They are based on waterproof accounting (i.e. the development of financial assets is systematically taken into account) and they recognize interactions between stocks and flows. Furthermore, SFC models shed light on the interrelations of different sectors. In particular, SFC models can be applied to various theoretical and institutional frameworks. Most importantly, SFC models are excellent for policy and scenario analysis (see Godley and Lavoie 2012). PK-SFC models are particularly efficient in identifying unsustainable processes as they evolve through historical time.

Nevertheless, SFC models have also some weaknesses. SFC models cannot say anything about what happens within periods as they can only illuminate developments between periods (or at the end of a period). Furthermore, economic agents are typically aggregated into sectors and, thus, the models do not shed light on intra-sectoral issues. Behavioural equations assume stable parameters while in reality it is likely that they are constantly changing. SFC models can easily become very complex and, therefore, hard to solve and understand. Due to their high data requirements, SFC models are not particularly useful for short-term forecasting. Even though they have shortcomings, I believe that due to their watertight accounting SFC models provide a very useful framework for economic analysis.

Chapter 8 builds the very first SFC model of FRB.[22] The model is called REFORM2 and it is developed from Godley and Lavoie's (2012) model INSOUT. Even though this simple model can account for certain causal mechanisms and capture some important elements from reality, the results should be interpreted as tentative, contingent and indirect.

The key features of the model are as follows. Firstly, banks are required to hold central bank reserves equal to their demand deposits (full-reserve requirement). Secondly, the central bank sets the amount of reserves by buying government bills. Thirdly, households are the residual buyer of bills and, therefore, the bill rate is endogenous. Fourthly, banks adjust the interest rate on time deposits to attract enough deposits to fund loans.

I find that a stationary steady state exists. It is a necessary precondition for FRB to be compatible with a zero-growth economy. In the steady state both

[22] A previous version of the model, called REFORM, was published in Lainà (2015b).

full employment and zero inflation can be sustained. However, it should be noted that long-term economic growth is excluded from the model as there is no fixed capital or productivity growth by assumption.

Subsequently, I conduct an experiment in which money is created through government spending in an FRB system. I compare the results to the cases when government spending is increased under FRB but without money creation and under endogenous money, that is, the current monetary system. I find that in all cases a temporary increase in government spending temporarily increases output, employment and inflation in a very similar manner. Unlike in other cases, however, money creation under FRB leads to a permanent reduction in consolidated government debt. An increase in central bank reserves translates into an almost equal increase in demand deposits. An unusually large change in the money supply only leads to smooth and relatively small changes in interest rates.

Furthermore, I compare three additional ways to create money under FRB. Money creation through tax cuts or citizen's dividends yields roughly similar results as creating money through government spending. Contrastively, creating money by repaying government debt (quantitative easing) affects only monetary aggregates and interest rates, but not the real economy. As the effects of money creation vary according to the channel, money creation under FRB would require some coordination between the government and the central bank. In other words, the appropriate amount of new money should depend on how it enters the economy.

Finally, I explore the circumstances in which FRB might lead to a credit crunch. Although in every money creation experiment banks are able to satisfy the demand for loans, temporary credit crunches can occur when households' liquidity preference suddenly increase or firms quickly demand more loans. As the required changes are quite drastic, credit crunches under FRB seem to be possible but rare. Introducing fixed capital, productivity growth or lower bank liquidity targets, however, might alter this conclusion.

The findings are broadly in line with other FRB models. I find that FRB has a positive impact on output, in line with Benes and Kumhof (2012; 2013) and Egmond and Vries (2015). Benes and Kumhof (2012; 2013), Prescott and Wessel (2016) and Egmond and Vries (2015) also found that zero inflation becomes feasible under FRB. Benes and Kumhof (2012; 2013), Yamaguchi (2010; 2011; 2014) and Egmond and Vries (2015) found that FRB would reduce public debt. The conclusion that FRB would not cause a credit crunch is also reached by Prescott and Wessel (2016), Singh (2009), Flaschel et al (2010) and Chiarella et al (2011). Previously, various ways to create new money in an FRB system have not been compared. Although a lot of research remains to be done, these findings are important academic contributions.

To summarize, it seems that FRB would be a most welcome reform. It would generate a significant seigniorage revenue, and thus increase the fiscal capacity of the government. Furthermore, it does not have adverse effects on

economic stability. Thus, there are good reasons to implement FRB in the near future.

1.6 STRUCTURE

The structure of this thesis is as follows. This first chapter gives a brief overview of the premises, definitions and results of this study. Chapter 2 presents the historical development of money and banking regulation since the 17th century. It focuses on the UK, the US and international institutions. It also discusses the economic impact of two FRB experiments in the 19th century more closely.

Chapter 3 discusses various theories of money and banking. Firstly, I present the exogenous money approach and how mainstream equilibrium mechanisms build on it. Secondly, I present convincing evidence for endogenous money and how money creation is constrained. I also discuss how the mainstream position that money is neutral in the long run can be saved under endogenous money. Then, I present two theories based on endogenous money. The Monetary Circuit Theory focuses on private money creation, while the Modern Monetary Theory concentrates on government money creation. Finally, I discuss how money and banking are theorized in GPE. In particular, I concentrate on democratic theories.

Chapter 4 presents the history of FRB proposals. I begin from the first FRB proposal, which can be traced back to David Ricardo. Then, I elaborate the Chicago Plan outlined in the 1930s during the New Deal banking reforms before discussing the FRB proposals of the latter half of the 20th century. Lastly, I present the recent new wave of FRB proposals following the GFC.

Chapter 5 presents the benefits of FRB. I discuss the benefits from political, economic, social and ecological points of view.

Chapter 6 discusses the criticism presented against FRB. I focus on economic perspectives, but also cover political, social and ecological points of view.

Chapter 7 presents the methodology of PK-SFC modelling. Firstly, I present a very brief history of PK-SFC modelling. Secondly, I give a general overview of the method. Thirdly, I contrast PK-SFC modelling with DSGE modelling of neoclassical economics as well as with James Tobin's SFC models. Fourthly, I discuss the strengths and weaknesses of PK-SFC modelling.

Chapter 8 presents my SFC model of FRB. Firstly, I present the matrices. Secondly, I present and explain the equations. Thirdly, I discuss the calibration process and the properties of the "old" steady state. Fourthly, I conduct a money creation experiment through government spending and study the transition to the "new" steady state. I compare the developments to a similar increase in government spending but either under FRB without money creation or under the current monetary system. Fifthly, I compare

other options for money creation under FRB. Finally, I explore the conditions under which FRB might cause credit crunches.

Chapter 9 concludes. Firstly, I recap the research of this PhD thesis. Then, I ponder the political, technocratic and technological possibilities of FRB in the near future. Finally, I discuss the limitations of this study and ponder possible avenues for further research.

2 DEVELOPMENT OF MONEY CREATION AND BANKING REGULATION

The prerequisites for money emerged through the birth of agriculture and the ability to store food (particularly grain). Together with the development of writing, mathematics and accounting, humans began to comprehend abstract (economic) value.

Societies have used commodities such as beads, feathers, tobacco, salt, animal skins, cattle and precious metals as money. Modern money, however, emerged through credit. According to Graeber (2012), primitive non-monetary societies were built on credit and gift relations, which can be traced back at least 5000 years. At first, credit relations were informal and memorized, but later they were recorded on, for example, clay tablets, which could circulate as money.

According to Graeber (2012), the first known metallic coins were issued in Lydia (in what is now western Turkey) around 600 BC. Later, paper money (notes) replaced coins. According to King (2016), the first paper notes appeared in China in the 7th century AD. Finally, paper money was replaced by deposit money. Bank deposits remain the dominant means of payment in most societies today.

Graeber (2012) argues that the origins of modern banking are generally associated with Northern Italy in the 14th century. According to Graeber (2012), banks, however, began to create new money through lending, known as fractional-reserve banking, only in the 17th century (as opposed to lending pre-existing money).

Although it is important to identify the roots of credit, money and banking, this chapter focuses on the historical development of the regulation of money creation imposed on banks since the 17th century (the origins of modern money and credit are discussed in Subsection 3.4.2). Most importantly, FRB was implemented in the UK and the US in the 19th century. This chapter is strictly limited to historical description while the next chapter will present the theoretical approaches to money and banking. This chapter first outlines the development of regulation in the United Kingdom, followed by the United States and then on the international level. Finally, this chapter examines the FRB experiments in the UK and the US in the 19th century more closely.

2.1 UNITED KINGDOM

The Bank of England was established in 1694 to raise funds for the government but also to institutionalize and regulate money creation through fractional-reserve banking. According to a Bank of England paper authored by Norman et al (2011), at the time the Bank of England was a private financial institution

which was granted a monopoly to issue notes as a joint stock bank (other banks were partnerships that could issue their own notes too). Slowly, according to Norman et al (2011), the notes issued by the Bank of England replaced other settlement assets (such as metal coins) among banks. In other words, other banks adopted the liabilities of the Bank of England as the means of final clearing. This reinforced its role as an early "central bank".

The Bank Charter Act of 1844 (Peel's Act) was the response of the English government to a wave of bank failures between 1825 and 1839. The bank failures were a result of reckless lending and speculation after the Napoleonic Wars in 1815. The Act divided the Bank of England into an issuing department and a banking department. Consequently, the Bank of England has two separate balance sheets, unlike most other central banks. The issuing department keeps track of notes while the banking department covers other central bank activities.

Effectively, the Bank Charter Act of 1844 implemented FRB. The Act required full backing of notes issued by commercial banks – which were the dominant means of payment at the time. However, in addition to gold, bank notes could also be backed by government debt. Eventually, the Bank of England gained a monopoly on issuing notes as commercial banks were discouraged from issuing their own notes[23].

Nevertheless, the Bank Charter Act of 1844 did not cover bank deposits. Hence, over time banks were able to substitute bank notes with bank deposits. As Kindleberger (1984, 69) put it: "[t]he Bank Act of 1844 had restricted bank notes but not bills of exchange or bank deposits and these expanded in England by large amounts". In addition, according to Huber (2013), the Act was suspended whenever a real panic occurred in the subsequent years. These issues slowly led to the deterioration of FRB in the UK.

After the financial crisis of 1866 the Bank of England accepted its role as a lender of last resort. Before that it was unwilling to provide emergency loans to banks. At the time it had become a modern central bank with all the regular functions thereof: regulator of the value of currency; sole issuer of notes; provider of the means (notes and reserves) for banks to clear payments; banker for the government; lender of last resort to banks; and supervisor and regulator of banks.

Nationalization of the Bank of England took place in 1946 after two and half centuries of private control. It did not affect money creation per se, but now the seigniorage income from currency creation benefitted the government instead of rich individuals.

In 1971 the UK introduced a package of regulatory reforms called "Competition and Credit Control" which aimed to reduce control over bank lending and thus money creation. The package included a reduction in the

[23] The Bank of England gained a monopoly on issuing notes in England and Wales, but a few commercial banks may still issue their own notes in Scotland and Northern Ireland under the supervision of the Bank of England.

amount of liquid assets that banks had to hold against their deposits from 28% to 12.5%.

Reserve requirements were completely abolished in 1981. Nevertheless, according to McLeay et al (2014b), the Bank of England does require banks to hold a proportion of non-interest bearing "cash ratio deposits" with the Bank of England for a subset of their liabilities. In addition to the UK, nowadays there are no reserve requirements at least in Canada, Australia, New Zealand, Hong Kong, Switzerland and Sweden.

Since reckless lending by banks was seen as a major cause for the GFC, recently there has been some attempts to limit banks' ability to create money. Independent Commission on Banking (2011) wrote a report known as the Vickers Report. The commission was chaired by John Vickers and commissioned by Bill Winters, Martin Taylor, Clare Spottiswoode and Martin Wolf. The leading principle of the report was ring-fencing, that is, structural separation of activities for deposit banks. The commission would prohibit deposit banks from dealing in securities and derivatives, from investing in hedge funds and private equity, from engaging in market-making, and from allowing non-trading exposures to other financial institutions. The suggestions of the commission were enacted into law by 2015.

2.2 UNITED STATES

In the colonial times of the US, the Bank of England held the monopoly over legal tender currency. According to Russell (1991), the US colonies tried to alleviate the shortage of British pounds by issuing their own money. The colonies typically gave their own money legal tender status so that it would clear at par (i.e. at face value) with the pound sterling. The Currency Act of 1751 deprived the New England colonies the right to issue their legal tender money and virtually eliminated their ability to issue any kind of paper money. The Currency Act of 1764 extended the prohibition to all colonies. Thus, the US colonies were forced to use only British pounds as a medium of payment.

When the US gained independence in 1776, it broke away from the British monetary system. According to Calomiris (1988), 40% of the funding for the Revolutionary War leading to the independence of the US came from issuing "Continentals". "Continentals", however, became practically worthless after the war due to both British counterfeiting and loose monetary policy due to lack of coordination. After independence, the US did not have a federal monetary system, but instead, according to Russell (1991), the states issued their own monies.

The first bank, the Bank of North America, was established in 1781 and within ten years there were three state-chartered banks. Private paper money system prevailed at the time. It meant that banks issued their own notes, which were redeemable in gold or silver. They practiced fractional-reserve banking, which meant that in total there was not enough gold or silver to be redeemed.

The First Bank of the United States (which was the first *national* bank, in contrast to state banks) was created in 1791 with a 20-year charter. It served as the first US central bank, although it did not perform all of the core functions of a central bank. According to Phillips (1994a), opposition by states and state-chartered banks led to its demise after its charter expired in 1811.

The Second Bank of the United States was chartered in 1816, again for twenty years. It also served as the central bank, albeit lacking some modern functions. The charter was not renewed in 1836.

After the demise of the Second Bank the US entered the so called "free banking era". During this period the money supply consisted mainly of privately-issued bank notes. The law required the bank notes to be redeemable in gold or silver, but there was no central bank to supervise the banks. According to Timberlake (1965), Congress tried to pass legislation to impose reserve requirements, but the bill was tabled. A number of states, however, did pass legislation to regulate reserves. For instance, the Louisiana Bank Act of 1842 required deposits and bank notes to be one-third backed by specie (e.g. gold) and two-thirds by short-term, high-quality assets.

According to Timberlake (1965), the US Treasury was established in 1846 to eliminate the risks associated with depositing government funds into private banks. Until 1860 the Treasury frequently financed its deficits by issuing non-interest-bearing notes. In other words, at the time it was customary to monetize government budget deficits.

According to Phillips (1994a), both sides of the Civil War financed their fiscal deficits by issuing legal tender currency in anticipation of future taxes. In 1862, the Legal Tender Act was passed, which authorized the issuing of "Greenbacks". These legal tender notes were issued by the Treasury and were redeemable in gold at some unspecified point in the future.

The National Currency Act of 1863 and the National Banking Act of 1864 implemented an FRB requirement for all national banks in the US. According to McCallum (1989, 318), these Acts required national bank notes to be 111.11 percent backed by government bonds (so it was even more than *full*-reserve banking as it imposed a 111.11 percent reserve requirement). In comparison, today the reserve requirement on demand deposits is 0, 3 or 10 percent depending on the total value of deposits at a bank, while there is no reserve requirement on time deposits. The national bank notes were not legal tender, but were convertible into Greenbacks. According to Grant (1992), the "free banking era" ended when these Acts established a uniform currency and a national banking system. This created a system of national banks instead of a single bank, as had been established in 1791 and 1816.

Banks could, however, be chartered by states as well as by the nation. The Acts of 1863 and 1864 applied only to national banks. To curb money creation by state-chartered banks, according to White (1983, 11), Congress imposed a 10 percent tax on any new issuance of bank notes by state-chartered banks. These measures led banks, both national and state-chartered, to reduce the

issuing of bank notes. As in the UK, the US banks were, nevertheless, able to undermine the reform by increasing their issuance of demand deposits.

The Federal Reserve Act of 1913 created a new central bank and a national currency not issued by the Treasury, but rather by a private corporation owned by its member banks. According to Phillips (1994a), Federal Reserve notes were redeemable in lawful money: greenbacks or gold.

According to Minsky in the foreword of Phillips (1994a), the Federal Reserve Act of 1913 demonetized government debt. That is, government debt was no longer eligible as an offsetting asset for currency. Instead, currency had to be offset in the books of Federal Reserve Banks with gold and bank loans to firms. Phillips (1994a) argued that what is crucial in monetary policy are the assets against which the central bank issues its liabilities. Because of the real bills doctrine, the Federal Reserve was unable to provide an elastic currency. That is, it could not necessarily stabilize the money supply in all circumstances. The primary assets of the Federal Reserve were gold certificates and advances to private banks. Government securities accounted for a tiny fraction of the Fed's total assets. This constrained the Fed's ability to act as a lender of last resort. Phillips (1994a) argued that, after recognizing these limitations, the Fed finally began open market operations in government securities in 1923.

According to Friedman and Schwartz (1963, 266), in the latter part of the 1920s there was a dispute over whether the Fed should purchase real bills or government securities. It was argued that real bills would not feed speculation while government securities would. Commercial paper was still the primary asset eligible for discount by the Fed although open market operations were already possible in government securities. According to Friedman and Schwartz (1963, 321), the first Glass-Steagall Act in 1932 (in the economic literature the term "Glass-Steagall Act" usually refers to the Banking Act of 1933) allowed the Federal Reserve to discount government securities against Federal Reserve notes.

In the early 1930s, the US government tried to alleviate the credit crunch brought about by the Great Depression. The Emergency Relief and Construction Act of 1932 authorized the Federal Reserve Banks to make direct loans to private enterprise. In addition, the Reconstruction Finance Corporation was established in 1932 to provide additional loans. According to Olson (1988, 82), by the end of the capital purchase programme in June 1935, the Reconstruction Finance Corporation owned more than one-third of all the assets of the entire banking system.

According to Phillips (1994a), after Franklin D. Roosevelt's inauguration in March 1933 the financial system was saved by the economic stimulus created by government deficits (even though Roosevelt ran on a budget balancing campaign, attacking Hoover's spending programmes) and the government's willingness to issue currency against any bank assets. To alleviate the potential balance of payment problems arising from its expansionary fiscal policy, the US followed the international trend and abandoned the gold standard in 1933. The Emergency Banking Act of 1933 enabled the issuing of currency against

almost any bank asset, made government debt eligible as collateral for Federal Reserve discounts and permitted banks to offer deposit accounts fully-backed by government money.

FRB was made possible in the Emergency Banking Act of 1933 which, according to Phillips (1994a), built on the principle employed in the National Acts of 1863 and 1864. The Emergency Banking Act permitted banks to offer deposit accounts backed with cash, central bank reserves or government bonds. In other words, these deposit accounts operated according to the FRB principle. Other deposit accounts existed as well, and thus only a small fraction of demand deposits became fully-backed by government money. For the banks, the full-reserve requirement of these accounts was easy to satisfy as the Fed flooded the banking system with excess reserves by changing its policy and issuing reserves against almost any bank assets. The monetary system could be classified as deposited currency (see Chapter 4).

The idea of FRB was also practiced without legal obligations on the banks themselves. According to Phillips (1994b), John M. '100%' Nichols put the theory fully into practice by successfully operating a bank according to the FRB principle for over a decade.

The Banking Acts of 1933 (better known as the Glass-Steagall Act) and 1935 separated commercial and investment banking, provided deposit insurance[24] and improved the government's control over monetary policy and money supply. According to Tugwell (1957, 368), the banking reform objectives of the New Deal were to: 1) make deposits safe; 2) separate deposits from investments in order to prevent speculation with depositors' money; 3) raise and stabilize price levels; and 4) strengthen the management of business activity. The Banking Acts of 1933 and 1935 fulfilled these objectives satisfactorily.

As discussed above, the world's first deposit insurance was established in the US in 1933. According to Phillips (1994a), "Deposit insurance made banks 'safe' not by direct restrictions on their assets, but rather by the promise that the government would guarantee a percentage of the deposits in all banks, good and bad." Phillips (1994a) argued that although deposit insurance succeeded in stopping bank runs and restored confidence in the payment system, it did not address the second primary function of banks: to fund capital development of the economy.

The Banking Act of 1935 was the last New Deal banking reform. After that banking legislation remained practically unchanged for decades.

Deregulation became the leading principle for financial legislation in the 1970s. For instance, the Depository Institutions Deregulation and Monetary Control Act of 1980 removed regulations on deposit interest rates. According to Weeks (2014), this Act was one of the main reasons for the Savings and Loan Crisis in the late 1980s.

[24] Deposit insurance is known as the Federal Deposit Insurance Corporation (FDIC) in the US and the Financial Services Compensation Scheme (FSCS) in the UK.

Despite the deregulation of financial markets, the Banking Acts of 1933 (Glass-Steagall Act) and 1935 served as the de facto basic banking legislation until the late 20th century. The Gramm-Leach-Bliley Act of 1999, in effect, repealed the Banking Acts by allowing commercial banks, investment banks, securities firms and insurance companies to consolidate. Consequently, there were no limits to the types of assets that deposit banks could hold (compared to other financial institutions). The Act amplified credit creation for real estate acquisition, which eventually led to the housing bubble followed by the GFC in 2007–8.

The GFC finally reversed the long trend of deregulation. The Dodd-Frank Act of 2010 contained similar elements to the Glass-Steagall Act, as it aimed to restore the separation of commercial banking from investment banking. The Act implemented the so called "Volcker Rule" to ban proprietary trading by deposit banks. Proprietary trading occurs when banks trade financial assets with their own money – as opposed to depositors' money – to make a profit for themselves. In addition, the Act also prohibited deposit banks from dealing in securities and derivatives, investing in hedge funds and private equity, and constructing a holding company structure with banking and trading subsidiaries. In fact, the Glass-Steagall and Dodd-Frank periods can be seen as mild versions of narrow banking (see Chapter 4) as they limit the types of assets that deposit banks can hold against their deposits and other liabilities. Those narrow banking periods are, however, not considered FRB as they do not limit the eligible assets of banks to government money or commodities.

Even though they were trying to achieve essentially the same goal, the complexity of regulation has exploded from the Glass-Steagall Act to the Dodd-Frank Act. The Glass-Steagall Act in 1933 was mere 37 pages while the Dodd-Frank Act in 2012 included over 9000 pages.

2.3 INTERNATIONAL

The world's first central bank was Sweden's Riksbank, established in 1668[25]. Nowadays, practically all currency areas have their own central banks. Central banks' core functions are also very similar across countries. Central banks have a monopoly on issuing notes (and reserves), function as the banker for the government and act as the lender of last resort. Central banks have the legal power to set reserve requirements and specify the assets (monetary base) by which such requirements need to be satisfied. Moreover, they typically provide the payment system infrastructure for final settlement and manage foreign exchange reserves.

[25] According to Goodhart (1987; 1993), a period of FRB preceded the establishment of the Riksbank. He argued that FRB collapsed in the face of commercial pressures. Consequently, the Riksbank was founded as the central bank of Sweden.

Regulation of private banking has also become very similar across countries. Private banks are allowed to create most of the money in all countries. To mitigate the problems arising from bank runs, the world's first deposit insurance was established in the US after the Great Depression. Now, the state guarantees bank deposits in practically every developed economy.

In general, monetary systems are surprisingly similar in all countries worldwide. One explanation for the homogenization could be imitation and learning as some convergence can be observed even when there was no international coordination.

However, international institutions have also had a significant impact on the development of homogenization. Although international institutions have no formal regulatory power on money creation and banking, countries rarely dare to diverge from the "standard". The cost of disregarding the recommendations of international institutions can be high due to market pressures (e.g. capital flight, loss of competitiveness or lack of investor confidence). If a country were to diverge – even without objective economic justifications – discouraging statements by international institutions and credit rating agencies would likely have adverse effects on the domestic economy. Thus, most countries decide to submit to the "standard".

Next, I will discuss the roles of the International Monetary Fund (IMF) and the Bank for International Settlements (BIS) on the observed convergence of monetary systems across the world. Furthermore, I will discuss the Economic and Monetary Union (EMU), which has obviously had a significant role in the convergence process in Europe.

International Monetary Fund

Three international institutions were established by Bretton Woods: the IMF, the World Bank (originally called the International Bank for Reconstruction and Development, IBRD) and the World Trade Organization (originally called the General Agreement on Tariffs and Trade, GATT). All these institutions continue to exist today. I will focus on the IMF as it is the most important in terms of money and banking.

The IMF was designated to coordinate international monetary arrangements. In Bretton Woods it was agreed that all countries would maintain a fixed exchange rate against the USD and the US agreed to fix the dollar against gold. This international gold standard worked from 1945 to 1971 and became known as the Bretton Woods system.

In operational terms the Bretton Woods system functioned as follows. All national central banks held accounts at the Federal Reserve, which settled payments between accounts. Reserves held at the Fed were redeemable in gold (although this claim was rarely redeemed). To maintain the system, countries used capital controls, interest rate management and quantitative and qualitative restrictions on bank lending.

The Bretton Woods era came to an end in 1971 when both France and Switzerland demanded payment of their reserves at the Fed in gold. The US unilaterally declared that it would no longer convert reserves to gold and the link between national currencies and gold was thereby abolished. Since then, most major currencies have floated against each other.

Nevertheless, the institutions established in Bretton Woods persisted. Surprisingly, contrary to what might have been expected, the IMF has probably more influence today than during the Bretton Woods era. Its role has been highlighted by conditioning its loans with structural adjustment programmes requiring harsh austerity, deregulation, privatization and liberalization measures.

Furthermore, the IMF is not only a fund that offers liquidity assistance to countries with balance-of-payment problems: it also issues Special Drawing Rights (SDRs). Thus, the IMF has effectively become a bank and its name as a fund is quite misleading[26]. Nevertheless, SDR are not really a currency. Instead, they are claims on currency for which they can be exchanged (in this sense they can be compared to bank deposits, which are also claims on currency). Currently, SDRs can be exchanged for US dollar, euro, UK pound and Japanese yen. Chinese yuan is in the process of being accepted as an SDR-convertible currency. Although SDR is not a currency per se, it is a unit of account, the value of which is determined by the four currencies mentioned above.

Regardless of globalization and convergence of monetary systems, there exists no international clearing house. Clearing of payments must take place within each currency area. To overcome the impracticalities associated to this arrangement, an international reserve currency and clearing house has been proposed. For instance, Davidson (2009) suggests reviving Keynes's proposal for the bancor as an international currency and underlines its potential to manage international current account imbalances. The Governor of the People's Bank of China, Zhou (2009), on the other hand, wants to reform the international monetary system and allocate a more prominent role for SDRs.

Bank for International Settlements

The BIS, often referred as the central bank of central banks, was established in 1930. Although it is mainly a discussion forum with no legislative power, it is a very important – if not the most important – institution in setting international standards for national banking systems.

The power of the BIS manifests most evidently through the Basel Accords. Although the Basel Accords are mere recommendations, most countries have

[26] Similarly, the name of the World Bank is misleading. It is not really a bank as it cannot issue deposits denominated in any currency. Instead, the World Bank can be classified as an other financial institution as it is an intermediary which mediates existing funds from lenders to borrowers.

implemented them directly into their legislation. Singer (2007) argued that the political environment was feasible for international regulatory harmonization in the late 1980s as there were several banking failures while foreign financial institutions were able to capture large market shares because of less stringent requirements.

Consequently, Basel I was agreed in 1988 and mostly implemented by the end of 1992 (see BIS 1988). The minimum capital requirement for banks was 4 % (Tier 1) and 8 % (total) of risk-weighted assets. Risk-weights varied across assets, for instance, 0 % for cash and domestic government debt, 20 % for mortgage-backed securities with AAA ratings, 50 % for mortgages and 100 % for corporate debt. For instance, AAA rated mortgage-backed securities required only 1.6 % (20 % x 8 %) of total bank capital while domestic government debt did not require any capital from banks.

Basel II was implemented by most major economies in 2008 (see BIS 2004; 2006). The minimum capital requirements were the same as in Basel I: 4 % (Tier 1) and 8 % (total) of risk-weighted assets. Unlike Basel I with its standardized approach, Basel II allowed for sophisticated statistical methods for calculating risk weights. Thus, it became less obvious how much capital banks needed for different types of assets and often they were able to significantly lower the risk weights compared to the standardized approach.

Basel III was a reaction to deficiencies in financial regulation revealed by the GFC and it is being gradually implemented from 2013–2019 (see BIS 2011). Minimum capital requirements were raised to 4.5 % (CET1), 6 % (Tier 1) and 8 % (total) of risk-weighted assets. In addition, Basel III introduced a capital conservation buffer of 2.5 %, which limits the dividends a bank can pay out of its profits. Moreover, regulators can activate a discretionary countercyclical capital buffer of up to 2.5 %[27]. Thus, the maximum total capital requirement can be 13 % of risk-weighted assets. Furthermore, systemically important banks are subject to 1–2.5 % additional capital requirement of risk-weighted assets to reflect their greater risks they impose on the financial system. Thus, systemically important banks can face up to a 15.5 % capital requirement compared to their risk-weighted assets.

Most importantly, however, Basel III introduced a minimum capital requirement of 3 % (Tier 1) of non-risk-weighted assets. This is meant to avoid the problems emanating from uncertainty in determining correct risk-weights. In fact, Basel III seems to fully adopt Minsky's (1986, ch. 13) suggestions for minimum capital-to-asset ratio and for mandatory retained earnings for banks to mitigate financial instability.

[27] In Lainà (2013) I calculated, following the recommendations of the BIS, whether the countercyclical capital buffer would have been activated prior to financial crises in Finland.

For the first time Basel III included liquidity requirements[28] to supplement capital requirements (see BIS 2013; 2014). The liquidity coverage ratio tries to ensure that banks hold sufficient liquid assets to cover outflows over 30 days while the net stable funding ratio[29] tries to secure stable funding over a one-year period of extended stress.

In addition to the countercyclical capital buffer, BIS (2012) has suggested capital, liquidity and asset-based macroprudential instruments. Those are meant to enlarge the discretionary toolkit available to regulators to tackle specific sources of potential instability. As capital-based instruments, BIS (2012) suggested dynamic provisions, which are bank-specific, and sectoral capital requirements (e.g. sectoral risk-weights to prevent sector-specific bubbles). As liquidity-based instruments, BIS (2012) suggested countercyclical liquidity requirements and margins and haircuts in markets. As asset-side instruments, BIS (2012) proposed loan-to-value caps, which set the minimum requirement for down payments for certain types of bank loans, while debt-to-income caps set the maximum amount for a bank loan in relation to the debtor's income.

International banking regulation has also become more complex. Basel I consisted of a mere 28 pages (BIS 1988), Basel II was 251 pages long (BIS 2004) and Basel III included multiple documents covering 169 pages (BIS 2011; 2013; 2014) and other complementary tools and documents (such as recommendations for new macroprudential instruments).

European Union

The EMU was established in three stages, beginning from 1990. In the first two stages convergence criteria concerning public finances, inflation rates, interest rates and exchange rates were introduced, capital controls were abolished, and the ECB was created.

The EMU entered its third and final stage in 1999 when the euro was adopted as the common currency. During the three-year transition period, euro was only an accounting currency until physical cash was introduced into circulation in 2002. By 2015 euro has been adopted as the official currency of 19 countries.

The framework for fiscal governance laid out in the Stability and Growth Pact in 1997 was reformed in the Six-Pack, Two-Pack and Fiscal Compact legislation between 2011 and 2013. The reforms set stricter limits for public deficits, increased monitoring and enhanced compliance. While the Maastricht Treaty limited actual government budget deficit to 3 % and

[28] According to Banerjee and Mio (2014), the liquidity requirements required by Basel III did not affect the real economy through reduced supply of loans or higher interest rates in any way, while banks adjusted both assets and liabilities towards higher liquidity.

[29] Kauko (2015) points out that the net stable funding ratio requirement might be potentially destabilizing when there is a substantial amount of foreign debt.

government debt to 60 % of GDP, the recent reforms limit structural government budget deficit to 0.5 or 1 % depending on whether government debt has breached 60 % of GDP.

The European Stability Mechanism (ESM) was established to provide instant financial assistance for the member states of the euro area in case of financial difficulty or banking crises. The ESM entered into force in 2012 and it replaced two earlier funding programmes: the European Financial Stability Facility (EFSF) and the European Financial Stabilisation Mechanism (EFSM). Receiving financial assistance from the ESM is, however, heavily conditional and subjects the member state to strict supervision.

Bank capital requirements have also been standardized in the EU. Bank capital was regulated by Capital Adequacy Directives, first issued in 1993. In 2007, Capital Requirement Directives superseded Capital Adequacy Directives. Most recently, in 2013, the Capital Requirement Directive and Regulation (CRD-IV/CRR) implemented Basel III to a large extent in the euro area.

Reserve requirements in the euro area are set by the ECB. The ECB decided to lower reserve requirements on demand deposits from two percent to one percent in 2012. There are no reserve requirements on time deposits.

The Banking Union of the EU, initiated in 2012, is another significant reform which aims to transfer the responsibility for banking from the national level to the EU level. The Banking Union consists of three initiatives: Single Supervisory Mechanism (SSM), Single Resolution Mechanism (SRM) and common deposit insurance. The SSM was implemented in 2014 as the ECB took over the supervision of large banks. The SRM introduced a common rulebook and fund for bank recapitalization and was implemented in 2016. Although common deposit insurance has not yet proceeded, the Deposit Guarantee Scheme Directive of 2014 established more uniform national deposit insurance schemes by harmonizing deposit insurance to 100 000 euros across the euro area.

As in the UK and the US, similar proposals and legislative initiatives to limit the functions of deposit banks have emerged also in Europe. Liikanen et al (2012), known as the High-Level Expert Group, wrote a report for the European Commission. While Independent Commission on Banking (2011) recommended ring-fencing commercial banking, the leading principle of Liikanen et al (2012) was ring-fencing trading from the rest of the economy. The report proposed subsidiarization, that is, placing proprietary and higher-risk trading activity in a separate legal entity. The report suggested forbidding deposit banks from dealing in securities and derivatives, investing in hedge funds and private equity and engaging in market-making. Although the EU seemed to be on its way to separate deposit and investment banks (which can be seen as a mild version of narrow banking not counted as FRB), the proposals of the High-Level Expert Group have faced resistance from large European banks and the legislation process is unlikely to proceed in the near future.

2.4 FULL-RESERVE BANKING EXPERIMENTS

This section investigates more closely the historical experiments with FRB. Specifically, this section examines economic developments around 1844 in the UK and 1863–64 in the US, when FRB was implemented. The FRB reforms in the UK and US were never really abandoned. Indeed, banks are still forbidden to issue their own notes (at least without fully backing them with government money). Nevertheless, banks were able to circumvent the FRB requirement by issuing deposits. Thus, today there are no societies running an FRB system.

Firstly, however, it is interesting that bank deposits seemed to have already emerged as an important medium of payment before FRB was implemented. According to the US Bureau of the Census (1975), in 1862, deposits already constituted two-thirds of the money in circulation while cash constituted only one-third. After FRB was implemented in the US in 1865, the figures changed to 80–20 % in favour of deposits. After a decade, the ratio had changed to 86–14 % for deposits.

According to data in Thomas and Dimsdale (2017), the situation in the UK was similar. There, a decade before FRB was implemented, half of the money supply consisted of coins and notes. In 1844, the numbers were already 62–38% for deposits and a decade later 69–31% for deposits.

Thus, banks substituted their privately issued bank notes quickly with deposits after FRB had been implemented. However, what is seldom recognized is that banks had already substituted the majority of the money supply with privately issued deposits before FRB requirements were imposed on bank notes. Thus, imposing FRB in the UK and the US was not such a radical reform as is sometimes described.

Now, I will begin with a description of economic developments in the UK and then proceed to the developments in the US. Before starting, however, it should be stated that it is hard to distinguish from crude macroeconomic data what effects were caused by FRB and what were caused by other factors. If, for example, there was an economic depression right after the implementation of FRB, the recession might have been caused by war, drought or other factors than FRB. However, historical examination can be helpful in ruling out certain possibilities. For instance, in the previous example we could not rule out the possibility that FRB would indeed have caused an economic slump. However, if the economy were to continue on its previous path, the argument that FRB would have caused a depression could be rejected quite confidently.

Thomas and Dimsdale (2017) provide long data series of macroeconomic variables for the UK. Real GDP grew very rapidly at 7.4% when FRB was implemented in 1844, although recovery from the previous years' depression had already begun in 1843, when real GDP grew by 3.4%. Nevertheless, the growth rate in 1844 was exceptionally high and real GDP continued to grow at almost 5 % in the following two years. Although it is difficult to attribute the high growth rate directly to FRB, it is quite reasonable to state that the

implementation of FRB did not have a detrimental effect on economic activity at least.

According to BIS (2016) data, inflation in the UK was volatile at the time. A decade before the implementation of FRB, annual inflation figures fluctuated from 15% inflation to 10% deflation. In particular, the UK suffered from deflation for four years before FRB was implemented – deflation climbing to 10% in the previous year. In 1844, when the Bank Charter Act implemented FRB, a modest inflation of 3.6% was achieved. Nevertheless, volatile inflation continued even after FRB was implemented. In the next year the UK experienced 2% deflation and in the following three years inflation climbed first to 4% and then to 18% before prices dropped by 19% in 1848. As consumer prices continued their volatile path, it seems that there is little evidence that FRB caused either inflation or deflation in the UK, but neither was the reform able to mitigate them.

Unfortunately, Thomas and Dimsdale (2017) do not provide data on credit aggregates around the implementation of FRB. However, a glimpse is revealed through the development of investments. Thomas and Dimsdale (2017) report that real investment started to pick up after FRB was implemented. This would imply that there was no lack of credit. On the contrary, investment boomed after FRB and that would indicate that there was plenty of funding available. It should, however, be stated that most investments were not necessarily financed with borrowed capital and thus there remains a small possibility that FRB could have limited credit availability, but other sources of funding (such as equity) more than compensated for it.

Interest rates did not become particularly volatile after FRB was implemented. According to data in Thomas and Dimsdale (2017), the interest rate on prime commercial paper did not become more volatile after the reform. Although the interest rate rose after the reform from 2% to 6% in three years, similar cyclical fluctuations can be observed before the reform and it is possible that the interest rate on commercial paper was in a trough when FRB was implemented. Indeed, if one compares it to the Bank Rate (i.e. the interest rate set by the Bank of England), there is no significant widening of the risk premium. Thus, it is possible that the prime commercial paper rate rose only because the Bank Rate rose in reaction to the wider economic situation, and not because of tighter credit availability – although that option cannot be ruled out either.

It seems that the adoption of an FRB system did not cause a capital flight in the UK either. According to data in Thomas and Dimsdale (2017), the UK exchange rate against the US dollar was extremely stable before the implementation of FRB and it remained so after the implementation. When FRB was implemented in 1844, the UK also recorded a current account surplus of 2% of GDP. Thus, there were more funds coming into the UK than going out.

Banks were not too busy redeeming their privately-issued notes from circulation after FRB was implemented. According to data in Thomas and

Dimsdale (2017) and the author's calculations (subtracting Bank of England notes in circulation from total notes in circulation), the growing trend of private bank-issued notes had already begun to decline in 1840. It is surprising that the declining trend paused when FRB was implemented in 1844 and over the following couple of years. One would expect the UK banks to speed up the redemption process. The temporary halt could, however, be because the UK economy was growing rapidly and therefore economic expansion increased the demand for bank notes even if banks themselves were eager to withdraw them from circulation.

It is less surprising that the amount of bank deposits surged when FRB was implemented. According to data in Thomas and Dimsdale (2017) and the author's calculations (deducing coin and total notes in circulation from M2 monetary aggregate), deposits grew by 10 % in 1844 and by 12 % in the following year. On the other hand, this surrogate measure for deposits had been very volatile in the past and double digit positive and negative numbers are not exceptional for the period. Thus, it is hard to be certain that the high growth figures of deposits were directly associated with FRB. The development is, nevertheless, consistent with the presumption that banks try to avoid the FRB requirement on notes by issuing other kinds of liabilities.

The US implemented FRB through the National Currency Act of 1863 and the National Banking Act of 1864. Fortunately, there is also data available for the US. I will go through the development of economic activity, inflation, money supply and credit in the US. It should, however, be recalled that FRB was implemented during the Civil War which, of course, had an enormous independent impact on the economy.

As in the UK, economic activity continued to expand rapidly during the implementation of FRB in the US. According to data in Philippon (2015), real GDP expanded by 9% in 1863 and by 6% in 1864. Nevertheless, there was a small drop of 3% in the real GDP in 1865, which was the final year of the Civil War. Based on the rapid economic expansion during the implementation years, it seems that FRB did not have a significant negative impact on economic activity.

Inflation picked up in 1863 and 1864, too. Consumer prices rose by 23% and 27% respectively. However, this is probably mostly due to the US government printing greenback dollars to fund war expenses. Indeed, according to US Bureau of the Census (1975), the amount of currency in circulation expanded rapidly during the first three years of the Civil War: 11% in 1861, 25% in 1862 and 54% in 1863. In the decade following the Civil War, total currency in circulation contracted by some 20%.

However, in the bigger picture the US returned to stagnating prices. Consumer prices had halved since the beginning of the century until the middle of the century and remained there until the Civil War. Even though consumer prices almost doubled during the Civil War (restoring the price level that prevailed at the beginning of the century), after the short inflationary spike, the US returned to its previous deflationary path. In fact, consumer

prices halved again by the end of the century, dropping to the level from before the Civil War.

Nevertheless, at least the US did not experience a chronic credit crunch. According to the US Bureau of the Census (1975), bank loans hardly changed in 1863 but dropped by 15% in 1864. A similar drop had previously occurred in 1858, although otherwise the bank loan stock developed quite smoothly in the pre-Civil War years. After the Civil War, bank loans expanded steadily over the rest of the century. It is possible that FRB caused a temporary credit crunch in 1864 although, as will be shown next, it is more likely that the drop in the loan stock was caused by defaults on existing debts rather than insufficient supply of credit.

According to data in Philippon (2015), there was no drop in the flow of debt to households in the US when FRB was implemented or over the following years. The stock of household debt developed smoothly except for a small temporary dip in 1864. However, the dip must be due to debt defaults (or repayments) rather than insufficient credit supply as the flow of debt to households remained strong in 1864.

Moreover, according to data in Philippon (2015), neither did interest rates shoot up. In fact, key interest rates declined steadily during and after the implementation of FRB. Consequently, there is little evidence that FRB caused a credit crunch or excessively volatile interest rates in the US.

This section examined the economic developments in the UK and US after FRB was trialled in the 19th century. It turned out that there were no dramatic changes in macroeconomic indicators during or after the implementation of FRB even though it was implemented in the US during the Civil War. In fact, many macroeconomic indicators pointed more to positive than negative effects during the implementation process of FRB. Perhaps one reason why FRB did not have a more significant impact was that banks had already substituted most bank notes (issued by private banks rather than the government) with bank deposits before FRB was imposed, although the rate of substitution clearly accelerated after the reform.

3 THEORIES OF MONEY CREATION AND BANKING

Basically, there are two approaches to explaining the money creation process in the modern economy. In the exogenous money approach, reserves are first injected by the central bank and then lent on by commercial banks. In the endogenous money approach, loans are first extended by commercial banks and then backed by reserves acquired from the central bank.

The origins of the debate over whether money is exogenous or endogenous can be traced back to the Currency school and the Banking school in the early 19th century. The Currency school argued for exogenous money, while the Banking school maintained that money is endogenous. Today, the exogenous money approach is commonly taught in mainstream economics textbooks, while the endogenous money approach is supported by econometric data and widely adopted by scholars working in the field of macro-finance.

This chapter's five sections cover the theoretical approaches to money and banking. The first section presents the exogenous money approach and how mainstream equilibrium mechanisms build on it. The second section presents some evidence for endogenous money and how money creation is constrained. It also discusses how the mainstream position that money is neutral in the long run was saved under endogenous money. The third section presents the Monetary Circuit Theory, which maintains that money is endogenous and focuses on private money creation. The fourth section presents the Modern Monetary Theory, which also builds on endogenous money but focuses on government money creation. Finally, the fifth section discusses how money and banking are theorized in GPE. While this chapter focuses solely on money and banking, Sections 7.3 and 7.4 discuss economic theories more broadly before making use of them in Chapter 8.

3.1 EXOGENOUS MONEY

This section presents the exogenous money approach, also known as the monetary theory of credit. Although nowadays theories based on exogenous money are widely rejected in state-of-the-art economic models (both mainstream and heterodox), they are still presented in standard economics textbooks and sometimes repeated even by distinguished economists who have not specialized in macro-finance. Therefore, it is worthwhile to recognize these theories, their applicability and their implications. The next two subsections present the Quantity Theory of Money and the Money Multiplier Theory, which can regularly be found in standard economics textbooks. The third subsection presents the mainstream's two equilibrium mechanisms, which have been used for defending the neutral money axiom.

3.1.1 QUANTITY THEORY OF MONEY

The Quantity Theory of Money was used to justify the neutrality of money. That is, it argued that, at least in the long run, the amount of money would only affect the price level and not the real economy. The Quantity Theory of Money is based on the following equation:

$$M \times V = P \times Y \quad (1)$$

where M is the money supply, V is the velocity of money, P stands for the price level and Y is the value of transactions (which is assumed to correspond the level of real output). The equation above is not contested as it is an identity and, thus, always true by definition.

What was contested and nowadays refuted by almost all economists are the assumptions and the consequences that quantity theorists of money build upon the above equation. They assumed that the velocity of money is constant and real output is at its "natural" (potential) level. Moreover, it was assumed that causality runs from the money supply to the price level and not vice versa.

In addition, it was assumed that the money supply is under total control of the central bank. All this led the quantity theorists of money to conclude that the money supply determines the price level with no impact on the level of real output or employment in the long run. In other words, inflation is solely due to too much money. Symmetrically, deflation is caused by insufficient money. Nevertheless, it should be noted that neither inflation nor deflation should have any effects on the real economy and thus these economic phenomena should be, in this respect, irrelevant.

Quite shortly after the monetarist experiments of the 1980s, it became obvious that the monetary economy is more complex than the Quantity Theory of Money implied. Both real output and the velocity of money were not constant but seemed to react to changes in the money supply (or the money supply reacted to changes in real output and the velocity of money). Although the Quantity Theory of Money was abandoned, the Money Multiplier Theory was able to maintain that the money supply is ultimately controlled by the central bank.

3.1.2 MONEY MULTIPLIER THEORY

Another exogenous money approach regularly encountered in standard economics textbooks is the Money Multiplier Theory. For instance, Krugman and Wells (2006, 730-733), Sloman (2006, 496-497) and Samuelson and Nordhaus (2009, 464-465) offer this explanation for money creation. Although it elaborates on the exogenous money creation process, the Money Multiplier Theory does not include any substantive claims on the broader economic implications of money (e.g. whether its creation boosts economic activity or inflation).

The idea behind the Money Multiplier Theory is that a given amount of cash (or central bank reserves) is deposited in a bank, which must hold in its vaults a percentage indicated by the reserve requirement. The bank can lend out the rest of the initial deposit. Then, the economic agent receiving the loan makes a payment to another agent (e.g. paying for a house), who deposits the money in another bank, which again holds the amount indicated by the prevailing reserve requirement in its vault while lending out the rest. This process continues until the leakage to reserves (in a more sophisticated version, also to holdings of cash) is equal to the amount of the initial cash deposit.

More formally, the money multiplier gives the maximum ratio of money that commercial banks can create (lend out) given the required reserve ratio. It is given as:

$$MM = \frac{1}{RR} \tag{2}$$

where *MM* is the money multiplier and *RR* is the required reserve ratio. For instance, in the euro area the required reserve ratio is currently one percent and, consequently, the money multiplier is 100. The amount of money that commercial banks can create is:

$$M = MM \times R \tag{3}$$

where *M* is bank deposits and *R* is central bank reserves.

The money multiplier can be defined either theoretically or statistically, in which case it is based on empirical measures of the money supply. As a statistical measure, the money multiplier is not controversial as it simply indicates the ratio between bank deposits and reserves.

Theoretically, however, the money multiplier implies that reserves ultimately determine the money supply. In other words, central banks can effectively control the money supply that commercial banks create.

Although some textbooks have expressed reservations about this mechanical relationship after the GFC, they preserve the fundamental idea that money is exogenous. For instance, Samuelson and Nordhaus (2009, 487) argue that in financial crises the money multiplier relationship can break down as banks accumulate excess reserves. Nevertheless, they argue that even though the central bank cannot force the money supply to grow, it can force it to shrink.

The Money Multiplier Theory implies three things:

1) Banks have to wait until someone puts money (usually assumed to be in the form of cash) into a bank before they can make loans.
2) The central bank has ultimate control over the total amount of money in the economy. It can control the amount of money by changing either the reserve ratio or the amount of base money.

3) The money supply cannot grow out of control, unless the central bank allows it to.

Although distinguished scholars such as Sargent and Wallace (1981) believed in the Money Multiplier Theory, it has been dropped from recent advanced economic literature. Nevertheless, the idea is still propagated in many standard economics textbooks (e.g. Krugman and Wells 2006, 730–733; Sloman 2006, 496–497; Samuelson and Nordhaus 2009, 464–465). The next subsection will introduce two well-known equilibrium mechanisms build on exogenous money.

3.1.3 MAINSTREAM EQUILIBRIUM MECHANISMS

In the mainstream literature, money is neutral in the long run. This means that real variables such as output and employment are not affected by money. This phenomenon is known as the classical dichotomy between real and nominal variables. After the Quantity Theory of Money was abandoned, at least two types of equilibrium mechanisms based on exogenous money remained to justify the long-run neutrality of money.

The first explanation is based on the interest rate mechanism. For instance, Wicksell (1898), Robertson (1934) and Ohlin (1937), building on Loanable Funds Theory[30], argue that when the private sector's willingness to save increases and aggregate demand is thus reduced, interest rates are lowered as economic agents have excess funds which can be lent. As the interest rate is lowered, economic agents are assumed to be more willing to invest and, consequently, the natural level of output and employment are automatically restored. The same logic works also the other way around when there is a shortage of funds.

Behind the interest rate mechanism is the concept of the natural rate of interest. The natural rate of interest is the interest rate compatible with the natural level of output and employment. The natural rate of interest can establish the long-run neutrality of money.

However, particularly in deflationary crises, the natural rate of interest can be negative. Cash provides a safe asset with zero interest and thus sets the zero lower bound on the interest rate, causing a potential liquidity trap. In other words, the interest rate mechanism cannot restore the natural level of output in all circumstances. Therefore, the mainstream needed another equilibrium mechanism.

The second mechanism is the real balance effect. It is also known as the Pigou-Patinkin effect following Pigou (1943) and Patinkin (1965). According to this logic, when the price level drops, the real value of money rises. Therefore, after a deflationary shock more real output can be bought with the

[30] In the Loanable Funds Theory banks can create money out of thin air. This "forced saving" then affects the market interest rate, which is the only interest rate in the economy.

same amount of money. As the real value of money increases, consumption increases (i.e. real money balance enters the consumption function) and ultimately the natural level of output and employment is restored again.

The next section will explore the endogenous nature of money, which is accepted almost universally today. The section also discusses how the long-run neutrality of money is rescued in the mainstream literature after endogenous money refuted the mainstream's equilibrium mechanisms, discussed in this subsection.

3.2 ENDOGENOUS MONEY

Today most advanced macro-financial economic literature (both mainstream and heterodox) recognizes that money is endogenous even though this is not the case in undergraduate and graduate textbooks. The endogenous money approach holds that the money supply is determined endogenously by the banking sector, rather than exogenously by the central bank. Theories building on endogenous money reverse the causality of theories building on exogenous money and argue that money comes into existence as it is needed by the real economy and that banking system reserves are enlarged or drained as needed to accommodate the demand for lending at the prevailing interest rate. Basically, as long as banks find lending profitable while borrowing at the interest rate set by the central bank, then the reserves necessary to support the lending will automatically be supplied by the central bank.

Theories building on endogenous money are sometimes called credit theories of money (in contrast to monetary theories of credit, which are based on exogenous money). The name comes from the idea that in a pure credit economy no "money" is needed to settle payments as debts and claims cancel each other out over time.

The first subsection presents the logical arguments, empirical findings and central bank statements for money being endogenous rather than exogenous. The second subsection discusses the constraints on money creation under endogenous money. The third subsection discusses endogenous money in the contemporaneous mainstream literature and how long-run neutrality of money is rescued in this framework.

3.2.1 EVIDENCE

This subsection presents logical arguments, empirical findings and central bank statements to support the endogenous nature of money. As already mentioned, logical arguments to refute the exogenous money approach and support the endogenous money approach have been put forward since Thomas Tooke (1838) and the Banking school. Basil Moore (1988) probably presented the best-known logical defence of endogenous money.

Moore (1988) refuted the exogenous money approach by arguing that there is a trade-off between controlling the quantity of money and setting the interbank interest rate[31]. Wray (2000) elaborated on Moore's argument by pointing out that if the central bank started to limit the quantity of money, it would necessarily mean that banks, unable to get access to reserves through the discount window, would need to acquire them from the interbank markets. This, in turn, would mean that the demand for central bank reserves would exceed their supply. Consequently, there would be pressure to raise the interbank interest rate. Wray (2000) argued that, to keep the interest rate unchanged, the central bank would be forced to supply more reserves to banks. Thus, the central bank would lose its ability to control the quantity of money. In other words, the exogenous money approach cannot possibly hold in a world where central banks have an interest rate target.

Since the late 1980s, practically all major central banks have adopted an interest rate target. Thus, it should be obvious that money is endogenous today. However, according to Moore (1988, 103), the exogenous money approach did not hold in practice even when central banks set the quantity of money as an explicit target.

Monetarism was a series of attempts to make money exogenous in the late 1970s and early 1980s. When commercial banks had extended credit, central banks were always willing to supply the necessary reserves and, hence, the actual growth rates of specified money aggregates continually overshot their targeted range. Had the central bank not provided the needed reserves, it would have initiated a liquidity crisis as banks would have been unable to fulfil their reserve requirements.

Hence the monetarist experiments failed. They assumed that banks need reserves to lend, while in practice banks lend and then obtain the required reserves. In other words, monetarists applied exogenous money theoretically in an institutional setting in which money was still fundamentally endogenous.

Nevertheless, according to Moore (1988, 84), the main argument for abandoning the exogenous money approach is that it leads to a misunderstanding of how changes in the stock of credit money occur. Most importantly, the critical role of changes in the demand for credit is completely obscured. According to Moore (1988, 84), contrary to reality, public's asset and debt preferences are supposed to be irrelevant, except if they alter their cash to deposit ratios, that is, their liquidity preference changes. Also, for instance, Charles Goodhart (1984), who is a member of the Monetary Policy Committee in England and chief advisor to the Bank of England, and Marc Lavoie (2003) have debunked the exogenous money approach.

Perhaps the best-known empirical challenge to the exogenous money approach came from Kydland and Prescott (1990). The findings of Kydland and Prescott (1990) seemed to support the perception that money is

[31] The interbank interest rate is known as the Federal Funds Rate in the United States and Euribor in the euro area.

endogenous. They showed that the central bank does not control the business cycle by controlling the monetary base:

> *There is no evidence that either the monetary base or M1 leads the cycle, although some economists still believe this monetary myth. Both the monetary base and M1 series are generally procyclical and, if anything, the monetary base lags the cycle slightly. […] The difference M2–M1 leads the cycle by even more than M2, with the lead being about three quarters.*

Other empirical studies have supported their findings. Recently, for instance, Carpenter and Demiralp (2012) and Werner (2014) show that the theoretical money multiplier mechanism does not exist in the real world.

Central banks around the world have recently argued quite explicitly that money is endogenous. For instance, in the Bank of England's publication "Money creation in the modern economy" McLeay et al (2014b, 2) refute the exogenous money approach:

> *One common misconception is that banks act simply as intermediaries, lending out the deposits that savers place with them. […] Another common misconception is that the central bank determines the quantity of loans and deposits in the economy by controlling the quantity of central bank money — the so-called 'money multiplier' approach.*

McLeay et al (2014b, 8) support the endogenous money approach:

> *The supply of both reserves and currency (which together make up base money) is determined by banks' demand for reserves both for the settlement of payments and to meet demand for currency from their customers — demand that the central bank typically accommodates. This demand for base money is therefore more likely to be a consequence rather than a cause of banks making loans and creating broad money. This is because banks' decisions to extend credit are based on the availability of profitable lending opportunities at any given point in time. […] [I]n reality, the theory of the money multiplier operates in the reverse way to that normally described.*

Similar statements are put forward in the BIS publication Disyatat (2008). The most developed form of mainstream economics, known as new consensus macroeconomics (or the new monetary consensus), also acknowledges the endogenous nature of money (see e.g. Svensson 1999, Taylor 1999 and Woodford 2003). [32]

[32] Jakab and Kumhof (2015) argue that cutting-edge DSGE models include banks and admit that no financial saving is required for banks to make loans as loans create deposits. However, those models rely on a fundamentally non-monetary view of the economy as they are built on

In sum, there seems to be a shared understanding among high-level academics and central bankers that money is endogenous today, although this is not always evident to economists working outside the modern macro-financial field or writing elementary textbooks.

Nevertheless, it is less clear whether money is inevitably endogenous, even among post-Keynesian scholars. Some post-Keynesian authors, for instance, Fontana and Sawyer (2016) argue that money is endogenous by nature. Rochon and Rossi (2013) go even further, arguing that money has always been and cannot be anything but endogenous. Other post-Keynesian authors, for example Chick (1986), maintain that money is endogenous today by institutional design, but it was previously exogenous and it can be made exogenous again if institutions choose to do so.

3.2.2 CONSTRAINS ON MONEY CREATION

After it is recognized that money is endogenous, it does not follow that banks are free to create unlimited amounts of money. Although central bank reserves might be an inefficient tool to constrain bank lending, there are other restrains on banks' money creation. This subsection summarizes why reserves are unable to curb money creation by banks before presenting other constraints on banks' money creation. Finally, it presents accommodationist and structuralist views that disagree on how much monetary policy can influence money creation by banks.

As long as money is endogenous, reserve requirements do not impose any direct limit on bank lending. The endogenous money approach holds that commercial banks are not generally constrained by insufficient reserves. Banks can always acquire the reserves needed to extend credit either directly from the central bank (discount window) or indirectly from the interbank markets. In other words, under endogenous money, the central bank always accommodates the demand for reserves (and cash). For example, BIS economist Disyatat (2008) and Godley and Lavoie (2012, 357-360) argue that reserve requirements should be considered a tax on banks.

There are two more reasons why adjusting reserve requirements are an inefficient tool for influencing bank lending. First, to the extent that payments are made between customers of the same bank, no extra reserves will be required. The more a banking system is dominated by a few large banks, the greater the number of payments that can be made across the banks' own books

---

the "intermediation of loanable funds" approach. According to Jakab and Kumhof (2015), mainstream economic models implicitly assume real saving (goods are deposited in banks) as a precondition for banks to make loans. As real saving requires previous production and thus takes time, those models predict far smaller and slower changes in bank lending and less significant effects on the real economy than more realistic models (that are more in line with empirical observations) which do not require previous real saving.

and the less that banks will need central bank reserves to make payments to each other.

Second, if banks grow their lending at similar rates, and flows of deposits between banks are fairly balanced, then banks can increase their lending considerably while requiring no or very little additional reserves. As Keynes (1930a) explained:

> *It is evident that there is no limit to the amount of bank money which the banks can safely create provided they move forward in step. [...] Every movement forward by an individual bank weakens it, but every such movement by one of its neighbour banks strengthens it; so that if all move forward together, no one is weakened on balance.*

Keynes argues above that lending too much might cause illiquidity problems for an individual bank as more reserves would be transferred to other banks than it receives payments from other banks. That is, when an individual bank creates deposits, it is very likely that some of the additional deposits are transferred to other banks and those need to be cleared with reserves. However, if other banks also increase their lending, there will be no liquidity problems as this will likely increase the reserves that are transferred back to the individual bank too.

Generally, central bank reserves do not accumulate in some banks while other banks run short. However, even if they did, it would not pose a problem nowadays. As shown in the previous subsection, central banks are more than willing to provide all the required reserves for banks through the discount window. Thus, the funding gap (difference between loans and deposits) on the bank level can be closed with wholesale funding (i.e. borrowing from interbank market or from central bank). Therefore the behaviour of other banks does not impose any meaningful limits on banks' money creation today.

Then what does constrain banks' ability to create money if not reserves? The short answer is banks' own perception of the creditworthiness of borrowers. There are, however, other constraints as well – although their effectiveness can be debated. For instance, Tobin (1963) had discussed the constraints in the 1960s. The same constraints were mostly repeated in the Bank of England's paper "Money creation in the modern economy", authored by McLeay et al (2014b).

They argue that at least three things constrain banks' ability to lend and thus create money. First, monetary policy can influence money creation by manipulating interest rates. Second, banks must fulfil regulatory capital requirements and lending must be profitable (few credit losses). Third, the behaviour of the money holders can affect the money supply as they can, for instance, pay down their bank loans and thus destroy money. Phillips (1994a) adds that which assets the central bank is willing to discount is also important. Nevertheless, some of these measures might prove inefficient.

Through adjusting the price of reserves (setting the policy interest rate), the central bank can indirectly influence banks' incentives to lend. However,

according to Sigurjonsson (2015), this indirect channel can be inefficient. Raising the interest rate to curb lending can increase foreign demand for domestic currency, which can strengthen the exchange rate, making imports less expensive and cause a trade deficit. Raising the interest rate can also increase debt servicing costs and make the existing level of debt unsustainable. Furthermore, "irrational exuberance" can continue for quite some time even after higher interest rates have been introduced until reality strikes. Because of these and various other side-effects, the central bank's ability to influence bank lending by adjusting the policy interest rate is limited.

Capital requirements rarely impose a binding limit on bank lending. Moreover, banks' capital often develops procyclically. That is, during booms, when lending should be curbed, banks make large profits that allow them to lend more. Similarly, during busts, when banks should be encouraged to lend more, banks' profits fall, which can constrain their ability to lend.

Basel III introduced new macroprudential instruments such as countercyclical capital buffers, which may be able to tackle the procyclical tendency of bank lending (see, e.g., Lainà 2013 for how it would have been implemented in Finland). Nevertheless, the new tools might be undermined by banks' ability to raise additional capital during booms. During boom periods, banks' profits are often high and this leads to a higher return on equity, and thus an increase in the price of banks' shares. Therefore, banks are unlikely to face major difficulties in satisfying higher capital requirements during booms. Securitization is another way for banks to undermine the countercyclical capital buffer. By packaging loans and selling them forward (known as originate-and-distribute business model in contrast to originate-and-hold), banks can free up capital that was previously held to cover potential losses on the loans.

Credit controls proved to be an effective way to prevent debt bubbles. However, credit controls have become an unorthodox monetary policy tool since the deregulation of the financial markets in 1980s. For instance, according to Kari (2016, 23), Finland gave up the upper limit on bank lending in 1986. Since then, practically no developed country has dared to impose direct credit controls on banks. In fact, in the recession followed by the GFC banks have been encouraged to lend through various ways (e.g. funding for lending schemes in the euro area and the UK).

Although nowadays most economists agree that money is created endogenously, there exist two perspectives, known as the accommodationist view and the structuralist view. The accommodationist view maintains that central banks are always willing to fully accommodate the commercial banks' need for reserves. In addition, it suggests that the money supply is not controlled through the monetary base, but through interest rates. Thus, the supply curves of reserves and deposits are horizontal in money-interest space as in Moore (1988). The supply curve of reserves is horizontal at the interbank rate, while the supply curve of money is horizontal at the interbank rate plus a markup.

The structuralist view, on the other hand, holds that central banks do not fully accommodate the necessary reserves. It also holds that central banks can exert some control over the money supply through the monetary base, if they choose so, but conclude that they mostly do not. Thus, the supply curves of reserves and deposits are upward sloping in money-interest space. Palley (1996) provides a formal presentation of how reserves, loans, deposits and interest rates on reserves and loans are determined according to accommodationist and structuralist views.

Although accommodationist and structuralist views may seem to be contradictory, they can both be accurate descriptions as time is not included in the money-interest diagram. Thus, whether such figures depict the relationship between the quantity of money and the rate of interest in terms of supply and demand *at* some point in time or *over* some period of time is ambiguous.

The accommodationist view could be an accurate description of the short run, while the structuralist view could be a plausible explanation of the intermediate run. In the short run, banks may be able to borrow without restriction from the central bank at the prevailing interest rate, but in the intermediate run the central bank can react to observed changes in the money supply and adjust the interbank interest rate to encourage or mitigate bank lending. Therefore, accommodationist and structuralist views can be complements rather than substitutes. Although there still seems to be some dispute over which view of endogenous money is correct, accommodationist and structuralist views agree that money, regardless of the details, is endogenous today.

3.2.3 MAINSTREAM'S EQUILIBRIUM "MECHANISMS" RESCUED

For a long time, money has been endogenous in post-Keynesian literature, but nowadays even mainstream economics has adopted the endogenous approach to money. Under endogenous money, however, the mainstream's equilibrium mechanisms presented in the previous section cannot hold. Nevertheless, mainstream economics can hang onto the long-run neutrality of money by modifying its equilibrium mechanisms creatively. Mainstream economists see the Taylor rule as the new "interest rate mechanism" and fiscal policy as the new "real balance effect".

As Ahokas and Holappa (2014) argue, neoclassical equilibrium mechanisms, particularly the interest rate mechanism and the real balance effect, cannot hold under endogenous money. The interest rate mechanism maintains that the natural level of output would be restored as low (high) demand would cause interest rates to decline (to increase), which boosts (reduces) investment. The interest rate mechanism relies on the Loanable Funds Theory, which admits that banks can create money, but the money supply is assumed to be exogenous. The Loanable Funds Theory is a theory of interest rate determination, so in order to allow the interest rate to be

determined endogenously the money supply must be exogenous. As this section has shown, this clearly cannot be applicable under the current endogenous monetary system.

The real balance effect maintains that during deflation the natural level of output would ultimately be restored as the real value of money would increase. Kalecki (1944) pointed out early on that Pigou's real balance effect focused only on money and ignored its counterpart – debt. Even if the real value of money increased, the real value of debt (which is the counterpart of money when issued through loans) would also increase. Thus, in a deflationary situation the real value of money might increase but so would the real value of debt, which again would reduce investment and consumption. Pigou's error was to assume that the nominal money stock would be constant and independent of bank loans. Thus, the equilibrium mechanisms cannot solve the problems arising from debt-deflation first depicted by Irving Fisher (1932; 1933).

Even though cutting-edge mainstream economics, known as new consensus macroeconomics, does acknowledge the endogenous nature of money, it is able to hang on to the long-run neutrality of money through innovative modifications to the equilibrium mechanisms. The new consensus macroeconomics models can do this with the theoretical concept of the non-accelerating inflation rate of unemployment (NAIRU) (see e.g. Phelps 1994). The point is to show that demand does not determine the long-run level of output or employment. Instead, they are determined purely by supply.

The neutrality of money requires a stable NAIRU. However, Joan Robinson (1956) has argued that the NAIRU follows the actual unemployment rate and is therefore endogenous. This phenomenon is known as hysteresis. There are several reasons for this: for example, unemployment may cause skills dilution and stigmatization. This means that money cannot be neutral in the long run as demand can influence the NAIRU.

Furthermore, Sawyer (2001) has criticized NAIRU for not being a strong attractor point: that is, the unemployment rate would not always tend towards it. Instead, he argues that the unemployment rate would need to be steered towards NAIRU by active policy.

Nowadays, the natural rate of interest is the interest rate compatible with NAIRU. In other words, to achieve NAIRU the interest rate in the economy must be equal to the natural rate of interest. This contrasts with the original concept by Wicksell (1898), who defined the natural rate of interest as compatible with zero inflation.

This leads us to interest rate manipulation by the central bank, which is an inseparable part of new consensus macroeconomics. In new consensus macroeconomics the central bank follows the well-known Taylor rule[33] in setting the short-term interest rate. According to Pilkington (2014), new

[33] The Taylor rule informs how much the central bank should change its policy interest rate in reaction to changes in observed inflation and output.

consensus macroeconomics implicitly assumes that the interest rate target would be the natural rate of interest. Thus, the Taylor rule is able to replace the previous interest rate mechanism. However, as Ahokas and Holappa (2014) argue, a central bank operating under a Taylor rule is not a market mechanism any more but a conscious and pre-determined monetary policy.

Even then the economy could end up in a liquidity trap. As the real balance effect cannot be functional under endogenous money, there is no automatic way out even when the central bank is allowed to operate under a Taylor rule. Put differently, there are no market mechanisms able to provide the natural level of output. Instead, mainstream economics admits that fiscal policy is also needed to steer the economy towards the natural level of output.

After admitting that money is endogenous, mainstream economics is still able to save the idea that money is neutral in the long run. To achieve this conclusion, it cannot rely on market *mechanisms* but requires conscious monetary and fiscal *policy*. Instead of endogenous money, the natural rate of interest seems to be the key concept which has allowed mainstream economics to defend the neutrality of money for over a century. Indeed, according to Pilkington (2014), the distinguishing feature between mainstream and post-Keynesian monetary theory is the natural rate of interest.

