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ESSAYS ON NATURAL RESOURCES AND FINANCE

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ACADEMIC DISSERTATION
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Abstract

In countries highly dependent on their mineral resource sectors, the failure to diversify industrial activity is sometimes characterized as a resource curse. Several factors which are known to be harmful for economic development, such as a lower level of education and poor governance, have been shown to be present in resource-dependent countries. It is not clear, however, whether a resource curse is merely the natural outcome of organizing an economy around its resource sector based on a country's factor endowments. If the resource industry does not need a particularly well educated labor force or a highly developed legal system, it is not surprising that those areas do not develop in countries with a large resource sector.

This thesis focuses on unraveling the link between the resource curse and finance. All three articles take a different approach to the same question: does finance play a role in enhancing the resource curse? The first article, using cross-country panel data, presents evidence that domestic bank lending to the private sector is less common and the use of market-based finance more common in resource-dependent countries than in their resource-poor counterparts. That could create an environment difficult for small firms or emerging industries, which are known to rely on domestic bank lending.

The second article enters more deeply into the reasons behind this first finding and, using firm-level data, presents evidence that resource firms use less debt and debt of longer maturity than other non-financial firms. Similarly, firms in other sectors in resource-dependent countries have less debt than firms with similar characteristics in other countries. The results suggest that resource firms have demand for a certain type of finance, which could steer the supply of financial services in resource-dependent countries.

The third article shows empirical evidence that an oil price collapse adversely affects leverage of not only resource firms but also other firms in resource-dependent countries. In other countries, however, only the resource sector is harmed by the fall in oil price. This fact suggests that volatility is one channel through which the resources affect finance in resource-dependent countries.

All in all, the results show that finance is a channel through which the resource curse operates. Resource firms have demand for a certain type of financial services, which could affect the supply of financial services in resource-dependent countries. The financial sector could be formed to serve the needs of large resource firms, and it perhaps leaves other types of firms with inadequate service. Moreover, external commodity price shocks adversely affect firm leverage growth in

resource-dependent countries. Consequently, addressing the financial needs of non-resource firms in resource-dependent countries could help to mitigate the resource curse.

Tiivistelmä

Monissa raaka-ainevaroiltaan rikkaissa maissa talouden on havaittu kehittyvän muita maita heikommin ja tätä ilmiötä kutsutaan usein raaka-ainekiroukseksi. Muun muassa alhainen koulutustaso sekä heikko hallinto ovat tekijöitä, jotka näyttävät esiintyvän tyypillisesti yhdessä suurten raaka-ainevarojen kanssa. Mikäli kaivannaisteollisuus ei tarvitse korkeasti koulutettua työvoimaa tai kehittynyttä lainsäädäntöä, ei ole yllättävää että ne yhteiskunnan alueet eivät raaka-aineriippuvaisissa maissa kehity. Raaka-ainekirouksen onkin havaittu toimivan osittain talouden instituutioiden kautta.

Tämä väitöskirja keskittyy tutkimaan raaka-aineriippuvuuden ja rahoitussektorin yhteyttä, sillä myös rahoitussektori voi olla raaka-aineista riippuvaisissa maissa erilainen kuin muissa maissa. Kaikki kolme osatyötä lähestyvät eri kulmista samaa kysymystä: ruokkiiko rahoitussektorin toiminta raaka-ainekirousta?

Ensimmäisessä osatyössä esitetään, että raaka-aineista riippuvaisissa maissa on muita maita pienempi pankkisektori ja markkinaehtoisen rahoituksen käyttäminen on yleisempää. Tällainen ympäristö voi heikentää pienten ja nuorten yritysten mahdollisuuksia saada rahoitusta, sillä ne ovat tyypillisesti riippuvaisia kotimaisista pankeista.

Toisessa osatyössä pureudutaan ensimmäisessä löydetyn ilmiön syihin käyttämällä yritysten tilinpäätöstietoja 70 eri maasta. Aineiston avulla osoitetaan, että raaka-aineyritykset ovat vähemmän velkaantuneita ja niiden lainojen laina-aika on pidempi kuin muilla yrityksillä. Kun rajataan tarkastelu raaka-aineriippuvaisiin maihin, havaitaan, että myös muiden alojen yritykset käyttävät vähemmän lainarahaa mikäli ne sijaitsevat raaka-aineistaan riippuvaisissa maissa. Tulos viittaa siihen, että maan suuri raaka-ainesektori voi vaikuttaa myös muiden alojen yritysten pääomarakenteeseen.

Kolmannessa osatyössä osoitetaan, että öljyn hinnan romahdus vähentää raaka-aineista riippuvaisissa maissa sekä raaka-aineyhtiöiden että muiden yritysten velkaantuneisuutta, kun muissa maissa haitallinen vaikutus tuntuu vain raaka-aineyhtiöillä. Tämä ilmiö viittaa siihen, että raaka-aineiden hintojen voimakas liikehdintä on yksi kanava, mitä kautta raaka-aineriippuvuus heikentää talouden kehitystä.

Tulokset osoittavat, että rahoitussektori on yksi reitti, mitä kautta raaka-ainekirous toimii. Raaka-ainesektorin yrityksillä on tietynlaiset rahoitustarpeet, mikä voi vaikuttaa koko raaka-aineista riippuvaisen maan rahoituksen tarjontaan. Mikäli rahoitussektori on keskittynyt palvelemaan raaka-ainesektorin yrityksiä, se ei välttämättä tarjoa talouden muille sektoreille

sopivia palveluita. Lisäksi raaka-aineiden hintojen voimakas pudotus heikentää muidenkin alojen yritysten rahoitusta raaka-aineista riippuvaisissa maissa. Raaka-ainekirousta voitaisiin siis mahdollisesti lieventää löytämällä ratkaisuja talouden muiden sektoreiden rahoitustarpeisiin.

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As a child, more than 20 years ago, I asked my father: “How is it possible that, despite all the oil and gold and other resources that Russia has, they are always doing so poorly, while we in Finland don’t have much but are doing so well?” My father promptly replied: “That’s a good question”. That question was one of several which confirmed my passion for economics and followed me all the way through my university studies. Finally, the question of the resource curse ended up becoming the topic of my doctoral dissertation.

My path from an economics freshman to submitting my dissertation took 15 years. It was never a clear path, and eventually even I myself have been surprised that I did it. There are so many who have helped me on my way, and I am extremely grateful to all of them. One of the most important turning points in my career was when Pekka Sutela hired me as a summer economist at BOFIT in 2006. There I met Dr. Zuzana Fungáčová, who soon became my friend and later the supervisor of my dissertation, providing me with effusive support for my research. I also want to thank the rest of the BOFIT team for creating a warm and open atmosphere and thus giving me the opportunity to learn and grow as a researcher.

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Sanna Kurronen

Contents

1 Introduction

It seems intuitive that natural resource wealth, like any other wealth, should be beneficial for countries' economic performance. However, as mineral resources have been shown to be harmful for growth (see e.g. Sachs and Warner 2001), a large branch of literature has emerged around this puzzle to explain the adverse effect of mineral resources on economic development, an effect known as the resource curse.

Sokoloff and Engerman (2000) and Acemoglu et al. (2001) take a historical perspective on the economic development and develop a colonial endowment view. Colonies built around few immigrants managing resources with large returns to scale failed to develop stable institutions and were left behind in economic development, whereas colonies with large numbers of immigrants with dispersed assets managed to create sustainable economic growth over centuries. These findings suggest that beneficial institutions, such as education systems, franchise and land ownership are not exogenous in any way, but stem from countries' factor endowments. La Porta et al. (1998) also show that a country's legal background affects the development of the financial sector.

Countries with vast mineral resources have been shown to under educate their people (Gylfason 2001) and tend to suffer from poor governance and rent-seeking behavior (Bardhan 1997). These countries also have more incentives for trade policy closure and a lower level of economic diversification than their resource-poor counterparts (Auty 2001). Frankel (2010) summarizes the channels through which the resource abundance is discovered to harm the economic development, a phenomenon known as the resource curse: long-term trends in world commodity prices, volatility, crowding out of manufacturing, civil war, poor institutions, and the Dutch Disease are all potential causes for poor economic performance associated with mineral

resources. Despite the extensive literature on the field, the role of the financial sector has received very limited attention.

Factor endowments, that is, labor, capital and natural resources affect not only institutions but also the development of industrial sectors in a country. Countries with substantial mineral wealth naturally have a large resource extraction sector. The production sector of the economy then further affects the development of the institutions. More specifically, Lin et al. (2009) argue that the financial sector of the economy is formed based on the needs of the production sector. Large firms in capital intensive industries are better served by big banks or financial markets, whereas smaller labor intensive firms are better off with smaller local banks. Institutions also evolve together with economic development (Demirguc-Kunt, Feyen et al. 2011).

Although initial natural resource endowments can be considered to be exogenous, over time their use and conservation depends greatly on country-specific factors and can then be considered endogenous. However, exogenous shocks from commodity prices continue to affect countries with large mineral resources.

The goal of this research is to disclose the role of finance in resource-dependent countries. The main hypothesis is that, when the resource sector is sufficiently large, it can shape the financial institutions in the country to the extent that they do not provide adequate service for other types of firms. In addition, when the resource-dependent economy continues to be hit by exogenous commodity price shocks, the financial sector can either be a buffer or an accelerator to these shocks. Identifying the channels through which the resource curse hampers the economic performance of the country is the way to find the cure for the curse.

1.1 Natural resources, financial sector and capital structure

Throughout this thesis, countries where minerals' share of total exports exceeds 40% are defined as resource-dependent, and the data for fuel and metals exports is extracted from World Bank World Development Indicators. Diamond exports are also included in total mineral exports for major diamond producers when the data is available. Export dependence, previously used by e.g. Nili and Rastad (2007) indicates whether the country's competitiveness is based mainly on mineral resources. I also use subsoil wealth and non-manufacturing industrial production as alternative measures of resource-dependence to confirm the results in the first article. Resource firms are based on the Global Industry Classification Standard (GICS). Firms with the industry name of "Metals & Mining" or "Oil & Gas Exploration & Production" or the sub-industry name of "Oil & Gas Drilling", "Integrated Oil & Gas" or "Coal & Consumable Fuels" are classified as resource firms in the second article. That is, firms from the energy sector are not included if they are concentrated on transportation, marketing or equipment, as I focus only on the mineral extraction. However, in the third article, when studying the effects of oil price changes, I include the whole sector "Energy" in the group of resource firms, excluding only the sub-industry "Oil & Gas Refining & Marketing" from the energy sector, as Lee and Ni (2002) show that, in contrast to the energy sector in general, the refining industry, which uses commodities as an input, benefits from a lower oil price.

Like other institutions, a country's financial sector is not exogenously determined. Development of the financial sector is a continuous process, where development level, factor endowments, existing industries and institutional and regulatory environment reshape the financial sector. (Lin et al. 2009; Demirguc-Kunt et al. 2011)

All in all, the importance of finance for economic development has received much attention in the previous literature (e.g. King, Levine 1993). Levine (2005) summarizes the existing knowledge of the role of the financial sector. The financial system helps to manage risk, mobilizes

savings and allocates capital. It also has an important role in monitoring investments and exercising post-financing corporate governance. The financial system also facilitates the exchange of goods and services.

By a significant margin, the literature on the structure of the financial sector has concentrated around the superiority of bank-based or market-based financial systems (Gerschenkron 1962; Demirgüç-Kunt and Levine 1999). Lin et al. (2009) argue that bigger firms are better served by big banks and that smaller firms benefit from a more dispersed banking sector.

Resource endowments are likely to lead to a large resource sector. A large resource sector affects institutions including the financial sector, as the financial sector is used to serve resource firms, not necessarily other types of firms. Moreover, the resource firms might be uninterested in the development of the domestic financial sector if they are big enough to tap international capital markets. Even an elite of incumbents might exist, with an interest in hampering the development of the financial sector to prevent competition. Beck (2011) shows some preliminary empirical evidence that the financial sector is indeed smaller in resource-dependent countries than elsewhere. Van der Ploeg and Poelhekke (2009) argue that the resource curse is just a red herring and that the true challenge for the resource-dependent countries is the economic volatility that follows from the commodity price movements. They further suggest that a developed financial sector can mitigate the external shocks from commodity prices.

The capital structure of the firm is not independent of the institutional environment of the country, either. Fan et al. (2012) show that a country's level of corruption, legal and tax system, and preference for capital suppliers explain a large part of the variation in capital structure. However, these institutional factors can be affected by the country's resource wealth, which provides one channel through which the resources affect firm capital structure.

The motivation for unraveling the capital structure puzzle by looking at the capital structure of resource firms stems from the dominant role of the resource sector in resource-dependent

economies. If the resource firms have a certain capital structure, that could steer the supply of finance by creating a standard offering of financial services based on the needs of the major sector in the economy. In this way, the existing resource sector could indirectly affect the capital structure of other firms in a resource-dependent country, providing another channel from resources to capital structure of a firm.

The extensive literature on firm capital structure is not unambiguous, but a common understanding is that the assumptions of the seminal work by Modigliani and Miller (1958) of frictionless financial markets are unrealistic. That is, it is fair to assume that firms cannot choose their capital structure freely.

Frank and Goyal (2009) summarize what we know about the determinants of firm capital structure. Both the book and market leverage of a firm are supported by asset tangibility and high median industry leverage, whereas high profitability is associated with lower leverage levels. Most evidence also points to bigger firms having higher leverage, firms with a high market-to-book ratio having lower leverage levels and firms in countries with a high inflation rate having higher leverage.

In some studies, volatility has also been shown to be an important determinant of firm capital structure. Bradley et al. (1984) show that earnings volatility is negatively associated to firm leverage, whereas e.g. Titman and Wessels (1988) find no evidence of earnings volatility affecting the firm capital structure.

Following the global financial crisis in 2008-2009, the literature on the changes in firm capital structure after a shock has grown rapidly. With US data, Harrison and Widjaja (2014) show that the role of assets tangibility increased after the financial crisis as a determinant for leverage. Ivashina and Scharfstein (2010) use data on US firms to show evidence of firms increasing their leverage to secure liquidity rapidly after the beginning of the financial crisis. Using data from Western Europe, Iqbal and Kume (2014) show that firm leverage ratios first increase during the

financial crisis but decrease again after the crisis. Zeitun et al. (2016) present empirical evidence from GCC countries, which are resource-dependent, that leverage ratios decreased after the financial crisis due to the lack of supply by lenders.

All in all, the resource sector has not been at the center of the capital structure literature. Similarly, the response to oil price shocks by resource firms or firms in resource-dependent countries has not been extensively studied. However, the theoretical framework for the response in the financial sector provides a suitable framework for empirical studies. Holmstrom and Tirole (1997) show that flight to quality in lending is initiated by a credit crunch, a collateral squeeze or a savings squeeze. A fall in oil price can cause a collateral squeeze as resource asset values are depreciated, and that could be of significant magnitude in resource-dependent countries. According to Bernanke et al. (1996), borrowers with high agency costs of borrowing are likely to be most affected by an economic downturn. Thus, a credit crunch swiftly affects smaller, younger and less capitalized firms. This "flight to quality" coincides with a reduction in economic activity (Lang and Nakamura 1995).