Holappa (2012) argues that mainstream economic theory has been able to stick to the idea of neutral money although the justifications have varied over time. He argues that both the gold standard and disciplinary neoliberalism are global modes of regulation that constrain government spending by restricting the ability of governments to finance their deficits from their central banks. According to Holappa (2012), disciplinary neoliberalism will probably be practiced as long as the hegemonic economic theory is built on the long-run neutrality of money.

Challenging a hegemonic idea, however, is difficult. Following Gramsci (1971), hegemonic power is the most effective form of governance as a hegemonic idea has lost its openly political nature. A hegemonic idea cannot be contested either on moral or political grounds. Holappa (2012) argues that the only way to defeat a hegemonic idea is to show that it does not actually hold. That is, the hegemonic idea can be challenged by showing that it is not operationally binding. However, even in this case it is uncertain whether people are willing to abandon the idea as they have become accustomed to seeing the world through the lens of that very idea.

This thesis rejects the long-run neutrality of money and builds upon post-Keynesian economic theory[34], in particular the Monetary Circuit Theory and the Modern Monetary Theory. Both discard the natural rate of interest as an interest rate theory and build on the liquidity preference theory instead. The next section will present the Monetary Circuit Theory, which focuses on the creation, circulation and destruction of bank deposits. The last section of this chapter will present the Modern Monetary Theory, which conversely deals

[34] For an excellent overview of post-Keynesian economic theory, see Lavoie (2015).

with the hierarchy of different types of money and argues that government money (currency) is at the top of the pyramid.

3.3 MONETARY CIRCUIT THEORY

This section presents the Monetary Circuit Theory (MCT), which focuses on how production takes place from the perspective of money and debt. Therefore, it is also known as the Monetary Theory of Production. As should be obvious by now, money is endogenous in the MCT. The MCT focuses on private money creation while the Modern Monetary Theory, which will be presented in the next section, focuses on government money creation.

3.3.1 THEORETICAL DEVELOPMENT

The roots of the MCT are deep. The circular approach to money and production can be traced back to Marx and Engels (1885) at least. Although money was exogenous in Marx's work, he highlighted the circular function of money. In the second volume of *Capital*, subtitled "The Process of Circulation of Capital", Marx and Engels (1885) identified the MCT in the famous equation:

$$M \rightarrow C \ldots P \ldots C' \rightarrow M' \tag{4}$$

in which $M \rightarrow C$ stands for the use of money capital to purchase labour power and means of production (equipment and raw materials), which are then used in stage P to produce a product which is then sold for money in the final stage $C' \rightarrow M'$. The difference between C and C' is the surplus value added during production.

Wicksell (1898) is also often cited as an early contributor to the MCT as he recognized the endogenous nature of money (although he focused mainly on the natural rate of interest and market interest rate determination). Schumpeter (1911) clearly understood the circular role of bank credit and its effects on economic development.

In the *Treatise of Money,* Keynes (1930a) saw money as endogenous, as banks could advance credit to firms in order to start the production process. Later, in the *General Theory,* Keynes (1936) reverted back to the exogenous approach to money as money was mainly a store of value. Nevertheless, in the *General Theory* Keynes (1936) depicted a monetary production economy in which money, although exogenous, played an important role.

Early attempts to build a general macro-monetary circuit came from Bernard Schmitt (1960) and Jaques Le Bourva (1962). The modern version of the MCT is the Franco-Italian approach developed by Alain Parguez (1975; 1984; 1996) and Augusto Graziani (1977; 1984; 1989). The iconic presentation of the MCT is generally considered to be given by Graziani (2003).

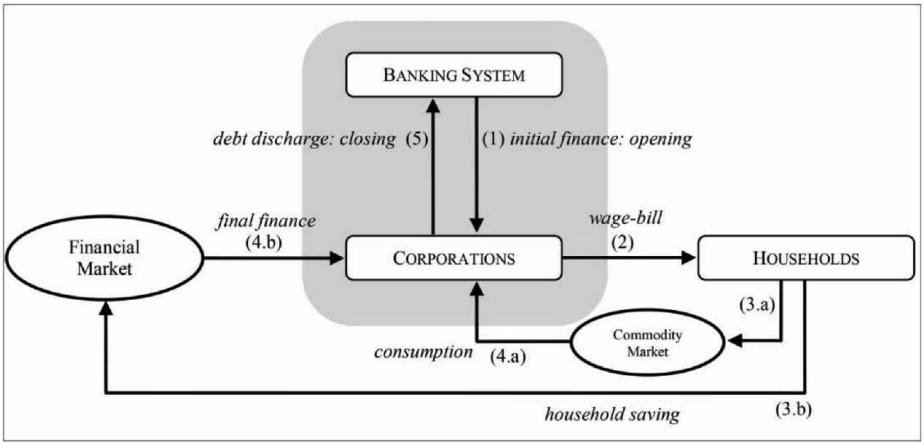
Originally known as the Franco-Italian approach, the MCT has also been incorporated into post-Keynesian economics, developed by Keynes's pupils such as Nicholas Kaldor, Joan Robinson and Michal Kalecki. For instance, contemporary post-Keynesians such as Godley (1999b), Lavoie (1987; 2004), Rochon (1999), Keen (2009) and Zezza (2012) embrace the MCT.

As it recognizes that all financial flows must come from and go to somewhere, the MCT also contributes to sectoral balance analysis and SFC modelling. Indeed, Godley and Lavoie (2012, 47-56) illustrate some aspects of the MCT in an SFC framework (the SFC modelling technique will be introduced in Chapter 7).

3.3.2 MAIN REPRESENTATION

This subsection presents the MCT following Graziani's (2003) seminal work. Graziani (2003) argued that the role of money is to enable the circulation of commodities, but money also determines the level of production and consumption as well as influencing the distribution of income. According to Graziani (2003), the term "monetary circuit" draws its origin from the fact that the theory studies the complete life cycle of money: from its creation by the banking system, via its circulation in the market, to its destruction at the time of repayment.

The fundamental insight of the MCT is that banks create money out of thin air when they make loans – without any need for previous savings. As banks also settle payments, all transactions in a monetary economy involve three parties: a seller, a buyer and a bank.



Source: Passarella (2014)

Figure 1 Monetary Circuit Theory Illustrated

The MCT by Graziani (2003, 26-31) is depicted in the figure above. The stages are:

1) The monetary dynamics begin with a decision by banks to grant credit to firms. This is known as *initial finance*.
2) Credit enables firms to start a production process. With the borrowed money, firms can pay households for producing commodities.
3) Households spend a part of their income on produced commodities (a). Instead of consuming all their income, households can also decide to save (b).
4) Money is returned to firms either through the commodity market (a) or through the financial market (b). *Final finance* refers to the securities issued by firms, which ultimately finance investment by the end of the production period.
5) Now, firms can use the returned money to repay their debts to the banks.

In the basic MCT the function of banks is to provide credit for firms to start the production process. Conversely, the function of other financial institutions (securities market) is to allow firms to recover the liquidity they inflated in the circuit at the beginning of the period.

As bank lending creates money, the repayment of bank loans similarly destroys money. Thus, when firms repay their loans to banks, the circuit is closed. As a result, the balance sheet of every economic agent is at its initial value, which is zero. However, the temporary existence of bank credit created real economic transactions, thus leaving the economy better off than it would have been without the temporary credit extension.

The demand for and supply of credit is assumed to be affected mainly by future prospects (including current indebtedness) to service and repay debt. For example, if a firm expects to make enough profit from a potential investment after servicing and repaying the debt needed to finance the investment, the firm will most likely demand credit. If a bank also assesses that the firm will be able to carry out the payments related to the potential debt, the bank will most likely supply credit.

3.3.3 CRITIQUE

In the simple model described above, the circuit closes only if some underlying assumptions are satisfied. The first dilemma consists of interest payments. In the general model Graziani (2003) assumes interest payments away but acknowledges them as a problem. Graziani (2003, 31) argues that part of the commodities produced can be sold to bankers. This seems reasonable as bankers can spend the interest payments back into the economy, thus enabling full repayment of loans. If they do not spend the interest payments entirely, it is, in effect, exactly the same problem as hoarding, which will be discussed shortly.

Furthermore, in Graziani's (2003) model the money profits of firms are zero in the aggregate. This seems implausible, as in reality firms can indeed make aggregate profits on a given time horizon. Hence the circuitists have sometimes been criticized for the quite significant issue that the real world cannot possibly work in their theory. Keen (2009), on the other hand, argues that this conundrum is due to applying inappropriate analytical tools to valid economic insights. Keen (2009) models the circuit theory with a dynamic model, which does not include either a government sector or a central bank. In his model of pure credit economy, firms can, besides making monetary profits in the aggregate, also service and repay debt with a constant scale of production. Godley and Lavoie (2012, 47-56) confirm this finding in an SFC framework.

In addition to consumption in commodities and saving in securities, there is also a third part of income that can be hoarded, that is, kept as idle bank deposits. This is assumed away in Graziani's (2003) general representation. Graziani's (2003) MCT requires that households spend their incomes entirely on commodities and securities. If they do not, then a problem arises. If households choose to keep some portion of their income in the form of liquid balances, such as cash, and not spend it, firms are unable to repay their debts to the banks. For instance, Keynes (1936) argued that this is typical behaviour of households (and indeed every economic agent, to prepare for an uncertain future). According to Keynes (1936), hoarding is the first approximation of the well-known liquidity preference.

To avoid the problems of hoarding, it has been suggested that the money supply must continuously increase to finance a constant scale of production. According to Graziani (2003, 31), the money supply in the second circuit must equal the wage bill of households plus the liquid balances put aside by households. If banks are also allowed to hoard, then the money supply in the second circuit to finance a constant scale of production must equal the wage bill of households plus the liquid balances put aside by households *and* bankers. Alternatively, Febrero (2006) suggests that firms must negotiate a conversion of short-term debt into long-term debt with banks.

Another shortcoming of the MCT is to undermine money creation for other purposes than production. For instance, banks do not issue credit directly to households in Graziani's (2003) model. Instead, households have to acquire purchasing power indirectly from firms, who have exclusive access to credit. In reality, of course, banks also grant credit for other purposes, such as household consumption and asset acquisition. This also creates new purchasing power, which then circulates in the economy.

According to Febrero (2006), introducing additional economic agents and alternative circuits does not radically alter the main message of the MCT. He argues that it is possible to add a government, a central bank and international trade into the model and stick to its implications. He also argues that the implications are not affected even if households are granted access to credit and if borrowing for speculative purposes is allowed. Nevertheless, Febrero

(2006) admits that including those modifications could enrich the analysis. Indeed, as will be discussed next, the MCT has been expanded in these directions recently.

3.3.4 RECENT ADVANCES

Especially during the 1970s, when the MCT attained its first modern form, banks played a major role in financing production and investment, while the securities market channelled household saving towards firms. In the 1970s profits came mainly from real production. Since then, profits have come to a higher degree from financial activities.

Since the 1970s, a remarkable change has occurred in financial systems throughout the world. Financialization processes were brought about by neoliberal economic policies, among other things. Although the first golden age of "high finance" occurred before the Great Depression of the 1930s, the processes of financialization re-emerged in the world economy in the 1970s and they intensified at least until the onset of the GFC in 2007. Epstein (2005) defined financialization as financial motives, financial markets, financial actors and financial institutions gaining increasing hold over both private economic processes and public economic policymaking. As a result of financialization, the economic focus is shifting from the real economy towards the financial economy – especially asset markets. If firms allocate capital to financial assets instead of real investments, it can have profoundly destabilizing consequences, as Minsky (1986) pointed out.

The financialization processes have challenged the present-day applicability of Graziani's (2003) MCT, which focused on how production is financed. To meet the challenge, the MCT has recently been expanded to include financial markets and financialization processes more explicitly. For instance, Pilkington (2009), Fumagalli and Lucarelli (2011), Seccareccia (2012), Caiani et al (2014), Passarella (2014) and Botta et al (2015) allocate an explicit role for financialization processes within the MCT framework.

Expanding the MCT to include financialization is natural in the sense that the MCT challenges the dichotomy between market-based and bank-based financial systems. The US and the UK are typical examples of a market-based financial system while Continental Europe is a typical example of a bank-based financial system. [35] For instance, Sawyer (2014) argues that there cannot really be a distinction as bank credit functions as the dominant medium of payment in all financial systems today. However, the MCT can be useful for emphasizing the difference between real investment and financial investment.

[35] In market-based systems, firms fund their investments mainly by issuing securities (especially shares), whereas in bank-based system investments are funded by borrowing from banks. In the former an increase in saving increases investments (typical neoclassical position), while in the latter an increase in investments increases saving (typical post-Keynesian position).

As the MCT has recently been expanded towards more complex financial markets and financialization processes, MCT is, in my opinion, a more descriptive name for the theory than the Monetary Theory of Production.

Lavoie (2001) introduces a more meaningful dichotomy between asset-based and overdraft banking systems. Again, the US and the UK are examples of asset-based banking systems while Continental Europe is an example of an overdraft banking system. In an asset-based banking system, most reserves are created through open market operations (banks hold government securities, which the central bank buys). Conversely, in an overdraft banking system, most reserves are created through lending (banks hold no government securities and are wholly dependent on being constantly indebted to the central bank).

3.4 MODERN MONETARY THEORY

This section presents the Modern Monetary Theory (MMT), also known as (Neo-)Chartalism or the State Theory of Money. While the MCT focused on private money creation, the MMT focuses on government money creation. Therefore, the MCT and the MMT should be seen as complements instead of substitutes.

The descriptive analysis of the MMT is based on the development of money and the mechanics of the payment system. A key conclusion is that government money always lies at the top of the money hierarchy. Consequently, a government with full monetary sovereignty can always finance its expenditures or roll over its debt by borrowing from its central bank. Full monetary sovereignty requires the fulfilment of three conditions: a country must have its own currency, issued by its central bank; the exchange rate is flexible; and practically all government debt is denominated in domestic currency. From a historical perspective, the monetary sovereignty of most countries has increased after the Bretton Woods era, as during the Bretton Woods era the monetary sovereignty of most countries was ultimately constrained by a promise to convert currency into gold at a fixed exchange rate.

Building on these findings, proponents of MMT argue for policy prescriptions such as functional finance and employer of last resort. Functional finance contrasts with sound finance and it diverges from standard Keynesian fiscal stimulus as it emphasizes continuous demand management. The goal of employer of last resort is to achieve full employment without generating inflation as the state guarantees a job for everybody. Employer of last resort is also known as a job-guarantee programmes or buffer-stock employment programmes. It should, nevertheless, be kept in mind that the policy prescriptions of the MMT apply only to countries with full monetary sovereignty. This section focuses on the descriptive analysis of the MMT and the policy prescriptions are not discussed further in this thesis.

3.4.1 THEORETICAL DEVELOPMENT

Knapp (1905) is usually seen as the founder of the MMT. Innes (1913; 1914) is an important early contributor. The approach also influenced Keynes (1930a), who positively cited Knapp and Chartalism in the opening pages of the *Treatise on Money*.

Mainstream literature has traditionally emphasized money's function as a means of exchange. Keynes (1936), however, argued that the transaction motive was only one of the motives to hold money. The business motive, speculative motive and precautionary motive were the other reasons. In this sense Keynes (1936) can also be seen as a contributor to the MMT.

The MMT experienced a revival under Lerner (1943; 1947) who argued for functional finance. The main contemporary presentations of the MMT are given in Mosler (1994; 1997) and Wray (1998; 2000; 2012). Bill Mitchell in his blog writings, Stephanie Bell (2000; 2001), now Kelton, and Bell and Nell (2003) are also important contributors. Contemporary studies make use of the sectoral balance analysis put forward by Wynne Godley (1999a) and the Cambridge Group (sectoral balances are discussed in more detail in Chapter 7, which presents the SFC modelling method).

3.4.2 GOVERNMENT MONEY

The MMT scholars begin their analysis by asking how money has developed and from where it derives its value. From this they draw the conclusion that government money (public money) always lies at the top of the money hierarchy, for instance, above private money such as bank deposits.

As described in the previous chapter, there is little debate over the physical development of money. It is generally agreed that the history of physical money began from a commodity such as clay tablets or tally sticks. Then, money became metallic in the form of coins. Later, paper money (notes) replaced coins and, finally, paper money was replaced by deposit money.

However, the physical form of money tells us little about its essence. The mainstream view is that the origins of money can be found in the needs of exchange. Menger (1892) provides the mainstream story of how money developed. The mainstream story of money begins from a barter economy in which no money exists. At some point, commodity money is invented to facilitate exchange. Ultimately, money reaches its current form – credit money. The important implication of the mainstream story is that credit has not had any significant role in the history of money. Instead, credit is seen as a relatively recent financial innovation.

The mainstream view is in stark contrast to the post-Keynesian view of money, in which money has always been credit. While credit is the most developed form of money in the mainstream literature, in post-Keynesian story credit precedes physical money. According to Ferguson (2008), money is trust inscribed and it does not matter on what it is inscribed. Ultimately, money is backed by the productive capacity and output of the economy.

Furthermore, Knapp (1905) and other proponents of the MMT argue that it is impossible to separate the origins of modern money from the government. Graeber (2012) argues that even the value of early metallic coins was induced and not intrinsic. Their value was based on the fact that the government (or ruler) was usually the issuer of coins. As the government accepted them as payment for taxes and other payments, this created demand for government money and made it widely acceptable among the general public.

Although both views are internally consistent, there is not much historical evidence to support the mainstream view. According to Kindleberger (1984), Goodhart (1998), Ingham (2004) and Graeber (2012), the post-Keynesian story is much more strongly supported by historical evidence.

As credit and the government are inseparable parts of the history of money, the MMT maintains that government money derives its value from three sources that guarantee demand for government money. Firstly, the government can declare that taxes and other payments must be paid in its own currency. Secondly, the government can declare its money legal tender, that is, it must be accepted as a medium of payment in private transactions as well. Thirdly, government money can be declared eligible for repayment of all debts, public and private. All these regularly practiced measures ensure that government money is the most important form of money.

For instance, Wray (2000) argued that money has always derived its value from the fact that a sovereign government can levy taxes and other payments denominated in its own currency and thus generate demand for it. This creates incentives for every economic actor, who has to make payments to the government (for example, in the form of taxes), to acquire government's currency. Wray (2000) argued that the value of a currency depends on the difficulty of obtaining it. As the monopoly issuer, the sovereign government can determine what must be done to obtain its currency. Other economic agents will offer goods and services to the government to obtain the currency valid for paying taxes. Then the government can spend its money in exchange for the goods and services it desires. Thus, a currency does not derive its value mainly from precious metals or scarce resources that are used for backing, but from its monopoly for paying taxes. Accordingly, Wray (1998, ix) argued that "[t]he government does not 'need' the 'public's money' in order to spend; rather, the public needs the 'government money' in order to pay taxes."

In addition, Febrero (2009) has put forward a complementary argument. He argues that money is also valuable due to its legal ability to cancel private debt and not just because the issuing authority can levy taxes denominated in its currency.

The proponents of the MMT draw the conclusion from the historical development of money that government money is always at the top of the money pyramid. Government money becomes widely acceptable among the public because of the government's ability to levy taxes and other payments denominated in the currency it chooses and issues. Although government

money has become quite irrelevant in quantity terms (at least until the advent of quantitative easing), it plays an important role in clearing payments.

3.4.3 PAYMENT SYSTEM

The MMT analysis continues to the workings of the payment system. The MMT stresses that commercial banks can create money (deposits), but payments between banks must always be cleared solely with government money (reserves). They also point out that central bank reserves cannot be lent out to the public, which is confirmed by the Bank of England in McLeay et al (2014b, 12): "banks can use [reserves] to make payments to each other, but they cannot 'lend' them on to consumers in the economy, who do not hold reserves accounts."

Sectoral balances are the contemporary work-horse of the payment system analysis. The idea is that all transactions must sum to zero and the financial net worth must also sum to zero. The analysis makes use of sectoral balance sheets, put forward by Wynne Godley (1999a) and the Cambridge Group. It does not involve any assumptions. Sectoral balances simply describe the historical financial net worth and transactions between sectors.

Sectoral balances are the basis of the SFC modelling method. Sectoral balances become a methodological tool when behavioural assumptions are added. SFC modelling is the methodology this thesis builds on and it will be presented in Chapter 7.

One of the key findings of the payment system analysis is the effect of government deficits on short-term interest rates. In contrast to mainstream economics, MMT scholars argue that government deficits reduce overnight interest rates instead of increasing them. According to Mosler (1994, 12) a government deficit will drive the overnight interest rate down unless the central bank engages in compensating operations. This happens because reserves are added to the clearing system when the government pays its expenditures through its central bank account. As banks have excess reserves, the overnight rate tends to decrease. To keep the overnight rate at its target level, the central bank must make a defensive intervention, for example by selling government bonds to banks. Symmetrically to government spending, taxes tend to increase the overnight interest rate because reserves are drained from the banking system as they are transferred to the government's account at the central bank. Although not widely acknowledged, the same point was made earlier by Joan Robinson (1937, 88) and Godley and Cripps (1983, 158).

Proponents of the MMT have also shown that it is possible to fix both the short-term and the long-term interest rate. Indeed, both rates have been fixed historically. According to Godley and Lavoie (2012, 149-150), monetary authorities (including the central bank and the treasury) were for a long time keen to fix both the short rate and the long rate (the bill rate and the bond rate, respectively). Gradually, monetary authorities around the world renounced intervention in the bond rate. More recently, the bill rate has been replaced by

the inter-bank overnight rate as the policy interest rate. Now, however, with the quantitative easing policies conducted by a number of central banks, it is again more evident that monetary authorities can control both the short and long rate.

Understanding the payment system can also help to understand the funding gap, that is, the difference between bank deposits and loans. When initially issued, bank deposits must equal bank loans, as bank deposits are created in the process of bank lending. However, in practice there can be a significant difference between bank deposits and loans.[36] There are at least six reasons why this is so. First, banks can buy (or sell) assets simply by crediting (debiting) the bank account of an economic agent with deposits. This creates (destroys) deposits without a corresponding change in loans. Second, banks can also make payments simply by crediting a bank account by reducing bank equity. Third, bank deposits can be withdrawn in the form of cash. Fourth, bank deposits can be transferred to a different country (or to a different bank if the funding gap is measured on the bank level). Fifth, the value of loans can change, for instance through defaults. Sixth, the central bank can purchase bonds from non-banks, which reduces the funding gap (for instance, in the quantitative easing programmess of the UK). The funding gap has to be covered with wholesale funding, that is, from interbank markets or directly from the central bank.[37]

The MMT can also provide some answers to the problems of the euro area. Lavoie (2013) suggests that the euro area member states could regain some monetary sovereignty by acquiring government securities through publicly-owned commercial banks at a price it chooses (or persuade privately-owned commercial banks to buy them). This could alleviate and even control upward pressures on the interest rates on government securities. However, as the Greek case has demonstrated, the ECB has the ability to undermine these efforts. After the left-wing party Syriza won the Greek parliamentary elections in 2015, the ECB did not approve Greek government debt as collateral in its main refinancing operations. This made Greek banks dependent on ELA funding with higher interest rates. The ECB also has the option to cut the ELA funding, which would have collapsed the Greek banking system as banks would have been unable to settle payments. The ECB relaxed its liquidity controls (that is, it supplied more reserves) on Greek banks only after the Greek government gave in to the demands of its creditors (mainly other euro area countries). Thus, it seems very challenging to circumvent the Maastricht Treaty to regain some monetary sovereignty.

---

[36] According to Schularick and Taylor (2012), deposits and loans were practically equal until World War II, but have diverged since then.

[37] For these reasons Huber (2017) argues that deposits and loans actually go hand in hand if long-term and wholesale bank liabilities to non-banks are included and if no non-banks were treated as banks in the statistics.

In order to avoid the problems of hoarding, it has been suggested that the government can create (monetary) net worth for the private sector. Nersisyan and Wray (2010) argue that when an economic actor in the private sector goes into debt, its liabilities are another's assets. Thus, there is no net worth creation. But when a government issues debt, it creates an asset for the private sector without an offsetting private sector liability. According to Nersisyan and Wray (2010), if the government is not income constrained, that is, it has some substantial monetary sovereignty, it can mitigate the problem of hoarding by issuing debt through budget deficits. From this perspective, it seems peculiar that many commentators defending the interests of either firms or tax payers insist that governments should cut their deficits to overcome the public debt crisis.

By recognizing that government money always lies at the top of the money hierarchy and by revealing the functioning of the payment system, the MMT draws the conclusion that a government with full monetary sovereignty can always finance its expenditures or roll over its debt by borrowing from its central bank. Building on these findings, proponents of MMT argue for functional finance and employer of last resort programmes. I will not discuss these propositions in more detail here. There is a dedicated literature on functional finance and employer of last resort (see e.g. Forstater 1999 and Tcherneva 2012). The next subsection discusses the critique presented against the MMT.

3.4.4 CRITIQUE

Some of the bold propositions of the MMT have faced harsh critique. The conclusions drawn from the workings of the payment system are sometimes criticized. Although Lavoie (2013) agrees with the core framework, he criticizes some excessive claims of the MMT (for more critique of the MMT, see Febrero 2009 and Walsh and Zarlenga 2012).

Lavoie (2013) argues that the terminology used by some proponents of the MMT is confusing. For instance, Stephanie Bell (2000), now Kelton, and Wray (1998, 117) argue that taxes and borrowing do not fund government expenditures. Lavoie (2013) argues that it is misleading to consolidate the government (treasury) and the central bank as the state and then argue that the state does not need to tax or borrow to fund its expenditures. According to Lavoie (2013), it obscures the fact that in this instance the government borrows from its central bank to finance its spending.

Lavoie (2013) argues that another shortcoming in the MMT is its domain of applicability. Obviously, the member states of the euro area do not satisfy the criteria for being monetary sovereign countries, but neither does the US, even though proponents of the MMT typically use it as an example. Even the US government cannot sell its newly-issued bonds or bills to its central bank. Instead, the US government must sell its securities to private agents as the Federal Reserve is prohibited by law from buying government securities

directly. In fact, Lavoie (2013) argues that Canada is probably the most monetary sovereign country in the world as its central bank is allowed to purchase unlimited amounts of government bonds directly from the government.

Lavoie (2013) also argues that it is not generally true that government expenditures must precede tax collection: creation of cash and reserves requires government deficits and central bank advances can be assimilated to government expenditure. All these arguments are based on the consolidation of the government and the central bank and, moreover, they are limited to very specific scenarios.

Furthermore, a fully monetary sovereign government cannot impose taxes on other countries' economic agents. Thus, the MMT can explain the valuation of money within a country, but not between countries. Wray (2000) argued that in international trade currencies have only relative value and, at least earlier, net clearing took place in terms of a scarce resource, such as gold. According to Wray (2000), nowadays, however, international net clearing takes place in terms of the currency of a dominant nation (e.g. the US dollar).

The MMT has highlighted some important aspects of the economy. It also builds the theoretical basis for sectoral balance analysis and SFC modelling. However, it has also made some excessive claims. The excessive claims are not necessary to support the argument that a government with full monetary sovereignty can always clear its debt obligations, nor to justify the propositions of functional finance and employer of last resort.

3.5 THEORISATION IN GLOBAL POLITICAL ECONOMY

This section discusses the theorization of money and banking in GPE literature. The first subsection presents the different views on the role of the state in monetary governance. The second subsection focuses more specifically on the extent of democratic control of money. The third subsection criticizes the approaches in GPE for misunderstanding the operational realities of modern monetary systems due to uncritical adoption of monetary theories from neoclassical economics textbooks.

3.5.1 MONEY AND THE STATE

GPE scholars often emphasize monetary hegemony (instead of sovereignty). Monetary hegemony means that the currency of the hegemonic state is widely used as the international reserve currency and in international trade and finance. The explanations focus on the benefits that the monetary hegemon enjoys (currently the US). For instance, the monetary hegemon can sustain current account deficits which would not be possible for other countries.

An important conclusion drawn by several GPE scholars is that the economic policy space of governments has shrunk in the post-Bretton Woods

era (see e.g. Blyth 2013; Rodrik 2011; Patomäki 2009; Ruggie 1982). The basic idea is that free capital mobility has forced governments to pursue policies that satisfy investors in order to attract capital.

Cohen (2008) suggests that the "new geography of money" erodes the monetary sovereignty of contemporary states. The point is that there are two types of processes leading towards the deterritorialization of money. Firstly, currency internationalization means that certain currencies are widely used in transactions between countries (international trade/reserve currencies). Secondly, currency substitution indicates that some foreign currencies are used more regularly within countries (dollarization). Cohen (2008) argues that both these processes continue to intensify.

Gill and Law (1989) use the concept "disciplinary neoliberalism", which refers to various mechanisms that constrain economic policy. The most important of these mechanisms is international capital mobility, which forces governments to implement "sound" and "responsible" macroeconomic policies. The idea is that the structural power of capital constrains the economic policy space available to contemporary nation states.

Singer (2007), on the other hand, theorizes banking regulation as a trade-off between competitiveness and stability. That is, more regulation means financial stability but a less internationally competitive domestic banking sector. Symmetrically, less regulation would enhance the international competitiveness of the domestic banking sector but increase the risk of financial instability.

3.5.2 DEMOCRACY AND MONEY

While the previous subsection discussed the role of the state in monetary governance generally, this subsection focuses on the extent of democratic control over money. Although they often recognize that banks create money, GPE scholars often depict the process as exogenous, that is, the central bank (or monetary authority more generally) is ultimately in control of the money supply. In this sense GPE borrows directly from the theory in neoclassical economics textbooks. As they are seen as key economic actors, GPE scholars have paid significant attention to whether central banks should be independent or subject to democratic decision-making. Before addressing the (un)democratic nature of central banks, this subsection discusses potential positions on monetary governance derived from various theoretical views on democracy.

Held (2006) groups several theoretical models of democracy under two broad categories: liberal democracy and direct democracy. Liberal democracy is based on the idea that elected politicians represent the interests and views of citizens within the framework of the rule of law. It maintains that the state is a free political space. In particular, the theory of deliberative democracy holds that discussion and argumentation is key in decision-making. From this perspective, the current monetary system, in which money creation has been

outsourced to banks, is the result of convincing argumentation. On the other hand, to change the monetary system only requires persuasive argumentation and deliberation.

According to Held (2006), direct democracy, on the other hand, emphasizes the need for people to decide on public affairs directly without representation. The Marxian tradition in particular emphasizes class conflict. Thus, the decisions of policy makers do not reflect reasoned arguments but class relations. As capitalists are usually considered the more powerful class, the state is a repressive structure from the workers' perspective. For this reason, some Marxists are cautious of the state as it exercises influence through power structures or intervenes directly in the lives of individuals. However, Marxists emphasize that this is not inevitable. Indeed, Marxists like to envision a revolution that would marginalize capitalists and put workers in control.

From a Marxian perspective the current dominant role of banks in money creation is a mere reflection of class relations. Moreover, increasing the state's role in monetary governance is not necessarily preferable (e.g. through FRB). If the underlying class relations are not altered, the increased role of the state in monetary governance would only reflect the preferences of capitalists. Thus, increasing the role of the state in money creation – at least to advance the interests of workers – would presuppose a change in class relations.

Following Antonio Gramsci's notion of cultural hegemony, Poulantzas (1973) argued that the state must also obtain the consent of the oppressed. One way to achieve this is by occupying a contradictory class position, that is, workers identifying with their oppressors. In other words, workers falsely believe that they share the same fate as capitalists. According to Poulantzas (1973), another way to obtain consent is through class alliances. That is, the dominant group (capitalists) makes an alliance with the subordinate group (workers). More recently, Poulantzas's views have been advanced by Bob Jessop (1990).

From this perspective, the current monetary system is an outcome of false identification by workers. It is possible that workers, as small-scale depositors and thus receivers of some interest, identify with capitalists. Of course, banks also pay taxes from their profits and are probably able to offer lower lending rates due to their ability to create money. Thus, it is also possible to see the current monetary system as a deal between capitalists and workers.

Teivainen (1997) examined the democratic nature of the ECB. Teivainen (1997) challenged the priority given to price stability in the ECB's mandate and its lack of democratic accountability. According to Teivainen (1997), the ECB can independently set its operational goal, that is, what is meant by price stability (currently it is interpreted as slightly below 2% inflation). Teivainen (1997), however, pointed out that the decision-makers of the ECB cannot be "punished" if the goal of price stability is not met – even when the goal is defined on their own terms. This has effectively insulated the ECB from democratic control.

Teivainen (1997) argued that even more important is the irreversibility of central bank independence. Independent central banking is not necessarily undemocratic (although it can be) as it can be seen as an outcome of democratic decision-making to voluntarily delimit the scope of monetary policy. However, making the arrangement permanent does reduce the democratic horizon available to citizens. Teivainen built on what Stephen Gill (1995) called "new constitutionalism". It means that certain key principles are written in the constitution to ensure their continuity. In the EMU context, Teivainen (1997) argued that this has made the system very inflexible as changing the EU treaties requires unanimity of all member states. If the political majority in the euro area would like to pursue alternative values than price stability, it can, following realpolitik, undermine the rule of law or bring down the whole monetary union. Indeed, I would argue that the Euro Crisis came close to bringing down the euro and it did undermine the rule of law as the ECB purchased government bonds, which was explicitly forbidden in the EU treaties. In any case, this posed serious questions regarding the legitimacy of the ECB.

Teivainen (1997) depicts the isolation of monetary policy in the euro area as the monarchization of democracy. Many countries are still formally monarchies but the monarchs have been effectively shielded from political decision-making. Although Teivainen (1997) does not think it very likely that democratic decision-making would be completely shielded from real influence, he sees monetary policy in the euro area as one particular case of isolating democratic decision-making.

Moreover, Teivainen (1997) highlighted the underlying values of the ECB's mandate. He argues that the ECB is conservative as its mandate emphasizes predictability and credibility very strongly even relative to the mandates of other central banks. A central bank pursuing democratic values should emphasize accountability and openness to change, instead. Ronkainen (2017) emphasizes the political nature of the ECB's actions in the aftermath of the GFC and during the Euro Crisis.

3.5.3 CRITIQUE

GPE is sometimes criticized for not having any standard theories of money creation and banking. As discussed in the subsections above, in GPE it is customary to theorize monetary institutions and monetary governance instead of money and banking per se. Thus GPE tends to rely at least implicitly on theories developed in economics. Often, theories of money creation and banking are adopted directly from standard neoclassical textbooks, which maintain that money is exogenous. Only occasionally are GPE scholars able to identify the endogenous nature of money.

Holappa (2016; 2017a) shows that even some cutting-edge GPE scholars tend to uncritically adopt economic theories from neoclassical economics textbooks. According to Holappa (2016; 2017a), Wolfang Streeck for instance

sees balancing the government budget as a real material constraint rather than an ideological or political constraint. Therefore, some GPE scholars tend to deny the political possibility of financing government budget deficits directly from the central bank (a position many proponents of the MMT subscribe to). Holappa (2016; 2017a) argues that some GPE scholars simply adopt the position of neoclassical economics that it would undermine confidence in the currency. Neoclassical textbooks teach that budget deficits financed by the central bank can cause hyperinflation. According to Holappa (2016; 2017a), some GPE scholars adopt elementary neoclassical economic theory without critical discussion (or often with no discussion at all) on the mechanisms behind the presumed result.

The problem with GPE is that it does not fully recognize the operational realities of the modern monetary system. For instance, if one builds on the understanding provided by the MCT and the MMT of how the payment system works and the hierarchy of money, it becomes obvious that the domestic banking sector cannot face any foreign competition as it has a monopoly in issuing domestic currency denominated deposits. Thus, there is no trade-off between competitiveness and stability.

More importantly, the MMT maintains that the economic policy space of governments has, in fact, significantly increased rather than decreased after the Bretton Woods era. Thus, international financial markets cannot easily undermine governments' ability to finance their budget deficits.

Holappa (2012; 2017a; 2017b) and Kotilainen (2016) try to reconcile this apparent contradiction. They hold that the economic policy space of governments has, in principle, expanded in the post-Bretton Woods era as the MMT implies. However, increase in monetary sovereignty does not mean that a government exercises policies taking advantage of its increased monetary sovereignty.

Indeed, Holappa (2012; 2017a; 2017b) and Kotilainen (2016) argue that the monetary governance regime (ideologies and practices) prevent or at least discourage governments from taking advantage of the increased policy space enabled by post-Bretton Woods monetary arrangements that bolster monetary sovereignty. Kotilainen (2016) argues that governments are ideologically committed to satisfying the desires of investors. According to Holappa (2012; 2017a; 2017b), the underlying reason is the (false) hegemonic idea that money is ultimately neutral. Consequently, economic policies aim to maintain the confidence of the investors although there is no material necessity to do so. According to Kotilainen (2016), the euro area, with its self-imposed strict "constitutional" limits on government debt and deficits, is a case in point.

Instead of developing its own theories of money and banking, GPE has adopted them from neoclassical economics. GPE has focused on monetary institutions and monetary governance. By emphasizing political and ideological aspects, GPE has a lot to offer money and banking analysis. However, in order to be fully able to engage the analysis, GPE cannot blindly

build on neoclassical conceptions of money and banking; it must adopt a more progressive view that takes into account the operational realities of the modern monetary system. I believe such a view is presented in post-Keynesian monetary theories, in particular the MCT and the MMT, which are based on endogenous money.

By neglecting the endogenous nature of money, GPE scholars have probably exaggerated the importance of central banks. As key monetary decisions are not made by central banks but rather regular commercial banks (which can, of course, be indirectly influenced by central banks but to a lesser extent than usually depicted in the literature), there seems to be a need in GPE to focus more explicitly on the role of banks as creators of money (there are some recent exceptions, for instance, Teivainen 2017). Current research is too narrowly focused on the democratic accountability of central banks.

To sum up the critique, GPE has overemphasized the influence of "international capital" and central banks while underestimating the power of commercial banks. The reasons for this can be traced back to the uncritical adoption of theories presented in neoclassical economic textbooks.

4 HISTORY OF FULL-RESERVE BANKING PROPOSALS

The scope of this chapter is to chart the history of FRB proposals from the 19th century till the present day. As indicated in Section 1.4.1, I will focus on the FRB proposals put forward in the US and the UK, although other countries are not entirely excluded. The discussion on the advantages and shortcomings of FRB will be limited to the following two chapters.

The specific contribution of this chapter is a comprehensive mapping of the history of FRB proposals. Although Ronnie Phillips (1994a) laid down much of the groundwork – especially for the New Deal period – such a survey of the historical and contemporary proposals for FRB has not been conducted before, especially including the recent new wave of FRB proposals sparked by the GFC. As it turns out, the FRB proposals have become particularly popular after serious financial crises.

As Table 1 below illustrates, there are different versions of FRB. A pure commodity standard was the first type to emerge in the 19th century. Sovereign money was proposed before the Great Depression in the 1920s and it has probably become the most popular alternative since the GFC. The Chicago Plan was of high academic and political standing during the New Deal banking reforms in the 1930s. Deposited currency was an innovation of the mid-1980s. Narrow banking emerged as an alternative during the Savings and Loan Crisis of the late 1980s. The most recent newcomer is limited purpose banking in the mid-1990s. In the following sections I will go through and elaborate on these various FRB types in chronological order.

This chapter is structured as follows. In the next section I will present the first FRB proposals, starting from David Ricardo. In Section 4.2 I will move to the Chicago Plan outlined in 1930s during the New Deal banking reforms before discussing the FRB proposals of the latter half of the 20th century in Sections 4.3 and 4.4. Finally, in Section 4.5, I will present the recent new wave of FRB proposals following the GFC.

Table 1. *Different types of full-reserve banking*

	Pure Commodity Standard	**Sovereign Money**	**Chicago Plan**	**Deposited Currency**	**Narrow Banking**	**Limited Purpose Banking**
Features	All money, including bank deposits, backed by a commodity such as gold (in all other types backed by government money).	All demand deposits held at central bank. Deposit banks can make loans only by attracting savings or using own capital.	Deposit banks provide only payments services and cannot make loans.	Full-reserve requirement applied only to certain deposits. Other (not fully-backed) deposits not guaranteed. Individuals choose which type of deposits to hold.	Banks' assets restricted to those considered 'safe' by some standards.	Banks become unleveraged mutual funds. Banks' liabilities restricted to equity.
Notes	Associated with Austrian school.	Associated with Positive Money, New Economics Foundation and ecological economics.	Associated with 'old' Chicago school and monetarism.	For example, postal saving system or central bank accounts for the general public.	Less restrictive proposals not counted as FRB.	Instead of banks, all risks are born by investors.
Proposals	Ricardo (1824), Mises (1912), Hayek (1937), Rothbard (1962), Huerta de Soto (2009)	Soddy (1926; 1934), Currie (1934; 2004), Daly (1980; 2013), Rowbotham (1998), Huber and Robertson (2000), Yamaguchi (2010; 2011; 2014), Jackson and Dyson (2012), Kolehmainen et al (2013), Farley et al (2013), Wolf (2014a; 2014b), Lainà (2015b), Green Party UK (2015), Sigurjonsson (2015)	Knight et al (1933), Simons et al (1933), Fisher (1935), Douglas et al (1939), Simons (1948), Friedman (1948; 1960; 1969), Benes and Kumhof (2012; 2013), Prescott and Wessel (2016)	Tobin (1985; 1987), Jessup and Bochnak (1992), Gruen (2014), Lainà (2015a), Barrdear and Kumhof (2016)	Kareken (1986), Litan (1987), Spong (1996), De Grauwe (2008a), Kay (2009), Phillips and Roselli (2009), Flaschel et al (2010), Chiarella et al (2011), King (2016), Stiglitz (2016)	Pollock (1993), Kotlikoff (2010), Cochrane (2014)

4.1 FIRST STEPS: DAVID RICARDO AND OTHERS

The first proposal for FRB can be traced back to David Ricardo. In 1823, Ricardo (1824) drafted a 'Plan for the Establishment of a National Bank', in which he argued that money creation should be separated from lending by requiring the issuing department to hold 100 percent reserves in gold. Ricardo's plan was a full-reserve plan – but it accepted only gold as reserves. The plan was published in 1824, six months after his death.

Ricardo's (1824) plan was a **pure commodity standard** proposal. Unlike in a regular commodity standard – such as the gold standard effective until the 20th century – in a pure commodity standard, *all money*, including bank deposits, is backed by the commodity. In a regular commodity standard, only *base money* (i.e. cash and central bank reserves) is backed by the commodity.

Ricardo's (1824) goal seems to be to guarantee the independence of the central bank from political power by introducing a pure commodity standard system. According to Ricardo (1817), the logic is that without such heavy restrictions the state or private banks would ultimately abuse the power to create money. Similar distrust of the government characterises later pure commodity standard versions of FRB as well.

According to Phillips (1994a), Ricardo's plan served as a guideline for the Bank Charter Act of 1844. As described earlier, the Bank Charter Act (passed in the UK in 1844) effectively implemented FRB. The Act required the full backing of bank notes, which were the dominant means of payment at the time. However, unlike in Ricardo's (1824) plan, in addition to gold, notes could also be backed by government debt. Nevertheless, the Act did not cover bank deposits. Hence, over time banks were able to substitute bank notes with bank deposits. In addition, according to Huber (2013), the Act was suspended whenever a real panic occurred in the subsequent years. These issues slowly led to the deterioration of FRB in the UK.

The National Currency Act of 1863 and the National Banking Act of 1864 implemented an FRB requirement for all national banks in the US. According to McCallum (1989, 318), these Acts required national bank notes to be 111.11 percent backed by government bonds (so it was even more than *full*-reserve banking as it imposed a 111.11 percent reserve requirement). Later, according to White (1983, 11), Congress imposed a 10 percent tax on any new issuance of bank notes by state-chartered banks. This led banks, both national and state-chartered, to reduce the issuing of bank notes. As in the UK, the US banks were, nevertheless, able to undermine the reform by increasing their issuance of demand deposits.

Ludwig von Mises (1912) presented two reasons for addopting FRB. Firstly, the use of fiduciary money (i.e. money that represents dual sides of a balance sheet) would be destabilising and, secondly and more importantly, human influence on the credit system would be eliminated. As cash and central bank reserves are also fiduciary money, it is obvious that Mises was arguing for a

full-reserve gold standard (or some other metal standard). Thereby, Mises' FRB proposal substantially resembles Ricardo's pure commodity standard of almost a century earlier.

The origins of later **sovereign money** proposals can be traced back to Frederick Soddy. He was a Nobel Prize winner in chemistry in 1921, but also an economist. Soddy (1926) pointed out the difference between real wealth (buildings, machinery etc.) and virtual wealth (money and debt). Real wealth is subject to inescapable entropy laws of thermodynamics (depreciation), while virtual wealth is subject only to laws of mathematics (compounding at the rate of interest instead of depreciating). As a solution to this imbalance Soddy (1926; 1934) suggested FRB. Soddy's economic views, however, were largely ignored by his contemporaries and revived only much later by ecological economists.

Even though it was implemented in the 19th century both in the UK and in the US, FRB was unable to endure as near-money emerged and finally replaced bank notes as the dominant means of payment. This near-money, known as bank deposits, continues to be the main means of payment.

4.2 CHICAGO PLAN: ON THE POLICY AGENDA

During Roosevelt's New Deal banking reforms, FRB re-emerged in the form of the Chicago Plan. The Chicago Plan was presented as a way out of the Great Depression as well as providing a long-term reform of the financial system. This section is divided into three subsections. First, I outline the proposals for the Chicago Plan. Second, I present legislative initiatives implementing the FRB principle. Third, I describe academic reactions to the Chicago Plan.

4.2.1 PROPOSALS

The first version of the **Chicago Plan** was provided by Knight et al (1933) in the Chicago Memorandum of March 1933. The memorandum came from Garfield Cox, Aaron Director, Paul Douglas, Albert Hart, Frank Knight, Lloyd Mints, Henry Schultz and Henry Simons, and was signed by Frank Knight. All were members at the University of Chicago. Later, Douglas became a senator and is still known in economics for the Cobb-Douglas production function. The recipient of the memorandum was Henry Wallace, the Secretary of Agriculture.

In short, the proposal would require FRB in currency and central bank reserves, which would be backed by government debt in the books of the Federal Reserve Banks. The detailed proposal included:

1) federal ownership of the Federal Reserve Banks,
2) giving Congress the sole power to grant charters for deposit banking,
3) a two-year transition period for deposit banking,

4) creation of a new type of deposit bank institution with a 100 percent reserve requirement in notes and deposits at the Federal Reserve Banks,
5) abolition of reserve requirements for Federal Reserve Banks,
6) replacement of private credit with Federal Reserve Bank credit within a two-year transition period, and
7) restricting currency to only Federal Reserve notes.

As deflation was the pressing economic problem of the time, one of the short-term objectives of the proposal was reflation (a term coined by Irving Fisher to indicate inflation after deflation) of wholesale prices by 15 percent, until a long-run currency-management rule could be established. As a long-run currency-management rule the group proposed different versions of the stabilization of money supply (either total quantity M, total circulation MV, or per-capita total circulation MV/N; where M is the money supply, V is the velocity of circulation and N is the number of inhabitants).

According to Phillips (1994a), Wallace handed the Chicago Memorandum of March 1933 to President Roosevelt two and half weeks after his inauguration. The Chicago Plan was also sent to several other recipients, including John Maynard Keynes. According to Phillips (1994a), Keynes briefly expressed his interest in the plan, but did not elaborate on his views.

The second version of the Chicago Plan was provided by Simons et al (1933) in the Chicago Memorandum of November 1933. The memorandum was signed by the same group, but, according to Phillips (1994a), it was evidently written only by Henry Simons. The revised Chicago Plan included the same items as the March 1933 version, but added a simple rule for monetary policy and a price-level target set by Congress. It was argued that monetary policy should be subject to a rule instead of being discretionary. The revised Chicago Plan was not as restrictive as the first version. In addition to steady growth of the money supply, it accepted as a goal price stability or some other goal to be specified by Congress. The proposal included neither deposit insurance, as deposits would already be fully secured by the reserves backing them, nor a central bank discount window – as banks would always be able to settle their payments and credit availability was not seen as a potential problem. In addition, the proposal rejected the gold standard.

Proponents of FRB can also be found within the US administration. In 1934, Secretary of the Treasury Henry Morgenthau appointed Jacob Viner to assemble a group to come up with ideas involving money, banking and public finance. The group was referred to as the 'Freshman Brain Trust'. It included, among others, Lauchlin Currie and Albert Hart, who were open advocates of FRB, and Jacob Viner, who was at least sympathetic to it. Later that year, Currie became a personal assistant to the governor of the Federal Reserve Board, Marriner Eccles.

Lauchlin Currie (1934) submitted his proposal for FRB to Morgenthau in 1934. In Currie's **sovereign money** proposal, banks would initially meet the

100 percent reserve requirement with a non-interest-bearing note from the Federal Reserve Banks. The note could be left outstanding indefinitely or alternatively the note could be retired over five to 20 years by turning over government bonds to the Federal Reserve Banks. As the discount window would be abolished, the money supply could only be affected by open market operations. Currie (1934) was against an independent monetary authority as he argued that democracy should apply to monetary policy as well. As his memo from 1938 reveals, Currie (2004) continued to develop the idea of FRB. Another proposal for FRB, emanating from within the administration, came from Gardiner Means (1933), who was working at the Department of Agriculture.

According to Sandilands (2004), Currie had a major influence on the administration version of the Banking Act of 1935. Phillips (1994a) argued that Currie did not suggest FRB should be included in the administration version of the bill, as he saw it as politically unacceptable. According to Phillips (1994a), Currie compromised on the 100 percent reserve goal, and, in the end, his compromise prevented any possibility of such a reform being achieved in the future. Nevertheless, Currie was able to include in the administration version of the bill the stipulation that the Federal Reserve Board would have unlimited power to alter the reserve requirements – with a view to them eventually being raised to 100 percent. Senator Carter Glass, however, was able to rewrite the bill in Congress to limit the Fed's ability to raise reserve requirements higher than 30 percent. It goes without saying that this prohibited any attempt to raise the reserve requirement to 100 percent.

President Roosevelt and Irving Fisher, according to Phillips (1994a), were frequently in touch. Roosevelt asked Fisher to comment on his economic policies. Phillips (1994a) argued that Fisher first became aware of FRB as he was handed the Chicago Memorandum. Fisher was working on his own version of the Chicago Plan and provided a draft of his book *100% Money* to Roosevelt. Afterwards, according to Phillips (1994a), Fisher urged Roosevelt to consider the proposal several times. Roosevelt and Fisher continually exchanged letters on FRB and Roosevelt even showed some interest in it, but he was not willing to embrace the reform as the bankers were opposed to it. Nevertheless, Roosevelt forwarded Fisher's draft to his Secretary of the Treasury, Henry Morgenthau.

In 1935, Irving Fisher published his own version of FRB. Fisher's (1935) book *100% Money* was largely in line with the Chicago Plan, but it differed somewhat in its policy target. Fisher proposed a price-level stabilization rule instead of stabilization of monetary aggregates.

4.2.2 LEGISLATION

Legislation to implement FRB was introduced during the New Deal reforms. It is notable that FRB was made possible by the Emergency Banking Act of 1933. The Act permitted banks to offer deposit accounts backed with cash,

central bank reserves or government bonds. In other words, these deposit accounts operated according to the FRB principle. There were, of course, other deposit accounts as well and, thus, only a small fraction of deposits became fully backed by government money. For the banks, the full-reserve requirement of these accounts was easy to satisfy as the Fed flooded the banking system with excess reserves by changing its policy to issue reserves against almost any bank assets.

The idea of FRB was also practiced without legal obligations on the bank level. According to Phillips (1994b), John M. '100%' Nichols put the theory fully into practice by successfully operating a bank according to the FRB principle for over a decade.

There were also bills to fully implement FRB nationwide. According to Phillips (1994a), Henry Simons outlined and Robert Hemphill drafted a bill, largely based on the Chicago Memoranda, for Senator Bronson Cutting and Congressman Wright Patman. They introduced bill S. 3744, 'A bill to regulate the value of money' (H.R. 9855) in 1934. The goal of the bill was to correct the shortcomings of the Banking Act of 1933, which did not address the problem of the availability of credit and how to effectively control the money supply. As Phillips (1994a) put it: 'Deposit insurance made banks "safe" not by direct restrictions on their assets, but rather by the promise that the government would guarantee a percentage of the deposits in all banks, good and bad.' In other words, deposit insurance succeeded in stopping bank runs, but it did not address the second primary function of banks: funding the capital development of the economy.

The bill would have made lawful money cash and bank deposits fully-backed with either central bank reserves or government securities. The bill proposed:

1) to segregate demand deposits from savings deposits,
2) to require banks to hold 100 percent reserves against their demand deposits,
3) to require banks to hold 5 percent reserves against savings deposits,
4) to set up a new federal monetary authority with full control over the supply of currency, the buying and selling of government securities, and the gold price of the dollar,
5) to have the monetary authority take over enough bank bonds to provide 100 percent reserves against demand deposits, and
6) to have the monetary authority raise the price level to its 1926 level and keep it there by buying and selling government bonds.

Senator Cutting was, according to Phillips (1994a), personally disliked by President Roosevelt. This was one reason why the bill did not gain the support of the administration and, consequently, failed to pass. Later, however, the bill was reintroduced as S. 2204. A significant blow to the FRB legislation came in May 1935, during the fierce debate over the Banking Act of 1935, when Senator

Cutting died in an aeroplane crash. Senator Nye introduced the proposal for FRB for the last time, but his amendment was defeated. The Banking Act of 1935 was a watered-down version of Cutting and Patman's bill and – although it reformed some aspects, for instance by allowing the Federal Reserve to alter reserve requirements and making deposit insurance permanent – it did not reform money to become fully-backed by government money. Although the Chicago Plan was not adopted, it did have a significant influence on the New Deal legislation. To sum up, the Banking Acts of 1933 and 1935 gave the government better control over monetary policy and the money supply, but not full control over the money supply.

Phillips (1994a) gave four reasons why the FRB proposal was not adopted:

1) the administration blundered in its handling of the banking legislation as it did not keep Senator Glass up to date,
2) the public was ill-informed,
3) Senator Cutting died, and
4) the Banking Act of 1935 was not believed to be the final New Deal banking legislation.

Phillips (1994a) added that bankers were against the Chicago Plan as they believed it would reduce their profits. They resisted any changes to the *status quo*, unless it could be demonstrated that the new system would be even more profitable. Whittlesey (1935, 23) agreed, as he saw that the proposal was opposed because the free services of the banks would no longer be free, and bank owners would lose their main source of profits.

4.2.3 ACADEMIC REACTIONS

Only after the Banking Act of 1935 had passed did the Chicago Plan start to generate widespread academic interest. Most academic discussions were sympathetic to the plan: there were concerns about the transition and certain details, but the goals were widely seen as desirable.

Douglas (1935), Whittlesey (1935), Hart (1935), Graham (1936) and Higgins (1941) advocated FRB but they emphasized different reasons. In Angell's (1935) version, the government would place a lien on the total assets of the banks equal to the value of new currency received. Service charges would be avoided by banks paying a specified amount to a common pool and then receiving money from the pool relative to their demand deposits.

Watkins (1938, 44) cited Keynes: 'Those (monetary) reformers, who look for a remedy by creating artificial carrying-costs for money through the device of requiring legal-tender currency to be periodically stamped at a prescribed cost in order to retain its quality as money, or in analogous ways, have been on

the right track.' Watkins (1938, 44) argued that FRB would be the analogous way that Keynes meant, as it would raise service charges. [38]

Douglas et al (1939) circulated a paper which claimed that FRB was supported by nearly 300 economists while disapproved of by only 43. The paper was written by Paul Douglas, Irving Fisher, Frank Graham, Earl Hamilton, Willford King and Charles Whittlesey and it included many of the previous features of the FRB proposals. According to Allen (1977, 586), two years later the group also included John R. Commons and the supporters had grown to some 400 economists.

Hayek (1937), on the other hand, revived the **pure commodity standard** proposals. In his pure gold standard proposal, deposits should not be backed by government money, but only by gold. Otherwise Hayek's proposal resembled the original Chicago Plan.

The pure commodity standard type of FRB proposal is sometimes associated with 'free banking'. However, some free banking proposals are, by definition, excluded from being FRB proposals as there are no reserve requirements at all. Other proposals, such as Hayek's (1937), argued for 'free' banking with full gold backing. Apparently, 'free' means in this context 'free from any governmental control' as banks could not freely issue money.

Although FRB might sound like a radical solution now, at the time it was presented as a moderate alternative to the nationalisation of the whole banking system (see e.g. Simons 1948, 332-333; Douglas 1935, 184-187; and Watkins 1938, 11). Today it might also sound peculiar that demands for FRB came from the University of Chicago, whose economics department is known for *laissez faire* policy prescriptions. According to Phillips (1994a), the founders of the Chicago School of Economics – Frank Knight, Henry Simons, Jacob Viner and Lloyd Mints – were indeed proponents of *laissez faire* in industry, but at the same time they did not question the right of the government to have an exclusive monopoly on money creation.

4.3 POST-WORLD WAR II: ACADEMIC DEVELOPMENTS

After World War II, the atmosphere for reform was again propitious. Congressman Jerry Voorhis introduced bill H.R. 3648 in 1945 to establish a monetary authority as the sole creator of money. According to Phillips (1994a), Voorhis worked closely with Fisher, who by 1946 had received over 1100 positive responses out of 4662 members of the American Economic Association willing to endorse FRB (with no response from most of the members). However, the end of the political possibilities for FRB came in the 1946 elections, when Voorhis was defeated by Richard Nixon in his bid for re-election to Congress.

[38] Keynes is referring to Gesell's (1918) proposal of "stamped scrip".

In academia FRB was, nevertheless, not abandoned. After Irving Fisher died in 1947, Henry Simons (1948) continued to argue for the Chicago Plan and Lloyd Mints (1950, 186-87) made his proposal.

Maurice Allais presented his version of FRB in 1948 in French. His views were not published in English until 1987 in Allais (1987). Allais's proposal resembled previous versions of the full-reserve plan, but differed in some important respects. He argued that banks should be required to borrow long and lend short, whereas at the time (and now still) they borrowed short and lent long.

Milton Friedman (1948) suggested eliminating the private creation of money and the discretionary control of the money supply by the monetary authority. This would also mean the elimination of the discount window. Friedman (1948) argued that the chief function of the monetary authority should be to create money to meet government deficits or destroy money when the government has a surplus. In a later proposal, however, Friedman changed his stance.

Friedman's (1960) later proposal departed from the Chicago Plan by demanding that interest should be paid on reserves – because FRB would be, according to Friedman (1960), effectively a tax on the banking system. Friedman (1960, 74) argued that paying interest on reserves would reduce the incentive to evade the full-reserve requirement and to create near-monies. Friedman (1960, 65) also argued that holders of money balances and holders of government securities should be compensated equally. Friedman (1960, 70) saw 'no technical problem of achieving a transition from our present system to 100% reserves'.

Friedman (1969, 83) agreed with Simons's FRB plan, but for different reasons. Friedman's (1969, 83) aim was to reduce government interference in lending and borrowing and to allow greater variety in borrowing and lending arrangements.

Murray Rothbard (1962) argued that the central bank should be abolished and that a 'free banking' system should be adoptef. However, Rothbard suggested gold as the only eligible asset to back deposits. In other words, he proposed a **pure commodity standard**. Rothbard's 100 percent gold standard proposal is thus very similar to Hayek's (1937) proposal.

4.4 TURN OF THE MILLENNIUM: MORE CREATIVE IDEAS

After Friedman, academics and policy-makers alike lost interest in FRB for a couple of decades.[39] Proposals for FRB were, however, revived at the turn of

[39] According to Currie (1993), marginal reserve requirements were increased to 100 per cent several times in Columbia, the most recent time being in 1990–91. A marginal reserve

the millennium, which generated more creative proposals such as deposited currency, narrow banking and limited purpose banking. Of course, there were also more traditional proposals, including government money or gold as the asset to back deposits.

James Tobin's (1985; 1987) **deposited currency** proposal included the establishment of a currency functioning according to the FRB principle, while allowing other deposits as well. Thus, Tobin's (1985; 1987) deposited currency is optional or 'limited' FRB. In other words, only a fraction (whose size would be determined by the actions of various economic agents) of demand deposits would function according to the FRB principle.

Concretely, Tobin's (1985; 1987) proposal would widen access to central bank reserves by allowing individuals to hold deposit accounts with the central bank[40]. Alternatively, banks should be obliged to offer accounts fully backed by reserves. These full-reserve accounts would then be subsidized by the central bank by paying interest on reserves to offset some of the costs related to these accounts. In Lainà (2015a) I made a similar proposal to allow central bank accounts for all economic agents in Finland. This would provide, besides security against loss and theft and divisibility of denomination, electronic transfer of currency, the lack of which is, in my opinion, the most significant deficiency of cash.

In addition to Tobin's deposited currency, there were also other 'limited' FRB proposals. Jessup and Bochnak (1992) proposed reviving the postal savings system. According to O'Hara and Easley (1979, 744), funds in the postal savings accounts could only be invested in government securities or placed in solvent national banks. Thus, the postal saving system would be a limited implementation of FRB.

The turn of the millennium also saw proposals for **narrow banking** (sometimes called core banking). Narrow banking, a term coined by Litan (1987), allows any 'safe' asset to be the balancing item for bank deposits. Depending on the proposal, the safe assets can be anything from central bank reserves to traditional bank loans such as mortgages. Indeed, some narrow banking proposals are so permissive that they could not be labelled FRB proposals. However, Litan (1987), Kareken (1986) and Spong (1996) would impose sufficiently strict restrictions on bank assets that they *would* qualify as FRB proposals.

Gordon Getty, according to Ferguson (1993), wanted to replace the financial system controlled by the Fed with a parallel system of mutual funds. Pollock (1993), on the other hand, suggested reviving mutual savings and loan associations, which would restrict the funding of investments to equity or

---

requirement of 100 per cent means that FRB applies only to additional demand deposits but not to previously existing demand deposits.

[40] According to Godley and Lavoie (2012, 102), in some countries individuals are allowed to hold deposits at the central bank. Thus these countries already have a deposited currency system.

shares. These types of FRB proposals are labelled **limited purpose banking**. Mutual fund shares would effectively be money backed by the asset portfolio. There would be no government insurance and no guarantee of par value clearance. Instead of banks, individuals would carry the risks. Government money would function only as a unit of account.

While Hotson (1985) and Schemmann (1991) wanted to carry out the **Chicago Plan** in a more modern context, Islamic banking was also discussed as an alternative way to organize the monetary system. According to Phillips (1994a, 208-209), Islamic banking, which forbids charging interest, is also one type of FRB. Khan and Mirakhor (1985), Khan (1986; 1988) and Doak (1988) provide a detailed discussion on the connection between FRB and Islamic banking.

In 1998 Huerta de Soto (2009, ch. 9) proposed a **pure commodity standard** following a very liberal line of argument from the Austrian school. He proposed an FRB system which would offer total freedom of choice in currency, implement free banking and abolish central banking. Thus, Huerta de Soto's proposal is built especially on the FRB proposals of Ludwig von Mises (1912), Friedrich Hayek (1937) and Murray Rothbard (1962), who opposed any monetary system in which the government would have significant influence on monetary policy – either through interest rates or the quantity of money. As Hayek (1937) and Rothbard (1962) demanded FRB only in gold, Huerta de Soto (2009, 739) made the same argument for a pure commodity standard although after the initial transition to a 100 percent gold standard he was willing to accept 'the spontaneous and gradual entrance of other monetary standards' as well.

Daly (1980), and other ecological economists, finally revived Soddy's (1926; 1934) **sovereign money** version of FRB. Rowbotham (1998) concentrated on a holistic analysis of the current monetary system and on the reasons for monetary reform, but he also presented his version of how to concretely implement the sovereign money system. According to Rowbotham (1998), the fraction of government money should be gradually increased either through government spending or basic income.

Huber and Robertson (2000) presented the first detailed proposal for sovereign money. Their main argument was that seigniorage revenue should be restored as the sole privilege of the government. Hence, all new money would be issued as public revenue and it would be spent into circulation by the government.

4.5 AFTERMATH OF THE GLOBAL FINANCIAL CRISIS: BACK TO THE POLICY AGENDA

The GFC sparked a new wave of proposals for, and academic research on, FRB. The GFC also inspired social movements to campaign for FRB.

In this section, I first outline the contemporary proposals for FRB. Then, I describe legislative initiatives and social movements advocating FRB. Finally, I review academic modelling of FRB.

4.5.1 PROPOSALS

Positive Money in Jackson and Dyson (2012) probably presents the most detailed version of FRB so far. Positive Money's **sovereign money** proposal is written in the UK context and it has been endorsed by *Financial Times* columnist Martin Wolf (2014a) and former chairman of the Financial Services Authority Adair Turner (2016). Kolehmainen et al (2013) is my co-authored proposal, which adapts a sovereign money proposal for Finland. Our proposal did not take a stance as to whether the reform should be implemented across the whole euro area or if Finland should leave the euro and adopt it unilaterally. Obviously, implementing FRB would be easier in an alternative institutional setting that would not require such a bold step as abandoning a currency or achieving a broad consensus among multiple states.

Sovereign money differs from the Chicago Plan in that all money is held at the central bank. In the sovereign money system, a bank is allowed to offer both payments services (managing accounts at the central bank on behalf of their customers) and financial services (providing savings accounts and loans). Conversely, in the Chicago Plan banks offering payments services would be legally separated from banks offering financial services. In other words, the sovereign money system is a single-circuit monetary system while the Chicago Plan is a double-circuit system. In a single-circuit system all electronic money is held at the central bank while in a double-circuit system there are still reserves and bank deposits which circulate like they do today.

In Jackson and Dyson's (2012) system there would be two types of bank accounts, current accounts called 'transaction accounts' and savings accounts called 'investment accounts'. No money would be actually held in savings accounts as the money would be transferred from an economic agent's current account to a bank's 'investment pool', which is the bank's current account for making loans. Savings accounts would thus be promises by banks to pay money after a certain period. Jackson and Dyson (2012) introduce as a catch-all requirement that a bank must be able to repay the total sum of its current accounts at any time. This would effectively prevent any money creation by banks.

Jackson and Dyson (2012) propose that an independent body would decide how much new money should be created in order to prevent political abuse.[41] The newly created (destroyed) money would simply be added to (subtracted from) the government's budget and, subsequently, a political body such as parliament would decide how the newly created money would be used

[41] Lerven et al (2015) assess various options for determining the amount of new money creation under FRB.

(collected). Basically, there are four alternatives: increase government spending, cut taxes, make direct payments to citizens or pay off national debt. Additionally, in order to avoid a credit crunch, in some circumstances money could be created by lending it to banks on the condition that they re-lent it to the real economy. The monetary policy target would be unaffected unless decided otherwise. That is, the independent body responsible for money creation would target inflation.

Jackson and Dyson (2012) argue that money should be an asset to the holder, but not a liability to anybody. Contrary to previous FRB proposals, Jackson and Dyson (2012) and its former version Dyson et al (2011) suggest that deposits should be treated off-balance sheet in accounting. That is, all deposits would be held in custody at the central bank (although they also provide an alternative treatment in which deposits would be held on-balance sheet at the central bank). They argue that coins in the US are actually treated in this way even today.

The transition from the current banking system to FRB would be done in an overnight switchover in Positive Money's proposal (for a more detailed discussion on the transition period of various FRB versions see Dixhoorn 2013). Jackson and Dyson (2012) adopt Currie's (1934) proposal that demand deposits would be replaced in the balance sheets of banks with a 'conversion liability', which banks would have to repay to the central bank over ten to 20 years. The objective of the conversion liability would be to reclaim seigniorage revenue from previously issued deposits back to the government. Thus, their proposal is in line with Huber and Robertson's (2000) previous proposal.

Besides supporting Positive Money's FRB proposal in Wolf (2014a), Martin Wolf also came up with his own proposal. Wolf's (2014b) proposal greatly resembles Positive Money's sovereign money proposal but it would also strongly increase capital requirements. Other sovereign money FRB proposals include Iivarinen (2015, 239–243) and Werner (2012). Werner's (2012) proposal also includes a cover letter to the Icelandic Parliament.

Herman Daly (2013) follows the arguments of Frederick Soddy (1926; 1934) and Lauchlin Currie (1934; 2004). He justifies FRB by arguing that it would better serve a non-growing or de-growing economy. In addition, he argues that seigniorage revenue should go entirely to the government. In his sovereign money version of FRB monetary policy should be subject to parliamentary decision-making instead of being independent. Farley et al (2013) continue Daly's ecological justification of FRB.

Mayer's (2013a) proposal concentrates on the euro area and turns the established order of the EU Banking Union upside down. The EU Banking Union means the establishment of a Single Supervisory Mechanism (SSM), Single Resolution Mechanism (SRM) and Common Deposit Insurance (CDI) scheme for the euro area (and a chance for non-euro area EU states to opt in). SSM has been achieved, as the ECB took over financial supervision of the largest banks from national supervisors in November 2014 and SRM became fully operational in January 2016. CDI, however, has been postponed into the

indefinite future, even though national deposit insurance schemes have been harmonized at 100 000 euros.

Mayer (2013a) argues that the EU Banking Union should have been established starting from CDI, then SRM and finally SSM. Instead of governments guaranteeing bank deposits, Mayer suggests that FRB should be adopted to make deposit insurance obsolete. After that, according to Mayer (2013a), the establishment of SRM and SSM would have been more straightforward and the EU Banking Union would be more functional.

In addition, Mayer (2013b) provides the central bank seven accounting options for how new money can be brought into circulation under FRB. For example, new money could be issued through negative equity. This would mean changing only the liabilities side of the central bank's balance sheet when issuing money. As the central bank cannot go bankrupt, it can operate with negative equity without any problems.

The idea of **deposited currency** was revived after the GFC by Gruen (2014) with his elaborate proposal. In Lainà (2015a) I make a similar proposal to allow central bank accounts[42] for all economic agents in Finland. Barrdear and Kumhof (2016) explore the macroeconomic effects of Bank of England's deposited currency research project (the Bank of England calls it central bank digital currency) while Meaning et al (2018) assess its impact on monetary policy transmission mechanism more specifically. Wortmann (2017) proposes that a virtual euro be introduced to allow deleveraging of debt without causing a crunch. The virtual euro would be a deposited currency functioning alongside the euro.

It is also interesting that Italy's Minister of European Affairs, Paolo Savona, has proposed a deposited currency version of FRB in Fratianni and Savona (2017) (the proposal is elaborated in Fratianni 2017). Fratianni and Savona (2017) justify their proposal by arguing that it would greatly reduce government debt, for instance, in Italy from 132% to 85% of GDP if all deposits could be transferred to a "money bank". Their proposal would, however, allow the FRB requirement to be fulfilled by government debt as well. If banks were to simply hold more government bonds, one could question whether government debt would be reduced at all.

Nevertheless, Fratianni and Savona's (2017) proposal is particularly interesting because Savona was about to become Minister of Finance for Italy's first populist government in 2018. However, Italy's president turned down the first proposal for a coalition government (League and Five Star Movement) specifically because Savona was not acceptable as Minister of Finance. Given that the Italian populist government in its current form has already challenged the prevailing policies of the EMU, Savona as Minister of Finance could have brought FRB to the table when further euro area reforms are discussed.

[42] According to Godley and Lavoie (2006, 102), in some countries individuals are allowed to hold deposits at the central bank. Thus these countries already have a deposited currency.

Narrow banking has recently been proposed as a solution by De Grauwe (2008a), Kay (2009) and Phillips and Roselli (2009). In De Grauwe's (2008a) proposal, narrow banks would be precluded from investing in equities, derivatives and complex structured products. Nevertheless, he does not explicitly determine the assets valid for backing deposits. Phillips and Roselli (2009) would allow government securities – in addition to central bank reserves – as the balancing assets. De Grauwe (2008a) suggests that maturity mismatch would not be allowed for any financial institutions other than narrow banks (i.e. the average duration of other financial institutions' liabilities should equal the average duration of their assets). According to De Grauwe (2008a), if only a few countries would implement narrow banking, the banks of these countries would face a competitive disadvantage. Consequently, De Grauwe (2008a) also demands international coordination in order to avoid a regulatory race-to-the-bottom.

Another narrow banking proposal came from a former governor of the Bank of England, Mervyn King (2016), who explicates how the "safe" assets of narrow banks would be determined. King (2016) calls his suggestion the pawnbroker for all seasons. The idea is to ensure that all bank deposits are backed by instant access to central bank reserves. That is, banks would have to position assets in advance at the central bank, who would evaluate the value and riskiness of the assets. Those assets could then function as collateral for the central bank's promise to lend reserves. The central bank would not, in general, lend for the full value of the assets but rather impose a haircut depending on the type of asset.

Most recently, Nobel laureate Joseph Stiglitz (2016) proposed an innovative narrow banking reform. In Stiglitz's plan, banks would be obligated to hold 100% reserves against deposits (although Stiglitz does not explicitly mention this). However, the plan differs from sovereign money and the Chicago Plan as all new money would be issued through banks in the form of loans – exactly how most money is issued today. Nevertheless, the government would fully control the amount of money as it would auction rights to issue new (net) credit. In other words, although Stiglitz's (2016) FRB proposal would require full backing of deposits with government money, it would not separate money creation from bank lending, and thus not eliminate the link between money and debt.

Kotlikoff (2010), on the other hand, suggests **limited purpose banking**, a variant of FRB in which each pool of investments made by a bank would be turned into a mutual fund. This would mean that there would be no maturity mismatch between a bank's assets and liabilities. In other words, banks would not be leveraged at all and they would be pure intermediaries between borrowers and lenders. Kotlikoff (2010) admits that it could lead to irrational collective exuberance (financial instability), but he argues that risks and rewards would be better aligned. Contrary to sovereign money, banks could not fail as they are not leveraged. Losses would be absorbed by investors. The

Bank of England's former governor Mervyn King (2010) discusses FRB and shows cautious support for it – especially for Kotlikoff's version.

Cochrane (2014) argues for limited purpose banking. As bank deposits are run-prone liabilities of banks, Cochrane (2014) argues that banks should be funded 100 percent with equity. According to Cochrane (2014), technology is already available that allows everybody to sell assets (such as equities) and obtain fully-backed money instantly. Cochrane (2014) sees capital requirements as inefficient regulation and proposes taxing short-term bank debt instead in order to test whether run-prone liabilities are really worth having around. Furthermore, Cochrane (2014) argues that the central bank should include everybody as its counterparties when issuing reserves.

4.5.2 LEGISLATION AND SOCIAL MOVEMENTS

After Congressman Jerry Voorhis was defeated by Richard Nixon in the 1946 elections, there were no legislative initiatives to implement FRB in the US until the GFC. However, in 2011 Congressman Dennis Kucinich introduced bill H.R. 2990 'National Emergency Employment Defense Act' (NEED Act) to implement FRB in the US. The draft version of the bill was known as the American Monetary Act. The bill, however, failed to pass.

In 2010, a UK Member of Parliament, Douglas Carswell, introduced a short bill 'Financial Services (Regulation of Deposits and Lending)' which, in effect, would implement FRB in the UK. Unsurprisingly, the bill did not pass. Positive Money (2013) has drafted a much more detailed bill to implement FRB in the UK, but it has not been introduced yet.

The UK parliament, nevertheless, debated money creation for the first time in 170 years on 20 November 2014. The debate was entitled 'Money Creation & Society'. Although no voting on legislation followed the debate, it certainly raised awareness of the monetary system and its alternatives among members of the UK parliament. Indeed, in the following year, the Green Party UK (2015) included FRB in their political agenda in their general election manifesto. In 2016 Douglas Carswell tabled an amendment to "the Bank of England Bill" to implement FRB.

A similar debate took place in the Dutch parliament on 14 October 2015. Later, the Dutch parliament adopted motions to investigate money creation.

Iceland is considering whether to put the idea of FRB into practice. It is worth noting that Iceland is the only country in the world in which FRB has been embraced by the government and not only by single political parties or members of parliament (let alone activist groups or random economists).

Iceland's Prime Minister, Sigmundur Davíð Gunnlaugsson, commissioned a report on FRB authored by Frosti Sigurjonsson (2015). Sigurjonsson's (2015) report is very similar to Jackson and Dyson's (2012) proposal, but it gives more precise numbers. For instance, Sigurjonsson (2015) suggests a 45-day minimum maturity or notice period for time deposits. He would also make the interest rate on the conversion liability equal to the average current interest

rate on demand deposits in order to avoid making banks better or worse off than in the current system.

The new Prime Minister, Sigurður Ingi Jóhannsson, commissioned another report authored by global consulting and accounting firm KPMG (2016). Whereas Sigurjonsson's (2015) report focused on the shortcomings of the current monetary system and the details of FRB, KPMG's (2016) report focused on the political development of and academic research on FRB.

A monetary reform resolution was put on the agenda of the parliament of Iceland in February 2016. Almost all reviews of the resolution were positive towards FRB – even the central bank of Iceland indicated cautious support. Moreover, the ministries sorted out the legislative amendments required by FRB. If the resolution passes, a parliamentary committee, which reviews arrangements for money creation, will be established.

Worldwide there are a number of political parties, non-governmental organizations (NGOs) and social movements demanding FRB. Reforming money to function according to the FRB principle is one of the main goals of the following political parties: Green Party (UK), Money Reform Party (UK), Canadian Action Party (Canada), Humanwirtschaftspartei (Germany), Alternativet (Denmark) and Democrats for Social Credit (New Zealand). In Switzerland, Vollgeld-Initiative was able to collect over 100 000 signatories and, thus, FRB was put to a referendum in June 2018 (see Dawnay 2017), but it did not pass (24 % supported FRB, while the turnout was 34 %).

The International Movement for Monetary Reform is an umbrella organisation for national NGOs and social movements propagating the idea of FRB. In addition to Positive Money in the UK, there are many national NGOs and social movements advocating FRB, for instance, American Monetary Institute (US); Progressive Money (Canada); Sensible Money (Ireland); Fair Money (Australia); Positive Money NZ (New Zealand); Monetative (Germany); MoMo (Switzerland); Ons Geld (Netherlands); Monnaie Honnête (France); Moneta Positiva (Italy); Dinero Positivo (Spain); Boa Moeda (Portugal); Dinero Justo (Puerto Rico); Positiva Pengar (Sweden); Gode Penge (Denmark); Betra Peningakerfi (Iceland); and Suomen Talousdemokratia (Finland).

4.5.3 ACADEMIC MODELLING

Although recent years have seen a revival of interest in FRB, it has been little modelled so far and with mixed methods. Indeed, to the best of my knowledge, it has been formally modelled only once before the GFC in Chung (1991). Regardless of the diverse modelling approaches, according to the results, the consequences of adopting FRB seem to be generally positive. Next, I will briefly go through these modelling results. The scope is limited to formal models of FRB.

Benes and Kumhof (2012) conducted a study at the IMF and used the methodology of neoclassical economics – DSGE modelling – to reach the same

conclusions as Irving Fisher (1935) almost eight decades earlier. According to Benes and Kumhof (2012), FRB would 1) provide better control of money supply and bank credit, which are a major source of business cycle fluctuations; 2) eliminate bank runs; 3) reduce public debt; and 4) reduce private debt. Furthermore, they found that output would increase by almost 10 percent and inflation could be dropped to zero without causing any problems. Later, Benes and Kumhof (2013) revised their paper but the results remained unchanged.

Prescott and Wessel (2016) examine the functioning of a FRB system in a neoclassical model. They find that balanced growth with zero inflation is possible under FRB. They also argue that credit availability to businesses would not be reduced under FRB.

Suntum and Neugebauer (2015) build an overlapping-generations model of neoclassical economics. They find that FRB would drive the prevailing interest rate above the natural rate of interest and thus increase unemployment. They also argue that it would not reduce public debt. However, it should be noted that they exclude government spending from their model and central bank profits are distributed immediately to the private sector as transfer payments. Suntum and Neugebauer (2015) also exclude considerations of financial stability and how behavioural incentives might be changed.

Krainer (2015) compares FRB to the current banking system in a theoretical neoclassical model. Contrary to Diamond and Dybvig (1986) and Kashyap et al (2002), who argue that benefits from liquidity provision under the current banking system outweigh the cost of increased financial instability, Krainer (2015) finds that the benefits of FRB would outweigh its costs.

Chari and Phelan (2014) build a neoclassical theoretical model to compare the social and private costs and benefits of FRB with current fractional reserve banking. They find that, in general, the net benefits of FRB exceed those of fractional reserve banking as FRB can prevent costly bank runs. Chari and Phelan (2014) also find that in a fractional reserve banking system with low reserve requirements, private benefits exceed private costs. Thus, although FRB would be socially optimal, private agents do not spontaneously switch over to FRB from fractional reserve banking.

Singh (2009) builds a typical neoclassical model which assumes full employment. According to Singh (2009), although bank credit is reduced, FRB does not reduce total credit (when the central bank does not hold gold reserves). However, Singh (2009) argues that FRB is inefficient if commercial banks have a competitive advantage over the central bank in providing credit. However, it should be noted that the study builds on the Money Multiplier Theory and the Quantity Theory of Money, which, as discussed in Sections 3.1 and 3.2, are nowadays widely rejected as inaccurate.

Yamaguchi (2010) modelled the NEED Act, and later refined the modelling in Yamaguchi (2011; 2014), using an accounting system dynamics approach. Yamaguchi (2010; 2011; 2014) found that, in stark contrast to the current

monetary system, under FRB government debt can be liquidated without triggering recession, unemployment or inflation.

Flaschel et al (2010) and later Chiarella et al (2011) showed in a dynamic multiplier framework that FRB provides a more stable financial environment than the current fractional-reserve banking system – even if appropriate monetary policy is conducted. Furthermore, they showed that under FRB a sufficient loan supply can be guaranteed (and that bank runs do not occur, which should be obvious, since the logic of FRB makes bank runs redundant).

Correa (2012) uses a sectoral balance framework in which he disaggregates households into wage-earners and rentiers. Although it is not an SFC model as it lacks, for instance, behavioural equations, he considers some possibilities for setting asset-based reserve requirements for non-bank financial institutions under FRB.

Egmond and Vries (2015) build a dynamic simulation model which has some linkages to SFC modelling, but the model is not complete. Adjustment mechanisms are mainly neoclassical, that is, they are based on prices instead of quantities, although some post-Keynesian elements are included (e.g. inventories). Egmond and Vries (2015) calibrate their model for the Dutch economy with data from 1950–2010 and then simulate the model until 2050. They model FRB within this framework. According to Egmond and Vries (2015), compared to the current banking system FRB leads to price stability, higher real GDP, higher employment, lower interest rate and less government debt.

Practically all attempts to formally model FRB have been conducted very recently. The results of various modelling methods seem to be tentatively promising – at least for proponents of FRB. Nevertheless, because of various theoretical and meta-theoretical commitments, the feasibility of FRB is unlikely to be resolved with academic modelling. The viability of FRB can ultimately be discovered only by adopting it.

5 POTENTIAL BENEFITS OF FULL-RESERVE BANKING

This chapter presents a literature review of the political, economic, social and ecological benefits of FRB and discusses them. Each section begins with a description of the problems with the current monetary system and then presents how these problems might be mitigated under FRB.

The benefits and the critique discussed in the next chapter relate mostly to the sovereign money, Chicago Plan, narrow banking and limited purpose banking versions of FRB. When necessary, I distinguish between the benefits of various types of FRB. [43] The benefits do not necessarily apply to pure commodity standard and deposited currency types of FRB.

The underlying idea behind FRB is that a structural change is better than changing the regulation of the current banking system. The benefits of FRB can be summarized as follows:

- Democracy fostered
- Financial stability enhanced
- Inequality reduced
- Ecological production favoured

5.1 POLITICAL INCLUSION

This section begins with a description of current problems and then moves on to how FRB would enhance political inclusion by fostering democratic decision-making. Finally, the section estimates how much seigniorage revenue would be generated by the transition to FRB and the regular operation of the FRB system annually.

5.1.1 CURRENT PROBLEMS

Under the current system, the issuance of new money is undemocratic; over the past decades it has become even more undemocratic through the reduced role of the state in banking and through the doctrine of independent central banking. As deposits are created when banks make loans, banks decide who gets the newly created money. As banks decide which firms and industries receive funding and for what projects, the power to shape the economy lies with the banks rather than the public. According to Jackson and Dyson (2012), banks make more loans in a year than the government spends. If banks

[43] For a relatively balanced discussion on the pros and cons of various types of FRB proposals, see Dixhoorn (2013).

consider social or environmental issues unprofitable (regardless of whether they actually would be), they are not funded. Essentially, almost the entire money supply is on loan from the banking sector, and thus the public is also dependent on banks to maintain an adequate money supply.

Lending pre-existing funds does not, of course, create any additional money. In fact, it could be argued that all bank loans do not create new money. Bank lending creates money only to the extent that new loans exceed loan repayments. In other words, when loans are repaid banks receive funds which could be relent. It is a valid argument that only an increase in the loan stock creates new money.

Although the operation of banks is not democratic in the sense that every person would have an equal number of votes, not even depositors have much say in what purposes banks should create money for.[44] Depositors cannot directly influence bank lending decisions. Banks decide which loans they are ready to make and to whom. Depositors have to either take it or leave it. If depositors do not agree with their bank's lending policy, they can transfer their deposits to another bank. However, banks' activities are often opaque as they do not specify the types of loans they grant in detail. Thus, it is hard even for depositors to change their bank's lending policy to become more in line with their personal preferences.

Even though they do not directly decide the purposes for which new money is created, central banks and other international organizations regulating money creation (such as the BIS, the IMF and the World Bank) can also be criticized for their undemocratic nature. As was discussed in Subsection 3.5.2, some GPE scholars emphasize that the top executives of these institutions are not democratically elected nor are they accountable in any democratic sense (e.g. Teivainen 1997).

In sum, both money creation and regulation are not subject to democratic control. To change the undemocratic nature of money the public and politicians must first, of course, be aware that there is a democratic deficit in the monetary system. However, not only the public but even politicians seem to be quite ignorant of the functioning of the monetary system.

The public does not generally recognize who creates the money supply. Motivaction (2016) asked over 23 000 persons in 20 countries who they think creates most of the money supply. Half of the respondents thought that either government or central bank did so, 30% admitted that they do not know, while only 20% recognized that banks create the majority of money.

Other country-specific studies reach the same conclusion. For instance, Nietlisbach (2015) finds that 73 % of people in Switzerland assume that money is created solely by the state (government or central bank). Only 20 % knew

[44] Each depositor can, of course, invest their funds in whatever assets they desire, but the total amount of deposits is not reduced if a bank is not a counterparty. Therefore, somebody has to hold deposits and, thus, "fund" banks' activities.

that both the state and banks create money. However, even of these, one third assumed falsely that most money is created by the state and not by banks. Thus, only 13 % of the Swiss public seems to be aware that most money is created by banks. The figures seem to be quite similar in other countries too.

Niskanen (2016) conducted a questionnaire survey for first year business students in Finland. He found that over half thought that the central bank solely creates the money supply while 9 % thought that it is created solely by banks. Only 29 % recognized that both the central bank and commercial banks are responsible for creating the money supply.[45]

According to Niskanen (2016), business students, however, seem to be quite overconfident of their knowledge. Compared to 29 % who gave a correct answer, no less than 38 % think they know how money is created while 35 % admit that they do not know (27 % cannot say). Of course, not all of those who think they know are correct. Only 17 % responded that both the central bank and commercial banks create money and that they know how money creation occurs. This implies that over half of those who think they know how money creation occurs are actually wrong.

Knowledge about money creation is not better among politicians either. Dods (2014) asked 100 UK parliamentarians whether "[o]nly the government – via the Bank of England or Royal Mint – has the authority to create money, including coins, notes and the electronic money in your bank account" was true or false. 71 % of the parliamentarians erroneously thought the statement was true, while only 20 % recognized it as false and 9 % abstained from expressing their opinion. Even more interesting is that only 12 % knew that "[n]ew money is created when banks make loans, and existing money is destroyed when members of the public repay loans." 64 % thought the statement is false, while 24 % did not want to express their opinion. To summarize, only a small minority of the public and politicians recognize how money creation occurs today.

5.1.2 DEMOCRACY FOSTERED

After implementing FRB, the monetary system would work as most people falsely assume it is working already. In an FRB system only the state would be allowed to create money. Banks would still operate and mediate pre-existing money from lenders to borrowers. Wolf (2014b, 210) argues that money and payment systems should be public goods by their nature.

Furthermore, there is at least some evidence that most people would like the monetary system to work on an FRB basis. In a comprehensive international study, Motivaction (2016) found that 59% want the government or central bank to create most of the money. Only 13% would give banks the power to create most of the money supply. The remaining 27% were uncertain

[45] This seems to contradict a latter question in which over half recognize that money is created when a commercial bank makes a loan.

about who should be responsible for creating money. Among people who correctly stated that banks create most of the money in circulation, only 27% believe that this should continue to be the case, whereas 63% of them want to see this responsibility transferred to the state.

In other surveys, most of the Swiss and Finnish public think that money creation should be the prerogative of the state. According to Nietlisbach (2015), when the Swiss public was asked how money should be created, 78% replied that it should be created solely by the state. However, in the referendum in June 2018 the Swiss people turned FRB down as only 24% voted for it while 76% voted against.

In a survey, Niskanen (2016) finds support for FRB in Finland. Over half of those who were willing to express their opinion think that money should be created solely by the central bank. The current system, in which money is created by both the central bank and commercial banks, was supported by a quarter who expressed their opinion. The rest answered solely private banks, solely government, nobody or something else. Nevertheless, there seems to be some uncertainty as a third of the respondents could not choose between the given options.

Cobden Centre (2010), however, found dissimilar results for the UK. Only 26 % of UK respondents would go for FRB, while 33 % prefer business-as-usual (deposit insurance and bank bail-outs) and another 33 % think that banks should be subject to normal bankruptcy laws (no bank bail-outs). Cobden Centre (2010) also found that only 33 % of the UK public think it is wrong that banks relend (sic) demand deposits to fund loans while 61 % do not mind as long as they receive some interest and banks are not too reckless. The finding that the current system enjoys more support in the UK than in Switzerland or Finland is challenged by Motivaction (2016). It found that approximately half of the UK population would support FRB while only 10% back the current monetary system (38% undecided).

Of course, democracy cannot simply be reduced to popular opinion. There are methodological problems and uncertainties when results from questionnaires are generalized and extended to the whole population. For instance, the exact formulation of questions and the framework in which they are presented can greatly influence the outcome. Moreover, the sample is not necessarily representative. People's opinions and preferences can also be influenced by policy makers, media and other instances. Thus, preferences are not fixed. This means that there is no one-way link from citizens' opinion to policy makers but rather two-way interaction between citizens and other instances, including policy makers. Nevertheless, surveys can at least indicate the popularity of FRB.

Although not democratic in the sense that everybody would have an equal number of votes, under FRB investments would better reflect the wants of the public and not of the banking sector. By putting their money in different types of savings accounts or other saving options, the public could choose which sectors or types of investment receive funding (e.g. ethical and ecological

investments options have recently become more popular), although banks would still choose exactly which firms or individuals receive the funding. Thus, regular savers would have more influence on banking operations than in the current banking system.

Most importantly, under FRB the domain of economics subjected to democratic decision-making could expand. By separating money creation from bank lending, FRB could offer a way to reduce the influence of banks and thus change the power relations within global and national capitalism. In other words, FRB could have significant structural effects on society by reducing the influence of banks.

FRB could also foster democracy as new money would not be allocated by banks to the most profitable objects, but instead through the democratic decision-making of Parliament (see Jackson and Dyson 2012). Nevertheless, FRB would not nationalize the banking system – only the monetary system. Banks (and other financial institutions) would still be mostly responsible for allocating credit. However, they would not allocate new money. Allocation of new money would be determined by politicians rather than banks.

In this case the change in democratic accountability compared to the current monetary system would be reflected mainly in the allocation process of new money. Even though the responsibility of deciding how much new money to create would be shifted from private banks to public central banks, central banks are mostly independent and largely shielded from democratic decision-making.

However, FRB proposals can also be categorized according to the democratic accountability of the money creation process. Even within the classification I laid down in Chapter 4, there are major differences. For instance, within sovereign money FRB proposals, some proposals would delegate the amount of money creation to an independent central bank (e.g. Fisher 1935; Jackson and Dyson 2012) while other proposals would go further and make Parliament responsible for the amount of new money creation as well (e.g. Currie 1934; Daly 2013). The case that other proposals go significantly further in extending democratic accountability highlights the fact that FRB is not a fully coherent and monotonic collection of proposals.

FRB would not, however, automatically expand the democratic sphere. Proponents of the democracy argument often presuppose that the country in question has functioning democratic institutions in place and is not under authoritarian or totalitarian control. In other words, FRB would expand the economic influence of the state, but the state is not necessarily democratic. To foster democracy, FRB must operate in a democratic state.

More specifically, whether FRB would foster democracy comes down to one's conception of democracy. Following Held's (2006) categorization, discussed in Subsection 3.5.2, FRB has the most obvious potential to advance liberal democracy. Most FRB proposals would designate the power to allocate new money to Parliament (the decision of the amount of money is discussed in Section 6.2). Liberal democracy holds that parliamentary representation is

a necessary (although by no means only) condition for democracy. Increasing the power of Parliament is often interpreted as an increase in democratic decision-making.

However, democratic decision-making is not necessarily advanced from the perspective of direct democracy. In most FRB proposals, citizens would not be directly responsible for the allocation of new money. From a Marxian perspective, the increased economic role of the parliament could only continue to reflect the preferences of capitalists. Advancing democracy would require an underlying change in class relations.

On the other hand, FRB per se can be seen as a manifestation of a change in class relations (tilting the balance of power towards workers, albeit without completely revolutionalizing the mode of production and accomplishing full political and economic equality). From this perspective, FRB could be argued to advance even the Marxist conception of democracy.

It is also less evident that the seigniorage revenue generated by FRB would inevitably advance people's wellbeing. For instance, seigniorage could be used for arms races or making war. Indeed, there is a lot of historical evidence that governments have taken money creation more strictly under their control during periods of war. However, it is, at least in principle, possible that the decision to make war is reached through legitimate democratic processes, and thus be in line with the democracy argument (although these cases seem to be relatively rare).

Finally, the institutional context of FRB is very important in determining its feasibility. The euro area is an extreme case, as implementing FRB would require a broad consensus among the member states or, alternatively, a member state would have to leave the EMU. Even if FRB enjoys widespread popular support, it is highly unlikely that unanimity would be reached among the member states in order to alter the EU treaties. For a single member state, the price of leaving the euro might be too high compared to the advantages of FRB and the other benefits of having its own currency. For instance, Greece was unwilling to leave the euro in 2015 even though it was about to face a devastating austerity program in exchange for being bailed out. Thus it is unlikely that FRB would be implemented anywhere in the euro area.

The institutional context would be more welcoming for FRB if the state has already achieved monetary sovereignty (e.g. US and UK). Financial markets could not then easily undermine FRB (see Holappa 2012; 2017a; 2017b; Kotilainen 2016). On the other hand, monetary sovereignty might make FRB a less attractive option politically, as the state would already have relatively high fiscal capacity on hand. Thus, FRB might not rise to the top of the political agenda.

Politically, FRB would probably have the best chance to be implemented in a single country with somewhat reduced monetary sovereignty, but its own currency, a central bank and other functioning government institutions (e.g. Iceland). In other words, the country would not be too attached to foreign, regional or international institutions such as the EMU. Monetary sovereignty

might be reduced, for example, due to high public debt denominated in foreign currency. In particular, during a serious financial crisis FRB could emerge as a favourable option as a way out of the crisis and renewing the domestic financial system. Indeed, this is what happened in Iceland after the GFC, although rapid economic recovery has recently reduced the attractiveness of FRB.

The institutional context of FRB can also be approached from the perspective of the Mundell–Fleming trilemma. The trilemma maintains that it is impossible for a state to simultaneously satisfy all three criteria: monetary autonomy, fixed exchange rates and free capital mobility. Monetary autonomy refers to the ability to pursue independent monetary policy in terms of setting the policy interest rate and influencing the money supply (note that monetary autonomy differs from the concept of monetary sovereignty).

Currently, most states have chosen the combination of monetary autonomy and free capital mobility (no fixed exchange rate). This is also the combination that would make it possible to achieve monetary sovereignty. Indeed, a flexible exchange rate is one of the prerequisites for monetary sovereignty. As argued above, this is probably the safest way to implement FRB.

Secondly, it is possible to adopt an FRB system in a fixed exchange rate and free capital mobility regime as well (no monetary autonomy). However, in this case the central bank would probably have to actively defend the currency peg. In principle, as the money supply would be under (almost) total control of the central bank, FRB could be a more efficient way than the current monetary system of adjusting domestic demand to international capital flows. Nevertheless, it is possible that international investors are cautious of FRB and that could mean bigger fluctuations in capital flows, at least during the transition period. This would cause internal imbalances such as contractionary fiscal policy or unbearably high interest rates, which would suffocate domestic demand. Therefore, this is likely to be the most challenging regime for FRB.

Thirdly, FRB could be implemented in a regime with monetary autonomy and fixed exchange rate (no free capital mobility).[46] This might be tempting in order to avoid the possibility of capital flight. Even if international financial capital were wary of a country operating an FRB system, it would not matter since capital mobility would be restricted.

However, this raises the question of the broader international consequences of FRB. Although it is possible to consider an institutional context that would shield the country from the negative effects of international finance, that might not be the case for other policy areas. If economic institutions are not in line with the international community, other countries

[46] I would argue that the existence of this combination is somewhat questionable. Although capital mobility could not undermine the currency peg, trade flows could still cause external imbalances that should be tackled with monetary policy. In other words, under this regime monetary policy would not be completely autonomous.

could stop cooperation, for example in security policy. In the worst case scenario, the country could suffer the fate of North Korea, that is, becoming isolated from the international community.

Moreover, even if international financial capital could not undermine FRB, it might be true for international capital more broadly. International productive capital might not favour a country as a location if it sees that FRB might call into question the country's ability to integrate in global commodity and value chains. Multinational corporations could go with their exit option and relocate their production.

Due to potential political and economic hostility imposed by the international political community and international productive capital, implementing FRB in a single country might not turn out very successfully. On the other hand, hostility is not a necessary response to FRB as it is highly contingent on the beliefs and attitudes of actors. Based on historical data, Section 2.4 showed that the implementation of FRB did not cause capital flight in the UK in 1844 at least. As will be discussed in Sections 6.8 and 6.9, a country with an FRB system could even be perceived as a safe haven and attract international capital.

Nevertheless, due to dangers related to unilateral monetary reform in a single country, implementing FRB successfully might require international coordination. There are signs that the international order is changing. The hegemonic position enjoyed by the US since the end of the Cold War is in decline while China is rising. Moreover, the election of Donald Trump as president has increased the tendency of the US to withdraw from international institutions which do not necessarily place US interests first.

This could mean that China will take a leading role in international institutions in the future. Because the communist party is in power, China does not ideologically oppose public sector influence on the economy. Thus, there are good reasons to believe that public money creation would enjoy more support in China-led international institutions.

Should a new global financial crisis occur, Basel III – on which much national banking regulation relies– would most likely be judged as insufficient by the international community. As was discussed in Section 2.3, the Basel Accords have become increasingly complex. Perhaps in this case FRB could emerge in the Basel Committee on Banking Supervision as a reasonable way to reduce and simplify banking regulation while at the same time it could offer a new foundation for national monetary systems with a high potential to prevent financial crises. The economic stability aspects of FRB will be discussed in detail in Section 5.2.

The IMF could have a focal role in providing an international reserve currency functioning according to the principles of FRB. In fact, the IMF already provides an international reserve currency in the form of SDRs. SDRs are issued debt-free (see IMF 2017). As their creation is detached from lending, SDRs basically function according to some principles of FRB (not

completely, as SDRs contain a promise to be exchanged for a defined amount of major national currencies).

However, the amount of SDRs is very limited and they only have a minor role in international payments. In addition, access to SDRs is restricted mainly to states, and thus no private actor can obtain them. Therefore, international payments are mostly cleared with major national currencies – chiefly the US dollar.

The situation could change – in particular, if China were to gain more influence within the IMF. For instance, the governor of the People's Bank of China Zhou (2009) has suggested that SDRs could play a more prominent role in the international monetary system. Thus, there are reasons to believe that SDRs could assume the role of the standard international reserve currency in the future.

This could also revive Keynes's proposal for the bancor as an international currency, as suggested by Davidson (2009). According to Keynes, SDRs could allow management of international current account imbalances. With the seigniorage revenue generated by SDRs, it would also be possible to serve global goals such as tackling climate change and reducing poverty.

In addition to providing a standard international medium of payment, the IMF could also act as an international clearing house. Currently no international clearing house exists and therefore clearing of international payments must take place within each currency area. To overcome the impracticalities associated with this arrangement, an international clearing house could settle and clear payments in national currencies in addition to SDRs.

5.1.3 TRANSITION SEIGNIORAGE

Putting the global institutional context aside, this subsection calculates how much revenue the transition to an FRB system might generate for the government. Basically, the transition would be executed by the central bank buying government bonds or other securities and, thus, creating enough reserves for banks so that all deposits would be backed by reserves. Naturally, the transition seigniorage depends on how much banks have in reserves and deposits today.

As the figure below indicates, the US has, in practice, already moved to FRB – at least on the aggregate level. For a long time, banks kept the amount of reserves close to the minimum requirement. However, as a reaction to the liquidity crisis generated by the GFC, the Federal Reserve started to inject excess reserves into the banking system through quantitative easing (QE). The unprecedented scale of QE quickly increased the amount of reserves. In fact, reserves surpassed demand deposits in 2008 and have remained greater ever since. This implies that the monetary base (MB) is larger than cash in circulation and demand deposits (M1).



Note: Demand deposits are calculated as M1 minus cash in circulation.
Sources: Federal Reserve (2015a; 2015b)

Figure 2 Demand deposits and reserves in the United States

Reserves, of course, are not distributed in proportion to demand deposits across all US banks and, thus, each bank does not have more reserves than demand deposits. In other words, although on the aggregate level the US already fulfils the FRB requirement, on the individual bank level FRB does not apply. However, as there are already enough reserves in the banking system, it would only be a small step to make FRB a legal requirement. Those banks that do not have more reserves than deposits could obtain the required reserves from the interbank market; it would also be quite straightforward for the Federal Reserve to buy securities from those banks to the extent that they would satisfy the FRB requirement. In other words, in the US the transition to an FRB system would be relatively simple to carry out, at least as long as reserves temporarily exceed deposits.

Table 2 below calculates the one-shot seigniorage revenue from transition to FRB. The transition seigniorage is the amount that reserves should be increased to make them at least equal to demand deposits. In the end, as cash is included in both, monetary base MB would be at least equal to narrow money supply M1.

Table 2. *One-shot seigniorage revenue from transition to full-reserve banking*

	US	UK	Euro Area	Finland
Demand Deposits	1700 billion dollars	1300 billion pounds	5000 billion euros	81 billion euros
…of GDP	10 %	72 %	49 %	39 %
Reserves	2600 billion dollars	300 billion pounds	210 billion euros	17 billion euros
…of GDP	15 %	17 %	2 %	9 %
…of Demand Deposits	157 %	23 %	4 %	22 %
Transition Seigniorage	**0 dollars**	**1000 billion pounds**	**4800 billion euros**	**63 billion euros**
…of GDP	0 %	55 %	47 %	31 %
…of General Government Budget	0 %	144 %	101 %	54 %
…of Central Government Budget	0 %	158 %	226 %	117 %
Government Debt	13000 billion dollars	1600 billion pounds	8500 billion euros	105 billion euros
...of GDP	74 %	93 %	84 %	51 %
…held by central bank	2800 billion dollars	380 billion pounds	150 billion euros	0 euros
…held outside central bank	10200 billion dollars	1220 billion pounds	8350 billion euros	105 billion euros
Enough Debt for Transition?	Not needed	Yes	Yes	Yes

Notes: Demand deposits are calculated as M1 minus cash in circulation in the end of 2014. Reserves are outstanding central bank reserves in the end of 2014. Transition seigniorage is calculated as demand deposits minus reserves (when positive, otherwise zero). Government debt is the outstanding central government debt in the end of 2014. Enough debt for transition refers to whether government debt held outside central bank is larger than transition seigniorage.

Sources: IMF (2015), World Bank (2015), BEA (2015), CBO (2015), Federal Reserve (2015a; 2015b), US Department of the Treasury (2016), Office for National Statistics (2015a; 2015b), Bank of England (2015), Eurostat (2015a; 2016), ECB (2015a; 2015b; 2016), Statistics Finland (2015a; 2015b; 2016), Bank of Finland (2015; 2016), State Treasury Finland (2015), and author's calculations.

How much seigniorage would the transition to FRB generate for each country? As discussed above, for the US the transition to FRB would not generate any seigniorage revenue. The figure above shows that the US has already implemented the transition phase to FRB and could immediately switch to

FRB as their banks have more reserves than demand deposits. Satisfying the 100 % reserve requirement for demand deposits would not need any extra effort from the banking system as a whole (individual banks might have insufficient reserves, but they could borrow reserves from the interbank market). Indeed, as the US banks had reserves worth 2600 billion dollars and demand deposits worth 1700 billion dollars, they could satisfy even a 157 % reserve requirement.

Among the selected countries, the transition seigniorage would be the largest for the UK compared to GDP or to general government budget. The transition seigniorage in the UK would be worth 55 % of GDP or almost one and half times the annual general government budget. This is because the UK has the highest level of M1 even though its reserves are also highest.

For the euro area, the transition seigniorage would also be very significant as only 4 % of demand deposits are currently backed by reserves. The transition seigniorage corresponds to over twice the annual central government budgets of euro area member states, which is clearly the highest among the selected countries. The substantial gap between seigniorage relative to general and central government budget in the euro area compared to the UK is due to euro area local governments having large budgets while in the UK most public expenditures go through the central government budget.

The transition seigniorage for Finland (an example member of the euro area) is somewhat smaller than for the euro area on average. This is explained by lower M1 and higher reserves. Nevertheless, the transition seigniorage would be very notable as it would be 31 % of GDP and clearly exceed the annual central government budget.

If the transition to FRB were to be executed by increasing government spending by the amount of transition seigniorage, it would probably stimulate the economy too much or take too long. The transition seigniorage would double or even triple central government spending. Obviously, this would be too much. Therefore, alternative ways to carry out the transition phase should be considered.

The transition to FRB could be implemented by the central bank buying government bonds from the secondary market. For instance, Fisher (1935) suggested that the central bank should buy government debt from financial markets in order to create enough reserves to back all demand deposits. In fact, this is exactly what QE programmes are doing around the world.

According to Hyman Minsky the foreword to Phillips (1994a), one reason why FRB was not implemented in the 1930s was that there was not enough outstanding government debt to fully back demand deposits. This concern was also shared by Bossone (2002). Currently, however, as the table below shows, insufficient government debt would not impose any obstacle for the transition. Even if the central bank were not allowed to buy any private securities in each of the selected countries there would be plenty of government debt outstanding to be purchased by the central bank, as the last row of the table indicates.

Moreover, Minsky argued in the foreword to Phillips (1994a) that we already had the institutional prerequisites for FRB in 1994. The institutional prerequisites are: 1) large government debt to be monetized, 2) government fiscal posture to keep constant the balance of payment and the ratio of government debt to GDP and 3) money market and other mutual funds that can provide immediate liquid balances. Certainly, these prerequisites are still satisfied in 2016.

The transition phase to FRB would significantly reduce government debt held by private and foreign economic agents in most countries. As the banking system of the US already fulfils the FRB requirement on the aggregate level, the US government debt held outside its central bank would not be reduced from 59 % of GDP (10200 billion dollars).

The UK government debt held outside its central bank would fall from 66 % of GDP (1220 billion pounds) to 12 % of GDP (220 billion pounds). In other words, the UK government debt held outside central bank would be almost entirely wiped out.

The government debt of euro area member states held outside their central banks would be reduced from 83 % of GDP (8350 billion euros)[47] to 35 % of GDP (3550 billion euros). If government debt held by central bank were to be excluded from EDP government debt (which excludes intra-governmental debt except debt held by central bank), the Maastricht criterion of 60 % maximum government debt would easily be fulfilled by most members of the euro area. For instance, the Finnish government debt held outside central bank would be reduced from 51 % of GDP (105 billion euros) to 20 % of GDP (42 billion euros).

This subsection has explored the possibility of carrying out the transition phase of FRB through the central bank buying government debt from the secondary market. Another alternative would be to significantly reduce private debt. Instead of government debt, the central bank could buy private debt. Yet another way to conduct the transition would be to distribute new money evenly to citizens on the condition that they would have to repay their outstanding debts. Due to limited space available, these options will not be elaborated here.

[47] The ECB purchased government securities for the first time through the Securities Market Programme (SMP). The SMP included government bonds of the countries heavily affected by the Euro Crisis (this is why the Bank of Finland did not hold any government securities at the end of 2014). Previous asset purchase programmes, the Covered Bond Purchase Programme (CBPP) 1, 2 and 3 and Asset-Backed Securities Purchase Programme (ABSPP), did not include government securities. The SMP was replaced by the Outright Monetary Transactions (OMT) programme, which ended the acute phase of the Euro Crisis, in August 2012. The OMT programme included government bonds but it has never been activated. Most government bonds have been purchased by the ECB through the Public Sector Purchase Programme (PSPP) which was launched in early 2015 (the data in the table are from 2014).

5.1.4 ANNUAL SEIGNIORAGE

Although in an FRB system the allocation of new money would be determined by politicians, how much new money should be created can be left to an independent expert body. For instance, to prevent political abuse, Jackson and Dyson (2012) suggest establishing a Money Creation Committee similar to the Federal Open Market Committee in the US, the Monetary Policy Committee in the UK and the Governing Council of the ECB in the euro area. Instead of setting the interbank interest rate (or discount rate) as is done today, the committee would set the amount of money. Conversely, for example, Currie (1934) would let politicians decide – and therefore be accountable for – the amount of new money created.

Regardless of whether politicians or technocrats would make the decision, the table below gives an informed approximation of how much money could be created under FRB in the US, UK, euro area and Finland (as an example of a member of the euro area). The table gives an estimate of the *average* scale of annual revenue for government. It should not be interpreted to imply a monetarist growth rule for the money supply. Instead, the actual annual growth rate of the money supply can fluctuate significantly depending on economic conditions, as suggested by Jackson and Dyson (2012).

Obviously, there is significant uncertainty in the estimates as they are highly contingent on the behaviour of economic agents. As it is very difficult to know how behaviour would change in an FRB system, I simply assume that behaviour would continue as before, or various tendencies would cancel each other out. Therefore, the annual seigniorage revenue is calculated as the outstanding M1 money stock (consisting of cash and demand deposits) multiplied by the average historical growth rate of M1. The seigniorage revenue is also compared to GDP and general and central government budgets to give a more comprehensible view of its scale.

The estimated seigniorage varies significantly between countries. The annual seigniorage revenue from FRB in selected countries would be 1–8 % of GDP, 3–20 % of general government budget and 6–22 % of central government budget.

In the US annual seigniorage is only 1 % of GDP. This is primarily explained by low M1 money stock. It seems that people in the US prefer time deposits over idle demand deposits. In addition, M1 has also grown relatively slowly in the US.

The UK is the opposite case. There FRB would yield the highest annual seigniorage revenue for government. In the UK seigniorage revenue would be 8 % of GDP. Thus, FRB would generate 8 times more revenue for the government in the UK relative to GDP than in the US. The prominent seigniorage in the UK is explained by both high amounts of M1 and its rapid historical growth.

Table 3. *Annual seigniorage revenue from full-reserve banking*

	US	UK	Euro Area	Finland
M1	3000 billion dollars	1400 billion pounds	6000 billion euros	98 billion euros
...of GDP	17 %	76 %	59 %	48 %
M1 Growth	5.7 %	10 %	7.3 %	6.2 %
Annual Seigniorage	**170 billion dollars**	**140 billion pounds**	**430 billion euros**	**6,0 billion euros**
...of GDP	1.0 %	7.7 %	4.3 %	2.9 %
...of General Government Budget	3.1 %	20 %	9.2 %	5.2 %
...of Central Government Budget	5.7 %	22 %	21 %	11 %

Notes: M1 is the money supply consisting of cash and demand deposits in the end of 2014. M1 growth is the average growth rate of M1 using longest available data. Annual seigniorage is estimated as M1 times M1 growth rate.

Sources: BEA (2015), CBO (2015), IMF (2015), Federal Reserve (2015a), Office for National Statistics (2015a; 2015b), Bank of England (2015), Eurostat (2015b; 2016), ECB (2015a), Statistics Finland (2015b; 2016), Bank of Finland (2015), State Treasury Finland (2015), and author's calculations.

The fiscal benefits for the euro area on average and Finland as an example member of the euro area are somewhere in between the US and UK – although closer to the UK. In the euro area and Finland, annual seigniorage revenue would be 4 % and 3 % of GDP, respectively.

These estimates are more or less in line with the literature. For instance, Benes and Kumhof (2012; 2013) find that the annual seigniorage revenue from FRB would be 3.6 % of GDP in the US (here 1.0 % of GDP). However, they use M3 money aggregate for measuring seigniorage (banks have to back all their liabilities). According to Shadow Government Statistics (2016), the M3 money aggregate stood at around 15 000 billion USD in the end of 2014. This is five times more than M1 money aggregate. If the seigniorage revenue estimated by Benes and Kumhof (2012; 2013) with M3 is made proportional to M1, their seigniorage estimate would be 0.7 % of GDP. This number comes very close to the 1.0 % of GDP estimated in the table above.

Huber and Robertson (2000) estimated the seigniorage revenue from FRB for the US, the UK and the euro area. According to their calculations, in 1999 the annual seigniorage would be 1.1 % of GDP in the US, 3.9 % of GDP in the UK and 2.4 % of GDP in the euro area. These figures are also more or less in line with the table above.

Another method of estimating the average annual seigniorage revenue would be to calculate the targeted M1 growth rate under FRB as productivity growth rate plus inflation target. For example, if productivity grows 3 % and the inflation target is 2 %, then M1 should grow at 5 %. If M1 money stock is 50 % of GDP, then seigniorage revenue would be 2.5 % of GDP. This method would probably yield quite similar results to the table above.

How significant a source of income would the seigniorage revenue from FRB be for government? Currently, only cash and reserves yield seigniorage revenue for government. As cash and reserves are typically only a small fraction compared to demand deposits, the seigniorage revenue from the current monetary system is almost negligible. For instance, the actual seigniorage revenue generated by the Bank of Finland (central bank) was 180 million euros in 2014 according to State Treasury Finland (2015). This is only 0.3 % of central government budget.

Under FRB, all increases in M1 would be added to the government budget in full. In other words, in an FRB system the extension of demand deposits would also generate seigniorage revenue for government. According to the table above, seigniorage from FRB would increase the Finnish central government budget by 11 % (cf. 0.3 % actual addition in 2014). This is over 30 times more seigniorage than the Finnish government received in 2014. The seigniorage would be roughly equal to the administrative fields of Ministry of Defence, Ministry of the Interior, Ministry of Justice and Ministry for Foreign Affairs combined (including e.g. army, police, courts and development aid). The seigniorage revenue would also approximately match the estimated long-term fiscal sustainability gap. As these calculations illustrate, the seigniorage revenue from FRB would be very significant.

By increasing government revenue, FRB could extend the sphere of democratic decision-making although it is not an automatic consequence. Logically, the seigniorage can be used for increasing government spending, reducing taxes, paying citizen's dividends or repaying government debt. The exact emphasis between these options would depend on political power relations.

There are at least two arguments as to why the scale of annual seigniorage from FRB would deviate from the one estimated in the table above. Firstly, a larger proportion of newly created money would go directly to the real economy through government spending, tax cuts or citizen's dividend (only repaying government debt would not go directly to the real economy). Money creation for financial markets or acquisition of pre-existing real estate – typical of the current banking system – does not have such a direct effect on economic activity and inflation. Thus, there should be less money creation in an FRB system. Secondly, as will be discussed in Section 6.5, there could be a drop in credit availability. Under FRB, lending would be constrained to previous saving and more money would need to be created to maintain the previous level of loans (there are, of course, also valid arguments for a lower level of loans). Thus, more money should be created in an FRB system.

These two arguments, however, have the opposite implications. I would guess that the effects more or less cancel each other out. Therefore, the seigniorage estimates of the table above should only be seen as a first approximation of how much new money would need to be created under FRB on average. After all, there is a lot of uncertainty as the estimates are highly contingent on how the behaviour of economic agents would change in an FRB system.

Although both the annual and transition seigniorage revenue would be the highest for the UK, FRB might out to be politically challenging to implement exactly because of this. Bigger changes involve greater risks and require more courage. Contrastively, the annual and transition seigniorage would be the lowest in the US. In addition to the fact that the US is, on the aggregate level, in practice already running an FRB system, it would be a relatively small step politically to legally implement FRB in the US.

5.2 ECONOMIC STABILITY

FRB would reform the fundamentals of the monetary system instead of adding more complex bank regulation. In an FRB system, all money would be created solely by the state, while banks could only lend pre-existing money.

Although it would change the monetary system thoroughly, FRB cannot, of course, prevent all financial crises in the future. Speculation and credit booms would still be possible. However, funding speculation and credit booms would become more difficult. Financial crises would still be possible, but less frequent and less severe. In other words, financial instability would not disappear, but it would be tamed. As Wolf (2014b, 213) put it, FRB might be a necessary but not a sufficient condition for economic stability.

For instance, Fisher (1935; 1936) argued that the FRB system would 1) end bank runs; 2) reduce bank failures; 3) reduce government debt; 4) simplify the monetary and banking system; 5) eliminate great inflations and deflations; and 6) mitigate booms and depressions.

Allais (1987) argued that FRB would correct the following shortcomings of fractional-reserve banking system: 1) the creation and destruction of money by private banks; 2) the sensitivity of the credit mechanism to short-term economic fluctuations; 3) the basic instability engendered by borrowing short and lending long; 4) the distortion of income distribution by the creation of "false claims"; 5) the impossibility of control over the credit system; and 6) the inefficient control of the aggregate money supply.

The next subsection starts by identifying problems related to the current monetary system. The following two subsections present how FRB could solve these problems. The second subsection focuses on financial stability while the third subsection discusses the benefits for the real economy.

5.2.1 CURRENT PROBLEMS

Debt as a predictor of financial crises

The current banking system is a key cause of financial crises. Financial crises are often caused by excessive debt. Irving Fisher (1932; 1933) in his Debt-Deflation Theory and Hyman Minsky (1986) in his Financial Instability Hypothesis depicted the typical dynamics of financial crises. The dynamics are summarized below.

In the boom phase banks are willing to lend lavishly while households and firms borrow gladly. This increases the amount of money in the economy. Economic activity and asset prices rise while unemployment decreases. All this makes servicing and repaying debt easier. Confidence in the future increases, which again makes the banks more willing to lend and households and firms more willing to borrow.

At some point, however, for one reason or another the boom phase turns into a bust phase. Now, the same mechanisms operate in the opposite direction. Banks tighten their credit lines and households and firms are more cautious about borrowing. The amount of money decreases (or at least stagnates). The economy finds itself in a depression and asset prices fall while unemployment increases. Servicing and repaying debt becomes harder. Confidence in the future deteriorates, which again makes banks less willing to lend and households and firms less willing to borrow.

Indeed, empirical studies have verified that debt, in particular bank loans, is among the best indicators of impending financial crisis. For instance, in a literature review of 19 often-cited studies on early-warning indicators of financial crises, I find in my co-authored paper Lainà et al (2015) that debt seems to have predictive power in all studies with no exceptions. In the empirical part, Lainà et al (2015) use data from 11 EU countries and find that debt is the most reliable early-warning indicator of systemic banking crises. Kauko (2014) finds in another literature review that most banking crises are preceded by credit-driven booms. Schularick and Taylor (2012) aptly summarize that financial crises throughout modern history can be viewed as “credit booms gone bust”.

There is also evidence that credit booms fuel asset bubbles. For instance, Jordà et al (2014; 2015) argue that housing bubble and bank credit expansion feed each other and cause financial crises. Basel Capital Accords have something to do with asset speculation as well. For instance, if risk weight is 35 % for mortgage and 70 % for business loans, less capital is needed for unproductive lending (acquiring pre-existing housing), which is therefore encouraged.

Excessive risk-taking encouraged

Another consequence of the current system is that it encourages excessive risk-taking. As mentioned in Section 2.2, the US was the first country to implement deposit insurance in 1933. Today, practically all developed countries have some kind of deposit insurance scheme in place.

Deposit insurance was invented as a solution to bank runs. Indeed, classical bank runs, in which the public simultaneously tries to withdraw their bank deposits in cash due to the potential insolvency or illiquidity of a bank, have become rarities. Today, bank runs occur because of other reasons, such as exchange rate risks. For instance, the Greek bank run occurred in summer 2015 when Syriza questioned the austerity measures imposed on Greece. The public tried to avoid potential devaluation of their bank deposits (as a likely consequence of exiting the euro) either by withdrawing bank deposits in cash or by transferring them to a foreign bank. As the ECB cut off even the emergency funding of Greek banks, Greece had to shut down its banking system for a couple of weeks. After Syriza submitted to austerity measures, the ECB switched on its funding channels and the banking system was re-opened as the threat of a bank run had ceased.

Although deposit insurance has been successful in preventing classical bank runs, the GFC led to a bank run on another level. The interbank market, in which banks lend reserves to each other, froze as banks became wary of each other's solvency and liquidity. Banks were unwilling to lend reserves, which caused the uncovered interbank interest rate to spike. The interbank market settled only after central banks announced their willingness to discount reserves against almost any bank assets. Thus, the hoarding of reserves by banks was a bank run caused by banks instead of depositors.

Preventing depositor-originated bank runs has, however, created a moral hazard problem. As depositors are guaranteed by the government, they have no incentives to scrutinize the soundness of their bank's assets while banks have strong incentives to add risk in order to increase their profits.

In addition to deposit insurance, which bails out depositors, governments typically guarantee to bail out banks as well – at least implicitly. These government guarantees encourage banks to offer risky loans and take part in other high-risk activities. For instance, James Tobin (1985; 1987) criticized deposit insurance (as well as the central bank being the lender of last resort for the banking sector) for encouraging excessive risk-taking by banks.

Demirgüç-Kunt and Detragiache (2002) have shown empirically that banks take greater risks when their deposits are insured. They found that deposit insurance increases the likelihood of a banking crisis. Thus, Demirgüç-Kunt and Detragiache (2002) drew the conclusion that deposit insurance is ultimately destabilizing rather than stabilizing.

Angkinand (2009), on the other hand, found that the output losses of financial crises are smaller when deposits are insured, presumably because this prevents bank runs. Thus, it seems that deposit insurance can contain

output losses of financial crises somewhat, but it also increases the frequency at which crises occur.

Costs of financial crises

It is worthwhile to notice that there were practically no financial crises in developed countries in the Bretton Woods era after the Second World War until the early 1970s. In a study published by the IMF, Laeven and Valencia (2012) identify 147 banking crises worldwide between 1970 and 2011. The frequent occurrence of crises would not be a serious problem if they did not have significant effects on the real economy. However, the economic (as well as social and ecological) costs of financial crises are tremendous.

The most obvious economic costs of financial crises are the direct costs involved in bailing out failed banks. For instance, Chantrill (2012) calculated that the gross cost of bailing out the financial sector of the US after the GFC was 4.6 trillion USD (26 % of GDP). If repayments are included (revenue from purchased assets), Chantrill (2012) calculates that the net cost of the US financial sector bail-out was 3.3 trillion USD (19 % of GDP).

Admittedly, bail-out costs are difficult to measure and vary considerably across studies and crises. For instance, Reinhart and Rogoff (2013) report that in nine selected financial crises the bail-out costs varied from 2 % of GDP to 55 % of GDP. Usually, for each crisis the highest estimates are approximately double the lowest estimates, but there is also remarkable dispersion. For example, the estimated bail-out costs of the Argentinian financial crisis of 1981 vary from 4 % of GDP to 55 % of GDP. Nevertheless, these figures should give some insight to the scale of bailing out the financial sector after financial crises. Even the smallest estimates are substantial.

More indirect economic costs of financial crises are lost production and lower growth. According to Laeven and Valencia (2012), the average banking crisis costs 23 % of GDP. Hoggarth et al (2002) find that the average banking crisis costs approximately 20 % of GDP. Reinhart and Rogoff (2009b) found that GDP falls by 9 %. in the average banking crisis According to Angkinand (2009), a banking crisis reduces GDP by 3.1 % compared to its trend level. Dell'Ariccia et al (2008) find that, on average, banking crises reduce GDP growth by 1.1 % per year of crisis. For instance, a 5-year crisis would reduce GDP growth by 5.5 %. Although the estimates vary, it is clear that the economic costs of financial crises are huge.

There is also evidence that financial crises become more severe the more debt is accumulated before a crisis. According to Jordà et al (2011) and Taylor (2012), both the depth and length of a recession are proportionally related to credit growth in the runup to a recession. That is, the more excessive credit growth there has been before a recession, the deeper and longer the recession will be.

Contrary to conventional wisdom, real growth may be negatively affected by growth in finance. According to Borio et al (2015), financial crises have

negative effects on productivity growth as credit booms tend to misallocate labour. Cecchetti and Kharroubi (2015) find that higher growth in the financial sector reduces real growth. As liquidity (defined as interchangeability of assets and money) is a structural feature in the current monetary system that determines the conditions and incentives for banking, Fantacci (2013) argues that there is too much liquidity in the current system, which prevents financing of investment and trade.

In addition, financial crises impose social and ecological costs. Most obviously, financial crises often cause unemployment and declines in environmental standards. The social and ecological costs of financial crises are discussed later in Sections 5.3 and 5.4 along with other social and ecological implications of the current banking system.

As the costs of financial crises are massive, avoiding financial crises should be on the top of policy-makers' agenda. In the current monetary system, however, policy-makers have very limited tools to constrain (in a boom) or force (in a bust) bank lending, which is one of the key factors causing financial crises and prolonged recessions.

As was discussed in Subsection 3.2.2, policy-makers are usually unable to constrain bank lending during a boom. Reserve requirements will not be effective as long as money is endogenous. Capital requirements are also rarely binding as bank capital develops procyclically. Credit controls worked in the past, but they are now considered out of the question. Influencing interest rates can have some indirect impact, but it also has adverse side-effects that limit its usability. In other words, monetary authorities have very limited tools with which to prevent credit bubbles in the current monetary system.

Jackson and Dyson (2012) argue that after each crisis – instead of reforming the monetary system – banks have benefitted from new guarantees and concessions designed to patch up the system and get back to business as usual. For instance, in the UK the central bank became the lender of last resort after the Overend Gurney panic in 1866, deposit insurance was introduced after the crisis of the 1930s while bail outs and QE followed the GFC in 2007–8.

Bank regulation has also become increasingly complex. For instance, in the US the Glass-Steagall Act in 1933 was a mere 37 pages long while the Dodd-Frank Act in 2012 included over 9000 pages. International bank regulation has also exploded. Basel I was 28 pages long (BIS 1988), Basel II 251 pages (BIS 2004) and Basel III comprised multiple documents over 169 pages (BIS 2011; 2013; 2014) and other complementary tools and documents (such as recommendations for new macroprudential instruments). Relatively simple banking regulation was able to prevent financial crises from occurring during the Bretton Woods era, but increased complexity has certainly not been able to do so.

5.2.2 FINANCIAL CRISES MITIGATED

Proponents of FRB argue that financial crises would be rarer and less severe in an FRB system compared to the post-Bretton Woods era. FRB would make the payment system secure and eliminate the moral hazard associated with banking.

According to Jackson and Dyson (2012), FRB would make the payment system more secure as there could be no bank runs and banks could be allowed to fail without serious repercussions. As there would always be 100 % backing of deposits with reserves, banks could not become illiquid and insolvency would not compromise deposits. In other words, banks could always settle any amount of payment their customers wished to make.

Thus, deposit insurance would be redundant. Banks would become true financial intermediaries. Angell (1935) praised the FRB scheme for making deposit insurance redundant. The main objective behind Tobin's (1985; 1987) proposal was also to reduce the need for deposit insurance.

In fact, deposit insurance is what makes bank deposits money today. If deposits were not guaranteed by the government, they would not be equally valued. In other words, deposits at different banks would not necessarily clear at par against cash or deposits at other banks. For instance, it could be possible that a 10-dollar deposit at Bank A would be worth 9 dollars at Bank B and one would receive only 7 dollars when the deposit was withdrawn as cash. As deposit insurance eliminates the bankruptcy risk of a bank, deposits at various banks are equally valued and convertible at par to cash.

Chari and Phelan (2014) argue that FRB prevents bank runs and is therefore preferable. Moreover, the benefits of FRB are increased by improvements in communication technology. However, FRB does not spontaneously replace fractional reserve banking as the current system yields private benefits while the costs involved are not private.

FRB would also eliminate the moral hazard problem discussed in the previous subsection. According to Dixhoorn (2013), after the reform, banks could be allowed to fail. Although under FRB banks could not fail due to illiquidity, they could still fail due to insolvency (at least in the sovereign money version of FRB, in which banks are allowed to make loans). However, bank failures do not jeopardize the functioning of the payment system. If a bank fails, demand deposits can be simply transferred to another bank. Time depositors and other investors of a failing bank would have to take the hit.

As the failure of a bank does not impose any threat to the payment system under FRB, Dixhoorn (2013) argues that risks also become private. In other words, no bank is too big to fail. As shareholders and executives of banks are aware of this, they will very likely not engage in excessive risk-taking. This should strengthen financial stability. The moral hazard problem is considered in more detail in the next section, which discusses social issues related to FRB.

Sigurjonsson (2015) argues that FRB would reduce both private and public debt. Under FRB new money would be spent into circulation rather than lent. This, of course, increases incomes. As incomes rise and credit becomes less

available (if so chosen), there will be less debt (treasury debt to the central bank should not be counted as government debt as it is merely between two government agencies). How much public and private debt would be reduced by depends on a number of choices and factors.

According to Sigurjonsson (2015), lower levels of private and public debt mean less risk, which should translate into lower interest rates in general. In addition, he argues that FRB would also mean more stable interest rates throughout the economy as the policy rate does not have to be continually altered to limit or encourage money creation by banks.

Many have defended FRB on the basis that the regulatory burden of banks can be alleviated as they would no longer impose a threat to the payment system. For instance, according to Friedman (1969, 83), Golembe and Mingo (1985, 140-141) and Spong (1996), one objective of FRB is to reduce the government's role private sector borrowing and lending to a largely supervisory one. Phillips and Roselli (2009) also argued that the overall regulatory burden of banks could be reduced by more supervision combined with less regulation.

Lawrence and Talley (1988, 347) argued that one important advantage of FRB is that banks would need less capital and capital requirements would rise if a bank incurred greater credit risk. Lawrence and Talley (1988, 352) argued that this would mean a more stable payment system.

5.2.3 BUSINESS CYCLE TAMED

Booms and busts would be mitigated under FRB. As monetary policy would be separated from credit policy, the amount of money could move countercyclically rather than procyclically. Instead of the money supply expanding quickly in booms and shrinking in busts, following bank loans, the money supply could be increased in busts and decreased in booms – just what is needed to tame the business cycle. This argument is put forward, for instance, by Jackson and Dyson (2012).

FRB would give authorities better control over the money supply. According to Sigurjonsson (2015), fluctuations in the money supply would not be amplified by economic booms and debt-deflations. Monetary policy would be more effective as monetary authorities could influence the money supply directly instead of indirectly trying to manipulate it through interest rates.

According to Jackson and Dyson (2012), the money supply would also be more stable under FRB. The money supply would not fluctuate in line with bank credit creation or destruction. Granting and repaying bank loans would only circulate pre-existing money and, therefore, would not affect the money supply.

FRB would give the economy a permanent money supply. Now, the money supply is simply "rented" from banks and every euro, dollar, pound etc. must ultimately be returned to a bank. A permanent money supply does not, however, imply that it would be constant. In fact, the sovereign money version

of FRB, at least, emphasizes that the money supply should be constantly adjusted to the needs of the economy.

Dixhoorn (2013) argues that interest rates would genuinely reflect the preferences of savers and borrowers. Interest rates would not be (directly) affected by central bank interference nor distorted by government subsidies and implicit guarantees for banks. According to Chung (1991), FRB leads to optimal equilibrium as the deposit interest rate would be the negative of the marginal cost of servicing the deposit balance.

Indeed, conducting monetary policy by manipulating interest rates has recently been challenged. Most importantly, the financial markets face the same interest rates as the real economy (Musgrave (2014, 19–23). Thus, interest rate manipulation is a blunt tool for simultaneously controlling consumer prices and asset prices. Over the last few decades, asset prices soared while consumer prices increased gradually. Indeed, banks were at least partly responsible for fuelling asset prices (especially housing prices). For more arguments on the deficiencies of interest rate adjustment, see Musgrave (2014, 19–23).

Hart (1935) argued that truly effective monetary control would be the main argument in favour of the reform, while Graham (1936) saw that the right to issue fiduciary money should morally be the prerogative of the government. Higgins (1941), on the other hand, argued that FRB would provide an automatic check on investments in excess of voluntary savings, which would mitigate the possibility of inflationary booms. Voluntary saving refers to funds purposely set aside to finance investment, while forced saving refers to money creation by banks to fund investment. Ex-post, however, voluntary and forced saving together equal investment.

In the current system, banks are a major source of inflation as they are responsible for most money creation. Nevertheless, consumer price inflation at least has been successfully restrained at moderate levels over the last few decades. According to Dixhoorn (2013), this led many economists to conclude that inflation was already under adequate control. However, after the GFC many monetary authorities have faced difficulties in reaching an acceptable inflation target and some countries have even been plagued by deflation.

According to Sigurjonsson (2015), FRB would lead to lower inflation. As Dixhoorn (2013) points out, under FRB liquidity traps are no longer possible, so targeting zero inflation would also become feasible.

5.3 SOCIAL EQUALITY

This section first outlines the current problems of the present monetary system regarding social equality. Then, I will argue how FRB would distribute new money more evenly and how risk-return relations would be realigned.

5.3.1 CURRENT PROBLEMS

Jackson and Dyson (2012, 279) quote Paul Fisher, the executive director of Bank of England: "If you can issue a thousand pounds-worth of IOUs to everybody, you've got a thousand pounds for nothing". According to Jackson and Dyson (2012), UK banks have issued more than one trillion pounds of additional IOUs over the last decade. The value they got for "nothing" was a trillion pounds-worth of interest bearing assets in the form of debt contracts secured on the property and future labour of the British public. No other business is able to obtain value for itself in this way.

Indeed, the current banking system increases inequality in several ways. Firstly, asset price inflation fuelled by money creation by banks mostly benefits the rich. Secondly, the public must in effect "rent" the money supply from banks by paying interest on loans. Thirdly, although households also receive interest from banks, the great majority are net interest payers while only the richest 10 % are net interest recipients.

Financial crises caused by the current banking system also involve significant social costs. Most obviously, banks need to be bailed out with taxpayers' funds. However, regular people also suffer through rising unemployment and its negative impact on health, education, poverty and gender issues.

The current banking system also imposes costs on the society on a more general level. The government has to pay interest on its debts. Moreover, banks are incentivized to make bad investments. All these issues are discussed in more detail below.

According to Jackson and Dyson (2012), money creation by private banks has inflated house prices and rents as well as other asset prices. The greatest advantage from this development has gone to the better-off. Kennedy (1995), on the other hand, measured how much interest contributes to various prices in Germany. For instance, interest payments comprised 77 % of the rent of public housing, 47 % of drains and sewage maintenance and 38 % of drinking water supply. The lowest share of interest was in garbage collection, 12 %. According to Kennedy (1995), on average, half of the prices are due to interest payments. Creutz (2001) found similar results as he calculated that financing costs constitute 42 % of the average prices of goods and services .

Furthermore, Jackson and Dyson (2012) argue that, if all debts were repaid, money would not exist. That is, the general public has to be in debt only to support the money supply. The public (i.e. the non-banking sector) must "rent" the entire money supply from commercial banks. According to Jackson and Dyson (2012), in the UK this "rent" totalled 109 billion pounds. Even the small amount of money that is not created by commercial banks (cash) can only enter the economy in exchange for bank deposits. Any attempt to repay the debts on a large scale will result in significant economic problems through debt-deflation.

One way to evaluate the inequality caused by the current banking system is to compare the economic gains and losses produced by banks. The most

obvious way is to compare households' interest payments to and receipts from banks.

According to Kennedy (1995), Germans receiving the lowest 80 % income pay more interest than they receive. The second highest income decile receives roughly the same amount of interest as they pay. Only the richest 10 % are clearly net benefiters as they receive notably more interest than they pay. Later, Creutz (2001) replicated the study and found very similar results. However, these studies included all interest payments and not only the interest payments and receipts of banks. Thus, these two studies might contain some insights but they are not accurate estimates of the inequality directly caused by the current banking system.

Hodgson (2013) focuses solely on the interest payments and receipts of banks and, thus, it probably gives the most accurate estimate of the inequality caused directly by the current banking system. In addition, Hodgson (2013) takes into account salaries paid by banks. Even when salaries are included, Hodgson (2013) finds that only the highest income decile of the UK population are net recipients. That is, the richest 10 % benefits as the remaining 90 % are net payers.

The current banking system causes financial crises, which also involve social costs. Most obviously, banks need to be bailed out with taxpayers' funds. As presented in the previous section, the bail-out costs ranged from 2 % of GDP to 55 % of GDP. According to Reinhart and Rogoff (2009b), government debt also explodes after banking crises. In addition to bailing out and recapitalizing banks, the major increase in government debt is mostly due to collapses in tax revenues and surges in expenditures. Rising indebtedness can limit the political options available to a government which does not enjoy full monetary sovereignty.