External shocks from commodity prices lead to further re-allocation of resources. Hamilton (1983) suggests that oil price increases have played a role in initiating U.S. recessions after World War II. Gilbert and Mork (1986) argue that, regardless of direction, oil price change causes some costly resource re-allocation. The literature linking oil price movements to the output growth of industries or equity market performance confirms that the oil price shocks affect different industries and countries differently (Nandha and Faff 2008; Lee and Ni 2002; Scholtens and Yurtsever 2012; Park and Ratti 2008). Oil producers and exporting countries benefit from the rise in the oil price at the cost of the end users.

1.2 Panel data methods

All the three articles take an empirical approach, using cross-country panel data. In the first article dynamic multivariate regression analysis is used to detect special characteristics of the financial sector in resource-dependent countries. I use a fixed effects estimator, which however is known to have bias in the coefficient of the lagged dependent variable (Nickell 1981). Thus, the results are verified with the Anderson-Hsiao (AH) estimator, which according to Judson and Owen (1999) is suitable for unbalanced panels with more than 10 time periods. However, despite the biased behavior, the fixed effects estimator has been shown by simulations to work well with cross-country growth regressions with more than five time periods, as it is more efficient than the AH-estimator (Gaduh 2002).

The second article uses an ordinary least squares (OLS) estimator on firm capital structure data. As shown by Petersen (2009), estimating finance panel data sets with OLS and White standard errors results in biased standard errors with confidence intervals typically too small. However, this problem is corrected by clustering the standard errors by firm.

The difference-in-differences methodology used in the third article is a quasi-experimental approach well suited to estimate the effects of a sudden change in economic environment (Angrist and Krueger 1999). Two recent oil price collapses, the first in 2008 in conjunction with the beginning of a global financial crisis and the second in 2014, unrelated to any wider economic downturn, provide an environment for studying the differences in the change in leverage for more affected resource firms or firms domiciled in resource-dependent countries versus firms in other industries or in other countries. The crucial pre-condition for the validity of inference using a difference-in-differences estimator is that the compared treatment and control groups exhibit similar growth trends in the dependent variable before the shock. That is, without the shock, the growth rates would have continued to be similar. The shortcoming of the difference-in-differences approach is the difficulty in extrapolating the results outside the sample.

In a simple form the difference-in-differences estimator becomes

$$y_{it} = \beta_0 + \beta_1 I(Treat_{it}) + \beta_2 I(Post_{it}) + \beta_3 I(Treat_{it}) \times I(Post_{it}) + \varepsilon_{it}, \quad (1)$$

where y_{it} is the dependent variable for individual i in time t, and where $I(Treat_{it})$ is an indicator function that receives value 1 if the observation belongs to the treatment group and, otherwise, receives value 0. Similarly, $I(Post_{it})$ receives value 1 if the observation is from post-treatment period and, otherwise, 0. $I(Treat_{it}) \times I(Post_{it})$ is the difference-in-differences term, and ε_{it} is the random error.

The interpretation of the parameters is the following. β_0 is the pre-treatment coefficient for the control group, and β_1 is the pre-treatment difference of the treatment group from the control group. β_2 is the post-treatment difference in the coefficient for the control group from its pre-treatment coefficient. The main interest in the difference-in-differences estimator lies in the coefficient β_3, which is the difference in post-treatment differences between the treatment and control groups. It describes whether the reaction to the shock differs between the treatment and the control group.

In some regressions in the third article, I use nearest neighbor propensity score matching, introduced by Rosenbaum and Rubin (1983) to find a suitable control group for each of the treatment groups. This approach is motivated by heterogeneous groups in the data, and the goal is to adjust the data prior to the parametric analysis to reduce the relationship between the treatment group and the independent variables without causing bias or inefficiency. This nonparametric preprocessing can greatly reduce the model dependence in the parametric estimations.

1.3 Empirical findings

This thesis contributes to the existing literature in several ways. The first article shows previously undisclosed characteristics of the financial sector in economies which have a high share of mineral resources in their exports. At a low level of export dependence on minerals, the increasing mineral

share coincides with higher financial sector development measured by bank lending to the private sector. However, when the export share of minerals exceeds 6%, this correlation already turns negative, and resources seem to be harmful for banking sector development.

Although the country fixed effect seems to capture that threshold, multivariate dynamic panel data regressions confirm the initial finding: bank lending to the domestic private sector is less common in resource-dependent countries than in their resource-poor counterparts. This result is in line with the preliminary result by Beck (2011). Moreover, I find evidence that capital markets are more commonly used in resource-dependent countries than in other countries, confirming that the financial sector structure in resource-dependent countries is well suited to serve bigger firms.

Now, is the observed financial sector structure a result of the demand for certain types of financial services by the resource firms? Although the capital structure of the firm has been extensively studied, the special characteristics of the capital structure in the resource sector is, to the best of my knowledge, previously unexposed. I approach this question by using extensive cross-country firm level data, and I find clear evidence that resource firms tend to have a lower level of leverage and longer debt maturity than non-financial firms in other industries. Interestingly, other firms in resource-dependent countries are also drawn to a similar capital structure, which does suggest that the resource sector might affect the range of financial services available in a resource-dependent country.

In addition to this endogenous mechanism, resources could affect other sectors of the economy through external commodity price shocks. I study two events of recent oil price collapse and their impact on firms' leverage growth. I find evidence that oil price falls are followed by a deceleration in credit growth in resource-dependent countries for both resource and non-resource firms. The slower credit growth in non-resource sectors appears to be explained not solely by the deteriorating growth opportunities but also by flight to quality in lending, as bigger firms with low leverage and high asset tangibility are better off than smaller firms or firms with weaker

balance sheets. All in all, these firm-level results confirm the macroeconomic findings of Van der Ploeg and Poelhekke (2009) that economic volatility caused by the commodity prices is harmful for economic development in resource-dependent countries.

1.4 Summary of the chapters

The second chapter, by using panel regressions, shows that the domestic banking sector is smaller and the use of market-based financing is more common in resource-dependent countries than in other countries, even when controlling for several other country-specific determinants. There is also a very low threshold after which the natural resource dependence begins to be harmful for financial sector development.

Three alternative hypotheses are presented to explain the particular kind of financial sector found in resource-dependent countries. First, according to the demand hypothesis, demand for finance by firms is likely to be different in different sectors, so the existence of a large resource sector could be responsible for the different financial structure of the country. Second, the interest group hypothesis based on Rajan and Zingales (2003) argues that the financial sector of a country is unlikely to be formed based purely on the demand for services, but there could be a strong elite in resource-dependent countries which has no interest in supporting the development of the financial sector. Third, the volatility hypothesis suggests that the financial sector remains small in resource-dependent economies due to the macroeconomic volatility caused by commodity price movements.

The third chapter enters into the first hypothesis presented in the second chapter. Using an extensive micro-level dataset from listed firms in 70 different countries, it shows that resource firms seem indeed to have demand for certain types of financial services, as the capital structure of the resource firms is different from that of other firms even in developed countries and the United States. Resource firms have less debt and debt of longer maturity than other non-financial

firms. However, firms in other sectors, but domiciled in resource-dependent countries, also have less debt than their counterparts in other countries. That fact does not seem to be due to a different industrial mix. Thus, the results suggest that the large resource sector might steer the financial sector of the country towards a structure that serves resource firms well but that could provide inadequate service to sectors with very different needs.