Financial crises also cause unemployment and other social costs. According to Reinhart and Rogoff (2009b), the unemployment rate rises by 7 % points after the average banking crisis. According to Dijk (2013), financial crises also have a negative impact on health, education, poverty and gender issues. For instance, after a financial crisis average life expectancy declines by nine months, primary school enrolment drops by 3.5 % and fertility falls by 5.5 %. Furthermore, Dijk (2013) finds a 50 % increase in outbound refugees and inbound foreign aid.

The current banking system also imposes more general costs on the society. The current banking system is expensive for the government. According to State Treasury Finland (2015), interest payments on Finnish government debt were almost two billion euros in 2014. The interest payments comprised roughly 3 % of the central government budget and 1 % of GDP. The interest payments were larger than the administrative field of the Ministry of the Interior, which is responsible for the police force, among other things.

According to Jackson and Dyson (2012), to maximize and secure profits, banks engage in short-termism by borrowing mostly against collateralized assets rather than financing long-term productive projects. This is because

banks want to ensure that non-repayment does not result. If a collateralized loan is not repaid, bank can sell the collateral and thus receive compensation. Long-term productive projects, although beneficial for economic and social development, are hard to collateralize and thus are not funded to the extent that would be socially desirable.

Moreover, according to Dixhoorn (2013), there is a bias in the current banking system towards high-income debtors. High-income individuals often have more collateral and thus low credit risk. On the other hand, poor individuals, even if they have good business ideas, do not necessarily receive funding as they might not have enough collateral. This is especially problematic in developing countries. In other words, credit is not provided to those who are in the greatest need of it as they lack sufficient collateral, but to those who already have significant wealth or income.

Taxation has, of course, a function to redistribute incomes more evenly and, hence, increase social equality. The same can be said of punishing tax havens on the international level and tax evasion and avoidance on the domestic level. However, according to Rowbotham (1998, 103, 111), taxation might not be enough. He argues that we need a bigger change in the monetary system. In the UK the government budget deficit between 1993 and 1996 was on average 30 billion pounds. According to Rowbotham (1998), raising the tax rate of income taxes from 40 % to 100 % for all incomes over 100 000 pounds would produce a mere 6 billion pounds of revenue. In other words, confiscating all incomes exceeding 100 000 pounds would come nowhere close to covering even half of the government budget deficit.

5.3.2 NEW MONEY DISTRIBUTED EVENLY

Banks could not create money for nothing. As discussed in Subsection 5.1.2, clearly over half of the respondents to surveys do not approve of the majority of the money supply being created by private banks. Most people think that money creation should be the prerogative of the government. As Huber and Robertson (2000) put it, FRB would reclaim seigniorage revenue from banks.

Most likely, new money would be distributed more evenly. Banks, and the financial sector more generally, would still be mostly responsible for credit allocation. Although credit would still mostly be provided to those who have collateral or substantial income, Huber and Robertson (2000) argue that the first allocation of money would most likely be more egalitarian if the decision is made by Parliament. This would level the distribution of income.

FRB would reduce income inequality in other ways, too. According to Jackson and Dyson (2012), banks could not fuel asset price inflation, which mostly benefits the rich, by creating money.

Moreover, the money supply would become independent of the amount of bank loans. Jackson and Dyson (2012) point out that there would be a permanent money supply which would remain unchanged even if all loans would be repaid. In other words, the money supply would not have to be

"rented" from banks anymore. Although the rich would still have a number of interest-earning assets, at least interest payments from money creation would not flow upwards, making the richest 10 % of people even richer. According to Wolf (2014b, 211), FRB would reduce the income earned by bankers and so make the distribution of income more even.

As bank loans would not be required to support the money supply, Sigurjonsson (2015) argues that FRB would also mean less household debt. I would add that the behaviour of households might also change under FRB because of this. Less household debt could mean that people are inclined to work less and increase their well-being through additional leisure. Thus, FRB might affect society thoroughly.

According to Jackson and Dyson (2012), it would be relatively easy for the government to become debt-free (in the sense that it would not be indebted towards any private actor) and, thus, avoid paying interest to the private sector. This would save government funds for more pressing purposes.

Rowbotham (1998, 287) argued that FRB would also make Third World debt arbitration an easier and more desirable alternative as the continuous international struggle to acquire debt-free money (through current account surpluses) would be mitigated.

FRB would mitigate financial crises and, at least, isolate the payment system from banking crises. Thus, the negative social consequences of financial crises, such as unemployment and detrimental impact on health, education, poverty and gender issues, would be diminished as well.

5.3.3 RISKS AND RETURNS ALIGNED

FRB would eliminate two key causes of moral hazard in current banking: bank bail-outs and deposit insurance. Firstly, as a failure of a bank does not impose a systemic risk on the payment system, Jackson and Dyson (2012) argue that bailing out banks would be redundant. Banks would not engage in excessive risk-taking to the same extent, as they could not rely on the government to save them with taxpayers' funds. Under FRB there would be no bank which would be too big to fail.

Secondly, Jackson and Dyson (2012) argue that banks would not be incentivized to engage in high-risk lending due to the fact that depositors demand highest possible returns on their deposits because they are guaranteed by deposit insurance schemes. There is no economic or social justification for the government to guarantee risk-free returns (at least when it comes to private assets).

FRB would put the monetary system more in line with market principles. If there is no risk, Jackson and Dyson (2012) argue that there should not be any private returns either. Thus, FRB would re-align risk-return relations.

Although intimately related to social equality, eradication of poverty is discussed in more detail in the next section. The reason is that poverty is often

associated with a lack of economic growth which, again, has an impact on ecological sustainability.

5.4 ECOLOGICAL SUSTAINABILITY

After going through the ecological problems caused by the current banking system, this section examines how those problems might be solved under FRB. This section examines how FRB might alter the composition of production to make it more ecologically friendly. Moreover, this section associates economic growth with negative ecological impact and explores whether there is a growth imperative in the current monetary system. If there is, this section assesses how FRB could erase it. These aspects are later challenged in Section 6.12.

5.4.1 CURRENT PROBLEMS

This subsection discusses potential ecological problems caused by the current monetary system. I begin with how the current monetary system might favour unecological production. Then, I will move on to discuss economic growth and its relation to the current monetary system.

Unecological production favoured

Banks shape the economy by deciding the purposes for which money is created through lending. Instead of ecological considerations, banks naturally lend for most profitable purposes. According to Jackson and Dyson (2012), the UK banking sector might have more influence on the economy than the government as gross lending by banks exceeds government spending. In other words, banks allocate more funds annually than the UK government.

Due to the current monetary system, there might also be artificial scarcity of money. That is, there are not necessarily enough funds for environmental protection or ecological investment (as well as other societal goals). According to Jackson and Dyson (2012), this is particularly the case in economic downturns, when there is a tendency to relax environmental regulation.

Ecological limits to growth

Keynes (1930b) predicted that by the beginning of the 21st century we would have solved the "economic problem", that is, the challenge of producing reasonable material living standards for every person. He argued that once this was achieved we should devote our energies to non-economic purposes, that is, less work and more leisure. Almost 100 years later, however, producing greater economic growth still seems to be the key economic goal of our societies. Although most inhabitants of developed countries enjoy higher than

moderate living standards, there are numerous people who do not have enough.

Indeed, more growth is the standard solution to poverty. Woodward (2015) calculates that to eradicate the most severe absolute poverty (1,25 USD per capita) it would take another 100 years with the experienced patterns of income growth and distribution (under optimistic assumptions). Alternatively, to eradicate the most severe absolute poverty by 2030, real global GDP should grow by a factor of 12. According to Woodward (2015), it would take another 200 years to eliminate moderate absolute poverty (5 USD per capita) if current trends in income growth and distribution continue. Alternatively, to end moderate absolute poverty by 2030, real global GDP should grow by a factor of 175.

Clearly the growth rates required to eradicate poverty by 2030 are unimaginable, but could we simply wait another 100 or 200 years while maintaining more traditional rates of growth? Woodward (2015) argues no. It has become obvious that growth also takes its toll. Climate change, depletion of non-renewable resources and other environmental problems are imposing ecological limits to growth.

Ecological limits to growth were presented by Boulding (1966), Kneese et al (1970) and Georgescu-Roegen (1971) by incorporating the laws of thermodynamics into economic models. Soddy (1926) had already discussed this in the 1920s, but had been largely ignored, even by Georgescu-Roegen.

In the famous "Limits to Growth" report of the Club of Rome, Meadows et al (1972) predicted a grim future for mankind if no action is taken. According to their simulation, there would be an uncontrollable decline in population and production capacity within 100 years. Later, they found similar results with updated data in Meadows et al (2004). The simulations were based on the systems dynamics approach, but they did not include a price mechanism, an omission criticized by many neoclassical economists.

To limit the consequences of climate change, Victor (2008) illustrated that reducing CO_2 emissions by 60 per cent over 50 years is, in practice, impossible without restricting economic growth. Given the World Bank's forecast for population growth and assuming GDP per capita to follow a modest 1.4 per cent growth path (experienced in 1992–2002), CO_2 intensity should fall by 3.9 per cent annually. CO_2 intensity indicates how much CO_2 is emitted to produce one unit of real GDP. According to Victor (2008), this rate has not been reached even during the best periods. The average annual fall in CO_2 intensity has been only 1.5 per cent. Although the difference between 3.9 and 1.5 per cent does not sound insurmountable, Victor (2008) argued that, due to compounding, the difference is huge. With the same assumptions regarding population and GDP per capita growth, an annual reduction of 1.5 per cent in CO_2 intensity would mean an *increase* of 35 per cent in total CO_2 emissions – instead of a *reduction* of 60 per cent!

Although technological development can overcome some of the problems related to growth, it is hard to argue that technological development alone

(accompanied by the rates of growth we are used to) could solve our ecological problems.

Social limits to growth

Even if growth did not involve any ecological constrains, there are social reasons for why greater growth might be undesirable. In addition to ecological limits to growth, there might also be social limits to growth.

Hirsch (1976) attacked theoretically and Easterlin (1974) empirically the idea that more consumer goods increase absolute levels of well-being. Hirsch's (1976) basic idea was that as average consumption levels rise, individuals' satisfaction from consumption increasingly depends not only on their own consumption but on consumption by others as well. Thus, increasing everybody's income does not necessarily increase well-being.

In a literature review Layard (2005) reports that above 15 000 USD per capita per annum, happiness is unrelated to income on a country level. This is in line with Easterlin (1974), who argued that non-economic factors drive well-being rather than income growth after a certain point. Non-economic factors include, for instance, friendship, marriage, health and meaningful employment. This could render economic growth undesirable even among the majority of people.

To tackle climate change and other ecological problems, some have suggested degrowth, that is, to reduce or at least to maintain the level GDP in a coordinated manner (e.g. Daly 1977; 1996; Jackson 2009). To eradicate poverty Woodward (2015), suggests radical redistribution of incomes. Redistribution could, in principle, eradicate poverty even without any economic growth. However, before such policies can be seriously considered, one must first ask whether the current economic system is compatible with a non-growing economy. It seems that every time growth stops, the economy is caught in a crisis. Is there a growth imperative in the current monetary system?

Monetary system driving economic growth

Keynes (1930b) argued that avarice (greed) and usury (interest) are the key forces driving economic growth. He also argued that we should feed those features only as long as economic growth is required to satisfy basic human needs. Spash and Schandl (2009) argue, however, that the shortcoming of Keynes was that he never foresaw any problems in reversing patterns of consumerism or how powerful institutions would be created to maintain the status quo. By now, it is obvious that it would be completely possible to satisfy even the relatively high-order needs of every person at least in the developed countries but, instead of getting rid of them, our current monetary system still builds upon greed and interest.

Others have also argued that interest is a key cause of the growth imperative. A number of green critics of the current banking system argue that money creation as interest-bearing debt forces the economy to grow (e.g. Rowbotham 1998, Daly 1999, Douthwaite 2000, Binswanger 2009 and Farley et al 2013). Contrary to what is sometimes claimed by activists, the problem does not arise from the fact that banks create only enough money to pay back the principal of loans but not enough to cover interest payments as well. There is no problem because only principal repayments destroy money while interest payments can be recirculated by banks, for instance through wages and dividends. However, problems appear as banks do not generally recirculate interest payments in full but withdraw them partly from circulation in the form of undistributed profits.

The growth imperative emerges on both aggregate and individual levels. On the aggregate level, there must constantly be more borrowing in order to cope with the hoarding by banks. More debt tends to increase demand and thus grow the economy.[48] Otherwise, if more debt is not accumulated or, worse, the amount of debt is reduced, a debt-deflation spiral is generated.

On the individual level, the growth imperative is more intuitive. As every borrower must return more money (loan principal *plus* interest) than originally received (deposits equal to loan principal), they must somehow "make the money grow". Typically, borrowers simply produce more goods and services than they received through the loan. This tends to grow the economy.

However, making the money grow need not necessarily manifest as an increase in GDP. Borrowers can also make the money grow in the real estate or financial markets. Nevertheless, it is more ambiguous whether such growth can be sustained. Indeed, the fact that bubbles eventually burst and often lead to financial crises implies that growth can be sustained only temporarily through rising asset prices. Thus, the current monetary system might impose a growth imperative on the real economy, at least in the long run.

One additional reason for the growth imperative under the current monetary system is the sustainability of debt. Sustainability of debt is typically assessed using the debt-to-income relationship. For instance, government debt is generally expressed in relation to GDP[49]. Similarly, household debt is measured against their disposable income. Therefore, the sustainability of debt can be increased either through reducing the absolute amount of debt or

[48] I studied this in my Master's Thesis (Lainà 2011). My finding was that debt growth produces economic growth without any feedback from economic growth to debt growth. That is, there is one-way causality running from debt to economic activity. The finding should not, however, be taken too seriously as the analysis was based on econometric methods, which can produce ambiguous results and are usually sensitive to minor changes in assumptions.

[49] Post-Keynesians building on the MMT argue that the debt sustainability of a monetary sovereign government cannot be threatened and, thus, the debt-to-income relation is meaningless in this case.

increasing the denominator, which requires (at least nominal) economic growth.

As has been pointed out, reducing the absolute amount of debt is very challenging under the current monetary system as it easily leads to a debt-deflation spiral during which the denominator is also reduced. Fisher (1932; 1933) argued that the denominator could decrease even more than the numerator and, consequently, the sustainability of debt would in fact be reduced. Such situations, however, are very rarely encountered in the real world. Typically, a reduction in the absolute amount of debt increases debt sustainability but with disastrous consequences, including unemployment, bankruptcies and deflation. As repayment of loan destroys money, the government must design policy in order to encourage individuals, in aggregate, and itself to borrow rather than repay debts to avoid debt deflation.

5.4.2 COMPOSITION OF PRODUCTION CHANGED

FRB might be able to change the composition of production towards more ecologically friendly production. According to Dittmer (2015), FRB would transfer some of the productive resources from the private to the public sector. Dittmer (2015) argues that, although rarely spelled out, a savings-constrained banking sector would lend less than today, freeing up existing productive resources – such as labour-power and natural resources – to be claimed by public spending.

Thus, FRB could potentially elevate environmental considerations in decisions about resource allocation by increasing the role of the democratic state as an economic actor. For instance, Farley et al (2013) and Mellor (2010) argue that FRB could reduce the dominance of profit maximization over other criteria in allocating the productive resources of a society.

In addition, Jackson and Dyson (2012) argue that FRB could give the public a more direct way to influence investment. At least in the Chicago Plan and sovereign money versions of FRB, banks (or other financial institutions) would offer savings accounts in order to be able to fund loans. The public can choose not to put money in environmentally hazardous savings accounts. Presumably, the public would stress ecological issues more than banks, which tend to focus solely on profits.

In my view, the argument that FRB would make the composition of production more ecologically sustainable seems plausible. However, the macroeconomic and ecological significance is probably exaggerated and the outcome is highly dependent on the political preferences of the people. The composition of production might be slightly more environmentally friendly under FRB, but the change would not be very significant.

5.4.3 GROWTH IMPERATIVE REMOVED

FRB could eliminate the growth imperative coming from the current banking system. Although borrowers would still be obliged to return more funds than they originally received when a loan is granted, and thus on the individual level they should "make the money grow", money supply would exist independently of loans. Thus, it would become possible to repay all loans and still maintain the existing money supply. The economy as a whole would not have to be indebted and pay interest in order to support the money supply. The level of debt would more genuinely reflect the funding needs of the economy.

Banks could not impose a growth imperative through creating money by making loans and then hoarding a part of interest payments as undistributed profits. Hoarding in general (by banks or other economic actors), however, might create a need to grow the money supply. Nevertheless, growing the money supply would not involve any interest-bearing debt as its counterpart. Consequently, there would be no growth imperative.

Moreover, the government could pursue more ecologically friendly policies. As the money supply could be adjusted without changing the amount of debt in the economy, the government would not be incentivized to design policies which encourage the accumulation of debt.

Green proponents in particular see FRB as one way to eliminate the ecologically devastating growth imperative and allow degrowth. Lietaer et al (2012) and Daly (2013) support FRB for this reason. However, they do not want to go back in time. Instead of quantitative growth, they insist on qualitative growth. To emphasize this Daly (1996) makes a conceptual distinction between growth as quantitative and development as qualitative improvement. Growth is about producing larger amounts of the same stuff, which implies that more resources are needed. Development, on the other hand, is about producing better stuff with the same resources (or the same stuff with fewer resources). For Daly (1996) development is desirable whereas growth is not.

FRB will certainly not eliminate all tendencies driving economic growth. Indeed, technological development, profits, hoarding, ideology, individual preferences, government funding, income inequality and private ownership have all been named as potential causes of the growth imperative. Obviously, FRB would be unable to correct the growth imperative coming from these alternative sources. However, FRB might eliminate one tendency encouraging economic growth: the current banking system. Thus, many green proponents of FRB describe FRB as a necessary but not sufficient condition for the elimination of the growth imperative.

6 CRITICISM OF FULL-RESERVE BANKING

Sometimes there are simply false claims associated with FRB. For instance, FRB is sometimes interpreted as the nationalization of all banking and credit allocation. That is, government would make all lending decisions while private money lending would be forbidden. Another, milder, misconception is that no interest could be charged for lending money. As none of the FRB proposals presented in this thesis involves such measures, these claims are pure misconceptions and are not discussed further.

This chapter discusses common criticisms presented against FRB and how it has been addressed[50]. It is noteworthy that FRB is heavily criticized from diametrically opposite views. For instance, as will be seen in the following subsections, neoclassical economists often criticize FRB for being inflationary and a Soviet-style monetary system while a typical post-Keynesian critique is that it is deflationary and monetarism à la Milton Friedman. As Iivarinen (2015) put it, I am not sure whether any other proposal has ever been simultaneously labelled inflationary and deflationary as well as associated with both the Soviet Union and Milton Friedman.

Nevertheless, part of the criticism might have a point. In my opinion, the most important critique relates to the possibility that (shadow) banks would be able to innovate new near-monies and get them accepted as the dominant medium of payment and, thus, undermine FRB. Generally, the criticism seems to apply more accurately to pure commodity standard types of FRB proposals, while proposals based on public money involve more flexible elements that can avoid at least some of these caveats.

This chapter is structured as follows. The first two sections discuss criticism based on political causes. Then, the next eight sections will move to discuss criticism based on economic causes. The final two sections discuss criticism related to social and ecological causes.

6.1 UNRELIABLE GOVERNMENT

FRB would, undeniably, shift some power from the banking sector to the government. This has raised some questions concerning the trustworthiness of the government. It could be argued that even private banks are more trustworthy than the government when it comes to money creation.

As this section will show, some politically right-wing commentators argue that even if FRB might be a good idea theoretically, in practice it could and would be abused. Although private money creation can sometimes be

[50] For more detailed discussion on how criticism of FRB has been addressed, see Positive Money (2015), Musgrave (2014) and Huber (2014).

disastrous, government would do even worse. In other words, the government's ability to manage money would be inferior to that of the private sector. Corruption and self-benefit of politicians are named as the likely reasons for such failure.

The critique from this perspective maintains that citizens should be shielded from the excesses of the government. Following Held (2006), this is in line only with the thinnest interpretations of democracy. For instance, Teivainen (2002) describes "economism" as a strategy to depict certain institutions and issues as economic and therefore neutral. Because of this perceived neutrality, the advocates of this strategy argue that the economic sphere should be left private while democracy should be allowed to function in the political sphere. Teivainen (2002), however, challenges this artificial boundary between the economic and political spheres and shows that many issues in the economic sphere are not neutral but inherently political.

Moreover, even if monetary policy is not deemed inherently neutral, this line of critique seems to maintain that, paradoxically, reducing democratic decision-making in money creation would actually foster democracy. The underlying idea is that democratic monetary control will inevitably corrupt and deteriorate other, functioning democratic institutions. In other words, monetary policy must be shielded from democratic influence in order to protect other democratic institutions.

Critics of FRB have argued from various perspectives that the government is ultimately unreliable when it comes to money creation. Angell (1935) argued that FRB would inevitably lead to political abuse. Angell (1935) had difficulties with which assets would be sold in return for currency. He argued that the implementation of FRB would require much larger asset purchasing programmes than Fisher (1935) had suggested. According to Angell (1935), this would lead to continual involvement by the government, which would be followed by political abuse.

The theory of political business cycles emphasizes that politicians are tempted to increase government spending just before elections to get re-elected. If politicians were in total control of the money supply, the political business cycle could become even larger under FRB.

Coppola (2012) questions whether the government is better at regulating the amount of money than private banks. Coppola (2012) bases her argument on the observation that the government has not fared particularly well at forecasting economic developments. Dixhoorn (2013) brings out the argument that government money would not be entirely safe either. States can fail, and the value of money ultimately depends on the issuer.

This type of critique has been addressed in multiple ways. The general argument that the government would fare worse at managing the money supply than private banks is addressed, for instance, in Musgrave (2014). Musgrave (2014) points out that the GFC was a disastrous event caused by the systemic failure of banks. Although the government would not perform perfectly either, it seems very unlikely that it could do worse. I would add that

political legitimacy would be particularly important under FRB as the perception that government acts only in the interest of special interest groups or is inherently corrupt can undermine the value of money.

I would reply to Coppola's (2012) argument that forecasting is not the same as influencing. Monetary policy is mostly based on reacting to past events and it does not greatly matter whether forecasts are correct or not. Thus, mistaken forecasts would not impede the conduct of monetary policy regardless of whether it operated according to FRB principles.

Musgrave (2014) argues that it is true that governments can confiscate funds and dilute the value of money through inflation under FRB. However, he points out that both are equally possible in the current banking system. According to Musgrave (2014), governments do not have any problems confiscating funds in private banks or inflating the value of bank deposits by "printing" currency. Thus, irresponsible government will cause havoc regardless of the monetary system in place.

Iivarinen (2015) points out that, if we are not ready to trust democratically elected politicians when it comes to the monetary system, then why let them decide on anything? Would it not be wiser to let independent expert bodies decide on everything else too? Iivarinen (2015) answers his sarcastic question by arguing that it would be hard to imagine any other more effective means to lose the confidence of voters than disturbing the value of the nation's money.

Nevertheless, some advocates of FRB feel that government can be unreliable. In Jackson and Dyson's (2012) proposal, this mistrust in government is solved by establishing an independent body which would determine the money supply, while politicians would only determine what was done with new money (or how excess money would be removed from circulation). This independent body would be very similar to the present body within the central bank which sets interest rates (in the US the Federal Open Market Committee, in the UK the Monetary Policy Committee and in the euro area the Governing Council of the ECB), although it would be accountable to parliament. The independent body in Jackson and Dyson's (2012) proposal would merely have a different toolkit than the independent body setting interest rates today. Instead of setting the policy interest rate (in the US the federal funds rate, in the UK the base rate and in the euro area the rate of main refinancing operations) and letting the the market determine the money supply, under FRB the body would set the money supply and let the market determine the interest rate.

Furthermore, Jackson and Dyson (2012) point out that the risk of political abuse is present even now with all funds (tax money or borrowed money) in the government budget. In their proposal, new money would simply be added to the government budget and then spent according to the same principles followed today. New money creation would typically expand the government budget, but it would not be subject to any other abuses than today.

On the other hand, some authors have presented FRB as a way to reduce government influence rather than to increase it. For instance, Friedman (1969,

83), Golembe and Mingo (1985, 140-141) and Spong (1996) felt that FRB would reduce the role of the government and allow for greater freedom in the variety of borrowing and lending arrangements. Phillips and Roselli (2009) argued that that the overall regulatory burden of banks could be reduced after the adoption of FRB was. Indeed, the rationale behind the pure commodity standard version of FRB is to eliminate any government influence on the money supply.

Distrust in government is also one reason why FRB might be inflationary. However, this line of argumentation is discussed in a later section, as there are also economic reasons why FRB could be argued to cause inflation. While in this section FRB was criticized for trusting politicians too much, in the next section it is criticized for trusting them too little.

6.2 UNDEMOCRATIC

Subsection 5.1.2 showed that whether FRB would advance democracy depends strongly on the conception of democracy in question. Following Held's (2006) dichotomic classification of democratic models, the allocation of new money by parliament is mostly in line with liberal democracy. However, this is not necessarily in line with direct democracy as citizens would not directly decide the allocation of money. Nevertheless, FRB is rarely criticised from this perspective. The critics often take the liberal conception of democracy as given.

Moreover, Subsection 5.1.2 pointed out that FRB might increase the economic influence of the state, but that does not necessarily translate to greater democracy. The proponents of the democracy argument generally presuppose that the state has sufficient democratic institutions in place. It is possible that FRB might even reduce democratic influence if it is implemented in an authoritarian or totalitarian state. There is historical evidence that states have been more eager to control money during periods of war, when democratic institutions have often been undermined. However, rarely if ever do critics point to this possibility either.

Typically, the lack of democracy critique presented against FRB considers who makes the decisions of the amount of money. While in the previous section FRB was criticized for trusting politicians too much politicians on this issue, in this section it is criticized for trusting them too little. The critique of this section focuses on the independent body setting the money supply discussed in the previous section.

Some proposals for FRB include an independent expert body which would be responsible for conducting monetary policy. However, only certain proposals for FRB include an independent body (e.g. Fisher 1935; Jackson and Dyson 2012), while other proposals would make monetary policy subordinate to Parliament (e.g. Currie 1934; Daly 2013). Nevertheless, the critique of the independent body is worth discussing as it concerns where the political space should end and where technocracy should begin.

As the proposals for FRB differ to some extent, especially regarding who makes the decisions on money creation, there are good reasons to discuss the critique concerning a specific proposal. For instance, Ann Pettifor (2014a; 2014b) is critical of the independent body presented in Jackson and Dyson (2012). According to her, the independent body cannot be isolated from political influence under any circumstances. She argues that the body's political character is revealed, for example, in the theories it relies on, how inflation is measured etc. Similar critiques are presented by Dixhoorn (2013) and Mitchell (2015b). In GPE literature the issue has been examined, for instance in Teivainen (1997) and Ronkainen (2017), although they study the political aspects of the ECB in its current form and not in an FRB context.

Sawyer (2015) and Fontana and Sawyer (2016), on the other hand, argue that FRB would strengthen the dominance of monetary policy and the central bank over fiscal policy and democratic decision-making. In addition, they argue that the proper functioning of automatic stabilizers – an important part of democratic welfare states – is thwarted.

If the independent body were to be like the current ECB, there would be good reasons to call it undemocratic (as does Teivainen 1997). Gruber and Benisch (2007) summarize the privileges and immunities of the ECB. ECB cannot be sued in a court of law as it is exempt from national law. Even if it were possible, it would be very challenging to gather evidence against the ECB as all non-public documents are confidential and no European law enforcement officer has the right to examine or confiscate them. Gathering evidence would also be pointless as the ECB executives carry diplomatic passports and have immunity from prosecution. All this is to ensure that it is able to conduct monetary policy completely independently.

Jackson (2014) answered Pettifor's critique by pointing out that the decisions of the independent body would not be any less democratic than currently. Although the independent body would not be democratic, neither are private banks nor expert committees governing monetary policy (e.g. the Federal Open Market Committee in the US, the Monetary Policy Committee in the UK and the Governing Council of the ECB in the euro area). Thus, there would be no reduction in democracy under FRB even if money creation was left to an independent expert body.

For some reason Dow et al (2015), Pettifor (2014a; 2014b) and Dixhoorn (2013) are silent about the (un)democratic nature of banks and expert committees governing monetary policy. Saying that something cannot be perfect is not an argument against FRB, as the measures have to be compared to the current situation, which is even further from perfect even by their own standards. Furthermore, if Dow et al (2015), Pettifor (2014a; 2014b) and Dixhoorn (2013) are concerned about the undemocratic nature of some FRB proposals, they should be supportive of other FRB proposals in which both the amount and allocation of money is subjected to democratic decision-making (e.g. Currie 1934; Daly 2013). However, this seems not to be the case, perhaps because they are unaware of these variants of FRB proposals.

The argument made by Sawyer (2015) and Fontana and Sawyer (2016) that FRB would undermine fiscal policy seems to be related to their misconception that under FRB the government would cease to issue bonds and other securities as government deficits would be *fully* monetized by the central bank (which first decides the amount of monetization, and fiscal policy would have to adapt to that). The only FRB proposal I am aware of that has made this type of suggestion is Friedman (1948). All other FRB proposals allow the government to issue bonds in order to finance deficits in excess of money creation.

My assessment of FRB is based on comparing it with the current system rather than with alternative arrangements. The critics of FRB are rarely defenders of the current monetary system. In fact, they often criticize the current monetary system for its democratic deficits and are keen to provide alternative solutions. As has been shown, even the more democratically-cautious FRB proposals, which involve an independent expert body making decisions on the amount of money, would rarely be a downgrade to the current (un)democratic practices. Moreover, there are no logical reasons why democracy could not be pushed further and allow the amount of money to be decided democratically, as some FRB proposals have suggested (e.g. Currie 1934; Daly 2013).

Finally, Bacchetta (2017) argued that FRB would require some undemocratic practices or else it would be inefficient. Bacchetta (2017), whose study was funded by the Swiss Bankers Association, evaluated the consequences of the Swiss referendum to implement FRB. Bacchetta (2017) made a valid point that when monetary policy should be restrictive for a sustained period of time, money would need to be removed from circulation. That is, the central bank would have to tax the government (or people directly). Although operationally not very challenging, Bacchetta (2017) argued that it would be extremely difficult politically. To overcome this problematic would require either undemocratic practices or else it would impose unnecessary limits on monetary policy. Assuming that democracy would not be sacrificed would mean that getting rid of the floor imposed by the zero lower bound in the current monetary system would create a ceiling on the restrictiveness of monetary policy in a FRB system. This is a good point, but arguably the floor is much more dangerous than the potential ceiling and, thus, there is no need to bargain from democracy.

6.3 INFLATIONARY

In the previous sections I discussed criticism of FRB based on political reasons. Now I turn to discussing critique based on economic reasons. As inflation targeting is nowadays the main object of most central banks around

the world[51], inflation should be discussed first. This section relates closely to Section 6.1, which studied the argument that FRB was based on unfounded trust on the government's ability to control money. This section examines the argument that money creation, especially by the government, is inflationary. Thus, this section also acts as a smooth transition from the critique based on political reasons to the critique based on economic reasons.

The inflation argument against FRB and government money creation in general is common, especially among neoclassical economists. The argument goes that due to political pressures and abuses under FRB, the government would create too much money, which again would be inflationary. However, the exact mechanism of how FRB would be *more* inflationary than the current banking system remains unclear. This section also discusses the extreme case of hyperinflation as hyperinflationary periods are typically associated with irresponsible governments creating too much money.

Neoclassical economists commonly argue that money creation – especially by the government through budget deficits – is inflationary. For instance, Spahr (1938), Cagan (1956), Sargent and Wallace (1981) and McCandless and Weber (1995) argued that this is exactly the case. Friedman and Schwartz (1963) summarized the argument in a (in)famous statement that "inflation is always and everywhere a monetary phenomenon."

For some reason neoclassical economists typically focus only on government money or government budget deficits as a source of inflation but leave private money creation aside. One explanation might be the theoretical framework based on exogenous money, which was previously discussed along with other theories of money and banking.

Even if one builds on the flawed Money Multiplier Theory, it should be clear that the expansion of monetary base *per se* cannot lead to any significant inflation as the reserve requirement is 100 percent. That is, banks cannot multiply the base money they receive. This is why an average citizen and not an economist is a typical presenter of this kind of critique.[52]

Probably the most convincing inflationary critique relates to saving and spending habits. For instance, Parkkinen (2015) argues that under FRB there would be net financial wealth without corresponding debt (although the issued money would be a liability of the central bank, with no maturity date and no interest it is effectively debt-free). Households could accumulate wealth through saving, but this is a slow process. However, spending does not take a lot of time. All savers could simultaneously decide to spend their savings, and

[51] Inflation targeting has been questioned by Arestis and Sawyer (2008).

[52] Occasionally economists do make this argument. For instance, referring to FRB, Bacchetta (2017) argues that "[i]t is well known that deficit financing by the central bank is extremely bad policy." However, Bacchetta (2017) does not give any reason why new money creation through government spending would be very harmful. It seems to be based on an implicit assumption that increasing central bank money even under FRB would cause hyperinflation or otherwise reduce confidence in currency.

without corresponding debt there would be no obligation for anybody to offer labour or capital to produce goods and services. As the amount of goods and services would remain the same or even decrease (when savers reduce their work and decide to live off their savings), this could result in high inflation if not hyperinflation. This was also one of the concerns of Rowbotham (1998), but he thought it would be an extremely unlikely scenario. Furthermore, there would, of course, be debt in the economy (existing money lent), which would be an incentive for the indebted to work.

Another reason why FRB is associated with inflationary pressures might be a misunderstanding of at least some of the contents of FRB proposals. For example, Knight et al (1933), Simons et al (1933), Fisher (1935) and Jackson and Dyson (2012) would retain the separation of monetary and fiscal policies. That is, monetary policy would be independent of parliamentary decision-making. As discussed in the previous sections, this is supposed to prevent political pressures and abuses related to money creation. In other words, monetary policy would be independent – as is the case today.

It is true that some of the proposals do not retain such a strong separation between monetary and fiscal policies, but rather let Parliament decide how both should be managed. For instance, Currie (1934) and Daly (2013) support this type of arrangement. Personally, I also tend to lean towards this as my most preferred variant of FRB. Of all the FRB proposals, however, these are in the minority. Supporters of this approach, nevertheless, argue that FRB would not be inflationary even under these kinds of arrangements.

Ryan-Collins (2015) provides historical evidence that monetary financing of government budgets has not been inflationary. Furthermore, he offers a case study of Canada, where monetary financing was practiced regularly in 1935–75. Ryan-Collins (2015) finds that during this period Canada experienced high economic growth and industrialized rapidly with no higher inflationary pressures.

Now, I will move on to hyperinflationary periods, as they are commonly associated with irresponsible money creation by the government. The widely accepted definition of hyperinflation is Cagan's (1956) definition of a monthly inflation rate exceeding 50 percent (which approximately translates into 13 000 percent annual inflation or 1.4 percent daily inflation). Although the exact implementation of FRB can be debated, it is worth our while to consider the causes behind hyperinflations, as FRB would mean more money creation by the government compared to the current situation (but not necessarily compared to banks' previous money creation).

Hyperinflations have been studied surprisingly little until recently. Many prestigious economists have simply assumed that irresponsible money creation by the government has been the chief cause of hyperinflations, for instance, in Germany in the 1920s, in Hungary in the 1940s and also more recently in Zimbabwe in the 2000s. Although massive money creation by the government can be one reason for hyperinflation, it is not necessarily the main

cause. More precisely, money creation by the government can be a secondary cause or an effect of hyperinflation.

Zimbabwe's recent experience has finally brought about more research on hyperinflation. In recent studies the focus has been on Zimbabwe, although other periods have been scrutinized as well. Hanke and Krus (2012) compiled a table of all hyperinflations in the world. According to Hanke and Krus (2012), there have been only 56 hyperinflationary periods in the world (57 if North Korea is counted despite problems with data reliability). Hanke and Krus (2012) argue that the lesson behind their data is that hyperinflations arise mainly due to collapses in the productive capacity of economies. In other words, the main cause behind hyperinflation is extreme conditions such as war, regime change and political mismanagement. [53]

This seems to be the case also in the three infamous episodes of hyperinflation: Germany in the 1920, Hungary in the 1940s and Zimbabwe in the 2000s. The hyperinflation in Germany (Weimar Republic) in the 1920s has been studied by Feldman (1993), Kindleberger (1994), Ferguson (2010), Roche (2011), Montier (2013) and Sorsa (2014). To summarize these studies, Germany's hyperinflation in 1922–23 was caused by excessive war reparations claims denominated in gold and foreign currency, which Keynes (1919) had warned about. Previous accumulation of debt and printing money during the World War I was also partly responsible. The hyperinflation was further exacerbated by the French and Belgian occupation of the Ruhr district, which is one of the most important industrial concentrations in Germany. The occupation collapsed Germany's productive capacity. Furthermore, money creation by the central bank (although not to finance expansionary fiscal policy) aggravated the situation. Thus, Germany's case confirms the finding that hyperinflation is mainly caused by extreme economic circumstances and can be amplified by government money creation.

Another example is Hungary's world record hyperinflation in the 1940s. According to Hanke and Krus (2012), the monthly inflation rate peaked at 40 quadrillion percent in July 1946. At the time, prices doubled every 15 hours. According to Grossman and Horváth (2000) and Montier (2013), the run-up to these hyperinflation figures resembled Germany's experience. Montier (2013, 6) argues that World War II was "the terrible supply shock that was visited upon Hungary". According to Grossman and Horváth (2000) and Montier (2013), half of Hungary's capital stock was destroyed and 90 percent was damaged. Moreover, Hungary had to pay war reparations to the occupying Soviet army. The government's mistake in this case was to accommodate inflation by indexing pretty much everything to the inflation rate. The hyperinflation was eventually tamed in August 1946 when a new regime and currency were introduced.

[53] In addition, Weeks (2014, 153-158) highlighted debt service costs and trade imbalances as potential sources of hyperinflation.

Finally, the hyperinflation case of Zimbabwe has been studied by, for example, Hanke (2008), Hanke and Kwok (2009), McIndoe (2009), Noko (2011) and Montier (2013). A short summary of these studies is as follows: in Zimbabwe there was a drought in 1999 and a land reform in 2000 which redistributed large parcels of land to people with no farming experience. This led to a collapse of crop yields in a country in which more than half of the labour force is employed by agriculture. The annual inflation rate was constantly above 100 percent from 2001 onwards. Thus, in 2001 Zimbabwe's inflation was very rapid but it was still very far from hyperinflation figures[54]. By 2005, more than 80 percent of the labour force was unemployed. The government tried to hang on to its previous spending habits by resorting to massive money printing. Hyperinflation figures were reached in 2007 and the third Zimbabwe dollar was introduced in 2008 at 10 billion times the second Zimbabwe dollar. In November 2008, the monthly inflation rate peaked at 80 billion percent – the second highest rate in world history. Between 2000 and 2008, output contracted by 40 percent. Government budget revenue fell from 28 percent of GDP in 1998 to less than 5 percent of GDP in 2008. All this led to "dollarization", that is, inhabitants of the country used a foreign currency (USD) for daily transactions. By February 2009, authorities officially recognized this and adopted a "multicurrency system", which finally brought the hyperinflation to an end and initiated an economic recovery. To summarize, in Zimbabwe the economic collapse came first and money printing came afterwards. Zimbabwe's case is also in line with previous findings that a collapse in the productive capacity of the economy is the main reason for hyperinflation, although money printing by the government amplified the process.

I conclude that irresponsible money creation by the government is not necessarily the main cause of hyperinflation. However, excessive money creation by the government can give rise to a feedback loop which reinforces hyperinflationary tendencies initiated by a collapse of the productive capacity of an economy. Hence, money creation by the government is more often a secondary cause or a consequence of hyperinflation. The next section discusses the argument that money creation by the government under FRB would not be inflationary – let alone hyperinflationary – but instead deflationary.

6.4 DEFLATIONARY

Another line of argumentation maintains that FRB would not be inflationary but deflationary – a critique diametrically opposite to the previous section (although not necessarily contradictory). While neoclassical economists may

[54] Hyperinflation can be experienced even when annual inflation figures are clearly less than 13 000 percent as monthly inflation can fluctuate, although this was not the case with Zimbabwe.

criticize FRB for causing inflationary pressures, post-Keynesian economists are typically the ones who argue that it would be deflationary.

For instance, Jan Kregel (2012) argues that in the FRB system saving would exceed investment, which would create a deflationary tendency. According to Kregel (2012), the deflationary tendency can be overcome with expansionary fiscal policy by adopting, for example, Lerner's (1943) functional finance as a leading principle. Kregel (2012), however, does not see such an accommodative fiscal policy as a plausible alternative in the prevailing political atmosphere.

Another post-Keynesian, Ann Pettifor (2014a; 2014b,) associates FRB with monetarism à la Milton Friedman and argues that FRB would be deflationary due to shortage of money. Sawyer (2015) and Goodhart and Jensen (2015)[55] also seem to associate FRB with monetarism. Pettifor's argument is discussed further in the next section, which deals with the possible shortage of credit.

However, there are also post-Keynesians who support FRB, such as Ronnie Phillips and Victoria Chick. According to Phillips (1994a, 208): "differences [among post-Keynesians on FRB] center on the issue of the endogeneity of money". For instance, Godley and Lavoie (2012, 128) argue that in the new consensus macroeconomic models of neoclassical economics (see e.g. Woodford 2003) money is endogenous by default, whereas many post-Keynesian economists see endogenous money as a prerequisite for any well-functioning monetary system.

Many post-Keynesians are quite inconsistent in their critique. They argue that the amount of money is not generally important in the economy, for instance, with regard to inflation (an exception is when full employment has been reached). At the same time, they build on Irving Fisher's (1932; 1933) Debt-Deflation Theory and Hyman Minsky's (1986) Financial Instability Hypothesis, in which a reduction in the amount of money (as debts are repaid) feeds deflation. Similarly, an increase in the amount of money during booms feeds asset and debt bubbles. Thus, many post-Keynesian economists seem to hold simultaneously that money does not matter, but it matters after all.

Moreover, in post-Keynesian literature money is inevitably defined as debt. That is, of course, true when we look at balance sheets. Building on this, they argue against FRB as it does not matter whether money is "debt-free" or not. However, at the same time they emphasize that the structures of balance sheets play an important role in the economy, especially in determining financial stability. Again, there is an inconsistency.

Be that as it may, Jackson (2014) and Dyson et al (2016) address the deflationary critique by pointing out that the target of monetary policy would

[55] In a commentary on my paper Goodhart and Jensen (2015) associate the Currency school with rules and static financial systems, while they associate the Banking school with discretion and evolutionary financial systems. However, they also seem to associate FRB with the Currency school, although the now-popular sovereign money version of FRB clearly builds on the Banking school approach.

still be inflation. The only difference is that the money supply rather than the short-term interest rate would be the tool. In fact, manipulating the money supply should be a better tool as it is not delimited by the zero lower bound, which is the case for interest rate manipulation.

Other authors did not see FRB as a cause of deflation, but as a way to prevent it. Brown (1940, 309-313) and Angell (1935) saw (higher) service charges as a considerable disadvantage of FRB, although they did not relate this to any deflationary tendencies. For Keynes (1936), however, imposing service charges was the solution to hoarding and, thus, a means of preventing deflation. Watkins (1938, 44) argued that FRB would be analogous to what Keynes meant about raising service charges with stamped money. Thomas (1940) argued that the major advantage of FRB is to provide the means to avoid deflation during depressions.

Conversely, the Austrian school does not see deflation as a problem, but as a solution. According to Huerta de Soto (2009, 719), Ludwig von Mises argued that FRB would cause minor deflationary pressures, but he saw it as an advantage rather than a shortcoming. Increases in real income would not occur, at least to the same extent, through increases in nominal income, but rather through decreases in the price level. Von Mises argued that this real balance effect adjustment process would be superior to the present system.

Surely, the deflationary tendency of FRB depends on the specific version adopted. (Artificial) pure commodity standard versions are probably more prone to deflation than other versions which involve more discretionary monetary policy. Wolf (2014b) argues that it is not even distantly feasible to implement the pure gold standard version of FRB. According to Wolf (2014b), there are 54 trillion USD worth of bank deposits in the world whereas there is only 6 trillion USD worth of gold (including jewellery). In other words, the price of gold would have to increase 9-fold and all jewellery would need to be confiscated for monetary purposes to provide sufficient backing for all bank deposits. Obviously, deflation of this scale would be unbearable.

To sum up, it is not clear at all whether FRB would cause deflationary tendencies and if it did, whether it would be harmful. The danger of deflation is one of the most controversial critiques of FRB. In my view, it would be one-sided to deem FRB as either inflationary or deflationary. It would also be ignorant to suppose that FRB would cause neither. The issue is more complex. Of course, it is possible that some governments would exploit the power to create money and inflate the economy. Similarly, deflation is possible as some governments would be so stubborn that they would not engage in sufficiently expansionary monetary/fiscal policy (or they would be blocked by the pure commodity standard).

6.5 SHORTAGE OF CREDIT

The credit crunch argument against FRB is that removing banks' ability to create money will reduce their lending capacity and as a result the output of the economy will suffer. This section focuses on the amount of available credit and it ignores the effects on the rate of interest. The next section discusses interest rate volatility.

The argument that FRB causes a shortage of credit is presented by at least Dow et al (2015), Mitchell (2015b), Pettifor (2014a; 2014b), Dixhoorn (2013), Kregel (2012), the Independent Commission on Banking (2011), Bossone (2001; 2002), Goodhart (1993) and Thomas (1940). The problems that a credit crunch would cause differ between the authors. For instance, Mitchell (2015b) argues that it would cause a recession, Goodhart (1993) and Thomas (1940) argue that it would present difficulties particularly for small and medium-sized enterprises (SMEs) while Kregel (2012) sees that banks unable to create liquidity could not support creative destruction.

Even some proponents of FRB admit that there could be insufficient credit. Lauchlin Currie (1934) recognized that during the transition period FRB might cause a shortage of credit. To mitigate this, he argued that government agencies should, if necessary, alleviate the credit crunch through subscribing to the capital of local loaning agencies or establish their own loaning agencies, such as the Reconstruction Finance Corporation in the US.

As discussed in the previous section, Ann Pettifor (2014a; 2014b) argues that FRB would lead to a shortage of money which would be followed by deflation, low economic activity and high unemployment. According to Jackon (2014), Pettifor's critique assumes that the central bank would deliberately restrict the quantity of money.

Jackson (2014) replies to Pettifor:

> *Related to this is the fear that there is a political agenda behind reform of the monetary system. At various points in the article Ann associates the reforms with various schools of economic thought: the Chicago school of economics, Austrian school, neoclassical school, monetarism, Margaret Thatcher, Milton Friedman, and the Gold Standard.*

Jackson (2014) points out that there could not be a shortage of money as the money supply would be totally under the central bank's control and it would be its main operating tool. Thus, if there were to be a shortage of money, the central bank would simply create more money.

Nersisyan and Wray (2017) point out that this line of thinking relies heavily on fiscal policy. They argue that fiscal policy should be significantly more expansive in general. I take the point that responsibility might shift towards fiscal authorities, but if the state as a whole is able to achieve certain economic goals with a combination of monetary policy and fiscal policy today, it seems unlikely that under FRB the state would be unwilling to coordinate its policies to reach a desired outcome.

Jackson and Dyson (2012) argue that there are some false implicit assumptions underlying the credit crunch critique. Firstly, it is assumed that more lending is always better as lending funds productive investments. For instance, Goodhart and Jensen (2015) seem to assume that satisfying the demand of bank customers for credit is always a good thing. According to Ryan-Collins et al (2011), in the UK less than 10 % of all bank lending goes to businesses that contribute to GDP. Hence, most bank lending goes to other purposes, such as speculation on the housing market and derivatives.

Indeed, Musgrave (2014) reminds that the GFC and other financial crises were caused by overly cheap and easily available bank credit fuelling an asset bubble. Therefore, Musgrave (2014) argues that less credit might actually imply a healthier economy. He emphasizes that the rise in the cost of credit simply reflects the removal of government subsidies which guarantee bank deposits to clear one to one with currency. In addition, Jackson and Dyson (2012) maintain that house prices would be more reasonable under FRB as they could not be bid up with new money creation.

Secondly, it is assumed that banks will always satisfy the demand for credit. Jackson and Dyson (2012) argue that banks lend procyclically. That is, banks lend too much during booms and too little during busts. This means that banks amplify economic fluctuations. There are a number of empirical studies that confirm this, for instance, Borio and Drehmann (2009), Reinhart and Rogoff (2009a) and Lainà et al (2015).

Thirdly, it is assumed that under FRB banks would passively wait for funds. According to Jackson and Dyson (2012), banks can increase interest rates on savings accounts in order to attract funds. Market mechanisms push the interest rate up to ensure sufficient lending. In other words, the Loanable Funds Theory of mainstream economics would be applicable. Now, the theory is being applied in an institutional context in which money is fundamentally endogenous rather than the exogenous form that is required by the theory.

Fourthly, it is assumed that there might be no shortage of money, but there could be a shortage of credit. Jackson and Dyson (2012) address this by pointing out that if there were a shortage of credit across the entire banking system, the central bank can inject more money into the banking system by lending on the provision that the funds are on-lent into the real economy. This resembles the current funding for lending schemes in the UK and in the euro area. Jackson and Dyson (2012) emphasize that the discount window of the central bank is important, especially during the transition period. The discount window would allow the extension of both money and credit simultaneously, as is the case in the present system.

Fifthly, it is assumed that lending is a one-shot game instead of a cyclical process. Put differently, it is assumed that money is either in a current account waiting to be spent or tied up for a period of time in savings account. Jackson and Dyson (2012) argue that this might be true for individuals, but not for the system as a whole. Money is never held in savings accounts. Instead, money "deposited" in savings accounts is returned to current accounts through bank

lending. Moreover, Dyson et al (2016) point out that under FRB banks cannot create money, but similarly they cannot destroy it either. Loans being repaid to banks allow them to lend the money again. The net annual increase in the money supply is relatively small even today, which allows banks to sustain almost identical loan stock by making new loans as old loans mature.

To recap, in Jackson and Dyson's (2012) proposal, the central bank decides both the amount of *money* needed in order to maintain aggregate demand in line with the inflation target and the amount of *credit* needed in order to avoid a credit crunch. Bank credit is available from customers' savings accounts, from repayments of outstanding loans and from the discount window (in emergencies). These measures should ensure that credit crunches do not occur under FRB.

The critics often exaggerate the extent to which credit availability would be constrained under FRB. A vast amount of funding is not bank loans, but bonds, equities etc. FRB would have no effect on these other sources of funding. Only loans would be affected.

Jackson and Dyson (2012) note that today most funding comes from the "market" and not from the banking sector. For instance, institutional investors, such as pension and insurance funds and private mutual funds, have enormous financial assets. These investors must acquire funds before they can invest. This is in stark contrast to the banking sector, which is able to create its own funding in the process of lending by simultaneously creating new deposits. Nevertheless, this has not prevented other financial institutions from being profitable. In fact, before the GFC other financial institutions were doing excellently – as they are now. According to Jackson and Dyson (2012), the real challenge is to direct funding to productive and socially beneficial purposes rather than to speculation. This challenge exists even in the current banking system.

Prescott and Wessel (2016) argue that credit availability to firms would not be reduced under FRB:

> *Currently, most financing of businesses in the United States is mutual and is not coming from bank deposits. In 2012, checkable and time/savings deposits were approximately 0.65 GNP [gross national product], whereas business borrowing was 2.5 GNP (2012 Flow of Funds, Table L104-5). Nearly all of the rest of business borrowing is directly or indirectly from the household sector.*

According to Jackson and Dyson (2012), currently 42 % of all bank deposits in the UK are demand deposits and 58 % are time deposits. Should these numbers stay unchanged, there would be plenty of bank funding (all time deposits) available even under the FRB system.

According to the Economic Report of the President (2013, 406-7), the share of deposits available to fund investments would be even higher in the US. Currency, demand deposits and other checkable deposits totalled 2440 billion dollars in the end of 2012. Savings deposits, time deposits, and retail and

institutional money funds totalled 7960 billion dollars in the end of 2012. The historical development of these numbers is visualized in Weeks (2014). Thus, only 23 % of deposits would be unavailable to fund investments under FRB.

According to Véron (2013), bank loan financing is much more important for firms than bond financing in Europe and Asia than in the US. In the euro area and Asia, firms are financed almost entirely by bank loans. In the US, however, bank loans and bonds are equally important. Although in all instances bank loans are a very significant source of firms' funding compared to bonds, firms do have other important sources of funding as well – namely equity.

Kraemer-Eis et al (2014) find similar results, although there has been rapid development. Between 2002 and 2008, bank loans comprised 75 % of firms' debt funding in the euro area while other securities comprised only 25 %. However, between 2002 and 2014 bank loans had dropped to 55 % while other securities had risen to 45 %. During the same comparison period, bank loans in the US dropped from 40 % to a mere 20 % while other securities rose from 60 % to 80 %.

Gallès and Vallas (2014) compare the funding structure of firms in the euro area and the US – including equity, which was absent in the studies above. They find that bank loans comprise 45 %, bonds 20 % and equity 35 % of firms' funding in the euro area. In the US, on the other hand, bank loans form 10 %, bonds 25 % and equity 65 % of firms' funding. Thus, even if a large proportion of bank loans were to be unavailable under FRB, it would not impede firms' funding, at least in the US. In the euro area, however, there would be a genuine risk that FRB might reduce firms' funding.

Even though otherwise critical of FRB, Bacchetta (2017) calculates that credit availability would not be significantly reduced under FRB, at least during the transition phase. Even if banks were to transfer all their increased costs to borrowers, it would increase the lending rate by a mere 0.12 % points. This would have a negligible effect on the availability of and demand for credit.

According to Goodhart (1987; 1993), financial crises could not be eliminated in an FRB system. He argues that during boom times time deposits would be popular, fuelling a credit boom, but during busts there would be a "bank-run" on time deposits and that would lead to a banking crisis or at least to insufficient credit availability.

As was argued in Section 5.2, FRB would not, of course, make the financial system completely secure. Booms and depressions could still exist. For instance, Jackson and Dyson (2012) would not make FRB such a dogmatic approach that it would deny banks access to additional reserves under all circumstances. Instead, their proposal includes a central bank discount window, which could be utilized during crises.

Although Goodhart (1987) resists some versions of FRB (namely the Chicago Plan and sovereign money), his own proposal is actually one version of FRB – limited purpose banking. Goodhart (1987) suggests that the payment system operated by mutual funds would be safer than the current banking

system. There would be no risk of insolvency or illiquidity as the assets and liabilities of these mutual funds would move in tandem. In other words, the monetary balance of savers would vary in value depending on the underlying assets of the mutual fund. However, one distinguishing characteristic of Goodhart's proposal is that it would maintain the lender of last resort for banks. The reason is that the banking system would still be prone to banking crises (even if they do not provide demand deposits) because the value of their assets is uncertain while they have fixed nominal liabilities (time deposits).

This section examined the critique that FRB would lead to a credit crunch. The next section explores the critique that FRB would lead to excessively volatile interest rates. Note that a credit crunch can be seen as the mirror image of high interest rates. However, volatile interest rates indicate that interest rates are not simply high but fluctuate enormously.

6.6 VOLATILITY OF INTEREST RATES

Even if there were no general shortage of credit, it is claimed that FRB would lead to more volatile interest rates. Indeed, this is true of FRB by definition. Under FRB, monetary authorities would set the quantity of money and let the interest rate be determined in the market, while currently monetary authorities set the interest rate and let the market determine the quantity of money. Obviously, setting the rate of interest (policy interest rate) must be more stable than market determination. The question, however, is not whether the interest rate would be more volatile under FRB, but whether the interest rate would be *too* volatile.

Indeed, most of the time the policy target of central banks has been the rate of interest instead of the quantity of money. According to Romer (2000, 155), "the dominance of interest rates over monetary aggregates in the conduct of monetary policy is not a recent phenomenon. In the United States, for example, only in the 1979–1982 period did monetary aggregates play a significant role in policy." The 1979–1982 period refers to the Volcker experiment, which was an attempt by the Fed to target monetary aggregates by managing banks' holdings of non-borrowed reserves. However, it was a moderate attempt because, unlike with FRB, banks could still extend loans on their own balance sheets and they had access to the discount window.

Dow et al (2015) and Foot et al (1979) argue that the money supply would be too stiff to react flexibly to various shocks and this implies that the interest rate would become too volatile. Dittmer (2015) is not convinced that FRB would not provoke such an increase in the volatility of interest rates that the central bank would be forced to resume its role as lender of last resort and revert from quantity control to interest rate targeting. Also, Angell (1935) argued that short-run fluctuations could still be very large.

According to Phillips (1994a), although Hyman Minsky was a student of Henry Simons, he did not fully embrace Simons's policy prescription of FRB.

In FRB the discount window is abolished (although Jackson and Dyson 2012 allow it temporarily during periods of financial stress) and the reserves available are affected only through open market operations.

Minsky (1986, 324-325) took the opposite view that open market operations should be abolished and central bank reserves should be furnished by discounting bank assets. In other words, the central bank would be concerned with the interest rate and not with the quantity of money. Minsky (1986, 325) argued that the preferred asset for discounting would be "to-the-asset paper that reflects commercial or manufacturing inventories".

According to Phillips (1994a), Minsky's proposal was based on the real bills doctrine, although in his version the central bank reserves are subject to the real bills requirement instead of bank deposits. When loans are made, bank reserves would increase and, similarly, as loans fall due, bank reserves would decline. According to Minsky (1986, 325), such a system "blunts the tendency toward fragile financing techniques". This means that the supply of reserves would be infinitely elastic to all who hold eligible paper at some rate of discount. Minsky (1986, 326) argued that in this system the interest rate on speculative and Ponzi financing would be higher than on hedge financing. Minsky (1986) proposed that the discount window reform, coupled with higher capital and reserve requirements, would help to stabilize an unstable economy.

The real bills doctrine has, however, been challenged for feeding instability. According to Phillips (1994a), a shortage of specie (gold or silver) led to the "real bills doctrine", which maintains that as long as banks make short-term, self-liquidating loans for commercial reasons, banks can provide both deposit and lending services without any difficulties. Mints (1945, 30) argued that instability would result from the real bills doctrine, as a fall in nominal income would lead to a fall in both demand for and supply of money.

Schwartz (1992, 59) noted that there are shortcomings with the discount window as "it is impossible to know whether an institution that applies for discount window assistance faces a liquidity or a solvency problem". Wray (2013) recently confirmed her notion by pointing out that after the onset of the GFC the Federal Reserve did borrow for multiple years with lending rates significantly below the market rates. Thus, it can be argued that the GFC was not a liquidity crisis, but a solvency crisis.

Subsequently, however, Minsky (1994) found some merits in FRB, although he did not recant his discount window proposal. The main merit being that "it separates the two functions that the monetary and banking system has to perform: the provision of a safe and secure means of payments and to provide for the capital development of the economy." Later, according to Kregel (2012), Minsky gave up his support for FRB, although he does not provide any references to support his claim.

Some advocates of FRB have proposed that the supply of credit need not necessarily be constrained by savings. For instance, Benes and Kumhof (2013, 16) suggest that "[i]f the government wants to maintain low interest rates in

the investment trust sector [...], treasury credit can be used to supply additional funds". Currie (1934) had made the same point decades earlier.

As discussed in the previous section, Jackson and Dyson (2012) argue that the central bank should assess the need for money and credit separately, instead of lumping them together as is currently done. Should there be a need for more credit but not more money (at least without corresponding credit), the central bank could make advances to banks in order to keep the interest rate low and induce lending and borrowing. Thus, Jackson and Dyson (2012) believe that the supply of credit need not be constrained by previous savings in every situation. These additional lines of credit should ensure that interest rates do not become excessively volatile under FRB.

Kumhof (2016) went even further. He argued that under FRB it is not necessary that the central bank to have a money supply target. Instead, it is fully possible for the central bank to maintain an interest rate target. That is, all deposits would have to be backed with government money, but banks would have open access to the central bank's discount window – in the same spirit as in Minsky's proposal. In effect, banks could relatively freely make loans and issue deposits, but they would have to sell those loans to the central bank in order to satisfy the full-reserve requirement. Obviously, in this case the interest rate would not be any more volatile than it currently is.

6.7 END OF BANKING

The core economic functions of banks are to provide payments services, take deposits, make loans, practice maturity transformation and monitor borrowers. Indeed, in Subsection 1.3.4 banks were defined as financial institution which take deposits, grant loans, provide cash and make payments on behalf of their customers. Under FRB (at least in some versions) each of these functions would continue as before. As it might, however, be claimed that FRB would end banking as we know it – by ending the practice of maturity transformation and by ending the need to monitor borrowers to manage asymmetric information – these issues are discussed next.

Maturity transformation means that banks lend out long and borrow short. That is, they make loans which are paid back over a long period of time while they fund these loans with deposits (which they themselves issue) that can be redeemed in cash within a very short time. In other words, banks' assets and liabilities differ in duration. Banks are said to be experts in managing this asset-liability mismatch, which is important for the proper functioning of the economy. For instance, Bossone (2001; 2002) claims that FRB would end maturity transformation.

Jackson and Dyson (2012) address this claim. They argue that under FRB banks would continue managing asset-liability mismatch, but the discrepancy between the duration of assets and liabilities would be reduced. There would be no discrepancy between the duration of demand deposits and their

balancing asset (cash and central bank reserves), which would replace loans on the asset side of the bank balance sheet. Yet, banks would be able to provide savings accounts. Depositors would share some of the risk related to these savings accounts with a bank. Banks would be able to make loans from funds deposited in these savings accounts. Banks would still practice maturity transformation, but they would not be able to create money. They would fund long-term loans with shorter-term savings accounts. More precisely, they would have to manage the outflows resulting from loan-making and savings account withdrawals and the inflows resulting from loan repayments and savings account deposits. While there would be no maturity mismatch whatsoever between demand deposits (liability) and reserves (asset), the duration of savings accounts (liability) would differ from but better correspond to the duration of loans (asset).

It should also be noted that maturity mismatch can be one source of banking crises – namely liquidity crises. A liquidity crisis refers to a situation in which a bank cannot settle its maturing liabilities because its assets (although valuable enough) are tied up for a longer period of time. In this case the bank has to sell its assets on discount or resort to the emergency liquidity assistance of the central bank. Selling assets on discount or bearing the penalty costs of emergency liquidity assistance on a large scale can trigger a solvency crisis. Thus, reducing maturity mismatch can also reduce banking crises.

Regarding this, the Bank of England's former governor, Mervyn King (2010, 17), deems that:

> *[T]he pretence that risk-free deposits can be supported by risky assets is alchemy. If there is a need for genuinely safe deposits the only way they can be provided, while ensuring costs and benefits are fully aligned, is to insist such deposits do not coexist with risky assets.*

In other words, King is saying that it is impossible to make either current or savings accounts riskless as long as deposits are backed by bank loans. The only possible way to make deposits safe is FRB (in his book *The End of Alchemy* King (2016) provides his own narrow banking version). Otherwise, deposit insurance and bank bail-outs, which are ultimately funded by taxpayers, are needed. In Jackson and Dyson's (2012) proposal, demand deposits would be risk-free, while savings accounts would inevitably involve some risk. Thus, in their proposal there is no "alchemy".

Managing asymmetric information is another important function of banks. It means in the banking context that individual savers do not have enough information on the creditworthiness of potential borrowers to fund lending directly. As banks settle payments for their customers, they also obtain information on the creditworthiness of potential borrowers. Thus, there is less information asymmetry between a potential borrower and a bank. Other financial institutions, such as mutual funds, do not have the same information as banks as they do not settle payments for their customers. This is the main reason why certain type of loans, such as mortgages, are funded by banks and

not by other financial institutions, for example, pension, investment or mutual funds.

Phillips (1995) and Jackson and Dyson (2012) argue that under FRB banks would still settle payments for their customers and hence they would obtain the same information as before on the creditworthiness of potential borrowers. As banks are more able to assess the creditworthiness of potential borrowers, they can charge for this service by paying less interest on savings accounts than they receive from loans (net of credit losses). In short, under FRB banks' main business model would be the same as before: the interest rate margin.

Other arguments that FRB would end banking refer to bank profitability. Angell (1935) criticizes Currie's (1934) proposal that banks would be loaned the money to raise reserves to 100 percent and then the loan would be repaid over some specified period, simply because banks could not make such additional net payments. As Jackson and Dyson (2012) adopt the same method as Currie with their "conversion liability", Angell's critique is topical even today.

Coppola (2014) argues in response to Martin Wolf's (2014a) article in the *Financial Times* that banks cannot be profitable under FRB. Bossone (2001; 2002) also makes this argument. Previously, Thomas (1940) argued that short-term lending (credit cards, overdrafts etc.) would become much more expensive and might be abolished altogether.

Dyson (2014b) responds to their argument that banks would be able to charge for payments services related to demand deposits – as they already do now. In addition, banks' savings accounts (time deposits) would work like the rest of the financial sector, which has not had any problems making profit. On the contrary, even though they could not create money, other financial institutions expanded rapidly and were extremely profitable at least until the GFC.

Even though FRB would end banks' ability to create money, it can hardly be said to end banking. The next section focuses on "shadow banks", which are other financial institutions acting like regular deposit banks.

6.8 RISE OF SHADOW BANKING

This section discusses the systemic importance of shadow banks. The focus is on financial institutions. The next section discusses near-monies, which is a closely related subject as they are typically provided by shadow banks.

FRB can be criticized for concentrating too much on deposit banks and neglecting the systemic importance of "shadow banks", that is, other financial institutions providing similar services to deposit banks. Kregel (2012) and Turner (2010, 22-23) argue that proponents of FRB do not address the impacts on the financial system caused by the failure of other financial institutions than deposit banks. Admati and Hellwig (2013, 90) put it as follows:

> *Bear Stearns and Lehman Brothers were non-deposit-taking investment banks, AIG was an insurance company, and LTCM, seen as systemically important in 1998, was a hedge fund. None had depositors, and none was involved with the payment system.*

Paul Krugman (2014) wrote the following on his *New York Times* blog: "If we impose 100% reserve requirements on depository institutions, but stop there, we'll just drive even more finance into shadow banking, and make the system even riskier." The Independent Commission on Banking (2011), Diamond and Dybvig (1986), Fontana and Sawyer (2016) and Dow et al (2015) have made the same point.

Dow et al (2015) even illustrate the point with a case study. According to Dow et al (2015), Kaupthing, Singer and Friedlander, which is a UK-based subsidiary of Icelandic bank Kaupthing, had a 95 % reserve requirement imposed on it during the GFC. It was, however, able to undermine the almost full-reserve requirement with a liquidity swap with its parent company. When the depositors asked for their money, Kaupthing, Singer and Friedlander could not even deliver 300 billion of the 1600 billion pounds it was required to hold as reserves. Consequently, the financial supervisor of the UK had to step in and revoke its banking license. Finally, Kaupthing, Singer and Friedlander had to be taken over by the UK government. The lesson is, according to Dow et al (2015), that FRB requirements can and will be circumvented.

It is true that Bear Stearns, Lehman Brothers, AIG and LTCM were not deposit banks and banks were not the first institutions to fail in the GFC. However, Dyson et al (2016) argue that other financial institutions, such as those named above, issued bonds and other financial instruments and part of those instruments were bought by banks (by issuing deposits), and thus ended up on the asset side of banks' balance sheets. Thus, a failure of other financial institution could erode the solvency of regular deposit banks, too. As banks would be unable to buy securities by issuing deposits, FRB would eliminate these types of risky interlinkages between other financial institutions and banks.

The shadow banking critique is also addressed by Dyson (2014a). He argues that only demand deposits would be risk-free under FRB. Therefore, whatever happens in the shadow banking sector would be private risk-taking. In addition, there would only be demand for money substitutes if there was a shortage of risk-free money, but the target of the central bank would be to avoid any shortage of risk-free money. Finally, Dyson (2014a) argues that under FRB the government would no longer need to prevent bank failures for the sake of protecting taxpayer funds and the payment system, and could leave banking as an activity of private risk-taking. Contrary to the current system, under FRB shadow banks could not impose any risks on the payment system as banks' balance sheets would not be exposed to any risks emanating from shadow banking.

Phillips and Roselli (2009) reiterate that the idea of FRB is to make banks similar to other financial institutions in terms of lending, and thus no extra regulation would be needed. In fact, as banks would be completely safe under FRB (in terms that they could always make payments), there would be no need to regulate their lending practices any more than those of other financial institutions. This should eliminate any incentive to circumvent the FRB requirement by providing lending services through other financial institutions.

Goodhart and Jensen (2015), on the other hand, argue that if FRB limits banks' profit-making capabilities too greatly, banking services can be provided from abroad. FRB can, of course, be imposed only on domestic banks but, in a world with free capital mobility, foreign banks can relatively easily provide banking services to other countries. Therefore, De Grauwe (2008a) argues that implementing FRB requires international coordination as otherwise domestic banks are disadvantaged against foreign banks.

Although under free capital mobility foreign banks can offer their services to domestic economic agents, they cannot settle payments, offer deposits or make loans in domestic currency. Of course, if the domestic currency loses its credibility, it can lead to the dollarization of the economy, that is, most payments being made in a foreign currency. However, as long as the economy functions normally, the requirement that taxes have to be paid in domestic currency and the legal tender status of domestic currency (i.e. it must be accepted for all payments, including private debts) should ensure that there is sufficient demand for domestic currency and foreign banks cannot displace the domestic FRB system.

6.9 EMERGENCE OF NEAR-MONIES

Perhaps the most convincing criticism against FRB is the emergence of near-monies, that is, highly liquid non-legal tender assets. In other words, after FRB was implemented, bank deposits would become less significant means of payment as economic agents would replace bank deposits with some other means of payment. This happened in the 19th century when bank notes were replaced by bank deposits. In fact, demand deposits are not legal tender even today, but a near-money. Only currency is legal tender in most countries. Should FRB be implemented, very short-term time-deposits might become a substitute for legal tender money. This would only take the same problem to a higher level. This would mean that true FRB would be impossible as long as near-monies could emerge.

The problem of near-monies was already discussed by the original Chicago Plan authors. For instance, for Henry Simons (cited in Allen 1993, 708) the main concern of the Chicago Plan soon became "how to keep deposit banking from growing up extensively outside the special banks with the 100%

reserves". According to Phillips (1994a), Henry Simons became a bit sceptical of the Chicago Plan, but he continued supporting it.

Some economists saw near-monies as an obstacle to FRB. Schumpeter (1954, 723) argued that checking the creation of near-monies "is the difficulty that all such [FRB] schemes meet". According to Phillips (1994a), Hayek was sceptical of the Chicago Plan in his letters to Simons because of near-monies. Brown (1940, 309-313) argued that even though near-monies would initially be banned, they would later emerge and generate instability. Also Angell (1935) saw that FRB would lead to the creation of close substitutes for official money.

Bacchetta (2017) calculates with Swiss data that under an FRB version with no interest on demand deposits, demand for demand deposits would be reduced by 36%. This reduction would be matched by an increase in other assets.

Phillips (1994a, 185) argued that the development of near-monies is inevitable as long as we live in a "money-as-debt economy". According to Phillips (1994a, 209), near-monies would not be a problem in a pure commodity standard, such as a 100 percent gold standard, as there would be only one kind of money. However, I would argue that Phillips missed the main point here. Even under FRB there would be only one kind of money, currency and demand deposits. Nothing prevents near-monies from emerging even under a pure commodity standard. For instance, under a 100 percent gold standard, silver or promises of gold (in the form of notes) might emerge as a substitute. Hence, emergence of near-monies is a problem which needs to be addressed under any monetary system.

Allais (1987) emphasized that the problem with FRB would be the emergence of near-monies. He argued that the Chicago Plan was an attempt to define the money supply as currency and demand deposits and, thus, the reform would make MB identical to M1. He criticized the Chicago Plan for this definition of money and offered an alternative view that the money supply should be defined as MB and the degree to which other financial assets are seen as money by the holder. He argued that the UK Bank Charter Act of 1844 applied the FRB principle to bank notes, while demand deposits were a close substitute. Similarly, the Chicago Plan would apply the FRB principle to demand deposits, while time deposits are a close substitute. According to Allais (1987), it followed that you cannot prevent the creation of near-monies, but you can affect the creation of credit. Credit creation is exactly what Basel III tries to check with its countercyclical capital buffer, loan-to-value cap and sectoral risk weights, among other instruments.

Goodhart and Jensen (2015, 23) make a similar argument. They argue that under FRB "[b]anks would still be able to make loans by writing up both sides of their balance sheet, only in the form of short-dated time deposits rather than demand (sight) deposits. Borrowers would have to wait a week before accessing their funds".

Other scholars seem to subscribe to Goodhart's Law, that is, when the state imposes control over money, new monies will emerge. For instance, Dixhoorn (2013), Dow et al (2015) and Fontana and Sawyer (2016) think that FRB would soon be undermined by a new, alternative means of payment.

Becke and Sornette (2017) make a similar case, but they base their argument on the hierarchy of money. They argue that liabilities on a higher level of hierarchy act as assets (e.g. money) for a lower level. According to Becke and Sornette (2017), proponents of FRB do not recognise this and, if they did, they could not support FRB. However, Iivarinen (2015) makes exactly the same case for the hierarchy of money, but uses this to justify FRB.

Near-monies can, of course, be imported from abroad as well. This is known as "dollarization", that is, when the economic agents of a country use a foreign currency (typically USD) for daily transactions instead of their official currency. As was previously described in Section 6.3, according to Noko (2011), this is what happened in Zimbabwe during the hyperinflation in the 2000s. If domestic currency subject to FRB is seen as unreliable, Fontana and Sawyer (2017) point out that it could be replaced by a foreign currency functioning according to the principles of fractional-reserve banking. Thus, the medium of payment of a country would not in practice be subject to full-reserve requirement.

The potential emergence of near-monies has been addressed in several ways. Firstly, Irving Fisher was not particularly worried about the possible emergence of near-monies. Fisher (1935) argued that the emergence of near-monies should be monitored and made impossible.

There is historical evidence that near-monies do not spontaneously emerge if they are not allowed to. During the Glass-Steagall period, deposit banks were the only financial institutions allowed to issue deposits in the US. The Act prohibited deposit banks from speculating in the stock market. In other words, the Act restricted the types of assets that deposits banks could hold against their deposits and other liabilities. It did not lead to the emergence of near-monies or other financial instruments offered by other financial institutions. Only a series of political decisions to deregulate banks (including the repeal of the Glass-Steagall Act) led to a boom in alternative financial instruments. Thus, as long as the FRB requirement is sufficiently supervised, it seems unlikely that FRB could be undermined to any significant extent.

Secondly, to mitigate the possibility that short-term time deposits would replace fully-backed demand deposits, Sigurjonsson (2015) suggested a 45-day minimum notice period for time deposits. Furthermore, he suggested that transferring the ownership of time deposits should be prohibited. I would add that Goodhart and Jensen (2015) fail to notice that after a week (or whatever the minimum notice period would be) the bank would need to acquire demand deposits and an equivalent amount of reserves to back them. Therefore, banks would not create money under FRB, even though they could expand their balance sheets.

Thirdly, Friedman (1960, 74) argued that paying interest on reserves would reduce the incentive to evade the full-reserve requirement and to create near-monies. That is exactly what most central banks do today, although in several countries the interest rate paid on reserves is currently negative. Negative interest rates on reserves would heighten the incentives to evade the full-reserve requirement and to create near-monies. In order to reduce the incentives, the interest rate on reserves should be positive. This could be relatively easily achieved under FRB as the main tool of monetary policy would be the quantity of money instead of the interest rate. The central bank would have full control over the interest rate paid on reserves and thus could practice expansionary monetary policy (through increasing the amount of money) while keeping the interest rate on reserves positive. In other words, zero or negative interest rate on reserves would not be a necessary condition for expansionary monetary policy.[56]

Fourthly, Jackson and Dyson (2012) argue that under FRB there are no logical reasons why "dollarization" would happen. According to Jackson and Dyson (2012), FRB has no logical implications for international currency exchange. International currency exchanges would be settled over the banks' account at the central bank as they are now. Nevertheless, there might be psychological market reactions. Jackson and Dyson (2012) admit that implementing FRB could at least temporarily increase uncertainty and cause speculators to attack the currency. Although there are no fundamental reasons, this might lead to depreciation of the currency in the short run. On the other hand, Jackson and Dyson (2012) argue that FRB could make the country a safe haven for money. Consequently, the currency might appreciate (rather than depreciate) in the intermediate run (which can be managed more easily than depreciation). I would add that there is, however, also a chance that such a self-correction does not occur as there is no automatic mechanism producing it.

In addition, Musgrave (2014) argues that the value of cryptocurrencies is so volatile that it is very unlikely that they would become popular among the vast majority. Moreover, he argues that it is unrealistic to think that any government would allow cryptocurrency to displace the official currency. Musgrave (2014) gives Russia as an example, where Bitcoin has already been banned.

Fifthly, several near-money critics see bank innovation as simply circumvention of FRB regulation. Dixhoorn (2013) points out that FRB might even reduce innovation in the payment system. However, according to Jackson and Dyson (2012), FRB would produce the opposite result. Jackson and Dyson (2012) argue that FRB would increase competition in the payment system and would encourage the development of more innovative ways to make payments. Musgrave (2014) argues that FRB would create more

[56] For a discussion on negative interest rates and FRB, see Daly (2016).

incentives for banks to develop new payment technologies in order to increase their profits.

Indeed, the critics seem to they fail to grasp that in order to circumvent regulation, banks need to invent something new and beneficial for their customers. For instance, few deny that bank deposits are more practical than cash as they can be easily divided and transferred in non-physical form. Transferring cash requires physical presence and change. In this sense, even if banks were able to circumvent the full-reserve requirement, they would need to invent something more practical and that in itself would be a positive consequence.

Finally, as a solution Phillips (1994a) suggested that near-monies need not be prevented completely. Phillips (1994a) argued that in times of uncertainty people tend to shift to safe assets, while in better times they tend to shift to money market funds, mutual funds, shares etc. Under FRB safety would be in currency and demand deposits. In other words, Phillips argued that FRB would offer stability by providing a safe asset, while near-monies could operate alongside. Neither was Fisher's (1935) point to prevent even distantly-near-monies from emerging, but to clarify the line between legal tender money and other types of monies. Fisher (1935) argued that instead of being a thin line (as is the case with bank deposits), the line should be more visible and understandable to the general public.

Sigurjonsson (2015) points out that under FRB the aim is not to control every possible medium of payment, but only the one legally eligible for payment of taxes and debts. He argues that local currencies can beneficially complement the legal medium of payment under some circumstances.

Indeed, many proponents of FRB seem to support rather than object to parallel currencies (in particular local currencies). For this reason, Dyson et al (2016) emphasize that it would be important to remove government guarantees for private monies or money-like assets. In particular, they argue that the government should not ensure repayment or par clearance of private assets such as bank deposits. For instance, deposit insurance and central banks' function as the lender of last resort to banks should be eliminated. Fontana and Sawyer (2017) argue that the elimination of state guarantees of private monies might not be able to prevent near-monies from emerging. However, if people are still willing to invest in these risky assets, they should be allowed to do so and bear the risks involved just as they can invest in, say, shares today.

This section discussed the emergence of near-monies, which is probably the most convincing criticism presented against FRB. However, some of the critique seems partly misguided as it is based on extreme assumptions on what FRB is meant to achieve. Although FRB would endow the government with significant monetary control, some critics are ready to deem FRB a failure if it is not able to establish absolute control over *all* media of payment. The critics are right that near-monies could, in some circumstances (even rightly so), undermine the monetary control of the central bank.

However, near-monies do not impose a threat to the financial system as long as they do not expose the government to any bailouts. In other words, near-monies are not a problem when they are not guaranteed by the government and they do not become the dominant means of payment. Appropriate legislation and the government's requirement that taxes must be paid with its own full-reserve currency might be sufficient measures to ensure it – or not. Only experimenting with FRB would generate knowledge of what would happen. It is difficult to know beforehand whether the government really would restrain from bailing out large financial institutions when push comes to shove. In addition, power relations in a society matter greatly as to whether certain institutions are bailed out or not.

6.10 INEFFICIENT

The last type of economic criticism argues that FRB is inefficient. In other words, FRB is unable to achieve the benefits claimed for it, or there are better ways to achieve the same benefits.

While not actively resisting FRB, Nersisyan and Wray (2016) interpret (falsely in my opinion) that the main aim of the advocates of FRB is to eliminate interest payments on government debt. They argue that this goal could be achieved more easily and efficiently with a perpetual zero interest rate policy and the government issuing only short-term securities (e.g. Treasuries in the US). This would preserve the current monetary system, but the government would not have to pay any interest on its debt.

Lehman (1936) argued that FRB would be desirable should the monetary system be built from scratch. The advantages of FRB would be eliminating bank runs and abolishing the destruction of demand deposits due to bank failures. However, he argued that the system was already made run-proof by deposit insurance and the widening of the discount window. Thus, Lehman (1936) concluded that there is no point in adopting monetary reform. Dixhoorn (2013) points out that even if FRB were to be optimal should the monetary system be designed from scratch, the transition costs might outweigh the potential benefits.

Furthermore, Dixhoorn (2013) argues that bank runs are an irrelevant problem as the safety of the payment system is already ensured by deposit insurance. Furthermore, FRB focuses on the liabilities side of banks' balance sheet while the major problems arise from the asset side.

Although he admits that deposit insurance and lenders of last resort can solve banking problems, Musgrave (2014) argues that both of these are unjustified subsidies for the private banking sector. Musgrave (2014) draws the conclusion that FRB is needed to erase these unnecessary subsidies. I would add that although deposit insurance has prevented bank runs, the GFC involved a bank run at the interbank market. FRB would be able to prevent this type of bank runs as well.

Moreover, it is true that the asset side causes more significant problems for banks, but they are created as a by-product when the liability side is extended (deposits created). Thus, limiting the ability of banks to extend the liability side of their balance sheet can also solve problems emanating from the asset side. In other words, the liability and asset sides of banks' balance sheet are interrelated, and it is almost useless to distinguish problems according to which side of the balance sheet they originated from.

Fontana and Sawyer (2015) argue that asset price bubbles would still be possible under FRB. They argue that asset price bubbles depend on hedge, speculative and Ponzi finance, as Minsky (1986) described. Plenty of finance would still be available, especially during booms. Thus, Fontana and Sawyer (2015) conclude that financial instability would not be reduced under FRB.

Mitchell (2015a) follows the same logic and argues that financial crises are due to the deregulation of financial markets and not to banks' ability to create money. Consequently, Mitchell (2015a) argues that it is possible to mitigate financial instability within the current monetary system with more and better regulation.

As already presented, FRB does not, of course, imply that financial instability could be eliminated under FRB. In addition, arguing that FRB could mitigate financial instability does not rule out the possibility that it could be tackled in any other way. Surely, more and better financial regulation could make the current monetary system more resilient. However, proponents of FRB think that a structural reform is a simpler and more efficient way to do so than increasing already complex regulation. Furthermore, FRB would have many other benefits (discussed in the previous chapter).

Parkkinen (2015) questions whether FRB would restrain housing and financial bubbles from a different perspective. According to Parkkinen (2015), we have a false mental image that money flows into something. We imagine that bank-created money often goes to housing or financial assets, which raises their prices.

Parkkinen is correct in pointing out the bigger picture that somebody must receive the same amount of money when he/she sells the asset as the buyer loses when he/she buys it (indeed, this is the whole point of SFC modelling!). He is also correct in arguing that the price of an asset can increase without an increase in the trading volume of that asset, as the market price is simply the amount that the buyer and seller are both willing to accept. However, Parkkinen neglects the fact that easily available bank credit for acquiring housing or financial assets increases their demand, which is often associated with higher prices and trading volumes. Therefore, money flowing first into an asset class is an important boost to the demand for and thus the price of that asset class. Without such a boost, the prices of housing and financial assets would necessarily be lower. Thus, FRB could at least reduce housing and financial bubbles.

Another potential source of financial instability under FRB would be the interlinkages of banks and their holding companies. Mingo (1987, 13) pointed

out a problem in FRB should the assets of a full-reserve bank to be used to bail out a subsidiary owned by the same holding company that also owned the full-reserve bank. Litan (1987, 165), Golembe and Mingo (1985, 142) and Gilbert (1987, 13) argued that this problem could be solved by requiring that the assets of a full-reserve bank must be separate and unreachable. Phillips (1994a, 180), on the other hand, warned that if we adopt FRB and then guarantee other financial assets, nothing would have been accomplished. This is important especially as deposit insurance schemes typically also cover time deposits.

Dow et al (2015) doubt that controlling the money supply could effectively control credit too. They also hint that the amount of credit would be more important for effective demand, employment and inflation than the amount of money.

Musgrave (2014) and Mitchell (2015a; 2015b) argue that the seigniorage revenue from FRB is not important in itself. Even under the current banking system, the government can create new base money to fund spending.

Finally, if some of the critique is presented from diametrically opposite angles (e.g. FRB simultaneously both inflationary and deflationary), the claimed benefits of FRB are also partly based on mixed positions. For instance, FRB is motivated by higher economic activity (e.g. Fisher 1935; Benes and Kumhof 2012; 2013) while at the same time it is defended by arguing that it would allow a non-growing or de-growing economy (e.g. Daly and Farley 2011). Of course, the effects can vary according to context. Another way to reconcile these two views would be to argue that FRB would *allow* (not cause) either higher growth or degrowth, but it would be a political decision which direction was pursued.

6.11 SOCIALLY DISINTEGRATING

FRB has also been criticized for increasing instead of reducing social inequality. The arguments are mostly based on the availability of credit and economic growth under FRB.

It can be argued that FRB would tighten credit availability and the least well-off individuals would be cut off from credit. This would sentence the least well-off to poverty and social mobility would be reduced. In the production sector, SMEs would not receive sufficient funding as they do not have collateral. This would impair their growth potential.

Insufficient credit availability is also interpreted to cause economic stagnation. Stagnating economic growth, in turn, is often paid for by the poorest through high unemployment and budget cuts.

Alternatively, even if the least well-off individuals and SMEs were able to obtain funding, Dixhoorn (2013) points out that they would need to pay higher interest rates. Moreover, wealthy individuals would obtain higher interest returns from those who need to borrow. This would increase instead of decreasing income inequality and deepen the problems of SMEs.

Piketty's (2014) famous observation is that income inequality grows when the rate of return on capital is higher than the rate of economic growth. According to critics, under FRB the rate of return on capital would be higher and the rate of economic growth lower. Thus, income disparities would grow rather than diminish under FRB.

As banks could no longer profit from interest rate spread between deposits and loans, they would probably start to charge for services. There is a reasonable possibility that service charges would fall disproportionately on poorer households.

Exclusion from bank services is another concern, although it is not necessarily related only to FRB. Banks could be unwilling to offer services to poorer households. To ensure access to bank services, there should be a legal right to a current account. In fact, for similar concerns under the current monetary system, current accounts and related basic bank services (such as a debit card) already became a legal right in Finland in 2017. Against this backdrop, exclusion from bank services seems not to be a problem for FRB.

Although he admits that bank bail-outs would be redundant and bank subsidies could be disposed of, Musgrave (2014) does not see that FRB would reduce inequality. He argues that interest payments and receipts would not necessarily be distributed more evenly. Musgrave (2014), however, admits that by mitigating the business cycle FRB could reduce periods of high unemployment, which could slightly reduce inequality. Nevertheless, he thinks that those effects are secondary and, thus, social equality is not substantially affected under FRB.

Even though some of the concerns might be valid, Musgrave seems to have a rather narrow view of social equality. Apparently, he equates social equality with income distribution. However, disposing of bank subsidies and bail-outs as well as generating annual seigniorage revenue for the government would certainly be improvements to social equality as well. Thus, FRB seems to have a negligible effect on income distribution but a significant effect on broader social equality.

6.12 ECOLOGICALLY IRRELEVANT

Section 6.10 presented arguments as to why FRB would be inefficient economically, but this section focuses on the arguments for why FRB would be inefficient in achieving the ecological goals claimed for it. This section presents the critique for why FRB might not significantly alter the composition of production. Moreover, this section focuses on why the current monetary system does not necessarily contain a growth imperative and, if it does, why FRB might be unable to remove it.

Although an advocate of FRB, Musgrave (2014) argues that the environment has little to do with the monetary system. Musgrave (2014) does not see that switching to FRB could change the composition of production.

That is, the decisions over what is produced, how it is produced and for whom it is produced are not affected by FRB. Fontana and Sawyer (2017) argue that loan decisions would be unaltered in an FRB system and, therefore, FRB does not have a particular ecological impact.

According to Musgrave (2014), subsidies and taxes are key to influencing ecological sustainability through consumption and production decisions. He concludes that whether the monetary system operates according to FRB or current principles is irrelevant in ecological terms.

Green proponents of FRB often associate economic growth with negative ecological impact. This in itself is already a controversial claim that neoclassical economists in particular have challenged. Some economists even see economic growth and ecological sustainability as mutually reinforcing rather than mutually exclusive. In particular, the environmental Kuznets curve hypothesis maintains that the environmental impact indicator is an inverted U-shaped function of income per capita (for discussion, see Stern 2004). That is, when the economy grows, initially the environmental impact increases but then it decreases.

On the other hand, many ecological economists have pointed out that the decoupling of economic growth and negative ecological impact has not yet been achieved in many important environmental areas and is unlikely to be achieved in the near future. Ecological economists have shown that CO_2 emissions are tightly linked with GDP growth (see e.g. Victor 2008). I tend to lean towards the position that economic growth indeed has a negative ecological impact in general, even though I recognize that the economy can grow in many ways which have diverse ecological impacts. Although it is, at least in theory, possible to overcome the link between growth and environmental sustainability, I do not see it as realistic in the near future.

It is therefore important to examine whether the current monetary system involves a growth imperative and, if it does, whether FRB would be able to eliminate it (see Section 5.4). I will challenge the critics' view that the current monetary system does not involve a tendency to grow the money supply. However, I agree with the critics that growth of the money supply does not necessarily imply real economic growth as well.

To show that the current monetary system does not involve a need to grow the money supply and thus ever increase the level of debt, critics point out that interest payments to banks do not eradicate money from circulation. Musgrave (2014) points out that the interest paid to banks can be subsequently returned into circulation in at least three ways. First, banks also pay interest to depositors. Second, banks make dividend payments to shareholders. Third, banks pay their staff and make other payments (e.g. when buying computers). In a Bank of Finland publication, Kauko (2011) confirms these ways to return interest charged by banks back into circulation.

Also Parkkinen (2015) argues that it is a mistake to blame the debt-based monetary system for the growth imperative. He calls the logic behind this as the "perpetual debt hoax". Although he is correct to point out that even if the

interest is not created when banks create money, it is possible to repay all debts.

However, both Musgrave and Parkkinen mistake possibility with actuality. Even if it is possible to pay back all debts in theory, it does not follow that they could be repaid in practice. The circumstances which would allow full repayment (i.e. no hoarding etc.) most likely do not exist in the real world. Thus, it seems that interest related to money creation really does impose some problems for the functioning of the current monetary system, but it does not necessarily mean that the problems could not be solved other (e.g. through bankruptcies or government issuing new debt-free money to cope with hoarding) than by growing the economy.

The supporters of the growth imperative argument could be criticized more aptly for mistaking growth in the money supply to necessarily indicate economic growth as well. Even if there is a tendency to grow the money supply continually as banks do not recirculate interest payments in full, it does not mean that growing the money supply must imply economic growth. Furthermore, the supporters of the growth imperative argument often confuse nominal with real economic growth, or make the far-fetched assumption that nominal economic growth would also mean real economic growth. Thus, even if the current monetary system were somehow to impose a tendency to nominally grow the economy, it does not automatically follow that nominal growth would translate into real economic growth as there can be positive inflation.

It is possible to approach the relation of interest and growth from a different perspective. Herrman (2013) argues that interest per se does not lead to growth. If interest led to growth, during recessions central banks could simply increase the interest rate in order to force more growth. However, what happens during the recessions is the opposite: central banks lower the interest rate.

To support her claim, Herrman (2013) shows that growth due to interest is not historically true. She argues that interest has been charged on money for ages, but economies did not grow. Sustained growth only took off after the First Industrial Revolution from the 1820s onwards.

Of course, one could make the counterargument that interest charged on money did not impose a growth imperative as long as economies were mostly based on subsistence production rather than market production. That is, money was not important when people were able to provide for their families directly from their work rather than indirectly receiving wages which then have to be traded for goods and services. Only when wage-labour became more common did the monetary system begin to play an important role in terms of growth. That counterargument, however, does not seem very convincing.

It has also been argued that a non-growing economy could be achieved under the current monetary system. Fontana and Sawyer (2015) argue, using a demand-driven macroeconomic model, involving a crucial role for money and finance, that sustainable ecological footprint requires slower growth and

a lower level of investment. Slower or zero growth and lower levels of investment, however, are likely to lead to lower capacity utilization and higher unemployment unless compensated with higher budget deficits. Although budget deficits would be higher, which stimulates aggregate demand, a lower level of investment would ensure a lower growth path. They argue that full employment, reduction of inequality and financial stability should be the key goals in such an ecologically sustainable economy.

Jackson and Victor (2015), on the other hand, use an SFC model to study whether there is a growth imperative in the present monetary system, in which money is created as interest-bearing bank loans. For instance, Loehr (2012) claims that a non-growing economy is incompatible with positive interest rates. Jackson and Victor (2015) find, in line with Godley and Lavoie (2012), that there is no growth imperative inherited in the current monetary system and positive interest rates are completely possible in a non-growing economy. Although they do not blame the current banking system for a growth imperative, Jackson and Victor (2015) support FRB for other reasons, for instance, for providing a solution to unsustainable levels of private and public debt, financial instability, speculation and inequality.

SFC modelling might, however, not be the most suitable tool for studying whether the current banking system involves a growth imperative. Firstly, the existence of a growth imperative is, by definition, ruled out from any stationary SFC model. Secondly and more importantly, the result of Jackson and Victor is highly sensitive to the assumption that all profits are always distributed. If firms and/or banks retain earnings, there would be a continuous deflationary tendency and GDP would be on a downward spiral. Thus, introducing retained earnings to the SFC model would lead to the opposite conclusion: that a zero-growth economy cannot be achieved under the current banking system. The next chapter discusses the methodology of SFC modelling in detail.

On balance, the current monetary system seems to be problematic in many ways. However, it is more ambiguous whether one of the problems is an imperative for real economic growth. I would say that the current monetary system does impose a growth imperative, but only on the money supply and not on the real economy. Taking into account hoarding by other economic agents than banks[57], there would be a tendency to grow the money supply even under FRB. Nevertheless, growing the money supply under FRB does not

[57] If one acknowledges that bankers can be partly responsible for the growth imperative of the money supply as they do not fully recirculate interest payments they receive, there can also be other types of hoarding. Proponents of FRB only identify hoarding by banks as a problem but similar problems arise through hoarding by any economic agent. If any economic agent puts money aside, there is not enough money for the rest of the economy to repay all bank loans. Thus, all hoarding would have negative consequences (unemployment, deflation, insolvency etc.) which are then tackled by expansionary monetary policies (e.g. encouraging borrowing). In other words, hoarding in general would gear economic policies towards expanding the money supply.

require any borrowing and thus it could be achieved without accumulating debt. Most likely, the drive for growth is more deeply rooted in our economic system. It seems that capitalism – rather than the monetary system – encourages the continuous increase of profits and accumulation of wealth. This has little to do with the monetary system.

Taking into account all the claimed benefits and criticisms, FRB seems to be a progressive reform. Nevertheless, it seems that FRB is able to satisfy some normative premises better than others. FRB seems to have a particularly positive impact on economic stability and democracy, while it is only slightly able to promote social equality. Whether it is able to advance ecological sustainability is more dubious, but it is quite clear that FRB would not work against it either.

7 METHODOLOGY OF STOCK-FLOW CONSISTENT MODELLING

In order to assess the economic impact of FRB, we need a systematic framework to account for various interdependencies. Based on coherent and complete accounting and realistic economic theory, post-Keynesian stock-flow consistent (PK-SFC) modelling seems a very promising option.

The premises of PK-SFC modelling are, according to Godley and Lavoie (2012), that modern economies have complex institutional structure comprising households, firms, banks, central banks and governments. Furthermore, the evolution of economies through time is dependent on how these institutions make decisions and interact with one another. PK-SFC modelling offers a fully tractable, parametric, coherent and complete way to depict the functioning of modern monetary economies.

This chapter presents the methodology of PK-SFC modelling before making use of it in the next chapter. The first section presents a very brief history of PK-SFC modelling. The second section gives a general overview of the method. The third section contrasts PK-SFC modelling with the dynamic-stochastic general equilibrium (DSGE) modelling of neoclassical economics as well as with James Tobin's SFC models. Finally, the fourth section discusses the strengths and weaknesses of PK-SFC modelling. If the reader is already familiar with the methodology of PK-SFC modelling, I recommend skipping this chapter and proceeding to the next chapter, which presents a PK-SFC model of FRB.

7.1 HISTORY

This section reviews the history of PK-SFC modelling[58]. The SFC approach is built on Copeland's (1949) quadruple-entry bookkeeping principle. The fundamental idea is that each income (expenditure) flow must appear as expenditure (income) flow of another sector and as an equivalent change in the financial balance of both sectors.

SFC modelling has its origins at the Yale University in the late 1960s when James Tobin started to develop models integrating economic stocks and flows in a coherent manner. A few years later at Cambridge University, Wynne Godley and Francis Cripps began to build their SFC models, which came to be known as the first PK-SFC models. According to Godley and Lavoie (2012), scholars at both universities worked independently until a 1983 conference held in Cambridge, UK. The Yale Group (or the New Haven school) built on

[58] For a comprehensive overview of the current PK-SFC literature, see Caverzasi and Godin (2015) and Nikiforos and Zezza (2017).

neoclassical economics and focused on portfolio choices, while the Cambridge Group (or the New Cambridge school) built on post-Keynesian economics and concentrated on balance of payments problems and forecasting whether economic expansion was sustainable. Godley and Cripps (1983) is one of the seminal works of the Cambridge Group while Backus et al (1980) is a good example of the Yale Group.

In the middle of the 1980s, according to Godley and Lavoie (2012), both schools faded away as their funding was cut off. SFC approaches gave way to the representative agent approaches of the New Classical and New Keynesian schools. The Yale Group never returned.

The Cambridge Group tradition, however, was revived at the beginning of the millennium after the post-Keynesian focus on Critical Realism in the 1990s diminished. The scholars working on PK-SFC modelling were centred on the Levy Economics Institute of Bard College and the New School University, both located in the state of New York. For instance, Lavoie and Godley (2001), Taylor (2004) and Dos Santos and Zezza (2008) offer a basis for financial analysis in demand-led models. Finally, in 2006 PK-SFC modelling was popularized by Wynne Godley and Marc Lavoie in the first edition of *Monetary Economics* (Godley and Lavoie 2012, which I often cite, is the second edition).

PK-SFC modelling is particularly suitable for analysing financial markets. Financialization and financial instability are explored in, for instance, Dos Santos (2005), Passarella (2012) and Dafermos (2017). Lucarelli (2012), on the other hand, models the dynamics of Schumpeterian innovation economy. Le Héron and Mouakil (2008) and Charpe et al (2012) examine the specific case of credit rationing (banks not providing loans to all creditworthy borrowers).

PK-SFC modelling has also been extended to ecological economics. For instance, Jackson and Victor (2015) explore whether the current monetary system contains a growth imperative. However, they do not directly link their SFC model with environmental issues. Genuine attempts to integrate material and energy balances into SFC models have been rare and demanding. Some attempts include Jackson et al (2015), Berg et al (2015), Dafermos et al (2017a; 2017b), Bovari et al (2018) and Godin et al (2017).

Recently, PK-SFC modelling has become increasingly popular, as neoclassical models were unable to anticipate the GFC. Even central banks, which previously relied on neoclassical DSGE models, have shown interest in alternative approaches. For instance, the Bank of England and the ECB have published some papers built on SFC approaches, including Bê Duc and Le Breton (2009), Barwell and Burrows (2011) and ECB (2011). Although these papers are not SFC *models*, they do make use of national income and flow-of-funds information consistently in looking at empirical data and interpreting past developments. Furthermore, Winkler et al (2013a; 2013b), all affiliated with the ECB, have edited a two-volume book based on SFC perspectives.

Recently, moreover, the Bank of England published a paper by Burgess et al (2016), who built an empirical PK-SFC model of the UK economy[59].

There has also been interest in integrating PK-SFC models with Agent-Based models. For instance, Caiani et al (2016) is an ambitious attempt. It is also encouraging that the paper's list of authors includes such a notorious name as Joseph Stiglitz. Although Stiglitz has been one of the most progressive neoclassical economists, until recently he has distanced himself from post-Keynesian economics due to methodological differences. Thus, the SFC framework might be able to offer common ground for collaboration and even transcend the division between neoclassical and post-Keynesian schools of thought[60].

7.2 METHOD

This section presents an overview of the PK-SFC modelling method following Godley and Lavoie (2012), although most of it can be generalized as SFC modelling without any theoretical commitments. The method of SFC modelling is based on the fact that every transaction by one sector implies an equivalent transaction by another sector (i.e. every purchase implies a sale). Flows (such as consumption and investment) interact with stocks (such as deposits and loans) and generate an interactive dynamic system which evolves through historic time. Such a system describes, with financial transactions fully integrated at the level of accounting, the processes which generate factor income, expenditure and production.

Firstly, I present the three matrices required in SFC modelling: balance sheet, revaluation and transaction-flow matrix. Secondly, I discuss the function of equations. Thirdly, I show how SFC models are solved and discuss the meaning of a steady state. I will start with the balance sheet matrix depicted in Table 4 below.

The balance sheet matrix below presents a simplified economy. It consists of four sectors: households, firms, government and banks (the central bank is incorporated into the government sector). There are two type of assets: real and financial. Real assets include only tangible capital while there is a variety of financial assets.

---

[59] Previously, for instance, Davis (1987a; 1987b) built a rudimentary SFC model of the UK economy.

[60] Some post-Keynesian elements have already been incorporated in and reformulated for neoclassical economics. Recently, for example, the importance of monetary sovereignty has been emphasized by De Grauwe (2012) and the possibility of a prolonged recession due to insufficient aggregate demand has been recognized by Summers (2014). Previously, endogenous money has been incorporated into DSGE models (e.g. Woodford 2003). Interestingly, neoclassical economists rarely acknowledge the precedence of post-Keynesian work and simply present the ideas as new and their own.

Table 4. *Balance sheet matrix*

		Households	Firms	Government	Banks	Sum
Real assets	**Tangible capital**	$+K_h$	$+K_f$			$+K$
Financial assets	**Cash and reserves**	$+H_h$		$-H$	$+H_b$	0
	Deposits	$+M$			$-M$	0
	Loans	$-L_h$	$-L_f$		$+L$	0
	Bills	$+B_h$		$-B$	$+B_b$	0
	Equities	$+e \cdot p$	$-e_f \cdot p_e$		$-e_b \cdot p_e$	0
	Net worth (balance)	$-NW_h$	$-NW_f$	$-NW_g$	$-NW_b$	$-K$
	Sum	0	0	0	0	0

Note: Plus signs indicate assets and minus signs liabilities.

The fundamental idea behind SFC modelling is that all rows and columns must sum to zero – except the row of real assets. Real assets do not have a liability counterpart. All financial assets have, by definition, a corresponding liability counterpart. The last row before sum is the net worth, which balances all columns to zero. Notice that the net worth has a minus-sign associated with it. That is, in order that each column sums to zero a positive net worth enters with a negative sign and vice versa. Due to watertight accounting, the net worth of the whole economy must equal the value of real assets, as can be read from the second-last row.

The tangible capital of households can be, for instance, real estate. The tangible capital of firms can be fixed capital, e.g. machinery and buildings, or working capital, that is, inventories (unsold and unfinished goods). Real assets of households are valued at market prices, but real assets of firms are valued at their replacement value, that is, the cost to produce the asset now (neither historical cost of acquisition nor expected selling price).

For all accounting identities to hold, all financial assets must be measured at current market prices. It should be noted that firms' equities reflect their total market value and, thus, they do not correspond to equity in the firms' accounting. Furthermore, the net worth of firms does not have any practical interpretation (negative does not imply insolvency) except that whenever it is negative (net financial assets are greater than the replacement cost of its real assets) Tobin's (1969) Q-ratio is greater than unity and vice versa.

Table 5 presents the revaluation matrix, which accounts for balance sheet changes not emanating from flows. In other words, it takes into account capital gains (or losses) due to changes in prices.

Table 5. *Revaluation matrix*

		Households	Firms	Government	Banks	Sum
Real assets	**Tangible capital**	$+\Delta p_k \cdot K_{h-1}$	$+\Delta p_k \cdot K_{f-1}$			$+\Delta p_k \cdot K_{-1}$
Financial assets	**Equities**	$+\Delta p_e \cdot e_{-1}$	$-\Delta p_e \cdot e_{f-1}$		$-\Delta p_e \cdot e_{b-1}$	0
	Change in net worth	$-\Delta NW_h$	$-\Delta NW_f$		$-\Delta NW_b$	$-\Delta p_k \cdot K_{-1}$
	Sum	0	0	0	0	0

Note: Plus signs indicate assets and minus signs liabilities.

As in the balance sheet matrix, in the revaluation matrix all rows and columns must also sum to zero except the row of real assets. Now, the changes of net worth due to revaluations must equal the change in the real assets of the whole economy. Note that bills do not enter the revaluation matrix here as they are assumed to be short-term securities that mature within each period.

Finally, Table 6 below depicts the transaction-flow matrix. A vitally important feature of the transaction-flow matrix is that every column and row must sum to zero (without an artificial balance row). This implies a quasi-Walrasian principle that the n^{th} variable is implied by the other n−1 variables. Subsequently, solving the model requires that one equation must be dropped in order to avoid over-determination.

Table 6. *Transaction-flow matrix*

		Households	Firms		Government	Banks	Sum
			Current	Capital			
National income	**Consumption**	−C	+C				0
	Government expenditures		+G		−G		0
	Investment		+I	−I			0
	[Memo: GDP]		[Y]				[Y]
	Wages	+WB	−WB				0
	Profits	+F	−F				0
	Taxes	−T			+T		0
	Subtotal	SAVING	0	INVESTMENT(−)	GOVT SURPLUS	0	0
Flow-of-funds	**Change in the stock of loans**	$+\Delta L_h$		$+\Delta L_f$		$-\Delta L$	0
	...cash and reserves	$-\Delta H_h$			+ΔH	$-\Delta H_b$	0
	...deposits	−ΔM				+ΔM	0
	...bills	$-\Delta B_h$			+ΔB	$-\Delta B_b$	0
	...equities	$-\Delta e \cdot p_e$		$+\Delta e_f \cdot p_e$		$+\Delta e_b \cdot p_e$	0
	Sum	0	0	0	0	0	0

Note: Plus signs indicate sources of funds and minus signs uses of funds.

The zero-sum rule for each column represents the budget constraint of each sector. For instance, in order that households can consume more than they earn, they must either borrow or alternatively decrease their holdings of financial assets. Note that sources of funds carry a plus sign and uses of funds a minus sign. This also means that, counter-intuitively, acquisition of financial assets (adding to the existing stock) is described with a negative sign. However, the issue should become clearer when the acquisition of assets is conceived as a use of funds similar to consumption.

The firms sector is divided into two columns: current account and capital account. Current account records all payments (inflows and outflows), while the capital account records all changes in the balance sheet. As investment goods are purchased from other firms, in order to pay attention to the effects of investment on firms' balance sheet, firms' current and capital accounts are separated into two columns. This could be done for other sectors too, but in the transaction-flow matrix above, other sectors' current and capital accounts are aggregated into one column.

The transaction-flow matrix consists of two parts: national income and flow-of-funds (i.e. financial accounts). From the national income part of the transaction-flow matrix it is easy to read the national income identity that GDP equals either total expenditure or total income, that is:

$$C + G + I = Y = WB + F \tag{5}$$

Note that Y appears only as a memo item in the matrix for clarification.

The national income part of the transaction-flow matrix, the subtotal row, reveals another identity that (private and public) saving equals investment. At least among post-Keynesian scholars it is a well-known identity that in a closed economy private sector net saving equals government deficit:

$$SAVING - INVESTMENT = GOVERNMENT\ DEFICIT \tag{6}$$

In an open economy, private sector net saving would equal the sum of government deficit and current account surplus. In other words, in an open economy, net saving of the private sector, that is, the net acquisition of financial assets (NAFA), being positive must mean that either the government or the foreign sector accumulates debt.

The lower part of the transaction-flow matrix depicts the flow-of-funds of the economy. It records all changes in the stocks of financial assets (which are not due to changes in prices between periods that are captured by the revaluation matrix). Because of watertight accounting, changes in the flow-of-funds part of each sector must match changes in the national income part exactly, and thus the final row must sum to zero.

Fully integrating the three matrices above allows us to trace the development of stock variables through time. The balance sheet develops from one period to another by taking into account the revaluations as well as the flows described in the transaction-flow matrix. In other words:

$$Stocks_t = Stocks_{t-1} + Revaluation_t + Flows_t(-) \tag{7}$$

where *Stocks* refer to the balance sheet matrix, *Revaluation* to the revaluation matrix and *Flows* to the flow-of-funds part of the transaction-flow matrix

(signs reversed as, in the transaction-flow matrix, minus-sign refers to use of funds and plus-sign to source of funds).

Until now, everything has been sectoral balances based on accounting identities. The three matrices above are merely descriptive and do not include any behavioural assumptions (except some existential assumptions, for instance, which sectors exist, what type of payments are possible, and what types of assets and liabilities can be held by each sector).

The theoretical underpinnings of SFC modelling are revealed in equations (sometimes called the "closure" of the model). The essence of SFC *modelling* is which variables are chosen to be endogenous and which exogenous, and how they relate to each other.

All the equations, together with parameter and initial balance sheet values, allow us to solve the model as a sequence proceeding through time. The principle that every row and column must sum to zero imposes identities that must be satisfied in every solution to the model. The solution for each period depends crucially on the balance sheet values created in the previous period.

An SFC model can be solved either analytically or by simulation. Simple SFC models allow for an analytical solution while more complex models need to be solved by simulation. When solving the model, as explained above, in order to avoid over-determination one equation must be dropped as it is logically implied by all the other equations. The redundant equation, however, can be used for checking that the model really is SFC.

It is said that the model has a steady state[61] when all key variables, both stocks and flows, remain in a constant relationship to each other. The steady state can be either stationary or growing. In a stationary steady state stocks and flows remain constant while in a growing steady state (i.e. there is economic growth in the model) the relationships remain constant.

When a steady state is found (if one exists), it is possible to experiment with the model by shocking it. Shocking the model involves changing a variable or a parameter. If a new steady state is achieved after shocking the model, the steady states can be compared and the transition process interpreted. However, if the model becomes unstable after the shock (values of variables either collapse or explode), it is possible to find explanations for this. Note that a model does not necessarily have a steady state and it is possible to try to explain why.

I will not go through an example of a model with equations as the next chapter presents a full model with several equations. However, before moving on to the SFC model of FRB, the next sections compare PK-SFC modelling with

[61] The definition of a steady state is somewhat different in SFC modelling than in ecological economics. In ecological economics steady state typically refers to a physically non-growing economy. More specifically, Daly (1977) argued that in a steady state of ecological economics, the use of environmental and resource stocks is kept constant over time. This is not necessarily incompatible with a steady state in SFC modelling – especially if a steady state is stationary.

other modelling techniques and discusses the advantages and shortcomings of PK-SFC models.

7.3 SIMILARITIES AND DIFFERENCES

Firstly, this section contrasts PK-SFC models with neoclassical DSGE models. Secondly, this section compares PK-SFC models and Tobin's SFC models.

Today, DSGE models are in a dominant position within mainstream economics. They were developed in the late 1990s to replace models based on neoclassical synthesis. DSGE models combine New Classical microfoundations and dynamic tools with New Keynesian frictions in labour and commodity markets.

However, due to their underlying assumptions, DSGE models are able to provide only certain interpretations of reality. DSGE models often strengthen the conception that the market economy is inherently stable. This reveals the political dimension of DSGE models.

Superficially, PK-SFC and DSGE models seem very similar. Typically, the starting point of both is that the economy is in a steady state/general equilibrium. In both cases the system can only be disturbed by exogenous shocks. The idea is to trace out the time paths to the new steady state/general equilibrium. In DSGE models, price frictions cause delay in the achievement of the new general equilibrium (with completely flexible prices the new equilibrium would be achieved immediately), while the reason in PK-SFC models is mistaken expectations and partial adjustment processes. Although PK-SFC models usually also converge to a new steady state after a shock, convergence is not necessary. PK-SFC models can illuminate underlying instabilities, as variables of the model can end up in collapsing or exploding time paths. Nevertheless, both modelling techniques build on a steady state/general equilibrium which is disturbed only by shocks.

However, PK-SFC and DSGE models differ in important aspects. Most importantly, DSGE models do not *systematically* incorporate stocks and flows and thus they cannot help us in understanding how expenditure decisions affect assets and, consequently, how changes in assets affect future expenditure decisions. If stocks and flows are not systemically accounted for, there is a genuine possibility that the model includes serious inconsistencies.

DSGE models have "microfoundations" while PK-SFC models focus more on the aggregate level. However, the distinction is not very clear-cut. DSGE models explicitly model the preferences of economic agents which is typically lacking in PK-SFC models. Nevertheless, DSGE models often build on only one representative agent for each sector and, thus, do not really differ from the aggregate analysis of PK-SFC models.

In PK-SFC models the behaviour of economic agents is steered by norms instead of optimization, as is the case with DSGE models. Moreover, rational expectations, that is, perfect foresight is often assumed in DSGE models.

Hence, there is no room for change in behaviour due to mistaken expectations. Thus, DSGE models rule out fundamental uncertainty, which is present in PK-SFC models. Instead of rational expectations, PK-SFC models build on adaptive expectations. However, in DSGE models the assumption of completely rational expectations is being dropped more often (see e.g. Woodford 2013) and replaced with alternative formation of expectations, such as learning (see e.g. Evans and Honkapohja 2011).

Furthermore, PK-SFC models are typically deterministic rather than stochastic (although it is possible to introduce stochastic elements into PK-SFC models too). In addition, contrary to DSGE models, in PK-SFC models there are generally no price-clearing mechanisms to equate demand and supply (except in the equities market). To reconcile demand with supply, PK-SFC models include various buffers (e.g. inventories), which is not generally the case with DSGE models.

In most macroeconomic models, such as DSGE, the balance of payments is determined on the income side and financial flows simply adjust. In PK-SFC models it is also possible that shocks arise on the financial side and thus force adjustment of real variables.

In contrast to PK-SFC models, sometimes it is claimed that severe depressions are impossible in a DSGE framework. However, Kiyotaki and Moore (1997) show that small changes in firms' net financial wealth can cause severe and long-lasting depressions as the value of collateral is reduced and thus cause banks to lend less. This reduces investment, which again feeds back as lower demand, income and net financial wealth. Gertler and Kiyotaki (2010) argue that disruptions in the interbank market can amplify the original shock and cause a severe depression. Stiglitz (2011) criticizes DSGE models because in them only exogenous shocks can cause fluctuations. However, De Grauwe (2008b) showed that endogenous fluctuations are also possible (in this sense De Grauwe's model does not represent "standard" DSGE models).

Due to recent developments, PK-SFC and DSGE models have become more alike. DSGE models have introduced many elements previously included only in PK-SFC models. For instance, adaptive expectations, secular stagnation and a bigger role for money and financial markets have become part of cutting-edge DSGE models. Nevertheless, PK-SFC and DSGE models still differ in many significant aspects.

Obviously, there are more similarities between PK-SFC and Tobin's SFC models as they are both explicitly stock-flow consistent[62]. Essentially, the basics are the same. Both link income and expenditure flows to changes in stocks of financial assets. In both, national accounts, flow-of-funds and sectoral balance sheets relate coherently to each other. Moreover, the portfolio

[62] For an extensive comparison of PK-SFC and Tobin's SFC models, see Dos Santos (2002). Godley and Lavoie (2012) devote their last chapter to distinguishing their models from Yale models such as Brainard and Tobin (1968), Tobin (1969) and Backus et al (1980).

choices of households are similar (at least in later PK-SFC models, which adopted portfolio choices from Tobin).

The differences between PK-SFC and Tobin's SFC models are theoretical. Different theoretical considerations are revealed through their behavioural equations. There are differences over which variables are chosen to be endogenous and which exogenous. Furthermore, Tobin's models assume that the system is on its way to equilibrium whereas in PK-SFC models this assumption is dropped.

The temporal focus of PK-SFC and Tobin's SFC models also differs. Tobin's models focus on one-period models and their steady states, but do not explicitly determine the time paths to steady states. PK-SFC models, in contrast, focus on multiple periods and are explicit about the time paths to steady states.

One of the major differences is how the banking system is precisely modelled. In PK-SFC models, the main function of banks is to create loans, which fund investment. In Tobin's models, banks are mere intermediaries, which extend the range of assets and liabilities available for households. In Tobin's models (e.g. Brainard and Tobin 1968; Backus et al 1980) banks simply intermediate deposits from lenders to borrowers, thus reiterating the exogenous money theory, which Tobin (1963) himself had previously rejected. Unlike in PK-SFC models, in Tobin's models banks do not set interest rates. Instead, deposit and loan rates adjust to balance demand and supply.

Behaviour of economic agents is another major difference. The behaviour of economic agents is steered by optimization in Tobin's models while norms direct the behaviour in PK-SFC models. Furthermore, in PK-SFC models economic agents display procedural (or bounded) rationality while Tobin's models build upon neoclassical perfect rationality. Due to uncertainty, economic agents make mistakes in PK-SFC models while in Tobin's models mistakes are not possible. To mitigate uncertainty, PK-SFC models include buffers while no buffers exist in Tobin's models.

In PK-SFC models, prices are generally administered (equities market is an exception) while in Tobin's SFC models market-clearing happens through prices. PK-SFC models typically include cost-plus pricing while Tobin's models follow profit-maximizing pricing. For instance, in Tobin's models, firms' investments rely on Tobin's Q-ratio while in PK-SFC models investments depend on stock-flow norms such as target inventories to expected sales ratio.

7.4 STRENGTHS AND WEAKNESSES

This section discusses first the strengths and then the weaknesses of SFC modelling in general and PK-SFC modelling in particular.

SFC models are fully tractable, parametric, coherent and complete. They are based on waterproof accounting and recognize interactions of stocks and

flows. The models evolve through time, solving dynamically from one period to the next. This allows the tracing of a complete and watertight path between periods.

SFC models are excellent for policy and scenario analysis. Based on watertight macro modelling, SFC models can comprehensively compare the economic consequences of various policies or scenarios. For example, in the next chapter I will investigate the economic consequences of money creation under FRB.

SFC models also shed light on the interrelations of different sectors. The behaviour of sectors is constrained by accounting identities. In addition, SFC modelling can be applied flexibly to a number of institutional features. For instance, reserve requirements and capital adequacy ratios can be included in a relatively straightforward manner.

SFC models are useful for theoretical analysis, too. For instance, Godley and Lavoie (2012) illustrate that SFC modelling can be applied to analyse Keynes's (1936) paradox of thrift or the MCT. PK-SFC models are able to incorporate many elements that are, I would argue, more realistic than neoclassical elements. PK-SFC models often emphasize historic time, fundamental uncertainty, endogenous money and the role of institutions.

However, SFC models are not limited to the post-Keynesian school of thought. Instead, SFC modelling can be applied to various economic schools of thought. Indeed, James Tobin applied SFC modelling to the standard neoclassical setting in which economic agents have perfect foresight and exhibit perfect rationality when making decisions. Although Godley and Lavoie (2012) use it mostly in a post-Keynesian setting, they have also applied SFC modelling to a neoclassical setting in order to show that it is possible.

One of its strengths is that SFC modelling can account for different behaviour and formation of expectations. In PK-SFC models, economic agents typically display procedural (or bounded) rationality. Therefore, instead of optimization, the behaviour of economic agents is informed by norms. These norms specify target ratios between stocks and flows (e.g. desired inventories to expected sales).

In PK-SFC models, economic agents typically have adaptive expectations in contrast to rational expectations, which presuppose perfect information of the future. Therefore, in PK-SFC models, expectations are not generally fulfilled, and thus economic agents make mistakes. As decisions are based on expectations, which are not generally fulfilled, each sector has a buffer that reconciles expected with realized outcomes. For instance, the buffer can be demand deposits for households, inventories for firms and government securities for the government and banks. Ultimately, however, PK-SFC models usually converge to a steady state regardless of how expectations are formed or whether they are correct (except when expectations are perverse, that is, they ignore or compound previous errors).

PK-SFC modelling is a particularly efficient tool for identifying unsustainable processes. Modelling does not necessarily yield a steady state,

or it can yield a quasi-steady state, that is, a steady state that cannot be attained. For instance, the model can identify as a steady state a situation in which foreign exchange reserves continually diminish. Obviously, foreign exchange reserves will be depleted at some point in time and reveal the underlying instability beneath apparent stability. Thus, PK-SFC models can be useful for longer-term prediction, which is needed to steer, for example, macroprudential policy.

PK-SFC models are generally demand-led but supply-constrained. That is, demand typically determines supply, but excess demand manifests itself, for example, as inflation. Moreover, all firms' profits are not necessarily distributed to households, as is invariably assumed in neoclassical macro.

As PK-SFC models have shown, no market-clearing price mechanism is necessary to bring supply into equilibrium with demand. Thus, signals are provided by quantities rather than prices. The role of prices is to distribute the national income between wages, profits and rents rather than to allocate resources.

While there are advantages to SFC modelling, there are, of course, some drawbacks too. The steady states of SFC models are sensitive to changes in parameter values and initial values of exogenous variables. Thus, the existence of a steady state and the outcomes it implies might not be particularly reliable. The models can be relatively easily manipulated to yield the desired results.

Furthermore, quasi-steady states can be problematic. SFC models do not generally give answers regarding what would happen when it becomes impossible to attain a steady state. In neoclassical economics it is typically assumed that some correction mechanism, at least in the long-run, converges the model back to equilibrium. However, in the real world and particularly in PK-SFC models those correction mechanisms are often absent. Thus, SFC models might be able to identify unsustainable steady states but are not necessarily able to say what happens afterwards.

The focus on steady states also undermines cyclical processes. For instance, Toporowski and Michell (2011) argue that even PK-SFC models are unable to describe Minsky's Financial Instability Hypothesis, the core idea of which is that stability leads to instability. In addition, Toporowski and Michell (2011) argue that PK-SFC models ignore endogenous processes – in particular, the role of investments in determining profits.

SFC models do not say anything about what happens *within* periods as they can only illuminate developments *between* periods. For instance, the models do not trace what medium of payment firms pay wages with and what they receive from consumption or issuing equities. In other words, even PK-SFC models do not fully recognize the role of means of payment. The MCT is better in explaining sequential payments in the economy, and perhaps for this reason Sawyer and Passarella (2017) try to embed the MCT into a PK-SFC model in order to analyze the effects of financialization.

In PK-SFC models, multiplier effects are often assumed to happen within a period and then the subsequent period uses these values as starting values. If

the chosen period is, for example, a year (let alone a shorter period) it is highly unlikely that money would circulate quickly enough to generate the multiplier effect in full. More likely, part of the multiplier effects will be realized in the subsequent periods.

Behavioural equations in PK-SFC models typically assume stable parameters while in reality it is likely that they are constantly changing. Although it might be plausible that agents base their decisions on norms, it is less plausible that these norms would not change over time. After all, Minsky's (1986) Financial Instability Hypothesis was based on the notion that important stock-flow norms are relaxed during euphoria and then tightened again during depressions. Endogenizing parameter values could overcome some of the problems but it would add complexity to the models.

Behavioural equations are also relatively simple and short-sighted in PK-SFC models. In the decision-making process, agents forecast only values in the next period, but no further. If one period is, say, one quarter, this assumption is rather distant from the real world. However, behavioural equations could be made more realistic and farsighted by incorporating findings from behavioural economics and psychology (e.g. the Prospect Theory first articulated by Kahneman and Tversky 1979).

In reality, economic agents certainly have different norms and preferences, but in PK-SFC models they are generally aggregated into sectors. Some outcomes in the real world depend on heterogeneous norms and preferences and, thus, aggregation can be misleading (especially in the "three balances approach", which includes only private, public and foreign sectors). It is quite possible that at the aggregate level a sector might not show any risk of destabilizing development, although some subsectors might induce instability.

Sectors are also typically vertically integrated in SFC models. Thus, they can shed light only on income distribution issues between sectors, for instance, between households (wage income), banks (rentier income) and firms (entrepreneurial income). However, if the sectors are vertically integrated, the models are unable to illuminate income distribution issues within sectors, particularly the household sector.

One solution is to disaggregate sectors into subsectors, but then models easily become increasingly complex and therefore hard to solve. In addition, the dynamics might become difficult to track. Moreover, other important elements might need to be dropped in order to make the models more comprehensible. Another solution could be to integrate PK-SFC models with Agent-Based models that allow the study of the aggregate behaviour of heterogeneous agents and also stocks and flows *within* sectors (e.g. Caiani et al 2016 is a promising attempt).

There are several difficulties in the construction of empirical SFC models and their utilization in analysis. Firstly, there is insufficient data for most countries to build an empirical SFC model. Even for those countries that provide detailed statistics of all relevant variables, definition and classification typically differ between national income accounting and flow-of-funds

statistics. Thus, combining national income accounting with flow-of-funds statistics on the empirical level is challenging. According to Kinsella (2011), even when national income accounting and flow-of-funds statistics can be successfully combined after data manipulation, there might not be data for a sufficiently long time period in order to estimate stock-flow norms and other required parameters.

Secondly, using empirical SFC models for forecasting short-term economic development is very challenging due to data publication lag. In other words, up-to-date data for all relevant variables are not readily available as compiling reliable statistics can take up to two years. Thus, SFC models are not particularly useful in day-to-day decision-making.

Thirdly, estimating norms and other parameters from empirical data can turn out to be challenging. For instance, estimating asset demand functions (portfolio equations) can be difficult due to collinearity in the returns on different financial assets. Furthermore, Kinsella (2011) points out that demand for various assets is very unlikely to be stable enough for reliable estimation. In addition, Dos Santos and Macedo e Silva (2010) point out that in empirical SFC models a very large number of parameters will inevitably cause at least minor errors in each estimation. The effect of these errors can accumulate and distort the solution significantly.

Fourthly, even though values of parameters and exogenous variables would have strong empirical foundations, they might lead to an unrealistic steady-state solution. Taylor (2008) argues that one must often assume unrealistic values for parameters and exogenous variables in order to achieve a realistic steady state. Thus, empirically accurate parameters and exogenous variables might not be compatible with an empirical steady state.

Fifthly, as with DSGE models, empirical SFC models must be solved using an algorithm. According to Godin et al (2012), there is no fully reliable method for solving complex empirical SFC models.

Although SFC modelling involves some drawbacks, there are good reasons to apply it more broadly. Neoclassical macro is currently based on national accounts, but it stops there. SFC models are able take the analysis further by asking what form savings takes. Watertight accounting, which forces us to articulate how each part of the economy is interconnected, is typically lacking in neoclassical economics. Without a formal model based on watertight accounting it is very hard to take into account all the interconnections. Consequently, in neoclassical economics the numbers do not necessarily always add up. Hence, there are good reasons for even neoclassical economists to engage in SFC modelling.

8 STOCK-FLOW CONSISTENT MODEL OF FULL-RESERVE BANKING

The specific contribution of this chapter is to build a PK-SFC model of FRB. FRB has not previously been modelled in the SFC framework popularized by Godley and Lavoie (2012). Previously, it has only been modelled in a DSGE framework (Benes and Kumhof 2012; 2013), in an overlapping-generation framework (Suntum and Neugebauer 2015), in a system dynamics framework (Yamaguchi 2010; 2011; 2014), in a dynamic simulation framework (Egmond and Vries 2015), and in a dynamic multiplier framework (Flaschel et al. 2010; Chiarella et al. 2011). The last two of these come closest to SFC modelling, being based on stocks and flows, but not in a complete and coherent way as in Godley and Lavoie (2012).

Before presenting the PK-SFC model of FRB, it is worth discussing the role of the model in this doctoral thesis. The model aims to shed light on some of the economic aspects of FRB. In particular, it compares the development of real variables (such as output and employment), monetary aggregates, debts and interest rates between FRB system and the current monetary system when government spending is increased. Furthermore, it explores different ways to create new money and the possibility of credit crunches in an FRB system. The model does not, however, study how economic agents react to credit crunches or financial instability more generally. The limitations and possible avenues to develop the model further are discussed in Sections 9.3 and 9.4.

The SFC model of FRB is theoretical rather than empirical. That is, the model does not try to depict any particular existing economy (e.g. the US) but rather it portrays the functioning of an FRB system in a more generic sense in a theoretical framework. Given this rather abstract starting point, can the model be of any use in understanding the functioning of an FRB system?

I draw from Uskali Mäki (2011) in arguing yes. According to Mäki (2011), what is important in modelling are the mechanisms at work and the resemblance of the model to reality. Mäki (2011) argues that the truth-value of a model can be assessed by its resemblance with reality.[63]

Mäki (2011) illustrates his point with an example of "Thünen rings", which are sometimes called the world's first economic model. Thünen (1826) modelled agricultural land use in a highly idealized and isolated setting. Despite their very simplistic and unrealistic assumptions, Mäki (2011) argues that "Thünen rings" are able to capture essential elements of reality. According

[63] When the potentially significant divergence of neoclassical models from economic reality is pointed out, some neoclassical economists defend their theoretical framework by relying on Giere's (1988) account that models cannot be truth-valued except internally, that is, whether a model itself is logically consistent. From this perspective, it is insignificant whether models have any resemblance with reality.

to Mäki (2011), the model is able to depict real causal mechanisms influencing agricultural land use and – although actual "Thünen rings" cannot be found anywhere on earth – it clearly resemblances reality to some degree.

According to Mäki (2011), by gradually relaxing assumptions of isolation and idealization it is possible to approach a realistic representation of reality. An empirical SFC model could provide a more reasonable picture of the functioning of FRB. Mäki (2011) argues that introducing more complex elements to a model is one worthwhile approach, but it is by no means the only route. According to Mäki (2011), even abstract and simplified theoretical models can be very insightful.

Relying on SFC modelling method and post-Keynesian economic theory, I argue that my model of FRB can systematically account for certain causal mechanisms at work and, thus, capture important and relevant elements of reality. Recall that institutions of money and banking have become very much alike across the globe and therefore even the simple theoretical model developed here can reveal important aspects of reality.

I believe that the model can provide an educated guess of the sign (positive or negative) and the rough magnitude of an action. Of course, the underlying theoretical and methodological framework can and should be challenged to develop better and more realistic estimates and to account for varying institutional settings more comprehensively. Therefore the model developed here should be seen mainly as a tool for thinking and the results should be interpreted as tentative, contingent and indirect rather than as a definite verdict on the effects of FRB.

Next, I will summarize the model and give a brief overview of the following sections. The SFC model of FRB built in this chapter is called REFORM2[64]. It is developed from Godley and Lavoie's (2012) model INSOUT. The model REFORM2 is available for download[65]. The key features of REFORM2 are:

- Banks are required to hold central bank reserves equal to their demand deposits (full-reserve requirement).
- The central bank sets the amount of reserves by buying government bills.
- Households are the residual buyers of bills and, therefore, the bill rate is endogenous.

[64] A previous version of the model, called REFORM, was presented in Lainà (2015b). The most notable changes are that cash has been added and additional ways to create money as well as the possibility of credit crunches are explored.

[65] The baseline scenario (the "old" steady state) is available at: www.patriziolaina.com/tiedostot/reform2_steady_state.txt. The money creation experiments are available at: www.patriziolaina.com/tiedostot/reform2_money_created.txt. The credit crunch experiments are available at: www.patriziolaina.com/tiedostot/reform2_credit_crunch.txt. A licensed version of EViews is required to run the programs.

- Banks adjust the interest rate on time deposits to attract enough deposits to fund loans.

The chapter is structured as follows. Section 8.1 presents the balance sheet, revaluation, and transaction-flow matrices. Section 8.2 presents and explains the equations.

Section 8.3 discusses the calibration process and the properties of the "old" steady state. It is found that a stationary steady state exists. It is a precondition for FRB to be compatible with a zero-growth economy. However, long-term economic growth is excluded from the model as there is no fixed capital or productivity growth by assumption. Furthermore, both full employment and zero inflation can be sustained in the steady state.

Section 8.4 conducts an experiment in which under FRB *money is created* through government spending. The section compares the time paths of variables to the cases in which government spending is increased under FRB *without money creation* and under *endogenous money*, that is, the current monetary system. To simulate the current monetary system, the section makes use of Godley and Lavoie's (2012) model INSOUT, from which the model REFORM2 has been developed. There is sufficient resemblance to make a reasonable comparison.

It is found that under FRB government spending increase financed with seigniorage revenue leads to a temporary increase in output, employment and inflation. The evolution of these variables is practically identical to when government spending is increased under FRB without money creation and under the current monetary system. Unlike in other cases, however, money creation in an FRB system leads to a permanent reduction in consolidated government debt. An increase in central bank reserves translates into an almost equal increase in demand deposits. Furthermore, an unusually large change in the money supply only leads to smooth and relatively small changes in interest rates.

Section 8.5 compares three additional ways to create money under FRB. Money creation through reducing taxes or paying a dividend to citizens yields roughly similar results to creating money through government spending. Conversely, creating money by repaying government debt (quantitative easing) affects only monetary aggregates and interest rates but not the real economy. As the effects of money creation vary according to the channel, money creation under FRB would require coordination between the government and the central bank. In other words, the appropriate amount of new money depends on how it enters the economy.

Finally, Section 8.6 explores the circumstances under which FRB might lead to a credit crunch. Although in every money creation experiment banks are able to satisfy the demand for loans, temporary credit crunches can occur when households' liquidity preference suddenly increases or firms suddenly demand more loans. As the changes required are quite drastic, credit crunches

under FRB seem to be possible but rare. Introducing fixed capital, productivity growth or lower bank liquidity targets, however, might alter this conclusion.

8.1 MATRICES

This section presents the matrices of the model REFORM2. The first subsection presents the balance-sheet matrix. The second subsection presents the revaluation matrix. Finally, the third subsection presents the transaction-flow matrix.

8.1.1 BALANCE SHEETS

This subsection presents the balance-sheet matrix for the model REFORM2. The table below depicts all the real and financial assets and liabilities each sector can hold. Naturally, all columns and rows sum to zero except for real assets (inventories).

Table 7. *Balance sheet matrix of REFORM2*

	Households	Firms	Government	Central bank	Banks	Sum
Inventories		+IN				+IN
Cash and reserves	$+H_h$			$-H_s$	$+H_b$	0
Demand deposits	+M1				−M1	0
Time deposits	+M2				−M2	0
Bills	$+B_h$		$-B_s$	$+B_{cb}$		0
Bonds	$+p_{bL} \cdot BL$		$-p_{bL} \cdot BL$			0
Loans		−L			+L	0
Balance	−V	0	+GD	0	0	−IN
Sum	0	0	0	0	0	0

Note: Plus signs indicate assets and minus signs liabilities.

The balance sheet matrix of REFORM2 is very similar to the balance sheet matrix of INSOUT in Godley and Lavoie (2012). Households hold cash, demand deposits, time deposits, government bills, and government bonds. Firms finance their inventories (working capital) with bank loans. Fixed capital is omitted. The government finances its budget deficit by issuing bills and bonds. The central bank buys government bills in order to issue cash and

reserves. Banks hold reserves and loans as assets and demand and time deposits as liabilities.[66]

The only differences between REFORM2 and Godley and Lavoie's (2012) INSOUT model are that banks do not hold bills and banks do not have access to central bank advances.

8.1.2 REVALUATIONS

This subsection describes the revaluation matrix for the model REFORM2. The table below shows the revaluation matrix.

As in Godley and Lavoie's (2012) INSOUT model, government bonds are the only asset that can change value between periods. Bonds are long-term securities, here defined as perpetuities (also called consols) because they are never redeemed. It is assumed that each perpetuity pays the owner one unit of currency (e.g., dollar) after one period has elapsed. The single unit of currency is the coupon of the perpetuity.

Table 8. *Revaluation matrix of REFORM2*

	Households	Firms	Government	Central bank	Banks	Sum
Bonds	$+\Delta p_{bL} \cdot BL_{-1}$		$-\Delta p_{bL} \cdot BL_{-1}$			0

Note: Plus signs indicate assets and minus signs liabilities.

Bills are assumed to be short-term securities that mature within each period; therefore, their value cannot change between periods.

8.1.3 TRANSACTION FLOWS

This subsection presents the transaction-flow matrix for the model REFORM2. The table below presents the transaction-flow matrix, which captures all transactions and flows between sectors and between periods. Thus, what happens within a sector or within a period is not depicted. As usual, all the rows and columns of the transaction-flow matrix sum to zero.

The upper part of the transaction-flow matrix represents national income. The key features are that only sales are taxed (no income tax) and all profits are always distributed (no retained earnings). GDP is added only as a memo item for clarification. As can be read from the table, interest payments on time deposits, government bills, and government bonds are not part of GDP, but interest payments on loans are.