The fourth chapter takes the volatility hypothesis of Van der Ploeg and Poelhekke (2009) to the firm level and presents evidence, using difference-in-differences regressions, that recent oil price collapses have caused a reduction in firm leverage in resource-dependent countries not only for resource firms but also, in similar magnitude, for firms in other sectors as well. This firm-level evidence confirms the harmful effect of economic volatility caused by commodity prices. There is also some evidence of flight-to-quality following an oil price collapse, which could harm smaller firms even more than the listed firms in the sample used. However, the oil price collapses in 2008 and 2014 had slightly different consequences. In 2008, when the oil price drop coincided with a global financial crisis, the flight-to-quality seemed to play a role, whereas after the oil price drop in 2014, which was not associated with deterioration in global growth outlook, we find no evidence of flight to quality in our sample of listed firms. Nevertheless, in both cases the fall in the oil price was followed by deterioration in firm leverage for both resource and non-resource firms in resource-dependent countries, whereas in other countries only the resource sector was harmed.

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2 Financial sector in resource dependent economies

2.1 Introduction[1]

Many resource-rich economies are unable to develop competitive industrial sectors outside the production of raw materials and experience lower economic growth rates than their resource-poor counterparts. In particular, the previous literature on this resource trap or resource curse, well summarized by Frankel (2010), has found point-source resources, namely energy products and other minerals harmful for economic development. Several reasons for this underdevelopment of resource-rich economies have been suggested, such as low quality of institutions in resource-rich countries, economic uncertainty caused by commodity price volatility and the Dutch Disease. Nevertheless, the role of financial development in these economies has received very limited attention, even though the overall importance of the financial sector for economic development has been extensively studied.

Levine (2005) summarizes the key functions of the financial sector addressed in the previous literature. The financial sector produces information on possible investments, allocates capital, monitors investments, and exerts post-financing corporate governance. The financial system facilitates the trading, diversification and management of risk. It also mobilizes savings and eases the exchange of goods and services.

As financial sector structure is expected to reflect the production structure of the economy (Lin et al. 2009), we presume that the financial sector in a resource-dependent economy is shaped

[1] This chapter is based on an article with the same title, published in the Emerging Markets Review 23, 208-229, 2015

by the needs of big well-known firms in the mineral extraction sector. That is, the domestic banking sector plays a smaller role and the use of capital markets is more common than in resource-poor countries. Lin et al. (2009) argue, that such a financial system is especially challenging for small- and medium-sized enterprises as well as for emerging industries.

This is one of the first papers to investigate the structure of the financial sector in resource-dependent economies. We describe financial sector characteristics by presenting cross-country data on financial sector development and resource dependence based on an extensive dataset collected from different sources, covering large amount of countries and the period 1995 to 2009. We present empirical evidence that, even if we control for several other factors that previous literature has designated as important for financial sector growth, resource-dependence still has a dampening effect on domestic banking sector development, a result in line with preliminary work by Beck (2011). We also find evidence that the use of market-based financing is more common in resource-dependent economies. We confirm our results by using three alternative indicators of resource-dependence, namely export dependence, production dependence and subsoil wealth.

We contribute to the still scarce literature linking the financial development and resource curse using more comprehensive data than the previous studies linking resource sector and finance, including often omitted diamond producers, and suggest that the negative link between resource-dependence and financial development is not linear. Further, we contribute to the research related to financial sector development by presenting previously unrecognized characteristics of financial sector in resource-dependent economies, namely the larger role of market based finance. Natural resources as the countries' third initial endowment in addition to labor and capital, have thus far received very limited attention as a driver of financial sector structure. We also suggest three alternative channels through which the resource wealth could cause the underdevelopment of the domestic banking sector.

The rest of this paper consists of four sections. Section 2 introduces the related literature, section 3 discusses the data and estimation results, section 4 presents our interpretation of the results, and section 5 concludes.

2.2 Explaining the structure of the financial sector

There are several often-cited determinants of financial sector development. According to La Porta et al. (1997), investor protection is the key to financial sector development. Roe and Siegel (2011) argue that political instability impedes financial development. Engerman and Sokoloff (2002) and Acemoglu et al. (2001) develop a colonial endowment view according to which colonies that have been run by a small elite of immigrants using plenty of unskilled local labor have tended to have weak property rights. These colonies were typically built around extraction industries or agriculture. In colonies settled by bigger groups of immigrants, stronger property rights, higher level s of education and stronger financial and economic development were present. Thus, beneficial institutions are not exogenously determined and more attention should be paid to the question of why institutions are less developed in some countries.

A big branch of research has been focusing on structural issues, namely whether a bank-based or market-based financial sector is better for economic growth (see e.g. Demirgüç-Kunt, Levine 1999). Gerschenkron (1962) suggests that banks are more efficient than markets in the early stages of development, when the institutional environment is underdeveloped. The idea is that banks are more powerful than individual investors in forcing firms to reveal their accounts and pay their debts. Securities markets offer mostly long-term funding, whereas banks are superior in offering funds for shorter term investments (Demirgüç-Kunt, Maksimovic 2002). There is some tendency for countries to become more market oriented as they become richer. Also, a low level of corruption, strong protection of shareholder rights and good accounting regulations tend to enhance market-based finance. However, an extensive deposit insurance scheme seems to support

bank-based financial system development (Demirgüç-Kunt, Levine 1999). Nevertheless, what matters for economic development, is the overall sector development; the relative mix of banks and markets is less important (Demirguc-Kunt et al. 2011). However, this conclusion is drawn for developed economies.

Bank size seems to play an important role. Small businesses usually have difficulties in obtaining loans from big banks, whereas small banks specialize in lending to small businesses. In small banks, lending decision makers are usually close to their clients and thus gather soft information on firms, such as information about the character of the firm's managers, which can be effectively utilized in the lending decision. On the other hand, small banks are unable to finance big firms, as banks control risks by diversified lending portfolios. Big banks, in which lending decisions are typically made at rather high levels, tend to pay more attention to standard information, such as the firm's financial statements, which are also more readily available to big firms. (Lin, Sun et al. 2009)

Literature on new structural economics highlights the evolving role of the financial sector in different stages of economic development (Demirguc-Kunt et al. 2011). Lin et al. (2009) point out that the optimal mix of banks and markets or of big and small banks depend on the economy's factor endowments. The relative composition of labor, capital and natural resources define the optimal structure for production, and the production structure defines the optimal financial sector. Capital intensive countries tend to have big production firms and thus are better served by a market-based financial system or by big banks, whereas labor intensive economies have smaller firms that are better served by smaller local banks. However, their work does not pay much attention to the role of natural resources, although it is recognized as the third initial endowment.

According to previous literature, resource-dependent economies indeed seem to suffer from many of the handicaps that can deter financial sector development. According to Bardhan (1997), resource abundance enhances rent-seeking and poor governance. Also, resource-rich economies

tend to under educate their people (Gylfason 2001). According to Auty (2001), there are four reasons why developmental states are associated with poor natural resource endowment: 1) low tolerance of the poor majority for rent extraction from the limited natural resources; 2) efficient use of scarce resources, and investments aimed at developing abundant assets such as human capital; 3) lacking booming commodities, resource poor countries have less incentive for trade policy closure; 4) diversification into competitive manufacturing begins at lower income levels.

All in all, the literature on the relationship between resource abundance and financial development is still scarce. Preliminary study by Beck (2011) suggests that economies dependent on natural resources have lower level financial development. Further, he argues that the underdevelopment is not due to low quality of the financial sector. Yuxiang and Chen (2011) find evidence from provincial panel data of China, that negative link between financial development and resource abundance exists. Nili and Rastad (2007) find that oil economies have lower levels of financial development and that financial development has a net dampening effect on investments in oil economies due to the low quality of financial intermediation. Berglof and Lehmann (2009) argue that in the case of Russia, financial sector development does not seem to have unleashed the sectors that are dependent on external financing in developed economies. Bank lending is still of limited importance for corporate investment in Russia.