[66] Thus the model is effectively a combination of the Chicago Plan (demand deposits held with banks) and sovereign money (banks can make loans by issuing time deposits).

The lower part of the transaction-flow matrix is the flow-of-funds section, which records changes in financial assets. The changes must match the national income part exactly. For example, if households have more inflows than outflows in the national income part, they are saving. In the flow-of-funds part this means that they are accumulating at least one type of asset (which is recorded with a minus sign in order to balance the column).

Table 9. *Transaction-flow matrix of REFORM2*

	Households	Firms		Government	Central bank		Banks		Sum
		Current	Capital		Current	Capital	Current	Capital	
Consumption	$-C$	$+C$							0
Government expenditures		$+G$		$-G$					0
Change in inventories		$+\Delta IN$	$-\Delta IN$						0
[Memo: GDP]		[Y]							[Y]
Sales tax		$-T$		$+T$					0
Wages	$+WB$	$-WB$							0
Entrepreneurial profits	$+F_f$	$-F_f$							0
Bank profits	$+F_b$						$-F_b$		0
Central bank profits				$+F_{cb}$	$-F_{cb}$				0
Interest on loans		$-r_{l\text{-}1}\cdot L_{\text{-}1}$					$+r_{l\text{-}1}\cdot L_{\text{-}1}$		0
…time deposits	$+r_{m\text{-}1}\cdot M2_{\text{-}1}$						$-r_{m\text{-}1}\cdot M2_{\text{-}1}$		0
...bills	$+r_{b\text{-}1}\cdot B_{h\text{-}1}$			$-r_{b\text{-}1}\cdot B_{s\text{-}1}$	$+r_{b\text{-}1}\cdot B_{cb\text{-}1}$				0
...bonds	$+BL_{\text{-}1}$			$-BL_{\text{-}1}$					0
Change in the stock of loans			$+\Delta L$					$-\Delta L$	0
…cash and reserves	$-\Delta H_h$					$+\Delta H_s$		$-\Delta H_b$	0
…demand deposits	$-\Delta M1$							$+\Delta M1$	0
…time deposits	$-\Delta M2$							$+\Delta M2$	0
...bills	$-\Delta B_h$			$+\Delta B_s$		$-\Delta B_{cb}$			0
...bonds	$-p_{bL}\cdot\Delta BL$			$+p_{bL}\cdot\Delta BL$					0
Sum	0	0	0	0	0	0	0	0	0

Note: Plus signs indicate sources of funds and minus signs uses of funds.

The national income part of the transaction-flow matrix (the upper part) is exactly the same as in Godley and Lavoie's (2012) model INSOUT. The only differences in REFORM2 are that there are no changes in the stocks of advances or bills held by banks (as banks do not hold advances or bills), and thus there are no interest payments on central bank advances or on banks' holdings of bills either.

8.2 EQUATIONS

This section presents all the equations of the model REFORM2. In total there are 80 equations of which 74 enter the model. As was discussed in Section 1.2, equations alone are insignificant. What matters are the underlying theories,

which try to shed light on how the economy functions. The equations described in this section convey many elements from post-Keynesian economic theory, discussed in Sections 7.3 and 7.4, as well as more specific theoretical elements related to money and banking, as discussed in Chapter 3.

The notation of equations follows that of Godley and Lavoie (2012). Thus, for readers of *Monetary Economics* this section should be quite easy to follow. Capital letters denote nominal values while lower case letters denote real (inflation accounted) values. Greek letters are parameters.

Subscript *–1* refers to value at the end of the previous period (starting value for the current period). Subscripts *s* and *d* refer to supply and demand, respectively, in a broad sense. Subscripts *f*, *h*, *g*, *cb,* and *b* refer to different sectors: firms, households, government, central bank, and banks, respectively. Variables without subscripts refer to realized values.

Superscript *e* refers to short-term expected or target value, while superscript *T* refers to long-term target value. Short-term and long-term target values differ as short-term targets typically follow a partial adjustment process. That is, economic agents do not try to reach their long-term targets immediately (within one period), but instead slowly adjust their short-term targets towards their long-term targets.

Suffix *A* in the numbering of equations denotes that the equation has been dropped from the model, either because it is redundant or it is there only for clarification. All endogenous variables appear only once on the left-hand side of an equation. The full list of variables with (initial) values is provided in the Appendix.

8.2.1 FIRMS

Decisions:

(F.1) $$y = s^e + (in^e - in_{-1})$$

(F.2) $$N = \frac{y}{pr}$$

(F.3) $$WB = N \cdot W$$

(F.4) $$UC = \frac{WB}{y}$$

(F.5) $$s^e = \beta \cdot s_{-1} + (1 - \beta) \cdot s^e_{-1}$$

(F.6) $$in^T = \sigma^T \cdot s^e$$

(F.7) $$\sigma^T = \sigma_0 - \sigma_1 \cdot r_l$$

(F.8) $in^e = in_{-1} + \gamma \cdot (in^T - in_{-1})$

(F.9) $p = (1 + \tau) \cdot (1 + \varphi) \cdot NHUC$

(F.10) $NHUC = (1 - \sigma^T) \cdot UC + \sigma^T \cdot (1 + r_l) \cdot UC_{-1}$

(F.11A) $F_f^e = \frac{\varphi}{1+\varphi} \cdot \frac{1}{1+\tau} \cdot p \cdot s^e$

Real output is determined by expected sales and the expected change in inventories (F.1). This yields precisely the same result as using realized values because when sales differ from expected, inventories differ by exactly the same amount in the other direction. Employment is determined by real output divided by productivity (F.2). The total wage bill is employment times nominal wage (F.3), while unit costs are the wage bill divided by real output (F.4). Expected sales depend on previous realized sales and what was expected in the previous period (F.5). The long-term target for inventories is a fraction of expected sales (F.6), where the fraction depends on an autonomous term and negatively on the interest rate on loans (F.7). The short-term target for inventories follows a partial adjustment process in which the inventories are gradually steered towards their long-term target (F.8). The price level of the economy depends on a mark-up set over normal historic unit costs and sales tax rate (F.9). Normal historic unit costs depend on current and previous unit costs, including financing costs (F.10). Expected entrepreneurial profits can be written in terms of nominal expected sales, the sales tax rate, and the mark-up (F.11A), but this equation does not explicitly enter the model.

Wage inflation:

(F.12) $\omega^T = \left(\frac{W}{p}\right)^T = \Omega_0 + \Omega_1 \cdot pr + \Omega_2 \cdot \frac{N}{N_{fe}}$

(F.13) $W = W_{-1} \cdot \{1 + \Omega_3 \cdot (\omega_{-1}^T - \omega_{-1})\}$

Inflationary forces are introduced into the model through wages. Workers target a real wage, which is positively related to productivity and employment (F.12). Workers partially adjust their nominal wage according to the discrepancy between the targeted and realized real wage in the previous period (F.13). Consequently, in line with "standard" post-Keynesian theory there is a level of employment at which inflation is steady. However, contrary to NAIRU theory in neoclassical economics, there are no automatic mechanisms driving the economy towards this level of employment (see Subsection 3.2.3).

Realized outcomes:

(F.14) $s = c + g$

(F.15) $S = p \cdot s$

(F.16) $in = in_{-1} + y - s$

(F.17) $\sigma_s = \frac{in_{-1}}{s}$

(F.18) $IN = in \cdot UC$

(F.19) $L_d = IN$

(F.20) $F_f = S - T - WB + \Delta IN - r_{l-1} \cdot L_{s-1}$

(F.21) $\pi = \frac{p - p_{-1}}{p_{-1}}$

(F.22) $Y = p \cdot s + UC \cdot \Delta in$

Real sales are the sum of real consumption and government expenditures (F.14), while nominal sales are simply real sales multiplied by the price level (F.15). Real inventories are inventories inherited from the previous period plus the discrepancy between real output and sales (what is produced but not sold must add to the inventory stock) (F.16). Realized fraction of inventories to sales is the end-of-period inventories divided by sales (F.17). As is customary, the nominal value of inventories is real inventories multiplied by unit costs, that is, inventories are valued at their production cost and not, for instance, at their expected sale price (F.18). Firms demand loans to finance their inventories (F.19). Realized entrepreneurial profits are nominal sales and the change in the nominal value of inventories minus taxes, wages, and interest payments on loans (F.20). Inflation is defined, as usual, as the relative change in the price level (F.21). Finally, nominal output is nominal sales plus the change in nominal inventories (F.22).

8.2.2 HOUSEHOLDS

Realized outcomes:

(H.1) $YD_r = WB + F + r_{m-1} \cdot M2_{h-1} + r_{b-1} \cdot B_{h-1} + BL_{h-1}$

(H.2) $CG = (\Delta p_{bL}) \cdot BL_{h-1}$

(H.3) $YD_{hs} = YD_r + CG$

(H.4) $F = F_f + F_b$

(H.5) $V = V_{-1} + YD_{hs} - C$

(H.6A) $V = H_h + M1_h + M2_h + B_h + p_{bL} \cdot BL_h$

(H.7) $V_{nc} = V - H_h$

(H.8) $yd_r = \frac{YD_r}{p} - \pi \cdot \frac{V_{-1}}{p}$

(H.9) $yd_{hs} = yd_r + \frac{CG}{p}$

(H.10A) $yd_{hs} = c + \Delta v$

(H.11) $v = \frac{V}{p}$

Unlike with firms, I describe the equations for households starting from realized outcomes and only then proceed to decisions. Regular disposable income includes wages, profits, and interest revenue on time deposits, bills, and bonds (H.1). Capital gains are the change in the price of bonds multiplied by the end-of-period amount of bonds (H.2). Haig-Simons nominal disposable income includes regular disposable income and capital gains (H.3). Total profits distributed to households consist of entrepreneurial profits and banks' profits (H.4). Notice that profits are always distributed in full and therefore there are no retained earnings.

Wealth of households is the wealth inherited from the previous period plus Haig-Simons disposable income minus consumption (H.5). Wealth of households could also be written as the sum of all financial assets (H.6A), but as will be later seen this equation is reserved for another purpose. Wealth of households expressed as net of cash will be useful in portfolio equations (H.7). Real regular disposable income is nominal regular disposable income minus the inflation tax on real wealth (H.8). As before, Haig-Simons real disposable income is real regular disposable income plus real capital gains (H.9), which is the same as real consumption plus change in real wealth (H.10A). Real wealth is nominal wealth divided by the price level (H.11).

Decisions:

(H.12) $c = \alpha_0 + \alpha_1 \cdot yd_r^e + \alpha_2 \cdot v_{-1}$

(H.13) $yd_r^e = \varepsilon \cdot yd_{r-1} + (1 - \varepsilon) \cdot yd_{r-1}^e$

(H.14) $C = p \cdot c$

(H.15) $$YD_r^e = p \cdot yd_r^e + \pi \cdot \frac{V_{-1}}{p}$$

(H.16) $$V^e = V_{-1} + (YD_r^e - C)$$

(H.17) $$V_{nc}^e = V^e - H_h$$

Households make a two-stage decision following Keynes (1936, 166). First, they decide how much they will save (by deciding how much they spend). Second, they decide how to allocate their wealth (portfolio equations below). Real consumption of households depends on expected real regular disposable income, real wealth of previous period, and an autonomous term (H.12). In turn, expected real regular disposable income depends on previous real regular disposable income and what was previously expected (H.13). Nominal consumption is real consumption times the price level (H.14). However, expected nominal regular disposable income depends on expected real regular disposable income times the price level but also on inflation revenue on real wealth (H.15). Putting things together, nominal expected wealth depends on previous wealth plus expected savings (expected nominal regular disposable income minus consumption) (H.16). Nominal expected wealth net of cash is simply nominal expected wealth minus cash (H.17).

Demand for assets (portfolio equations): [67]

(H.18) $$H_d = \lambda_c \cdot C$$

(H.19A) $$\frac{M1_d}{V_{nc}^e} = \lambda_{10} + \lambda_{12} \cdot r_m + \lambda_{13} \cdot r_b + \lambda_{14} \cdot r_{bL} + \lambda_{15} \cdot \frac{YD_r^e}{V_{nc}^e}$$

(H.20) $$\frac{M2_d}{V_{nc}^e} = \lambda_{20} + \lambda_{22} \cdot r_m + \lambda_{23} \cdot r_b + \lambda_{24} \cdot r_{bL} + \lambda_{25} \cdot \frac{YD_r^e}{V_{nc}^e}$$

(H.21A) $$\frac{B_d}{V_{nc}^e} = \lambda_{30} + \lambda_{32} \cdot r_m + \lambda_{33} \cdot r_b + \lambda_{34} \cdot r_{bL} + \lambda_{35} \cdot \frac{YD_r^e}{V_{nc}^e}$$

(H.22) $$\frac{p_{bL} \cdot BL_d}{V_{nc}^e} = \lambda_{40} + \lambda_{42} \cdot r_m + \lambda_{43} \cdot r_b + \lambda_{44} \cdot r_{bL} + \lambda_{45} \cdot \frac{YD_r^e}{V_{nc}^e}$$

Now, we arrive at the second stage of Keynes's (1936, 166) decision-making process, in which households decide how they allocate their wealth. Demand for various assets is depicted in the portfolio equations above following

[67] The rates of return on demand deposits and λ_{i1} associated to them are dropped from portfolio equations as the rate of return on demand deposits is assumed to be zero.

Tobinesque principles. Adding-up constraints, emphasized by Tobin (1969), are satisfied. [68]

The demand for cash is a fraction of consumption as in Godley and Lavoie's (2012) INSOUT model (H.18). The underlying idea is that households conduct a certain amount of their consumption transactions with cash and demand for it does not depend on the rates of return on other assets.

The fraction of demand deposits to expected wealth net of cash depends positively (the coefficient is positive) on an autonomous and a transaction term (first and last terms on the right-hand side) and negatively on rates of return on other assets (H.19A). In turn, the fraction of time deposits depends positively on an autonomous term and its own rate of return (first two terms on the right-hand side) and negatively on rates of return on other assets and transactions (H.20). Like time deposits, the fraction of bills depends positively on an autonomous term and its own rate of return and negatively on rates of return on other assets and transactions (H.21A). As with time deposits and bills, the fraction of bonds also depends positively on an autonomous term and its own rate of return and negatively on rates of return on other assets and transactions (H.22).

Realized asset holdings:

(H.23) $$H_h = H_d$$

(H.24) $$M1_h = H_b - (M2_h - L_s)$$

(H.25) $$M2_h = M2_d$$

(H.26) $$BL_h = BL_d$$

(H.27) $$B_h = V - H_h - M1_h - M2_h - p_{bL} \cdot BL_h$$

(H.28A) $$B_h = B_s - B_{cb}$$

(H.29) $$r_b = \frac{\frac{B_h}{V_{nc}^e} - \lambda_{30} - \lambda_{32} \cdot r_m - \lambda_{34} \cdot r_{bL} - \lambda_{35} \cdot \frac{YD_r^e}{V_{nc}^e}}{\lambda_{33}}$$

Although portfolio equations determine the demand for assets, the realized holding of some assets differs because realized wealth and income usually differ from what was expected. The realized holding of cash, however, is exactly equal to its demand (H.23).

[68] Vertical conditions are: $\sum \lambda_{i0} = 1$, $\sum \lambda_{i1} = 0$, $\sum \lambda_{i2} = 0$, $\sum \lambda_{i3} = 0$ and $\sum \lambda_{i4} = 0$. Symmetry conditions (which together with vertical conditions also satisfy horizontal conditions) are: $\lambda_{ij} = \lambda_{ji}, for\ all\ i \neq j$.

As in Godley and Lavoie (2012), demand deposits act as a "buffer" that reconciles the discrepancy between expected and realized outcomes. The realized holding of demand deposits is determined by central bank reserves minus the difference between time deposits and loans (H.24). This can also be read from banks' balance sheet. The idea is that demand deposits are initially equal to reserves. However, households can invest in time deposits offered by banks, which reduces demand deposits held by households. Banks can then use these funds to make loans. As banks make loans, demand deposits are returned into circulation (thus, bank lending does not create money under FRB). If banks do not make as many loans as households make time deposits, demand deposits do not get returned into circulation and, therefore, their amount is less than reserves.

Keynes (1936, 110–11) pointed out that the demand for money (liquidity preference) is irrelevant in the sense that it cannot directly affect the amount of money:

> *The concept of hoarding may be regarded as a first approximation to the concept of liquidity-preference. […] For the amount of hoarding must be equal to the quantity of money […]. All that the propensity of the public towards hoarding can achieve is to determine the rate of interest [and rates of return on financial assets more generally] at which the aggregate desire to hoard becomes equal to the available cash. (Italics in original)*

Time deposits and bonds are determined more straightforwardly. The realized holdings of time deposits and bonds equal their demand (H.25 and H.26).

The realized amount of bills held by households is total wealth minus other financial assets (H.27). This equation is simply (H.6A) rearranged. However, the amount of bills left for households is entirely determined by the decisions of the government (how many bills it issues) and the central bank (how many bills it buys to monetize government debt) (H.28A). In other words, households are the residual buyer of bills. Nevertheless, households cannot be forced to hold bills against their will.

In order to ensure that households buy exactly all the remaining bills, the interest rate on bills must be endogenous. Thus, the interest rate on bills is determined by the portfolio equation (H.21A) solved for the bill rate instead of the amount of bills (H.29). In the model the bill rate is the benchmark interest rate, which is comparable to the policy rate in the current system (e.g., the federal funds rate in the US, the base rate in the UK, and the rate of main refinancing operations in the euro area) as banks use it as a basis for setting their loan rate.

The redundant equation is the equation indicating that households are the residual buyer of bills (H.28A). Although equation (H.28A) does not explicitly enter the model, it gives the same result as (H.27). The equation is dropped from the model as otherwise the model would be overdetermined. This means that all the other equations together already imply the dropped equation.

8.2.3 GOVERNMENT

Fiscal policy:

(G.1) $$T = \tau \cdot (S - T) = S \cdot \frac{\tau}{1+\tau}$$

(G.2) $$G = p \cdot g$$

(G.3) $$PSBR = G + r_{b-1} \cdot B_{s-1} + BL_{s-1} - (T + F_{cb})$$

(G.4) $$B_s = B_{s-1} + PSBR - (\Delta BL_s) \cdot p_{bL}$$

(G.5) $$BL_s = BL_h$$

(G.6) $$r_{bL} = \bar{r}_{bL}$$

(G.7) $$p_{bL} = \frac{1}{r_{bL}}$$

(G.8) $$GD = B_s + p_{bL} \cdot BL_s$$

(G.9) $$GD_{net} = B_h + p_{bL} \cdot BL_s$$

The government collects taxes according to the sales tax rate it sets exogenously (G.1). Nominal government expenditures are simply real government expenditures, which are set exogenously, multiplied by the price level (G.2).

The government budget deficit, that is, the public sector borrowing requirement (PSBR) is the difference between total outlays (including spending and interest payments on bills and bonds) and total income (including taxes and central bank profits) (G.3). The government issues (redeems) bills to finance the part of the budget deficit (surplus) that is not financed by the issuance of government bonds (G.4). The government lets households decide how many bonds they want to hold (G.5) with the interest rate set exogenously by the government (G.6). The price of bonds is simply the coupon (one unit of currency) divided by the bond rate (G.7).

Gross government debt[69] is simply the value of outstanding bills and bonds (G.8). Consolidated government debt[70] is the value of bills and bonds held by non-public entities (G.9). Put differently, consolidated government debt is gross government debt minus intra-government debt (in this case bills held by the central bank). Consolidated government debt can alternatively be called net government debt.

8.2.4 CENTRAL BANK

Monetary policy:

(C.1) $H_s = B_{cb}$

(C.2) $B_{cb} = \bar{B}_{cb}$

(C.3) $r_h = 0$

(C.4) $F_{cb} = r_{b-1} \cdot B_{cb-1}$

The central bank can greatly influence the money supply through reserves. As can be read directly from the balance-sheet matrix, the central bank sets the amount of reserves by determining how many bills it holds (C.1). The simplest monetary policy rule is to keep the amount of bills constant, that is, the amount of bills is exogenous (C.2). Alternative monetary policy rules are worth considering but they are not the topic of this chapter.

As it is assumed that interest is not paid on cash or reserves (C.3), the profit of the central bank is determined by the interest payments it receives on bills from the government (C.4).

8.2.5 BANKS

Liquidity:

[69] The market value of government debt can differ from its recorded historical value, which is generally reported by officials, to the extent that bond prices have appreciated or depreciated. However, as the bond rate is set exogenously, there cannot be any changes in bond prices and thus in this instance the market value of government debt also equals its recorded historical value.

[70] Consolidated government debt comes close to excessive deficit procedure (EDP) government debt, which is the "official" figure for government debt in the EU as it is used for calculating the Maastricht criteria. Unlike consolidated government debt, EDP government debt does include government debt held by the central bank.

(B.1) $$H_{min} = \rho_1 \cdot M1_s + \rho_2 \cdot M2_s$$

(B.2) $$H_b = H_s - H_h$$

(B.3) $$BLR = \frac{H_b}{H_{min}}$$

The full-reserve requirement is incorporated by setting the reserve requirement for demand deposits ρ_1 equal to 1 (B.1). There is no reserve requirement for time deposits, so ρ_2 is equal to zero. Banks hold whatever reserves they are left with after the central bank has decided the amount and households have satisfied their demand for cash (B.2). The bank liquidity ratio is the ratio between reserves held by banks and required reserves (B.3). Under FRB this ratio must be at least 1.

Monetary and credit aggregates:

(B.4) $$M1_s = M1_h$$

(B.5) $$M2_s = M2_h$$

(B.6) $$L_s = L_d$$

Banks supply both demand and time deposits in whatever amount is required (B.4 and B.5). As previously described, the amount of demand deposits can be read from banks' balance sheet (H.24). The amount of time deposits is completely determined by their demand (H.20 and H.25). Banks also accommodate the demand for loans for all creditworthy firms (B.6).

Determination of interest rates:

(B.7) $$r_m = r_{m-1} + \Delta r_m$$

(B.8) $$\Delta r_m = \varsigma_m \cdot (z_1 - z_2)$$

(B.9) $$z_1 = 1, iff\ BLR_{-1} < BLR_{bot}$$

(B.10) $$z_2 = 1, iff\ BLR_{-1} > BLR_{top}$$

(B.11) $$r_l = r_{l-1} + \Delta r_l + \Delta r_b$$

(B.12) $$\Delta r_l = \varsigma_l \cdot (z_3 - z_4)$$

(B.13) $$z_3 = 1, iff\ BPM < BPM_{bot}$$

(B.14) $z_4 = 1, iff\ BPM > BPM_{top}$

(B.15) $BPM = \frac{F_b + F_{b-1}}{M1_{s-1} + M1_{s-2} + M2_{s-1} + M2_{s-2}}$

(B.16) $F_b = r_{l-1} \cdot L_{s-1} - r_{m-1} \cdot M2_{s-1}$

Banks can set the interest rates on time deposits and loans, while the interest rate on demand deposits is assumed to be zero (which is also very much in line with the real world today). Banks follow a partial adjustment process in setting the interest rate on time deposits (B.7 and B.8). If the bank liquidity ratio falls below its desired level in the previous period, banks increase the deposit rate to attract more time deposits (B.9). As households invest in time deposits, their demand deposits are reduced, and this increases bank liquidity ratio. Symmetrically, when the bank liquidity ratio increases above its desired level, banks decrease the deposit rate in the following period to reduce the amount of time deposits (B.10). As long as the bank liquidity ratio stays within its desired range, banks do not alter the interest rate on time deposits.

Banks set the interest rate they charge on loans to ensure a sufficient profit margin. When setting the loan rate, banks follow a partial adjustment process as well as the bill rate (B.11 and B.12). When the bank profit margin falls below its desired level, banks increase the interest rate they charge on loans (B.13). Symmetrically, when the bank profit margin goes above its desired level, banks decrease the interest rate on loans (B.14). Unlike in mainstream economics, banks do not maximize profits (at least in the short run). Godley and Lavoie (2012, 340) justify this through the banks' fear of government regulation or consumer outrage. The bank profit margin is determined by average profits divided by the sum of average demand and time deposits (B.15). Finally, banks' profits are determined by the difference between the interest payments they receive from loans and the interest payments they make on time deposits (B.16). In this model real rates are meaningless, but they could be used instead of nominal rates. [71]

8.3 CALIBRATION AND STEADY STATE

In the simplest SFC models it is possible to obtain a determinate analytical solution for a steady state. However, in more complex models, such as REFORM2, obtaining a determinate steady-state solution analytically becomes impossible as the model is path-dependent. It can be said that the model exhibits deep endogeneity as the steady state depends on its history.

[71] Real rates can be defined as $rr_h = -\frac{\pi}{1+\pi} = \frac{1+0}{1+\pi} - 1$, $rr_m = \frac{1+r_m}{1+\pi} - 1$, $rr_l = \frac{1+r_l}{1+\pi} - 1$, $rr_b = \frac{1+r_b}{1+\pi} - 1$ and $rr_{bL} = \frac{1+r_{bL}}{1+\pi} - 1$.

The solution for each set of parameters, exogenous variables and initial stock values can, however, be obtained through simulation.

Before going to the simulation results, I shall explain how the model was calibrated. First, all values of parameters, exogenous variables and initial stocks (of endogenous variables) were directly adopted from Godley and Lavoie's (2012) INSOUT model. Then, some of them were adjusted to yield a suitable solution. That is, the simulation yielded a steady state, no negative values existed for any variable and stock values were convenient (e.g. all monetary aggregates were at least 10). Initial stock values were then updated from the end values of the previous simulation (in which variables might fluctuate in the early periods) so that the system is in its steady state from the first period onwards.

Now, the properties of the steady state are presented. The steady state of REFORM2 is stationary, that is, the levels of key variables remain constant. Long-term economic growth is excluded from the model as there is no fixed capital, productivity growth or other forces driving economic growth. Stationary steady state is a necessary precondition for FRB to be compatible with a zero-growth economy. At least in the steady state FRB does not in itself cause economic growth or collapse.

In an FRB system with no economic growth both full employment and zero inflation are achieved. In other words, FRB does not in itself lead to a fall in employment. In addition, it causes neither inflationary – let alone hyperinflationary – nor deflationary tendencies.

In the steady state there is no increase in either public or private debt. Servicing debt is also entirely possible. Thus, under FRB there is no push for ever increasing (nominal or real) debt. [72]

There is no shortage of credit either. Banks are able to supply all loans demanded by creditworthy borrowers. In the long run the availability of loans is secured as banks adjust the interest rate on time deposits to attract enough deposits to fund the loans.

In the steady state time deposits exceed demand deposits. Although under FRB this might first sound a bit odd, it is entirely possible as the same money (demand deposits) can be re-lent. For instance, if households acquire time deposits, their demand deposits are reduced by the same amount. However, banks can lend these demand deposits to firms. Again, firms can pay wages to households with these demand deposits. Thus, the same demand deposits households used for acquiring time deposits can be returned to them through firms and used again to acquire more time deposits or other assets. In short, money circulates.

The existence of a steady state in an FRB system is already an argument for FRB, as it implies that the state of affairs can be sustained indefinitely. However, it is possible that the system becomes unstable as soon as something

[72] Hoarding by firms or banks (in the form of undistributed profits) is, however, not allowed in the model. If this assumption were relaxed, the conclusion might be different.

changes. Next, in order to address this issue, let us conduct money creation experiments with the model REFORM2. Later, the chance of a credit crunch is considered.

8.4 MONEY CREATION THROUGH GOVERNMENT SPENDING

Under FRB money can be created through government spending, as has been proposed by Jackson and Dyson (2012) and Sigurjonsson (2015) among others. This section compares what happens when government spending is increased under FRB – with and without money creation – and under endogenous money, that is, the current monetary system. FRB is studied with the model REFORM2, described in the previous sections, while endogenous money is studied with the model INSOUT (a full description of which can be found in Godley and Lavoie 2012, Ch. 10).

In all cases, real government spending is temporarily increased by 36% for one period and then returned to its original value (public expenditures initially account for 19% of GDP). Under FRB with money creation, that is, increase in government spending is financed with seigniorage revenue, the government increases its spending by 15 in nominal terms. At the same time, the central bank buys bills worth 15 which increases reserves by 15. The increases are 7% of GDP.

The increase in government spending takes place in period 6. For clarity, the following subsections use notation $t=0$ for indicating period 6, that is, exactly when government spending takes place, $t=1$ for the following period, etc.

In interpreting the figures, it is important to take the scale into account as the figures are scaled appropriately to depict the movements of variables. Therefore, depending on the scale, a radical-looking movement can be insignificant and a minor-looking movement can be very significant.

8.4.1 OUTPUT, EMPLOYMENT AND INFLATION

As can be seen from Figure 3 below, the development of output, employment and inflation is very similar under FRB – either with or without money creation – and under the current monetary system. Real GDP, employment and inflation speed up temporarily after government spending is increased. The level of real GDP peaks at a 7% higher level and then returns to its "new" steady state value, which is exactly the same as the "old" steady state (in the figure the initial levels are normalized to 1).

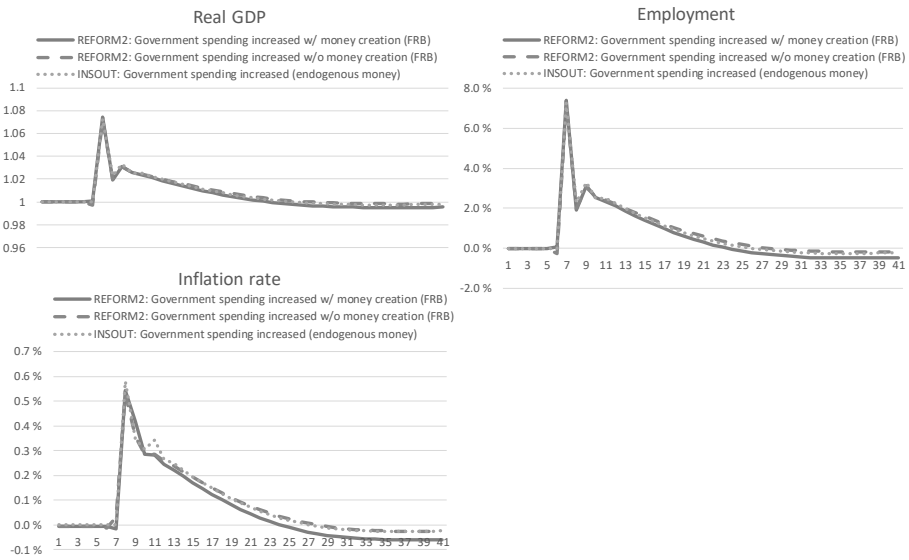


Figure 3 Output, employment and inflation

The development of employment resembles the development of output very closely (in the figure employment is compared to the "old" steady state). This is completely in line with post-Keynesian economic theory, as post-Keynesians often maintain that employment is determined mainly in the product market rather than in the labour market. Employment also peaks at a 7% higher level before converging back to the original level as the effect of the government spending stimulus fades.

The period-on-period inflation rate peaks at 0.5% before returning to zero in the "new" steady state. At the peak the price level is 3% higher, but as inflation is very slightly negative for multiple periods, the price level also ultimately converges to its "old" steady-state value.

The identical development of real GDP and inflation in all cases might strike one as surprising. However, it is completely in line with post-Keynesian literature as what matters are stocks and flows. FRB, or money creation under it, does not in itself create any additional income or expenditure flows and thus does not significantly alter, for instance, consumption or investment decisions (government spending decision is made identical in all cases by design).

8.4.2 GOVERNMENT DEFICIT AND DEBT

As post-Keynesians often emphasize, relying on an accounting identity, public sector debt increases private sector wealth. The net financial wealth of the whole private sector – comprising households, firms, and banks – is exactly equal to gross government debt (when the foreign sector is excluded as is the

case here). Figure 4 shows the government deficit in absolute terms and the development of bills and government debt compared to the "old" steady state.

In all experiments the government runs a brief but large budget deficit followed by a persistent but small budget surplus. Not surprisingly, gross government debt first increases and then slowly reverts in all cases. As pointed out, this also represents the development of the net financial wealth of the private sector. The temporary increase in net financial wealth encourages households to consume more (wealth enters the consumption function as equation H.12 indicated), but when gross government debt is reduced consumption also returns to its "old" steady state level.

However, more interesting is the smooth and permanent reduction in consolidated government debt under FRB when government spending is financed with money creation. The consolidated government debt-to-GDP ratio drops by 7% points, which is exactly equal to the seigniorage revenue. This has at least three implications. First, it reduces interest payments on government debt, which can be used otherwise to serve the public interest. Second, it allows a fiscal stimulus while reducing the relevant measure of government debt. Third, in the long run, after sufficient money was created, the government could also become "debt-free," if it so decided, in the sense that it would not be indebted towards any private agent. This, however, is not necessarily desirable as there is a recognized demand for risk-free financial assets bearing interest.

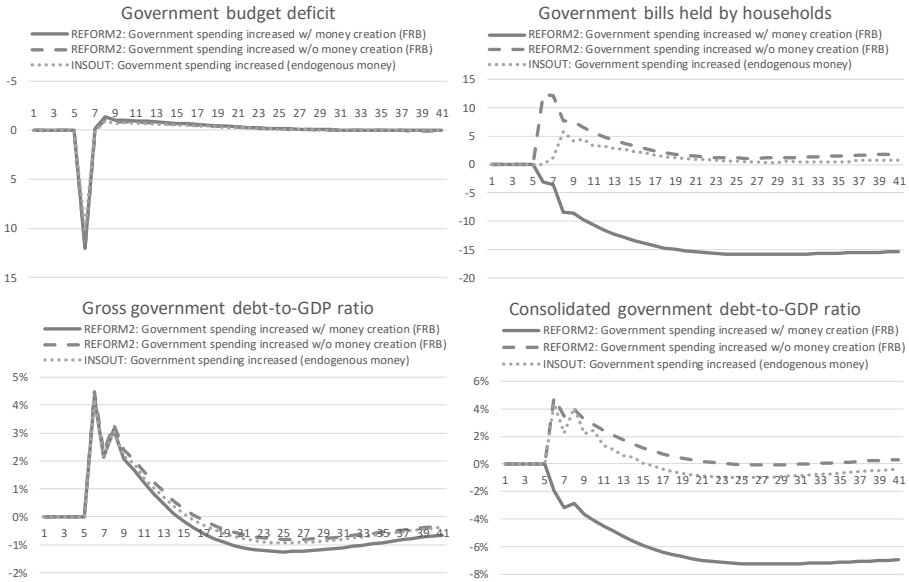


Figure 4 Government deficit and debt

Another interesting issue is that under FRB with money creation, bills held by households decrease – and they keep on decreasing over multiple periods even after the government does not receive any additional seigniorage (note that all government debt is held in the form of bills and bonds). In the experiment the central bank buys bills worth 15, the government increases its spending by 15 for one period, and then government spending returns to its previous value. Intuitively, the amount of bills held by households should stay constant as households are the residual buyer of bills.

The counterintuitive result can be explained as follows. As some of the government spending also increases tax revenue for the government, the government budget deficit is less than 15, that is, less than the increase in government spending (this is also true for the other cases as the figure above indicates). Although originally the government issues new bills worth 15, additional tax revenue is already collected during the accounting period and by the end of period 6 (t=0) government bills have only increased by 12. Under FRB with money creation this leads to the situation in which households' holding of bills is reduced by 3 during period 6 (t=0) as the central bank buys 15 of them.

In periods 7 and 8 (t=1–2) households reallocate their wealth and increase their holdings of bonds, whose interest rate remains unchanged (not depicted). This further reduces the amount of bills households hold as government debt can be restructured by households; that is, an increase in bonds means an equal decrease in bills (given the amount of government debt), as can also be read from equation (G.4).[73]

From period 7 onwards (t=1+), the government runs a small but persistent budget surplus, which also partly reduces bills and bonds held by households. Finally, the economy finds the "new" steady state where households have reduced their holding of bills by 16.

Under FRB with no money creation, consolidated government debt-to-GDP ratio moves similarly to gross government debt-to-GDP ratio. Under endogenous money, the developments resemble each other although the central bank has to buy part of the newly issued bills in order to keep the interest rate on bills constant. This explains why consolidated government debt is slightly lower under endogenous money than under FRB without money creation.

Even though output, employment and inflation evolved very similarly across experiments (see Figure 3), FRB could generate more capacity for fiscal policy. As Figure 4 shows, consolidated government debt decreases under FRB when new money creation occurs. In other words, FRB would increase the fiscal space of governments. When these reductions in consolidated

[73] In the INSOUT model, bills are also held by banks. This – in addition to the fact that households can directly decide in which form they want to hold government debt and not only as a result of reallocation – explains why households do not buy as many bills under endogenous money as under FRB without money creation.

government debt accumulate over time, this can allow more emancipatory economic policies, although they are not an automatic consequence of FRB.

8.4.3 MONETARY AND CREDIT AGGREGATES

Figure 5, below, shows the evolution of central bank money compared to the "old" steady state. The amount of cash barely changes as its demand is a tenth of consumption (notice the scale). It also evolves very similarly in all cases as consumption develops similarly.

Under FRB, when money is created, central bank reserves held by banks permanently increase by 15. The reason is that the seigniorage revenue, which in this experiment finances the increase in government spending, takes the form of central bank money. Notice that the amount of central bank money is the sum of cash and reserves (under FRB the amount of central bank money is under total control of the central bank, while under the current monetary system the amount of central bank money is determined endogenously). The small fluctuation in reserves is due to substitution between cash and reserves. In the other two cases the amount of reserves hardly changes.

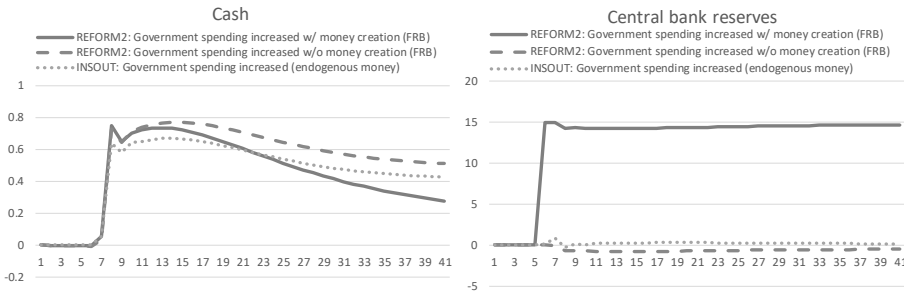


Figure 5 Central bank money

Figure 6, below, indicates the development of demand deposits, time deposits and loans relative to the "old" steady state. In all cases, demand deposits fluctuate in a parallel direction but there is a significant difference in level, particularly when money is created under FRB.

As equation (H.24) indicates, under FRB the amount of demand deposits held by households depends on reserves and the discrepancy between time deposits and loans. Should time deposits and loans stay constant or move by the same amount in the same direction, changes in demand deposits would exactly match changes in reserves. However, this is not the case, as households will reallocate their wealth and firms will adjust their demand for loans.

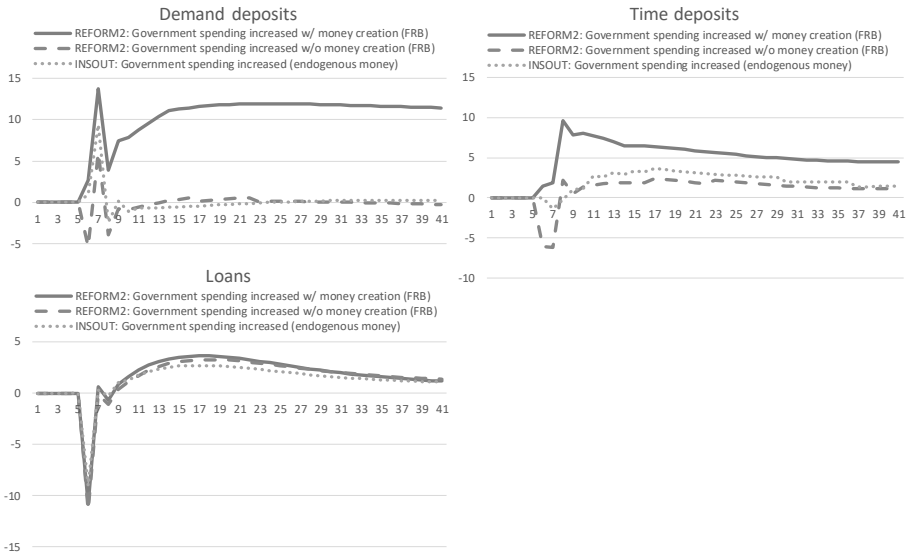


Figure 6 Bank deposits and loans

Under FRB with money creation, in period 6 (t=0), exactly when reserves increase by 15, demand deposits increase by only 3. The reason for this is that the gap between time deposits and loans widens by 12: time deposits increase by 1 and loans fall by 11 (the numbers add up to 15). The main reason that the gap widens is because firms demand fewer loans as they have fewer inventories that need to be financed. Inventories drop sharply as sales easily exceed expected sales. Because of this in particular an increase in reserves does not instantly translate into an equal increase in demand deposits.

In period 7 (t=1) monetary policy seems to transmit more effectively as demand deposits increase by 11 (compared to the "old" steady state total increase of 14, which is almost equal to the increase of reserves by 15). Demand deposits peak as loans almost return to their "old" steady state value, with firms adjusting their expected sales upwards in order to recover their inventories. As time deposits do not change, the gap between time deposits and loans shrinks by 11, which exactly matches the increase in demand deposits.

In period 8 (t=2) households continue to rebalance their asset portfolios, which leads to a sharp decline in demand deposits. As households increase their time deposits by 9 and the demand for loans decreases by 1, the fall in demand deposits is 10. Over the following transition periods (t=3+), demand deposits recover as time deposits decrease slightly while loans increase.

Finally, in the "new" steady state, all monetary and credit aggregates level off (there are only very minor movements as variables continue to converge to their ultimate values). In the end, compared to the "old" steady state, after

reserves increased by 15, demand deposits increased by 12, time deposits by 4, and loans by 1. To put it briefly, increasing central bank money under FRB translates into an 80% increase in demand deposits.

Under FRB with no money creation and under endogenous money, demand deposits fluctuate after government spending is increased. The fluctuation in these cases is also driven mainly by the sudden but brief drop in loans, which evolves identically in all cases. After a short fluctuation and reallocation of wealth, demand deposits level off to the same level as in the "old" steady state. In both cases time deposits end up on a slightly higher level in order to finance the small increase in the demand for loans.

The next subsection discusses how interest rates (are) adjust(ed) as a reaction to changes in monetary and credit aggregates.

8.4.4 INTEREST RATES

Perhaps the most significant differences between the experiments can be found in interest rates. Figure 7 depicts the development of interest rates on government bills, loans and time deposits relative to the "old" steady state. The interest rate on government bills is the main interest rate in all cases. However, its determination and development vary across experiments.

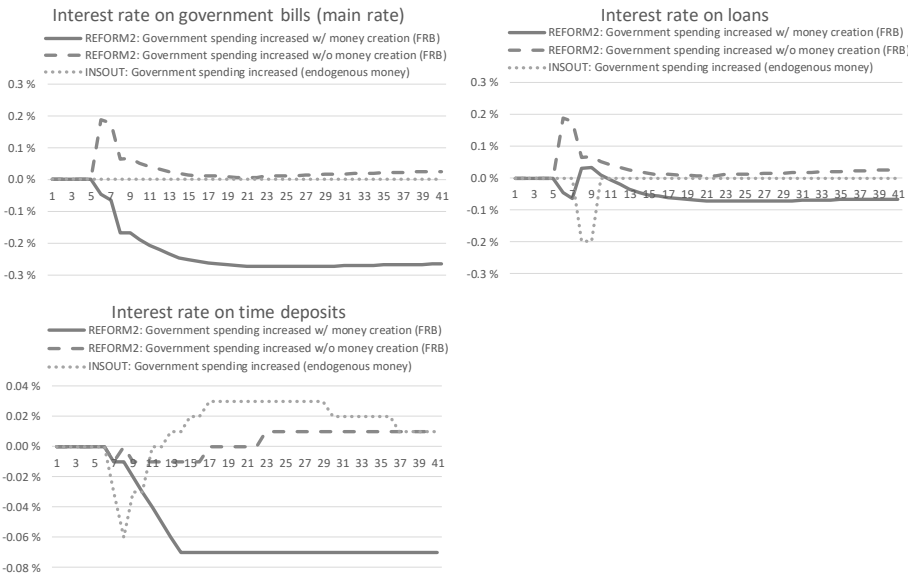


Figure 7 Interest rates on government bills, loans and time deposits

In the REFORM2 model, the main rate is determined endogenously, as equation (H.29) reveals. Because households are the residual buyer of bills, the main rate has to adjust in order to reconcile demand with supply.

Conversely, in the INSOUT model the main rate is determined exogenously by the central bank. Thus, it is the amount of bills that has to adjust. This is also why the main rate does not react to changes in government spending under endogenous money.

Under FRB, the main rate moves in tandem with the amount of bills held by households. If money is not created, the government has to issue more bills to households in order to finance the increase in expenditure. Households are only willing to buy the additional bills if their return is higher. Thus, the main rate increases temporarily.

However, under FRB with money creation the main rate drops to a permanently lower level. As explained in Subsection 8.4.2, the main rate drops immediately after government spending is increased as the budget deficit is less than the central bank monetizes government debt. In other words, as households are left with fewer bills, the interest rate on bills (the main rate) drops slightly to reconcile demand with supply.

The main rate, however, continues to decline even after government spending returns to its original level and the government does not receive any additional seigniorage revenue. The reallocation of household wealth contributes to the decrease in the bill rate. Government debt can be held in the form of bills or bonds and households decide to increase their holding of bonds as the return on bonds becomes relatively higher. Moreover, from period 7 onwards (t=1+), the government runs a small but persistent budget surplus, which also reduces the total amount of bills and bonds available to households. This government surplus is the third force pushing the bill rate down. Finally, the economy finds the "new" steady state, in which the main rate has dropped almost by 0.3% points.

The interest rate on loans is determined in the same way in all experiments. The loan rate depends on the main rate and banks further adjust it according to their profit margin. Under FRB without seigniorage, the bank profit margin remains within its target range and, consequently, the loan rate is a pure reflection of the development of the main rate.

Under FRB with money creation, however, the bank profit margin drops below its bottom range. Thus, the interest rate on loans is adjusted upwards and it does not simply follow the main rate. In the end, the loan rate settles at a slightly lower level. The main reason for the fall in bank profitability is that the amount of time deposits increases (shown in the previous subsection) and thus banks have to pay more interest to depositors. Also, the sharp drop in the amount of loans reduces the income stream of banks although the drop is very brief as the amount of loans recovers quickly.

Surprisingly, under endogenous money the bank profit margin increases above its top range. Therefore, banks temporarily lower the loan rate. Nevertheless, this reduces bank profits and eventually banks adjust the loan rate back to its initial level. The reason for a temporary increase in bank profitability is due to changes in bank balance sheet, chiefly as they acquire

more bills (which is not allowed in REFORM2), and because the interest rate on time deposits drops.

This leads us to the development of the interest rate on time deposits. In all experiments the driving force is bank liquidity. The definition of bank liquidity, however, differs. In REFORM2 the bank liquidity ratio was defined by equation (B.3) as reserves relative to demand deposits. Under FRB this ratio must be at least 1 to satisfy the liquidity requirement. In the model, banks have a safety margin, as their target range is 10–20% above the requirement. In INSOUT the bank liquidity ratio is defined in terms of government bills held by banks relative to both demand and time deposits. Moreover, in INSOUT the main rate also has a proportional impact on the deposit rate (although the main rate is exogenous and, thus, does not change in the experiment).

Under FRB banks can influence their liquidity ratio indirectly by changing the interest rate they offer on time deposits. This can partly help to explain the fluctuations in time deposits and, subsequently, in demand deposits, although the dynamics are mainly driven by other factors as will be seen next.

Under FRB with money creation, the adjustment process goes as follows. In period 6 (t=0) banks receive reserves worth 15 (see Figure 5), which increases their liquidity ratio over the preferred upper target. During the next period (t=1), banks react to this by reducing the interest rate on time deposits to curb households' demand for time deposits. Consequently, households end up with significantly more demand deposits (although, as was seen in Figure 6, above, this is mainly because of loans recovery). The increase in demand deposits drops the bank liquidity ratio back to its target range.

In period 8 (t=2) banks do not alter the deposit rate. Nonetheless, as was shown in Figure 6, above, households strongly increase their holding of time deposits. This, together with the lack of significant change in firms' demand for loans, reduces demand deposits strongly. Now the bank liquidity ratio again exceeds its upper target.

In periods 9–14 (t=3–8) banks react by reducing the deposit rate in each period. In the following periods (t=9+) the system starts to find its "new" steady state as the liquidity ratio is within its target range and, consequently, banks do not alter the deposit rate any more. Compared to the "old" steady state the interest rate on time deposits is 0.07% points lower.

Under FRB without money creation and under endogenous money, the interest rate on time deposits first drops and then increases above the initial level. Under endogenous money, the deposit rate reacts more strongly. First, in both cases the liquidity of banks increases. Under FRB without seigniorage, demand deposits decrease (see Figure 6). Under endogenous money, government debt increases, which leaves the banks with more bills (see Figure 4). Then the liquidity of banks decreases and banks hike up the deposit rate. Under FRB without seigniorage, demand deposits recover and increased demand for cash reduces the central bank reserves held by banks. Under endogenous money, the government surplus reduces the amount of bills held

by banks. Eventually in both cases, the interest rate on time deposits ends up slightly above the initial level.

As seen above, when the bank liquidity ratio target is breached under FRB, banks can adjust the interest rate on time deposits in an appropriate manner to provide all deposit and credit functions demanded. There is never a shortage of credit.

In contrast to some claims (e.g. Dow et al 2015; Dittmer 2015; Foot et al 1979; Angell 1935), FRB does not lead to excessively volatile interest rates. Both experiments with FRB led to a smooth and relatively small change in the main rate on its path to its "new" steady-state value (under the current monetary system the main rate was exogenous and thus constant by design). In fact, interest rates on loans and time deposits were more volatile in the current monetary system than in an FRB system. Therefore, the fear that FRB would destabilize interest rates seems exaggerated.

8.5 OTHER OPTIONS FOR MONEY CREATION

The previous section experimented with the REFORM2 model to see what would happen when new money is created through government spending in an FRB system and compared it to FRB without money creation and the current monetary system. In addition to government spending, Jackson and Dyson (2012) and Sigurjonsson (2015) give three additional ways to create money in an FRB system: reducing taxes; paying dividends to citizens; and repaying government debt (quantitative easing). This section experiments with REFORM2 and compares these three alternatives to the previous experiment.

8.5.1 TAX CUT

Note that only firms are taxed in the model, so that the tax cut is a reduction to firms' sales tax. For one period taxes are reduced by 15, which is exactly the same amount as nominal government spending was increased by in the previous experiment. It means that the sales tax rate is reduced from 24.2% to 15.7% for one period and then returned to its original value. The central bank monetizes the temporary tax reduction by buying government bills and simultaneously issuing new reserves worth 15.

Reducing taxes yields very similar – although more turbulent – results to when new money is created through government spending. The most significant difference is that the inflation rate in particular fluctuates more. Unlike when new money is created through government spending, there is first a deflationary shock and only then an inflationary shock. Both deflation and inflation peak at 6% while in the previous case period-on-period inflation peaked at a mere 0.5%. Ultimately, however, the price level returns to its previous level as it did in the previous experiment too.

Monetary aggregates also fluctuate a bit more. This causes bigger swings to the bank liquidity ratio although the FRB requirement is not violated at any point. Furthermore, interest rates are a bit more turbulent.

GDP, loans and government budget deficit behave in a similar manner. Although some variables fluctuate more, the end result of money creation through tax reduction is very similar to when money is created through government spending.

8.5.2 CITIZEN'S DIVIDEND

To analyze the effects of creating new money through citizen's dividends, advocated by Robinson (1937) among others, some equations have been modified. Citizen's dividend has been added as an additional source of funds to the regular disposable income of households (H.1). Similarly, citizen's dividend is added as an additional expenditure for the government (G.2). Citizens are paid a one-shot dividend worth 15 while the central bank buys government bills and issues reserves for the same amount.

Again, the dynamics are very similar to when new money is created through government spending. Most variables behave almost identically. However, some differences can be observed.

Unlike in the previous cases, the government has to borrow exactly the same amount as new money is created. That is, the government budget deficit peaks at 15 while in the previous cases the deficit peaked at 12. In the previous cases some of the stimulus returned in the form of higher tax revenue within the accounting period when new money was created. With a citizens' dividend, none of the stimulus occurs within the accounting period, and thus it cannot be returned through higher tax revenue. In this case the behaviour of economic agents is altered only in the following periods.

There are also other minor differences. Demand deposits – and the bank liquidity ratio – are a bit more volatile. In contrast, GDP, inflation and loans behave in a similar manner but peak at a slightly lower level.

8.5.3 REPAYMENT OF GOVERNMENT DEBT

When new money is created through repayment of government debt, government debt is monetized without any stimulus (except perhaps through lower interest rates). This experiment is actually the same as quantitative easing (QE), exercised by a number of central banks after the GFC, except that it is done under an FRB system. In the experiment, the central bank buys government bills and simultaneously injects new reserves worth 15 into the banking system.

Unlike in the previous experiments, government does not go into deficit at all and, thus, gross government debt stays constant. Consolidated government debt falls instantly by the amount of new money created. There are no stimulatory effects as GDP and inflation are not practically affected.

Demand and time deposits end up at the same level as when money was created through government spending, but the transition is smoother. The bill rate ends up at the same lower level but in this case the transition is much faster.

Creating new money through repaying government debt has a straightforward effect on monetary aggregates and the bill rate. However, if it is not accompanied with fiscal stimulus, it has negligible effects on the real economy. In other words, loose monetary policy alone is not enough to stimulate the real economy under FRB. As the aftermath of the GFC showed, this often seems to be the case in the current banking system as well.

8.6 CREDIT CRUNCH

In all the previous money creation experiments, banks were always able to supply all loans demanded by firms. Banks' liquidity target ranging from 1.1 to 1.2 ensures that in the steady state (or in the long run) banks respect the FRB requirement. However, in the short run a major enough shock could temporarily force banks to limit their supply of loans to avoid violating the FRB requirement.[74]

Basically, FRB can lead to a credit crunch in two ways: either reserves held by banks drop or demand deposits supplied by banks increase. This section experiments with the REFORM2 model to see how much certain exogenous parameters would have to change to make the bank liquidity ratio drop barely below 100%. To avoid this, banks would have to restrict their supply of loans and thus cause a credit crunch. In the first two experiments households' liquidity preference is increased while in the third experiment firms' demand for loans is raised.

In the first experiment households' liquidity preference increases as they demand more cash. This drains reserves from the banking system, which are used for 100% backing of demand deposits. Credit crunch would occur when λ_c increases from 0.1 to 0.132. That is, instead of 10%, households would like to hold 13.2% cash compared to their consumption. In other words, households would suddenly like to hold 32% more cash than previously.

In the second experiment households' liquidity preference increases but, instead of cash, they desire more demand deposits. Instead of draining reserves from the banking system, this increases the amount of reserves banks are required to hold (while the amount of reserves is not altered). As equation (H.24) indicated, demand deposits held by households can only be affected indirectly. In this experiment demand deposits increase as demand for time deposits decreases. Banks would have to limit their supply of loans when λ_{10}

[74] Alternatively, banks could adjust their interest rates more quickly (i.e. reaction parameters ς_m and ς_l would be given higher values or they would be endogenized). Another option would be to allow banks to borrow reserves from the central bank with penalty interest rates.

increases from 0.2 to 0.23 while λ_{20} drops from 0.34 to 0.31. In other words, households would suddenly like to shift 3% of their wealth (net of cash) from time deposits to demand deposits. This means that households would like to hold 18% more demand deposits and 9% less time deposits.

In the third experiment firms demand more loans. As equation (H.24) verifies, this adds demand deposits into the economy and, again, they have to be fully backed by reserves. In this experiment demand for loans is increased through an increase in firms' targeted inventories. It turns out that an increase of σ_0 from 0.3612 to 0.413 would be enough to induce a credit crunch. That is, firms suddenly want to raise their target inventories-to-sales ratio by 5% points. This would translate into a 16% increase in desired inventories, which also means that demand for loans increases by 16%.

In all three experiments the required changes in exogenous parameters are quite drastic but not unique. In other words, a credit crunch is possible but rare. However, one should keep in mind that the REFORM2 model is a severe simplification of the economy. For instance, lower bank liquidity targets would induce a credit crunch more easily. More importantly, the model lacks investment in fixed capital, which would probably add substantially to the demand for loans. Thus, allowing long-term economic growth might change the conclusion.

9 CONCLUSIONS

This chapter presents the main conclusions of this PhD thesis. Section 9.1 recaps the research setting and findings. Section 9.2 discusses the implications of this study while Section 9.3 discusses its limitations. Finally, Section 9.4 makes some suggestions for further research.

9.1 RESEARCH SUMMARY

Under FRB most of the money supply would consist of government money (i.e. cash, central bank reserves and government securities) or commodity money (e.g. gold or silver). That is, FRB would prohibit private money creation, at least in the sense that government would not guarantee repayment or par clearance of private monies or money-like assets (e.g. deposit insurance and lender of last resort to private actors).

The aim of this PhD thesis was to determine whether FRB would be a beneficial reform. The question was answered gradually throughout this thesis. In the end, the benefits of FRB seem to clearly outweigh its disadvantages.

The analysis was concretized by posing the following research questions. How have money creation and banking been regulated nationally and internationally? How have money creation and banking been theorized? Who has proposed FRB and when? Has FRB been implemented in the past? If so, when and where, and what were the consequences? Why does no country run an FRB system today? What are the advantages and shortcomings of FRB? How could the economic consequences of FRB be modelled?

To answer these questions, this thesis built on theories from post-Keynesian economics and utilized various qualitative and quantitative methods. More precisely, the thesis made use of the MCT and the MMT. As the MCT focuses on private money creation while the MMT focuses on government money creation, I argued that the theories should be seen as complements. Moreover, I pored over GPE literature and assessed FRB based on theories of democracy.

I used both qualitative and quantitative methods. With qualitative methods I studied the monetary system from historical and normative perspectives. I used quantitative methods to study the economic consequences of FRB with a PK-SFC model.

Next, I will summarize the key findings of this PhD thesis. The findings are presented in the order of appearance rather than importance.

9.1.1 MONEY CREATION AND BANKING REGULATION

Chapter 2 outlined the historical development of money creation and banking regulation. In addition, the two FRB experiments in the 19th century in the UK and US were examined in their historical context.

The need to regulate banking emerged when banks began to create new money in the 17th century (see Graeber 2012). Instead of getting rid of the fractional-reserve banking system, it was institutionalized and regulated.

The rules and practices regulating money creation and banking have become surprisingly similar across countries. Sweden established the first central bank in the world in 1668 and today almost all countries have a central bank. The functions of central banks have also become alike. Originally, central banks focused on raising funds for the government, but gradually they assumed all their modern functions as monopoly issuers of notes, clearing houses providing means (notes and reserves) for final settlement for banks, lenders of last resort to banks and supervisors and regulators of banks.

After economic instability in the 19th century, the UK and the US attempted to take away banks' ability to create money by implementing FRB. This was accomplished through the Bank Charter Act of 1844 in the UK and through the National Acts of 1863 and 1864 in the US. There were no dramatic changes in macroeconomic indicators during or after the implementation of FRB. According to BIS (2016), Thomas and Dimsdale (2017), US Bureau of the Census (1975) and Philippon (2015), real GDP, inflation, money supply, bank loans and interest rates continued on their previous paths more or less. At most, there were some signs that macroeconomic indicators turned more positive even though it is hard to associate that directly with the implementation of FRB.

Moreover, according to Kindleberger (1984), banks were able to undermine the FRB reform by issuing deposits. Previously, privately issued bank notes were the dominant means of payment and therefore the FRB requirement excluded bank deposits. In addition, banks had already replaced most bank notes (issued by private banks rather than the government) with bank deposits before FRB was imposed, although the rate of substitution clearly accelerated after the reform (Thomas and Dimsdale 2017; US Bureau of the Census 1975). This may have been one reason why FRB did not have a more apparent macroeconomic impact.

In the 1930s, there was another serious attempt to implement FRB in the US. The Great Depression inspired a series of New Deal banking reforms. According to Phillips (1994a), the Chicago Plan came close to being adopted, but the FRB idea was watered down in the Banking Acts of 1933 (better known as the Glass-Steagall Act) and 1935. Instead of preventing private money creation in the form of bank deposits, the Banking Acts separated commercial and investment banking, improved the government's control over money and provided deposit insurance for banks. Today, there are no countries running an FRB system.

The US was the first country to guarantee bank deposits during the Great Depression in the 1930s. As deposit insurance proved to be successful in preventing bank runs, almost all countries have followed suit and introduced their own deposit insurance schemes.

From the 1970s onwards, money creation and banking were deregulated in almost all countries. Currently, there are no reserve requirements at all in at least the UK, Canada, Australia, New Zealand, Hong Kong, Switzerland and Sweden.

Banking regulation has also been internationalized. After World War II, the IMF was designated to coordinate international monetary arrangements and, after the Bretton Woods system collapsed, it has focused on facilitating the deregulation process. The BIS has become a very important institution for setting international standards for national banking systems through the Basel Accords.

Finally, the deregulation trend ended with the GFC in 2007–8. After that, the UK and the US passed legislation to separate commercial and investment banking (Vickers Report proposals and the Dodd-Frank Act, respectively). The EU took similar steps (see Liikanen et al 2012), but the process is unlikely to proceed further in the near future. Although money creation and banking have been regulated more tightly, the foundations of the monetary system remain unaltered.

9.1.2 THEORETICAL OBSERVATIONS

Chapter 3 pointed out the shortcomings of neoclassical monetary theories. In particular, the chapter showed that the exogenous theories of money highlighted in neoclassical textbooks are not in line with the operational reality. Today, money is endogenous, that is, its creation is determined endogenously by the banking system rather than exogenously by the central bank.

Moreover, abandoning the exogenous money approach threatens the neoclassical position that money is ultimately neutral. As long as one accepts that money is exogenous, mainstream equilibrium mechanisms – the interest rate mechanism (see e.g. Wicksell 1898; Robertson 1934; Ohlin 1937) and the real balance effect (see Pigou 1943; Patinkin 1965) – can justify the long-run neutrality of money.

However, after cutting-edge neoclassical economics accepted that money is endogenous (e.g. Svensson 1999; Taylor 1999; Woodford 2003), it became logically impossible to build on the interest rate mechanism and the real balance effect. According to Ahokas and Holappa (2014), instead of abandoning the neutral money axiom, neoclassical economists were able to invent new equilibrium "mechanisms". The Taylor rule replaced the interest rate mechanism and fiscal stimulus replaced the real balance effect. Ahokas and Holappa (2014) underlined that neither, however, is a market *mechanism*. Both are *policies* that require conscious action. Neoclassical economists

simply assumed that both monetary and fiscal policy run on autopilot to save the premise that money is neutral in the long run.

GPE scholars often adopted the exogenous view on money directly from neoclassical economics textbooks. This had a negative impact on the analytical accuracy of GPE. For instance, many GPE scholars argued that the economic policy space of governments has shrunk in the post-Bretton Woods era (see e.g. Blyth 2013; Rodrik 2011, 204-205; Patomäki 2009; Ruggie 1982). The underlying idea is that free capital mobility has forced governments to pursue investor-friendly policies. However, Holappa (2012; 2017a; 2017b) and Kotilainen (2016) argued that operationally the economic policy space available to governments has in fact expanded after the Bretton Woods era. However, they also emphasized that it does not mean that governments automatically exploit the increased policy space. Indeed, the economic policy space of governments can and often is limited by ideologies and practices, often described in national constitutions.

Moreover, due to their neglect of the endogenous nature of money, GPE scholars have probably exaggerated the importance of central banks (e.g. Teivainen 1997). The misconception that governments are ultimately in control of their money supplies has led many GPE scholars to consider the functioning of the commercial banking system to be merely technical or non-political. Apparently due to this reason, many GPE scholars have neglected the (un)democratic nature of money creation by commercial banks (there are some recent exceptions, for instance Teivainen 2017). Until now, GPE research has focused too much on the democratic accountability of central banks. This would also explain why FRB has not been investigated in GPE literature.

9.1.3 PROPOSALS FOR FULL-RESERVE BANKING

Chapter 4 presented the history of FRB proposals. The chapter extended the previous work by Phillips (1994a) to include contemporary FRB proposals – especially proposals motivated by the GFC.

The chapter also grouped different types of FRB proposals into six categories. In chronological order, *pure commodity standard* (e.g. Ricardo 1824; Mises 1912; Hayek 1937; Rothbard 1962; Huerta de Soto 2009), first proposed by David Ricardo, maintains that all money, including bank deposits, have to be backed with a commodity such as gold (in all other types backed with government money).

In a *sovereign money* system (e.g. Soddy 1926; 1934; Currie 1934; 2004; Daly 1980; 2013; Huber and Robertson 2000; Jackson and Dyson 2012; Wolf 2014a; 2014b) all demand deposits are held at the central bank and regular banks can make loans only by attracting savings or using their own capital.

In the *Chicago Plan* (e.g. Knight et al 1933; Simons et al 1933; Fisher 1935; Douglas et al 1939; Friedman 1948; 1960; 1969; Benes and Kumhof 2012; 2013; Prescott and Wessel 2016) banks provide only payments services and cannot make loans.

Deposited currency version (e.g. Tobin 1985; 1987; Jessup and Bochnak 1992; Gruen 2014; Lainà 2015a; Barrdear and Kumhof 2016) makes FRB optional as economic agents can choose whether to hold deposits backed by government money or other types of non-guaranteed deposits.

Narrow banking (e.g. Kareken 1986; Litan 1987; Spong 1996; De Grauwe 2008a; Kay 2009; Phillips and Roselli 2009; King 2016; Stiglitz 2016) is vague as it restricts banks' assets to 'safe' by some standards (consequently, less restrictive proposals are not counted as FRB).

Finally, *limited purpose banking* (e.g. Pollock 1993; Kotlikoff 2010; Cochrane 2014) makes banks unleveraged mutual funds by restricting banks' liabilities to equity and, thus, instead of banks, all risks are borne by investors.

Today, sovereign money seems to be the most popular version of FRB while during the Great Depression it was the Chicago Plan. The most iconic and detailed proposals for FRB are probably Jackson and Dyson (2012) and Fisher (1935), representing sovereign money and the Chicago Plan respectively.

After the GFC, FRB has become politically more acceptable. Most importantly, the Icelandic government actively promoted FRB and Iceland's Prime Minister commissioned two FRB reports (Sigurjonsson 2015; KPMG 2016). In addition, political parties have added FRB to their political agenda (see e.g. Green Party UK 2015). Moreover, social movements are pressuring politicians to take action. For instance, Switzerland arranged a referendum on FRB (see Dawnay 2017), but it did not pass (only 24 % voted for FRB). Furthermore, the UK and Dutch parliaments have debated money creation. Actual bills to implement FRB have been put forward, at least in the US and the UK.

9.1.4 NORMATIVE ASSESSMENT

Chapters 5 and 6 evaluated the desirability of FRB based on prior literature. FRB was explicitly evaluated from four normative perspectives: democracy, economic stability, social equality and ecological sustainability.

Democracy

According to its supporters, FRB would benefit democracy. Surveys have revealed that the general public is unaware of who creates most of the money supply (e.g. Motivaction 2016; Niskanen 2016; Nietlisbach 2015; Dods 2014). Most people incorrectly believe that either the government or the central bank is responsible for money creation. Only a small minority recognizes that banks create the majority of the money supply.

Nevertheless, it seems that the principles of FRB enjoy genuine popular support. According to studies (e.g. Motivaction 2016; Niskanen 2016; Nietlisbach 2015), most of the general public think that money creation should be the prerogative of the state (although Cobden Centre 2010 found

contradictory results). Thus, if FRB were to be implemented, the monetary system would work as most people incorrectly assume it is already working today and, more importantly, it would more correctly reflect the preferences of the electorate.

FRB has the potential to expand the economic domain subject to democratic decision-making. This is because FRB would generate significant seigniorage revenue for the government. FRB could foster democracy as new money would not be allocated by banks, but instead through democratic processes of Parliament. This line of thought presupposes that the state has sufficient democratic institutions in place instead of being an authoritarian or totalitarian state. Moreover, following Held's (2006) dichotomic classification of democratic models, the allocation of new money by Parliament was mostly in line with the liberal conception of democracy.

I estimated the scale of seigniorage revenue generated by FRB. Transition to FRB would generate one-shot seigniorage, while operating an FRB system would continue to yield annual seigniorage. Most surprisingly, the transition to FRB would not yield any seigniorage revenue for the US government as it turned out that, on the aggregate level, the US is already effectively running an FRB system. That is, US banks have more reserves than demand deposits. In other selected countries, the transition seigniorage would be significant, ranging from 31% to 55% of GDP.