2.3 Empirical research[2]

2.3.1 Data description

The data are mainly from the World Bank World Development Indicator (WDI) database, with additional financial sector indicators from Beck et al. (2010). To include as wide a range of countries as possible, we employ data for the period 1995 to 2009. We have three main reasons

[2] All empirical analysis was conducted using R software

for choosing this period. First, many studies on resource dependent economies thus far have used older data, which do not include the post-Soviet states. As there are many clearly resource-dependent economies in that region with a common history, it is reasonable to assume that leaving these countries out might cause some bias to the estimations. Second, according to Rajan and Zingales (2003a), financial sector development has only started to gather pace in the 1990s. Thus, regarding financial sector development, the past two decades are of the greatest significance. Third, we complement the WDI data using country specific mineral export statistics for diamond producing countries, where the data are not available for longer term. The sample data include all the 128 countries for which data were available. However, some variables are limited to a much smaller group. The time span is 15 years, and the panel is unbalanced. Countries are listed in Appendix 1.

In considering resources, we focus on point-source resources, which are those extracted from a narrow geographic or economic base, such as oil and other minerals (Isham, Woolcock et al. 2005). That is due to the fact that all mineral resources seem to cause problems for economies that can be broadly described as the resource curse, whereas e.g. land and forest resources do not cause similar problems (Murshed 2004). However, WDI data appear to have one deficiency: mineral exports comprise only energy and most of the important metals, whereas in some countries production and export of precious stones plays an important role. Thus, we used country-specific statistics to add the share of precious stones in total exports for major diamond producers where data were available[3]. The effect of precious stones, ignored in the WDI statistics, should be more thoroughly captured in our second indicator of resource dependence, non-manufacturing industrial production as a share of total production. However, that indicator also includes the

[3] Central Bank of Angola, Central Statistics Office of Botswana, Statistical yearbook of Congo republic, Ghana statistical service, Statistics Namibia

utilities sector. The third indicator of resource-dependence, subsoil assets, includes only the energy products and metals recorded by the World Bank (2006).[4]

The variables used to describe resource-dependence are as follows:

i. MEXPORT: share of minerals on total merchandise exports, our main variable for describing resource dependence. This is a commonly used indicator (e.g. Nili, Rastad 2007) of resource dependence. We use it to describe export dependence, preferring it to another often used indicator, mineral exports to GDP. Share of minerals in total exports indicates whether the external competitiveness of the economy depends totally on the minerals sector.

ii. MQPROXY: share of non-manufacturing production in total industrial production. It is used as a proxy to describe production dependence on mining and quarrying. These data are readily available from WDI database, but we have not seen it used earlier to describe resource dependence. Its strength is its availability, and its shortcoming is that it also includes the third industrial sector, the utilities sector.

iii. SUBSOIL: ratio of subsoil assets in 2000 to GDP (Brunnschweiler, Bulte 2008). This is used because it is an exogenous indicator of resource abundance. The first figures were collected by World Bank for 1995, but these were limited to a much smaller group of countries than the later observations in 2000 and 2005.

Following previous literature, we consider the following key variables as indicators of domestic financial sector development:

i. PCRED: ratio of commercial bank credit to private sector to GDP. This is our preferred measure of banking sector size, as it best describes the market-determined banking sector and is also very commonly used. (Levine et al. 2000)

[4] Recorded products include oil, gas, coal, bauxite, copper, gold, iron ore, lead, nickel, phosphate rock, silver, tin and zinc.

ii. M2: ratio of money supply (M2) to GDP. Money supply (often called also as broad money or liquid liabilities) is commonly used as an indicator of financial depth. This measure of banking sector size is broader than PCRED, as it includes the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. We use this indicator in addition to private credit, as it includes public sector or more precisely public enterprises as well, which might be of importance in resource-dependent economies. (Levine et al. 2000)

iii. RATESPREAD: interest rate spread between bank lending and deposits; used as an indicator for domestic banking sector quality (Koivu 2002).

Further, to achieve a more thorough analysis of financial sector characteristics, we use the following variables from Beck et al. (2010):

iv. STMKTCAP: ratio of domestic stock market capitalization to GDP, used as an indicator for domestic market-based sources for finance. (Levine, Zervos 1998)

v. INTLDEBT: ratio of international debt issues to GDP indicates degree of access to international capital markets. This measure includes international debt issues by government and state-owned enterprises.

vi. NRBLOAN: ratio of loans by non-resident banks to GDP, used to indicate the use of foreign bank loans as a source of finance. Again, this measure includes the public sector.

Correlation matrix and descriptive statistics for selected financial sector indicators are presented in Table 1. It is noteworthy that our main indicator of resource dependence, the mineral export share of total exports is highly correlated with the two other resource indicators. In other words, countries abundant with mineral resources and also countries extracting the resources also seem to export them.

Table 1. Summary statistics of selected variables

	Mineral export share, %	Non-manufacturing production share, %	Subsoil assets to GDP	Private credit to GDP, %	M2/GDP, %	Stock market capitalization/GDP	International debt issues/GDP	Loans from non-resident banks/GDP	GDP/cap USD
	1	2	3	4	5	6	7	8	9
Descriptive statistics									
Mean	27.06	47.91	0.94	39.26	42.97	46.88	17.29	20.34	5248
Std. Dev.	30.20	20.73	2.00	39.10	32.32	53.84	28.21	44.18	8733
Min	0.00	10.19	0.01	0.00	0.00	1.01	1.01	1.00	81
Max	99.67	98.35	11.62	231.10	242.24	340.29	344.39	379.12	42133
Obs	1692	1780	1713	1827	1817	1158	942	1740	1973
Correlations									
1	1								
2	0.8 ***	1							
3	0.73 ***	0.61 ***	1						
4	-0.22 ***	-0.14 ***	-0.22 ***	1					
5	-0.28 ***	-0.2 ***	-0.23 ***	0.8 ***	1				
6	0.04	0.03	-0.07 *	0.62 ***	0.49 ***	1			
7	-0.03	0.01	-0.09 *	0.26 ***	0.08 **	0.29 ***	1		
8	-0.15 ***	0.03	-0.12 ***	0.29 ***	0.23 ***	0.18 ***	0.39 ***	1	
9	-0.05	0.01	-0.1 **	0.68 ***	0.48 ***	0.43 ***	0.47 ***	0.18 ***	1

*Significance level for Pearson correlations of 10%, 5%, and 1% are indicated by *, ** and *** respectively.*

We also use several control variables (from WDI unless otherwise noted), the most important being GDP per capita, to control for income level, as richer countries tend to have a more developed financial sector even relative to GDP. Secondary school enrollment is used to indicate the level of education (Gylfason 2001). Foreign direct investment to GDP describes the foreign firms' participation in the economy. GDP growth is used, as rapid growth might hamper financial sector development, measured against GDP. Inflation is used to describe macroeconomic stability, and several studies have shown inflation to have a direct effect on financial sector development (Boyd et al. 2001). Goldman Sachs Commodity Index (GSCI) is used to control for raw materials prices, which can clearly affect the export share of commodities and also strongly influence some financial sector indicators, such as stock market capitalization, in resource-rich economies. Energy products account for roughly 79% of index composition, metals account for about 8% and the rest is other commodities. An index of economic freedom is used as a proxy for quality of institutions, as institutional underdevelopment has been argued to be a major cause of both the

resource curse (Auty 2001) and the low level financial sector development (Demirgüç-Kunt, Levine 1999). We also use bank concentration measured by the share of top three banks´ assets of total banking sector assets from Beck et al. (2010) as the structure of the banking sector might affect lending. Finally, we use a dummy variable for common law legal origin, as legal origin has been shown to have an effect on financial development (La Porta et al. 1998). The data for the legal origin are from the CIA World Factbook (2012), which covers all the countries for which the rest of our data were available. Summary statistics for control variables are available in Appendix 2.