The average annual seigniorage revenues would range from 1% to 8% in selected countries. The wide difference in seigniorage estimates between countries is explained by their relative sizes and the historical growth rates of money supplies (M1).

Nevertheless, the result was in line with other similar studies. Huber and Robertson (2000) found very scales for the seigniorage revenue similar to those that I estimated in this study. The estimates of Benes and Kumhof (2012; 2013) are also very much in line with this study when one accounts for differences in the measurement of the money supply.

The annual seigniorage would be a very significant source of income for the government. For instance, for Finland the annual seigniorage revenue, worth 3% of GDP, would be over 30 times greater than that generated by the current monetary system. To put this into perspective, for Finland the annual seigniorage would be roughly equal to the *combined* costs of the administrative fields of the Ministry of Defence, Ministry of the Interior, Ministry of Justice and Ministry for Foreign Affairs – including, the armed forces, police, courts and development aid.

Critics of FRB have pointed out that the government can be untrustworthy and, conversely, that FRB might actually reduce democracy. Some fear that the government would abuse its power to create money (e.g. Angell 1935; Coppola 2012). However, Musgrave (2014) argues that there is no reason why governments could not abuse their power to create money today (and some certainly have done so in the past).

Other critics argue that FRB would reduce rather than increase democratic decision making. As has been suggested in some FRB proposals (e.g. Jackson and Dyson 2012; Fisher 1935), the amount of money created is to be decided undemocratically by an independent expert body instead of Parliament (e.g. Pettifor 2014a; 2014b; Dow et al 2015; Fontana and Sawyer 2016). This criticism is not particularly convincing, as in most countries an independent expert body is already responsible for monetary policy and, more importantly, the decisions of banks can hardly be said to be democratic. Furthermore, there are FRB proposals (e.g. Currie 1934; Daly 2013) that would make Parliament responsible for the amount of new money created, as well its allocation.

Although rarely pointed out by critics, whether FRB would advance democracy depends on the conception of democracy in question. Held (2006) classified democratic models under liberal and direct democracy. While FRB is mostly in line with liberal democracy, it is not necessarily in line with direct democracy as citizens would not directly decide the allocation of money. From this point of view, FRB could be argued to be undemocratic.

The institutional context of FRB is crucial. Monetary sovereignty would probably provide significant help in defending the currency against the animal spirits of international financial capital. Alternatively, a state could allow the currency to float, but restrict capital mobility. This, however, does not seem very viable in a globalized world.

Globalization is a comprehensive process. Challenging the current monetary system could risk international political cooperation in other policy areas and the positioning decisions of international productive capital. Reactions to FRB would, however, be highly dependent on the perceptions and attitudes of other actors.

Nonetheless, successful implementation of FRB might require international coordination. China is contesting the hegemonic position of the US. Donald Trump is also withdrawing the US from international institutions that do not necessary prioritize redefined US interests. Should China adopt a leading role in international institutions, FRB could become more likely. As it is ruled by the Communist party, China does not oppose public money creation, at least on ideological grounds.

Economic Stability

Defenders of FRB argue that economic stability would be strengthened in several ways. FRB would make the two factors feeding moral hazard – bank bailouts and deposit insurance – redundant. Under FRB, banks could be allowed to fail without serious repercussions and, logically, there could be no bank runs (e.g. Jackson and Dyson 2012; Chari and Phelan 2014). Therefore, banks would not be incentivized to engage in highly risky activities. Furthermore, banks could not fund credit booms by creating new money. Jackson and Dyson (2012) argue that this should reduce the occurrence of financial crises.

Even if there were be a financial crisis in a FRB system, the functioning of the payment system would be secure (e.g. Dixhoorn 2013). Thus, not only would financial crises be rarer under FRB, but also less severe.

The real economy would be more stable under FRB. By separating monetary policy from credit policy, the amount of money could move countercyclically rather than procyclically (e.g. Sigurjonsson 2015). Instead of banks expanding the money supply in booms and shrinking in busts, the central bank could increase the money supply in busts and decrease it in booms. This should at least smoothen the business cycle, even if it could not eliminate it entirely.

Moreover, monetary policy would be more effective under FRB. Central banks could influence the money supply directly instead of trying to manipulate it indirectly through interest rates (Jackson 2014; Dyson et al 2016; Sigurjonsson 2015). Indeed, conducting monetary policy by manipulating interest rates has turned out to be inefficient (see e.g. Sharpe and Suarez 2014). As financial markets face the same interest rates as the real economy, Musgrave (2014) argues that interest rate manipulation is a blunt tool for simultaneously controlling consumer prices and asset prices.

Critics say that FRB would increase economic instability or, at least, be inefficient. The most serious concern is that FRB would cause a credit crunch, as the availability of credit would be dependent on previous savings (e.g. Mitchell 2015b; Kregel 2012; Independent Commission on Banking 2011; Bossone 2001; 2002; Goodhart 1993). In addition, fluctuations in supply of and demand for loans would make interest rates excessively volatile (e.g. Dittmer 2015; Dow et al 2015). Although these are valid concerns, I found in Chapter 8 that these seem quite rare occasions and it would be relatively straightforward for monetary authorities to respond to these problems.

The critique regarding the development of prices is dispersed. Neoclassical economists argue that FRB would cause runaway inflation, while post-Keynesian economists are likely to point out that FRB would be deflationary (e.g. Kregel 2012; Pettifor 2014a; 2014b). According to Jackson (2014) and Dyson et al (2016), under FRB, the target of monetary policy would still be steady inflation and the only difference is that the money supply rather than the short-term interest rate would be the tool. Although inflation and deflation can be serious problems, I argued that it is very unlikely that FRB in itself would cause either. The inflationary or deflationary tendency in an FRB system depends mostly on "animal spirits" and the monetary and fiscal policy of the state – as is the case today.

I think that the potential emergence of near-monies is the most convincing critique of FRB. If private near-monies were to emerge and replace government money (or commodity money under pure commodity standard) in regular transactions, it would render FRB pointless (e.g. Schumpeter 1954; Goodhart and Jensen 2015; Dow et al 2015; Fontana and Sawyer 2016). This is what happened in the UK and the US when FRB was implemented in the 19th century and, critics argue, there is no reason why it would not happen

again. Even though it might be possible to prevent near-monies either by outlawing them (Fisher 1935), by dynamically extending the FRB requirement to them (Jackson and Dyson 2012) or by paying interest on FRB money (Friedman 1960), this would need to be considered carefully before FRB could be be successfully implemented.

On the other hand, Phillips (1994a) argued that near-monies need not be banned completely. In fact, many proponents of FRB seem to support rather than object to parallel currencies – in particular local currencies. Dyson et al (2016) emphasize that it would be important to remove government guarantees f private monies and money-like assets (repayment and par clearance, e.g. deposits insurance and lender of last resort to private agents). If people are still willing to invest in private assets, they should be allowed to do so and bear the risks involved.

Social Equality

Proponents of FRB maintain that social equality would be advanced under FRB. Firstly, as the decisions would be made by Parliament rather than banks, the allocation of new money would very likely make the distribution of income more equal (Huber and Robertson 2000; Wolf 2014b, 211). Secondly, banks could not inflate asset prices, which mostly benefits the rich, by creating money (Jackson and Dyson 2012). Thirdly, the money supply would not have to be "rented" from banks anymore, which would reduce the amount of debt throughout the economy (Sigurjonsson 2015), and interest payments from money creation would not flow upwards, making the rich even richer (Wolf 2014b). Fourthly, taxpayers would not have to bail banks out, as a failing bank would not impose a systemic risk on the payment system (Jackson and Dyson 2012). Fifthly, the government would not guarantee private risk-free returns through deposit insurance and, consequently, the monetary system would function more in line with market principles (Jackson and Dyson 2012). Sixthly, by reducing the occurrence and severity of financial crises, the negative social consequences of financial crises (see Reinhart and Rogoff 2009b; Dijk 2013), such as unemployment and detrimental impacts on health, education, poverty and gender issues, would be decreased.

FRB is criticized for increasing instead of reducing social inequality. The argument goes that, if banks cannot create credit out of thin air, the ability to make loans is restricted to prior savings, and thus interest rates both on loans and deposits would be somewhat higher (Dixhoorn 2013; Musgrave 2014). This would make the distribution of income less even.

However, this critique is based on a very narrow perception of social equality. It assesses social equality only in terms of interest flows and not even comprehensively in those terms. It might be true that interest rates would be a bit higher under FRB, but if there were less debt (e.g. because the money supply does not need to be supported by bank loans) interest flows to the rich might actually decrease.

In addition, there is much more to social equality than interest flows. For instance, disposing of bank subsidies and bail-outs as well as generating annual seigniorage revenue for the government would lead to improvements in social equality – let alone the reduced occurrence and severity of financial crises, which are most damaging for the poor. In sum, FRB might not be very important in terms of direct income distribution but most likely it would advance social equality more broadly.

Ecological Sustainability

Green supporters of FRB argue that FRB could make the composition of production more ecologically sustainable. Instead of banks deciding which projects are funded, (time) depositors would have a larger role in saying how their savings are invested (Jackson and Dyson 2012). Presumably, the public would stress ecological issues more than banks, which focus mainly on increasing their profits. In addition, higher seigniorage revenue for the government could potentially extend the sphere of political decision-making. It is assumed that the government would make more environmentally-conscious decisions than banks (Dittmer 2015; Farley et al 2013; Mellor 2010).

On the other hand, some critics argue that FRB is ecologically irrelevant. They point out that the composition of production would not change significantly under FRB. The decisions as to what is produced, how and for whom are not fundamentally affected by the monetary system (Musgrave 2014).

According to green supporters of FRB, FRB might facilitate ecological sustainability by eliminating the growth imperative related to the current monetary system. The starting point is that economic growth is tightly related to environmental degradation (see e.g. Boulding 1966; Kneese et al 1970; Georgescu-Roegen 1971; Meadows et al 1972; 2004) and might even be socially undesirable (see e.g. Hirsch 1976; Easterlin 1974; Layard 2005).

Neoclassical economists in particular have questioned the straightforward link between economic growth and environmental degradation. They argue that it is possible to see economic growth and ecological sustainability as mutually reinforcing instead of mutually exclusive. More specifically, the environmental Kuznets curve hypothesis maintains that the environmental impact indicator is an inverted U-shaped function of income per capita (for discussion, see Stern 2004). When the economy grows, initially the (negative) environmental impact increases, then it levels out and finally decreases.

Even though the link between growth and the environment remains up for debate, green supporters of FRB associate the current monetary system with economic growth.

Moreover, green supporters of FRB argue that FRB could advance ecological sustainability by eliminating the growth imperative underlying the current monetary system. The point is that banks currently do not recirculate interest payments in full, but rather hoard part of them as retained earnings

(Rowbotham 1998; Daly 1999; Douthwaite 2000; Binswanger 2009; Farley et al 2013). To tackle this, the amount of money and thus loans must increase. In addition, every borrower must return more money (loan principal *plus* interest) than originally received (deposits equal to loan principal). This means that borrowers must "make the money grow" in one way or another. Green proponents of FRB interpret this as a requirement for economic growth.

Green supporters of FRB maintain that FRB would eliminate this growth imperative as money would become independent of bank loans (Lietaer et al 2012; Daly 2013). Banks and other economic agents could still hoard, but an increase in the money supply would not require economic growth. Consequently, FRB has great potential to advance ecological sustainability by allowing (but not automatically leading to) zero-growth or degrowth.

Although green supporters of FRB admit that there are other factors that push for economic growth, they maintain that FRB would eliminate one of them. In my opinion, it remains ambiguous whether the current monetary system really imposes a growth imperative and, if it does, whether it could be tackled by other means. The critics of this position are right to point out that growing the money supply does not necessarily imply real economic growth.

Neither is it clear that FRB would be able to eliminate any potential growth imperative. Most likely, the observed tendency to grow the economy is more deeply rooted in our economic system. It seems that capitalism – rather than the monetary system – encourages us to continually increase profits, accumulate wealth and enhance productivity. These generic features of capitalism are unrelated to any monetary system.

Generally, the criticism presented against FRB applies better to pure commodity standard types of FRB proposals, while proposals based on public money involve more flexible elements that can avoid at least some of these caveats.

On balance, FRB is, in my view, a progressive reform. Nevertheless, it seems that FRB can satisfy some normative commitments better than others. In particular, FRB seems to have a clearly positive impact on economic stability and democracy, while it is only slightly able to advance social equality. Whether FRB can promote ecological sustainability is more ambiguous, but it does not work against it either.

The previous normative evaluation of FRB is relatively varied. This study seemed to be mostly in line with the positive findings of Jackson and Dyson (2012), Musgrave (2014), Sigurjonsson (2015) and Huber and Robertson (2000). Dixhoorn (2013) found partly similar results, although she emphasized the deficiencies of FRB. The normative evaluation of this study was less in line with Dow et al (2015), Goodhart and Jensen (2015), Fontana and Sawyer (2016) and Bossone (2001; 2002).

9.1.5 MODELLING FULL-RESERVE BANKING

Chapter 7 introduced the SFC modelling technique. SFC models are fully tractable, parametric, coherent and complete macroeconomic models. The fundamental idea of SFC modelling is that each income (expenditure) flow must appear as expenditure (income) flow of another sector and as an equivalent change in the financial balance of both sectors. In other words, SFC models integrate national income and financial accounts.

The origins of SFC modelling can be traced back to the late 1960s at Yale University, where James Tobin and his colleagues began to develop neoclassical SFC models. A few years later, Wynne Godley and his partners started to build a post-Keynesian alternative at the University of Cambridge. Neoclassical SFC models faded away in the mid-1980s, but post-Keynesian SFC models continue to prosper today.

Compared to neoclassical DSGE models, PK-SFC models share the same starting point: that the steady state/general equilibrium of an economy can be shocked and the subsequent time paths examined. However, there are also important differences. DSGE models do not systematically incorporate stocks and flows. Furthermore, PK-SFC models are typically deterministic rather than stochastic. In addition, the theoretical framework differs greatly. For instance, in PK-SFC models the behaviour of economic agents is informed by norms instead of optimization as is the case with DSGE models.

Evidently, PK-SFC and Tobin's SFC models have more in common, but some differences remain. In technical terms, PK-SFC models focus on multiple periods and the adjustment process, while Tobin's SFC models concentrate on one-period equilibrium. In addition, Tobin's SFC models build on neoclassical theory and, in this respect, they resemble DSGE models more than PK-SFC models.

Chapter 8 applied SFC modelling to FRB. I built a theoretical model called REFORM2 and it is developed from Godley and Lavoie's (2012) model INSOUT. To the best of my knowledge, REFORM2 is the first model in the world to explore FRB in an SFC framework (other than my previous version of the model, called REFORM).

The SFC model is simple, yet coherent and complete. I argued that the model can account for certain causal mechanisms and capture some important elements from reality, but the results should be interpreted as tentative, contingent and indirect.

The key features of the model were as follows. Firstly, banks were required to hold at least as much central bank reserves as demand deposits (i.e. full-reserve requirement). Secondly, the central bank set the amount of reserves by adjusting its holdings of government bills. Thirdly, households were the residual buyer of bills and, therefore, the bill rate became endogenous. Fourthly, banks adjusted the interest rate on time deposits to attract enough deposits to fund all loans demanded.

I found that a stationary steady state existed, which is a necessary precondition for FRB to be compatible with a zero-growth economy.

Furthermore, full employment and zero inflation persisted in the steady state even though long-term economic growth was excluded from the model.

I conducted experiments to study what happens when government spending is temporarily increased. The idea was to compare money creation under FRB to when money creation did not occur under FRB and to the current monetary system. It was found that, in all cases, government spending increase led to an almost identical temporary increase in output, employment and inflation. Unlike in other cases, however, money creation under FRB led to a permanent reduction in consolidated government debt. An increase in central bank reserves passed on as an almost equal increase in demand deposits. Furthermore, even an unusually large change in the money supply led to smooth and relatively small changes in interest rates.

I also compared three additional ways to create new money under FRB. Creating new money through tax cuts or citizen's dividends yielded more or less similar results as when money was created through government spending. In contrast, creating new money through repaying government debt (quantitative easing) influenced only monetary aggregates and interest rates but had negligible effects on the real economy. As the effects of money creation vary according to the transmission channel, money creation under FRB would require some coordination between the government and the central bank. In other words, the amount of new money should depend on the way it enters the economy.

None of the experiments exhibited any evidence of credit crunches. Moreover, according to the money creation experiments, claims that interest rates would become excessively volatile under FRB were not justified.

However, I also explored the possibility of credit crunches emerging under FRB. Persistent credit crunches could not occur as banks were able to adjust the interest rate on time deposits to attract sufficient savings and to curb demand for loans. Nevertheless, temporary shortages of credit remained possible if households' liquidity preferences suddenly increased or firms quickly demanded more loans. As the necessary changes were quite dramatic, credit crunches under FRB seemed to be quite rare although by no means impossible. However, this conclusion might need to be amended should the margins of safety be altered, or should long-term economic growth be introduced into the model.

My results with the SFC model of FRB were surprisingly similar to those that others have found using diverse modelling techniques. Benes and Kumhof (2012; 2013) and Egmond and Vries (2015) also found that FRB has a positive impact on output. Benes and Kumhof (2012; 2013), Egmond and Vries (2015) and Prescott and Wessel (2016) discover that FRB is compatible with zero inflation. Yamaguchi (2010; 2011; 2014), Benes and Kumhof (2012; 2013) and Egmond and Vries (2015) draw the same conclusion that FRB would reduce public debt. In line with Singh (2009), Flaschel et al (2010), Chiarella et al (2011) and Prescott and Wessel (2016), I found that FRB would not cause credit crunches. No previous study has compared various ways to create new

money under FRB, and therefore this study is a significant contribution to the literature.

9.2 IMPLICATIONS

Generally, this thesis could have a practical impact on the regulation of the monetary system; on the stability of the banking system; on the development of macroprudential instruments; and on the conduct and analysis of monetary policy.

This study has also several broader implications. First, I discuss the implications for economic schools of thought – in particular for neoclassical and post-Keynesian economics. Then, I discuss the political, technocratic and technological opportunities to implement FRB in the near future.

9.2.1 THEORETICAL IMPLICATIONS

FRB could have significant implications for economic schools of thought. FRB is often said to make the monetary system what most people think it already is. However, FRB would also make the monetary system what many neoclassical economists think it already is. This is one reason why neoclassical economists are relatively open to or at least have a neutral attitude towards FRB.

It is worth noting that FRB would make reality resemble neoclassical monetary theory more closely. Although money is endogenous in the state-of-the-art neoclassical models, standard neoclassical theories propagated in textbooks maintain that money is exogenous. Instead of adjusting theories, FRB would make the real world more like neoclassical theory.

FRB would also save neoclassical equilibrium mechanisms. The interest rate mechanism and the real balance effect would be functional under FRB. That is, interest rates would more genuinely reflect the propensity to save and invest. Because of the real balance effect, deflation would increase the purchasing power in the economy as money, effectively, would not have any debt as its counterpart (although under FRB deflation would, of course, increase the real value of other debts, which has an opposite effect on purchasing power). These two mechanisms would help – though not necessarily guarantee – self-adjustment of the economy. Perhaps because of these reasons, neoclassical economists are relatively open to or at least neutral towards FRB.

Surprisingly, post-Keynesian economics is probably the most anti-FRB economic school of thought. Post-Keynesian economists have not, in general, supported FRB (with a few noteworthy exceptions such as Ronnie Phillips and Victoria Chick). Dow (2016) explains this with different social ontologies. According to Dow (2016), post-Keynesians emphasize the tight link between money and production that is evident, for instance, in the MCT, while

proponents of FRB often rely on social ontology, which sees money and production as at least potentially independent of each other.

The antagonistic attitude of post-Keynesians is surprising, as FRB would change the focus of economic policy from monetary policy to fiscal policy, a move which most post-Keynesian economists would support. Monetary policy alone is, according to many post-Keynesians, a weak and unreliable tool for stabilizing GDP or for achieving full employment (see King 2003). FRB would subordinate monetary policy to fiscal policy – at least in the sovereign money version of FRB.

In a sovereign money system, monetary policy would inevitably include a fiscal policy component (except when government chooses to repay its debt, although even that decision would be taken in the sphere of fiscal policy). Interest rate setting would be abandoned in a sovereign money system and monetary policy would either enlarge or constrain the fiscal policy space available for government. By generating significant seigniorage revenue for the government, FRB would also probably increase government influence in the economy – a policy prescription often subscribed to by post-Keynesian economists.

What post-Keynesians really want is somewhat ambiguous. On one hand, they argue that credit availability should not be constrained, to allow productive firms to finance all desired investments (e.g. Kregel 2012; Dow et al 2015; Mitchell 2015b; Pettifor 2014a; 2014b). On the other hand, excessive credit is regularly cited as the main source of financial bubbles and financial crises (e.g. Minsky 1986). There seems to be a contradiction as post-Keynesians seem to want both more and less credit at the same time.

In defence of post-Keynesians, it must be stated that they generally make a distinction between productive and non-productive (i.e. speculative) credit. They argue for limitless productive credit but are willing to constrain credit creation for speculative purposes (see King 2003). Nevertheless, the economy can become overheated even under those conditions. A case in point is the Latin American banking crises, which were typically preceded by a boom mostly rooted in the real economy rather than financial markets. The overheating of the real economy manifested itself in the form of balance of payment crises.

I agree with Nersisyan and Wray (2017) that FRB requires a coherent analytical framework. Most theories, however, try to depict how the economy functions, but FRB would alter the foundations of the economy – the monetary system. Therefore, the existing post-Keynesian framework – being based on endogenous money – is unlikely to do the job.

Perhaps the key reason for post-Keynesian opposition towards FRB is like why neoclassical economists are more receptive. Instead of making the real world similar to post-Keynesian theory, FRB would make the real world less like post-Keynesian theory. Post-Keynesian monetary theory, based on endogenous money, is one of the key reasons why post-Keynesian economists hold that their theoretical framework is superior to that of neoclassical

economics. FRB would invalidate a large part of post-Keynesian monetary theory and thus undermine the societal significance of post-Keynesians.

Huber and Robertson (2000) explain opposition towards FRB along the same lines. Although they do not explicitly mention post-Keynesians, they indicate as potential opponents of FRB those academics who have acquired special knowledge of the current monetary system. According to Huber and Roberson (2000), FRB might undermine their expertise and, thus, it is understandable that they might oppose FRB.

I argue that the theoretical commitment to endogenous money has made many post-Keynesian authors reluctant of accepting FRB. FRB would make money exogenous in the sense that it is set by monetary authorities instead of being determined by demand.[75] Some post-Keynesian authors (e.g. Rochon and Rossi 2013) go so as far to argue that money has always been and cannot be anything else but endogenous, thus rejecting the possibility of effectively implementing FRB at all. Other post-Keynesian authors (e.g. Chick 1986) maintain that whether money is endogenous or exogenous remains a matter of institutional design.

It seems peculiar that those who reject the possibility of FRB are also often its fiercest adversaries. Why oppose something that cannot even exist? The internal logic of the argument seems flawed. Logically, it is impossible to simultaneously sustain the argument that money is inevitably endogenous and that FRB would be harmful for the economy. If money is inevitably always and everywhere endogenous, then FRB cannot cripple the economy because as much of other types of money are created as is demanded anyway. The argument seems to build on the ambiguous position that money does not matter, but it matters after all.

Rochon and Rossi's (2013) argument takes the near-money critique of FRB to its logical end. However, if near-monies were to emerge instantaneously when the official money supply is constrained, then no real harm can be done as the demand for money is satisfied and all intended transactions will take place. In order to make the claim that adopting FRB would cripple the economy, one must abandon the premise that money is always and everywhere endogenous. Should the money supply then be constrained by FRB, money would be at least partly exogenous for some time until near-monies emerged, replacing the national currency and thus allowed the economy to recover.

Another way to avoid the flawed internal logic of Rochon and Rossi's (2013) argument, while maintaining the position that money is always and

[75] Under FRB, money is endogenous in another sense. In most proposals, monetary authorities do not keep the money supply constant but instead react to changes in the economic environment by adjusting the money supply. In other words, money is also endogenous under FRB in the more traditional sense that it depends on certain other factors instead of being completely determined outside the model. Modelling the "reaction function" of the central bank makes money endogenous in the same sense, as interest rate is endogenous under the current banking system (typically modeled with a "Taylor rule").

everywhere endogenous, would be to argue that FRB would be completely meaningless. In other words, one could argue that FRB would not have any effect (negative or positive) on the real economy as near-monies would immediately substitute for (insufficient) official money. Thus FRB would not cripple the economy, as it would have no effect at all. However, Rochon and Rossi have taken neither path to develop the internal logic of their argument.

If endogenous money is crucial for post-Keynesian economists, they could support a version of FRB in which the central bank would set the price rather than the quantity of reserves. Although banks would be subject to a 100% reserve requirement, they could flexibly make loans as demanded by economic agents, as they could then (or immediately) rediscount these loans for reserves at the central bank (either selling the loans for reserves or borrowing reserves against loans as collateral). Consequently, all demand deposits would be backed with government money, but banks could continue to provide loans flexibly. For instance, Kumhof (2016) has made the argument that FRB can be fully compatible with endogenous money. Also, the current situation in the US, where banks have 150% reserves compared to demand deposits due to the unprecedented scale of quantitative easing, implies that FRB can be fully compatible with the current monetary policy regime (i.e. interest rate setting by central bank).

9.2.2 POLITICAL POSSIBILITIES OF FULL-RESERVE BANKING

Now, I will move on to discuss the political possibilities of FRB in the near future. Although there might be valid economic reasoning behind FRB and most of the critique could probably be either rebutted or addressed by refining the proposals, most politicians have been unwilling or unable to implement FRB through legislation in any country. The idea of FRB as politically unfeasible is perhaps the main reason that FRB has not been implemented after the 19th century.

Even during the heyday of the Chicago Plan, its supporters did not see it as politically acceptable. According to Phillips (1994a), Lauchlin Currie, who had a major influence on the administration version of the Banking Act of 1935 and was a major supporter of FRB, did not suggest that FRB be included in the administration version of the bill as he saw it as politically unfeasible. According to Phillips (1994a, 162-163), Irving Fisher lobbied industriously for FRB until his death in 1947, but he also recognized that FRB would be politically unacceptable without the open support of President Roosevelt. Simons (1948, 231) saw FRB as too politically radical. Consequently, Phillips (1994a, 183) argued that the implementation of FRB is largely a political problem.

In the US there were no bills to implement FRB in the six decades after Jerry Voorhis was defeated by Richard Nixon in 1946 elections. The global economy did relatively well after World War II. There were no great depressions. The only disturbances were minor slumps or local crises. Some

economists went even so far to claim that we inhabit the best of all possible worlds. Clearly, if this was the case, there would be no need for any change.

The GFC, however, changed all this. Suddenly, the world was no longer the best of all possible worlds and mainstream economic models were widely attacked even from the inner circle (e.g. Paul Krugman, Willem Buiter and Brad DeLong; see Economist 2009). As was shown in Section 4.5, bills, referendums, reports and movements demanding FRB emerged.

However, FRB is perceived as a too fundamental leap politically. Banking legislation has been revised worldwide, but policy-makers did not even discuss FRB seriously as an option. Although FRB has support across the political spectrum, the dilemma for policy-makers is that the scope of change involved would be so great that no democratically elected government could implement FRB without the broad-based consent of the electorate. Furthermore, banks have great influence in our society and, as FRB would most likely reduce their profit-making capacity, banks would object strongly to FRB. For this reason, using Marx and Engel's concept of utopianism, North (2016) deems FRB to be "utopian".

In other words, FRB is still politically unfeasible. Saying that something is politically unfeasible, however, means only that the prevailing attitudes of politicians and/or voters are against the reform. If FRB is such a great idea, why would these attitudes be against it? Which factors have hindered its adoption so far? What are the conditions under which FRB might be implemented in the future?

I would argue that there are at least three factors explaining why FRB has not been implemented after the 19th century. First, the general public is relatively ignorant. As was discussed in Section 5.1, there are a number of misperceptions regarding money creation. A global survey conducted by Motivaction (2016) revealed that 80% of the population does not recognize that banks create most of the money in the system. If people do not know how money creation occurs, how could they insist on any change?

Inaction is not a result of people favouring banks as creators of money, as the Motivaction (2016) survey revealed that almost 60% would prefer the state to create the majority of the money supply. Clearly, the reason for inaction must be either ignorance or, less likely, that people simply do not think that changing the situation is very important compared to other political objectives.

Amartya Sen explains why it is sometimes difficult for people to comprehend larger entities. According to Sen (2009, 169), "[i]llusions that are associated with some positional objectivity can be very hard to dislodge, even when the positionality involved misleads and misinforms rather than illuminates." Indeed, money and the monetary system seem to generally mislead when they are examined from a household's perspective.

Second, economic crises have not been severe enough for people to demand fundamental change. The Great Depression was a terrible experience for many in the US. However, Roosevelt's New Deal policies created fiscal stimuli that

facilitated economic recovery. Perhaps partly because of this, the Chicago Plan was not ultimately implemented. Since then, automatic stabilizers as well as countercyclical monetary and fiscal policies have more effectively dampened the falls. In particular, the GFC saw unprecedented actions taken by central banks and even fiscal policy was somewhat stimulatory in the first years, even though it was cut back in the following years. This, nevertheless, prevented the crisis from escalating into a worldwide social tragedy.

Even the disastrous Euro Crisis did not lead to any fundamental change in the euro area. Regardless of strong political support (e.g. Liikanen et al 2012), the euro area was unable to separate commercial and investment banking as the US and the UK did. The EU succeeded only in bringing about a Banking Union (still lacking common deposit insurance). Due to it being such a divisive reform and the unanimity requirement in changing the EU treaties, it is highly unlikely that political consensus will be reached on FRB even during periods of serious crisis. Thus, there are currently no hopes to implement FRB in the euro area.

Although Greece, Spain, Italy, Portugal and Ireland in particular suffered greatly from the Euro Crisis in social and economic terms, they did not pull off any significant national monetary reforms either. Perhaps the main obstacle is that they are part of the euro area. Implementing FRB in a single euro area member state would de facto require abandoning the euro and adopting a national currency. No euro area member state has had the courage to leave the euro to pursue the benefits of a national currency operating according to the current monetary system – let alone going for an FRB system.

Third, existing power-relations prefer the status quo. In particular, the influence of bankers would be greatly reduced should FRB be implemented. Obviously, bankers can have a lot of leverage on politicians and they would collectively oppose such a reform. Moreover, international organizations such as credit rating institutions, the IMF or the World Bank might not be supportive should a country deviate from the norm and implement FRB. Friedman (1960) recognized that the vested interests opposing FRB are too strong and the general public, who would benefit from it, is too disorganized to collectively demand FRB.

More surprisingly, however, even regular bank customers – depositors and borrowers – might oppose FRB. It is possible that bank customers are so short-sighted that they prefer to receive more interest on deposits and pay less interest on loans than to consider the huge economic and social costs of financial crises imposed on them as taxpayers or the indirect benefits from increased seigniorage revenue for the government. Dow et al (2015) suspect that depositors are unwilling to accept bail-in risks on all savings earning a return.

I argue that the political possibilities of FRB would increase significantly if the three factors that have hindered its success so far were eliminated. As the elimination of each of these factors independently increases the likelihood of FRB being implemented, it might not be necessary to eliminate all of them.

Eliminating even one could be a sufficient condition to implement FRB although it is more likely that several factors need to be eliminated.

After the GFC, Iceland seemed to defy most of these hindering factors. People became more aware of money creation, the economy plummeted exceptionally severely, and banks were nationalized, thus eliminating their societal influence.

Indeed, Iceland was on its way to implementing FRB politically. The Prime Minister commissioned two public reports on FRB (Sigurjonsson 2015; KPMG 2016) and a monetary reform resolution was put on the agenda of Parliament. Iceland was the only country in which FRB was advanced by the ruling government instead of being promoted only by single parliamentary parties or members of parliament.

After the economic breakdown, Icelandic government had the courage to default on the foreign liabilities of its private banking sector and take on progressive reforms. However, the progressive and unorthodox reforms and the rapid economic recovery followed by them might also prove to be the worst enemies of FRB. As the economy is doing well, there are suggestions that the Icelandic government is less enthusiastic about pressing on with further reform and thus risk losing a promising recovery. Now, it seems probable that Iceland will not implement FRB politically.

9.2.3 TECHNOCRATIC AND TECHNOLOGICAL POSSIBILITIES OF FULL-RESERVE BANKING

Although the political possibilities for implementing FRB seem low, the technocratic possibilities appear much more possible. The targets, tools and practices of monetary policy have varied over time and there is no reason why they would not vary also in the future. There are also ongoing technological trends favouring FRB.

Firstly, it should be noted that the US is, on the aggregate level, already running an FRB system – without passing any laws. As a result of QE, US banks have over 150% reserves compared to demand deposits. In other words, the US has already completed the transition phase to FRB. The only thing missing for a complete FRB system would be to ensure that the full-reserve requirement was also satisfied on the level of individual banks.

In most countries, reserve requirements are not set by law but rather left as a discretionary decision for central banks. Thus, after completing the transition phase as, for example, the US has done, the central bank could simply increase the reserve requirement, whether gradually or suddenly, to 100%. This would implement a complete FRB system without passing any legislation.

Monetary authorities could do the same thing in other countries, too. Indeed, many countries are on their way to reaching FRB on the aggregate level even though the transition phase remains to be completed.

In any case, this time the FRB experiment should be more rigorous, and more carefully prevent (government guaranteed) near-monies from emerging. It does not, however, mean that all near-monies should be completely banned, as they can diversify the economy and thus make it more resilient. Instead, the authorities should ensure that no near-money can threaten the dominant position of government money. This should be straightforward, if the government removes guarantees of repayment and par clearance of private money-like assets (e.g. deposit insurance and lender of last resort function to banks).

It seems much more likely that we would end up in an FRB system as a result of technocratic decisions by central banks rather than by political decisions of national parliaments. Central banks are much more able and willing to implement these kinds of reforms than politicians. Politicians can be manipulated by bankers and they are also blinded by misconceptions regarding how money creation occurs. Experts at central banks are at least conscious of the functioning of the monetary system, although obviously they are not completely immune to manipulation by bankers either.

The technocratic path to FRB also relates to the concept called new constitutionalism (see Gill 1995). New constitutionalism means that certain ideas are institutionalized in legal or semi-legal form to ensure the continuity of these ideas. In particular, new consensus macroeconomics has been institutionalized in most developed countries. New consensus macroeconomics emphasizes strong and independent monetary policy and constrained fiscal policy. As a result of new constitutionalism, new consensus macroeconomics is not a mere idea or theory that guides policy, but instead it constrains policy options directly (Holappa 2012; 2017a; 2017b; Kotilainen 2016). Indeed, over the past three decades, the discretionary powers of central banks have increased significantly while the fiscal policy space available to governments has been constrained by various laws and agreements. According to Kotilainen (2016), a case in point is the tight fiscal rules in the EU.

Although it has undermined democracy in many respects, new constitutionalism has probably made implementing FRB easier. New consensus macroeconomics has institutionalized the supremacy of monetary policy over fiscal policy. It has also separated monetary policy from political influence. Consequently, the implementation of FRB does not require public debate, but only a monetary policy decision. Nevertheless, it remains relatively unlikely that any central bank governor would dare to take the bold step of actually implementing FRB comprehensively.

Instead of banning private money creation entirely, it is more likely that central bankers are willing to implement FRB on a limited scale. There are signs that central banks would introduce digital cash, that is, implement the deposited currency version of FRB in the near future.

The UK might prove a potential host country for implementing deposited currency. After Brexit, the UK will no longer be bound to follow EU treaties. Thus, the UK has regained monetary sovereignty and is free to pursue the

monetary reforms it desires (although as it was not part of the euro area, the monetary sovereignty of the UK was not crucially constrained during its EU membership).

It is quite possible that the UK will implement deposited currency in the near future. The Bank of England (2016) invited researchers to investigate deposited currency. The Bank of England calls it central bank digital currency and is considering the use of distributed ledger technology in its management. Moreover, the Bank of England published two working papers on deposited currency, authored by Barrdear and Kumhof (2016) and Meaning et al (2018). Both papers assess deposited currency positively. Now, it seems more likely than not that the UK will implement limited FRB in the form of deposited currency in the coming years.

In the Nordics, the central banks of Sweden (Sveriges Riksbank 2017), Denmark (Danmarks Nationalbank 2017), Norway (Norges Bank 2018) and Finland (Grym et al 2017; Grym 2018) have undertaken studies on deposited currency. Only Danmarks Nationalbank (2017) has rejected the idea of issuing deposited currency in the future, while all the other central banks have been at least curious about it and suggested further research. Finland, being part of the euro area, is unlikely to be able to issue deposited currency by itself. Although Sweden and Denmark are part of the EU, they would be in a good position to experiment with deposited currency as common monetary policy does not constrain them. Norway would have an even better chance to experiment with deposited currency. Thus, being already highly digitalized in terms of payment transactions, it seems entirely possible that either Norway or Sweden would be the first country to issue deposited currency in the near future.

Moreover, technological progress and market pressures are driving the monetary system towards FRB. According to Chari and Phelan (2014), the benefits of FRB have increased with improvements in communication technology. Private digital currencies (e.g. Bitcoin) and local currencies (e.g. time banks) have emerged as substitutes to bank deposits. Typically, these parallel currencies are not based on debt. Rather they are tokens. Although these parallel currencies can separate money creation from bank lending, they do not implement FRB as they are still private. That is, most parallel currencies are nevertheless issued privately and are not backed by government money or a commodity. However, private parallel currencies can set a challenge for the ordinary debt-based monetary system controlled by banks.

Financial technology (FinTech) industry is also eager to bypass banks. New payment technologies, such as PayPal and MobilePay, have been developed. They allow payments to be made without directly using the financial architecture of banks. Nevertheless, these payment technologies are not independent of banks. Firms providing new payment technologies use bank accounts to settle payments on behalf of their customers (and banks use accounts at the central bank to settle payments among themselves).

Central banks seem willing to accelerate the technological progress. For instance, Mark Carney (2016), governor of the Bank of England, declared that the central bank will widen access to central bank reserves for non-bank payment service providers. This means that other financial institutions than banks will be able take deposits and make payments on behalf of their customers without the ability to create deposits through granting loans. Basically, they would provide digital access to government money for the general public. The EU has passed legislation to grant other financial institutions access to the financial architecture of banks, but that does not necessarily involve direct access to reserves.

Granting other financial institutions access to reserves means that they do not need commercial banks as middlemen anymore. For instance, PayPal could settle payments directly on the books of central banks. This would most likely undermine the role of banks and bank deposits as the dominant medium of payment. Concurrently, it would strengthen the role of government money as a medium of payment.

Ultimately, this would allow other financial institutions to develop new business models with automatized credit decisions and no physical presence. This would mean huge reductions in operating costs. Thus, these new financial firms could outcompete regular banks even without the power to create money. Even though traditional banking with a network of physical branches would continue to exist, it is likely that their role will be reduced and thus a higher proportion of the money supply would be provided by the government.

All these technocratic and technological developments seem to suggest that a limited version of FRB – deposited currency – will be implemented somewhere in the near future. Although the prohibition of private money creation by banks remains unlikely, it is very likely that government money will comprise a larger share of the money supply in the future.

9.3 LIMITATIONS

There are, of course, several limitations in this study. The most obvious limitation is spatial and temporal applicability. In studying the consequences of FRB, I focused on the US and the UK. Naturally, FRB might have divergent effects in other geographical areas due to different institutions and practices.

The findings of this thesis are temporally limited. Today, all countries have allowed most of their money supplies to be created by banks. Accounting rules regarding banking have also converged globally. Although societies develop in historical time and some processes are path-dependent, there are many underlying social processes constantly changing the structure of the economy and society more generally. Thus, not all of the findings of this thesis might be applicable at another point in time – particularly in the future.

I focused mostly on the economic aspects of FRB. This inevitably left other aspects with less attention. Even from the economic perspective, this thesis

largely ruled out the question of how the behaviour of economic agents would change under FRB and what effects that would have on society more generally.

The SFC model of FRB also involves many limitations. Most importantly, the model is very simple and, while it can account for certain causal mechanisms and capture certain important elements from reality, the results should be interpreted as tentative, contingent and indirect. Moreover, the model is theoretical rather than empirical. Thus the model does not try to depict any particular economy in the world. As each country has its own unique features, the findings of the SFC model cannot be directly extrapolated to any existing economy.

Moreover, one of the main critiques of FRB – the emergence of near-monies – is very challenging to study in a SFC framework. In the model, firms do not hold (accumulate) any financial assets. Thus, it is unclear, for instance, with what they pay wages and similarly what they receive as payment when they issue equities for households. The implicit assumption is that whatever financial assets firms receive, they spend all of them within each period. Thus, firms can pay wages with any assets that households hold as long as they accept the same assets for payment of consumption goods and equities. In other words, households might pay for consumption goods with cash, demand deposits, time deposits, bills, bonds, equities, bank capital or with a combination of these. The underlying dilemma is that it is impossible to trace the payment flows within periods in an SFC framework (only between periods). Thus, the SFC model is unable to shed light on the issue of whether near-monies would emerge under FRB.

In the SFC model there is no hoarding of money, and therefore the money supply can stay constant. In other words, banks and firms always distribute all their profits to households (and the central bank to the government). Hence, there is no push to grow the money supply simply to attain a certain level of economic activity and prices. In reality, due to fundamental uncertainty, firms, banks and especially households hoard money. This could alter some of the conclusions reached by the model.

Although I investigated the circumstances under which credit crunches might occur, how economic agents (chiefly banks) react to credit crunches was not within the scope of this study. Thus, this thesis did not provide any insight as to what would happen if there were insufficient funding of bank loans. Neither was financial instability more generally studied with the SFC model.

9.4 FURTHER RESEARCH

There are several avenues to supplement this research. Firstly, conceptual work could be done. Terminology should be consolidated.[76] Currently, there

[76] This PhD thesis tried to contribute by classifying various proposals under different headlines in Section 4.

are several proposals with various names. That is not a problem as long as proposals clearly differ. For instance, the Chicago Plan obviously differs from deposited currency. Nevertheless, it is less clear how, for example, certain narrow banking proposals differ from the Chicago Plan.

More importantly, what is lacking is an umbrella term covering all these various proposals. I have used FRB here. Its shortcoming is that it is sometimes equated with the Chicago Plan. Public money would seem the most promising alternative, but that would exclude the pure commodity standard. It might, however, be useful to make a clear distinction between versions building on commodity money and government money.

Credit availability under FRB remains ambiguous. It needs to be investigated how much of bank funding activities other financial institutions would need to take over. Furthermore we need to know whether other financial institutions have enough funds and incentives to take over part of bank lending activities. One interesting question is what would be required from the government to ensure sufficient credit availability under an FRB system.

The potential emergence of near-monies should be comprehensively and systematically scrutinized. For instance, it could be studied under what conditions economic agents would be willing to provide and accept near-monies as a medium of payment and how it could be tackled under an FRB system.

The transmission mechanisms of monetary policy under FRB also need to be studied more closely, in particular how the macroeconomic impact of various ways of creating new money differ under FRB.

Portfolio effects have also been largely neglected. Some insight is needed on how economic agents would reallocate their asset portfolios under FRB, in particular how much of their funds would they put into savings accounts and other non-guaranteed assets. In short, how would saving behaviour change?

The legal framework of FRB should be clarified. What changes to laws and accounting rules, if any, would be needed in different countries?

The transition period to FRB deserves more attention as well. In particular, how would a smooth transition to a FRB system be guaranteed?

FRB should also be considered in an open economy context in more detail. Would there be feedback mechanisms from foreign economies to the domestic economy that could potentially cause disruptions?

Distributional issues of FRB should be scrutinized. Studies have highlighted some aspects of how income distribution might be altered under FRB, but the overall effect on income distribution needs to be studied more systematically. In addition, its broader impact on social equality deserves attention.

An answer should be provided as to whether the current monetary system involves a growth imperative and, if so, whether FRB would be able to relieve it. The wider ecological impact of FRB should also be studied in more detail.

The SFC model of FRB could be developed in several ways. Most importantly, the model could be made more realistic by allowing long-term economic growth by including investment in fixed capital and productivity growth.

The consequences of hoarding should be scrutinized. In particular, undistributed profits, that is, retained earnings should be introduced. This would provide an answer as to whether the money supply needs to grow to support a zero-growth economy.

Exploring how economic agents (chiefly banks) react to credit crunches could serve as a viable avenue for further research. Basically, there are three options. First, banks could simply limit the amount of loans they supply. This would constrain investment (inventories in the model presented above) and thus have a negative impact on output.

Second, corporate equities or bonds could be introduced. They would cover the difference between loan demand and supply when the amount of loans is constrained by time deposits. The price of equities or bonds would be the flexible element equating their supply with demand.

Third, central bank advances to banks could be allowed. That is, banks could borrow reserves from central bank (possibly with penalty interest rates). Central bank advances would bring the supply of reserves into equivalence with demand. This could also shed light on how an FRB system might work should the current monetary policy regime stay untouched, that is, the central bank would continue to target interest rates instead of setting the money supply directly. In other words, this would clarify how an FRB system could function should money remain endogenous instead of becoming exogenous.

To study Minskyan financial instability more generally under FRB would require introducing economic sentiments into the SFC model. Changes in economic sentiments could then drive the leverage ratio of various sectors and create debt cycles. It would be interesting to know how financial instability might differ from the current monetary system under FRB.

Moreover, stability analysis could be conducted to test the robustness of the model with various parameter values – especially for reaction parameters. A range of values for parameters could be introduced separately and then the time paths of key variables could be compared. Monte Carlo simulations could be applied to test the stability of the model in terms of multiple variables changing at the same time. Monte Carlo simulations would yield a number of simulation results in which each parameter would receive a value which is normally distributed around its standard value.

To explore the intra-sectoral and intra-period events, agent-based modelling could be introduced. This would allow for heterogeneous economic agents within sectors and also allow intra-sectoral imbalances to be identified.[77]

[77] For example, along the lines of Caiani et al (2016).

The functioning of alternative monetary policy rules under FRB could be explored. Instead of maintaining a constant money supply, which is the simplest possible rule, the central bank could adjust the money supply to achieve a pre-determined inflation, employment or output target. Various fiscal policy rules, such as adjusting government expenditures countercyclically, would be useful to study although I would expect that the outcomes would be similar to those under the current monetary system (as found in Section 8.4).

Various versions of FRB could also be compared. For instance, it would be interesting to study whether there would be a difference if, as suggested in the sovereign money version, all demand deposits were to be held at the central bank. The transition from the current monetary system to a FRB system could be modelled in a SFC framework.

More ambitious would be to study FRB in an empirical SFC model. That is, the SFC model should be calibrated and estimated for an existing economy instead of studying the consequences of FRB in a theoretical model. Initial stocks should be taken from national income and financial accounts. Moreover, parameters should either be adopted from other empirical studies or be estimated from empirical data.

Perhaps the most ambitious goal would be to integrate ecological aspects in an empirical SFC model and then study the ecological impact of FRB. In addition to real and financial assets, the model should be explicitly linked with material and energy balances.[78]

Regardless of its quantity and quality, further research will not be able to provide a definite verdict on whether FRB would be beneficial. The only way to obtain reliable results is to implement FRB and see.

[78] For instance, Jackson et al (2015), Berg et al (2015), Dafermos et al (2017a; 2017b), Bovari et al (2018) and Godin et al (2017) can be considered first steps in this direction.

REFERENCES

Admati, A. & Hellwig, M. (2013) *The Bankers' New Clothes: What's Wrong With Banking and What to Do About It*. Princeton, NJ: Princeton University Press.

Ahokas, Jussi & Holappa, Lauri (2014) *Rahatalous haltuun: Irti kurjistavasta talouspolitiikasta*. Helsinki: Like.

Allais, Maurice (1987) "The Credit Mechanism and Its Implications", in Feiwel, George (ed.) *Arrow and the Foundations of the Theory of Economic Policy*. New York, NY: New York University Press.

Allen, William (1993) "Irving Fisher and the 100 percent reserve proposal", *Journal of Law and Economics* 36 (2), 703–717.

Allen, William (1977) "Irving Fisher, F.D.R., and the Great Depression", *History of Political Economy* 9, 560–587.

Angell, James (1935) "The 100 Per Cent Reserve Plan", *Quarterly Journal of Economics* 50, 1–35.

Angkinand, Apanard (2009) "Banking regulation and the output cost of banking crises", *International Financial Markets, Institutions and Money* 19, 240–257.

Arestis, Philip & Sawyer, Malcolm (2008) "New Consensus Macroeconomics and Inflation Targeting: Keynesian Critique", *Economia e Sociedade* 17, 631–655.

Bacchetta, Philippe (2017) "The Sovereign Money Initiative in Switzerland: An Assessment", Working Paper, 27 June 2017. Available at: http://www.swissbanking.org/de/medien/statements-und-medienmitteilungen/vollgeldinitiative-studie-zeigt-folgen-fuer-die-schweiz/the-sovereign-money-initiative-in-switzerland-an-assessement.pdf [Accessed 24 July 2017].

Backus, David & Brainard, William & Smith, Gary & Tobin, James (1980) "A model of U.S. financial and nonfinancial economic behavior", *Journal of Money, Credit and Banking* 12(2), 259–293.

Banerjee, Ryan & Mio, Hitoshi (2014) "The Impact of Liquidity Regulation on Banks", BIS Working Paper No. 470.

Bank of England (2016) "Digital Currencies Research Questions", July 2016. Available at: http://www.bankofengland.co.uk/research/Documents/onebank/cbdc.pdf [Accessed 15 February 2017].

Bank of England (2015) "Statistical Interactive Database", Updated 29 September 2015.

Bank of England (2014) "The Bank of England's Sterling Monetary Framework", Updated November 2014.

Bank of Finland (2016) "Eurosystem minimum reserves in Finland", Updated 29 February 2016. Available at: http://www.suomenpankki.fi/en/tilastot/rahapolitiikan_valineet/Pages/tilastot_rahalaitosten_lainat_talletukset_ja_korot_talletukset_varantojen_pito_en.aspx [Accessed 17 March 2016].

Bank of Finland (2015) "Finnish contribution to euro area monetary aggregates", Updated 30 September 2015. Available at: http://www.suomenpankki.fi/en/tilastot/tase_ja_korko/Pages/tilastot_rahalaitosten_l

ainat_talletukset_ja_korot_taseet_ja_raha_aggregaatit_rahamaarat_en.aspx [Accessed 13 October 2015].

Barrdear, John & Kumhof, Michael (2016) "The macroeconomics of central bank issued digital currencies", Bank of England Staff Working Paper No. 605, July 2016.

Barwell, Richard & Burrows, Oliver (2011) "Growing fragilities? Balance sheets in The Great Moderation", Bank of England, Financial Stability Paper No. 10, April 2011.

Bê Duc, Louis & Le Breton, Gwenaël (2009) "Flow-of-Funds Analysis at the ECB: Framework and Applications", European Central Bank, Occasional Paper No. 105, August 2009.

BEA (2015) "National Economic Accounts", Bureau of Economic Analysis. Available at: http://www.bea.gov/national/index.htm#gdp [Accessed 19 October 2015].

Becke, Susanne von der & Sornette, Didier (2017) "Should Banks Be Banned From Creating Money? An Analysis From the Perspective of Hierarchical Money", *Journal of Economic Issues* LI (4), 1019–1032.

Bell, Stephanie (2001) "The role of the state and the hierarchy of money", *Cambridge Journal of Economics* 25 (2), 149–163.

Bell, Stephanie (2000) "Do taxes and bonds finance spending?", *Journal of Economic Issues* 34 (3), 603–620.

Bell, Stephanie & Nell, Edward (eds.) (2003) *The State, the Market, and the Euro: Chartalism versus Metallism in the Theory of Money*. Cheltenham, UK: Edward Elgar.

Bell, Stephen (2012) "The Power of Ideas: The Ideational Shaping of the Structural Power of Business", *International Studies Quarterly* 56, 661–673.

Benes, Jaromir & Kumhof, Michael (2013) "The Chicago Plan Revisited", Revised Draft, 12 February 2013.

Benes, Jaromir & Kumhof, Michael (2012) "The Chicago Plan Revisited", IMF Working Paper No. 12/202.

Berg, Matthew & Hartley, Brian & Richters, Oliver (2015) "A stock-flow consistent input-output model with applications to energy price shocks, interest rates, and heat emissions", *New Journal of Physics* 17, 1–22.

Bhaskar, Roy (1979) *The Possibility of Naturalism*. Brighton: Harvester Press.

Bhaskar, Roy (1975) *A Realist Theory of Science*. Brighton: Harvester Press.

Binswanger, Mathias (2009) "Is there a growth imperative in capitalist economies? A circular flow perspective", *Journal of Post Keynesian Economics* 31 (4), 707–727.

BIS (2016) "BIS Consumer Price Series, National Sources", Bank for International Settlements, October 2016.

BIS (2014) "Basel III: The net stable funding ratio", Bank for International Settlements, Basel Committee on Banking Supervision, October 2014.

BIS (2013) "Basel III: The liquidity coverage ratio and liquidity risk monitoring tools", Bank for International Settlements, Basel Committee on Banking Supervision, January 2013.

BIS (2012) "Operationalising the selection and application of macroprudential instruments", Bank for International Settlements, Committee on the Global Financial System, CGFS Paper No. 48, December 2012.

BIS (2011) "Basel III: A global regulatory framework for more resilient banks and banking systems", Bank for International Settlement, Basel Committee on Banking Supervision, June 2011.

BIS (2006) "International convergence of capital measurement and capital standards: a revised framework", Bank for International Settlements, Basel Committee on Banking Supervision, Comprehensive Version, June 2006. Also known as Basel II.

BIS (2004) "International convergence of capital measurement and capital standards: a revised framework", Bank for International Settlements, Basel Committee on Banking Supervision, Original Version, June 2004. Also known as Basel II.

BIS (1988) "International convergence of capital measurement and capital standards", Bank for International Settlements, Basel Committee on Banking Supervision, July 1988. Also known as Basel I.

Blyth, Mark (2013) *Austerity: The History of a Dangerous Idea*. New York: Oxford University Press.

Borio, Claudio & Drehmann, Mathias (2009) "Assessing the risk of banking crises: revisited", *BIS Quarterly Review,* March 2009.

Borio, Claudio & Kharroubi, Enisse & Upper, Christian & Zampolli, Fabrizio (2015) "Labor reallocation and productivity dynamics: financial causes, real consequences", BIS Working Paper No. 534, December 2015.

Bossone, Biagio (2001) "Should banks be narrowed?", IMF Working Paper WP/01/159.

Bossone, Biagio (2002) "Should banks be 'narrowed'? An evaluation of a plan to reduce financial instability", Levy Economics Institute Public Policy Brief No. 69.

Botta, Alberto & Caverzasi, Eugenio & Tori, Daniele (2015) "Financial-Real Side Interactions in the Monetary Circuit: Loving or Dangerous Hugs?", University of Greenwich, Business School, Working Paper, 2015.

Boulding, Kenneth (1966) "The economics of the coming spaceship earth", in H. Jarrett (ed.) *Environmental Quality in a Growing Economy*. Baltimore, MD: Johns Hopkins University Press, 3–15.

Bovari, Emmanuel & Giraud, Gaël & Isaac, Florent Ms (2018) "Coping With Collapse: A Stock-Flow Consistent Monetary Macrodynamics of Global Warming", *Ecological Economics* 147, 383–398.

Brainard, William C. & Tobin, James (1968) "Pitfalls in financial model building", *American Economic Review* 58(2), 99–122.

Brown, Harry (1940) "Objections to the 100 Per Cent Reserve Plan", *American Economic Review* 30 (June), 309–314.

Burgess, Stephen & Burrows, Oliver & Godin, Antoine & Kinsella, Stephen & Millard, Stephen (2016) "A Dynamic Model of Financial Balances for the United Kingdom", Bank of England Staff Working Paper No. 614, September 2016.

Cagan, Phillip (1956) "The monetary dynamics of hyperinflation", in Friedman, Milton (ed.) *Studies in the Quantity Theory of Money*. Chicago: University of Chicago Press.

Caiani, Alessandro & Fumagalli, Andrea & Lucarelli, Stefano (2014) "Contemporary Capitalism as a New Monetary Economy of Production: The Logic of Conventions, M&A, and LBOs", *Forum for Social Economics* 43 (3), 223–253.

Caiani, Alessandro & Godin, Antoine & Caverzasi, Eugenio & Gallegati, Mauro & Kinsella, Stephen & Stiglitz, Joseph (2016) "Agent based-stock flow

consistent macroeconomics: Towards a benchmark model", *Journal of Economic Dynamics & Control* 69, 375–408.

Calomiris, Charles (1988) "Institutional Failure, Monetary Scarcity, and the Depreciation of the Continental", *Journal of Economic History* 48, 47–68.

Carney, Mark (2016) "Enabling the FinTech transformation: Revolution, Restoration, or Reformation?", Speech at the Lord Mayor's Banquet for Bankers and Merchants of the City of London at the Mansion House, London, UK, 16 June 2016.

Carpenter, Seth & Demiralp, Selva (2012) "Money, reserves, and the transmission of monetary policy: does the money multiplier exist?", *Journal of Macroeconomics*, 34 (1), 59–75.

Caverzasi, Eugenio & Godin, Antoine (2015) "Post-Keynesian Stock-Flow-Consistent Modeling: A Survey", *Cambridge Journal of Economics* 39, 157–187.

CBO (2015) "An Update to the Budget and Economic Outlook: 2015 to 2025", Congressional Budget Office, Updated on 25 August 2015. Available at: https://www.cbo.gov/publication/45069 [Accessed 16 October 2015].

Cecchetti, Stephen & Kharroubi, Enisse (2015) "Why does financial sector growth crowd out real economic growth?", BIS Working Paper No. 490.

Chantrill, Christopher (2012) "US Taxpayer Exposure: Financial Bailouts of 2008", Updated 21 March 2012. Available at: http://www.usfederalbailout.com/TARP_latest [Accessed 20 April 2016].

Chari, V.V. & Phelan, Christopher (2014) "On the social usefulness of fractional reserve banking", *Journal of Monetary Economics* 65, 1–13.

Charpe, Matthiu & Flaschel, Peter & Proaño, Christian (2012) "Income Distribution, Credit Rationing and Households' Debt", *Metroeconomica* 63 (3), 458–492.

Chiarella, Carl & Flaschel, Peter & Hartmann, Florian & Proaño, Christian (2011) "Stock Market Booms, Endogenous Credit Creation and the Implications of Broad and Narrow Banking for Macroeconomic Stability", New School for Social Research, Working Paper No. 7/2011.

Chick, Victoria (1986) "The evolution of the banking system and the theory of saving, investment and interest", *Économies et Sociétés* 20 (8–9), 111–126.

Chung, Dosung (1991) "Banks as Supplier of Medium of Exchange and Optimality of 100 % Reserve Banking", *Seoul Journal of Economics* 4 (3), 215–232.

Cobden Centre (2010) "Public Attitudes to Banking", June 2010. Available at: http://www.cobdencentre.org/?dl_id=67 [Accessed 16 March 2016].

Cochrane, John (2014) "Toward a run-free financial system", Working Paper. Available at: http://faculty.chicagobooth.edu/john.cochrane/research/papers/run_free.pdf.

Cohen, Benjamin (2008) *Global Monetary Governance*. New York: Routledge.

Copeland, M. A. (1949) "Social Accounting for Moneyflows", *Accounting Review* 24 (3), 254–264.

Coppola, Frances (2014) "Martin Wolf Proposes the Death of Banking", 25 April 2014. Available at: http://www.pieria.co.uk/articles/martin_wolf_proposes_the_death_of_banking [Accessed 18 May 2016].

Coppola, Frances (2012) "Full reserve banking: the largest bank bailout in history", Coppola Comment Blog, 29 October 2012. Available at:

http://www.coppolacomment.com/2012/10/full-reserve-banking-largest-bank.html [Accessed 18 May 2016].

Correa, Romar (2012) "Narrow Banking and Asset-Based Reserve Requirements in a Godley-Lavoie Model", Post Keynesian Economics Forum, 3 November 2012.

Cox, Robert (1981) "Social Forces, States, and World Orders: Beyond International Relations Theory", *Millennium* 10 (2), 126–155.

Creutz, Helmut (2001) *The Money Syndrome: Towards a Market Economy Free of Crises*. Fengate Peterborough: Upfront Publishing.

Currie, Lauchlin (2004) "The 100 percent reserve plan: August 12, 1938", *Journal of Economic Studies* 31 (3–4), 355–365.

Currie, Lauchlin (1993) Letter to Ronnie Phillips, 27 July 1993.

Currie, Lauchlin (1934) "A Proposed Revision of the Monetary System of the United States" in *The Supply and Control of Money in the United States*. Cambridge, MA: Harvard University Press [Reprinted in 1968 by Russell and Russell, New York].

Dafermos, Yannis (2017) "Debt cycles, instability and fiscal rules: A Godley-Minsky model", *Cambridge Journal of Economics* DOI:10.1093/cje/bex046.

Dafermos, Yannis & Nikolaidi, Maria & Galanis, Giorgos (2017a) "A stock-flow-fund ecological macroeconomic model", *Ecological Economics* 131, 191–207.

Dafermos, Yannis & Nikolaidi, Maria & Galanis, Giorgos (2017b) "Climate change, financial stability and monetary policy", Greenwich Papers in Political Economy No. GPERC54.

Daly, Herman (2016) "Negative interest rates or 100% reserves: alchemy vs chemistry", *Real-World Economics Review* 76, 2–4.

Daly, Herman (2013) "Nationalize money, not banks". Available at: http://steadystate.org/nationalize-money-not-banks.

Daly, Herman (1999) *Ecological Economics and the Ecology of Economics: Essays in Criticism*. Cheltenham, UK: Edward Elgar.

Daly, Herman (1996) *Beyond Growth: The Economics of Sustainable Development*. Boston, MA: Beacon Press.

Daly, Herman (1980) "The economic thought of Frederick Soddy", *History of Political Economy* 12 (4), 469–488.

Daly, Herman (1977) *Steady-State Economics*, San Francisco, CA: W.H. Freeman.

Daly, H.E. & Farley, J. (2011) *Ecological Economics: Principles and Applications*. Second Edition. Washington: Island Press.

Danmarks Nationalbank (2017) "Central bank digital currency in Denmark?", Danmarks Nationalbank Analysis No. 28, December 2017.

Davidson, Paul (2009) *The Keynes Solution: The Path to Global Economic Prosperity*. New York, NY: Palgrave Macmillan.

Davis, E.P. (1987a) "A stock-flow consistent macro-econometric model of the UK economy part I", *Journal of Applied Econometrics* 2(1), 111–132.

Davis, E.P. (1987b) "A stock-flow consistent macro-econometric model of the UK economy part II", *Journal of Applied Econometrics* 2(1), 259–307.

Dawnay, Emma (2017) "Sovereign Money Initiative: The Background to the National Referendum on Sovereign Money in Switzerland", Report. Available at: https://www.vollgeld-

initiative.ch/fa/img/English/2017_05_02_Referendum_on_Sovereign_Money_in_Switzerland.pdf [Accessed 13 September 2017].

De Grauwe, Paul (2012) "The Governance of the Fragile Eurozone", *Australian Economic Review* 45 (3), 255–268.

De Grauwe, Paul (2008a) "Returning to Narrow Banking", CEPS Commentary, 14 November 2008.

De Grauwe, Paul (2008b) "DSGE-Modelling When Agents Are Imperfectly Informed", ECB Working Paper No. 897, May 2008.

Dell'Ariccia, Giovanni & Detragiache, Enrica & Rajan, Raghuram (2008) "The real effect of banking crises", Journal of Financial Intermediation 17, 89–112.

Demirgüç-Kunt, Asli & Detragiache, Enrica (2002) "Does deposit insurance increase banking system stability? An empirical investigation", *Journal of Monetary Economics* 49 (7), 1373–1406.

Diamond, Douglas & Dybvig, Philip (1986) "Banking Theory, Deposit Insurance, and Bank Regulation", *Journal of Business* 59, 55–68.

Dijk, Mathijs van (2013) "The Social Costs of Financial Crises", SSRN Working Paper No. 2278526, June 2013.

Disyatat, Piti (2008) "Monetary Policy Implementation: Misconceptions and their Consequences", BIS Working Paper No. 269, December 2008.

Dittmer, Kristofer (2015) "100 percent reserve banking: A critical review of green perspectives", *Ecological Economics* 109, 9–16.

Dixhoorn, Charlotte van (2013) "Full Reserve Banking: An Analysis of Four Monetary Reform Plans", Sustainable Finance Lab, April–June 2013.

Doak, Ervin (1988) "Islamic Interest-Free Banking and 100 Percent Money: Comment", *IMF Staff Papers* 35(3), 534–536.

Dods (2014) "Parliamentary perceptions of the banking system", July 2014. Available at: https://positivemoney.org/wp-content/uploads/2014/08/Positive-Money-Dods-Monitoring-Poll-of-MPs.pdf [Accessed 16 March 2016].

Dos Santos, Claudio (2005) "A stock-flow consistent general framework for formal Minskyan analyses of closed economies", *Journal of Post Keynesian Economics* 27 (4), 711–735.

Dos Santos, Claudio (2002) "Cambridge and Yale on Stock-Flow Consistent Macroeconomic Modeling" in *Three Essays in Stock-Flow Consistent Macroeconomic Modeling*, PhD Thesis, New School University, November 2002, 37–99.

Dos Santos, Claudio & Macedo e Silva, Antonio (2010) "Revisiting 'New Cambridge': The Three Financial Balances in a General Stock-Flow Consistent Applied Modeling Strategy", Levy Economics Institute Working Paper No. 594.

Dos Santos, Claudio & Zezza, Gennaro (2008) "A Simplified, 'Benchmark', Stock-Flow Consistent Post-Keynesian Growth Model", *Metroeconomica* 59 (3), 441–478.

Douglas, Major (1933) *Social Credit*. New York, NY: Gordon Press.

Douglas, Paul (1935) *Controlling Depressions*. New York, NY: W.W. Norton and Co.

Douglas, Paul & Fisher, Irving & Graham, Frank & Hamilton, Earl & King, Willford & Whittlesey, Charles (1939) "A Program for Monetary Reform", Unpublished Paper, July 1939.

Douthwaite, Richard (2000) *The Ecology of Money*. Cambridge, UK: Green Books.

Dow, Sheila (2016) "The Political Economy of Monetary Reform", *Cambridge Journal of Economics* 40 (5), 1363–1376.

Dow, Sheila (1985) *The Methodology of Macroeconomic Thought: A Conceptual Analysis of Schools of Thought in Economics*. Cheltenham: Edward Elgar.

Dow, Sheila & Johnsen, Gudrún & Montagnoli, Alberto (2015) "A critique of full reserve banking", Sheffield Economic Research Paper No. 2015008, March 2015.

Dyson, Ben (2014a) "A Response to Paul Krugman on 'Is Banning Banking the Answer?´", 28 April 2014. Available at: http://www.positivemoney.org/2014/04/response-paul-krugman-banning-banking-answer/.

Dyson, Ben (2014b) "Positive Money Proposals Simply Force Banks to Work Like Any Other Financial Sector Business", 2 May 2014. Available at: http://www.positivemoney.org/2014/05/positive-money-proposals-simply-force-banks-work-like-financial-sector-business/.

Dyson, Ben & Greenham, Tony & Ryan-Collins, Josh & Werner, Richard (2011) "Towards a Twenty-First Century Banking and Monetary System: Submission to the Independent Commission on Banking", Centre for Banking, Finance and Sustainable Development at the University of Southampton, New Economics Foundation and Positive Money.

Dyson, Ben & Hodgson, Graham & Lerven, Frank van (2016) "A response to critiques of 'full reserve banking'", *Cambridge Journal of Economics* 40 (5), 1351–1361.

Easterlin, R.A. (1974) "Does economic growth improve the human lot? Some empirical evidence", published in David, P.A. & Reder, M.W. (eds.) *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz*. New York: Academic Press, 89–125.

ECB (2017) "What is Money?", European Central Bank, Updated 20 June 2017. Available at: https://www.ecb.europa.eu/explainers/tell-me-more/html/what_is_money.en.html [Accessed 22 June 2017].

ECB (2016) "Statistics Bulletin: 1.4 Minimum reserve and liquidity statistics", European Central Bank, Statistical Data Warehouse, Updated 11 March 2016.

ECB (2015a) "Monetary Aggregate M1", European Central Bank, Statistical Data Warehouse, Updated on 25 September 2015. Available at: https://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=117.BSI.M.U2.N.V.M10.X.1.U2.2300.Z01.E [Accessed 16 October 2015].

ECB (2015b) "Financial Statements of the ECB for 2014", European Central Bank, Press Release, 19 February 2015. Available at: https://www.ecb.europa.eu/press/pr/date/2015/html/pr150219_1.en.html [Accessed 17 August 2016].