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2.3.2 Models and results: piecewise linear regression

Multivariate regression analysis with panel data presents some challenges for the choice of the estimators. We use both pooled and fixed effects[5] estimators due to their different strengths. A pooled estimator takes into account all available information, but does not capture unobserved variables, whereas a fixed effects estimator controls for all time-constant variables, but is unable to estimate their specific contribution. Moreover, fixed effects estimators are inefficient for controlling slowly moving variables.(Wolf 2009)

Pooled model can however be used only in non-dynamic approach. When we use lagged values of dependent variables in the right hand side in equation in chapter 2.3.2.4, the pooled model is inconsistent. As the fixed effects estimator is in any case better suited to capture the uncontrolled country specific characteristics, we use the pooled model only for the preliminary estimations.

Using fixed effects estimator in dynamic panel data models is also problematic. The demeaning process creates bias in the estimate of the coefficient of the lagged dependent variable,

[5] The fixed effects estimator was chosen over the random effects estimator by the Hausman test

which in not mitigated by increasing individual units N (Nickell 1981). Increasing the time dimension does reduce the bias, but as Judson and Owen (1999) show, the bias still remains significant when T=20. In addition to fixed effects estimator, we thus use Anderson-Hsiao estimator to confirm the results.

Anderson and Hsiao (1981) suggest an approach, where they remove the fixed effect by first differencing the general equation

$$y_{it} = \alpha y_{it-1} + \beta x_{it} + e_{it}. \qquad (1)$$

As the first differenced errors $(e_{it} - e_{it-1})$ are correlated with the lagged first differenced independent variables, they recommend instrumenting for the $(y_{it-1} - y_{it-2})$ with either the level or the first difference of y_{it-2}. As the previous literature suggests that the lagged level is superior as an instrument (see e.g.Arellano, Bond 1991) we use only level as instrument in our estimations. According to simulations by Judson and Owen (1999), Anderson-Hsiao estimator is well suited for unbalanced panels where time dimension is more than 10. Simulation study by Gaduh (2002) agues however, that despite being consistent, AH-estimator is inferior to fixed effects estimator due to its inefficiency. Only when time dimension is as short as 5 periods, there is a strong case of using AH estimator or generalized method of moments estimator over fixed effects with parameter assumptions of a typical growth regression.

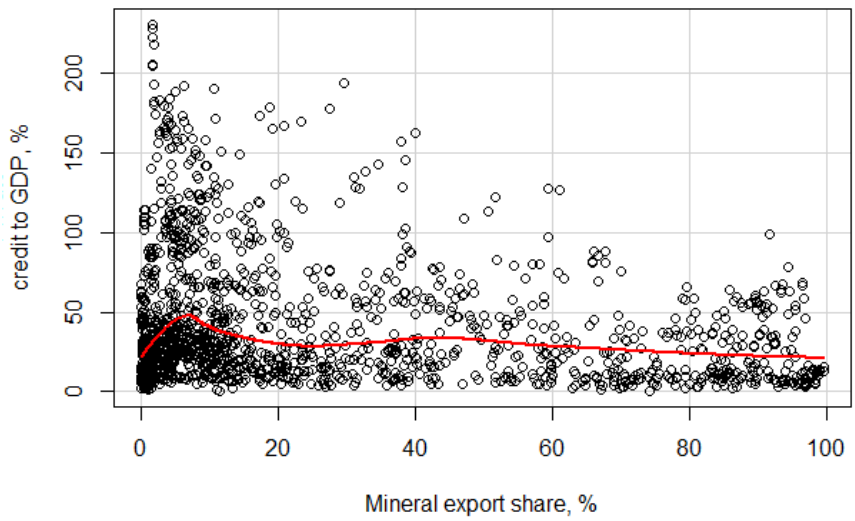
We use financial sector variables as dependent variables to determine whether the resource-dependence has a significant effect on financial sector characteristics. Following Nili and Rastad (2007) we use mineral export share of total merchandise exports as a base indicator for resource dependence. However, non-manufacturing production (MQPROXY) and subsoil wealth (SUBSOIL) are also used for robustness checks. Subsoil assets is clearly a more exogenous variable, as it is difficult to argue that financial sector size or any other variables would have a significant effect on the resource endowments of the country. Moreover, the prices at which those

resources are valued are also determined exogenously by international markets, where individual countries have little or no effect.

2.3.2.1 Locating the threshold

While the correlation between domestic banking sector size (PCRED and M2) and resource-dependence is negative and significant (table 1), it is not linear. Figure 1 plots the mineral export share and bank credit to the private sector. The smoothed line shows that, at very low mineral export share, the correlation is positive. This result is robust also to other indicators of resource dependence as well as to M2 as a banking sector indicator.

Figure 1 Mineral export share of total exports and private credit to GDP



Due to this property, we apply a piecewise linear regression to the data, following Hansen (1999). The general equation becomes

$$y_{it} = \mu_i + \beta_1 x_{it} I(q_{it} \leq \gamma) + \beta_2 x_{it} I(q_{it} > \gamma) + e_{it} \qquad (2)$$

where $I(.)$ is the indicator function, which equals 1 if true and 0 if false. Thus, the observations are divided into two regimes by the threshold γ. The regimes are distinguished by different regression slopes β_1 and β_2. Here, the idea is that only the coefficient of the resource indicator switches when the regime changes, as it is the key variable of interest.

Locating the threshold estimate and its confidence intervals from the scatterplot data depicted in Figure 1 was done by non-parametric methods by fitting a one knot degree one spline with 1000 bootstrap replications to equation

$$pcred_{it} = \mu_i + \beta_1(mexport_{it}) + e_{it}, \qquad (3)$$

Where $pcred_{it}$ equals logarithmic transformation of bank credit to private sector and $mexport_{it}$ equals the logarithmic transformation of mineral export share of total exports for country *i* in time *t*. The threshold level seen in figure 1 was located at $\log(\gamma_{MEXPORT}) = 1.806$ with 95% confidence interval [1.617, 2.036]. We then test for the significance of the located threshold using analysis of variance, comparing the linear model in equation 3 and the following form of piecewise linear model:

$$\begin{aligned} pcred_{it} &= \mu_i + \beta_1(mexport_{it})I(mexport_{it} \le 1.806) \\ &+ \beta_2 mexport_{it} I(mexport_{it} > 1.806) + e_{it}. \end{aligned} \qquad (4)$$

In equation 4, the coefficient for logarithmic transformation of mineral export share ($mexport_{it}$) changes when threshold level of 1.806 is reached. F-statistic with the corresponding p-value in table 2 shows that the located threshold is very significant.

As the estimated threshold level vs. M2 was also within that confidence interval, we use the same threshold level of mineral export share for both private credit and M2[6]. But no clear threshold for market-based financial sector indicators was found. Even though the threshold used

[6] Threshold for mexport when using M2 as independent variable was located at 1.626 and it was also found very significant

is reached already when about 6% of country's exports are minerals, almost one third of the observations are still below that threshold level. Similarly, the threshold level where the correlation coefficient changes sign is found for MQPROXY when the non-manufacturing production share equals 41% of total industrial production. Logarithmic threshold estimates with corresponding 95% confidence intervals are reported in table 3.

Table 2. Test for the significance of the located threshold

Test for the threshold level γ=1.806	
F-statistic	90.03
P-value	0.000

Table 3 Threshold estimates for mineral export share of total exports and non-manufacturing production share of total industrial production

	Estimate	95% confidence interval	Obs ≤ γ	Obs > γ
$\log(\gamma_{MEXPORT})$	1.806	[1.617, 2.036]	560	1132
$\log(\gamma_{MQPROXY})$	3.712	[3.405, 3.776]	852	928

2.3.2.2 Piecewise linear regression

We can now apply the located threshold level to the equation 1. We first estimate the domestic banking sector indicator, namely private sector credit to GDP. We also include estimations of interest rate spread, which we use as an indicator of domestic banking sector quality. We expect these variables to show whether banking sector structure depends on a country's resource dependence. The estimated equation for private credit as a dependent variable is of the following form:

$$
\begin{aligned}
pcred_{it} &= \mu_i + \beta_1 (mexport_{it-1}) I(mexport_{it-1} \leq 1.806) \\
&+ \beta_2 mexport_{it-1} I(mexport_{it-1} > 1.806) + \alpha_1 econf_{it} + \alpha_2 cpiyy_{it-1} \\
&+ \alpha_3 school_{it-1} + \alpha_4 gdppercap_{it-1} + \alpha_5 gdpgrowth_{it-1} \\
&+ \alpha_6 concentration_{it-1} + \alpha_7 FDI_{it-1} + \alpha_8 GSCI_{t-1} + \alpha_9 legal_i + e_{it}
\end{aligned}
\qquad (5)
$$

where the indicator function $I(.)$ equals 1 if the condition in the parenthesis is true and 0 if false. Sub index *i* refers to country and *t* to year. We use once lagged independent variables to reduce the risk of reverse causality. Only the index of economic freedom is not lagged further, as the index for each year is collected the previous year.

Second, we include other financial sector indicators, namely stock market capitalization, international debt issues and loans from non-resident banks, to estimate whether the roles of capital markets and foreign banks depend on a country's resource dependence. We also conduct dynamic analysis as well as several robustness checks to confirm the results.

2.3.2.3 Non-dynamic results

The existence of the threshold where coefficient of resource dependence as explanatory variable for financial sector development changes from positive to negative is an interesting result itself. That is to say that at low levels of resource dependence the relation is more intuitive, as natural resources wealth as any other wealth is assumed to support the financial sector development. Yet, at very low levels of resource dependence, when the share of mineral exports reaches 6% of total exports or non-manufacturing production share 41% of total industrial production, it appears that resources become a drag on financial development. Interestingly, the result seems to hold when extensive range of control variables is included in the regression. However, country fixed effects seem to control for this as the within estimator is negative and significant already at low levels of resource dependence.

Table 4 reports the regression results for credit to the private sector and stock market capitalization. The results for private credit are broadly in line with the preliminary study by Beck (2011). The high mineral export share of total exports explains the lower level of bank credit to the private sector in sample countries. In particular, the pooled estimator shows that the coefficient of mineral export share changes from small positive but insignificant to very significant negative as the threshold level is reached. Moreover, the result is not only statistically, but economically significant. An average country has mineral export share of 27% (table 1). An increase in export share by 10 percentage points to 37% would imply a drop of 3% in the share of private credit to GDP. Country fixed effects seem to capture the positive correlation between private credit and mineral export share at low levels of mineral exports, as the coefficient is negative and significant when the mineral export share of total exports is below the 6.1% threshold. On the contrary, stock market capitalization seems to be positively associated with high mineral export share.

Control variables are mostly as expected and also in line with previous studies. Index of economic freedom, secondary school enrollment, foreign direct investment and income level are positively correlated with financial sector size, when significant; whereas high inflation seems to hamper both banking sector and equity markets. High bank concentration seems to be associated with a smaller banking sector. Legal background as a binary and time-invariant variable appears only in the pooled model, but accords with previous literature in that common law legal origin seems to create a more favorable environment for financial sector development than do other legal backgrounds.

Table 4. Non-dynamic regression results for key variables

	Pooled estimator						**Within estimator**					
	pcred			*stmktcap*			*pcred*			*stmktcap*		
mexport> 6.1% (lag1)	-0.104	*0.011*	***				0.004	*0.016*				
mexport≤ 6.1% (lag1)	0.021	*0.023*					-0.059	*0.015*	***			
mexport (lag1)				0.055	*0.021*	***				0.074	*0.042*	*
econf	0.694	*0.174*	***	-0.313	*0.296*		1.222	*0.132*	***	0.705	*0.261*	***
cpiyy (lag1)	-0.431	*0.046*	***	-0.617	*0.085*	***	-0.090	*0.023*	***	-0.069	*0.057*	
school (lag1)	0.297	*0.048*	***	0.058	*0.124*		0.083	*0.064*		0.145	*0.172*	
gdp/cap (lag1)	0.249	*0.023*	***	0.431	*0.038*	***	1.100	*0.084*	***	1.307	*0.176*	***
gdpgrowth (lag1)	-0.266	*0.164*		-0.817	*0.276*	***	-0.013	*0.075*		-0.025	*0.143*	
concentration (lag1)	-0.224	*0.056*	***	-0.021	*0.085*		-0.124	*0.050*	**	-0.064	*0.090*	
FDI (lag1)	0.011	*0.098*		0.054	*0.179*		0.117	*0.045*	***	0.399	*0.103*	***
GSCI (lag1)	0.227	*0.050*	***	0.602	*0.071*	***	0.014	*0.031*		0.376	*0.059*	***
legal	0.290	*0.053*	***	0.827	*0.080*	***						
Obs.	1142			899			1142			899		
R^2	0.58			0.51			0.49			0.47		

*Standard errors are next to coefficients in italics. Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variables: "pcred": commercial banks' credit to private sector to GDP (%); "stmktcap": stock market capitalization to GDP (%). Independent variables: "mexport": mineral exports share of total merchandise exports (%); "econf": index of economic freedom;"cpiyy": consumer price inflation, year-on-year change (%);" school": gross secondary school enrollment (%); "gdp/cap": per capita GDP (USD); "gdpgrowth": GDP growth rate, year-on-year (%); "concentration": assets of top 3 banks of total bank assets; "FDI": foreign direct investment inflow to GDP (%); "GSCI": Goldman Sachs Commodity Index; "legal": binary variable for legal origin with 1=common law, 0=other. Country specific dummy variables were included but not reported.*

Appendix 3 confirms the regression results by using three other dependent variables, namely international debt issues, loans from non-resident banks and interest rate spread. International debt issues seem to be higher in countries with high mineral export share of total exports. When explaining the interest rate spread, the coefficient for mineral export share is insignificant, so we find no evidence that the smaller domestic banking sector in resource dependent countries would be due to low quality of financial intermediation. For all of these variables, the number of observations is clearly smaller than with estimations on private credit.

2.3.2.4 Dynamic results

Financial sector variables are likely to be persistent and typical business cycle might cause some of the effects observed in the first estimations. We now control for the business cycle component by using first and second lags of dependent variables as explanatory variables. The equation 5 now becomes:

$$\begin{aligned} pcred_{it} &= \mu_i + \alpha_1 pcred_{it-1} + \alpha_2 pcred_{it-2} + \beta_1 (mexport_{it-1}) I(mexport_{it-1} \le 1.806) \\ &+ \beta_2 mexport_{it-1} I(mexport_{it-1} > 1.806) + \alpha_3 econf_{it} + \alpha_4 cpiyy_{it-1} + \alpha_5 school_{it-1} \\ &+ \alpha_6 gdppercap_{it-1} + \alpha_7 gdpgrowth_{it-1} + \alpha_8 concentration_{it-1} + \alpha_9 FDI_{it-1} \\ &+ \alpha_{10} GSCI_{t-1} + e_{it} \end{aligned} \quad (6)$$

In addition to fixed effect estimator, we now use Anderson-Hsiao estimator (subsequently termed the AH estimator) to confirm the results. Here, we use only once lagged dependent variable in the right hand side of the equation and instrument it with the second lag level.