ECB (2011) "The Financial Crisis in the Light of the Euro Area Accounts: A Flow-of-Funds Perspective", European Central Bank, *ECB Monthly Bulletin*, October 2011, 99–120.

Economist (2009) "The other-worldly philosophers", 16 July 2009. Available at: http://www.economist.com/node/14030288 [Accessed 16 September 2017].

Egmond, N. D. van & Vries, B. J. M. de (2015) "Dynamics of a sustainable financial-economic system", Sustainable Finance Lab, Working Paper, March 2015.

Epstein, Gerald (2005) *Financialization and the World Economy*. Cheltenham, UK: Edward Elgar.

Eurostat (2016) “Gross Domestic Product at Market Prices”, Table tec00001, Updated 17 March 2016. Available at: http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tec00001&language=en [Accessed 17 March 2016].

Eurostat (2015a) “Total General Government Revenue”, Table tec00021, Updated 12 October 2015. Available at: http://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=tec00021&language=en [Accessed 16 October 2015].

Eurostat (2015b) “General Government Gross Debt”, Table tsdde410, Updated 12 October 2015. Available at: http://ec.europa.eu/eurostat/tgm/table.do?tab=table&plugin=1&language=en&pcode=tsdde410 [Accessed 16 October 2015].

Evans, George & Honkapohja, Seppo (2011) “Learning as a Rational Foundation for Macroeconomics and Finance”, Bank of Finland Discussion Paper No. 8/2011.

Fantacci, Luca (2013) “Why Banks Do What They Do: How the Monetary System Affects Banking Activity”, *Accounting, Economics and Law* 3(3), 333–356.

Farley, Joshua & Burke, Matthew & Flomenhoft, Gary & Kelly, Brian & Murray, D. Forrest & Posner, Stephen & Putnam, Matthew & Scanlan, Adam & Witham, Aaron (2013) “Monetary and Fiscal Policies for a Finite Planet”, *Sustainability* 5 (6), 2802–2826.

Febrero, Eladio (2009) “Three Difficulties with Neo-Chartalism”, *Journal of Post Keynesian Economics* 31(3), 523–541.

Febrero, Eladio (2006) "Monetary Theory of Production: A Classical-Circuitist Alternative Interpretation", Paper Presented at X Jornadas de Economía Crítica in Barcelona, Spain, 23–25 May 2006.

Federal Reserve (2015a) “Money Stock Measures: H.6”, Board of Governors of the Federal Reserve System, Updated 15 October 2015. Available at: http://www.federalreserve.gov/releases/h6/current/default.htm [Accessed 16 October 2015].

Federal Reserve (2015b) “Aggregate Reserves of Depository Institutions and the Monetary Base: H.3”, Board of Governors of the Federal Reserve System, Updated 15 October 2015. Available at: http://www.federalreserve.gov/releases/h3/current/default.htm [Accessed 19 October 2015].

Federal Reserve Bank of New York (2013) “How Currency Gets into Circulation”, July 2013. Available at: http://www.newyorkfed.org/aboutthefed/fedpoint/fed01.html [Accessed 20 October 2015].

Feldman, Gerald (1993) *The Great Disorder: Politics, Economics, and Society in the German Inflation 1914–1924*. Oxford: Oxford University Press.

Ferguson, Adam (2010) *When Money Dies: The Nightmare of Deficit Spending, Devaluation, and Hyperinflation in Weimar Germany*. New York, NY: PublicAffairs.

Ferguson, Niall (2008) *The Ascent of Money: A Financial History of the World*. New York: Penguin Press.

Ferguson, Tim (1993) “Business World: Getty Thinks There’s a Buck in Mutual Funds”, *Wall Street Journal*, 2 March 1993, A17.

Fisher, Irving (1936) “100 % Money and the Public Debt”, *Economic Forum*, April–June, 406–420.

Fisher, Irving (1935) *100 % Money*. New York, NY: Adelphi Company.

Fisher, Irving (1933) "The Debt-Deflation Theory of Great Depressions", *Econometrica* 1 (4), 337–357.

Fisher, Irving (1932) *Booms and Depressions*. New York: Adelphi Company.

Flaschel, Peter & Hartmann, Florian & Malikane, Christopher & Semmler, Willi (2010) "Broad Banking, Financial Markets and the Return of the Narrow Banking Idea", *Journal of Economic Asymmetries* 7(2), 105–137.

Fontana, Giuseppe & Sawyer, Malcolm (2015) "The Macroeconomics and Financial System Requirements for a Sustainable Future", published in Arestis, Philip & Sawyer, Malcolm (eds.) *Finance and the Macroeconomics of Environmental Policies*. Basingstoke, UK: Palgrave Macmillan.

Fontana, Giuseppe & Sawyer, Malcolm (2016) "Full Reserve Banking: More 'cranks' than 'brave heretics'", *Cambridge Journal of Economics* 40 (5), 1333–1350.

Fontana, Giuseppe & Sawyer, Malcolm (2017) "A rejoinder to "A response to critiques of 'full reserve banking'", *Cambridge Journal of Economics*, bex058. Available at: https://doi.org/10.1093/cje/bex058 [Accessed 5 October 2017].

Foot, M.D.K. & Goodhart, C.A.E. & Hotson, A.C. (1979) "Monetary base control", *Bank of England Quarterly Bulletin* 19 (2), 149–159.

Forstater, Matthew (1999) "Functional Finance and Full Employment: Lessons from Lerner for Today", Levy Economics Institute Working Paper No. 272, July 1999.

Fratianni, Michele (2017) "It is time to separate money banks from credit banks in Italy", MOFIR Working Paper No. 138, February 2017.

Fratianni, Michele & Savona, Paolo (2017) "Una proposta per tagliare il debito pubblico e riformare le banche", *Milano Finanza* 11 February 2017.

Friedman, Milton (1969) *The Optimum Quantity of Money and other Essays*. Chicago: Aldine.

Friedman, Milton (1960) *A Program for Monetary Stability*. New York, NY: Fordham University Press.

Friedman, Milton (1948) "A Monetary and Fiscal Framework for Economic Stability", *American Economic Review* 38(3), 245–264.

Friedman, Milton & Schwartz, Anna (1963) *A Monetary History of the United States, 1863–1960*. Princeton: Princeton University Press.

Fumagalli, Andrea & Lucarelli, Stefano (2011) "A Financialized Monetary Economy of Production", *International Journal of Political Economy* 40 (1), 48–68.

Gallès, Clémentine & Vallas, Antoine (2014) "Corporate financing via market: an uneven development within the Eurozone", Societe Generale, EcoNote No. 24, May 2014.

Georgescu-Roegen, N. (1971) *The Entropy Law and the Economic Process*. Cambridge, MA: Harvard University Press.

Gertler, Mark & Kiyotaki, Nobuhiro (2010) "Financial Intermediation and Credit Policy in Business Cycle Analysis", in Friedman, Benjamin & Woodford, Michael (eds.) *Handbook of Monetary Economics*. Amsterdam: North Holland, 547–599.

Gesell, Silvio (1918) *The Natural Economic Order*. London: Peter Owen.

Giere, Ronald (1988) *Explaining science*. Chicago: University of Chicago Press.

Gilbert, R. Alton (1987) "Banks Owned by Nonbanks: What Is the Problem and What Can Be Done about It", *Business and Society*, Spring 1987, 9–17.

Gill, Stephen (1995) "Globalisation, market civilisation, and disciplinary neoliberalism", *Millennium: Journal of International Studies* 24, 399–423.

Gill, Stephen & Law, David (1989) "Global Hegemony and the Structural Power of Capital", *International Studies Quarterly* 33 (4), 475–499.

Godin, Antoine & Campiglio, Emanuele & Dawkins, Elena & Kemp-Benedict, Eric (2017) "Climate financial bubbles: How market sentiments shape the transition to low-carbon capital", Unpublished working paper, January 2017.

Godin, Antoine & Tiou-Tagba Aliti, Gnanonobodom & Kinsella, Stephen (2012) "Method to Simultaneously Determine Stock, Flow, and Parameter Values in Large Stock Flow Consistent Models", June 2012. Available at: http://ssrn.com/abstract=2094996.

Godley, Wynne (1999a) "Seven unsustainable processes: Medium term prospects and policies for the US and the World", Levy Institute Strategic Analysis, Special Report, January 1999.

Godley, Wynne (1999b) "Money and credit in a Keynesian model of income determination", *Cambridge Journal of Economics* 23, 393–411.

Godley, Wynne & Cripps, Francis (1983) *Macroeconomics*. London: Fontana Paperbacks.

Godley, Wynne & Lavoie, Marc (2012) *Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth*. Second Edition [First Edition Published in 2006]. Basingstoke: Palgrave Macmillan.

Golembe, Carter & Mingo, John (1985) "Can Supervision and Regulation Ensure Financial Stability?", in Furlong, Frederick & Keeley, Michael (eds.) *The Search for Financial Stability: The Past Fifty Years*. San Francisco: Federal Reserve Bank of San Francisco, 125–146.

Goodhart, Charles (1998) "The two concepts of money: implications for the analysis of optimal currency areas", *European Journal of Political Economy* 14, 407–432.

Goodhart, Charles (1993) "Can we improve the structure of financial systems?", *European Economic Review* 37 (2–3), 269–291.

Goodhart, Charles (1987) "Why Do Banks Need a Central Bank?", *Oxford Economic Papers* 39 (1), 75–89.

Goodhart, Charles (1984) *Monetary Theory and Practice: The UK Experience*. London: Macmillan.

Goodhart, Charles & Meinhard, Jensen (2015) "A Commentary on Patrizio Lainà's 'Proposals for Full-Reserve Banking: A Historical Survey from David Ricardo to Martin Wolf' – Currency School versus Banking School: An Ongoing Confrontation", *Economic Thought* 4 (2), 20–31.

Graeber, David (2012) *Debt: The First 5000 Years*. Brooklyn, NY: Melville House.

Graham, Frank (1936) "Partial Reserve Money and the 100 Per Cent Proposal", *American Economic Review* 26 (3), 428–440.

Gramsci, Antonio (1971) *Selections from the Prison Notebooks*. Translated by Quitin Hoare and Geoffrey Nowell Smith. London, UK: Lawrence and Wishart.

Grant, James (1992) *Money of the Mind: Borrowing and Lending in America from the Civil War to Michael Milkin*. New York: Farrar Straus Giroux.

Graziani, Augusto (2003) *The Monetary Theory of Production*. Cambridge, MA: Cambridge University Press.

Graziani, Augusto (1989) "The Theory of the Monetary Circuit", *Thames Papers in Political Economy*, Spring, 1–26.

Graziani, Augusto (1984) “Moneta senza crisi”, *Studi Economici* 39, 3–37.

Graziani, Augusto (1977) “Scambi simultanei e successione ciclica nel processo economico”, *Quaderni Piacentini* 64, 113–137.

Green Party UK (2015) “For the Common Good: General Election Manifesto 2015”, Green Party of England and Wales.

Grossman, Peter & Horváth, János (2000) “The Dynamics of the Hungarian Hyperinflation, 1945–6: A New Perspective”, *Journal of European Economic History* 29 (2–3), 405–427.

Gruber, Georg & Benisch, Martin (2007) “Privileges and Immunities of the European Central Bank”, ECB Legal Working Paper No. 4, June 2007.

Gruen, Nick (2014) *Central Banking for All: A Modest Proposal for Radical Change*. London: Nesta.

Grym, Aleksi (2018) “The great illusion of digital currencies”, BoF Economics Review No. 1/2018.

Grym, Aleksi & Heikkinen, Päivi & Kauko, Karlo & Takala, Kari (2017) ”Central bank digital currency”, BoF Economics Review No. 5/2017.

Hanke, Steve (2008) “Zimbabwe: From Hyperinflation to Growth”, Cato Development Policy Analysis No. 6.

Hanke, Steve & Krus, Nicholas (2012) “World Hyperinflations”, Cato Working Paper No. 8.

Hanke, Steve & Kwok, Alex (2009) “On the Measurement of Zimbabwe’s Hyperinflation”, *Cato Journal* 29 (2), 353–364.

Hart, Albert (1935) “The ‘Chicago Plan’ for Banking Reform”, *Review of Economic Studies*, February 1935, 104–116.

Hayek, Friedrich (1937) *Monetary Nationalism and International Stability*. London: Longman.

Held, David (2006) *Models of Democracy*. Third Edition. Cambridge: Polity Press.

Herrman, Ulrike (2013) Der Sieg des Kapitals – Wie der Reichtum in die Welt kam: Die Geschichte von Wachsum, Geld und Krisen. Translated into Finnish by Mari Janatuinen in 2015. Helsinki: Into Kustannus.

Higgins, Benjamin (1941) “Comments on 100 % Money”, *American Economic Review* 31 (March), 91–96.

Hirsch, F. (1976) *Social Limits to Growth*. Cambridge, MA: Harvard University Press.

Hodgson, Graham (2013) “Banking, Finance and Income Inequality”, Positive Money Working Paper, October 2013.

Hoggarth, Glenn & Reis, Ricardo & Saporta, Victoria (2002) “Costs of banking system instability: some empirical evidence”, *Journal of Banking and Finance* 26(5), 825–855.

Holappa, Lauri (2017a) “The Bond Market Fallacy: Liberating Political Economy Research from the Dominance of Orthodox Economic Theory”, PhD Thesis, Unpublished Draft.

Holappa, Lauri (2017b) “Post-Keynesians to the Rescue? Political Economy Research and the Bond Market Power Fallacy”, Paper Presented at the Fourth Nordic Post Keynesian Conference, Aalborg, Denmark, 20 April 2017.

Holappa, Lauri (2016) “Wolfgang Streeck ja talouspolitiikan pakot”, *Poliittinen talous* 4 (1).

Holappa, Lauri (2012) "Disciplinary Neoliberalism and the Neutral Money Axiom", Paper Presented at the World Politics Post-Graduate Seminar in Helsinki, Finland, November 2012.

Hotson, John (1985) "Ending the Debt-Money System", *Challenge*, March–April 1985, 48–50.

Huber, Joseph (2017) "Does finance no longer need money? On the link between money and credit, in reply to a study commissioned by the Swiss Bankers Association", Working Paper. Available at: https://static1.squarespace.com/static/513a1e6be4b01b4441c7cdc0/t/5995a4af37c581af1f6c144e/1502979249020/Does+finance+no+longer+need+money+-+On+the+link+between+money+and+credit.pdf [Accessed 13 September 2017].

Huber, Joseph (2014) "Sovereign Money in Critical Context: Responding to Criticism of Monetary Reform from a Variety of Economic Viewpoints", October 2014. Available at: http://www.sovereignmoney.eu/sovereign-money-in-critical-context [Accessed 26 May 2016].

Huber, Joseph (2013) *Modern Money and Sovereign Currency*. Available at: http://www.sovereignmoney.eu/s/MMT-and-NCT.pdf.

Huber, Joseph & Robertson, James (2000) *Creating New Money: A Monetary Reform for the Information Age*. London, UK: New Economics Foundation.

Huerta de Soto, Jesús (2009) *Money, Bank Credit, and Economic Cycles*. Second Edition. Translated by Stroup, Melinda. Auburn, Alabama: Ludwig von Mises Institute.

Iivarinen, Ville (2015) *Raha: Mitä se todella on ja mitä sen tulisi olla?* Helsinki: Into.

IMF (2017) "Special Drawing Right (SDR)", Factsheet, International Monetary Fund, October 2017.

IMF (2015) "World Economic Outlook Database", International Monetary Fund, October 2015.

Independent Commission on Banking (2011) "Final Report: Recommendations", September 2011. Also known as the Vickers Report.

Ingham, Geoffrey (2004) *The Nature of Money*. Cambridge: Polity Press.

Innes, Alfred Mitchell (1914) "The Credit Theory of Money", *Banking Law Journal* 31 (Dec./Jan.), 151–168.

Innes, Alfred Mitchell (1913) "What is Money?", *Banking Law Journal* 30 (May), 377–408.

Jackson, Andrew (2014) "Why There Will Be No 'Shortage of Money'", 29 April 2014. Available at: http://www.positivemoney.org/2014/04/ann-pettifor-there-will-be-no-shortage-of-money/.

Jackson, Andrew & Dyson, Ben (2012) *Modernising Money: Why Our Monetary System is Broken and How It Can Be Fixed*. London, UK: Positive Money.

Jackson, Tim (2009) *Prosperity without growth: The transition to a sustainable economy*. Sustainable Development Commission.

Jackson, Tim & Victor, Peter (2015) "Does credit create a 'growth imperative'? A quasi-stationary economy with interest-bearing debt", *Ecological Economics* 120, 32–48.

Jackson, Tim & Victor, Peter & Naqvi, Ali Asjad (2015) "Towards a Stock-Flow Consistent Ecological Macroeconomics", PASSAGE Working Paper No. 15/02.

Jakab, Zoltan & Kumhof, Michael (2015) “Banks are not intermediaries of loanable funds: and why this matters”, Bank of England Working Paper No. 529, May 2015.

Jessop, Bob (1990) *State Theory: Putting the Capitalist State in Its Place*. Cambridge: Polity Press.

Jessup, Paul & Bochnak, Mary (1992) “A Case for a U.S. Postal Savings System”, *Challenge* 35, 57.

Jordà, Òscar & Schularick, Moritz & Taylor, Alan (2015) “Betting the house”, *Journal of International Economics* 96 (Supplement 1), S2–S18.

Jordà, Òscar & Schularick, Moritz & Taylor, Alan (2014) “The Great Mortgaging: Housing Finance, Crises, and Business Cycles”, Federal Reserve Bank of San Francisco Working Paper No. 2014-23.

Jordà, Òscar & Schularick, Moritz & Taylor, Alan (2011) “Financial Crises, Credit Booms and External Imbalances: 140 Years of Lessons”, *IMF Economic Review* 59 (2), 340–378.

Kahneman, Daniel & Tversky, Amos (1979) “Prospect Theory: An Analysis of Decision under Risk”, *Econometrica* 47 (2), 263–292.

Kalecki, Michal (1944) “Professor Pigou on ‘The classical stationary state’: A comment”, *Economic Journal* 54, 131–132.

Kareken, John (1986) “Federal Bank Regulatory Policy: A Description and Some Observations”, *Journal of Business* 59, 3–48.

Kari, Markus (2016) *Suomen rahoitusmarkkinoiden murros 1980-luvulla: oikeushistoriallinen tutkimus*. Helsinki: Into.

Kashyap, A. & Rajan, R. & Stein, J. (2002) ”Banks as Liquidity Providers: An Explanation for the Co-existence of Lending and Deposit-taking”, *Journal of Finance* 57, 33–73.

Kauko, Karlo (2015) “The net stable funding ratio requirement when money is endogenous”, Bank of Finland Discussion Paper No. 1/2015.

Kauko, Karlo (2014) “How to foresee banking crises? A survey of the empirical literature”, *Economic Systems* 38 (3), 289–308.

Kauko, Karlo (2011) “Lyhyt johdatus rahaan”, Bank of Finland, BoF Online No. 5/2011.

Kay, John (2009) “Narrow Banking: The Reform of Banking Regulation”, CSFI Report, 15 September 2009.

Keen, Steve (2015) “Is Neoclassical Economics Mathematical? Is there a Non-Neoclassical Mathematical Economics?”, in Morgan, Jamie (ed.) *What is Neoclassical Economics? Debating the Origins, Meaning and Significance*. New York: Routledge.

Keen, Steve (2009) "The Dynamics of the Monetary Circuit", in Ponsot, Jean-Francois & Rossi, Sergio (eds.) *The Political Economy of Monetary Circuits: Tradition and Change in Post-Keynesian Economics*. Basingstoke, UK: Palgrave, 161–187.

Kennedy, Margrit (1995) *Interest and Inflation Free Money*. Seva International.

Keynes, John Maynard (1936) *The General Theory of Employment, Interest and Money*. London: Macmillan [Reprinted in 2008 by BN Publishing].

Keynes, John Maynard (1930a) *A Treatise on Money*. London: Macmillan [Reprinted in 2011 by Martino Publishing, Mansfield Centre, CT, USA].

Keynes, John Maynard (1930b) “Economic Possibilities for Our Grandchildren”, reprinted in Keynes, John Maynard (1963) *Essays in Persuasion*. New York, NY: W. W. Norton & Co, 358–373.

Keynes, John Maynard (1919) *The Economic Consequences of the Peace*. London: Macmillan.

Khan, Mohsin (1988) "Islamic Interest-Free Banking: Reply", *IMF Staff Papers* 35(3), 537.

Khan, Mohsin (1986) "Islamic Interest Free Banking", *IMF Staff Papers* 33 (March), 1–27.

Khan, Mohsin & Mirakhor, Abbas (1985) "The Financial System and Monetary Policy in an Islamic Economy", IMF, Departmental Memoranda Series, 18 November 1985.

Kindleberger, Charles (1994) "The Great Disorder: A Review of the Book of that Title by Gerald D. Feldman", *Journal of Economic Literature* 32 (3), 1216–1225.

Kindleberger, Charles (1984) *A Financial History of Western Europe*. London: George Allen & Unwin.

King, John (2003) *A History of Post Keynesian Economics Since 1936*. Cheltenham: Edward Elgar.

King, Mervyn (2016) *The End of Alchemy: Money, Banking, and the Future of the Global Economy*. New York, NY: W.W. Norton & Company.

King, Mervyn (2010) "Banking: From Bagehot to Basel, and Back Again", Speech at Buttonwood Gathering, New York City, 25 October 2010.

Kinsella, Stephen (2011) "Words to the Wise: Stock Flow Consistent Modeling of Financial Instability", UCD Geary Institute Discussion Paper No. 2011/30.

Kiyotaki, Nobuhiro & Moore, John (1997) "Credit Cycles", *Journal of Political Economy* 105 (2), 211–248.

Kliesen, Kevin (1993) "Leaning Against the Wind: Does the Fed Engage in Countercyclical Monetary Policy?", *Regional Economist*, January 1993. Available at: https://www.stlouisfed.org/publications/regional-economist/january-1993/leaning-against-the-wind-does-the-fed-engage-in-countercyclical-monetary-policy [Accessed 6 July 2017].

Kolehmainen, Mika & Meilahti, Tomi & Kavonius, Toma & Lainà, Patrizio (2013) "Täyttä rahaa: ehdotus rahatalousjärjestelmän vakauttamiseksi", Economic Democracy Finland Publication No. 4, October 2013.

Kotilainen, Konsta (2016) "The Political Economy of Monetary Sovereignty in the Era of Modern Money: Moving towards a Flexible Synthesis of Post Keynesian Economics and Critical GPE", University of Helsinki, Master's Thesis, May 2016.

Kotlikoff, Laurence (2010) *Jimmy Stuart Is Dead: Ending the World's Ongoing Financial Plague with Limited Purpose Banking*. Hoboken, NJ: John Wiley & Sons.

Knapp, Georg (1905) *The State Theory of Money*. Translated in 1924. London: Macmillan.

Kneese, A.V. & Ayres, R.U. & d'Arge, R.C. (1970) *Economics and the Environment: A Materials Balance Approach*. Washington, DC: Resources for the Future.

Knight, Frank & Cox, Garfield & Director, Aaron & Douglas, Paul & Hart, Albert & Mints, Lloyd & Schultz, Henry & Simons, Henry (1933) "Memorandum on Banking Reform", Franklin D. Roosevelt Presidential Library, President's Personal File 431, March 1933. Also known as the first version of the Chicago Plan. [Reproduced in Phillips, Ronnie (1994) *The Chicago Plan & New Deal Banking Reform*. Armonk, NY: M.E. Sharpe, 191–199.]

KPMG (2016) “Money Issuance: Alternative Money Systems”, Report Commissioned by the Icelandic Prime Minister’s Office, September 2016.

Kraemer-Eis, Helmut & Battazzi, Francesco & Charrier, Remi & Natoli, Marco & Squilloni, Matteo (2014) “Institutional non-bank lending and the role of Debt Funds”, European Investment Fund Working Paper No. 2014/25, October 2014.

Krainer, Robert (2015) “Economic Stability under Alternative Banking Systems”, Working Paper, 25 November 2015.

Kregel, Jan (2012) “Minsky and the Narrow Banking Proposal: No Solution for Financial Reform”, Levy Economics Institute of Bard College, Public Policy Brief No. 125.

Krugman, Paul (2014) “Is a banking ban the answer?”, *New York Times*, 26 April 2014.

Krugman, Paul & Wells, Robin (2006) *Economics*. New York, NY: Worth Publishers.

Kuhn, Thomas (1962) *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Kumhof, Michael (2016) “Monetary Reform: The Chicago Plan and Central-Bank Digital Currencies”, Presentation at the Role of Money in the Modern Economy Seminar in Dutch Central Bank, Amsterdam, Netherlands, 23 November 2016.

Kydland, Finn and Prescott, Edward (1990) “Business cycles: real facts and a monetary myth”, *Federal Reserve Bank of Minneapolis Quarterly Review* 14 (2), 3–18.

Laeven, Luc & Valencia, Fabián (2012) “Systemic Banking Crises Database: An Update”, IMF Working Paper No. 12/163.

Lainà, Patrizio (2018a) “Varanto—virta-konsistentista mallinnuksesta”, *Finnish Economic Journal*, forthcoming.

Lainà, Patrizio (2018b) “Money Creation Under Full-Reserve Banking: A Stock-Flow Consistent Model”, *Cambridge Journal of Economics*, forthcoming.

Lainà, Patrizio (2018c) “Meta-Theory as a Uniting Framework for Economics and Global Political Economy”, *Journal of Critical Realism*, DOI:10.1080/14767430.2018.1483622

Lainà, Patrizio (2017) “Seignorage from Full-Reserve Banking”, SSRN Working Paper No. 3065319, November 2017.

Lainà, Patrizio (2016) “Introduction to Stock-Flow Consistent Modeling”, Paper Presented at the Sovereign Money Research Day in Hague, Netherlands, 24 November 2016.

Lainà, Patrizio (2015a) “Keskuspankkitili kaikille”, Left Forum Finland, Aloite No. 1/2015.

Lainà, Patrizio (2015b) “Money Creation Under Full-Reserve Banking: A Stock-Flow Consistent Model”, Levy Economics Institute Working Paper No. 851, October 2015.

Lainà, Patrizio (2015c) “Proposals for Full-Reserve Banking: A Historical Survey from David Ricardo to Martin Wolf”, *Economic Thought* 4 (2), 1–19.

Lainà, Patrizio (2015d) “Exogenous and Endogenous Theories of Money and Banking”, Paper Presented at the World Politics Post-Graduate Seminar in Helsinki, Finland, 1 October 2015.

Lainà, Patrizio (2013) ”Rahoituskriisien ennakoiminen: indikaattorit ja vastasyklinen pääomapuskuri Suomessa”, Bank of Finland, BoF Online No. 6/2013.

Lainà, Patrizio (2011) ”Dynamic Effects of Total Debt and GDP: A Time-Series Analysis of the United States”, Aalto University School of Economics, Master’s Thesis in Economics.

Lainà, Patrizio & Nyholm, Juho & Sarlin, Peter (2015) “Leading indicators of systemic banking crises: Finland in a panel of EU countries”, *Review of Financial Economics* 24 (1), 18–35.

Lakatos, Imre (1970) “Falsification and the Methodology of Scientific Research Programmes”, in Lakatos, Imre & Musgrave, Alan (eds.) Criticism and the Growth of Knowledge, 91–195. Cambridge: Cambridge University Press.

Lavoie, Marc (2015) *Post-Keynesian Economics: New Foundations*. Cheltenham: Edward Elgar.

Lavoie, Marc (2013) “The monetary and fiscal nexus of neo-chartalism: a friendly critique”, *Journal of Economic Issues* 47 (1), 1–32.

Lavoie, Marc (2004) “Circuit and coherent stock-flow accounting”, in R. Arena & N. Salvadori (eds.) *Money, Credit and the Role of the State. Essays in Honour of Augusto Graziani*. Aldershot: Ashgate.

Lavoie, Marc (2003) “A Primer on Endogenous Credit-Money” published in Rochon, Louis-Philippe & Rossi, Sergio (eds.) *Studies in the Modern Theories of Money*. Cheltenham: Edward Elgar, 506–543.

Lavoie, Marc (2001) “The reflux mechanism in the open economy”, in L.P. Rochon and M. Vernengo (eds) *Credit, Interest Rates and the Open Economy*, 215–242. Cheltenham: Edward Elgar.

Lavoie, Marc (1987) “Monnaie et production: Une synthèse de la théorie du circuit”, *Economies et Sociétés*, Série Monnaie et Production 4, 65–102.

Lavoie, Marc & Godley, Wynne (2001) “Kaleckian Growth Models in a Stock and Flow Monetary Framework: A Kaldorian View”, *Journal of Post Keynesian Economics* 24(2), 277–312.

Lawrence, Robert & Talley, Samuel (1988) “Implementing a Fail-Proof Banking System”, *Proceedings of a Conference on Bank Structure and Competition*. Federal Reserve Bank of Chicago.

Lawson, Tony (2013) “What is this ‘school’ called neoclassical economics?”, *Cambridge Journal of Economics* 37, 947–983.

Lawson, Tony (1997) *Economics and Reality*. London: Routledge.

Layard, Richard (2005) *Happiness: Lessons from a New Science*. London: Allen Lane.

Le Bourva, Jaques (1962) “Création de la monnaie et multiplicateur du crédit”, *Revue économique* 13 (1), 29–56.

Le Héron, E. & Mouakil, T. (2008) “A Post-Keynesian Stock Flow Consistent Model for Dynamic Analysis of Monetary Policy Shock on Banking Behaviour”, *Metroeconomica* 59 (3), 405–440.

Lehman, Fritz (1936) “100 % Money”, *Social Research*, February 1936, 37–56.

Lerner, Abba (1947) “Money as a Creature of the State”, *American Economic Review* 37 (2), 312–317.

Lerner, Abba (1943) “Functional Finance and the Federal Debt”, *Social Research* 10 (1), 38–51.

Lerven, Frank van & Hodgson, Graham & Dyson, Ben (2015) “Would there be enough credit in a sovereign money system?”, Positive Money Report.

Lietaer, Bernard & Arnsperger, Christian & Goerner, Sally & Brunnhuber, Stefan (2012) *Money and Sustainability: The Missing Link*. Devon, UK: Triarchy Press.

Liikanen, Erkki & Bänziger, Hugo & Campa, José Manuel & Gallois, Louis & Goyens, Monique & Krahnen, Jan Pieter & Mazzucchelli, Marco & Sergeant, Carol & Tuma, Zdenek & Vanhevel, Jan & Wijffels, Herman (2012) "High-level Expert Group on reforming the structure of the EU banking sector", Final Report, European Commission, Brussels, October 2012.

Litan, Robert (1987) *What Should Banks Do?* Washington, DC: Brookings Institution.

Loehr, Dirk (2012) "The euthanasia of the rentier: A way toward a steady-state economy?", *Ecological Economics* 84, 232–239.

Lucarelli, Stefano (2012) "A Stock-Flow Analysis of a Schumpeterian Innovation Economy", University of Bergamo, Working Paper No. 1/2012.

Marx, Karl & Engels, Friedrich (1885) *Das Kapital: Kritik der politische oekonomie*. Hamburg, Germany: Verlag von Otto Meisner. [English translation *Capital: Critique of Political Economy, Volume II* published by Progress Publishers, Moscow in 1956. Translated by I. Lasker]

Mayer, Thomas (2013a) "A Copernican Turn for Banking Union", CEPS Policy Brief No. 290.

Mayer, Thomas (2013b) "How can Sovereign Money be brought into circulation? Accounting options for a central Bank", Translated by Emma Dawnay, 8 February 2013. Available at: http://sovereignmoney.eu/papers-and-manuscripts/.

McCallum, Bennett (1989) *Monetary Economics: Theory and Policy*. New York, NY: Macmillan.

McCandless, George & Weber, Warren (1995) "Some Monetary Facts", *Federal Reserve Bank of Minneapolis Quarterly Review* 19 (3), 2–11.

McIndoe, T. (2009) "Hyperinflation in Zimbabwe: Money Demand, Seigniorage and Aid Shocks", Institute for International Integration Studies, IIIS Discussion Paper No. 293.

McLeay, Michael & Radia, Amar & Thomas, Ryland (2014a) "Money in the Modern Economy: An Introduction", *Bank of England Quarterly Bulletin* 54(1), 4–13.

McLeay, Michael & Radia, Amar & Thomas, Ryland (2014b) "Money Creation in the Modern Economy", *Bank of England Quarterly Bulletin* 54(1), 14–27.

Meadows, Donella & Meadows, Dennis & Randers, Jorgen (2004) *Limits to Growth: The 30-Year Update*. White River Junction: Chelsea Green Publishing.

Meadows, Donella & Meadows, Dennis & Randers, Jorgen & Behrens, William (1972) *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books.

Meaning, Jack & Dyson, Ben & Barker, James & Clayton, Emily (2018) "Broadening narrow money: monetary policy with a central bank digital currency", Bank of England Staff Working Paper No. 724, May 2018.

Means, Gardiner (1933) "Reorganization of the Banking System", Box 1, File: Banking Policy, The Papers of Gardiner C. Means, Franklin Roosevelt Library, Hyde Park, NY.

Mellor, Mary (2010) "Could the money system be the basis of a sufficiency economy?", *Real-World Economics Review* 54, 79–88.

Menger, Carl (1892) "On the Origins of Money", *Economic Journal* 2(6), 239–255.

Milonakis, Dimitris & Fine, Ben (2009) *From Political Economy to Economics: Method, the Social and the Historical in the Evolution of Economic Theory*. New York, NY: Routledge.

Mingo, John (1987) "Narrow Banks Part of Plan for Restructuring Regulatory System", *American Banker*, 15 September 1987, 5–13.

Minsky, Hyman (1994) "Financial Instability and the Decline (?) of Banking: Public Policy Implications", Levy Economics Institute of Bard College, Hyman P. Minsky Archive, Paper No. 88.

Minsky, Hyman (1986) *Stabilizing an Unstable Economy*. New Haven, Connecticut: Yale University Press.

Mints, Lloyd (1950) *Monetary Policy for a Competitive Society*. New York, NY: McGraw-Hill.

Mints, Lloyd (1945) *A History of Banking Theory*. Chicago: University of Chicago Press.

Mises, Ludwig von (1912) *Theorie des Geldes und der Umlaufsmittel*. Munich and Leipzig: Duncker and Humblot. [Published in English in 1980 as *The Theory of Money and Credit*. Translated by H.E. Batson. Indianapolis, IN: Liberty Classics.]

Mitchell, William (2015a) "Iceland's Sovereign Money Proposal – Part 1", Billy Blog, 5 May 2015. Available at: http://bilbo.economicoutlook.net/blog/?p=30827 [Accessed 23 September 2016].

Mitchell, William (2015b) "Iceland's Sovereign Money Proposal – Part 2", Billy Blog, 6 May 2015. Available at: http://bilbo.economicoutlook.net/blog/?p=30833 [Accessed 23 September 2016].

Moore, Basil (1988) *Horizontalists and verticalists: the macroeconomics of credit money*. Cambridge: Cambridge University Press.

Montier, James (2013) "Hyperinflations, Hysteria, and False Memories", GMO White Paper, February 2013.

Morgan, Jamie & Patomäki, Heikki (2017) "Contrast explanation in economics: its context, meaning, and potential", *Cambridge Journal of Economics* 41, 1391–1418.

Mosler, Warren (1997) "Full Employment and Price Stability," *Journal of Post Keynesian Economics* 20 (2), 167–182.

Mosler, Warren (1994) *Soft Currency Economics*. West Palm Beach.

Motivaction (2016) "Glocalities Survey: Knowledge about who creates money low amongst international population", November 2016. Available at: http://www.glocalities.com/files/Sustainable_Finance_Lab_-_Glocalities_-_Fact_sheet_international_survey_on_money_creation.pdf [Accessed 29 November 2016].

Musgrave, Ralph (2014) "The Solution is Full Reserve / 100 % Reserve Banking", MPRA Working Paper No. 57955, 17 August 2014.

Mäki, Uskali (2011) "Models and the locus of their truth", *Synthese* 180 (1), 47–63.

Nersisyan, Yeva & Wray, Randall (2017) "Cranks and heretics: the importance of an analytical framework", *Cambridge Journal of Economics* 41 (6), 1749–1760.

Nersisyan, Yeva & Wray, Randall (2016) "Modern Money Theory and the facts of experience", *Cambridge Journal of Economics* 40 (5), 1297–1316.

Nersisyan, Yeva & Wray, Randall (2010) "Does Excessive Sovereign Debt Really Hurt Growth? A Critique of This Time is Different, by Reinhart and Rogoff", Levy Economics Institute Working Paper No. 603.

Nietlisbach, Silvan (2015) "Vollgeldreform", University of Zurich, Master's Thesis, January 2015.

Nikiforos, Michalis & Zezza, Gennaro (2017) "Stock-Flow Consistent Macroeconomic Models: A Survey", Levy Economics Institute Working Paper No. 891, May 2017.

Niskanen, Antti (2016) "Kyselytutkimus rahan luonnista ja rahareformista", Haaga-Helia University of Applied Sciences, Thesis, October 2016.

Noko, Joseph (2011) "Dollarization: The Case of Zimbabwe", *Cato Journal* 31 (2), 339–365.

Norges Bank (2018) "Central bank digital currencies", Norges Bank Paper No. 1/2018.

Norman, Ben & Shaw, Rachel & Speight, George (2011) "The history of interbank settlement arrangements: exploring central banks' role in the payment system", Bank of England Working Paper No. 412, June 2011.

North, Peter (2016) "Money Reform and the Eurozone Crisis: Panacea, Utopia or Grassroots Alternative?", *Cambridge Journal of Economics* 40 (5), 1439–1453.

Office for National Statistics (2015a) "Quarterly National Accounts", Updated on 23 December 2015. Available at: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/rel/naa2/quarterly-national-accounts/index.html [Accessed 17 March 2016].

Office for National Statistics (2015b) "General Government Debt and Deficit", Updated on 16 October 2015, Available at: http://www.ons.gov.uk/ons/taxonomy/index.html?nscl=General+Government+Debt+and+Deficit#tab-data-tables [Accessed 16 October 2015].

O'Hara, Maureen & Easley, David (1979) "The Postal Savings System in the Depression", *Journal of Economic History* 39, 741–753.

Ohlin, Bertil (1937) "Alternative Theories of the Rate of Interest: Rejoinder", *Economic Journal* 47 (3), 423–427.

Olson, James (1988) *Saving Capitalism: The Reconstruction Finance Corporation and the New Deal, 1933–1940*. Princeton, NJ: Princeton University Press.

Oxford English Dictionary (2015) Online Dictionary, Updated September 2015. Available at: http://www.oed.com/ [Accessed 22 October 2015].

Palley, Thomas (1996) "Accommodationism versus Structuralism: Time for an Accommodation", *Journal of Post Keynesian Economics* 18 (4), 585–595.

Parguez, Alain (1996) "Beyond scarcity: a reappraisal of the theory of the monetary circuit", in G. Deleplace & E. Nell (eds.) *Money in Motion: The Post Keynesian and Circulation Approaches*. London: Macmillan.

Parguez, Alain (1984) "La Dynamique de la Monnaie", *Economies et Sociétés*, Série Monnaie et Production 1, 83–118.

Parguez, Alain (1975) *Monnaie et macroéconomie*. Paris, France: Economica.

Parkkinen, Tuure (2015) *Paradox Economics: 19 Counterintuitive Economic Phenomena and Common Misconceptions*. Reparodigm Publishing.Passarella, Marco Veronese (2014) "Financialization and the Monetary Circuit: A Macro-accounting Approach", *Review of Political Economy* 26 (1), 128–148.

Passarella, Marco Veronese (2012) "A simplified stock-flow consistent dynamic model of the systemic financial fragility in the 'New Capitalism'", *Journal of Economic Behavior & Organization* 83 (3), 570–582.

Patinkin, Don (1965) *Money, Interest, and Prices*. New York, NY: Harper & Row.

Patomäki, Heikki (2009) "Neoliberalism and the Global Financial Crisis", *New Political Science* 31 (4), 431–442.

Patomäki, Heikki (2003) "A critical realist approach to global political economy", in Cruickshank, Justin (ed.): *Critical Realism: The Difference it Makes*, 197-220. London: Routledge.

Patomäki, Heikki & Teivainen, Teivo (2004) *A Possible World: Democratic Transformation of Global Institutions*. London: Zed Books.

Pettifor, Ann (2014a) "Why I disagree with Martin Wolf and Positive Money", PRIME Economics, 26 April 2014. Available at: http://www.primeeconomics.org/articles/why-i-disagree-with-martin-wolf-and-positive-money.

Pettifor, Ann (2014b) "Out of thin air – Why banks must be allowed to create money", PRIME Economics, 25 June 2014. Available at: http://www.primeeconomics.org/articles/out-of-thin-air-why-banks-must-be-allowed-to-create-money.

Phelps, Edmund (1994) *Structural Slumps: The Modern Equilibrium Theory of Unemployment, Interest, and Assets*. Cambridge, MA: Harvard University Press.

Philippon, Thomas (2015) "Has the US Finance Industry Become Less Efficient? On the Theory and Measurement of Financial Intermediation", Data Appendix, *American Economic Review* 105 (4), 1408–1438.

Phillips, Ronnie (1995) "Narrow Banking Reconsidered: The Functional Approach to Financial Reform", Levy Economics Institute of Bard College, Public Policy Brief No. 18.

Phillips, Ronnie (1994a) *The Chicago Plan & New Deal Banking Reform*. Armonk, NY: M.E. Sharpe.

Phillips, Ronnie (1994b) "Safe Banking During the Great Depression: John M. Nichols, the FDIC and 100% Reserves", *Consumer Finance Law Quarterly Report* 48(1), 15–21.

Phillips, Ronnie & Roselli, Alessandro (2009) "How to Avoid the Next Taxpayer Bailout of the Financial System: The Narrow Banking Proposal", Networks Financial Institute at Indiana State University, Policy Brief No. 5.

Pigou, Arthur (1943) "The classical stationary state", *Economic Journal* 53 (4), 343–351.

Piketty, Thomas (2014) *Capital in the Twenty-First Century*. Translated by Arthur Goldhammer. Cambridge, MA: Belknap Press.

Pilkington, Marc (2009) "The financialization of modern economies in monetary circuit theory", in Ponsot, Jean-Francois & Rossi, Sergio (eds.) *The Political Economy of Monetary Circuits: Tradition and Change in Post-Keynesian Economics*. Basingstoke, UK: Palgrave, 188–216.

Pilkington, Philip (2014) "Endogenous Money and the Natural Rate of Interest: The Reemergence of Liquidity Preference and Animal Spirits in the Post-Keynesian Theory of Capital Markets", Levy Economics Institute Working Paper No. 817.

Pollock, Alex (1993) "No Need to Reinvent the Wheel for a Community Reinvestment Bank", *American Banker*, 8 July 1993.

Popper, Karl (1959) *The Logic of Scientific Discovery*. London: Hutchinson.

Positive Money (2015) "Sovereign Money – Common Critique", 22 August 2015. Available at: http://positivemoney.org/2015/08/sovereign-money-common-critiques/ [Accessed 23 September 2016].

Positive Money (2013) "Bank of England (Creation of Currency) Bill", 12 April 2013. Available at: http://www.positivemoney.org/publications/draft-legislation/.

Poulantzas, Nicos (1973) *Political Power and Social Classes*. London: New Left Books.

Prescott, Edward & Wessel, Ryan (2016) "Monetary Policy with 100 Percent Reserve Banking: An Exploration", Federal Reserve Bank of Minneapolis, Staff Report No. 530, June 2016.

Reinhart, Carmen & Rogoff, Kenneth (2013) "Banking Crises: An Equal Opportunity Menace", *Journal of Banking and Finance* 37, 4557–4573.

Reinhart, Carmen & Rogoff, Kenneth (2009a) *This Time Is Different: Eight Centuries of Financial Folly*. Princeton, New Jersey: Princeton University Press.

Reinhart, Carmen & Rogoff, Kenneth (2009b) "The Aftermath of Financial Crises", NBER Working Paper No. 14656.

Ricardo, David (1824) "Plan for the Establishment of a National Bank" reprinted in Ricardo, David (1951) *The Works and Correspondence of David Ricardo. Volume 4: Pamphlets and Papers 1815–1823*. Cambridge: Cambridge University Press.

Ricardo, David (1817) *On the Principles of Political Economy and Taxation*. London: John Murray.

Robertson, Dennis (1934) "Industrial Fluctuation and the Natural Rate of Interest", *Economic Journal* 44, 650–656.

Robinson, Joan (1956) *The Accumulation of Capital*. London: Macmillan.

Robinson, Joan (1937) *Introduction to the Theory of Employment*. London: Macmillan.

Roche, Cullen (2011) "Hyperinflation: It's More Than Just a Monetary Phenomenon", Working Paper, March 2011. Available at: http://ssrn.com/abstract=1799102.

Rochon, Louis-Philippe (1999) "The Creation and Circulation of Endogenous Money: A Circuit Dynamique Approach", *Journal of Economic Issues* 33 (1), 1–21.

Rochon, Louis-Philippe & Rossi, Sergio (2013) "Endogenous Money: The Evolutionary Versus Revolutionary Views", *Review of Keynesian Economics* 1 (2), 210–229.

Rodrik, Dani (2011) *The Globalization Paradox: Why Global Markets, States and Democracy Can't Coexist*. Oxford: Oxford University Press.

Romer, D. (2000) "Keynesian macroeconomics without the LM curve", *Journal of Economic Perspectives* 14 (2), 149–169.

Ronkainen, Antti (2017) "Money as Power in the Euro Zone Crisis", Paper Presented at the Fourth Nordic Post Keynesian Conference, Aalborg, Denmark, 19 April 2017.

Rothbard, Murray (1962) "The Case for a 100-Percent Gold Dollar", published in Yeager, Leland (ed.) *In Search of a Monetary Constitution*. Cambridge, MA: Harvard University Press.

Rowbotham, Michael (1998) *The Grip of Death: A Study of Modern Money, Debt Slavery and Destructive Economics*. Charlbury, UK: Jon Carpenter.

Ruggie, John (1982) "International Regimes, Transactions, and Change: Embedded Liberalism in the Postwar Economic Order", *International Organization* 36 (2), 379–415.

Russell, Steven (1991) "The U.S. Currency System: A Historical Perspective", *Federal Reserve Bank of St. Louis Review* 73 (5), 34–61.

Ryan-Collins, Josh (2015) "Is Monetary Financing Inflationary? A Case Study of the Canadian Economy, 1935–75", Levy Economics Institute Working Paper No. 848, October 2015.

Ryan-Collins, Josh & Greenham, Tony & Jackson, Andrew & Werner, Richard (2011) *Where Does Money Come From? A Guide to the UK Monetary and Banking System*. London, UK: New Economics Foundation.

Samuelson, Paul & Nordhaus, William (2009) *Economics*. Nineteenth Edition. New York, NY: McGraw-Hill.

Sandilands, Roger (2004) "Editor's introduction: New light on Lauchlin Currie's monetary economics in the New Deal and beyond", *Journal of Economic Studies* 31 (3–4), 170–193.

Sargent, Thomas & Wallace, Neil (1981) "Some Unpleasant Monetarist Arithmetic", *Federal Reserve Bank of Minneapolis Quarterly Review* 5, 1–18.

Sawyer, Malcolm (2015) "The Scourge of Green Monetarism", Unpublished Draft, June 2015.

Sawyer, Malcolm (2014) "Bank-based versus market-based financial systems: a critique of the dichotomy", FESSUD Working Paper No. 19, January 2014.

Sawyer, Malcolm (2001) "The NAIRU, Aggregate Demand, and Investment", Paper Presented at the Path to Full Employment Conference in Newcastle, Australia, 14–15 June 2001.

Sawyer, Malcolm & Passarella, Marco Veronese (2017) "The Monetary Circuit in the Age of Financialisation: A Stock-Flow Consistent Model with a Twofold Banking Sector", *Metroeconomica* 68 (2), 321–353.

Sayer, Andrew (2011) *Why Things Matter to People: Social Science, Values and Ethical Life*. Cambridge: Cambridge University Press.

Sayer, Andrew (1992) *Method in Social Science: A Realist Approach*. Second Edition. London: Routledge.

Schemmann, Michael (1991) *Money in Crisis*. Vancouver: Schemmann.

Schmitt, Bernard (1960) *La formation du pouvoir d'achat: l'investissement de la monnaie*. Paris, France: Sirey.

Schularick, Moritz & Taylor, Alan (2012) "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870–2008", *American Economic Review* 102 (2), 1029–1061.

Schumpeter, Joseph (1954) *History of Economic Analysis*. London: Allen & Unwin.

Schumpeter, Joseph (1911) *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*. Translated by Redvers Opie in 1934. Cambridge, MA: Harvard University Press.

Schwartz, Anna (1992) "The Misuses of the Fed's Discount Window", *Federal Reserve Bank of St. Louis Review* 74, 58–69.

Seccareccia, Mario (2012) "Financialization and the transformation of commercial banking: understanding the recent Canadian experience before and during the international financial crisis", *Journal of Post Keynesian Economics* 35 (2), 277–300.

Sen, Amartya (2009) *The Idea of Justice*. London: Penguin Books.

Shadow Government Statistics (2016) "Annual Growth and Money Stock Levels Since 2006", Updated 14 April 2016. Available at: http://www.shadowstats.com/charts/monetary-base-money-supply [Accessed 18 April 2016].

Sharpe, S.A. & Suarez, G.A. (2014) "The insensitivity of investment to interest rates: Evidence from a survey of CFOs", Federal Reserve Board Staff Working Paper No. 2014-02.

Sigurjonsson, Frosti (2015) "Monetary Reform: A Better Monetary System for Iceland", Report Commissioned by the Prime Minister of Iceland, March 2015.

Simons, Henry (1948) *Economic Policy for a Free Society*. Chicago: University of Chicago Press.

Simons, Henry & Cox, Garfield & Director, Aaron & Douglas, Paul & Hart, Albert & Knight, Frank & Mints, Lloyd & Schultz, Henry (1933) "Banking and currency reform", Manuscript. Also known as the second version of the Chicago Plan. [Reprinted in Samuels, Warren (ed.) (1990) *Research in the History of Economic Thought and Methodology*. Archival Supplement, Volume 4. Greenwich, CT: JAI Press.]

Singer, David (2007) *Regulating Capital: Setting Standards for the International Financial System*. Ithaca and London: Cornell University Press.

Singh, Gurbachan (2009) "Why is 100 % reserve banking inefficient?", Jawaharlal Nehru University Discussion Paper No. 09-07.

Sloman, John (2006) *Economics*. Sixth Edition. Harlow: FT Prentice Hall.

Soddy, Frederick (1934) *The Role of Money: What it should be, contrasted with what it has become*. London: George Routledge and Sons.

Soddy, Frederick (1926) *Wealth, Virtual Wealth and Debt: The Solution of the Economic Paradox*. London: George Allen & Unwin.

Sorsa, Ville-Pekka (2014) "Saksan hyperinflaation opetukset", 6 February 2014. Available at: http://www.poliittinentalous.fi/saksan-hyperinflaation-opetukset/.

Spahr, Walter (1938) *The Fallacies of Professor Irving Fisher's 100 Per Cent Money Proposal*. New York, NY: Farrar and Rinehart.

Spash, Clive & Schandl, Heinz (2009) "Challenges for Post Keynesian growth theory: Utopia meets environmental and social reality", in Holt, Richard & Pressman, Steven & Spash, Clive (eds.) *Post Keynesian and Ecological Economics: Confronting Environmental Issues*. Cheltenham, UK: Edward Elgar, 47–76.

Spong, Kenneth (1996) "Narrow Banks: An Alternative Approach to Banking Reform", in Papadimitriou, Dimitri (ed.) *Stability in the Financial System*. New York, NY: Macmillan.

State Treasury Finland (2015) "Valtiokonttorin ehdotus valtion tilinpäätökseksi varainhoitovuodelta 2014", 1 April 2015. Available at: http://www.valtiokonttori.fi/download/noname/%7B5EE1582D-9AB2-4F7B-9DDF-68B5FF79DCEC% 7D/91325 [Accessed 1 April 2016].

Statistics Finland (2016) "Annual national accounts", Official Statistics of Finland, Updated 16 March 2016. Available at: http://www.stat.fi/til/vtp/tau_en.html [Accessed 17 March 2016].

Statistics Finland (2015a) "General government deficit and debt", Official Statistics of Finland, Updated 30 September 2015. Available at: http://www.stat.fi/til/jali/tau_en.html [Accessed 13 October 2015].

Statistics Finland (2015b) "General government expenditure by function", Official Statistics of Finland, Updated 30 January 2015. Available at: http://www.stat.fi/til/jmete/tau_en.html [Accessed 16 October 2015].

Stern, David (2004) "Environmental Kuznets Curve", *Encyclopedia of Energy* 2, 517–525.

Stiglitz, Joseph (2016) "The Theory of Credit and Macro-Economic Stability", NBER Working Paper No. 22837, November 2016.

Stiglitz, Joseph (2011) "Rethinking Macroeconomics: What Failed, and How to Repair It", *Journal of European Economic Association* 9, 591–645.

Summers, Lawrence (2014) "U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound", *Business Economics* 49 (2), 65–73.

Suntum, Ulrich van & Neugebauer, Tom (2015) "Vollgeld, Public Debt, and the Natural Rate of Interest", Centrum für Angewandte Wirtschaftsforschung Münster, Working Paper, Revised June 2015.

Svensson, Lars (1999) "Inflation Targeting as a Monetary Policy Rule", *Journal of Monetary Economics* 43 (3), 607–654.

Sveriges Riksbank (2017) "The Riksbank's e-krona project", Report 1, September 2017. Available at: http://www.riksbank.se/Documents/Rapporter/E-krona/2017/rapport_ekrona_170920_eng.pdf [Accessed 21 September 2017].

Taylor, Alan (2012) "The Great Leveraging", NBER Working Paper No. 18290.

Taylor, John (1999) "The Robustness and Efficiency of Monetary Policy Rules as Guidelines for Interest Rate Setting by the European Central Bank", *Journal of Monetary Economics* 43 (3), 655–679.

Taylor, Lance (2008) "A Foxy Hedgehog: Wynne Godley and Macroeconomic Modelling", *Cambridge Journal of Economics* 32, 639–663.

Taylor, Lance (2004) *Reconstructing Macroeconomics: Structuralist Proposals and Critiques of the Mainstream*. Cambridge, MA: Cambridge University Press.

Tcherneva, Pavlina (2012) "Beyond Full Employment: The Employer of Last Resort as an Institution for Change", Levy Economics Institute Working Paper No. 732, September 2012.

Teivainen, Teivo (2017) *Maailmanpoliittinen kansalliskävely*. Helsinki: Into.

Teivainen, Teivo (2002) *Enter Economics, Exit Politics: Experts, Economic Policy and the Damage to Democracy*. London: Zed Press.

Teivainen, Teivo (1997) "The Independence of the European Central Bank: Implications for Democratic Governance", in Minkkinen, Petri & Patomäki, Heikki (eds.) *The Politics of Economic and Monetary Union*, 55–75. London: Kluwer Academic Publishers.

Thomas, Rollin (1940) "100 Per Cent Money: The Present Status of the 100 Per Cent Plan", *American Economic Review* 30 (June), 315–323.

Thomas, R. & Dimsdale, N. (2017) "A Millennium of UK Data", Bank of England OBRD dataset. Available at: http://www.bankofengland.co.uk/research/Pages/onebank/threecenturies.aspx [Accessed 26 June 2018].

Thünen, Johann von (1826) *Der isolierte Staat in Beziehung auf Landwirtschaft und Nationalökonomie*. Reprinted in 1910. Jena: Verlag von Gustav Fischer.

Timberlake, Richard (1965) *Money, Banking, and Central Banking*. New York: Harper & Row.

Tobin, James (1987) "The Case for Preserving Regulatory Distinctions", in Federal Reserve Bank of Kansas City (ed.) *Restructuring the Financial System*. Kansas City: Federal Reserve Bank of Kansas City, 167–183.

Tobin, James (1985) "Financial Innovation and Deregulation in Perspective", *Bank of Japan Monetary and Economic Studies* 3(2), 19–29.

Tobin, James (1969) "A general equilibrium approach to monetary theory", *Journal of Money, Credit and Banking* 1(1), 15–29.

Tobin, James (1963) "Commercial banks as creators of 'money'", Cowles Foundation Discussion Paper No. 159.

Tooke, Thomas (1838) *A History of Prices and the State of Circulation from 1793–1837*. UK: Longman, Orme, Brown, Green and Longmans.

Toporowski, Jan & Michell, Jo (2011) "The Stock-Flow Consistent Approach with Active Financial Markets", in Papadimitriou, Dimitri & Zezza, Gennaro (eds.) *Contributions to Stock Flow Modelling: Essays in Honor of Wynne Godley*. New York, NY: Palgrave Macmillan. 173–196.

Tugwell, Rexford G (1957) *The Democratic Roosevelt*. New York: Doubleday and Son.

Turner, Adair (2016) *Between Debt and the Devil*. Princeton, NJ: Princeton University Press.

Turner, Adair (2010) "What do banks do? Why do credit booms and busts occur and what can public policy do about it?" in Turner, Adair et al (eds.) *The Future of Finance*. London: London School of Economics, 5–86.

US Bureau of the Census (1975) *Historical Statistics of the United States: Colonial Times to 1970*. Bicentennial Edition. Washington D.C.: US Government Printing Office.

US Department of the Treasury (2016) "Federal Debt Held by Federal Reserve Banks", Fiscal Service, Updated 11 March 2016. Retrieved from FRED, Federal Reserve Bank of St. Louis. Available at: https://research.stlouisfed.org/fred2/series/FDHBFRBN [Accessed 24 March 2016].

US Mint (2011) "Annual Report 2010–2011".

Véron, Nicolas (2013) "Bank versus non-bank credit in the Unites States, Europe and China", Bruegel Policy Contribution 2013/07, June 2013.

Victor, Peter (2008) *Managing Without Growth: Slower by Design, Not Disaster*. Cheltenham, UK: Edward Elgar.

Walsh, Steven & Zarlenga, Stephen (2012) "AMI's evaluation of 'Modern Monetary Theory' (MMT)", American Monetary Institute, March 2012. Available at: http://www.monetary.org/wp-content/uploads/2012/10/AMI-Evaluation-of-MMT.pdf [Accessed 14 September 2016].

Watkins, Leonard (1938) *Commercial Banking Reform in the United States*. Ann Arbor: University of Michigan.

Weeks, John (2014) *Economics of the 1 %*. London: Anthem Press.

Werner, Richard (2014) "Can Banks Individually Create Money Out of Nothing? The Theories and the Empirical Evidence", *International Review of Financial Analysis* 36, 1–19.

Werner, Richard (2012) "How to Turn Banks into Financial Intermediaries and Restore Money Creation and Allocation Powers to the State", University of Southampton, CBFSD Policy Discussion Paper No. 3-12, 8 November 2012.

White, Eugene (1983) *The Regulation and Reform of the American Banking System, 1900–1929*. Princeton: Princeton University Press.

Whittlesey, Charles (1935) *Banking and the New Deal*. Public Policy Pamphlet No. 16. Chicago: University of Chicago Press.

Wicksell, Knut (1898) *Interest and Prices: A Study of the Causes Regulating the Value of Money*. Translated by R. Kahn. New York, NY: Macmillan.

Winkler, Bernhard & van Riet, Ad & Bull, Peter (eds.) (2013a) *A Flow of Funds Perspective on the Financial Crisis Volume I: Money, Credit and Sectoral Balance Sheets*. Basingstoke, UK: Palgrave Macmillan.

Winkler, Bernhard & van Riet, Ad & Bull, Peter (eds.) (2013b) *A Flow of Funds Perspective on the Financial Crisis Volume II: Macroeconomic Imbalances and Risks to Financial Stability*. Basingstoke, UK: Palgrave Macmillan.

Wolf, Martin (2014a) "Strip private banks of their power to create money", *Financial Times*, 24 April 2014.

Wolf, Martin (2014b) *The Shifts and the Shocks: What We've Learned – and Have Still to Learn – from the Financial Crisis*. London, UK: Penguin Books.

Woodford, Michael (2013) "Macroeconomic Analysis without the Rational Expectations Hypothesis", *Annual Review of Economics* 5, 303–346.

Woodford, Michael (2003) *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton, New Jersey: Princeton University Press.

Woodward, David (2015) "Incrementum ad Absurdum: Global Growth, Inequality and Poverty Eradication in a Carbon-Constrained World", *World Economic Review* 4 (1), 43–62.

Wortmann, Edgar (2017) "Deleverage without a crunch", Ons Geld Draft Working Paper, June 2017.

World Bank (2015) "World Development Indicators: Central Government Finances", Table 4.12, Updated on 14 October 2015. Available at: http://wdi.worldbank.org/table/4.12 [Accessed 16 October 2015].

Wray, L. Randall (2014) "Debt-free money: a non-sequitur in search of a policy", 1 July 2014. Available at: http://neweconomicperspectives.org/2014/07/debt-free-money-non-sequitur-search-policy.html [Accessed 20 October 2015].

Wray, L. Randall (2013) "The Lender of Last Resort: A Critical Analysis of the Federal Reserve's Unprecedented Intervention After 2007", Levy Economics Institute of Bard College, Research Project Report, April 2013.

Wray, L. Randall (2012) *Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems*. Houndmills, Basingstoke: Palgrave MacMillan.

Wray, L. Randall (2000) "The Neo-Chartalist Approach to Money", University of Missouri-Kansas City, Center for Full Employment and Price Stability, Working Paper No. 10.

Wray, L. Randall (1998) *Understanding Modern Money: The Key to Full Employment and Price Stability*. Cheltenham: Edward Elgar.

Yamaguchi, Kaoru (2014) *Money and Macroeconomic Dynamics: Accounting System Dynamics Approach*. Second Edition. Awaji Island, Japan: Japan Futures Research Center.

Yamaguchi, Kaoru (2011) "Workings of a Public Money System of Open Macroeconomies: Modeling the American Monetary Act Completed", Paper Presented at the 7th Annual AMI Monetary Reform Conference in Chicago, USA, 30 September 2011.

Yamaguchi, Kaoru (2010) "On the Liquidation of Government Debt under a Debt-Free Money System: Modeling the American Monetary Act", Paper

Presented at the 28th International Conference of the System Dynamics Society in Seoul, Korea, 26 July 2010.

Zezza, Gennaro (2012) "Godley and Graziani: Stock-Flow Consistent Monetary Circuits", in Papadimitriou, Dimitri & Zezza, Gennaro (eds.) *Contributions in Stock-Flow Consistent Modeling: Essays in Honor of Wynne Godley*. Basingstoke, UK: Palgrave MacMillan.

Zhou, Xiaochuan (2009) "Reform the International Monetary System", BIS Review 41/2009, 23 March 2009.

APPENDIX: LIST OF VARIABLES OF REFORM2

Table 10. *List of Endogenous Variables*

Symbol	Description	Initial value
B_{cb}	Bills held by central bank	50
B_d	Bills demanded by households	29.02
B_h	Bills held by households	29.02
B_s	Bills supplied by government	79.02
BL_d	Bonds demanded by households	1.29
BL_h	Bonds held by households	1.29
BL_s	Bonds supplied by government	1.29
BLR	Bank liquidity ratio	1.14
BPM	Bank profit margin	0.0032
c	Real consumption	108.87
C	Nominal consumption	178.99
CG	Capital gains	0
F	Total profits distributed to households	16.40
F_b	Profits of banks	0.27
F_{cb}	Profits of central bank	0.39
F_f	Entrepreneurial profits	16.13
F_f^e	Expected entrepreneurial profits	16.13
G	Nominal government expenditures	41.39
GD	Gross government debt	126.80
GD_{net}	Consolidated government debt	76.80
H_b	Reserves held by banks	32.09
H_d	Cash demanded by households	17.9
H_h	Cash held by households	17.9
H_{min}	Reserves required from banks	28.02
H_s	Cash and reserves supplied by central bank	50
in	Real inventories	43.54
in^e	Real short-term target inventories	43.54
in^T	Real long-term target inventories	43.54
IN	Nominal inventories	52.2
L_d	Loans demanded by firms	52.2
L_s	Loans supplied by banks	52.2
$M1_d$	Demand deposits demanded by households	28.02
$M1_h$	Demand deposits held by households	28.02
$M1_s$	Demand deposits supplied by banks	28.02

$M2_d$	Time deposits demanded by households	56.27
$M2_h$	Time deposits held by households	56.27
$M2_s$	Time deposits supplied by banks	56.27
N	Employment level	134.05
$NHUC$	Normal historic unit costs	1.203
p	Price level	1.64
p_{bL}	Price of bonds	37.03
$PSBR$	Public sector borrowing requirement (government budget deficit)	-0.01
r_b	Interest rate on bills	0.80%
r_l	Interest rate on loans	1.2%
r_m	Interest rate on time deposits	0.64%
s	Real sales	134.05
s^e	Real expected sales	134.05
S	Nominal sales	220.39
T	Nominal sales taxes	42.92
UC	Nominal unit costs	1.198
v	Real wealth of households	108.88
V	Nominal wealth of households	179.02
V^e	Expected nominal wealth of households	179.02
W	Nominal wage	1.198
WB	Nominal wage bill	160.69
y	Real output	134.05
Y	Nominal output	220.39
yd_{hs}	Real Haig-Simons disposable income	108.87
yd_r	Real regular disposable income	108.87
yd_r^e	Expected real regular disposable income	108.87
YD_{hs}	Nominal Haig-Simons disposable income	178.98
YD_r	Nominal regular disposable income	178.98
YD_r^e	Expected nominal regular disposable income	178.98
z_1	Dichotomic variable related to bank liquidity ratio	0
z_2	Dichotomic variable related to bank liquidity ratio	0
z_3	Dichotomic variable related to bank profit margin	0
z_4	Dichotomic variable related to bank profit margin	0
σ_s	Real inventories-to-sales ratio	0.32
σ^T	Real long-term target inventories-to-sales ratio	0.32
π	Price inflation	0
ω	Real wage	0.72
ω^T	Real long-term target wage	0.72

Table 11. *List of Exogenous Variables*

Symbol	Description	Value
$\bar{B}_{cb}$	Bills central bank decides to hold	50
BLR_{bot}	Bottom range of bank liquidity ratio	1.1
BLR_{top}	Top range of bank liquidity ratio	1.2
BPM_{bot}	Bottom range of bank profit margin	0.002
BPM_{top}	Top range of bank profit margin	0.005
g	Real government expenditures	25.18
N_{fe}	Full employment level	133.28
pr	Productivity level	1
$\bar{r}_{bL}$	Interest rate on bonds	2.7%
r_h	Interest rate on cash and reserves	0%

Table 12. *List of Parameters*

Symbol	Description	Value
α_0	Autonomous consumption	0
α_1	Propensity to consume out of regular income	0.95
α_2	Propensity to consume out of past wealth	0.05
β	Reaction parameter related to sales expectations	0.5
γ	Partial adjustment parameter related to target inventories	0.5
ε	Reaction parameter related to income expectations	0.5
ς_l	Reaction parameter related to changes in loan rate	0.002
ς_m	Reaction parameter related to changes in time deposit rate	0.0001
λ_c	Reaction parameter related to demand for cash	0.1
λ_{ij}	Reaction parameters in portfolio equations	See Table 13
ρ_1	Compulsory reserve ratio on demand deposits	100%
ρ_2	Compulsory reserve ratio on time deposits	0%
σ_0	Reaction parameter related to target inventories-to-sales ratio	0.3612
σ_1	Reaction parameter related to target inventories-to-sales ratio	3
τ	Sales tax rate	0.2419
φ	Costing margin in pricing	0.1
Ω_0	Reaction parameter related to real wage targeting	-0.325

Ω_1	Reaction parameter related to real wage targeting	1
Ω_2	Reaction parameter related to real wage targeting	1.5
Ω_3	Reaction parameter related to nominal wage setting	0.1

Table 13. *Reaction Parameters in Portfolio Equations*

$\lambda_{10} = 0.20$	$\lambda_{11} = 41$	$\lambda_{12} = -20$	$\lambda_{13} = -20$	$\lambda_{14} = -1$	$\lambda_{15} = 0.26$
$\lambda_{20} = 0.34$	$\lambda_{21} = -20$	$\lambda_{22} = 41$	$\lambda_{23} = -20$	$\lambda_{24} = -1$	$\lambda_{25} = -0.06$
$\lambda_{30} = 0.23$	$\lambda_{31} = -20$	$\lambda_{32} = -20$	$\lambda_{33} = 41$	$\lambda_{34} = -1$	$\lambda_{35} = -0.2$
$\lambda_{40} = 0.23$	$\lambda_{41} = -1$	$\lambda_{42} = -1$	$\lambda_{43} = -1$	$\lambda_{44} = 3$	$\lambda_{45} = 0$