Table 5 presents dynamic regression results for private credit and stock market capitalization as the dependent variables. When explaining the private credit to GDP, the coefficient for mineral export share of total exports is negative when significant, so well in line with the preliminary results. The results by the AH estimator are somewhat surprising, as the coefficients of the lagged value of the dependent variables are low and not even significant for the stock market capitalization as the dependent variable.

The results from both the within estimator and AH estimator confirm our hypothesis and the first results from chapter 2.3.2.3, that market-based finance is likely to play a bigger role in resource dependent economies. Although Beck (2011) failed to find significant coefficient for resource dependence with stock market capitalization as the dependent variable, his result of more market based financial systems in resource dependent economies is in line with our result.

Table 5. Dynamic estimations for private credit and stock market capitalization as the dependent variables

	Within estimator						**AH-estimator**					
	pcred			*stmktcap*			*pcred*			*stmktcap*		
dependent (lag1)	0.810	*0.030*	***	1.177	*0.033*	***	0.320	*0.161*	**	-0.006	*0.084*	
dependent(lag2)	-0.065	*0.029*	**	-0.466	*0.030*	***						
mexport> 6.1% (lag1)	-0.010	*0.010*					0.012	*0.011*				
mexport≤ 6.1% (lag1)	-0.019	*0.009*	**				0.007	*0.011*				
mexport				0.051	*0.024*	**				0.073	*0.030*	**
econf	0.185	*0.086*	**	0.073	*0.148*		0.177	*0.136*		-0.033	*0.244*	
cpiyy (lag1)	-0.088	*0.015*	***	-0.019	*0.032*		-0.086	*0.014*	***	-0.063	*0.046*	
school (lag1)	0.007	*0.040*		0.243	*0.098*	**	-0.024	*0.076*		0.130	*0.197*	
gdp/cap (lag1)	0.211	*0.058*	***	0.573	*0.109*	***	0.719	*0.244*	***	1.861	*0.282*	***
gdpgrowth (lag1)	0.140	*0.047*	**	-0.185	*0.082*	**	0.021	*0.057*		-0.299	*0.083*	***
concentration (lag1)	-0.039	*0.031*		-0.049	*0.051*		-0.047	*0.042*		-0.004	*0.084*	
FDI (lag1)	0.035	*0.027*		0.014	*0.057*		0.028	*0.028*		0.143	*0.060*	**
GSCI (lag1)	0.047	*0.019*	**	0.068	*0.034*	**	0.082	*0.030*	***	0.148	*0.061*	**
Obs. Used	1091			822			1091			822		
R^2	0.814			0.846								

*Standard errors are next to coefficients in italics. Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variables: "pcred": commercial banks' credit to private sector to GDP (%); "stmktcap": stock market capitalization to GDP (%). Independent variables: "mexport": mineral exports share of total merchandise exports (%); "econf": index of economic freedom;"cpiyy": consumer price inflation, year-on-year change (%);" school": gross secondary school enrollment (%); "gdp/cap": per capita GDP (USD); "gdpgrowth": GDP growth rate, year-on-year (%);"concentration": assets of top 3 banks of total bank assets; "FDI": foreign direct investment inflow to GDP (%); "GSCI": Goldman Sachs Commodity Index. Country specific dummy variables were included in the within model, but not reported. Anderson-Hsiao estimator with second lag of the dependent variable as the instrument*

The previous results on the domestic banking sector are not as strong if we use liquid liabilities (M2) as the dependent variable (Appendix 4). Thus, when the public sector is accounted for in the banking sector size measure, we find no evidence that resource dependence has a dampening effect on the banking sector in resource-rich countries. The low level of bank lending to private sector might be explained by a smaller private sector.

All in all, the introduction of business cycle component using lagged values of the dependent variable in the right had side of the equation does capture a big part of the relationship between resource dependence and financial sector detected in the first non-dynamic estimations, but it does not fully eliminate the effect. According to our estimations, high level of resource dependence hampers private credit in the domestic banking sector and supports market-based financing. It appears that the financial sector structure in resource-dependent economies indeed serves well the financial needs of big well-known firms. That is, domestic bank loans are less common, whereas the use of stock markets is more common. However, that results in an especially challenging environment for small and medium size enterprises as well as for emerging businesses, which are known to be more dependent on domestic banks. We thus suggest that financial sector structure is likely to constrain economic diversification in resource-dependent economies.

2.3.2.5 Robustness checks

Cross-country regressions always pose several challenges. The first is obviously country heterogeneity, which is difficult to fully capture by estimators. In particular, correlations tend to be kinked at the extreme ends of the income distribution. We now repeat the estimations removing high income countries based on the World Bank income rank in 1995. Limiting the data to low and middle income countries reduces the outlier problem, as some rich countries have extremely large banking sectors. The sample of low and middle income countries includes 104 countries.

Regression results are reported in Table 6. The results are mostly unaltered. Resource export share is negatively correlated with bank lending to private sector. For low and middle income countries, the threshold where correlation between mineral export share and private credit turns negative when mineral exports account for 15% of total exports in the country (Appendix 5), so the threshold level is slightly higher than when rich countries were included. Again, the country fixed effects seem to control for this phenomenon. We find no significant coefficient for the resource dependence with the AH-estimator in explaining private credit. Also in line with earlier regressions, stock market capitalization seems to be higher in resource-dependent countries according to both within and AH-estimator.

Table 6. Regressions repeated with low and middle-income economies

	Within estimator						**AH-estimator**					
	pcred			*stmktcap*			*pcred*			*stmktcap*		
dependent (lag1)	0.854	*0.032*	***	1.156	*0.037*	***	0.261	*0.123*	**	0.029	*0.093*	
dependent(lag2)	-0.095	*0.031*	***	-0.436	*0.034*	***						
mexport> 15% (lag1)	-0.015	*0.009*	*				0.012	*0.009*				
mexport≤ 15% (lag1)	-0.013	*0.009*					0.004	*0.009*				
mexport (lag1)				0.068	*0.026*	**				0.067	*0.032*	**
econf	0.195	*0.086*	**	0.248	*0.168*		0.212	*0.120*	*	0.164	*0.264*	
cpiyy (lag1)	-0.090	*0.014*	***	-0.004	*0.035*		-0.085	*0.013*	***	-0.058	*0.048*	
school (lag1)	-0.001	*0.042*		0.261	*0.120*	**	0.024	*0.070*		0.193	*0.217*	
gdp/cap (lag1)	0.177	*0.058*	***	0.522	*0.126*	***	0.826	*0.199*	***	1.784	*0.309*	***
gdpgrowth (lag1)	0.153	*0.047*	***	-0.143	*0.092*		0.013	*0.050*		-0.287	*0.091*	***
concentration (lag1)	-0.024	*0.032*		-0.065	*0.058*		-0.058	*0.040*		-0.051	*0.092*	
FDI (lag1)	0.033	*0.028*		0.016	*0.067*		0.055	*0.027*	**	0.125	*0.069*	*
GSCI (lag1)	0.058	*0.021*	***	0.076	*0.046*		0.065	*0.029*	**	0.176	*0.072*	**
Obs. Used	940			646			940			646		
R^2	0.84			0.85								

*Standard errors are next to coefficients in italics. Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variables: "pcred": commercial banks' credit to private sector to GDP (%);"stmktcap": stock market capitalization to GDP (%). Independent variables: "mexport": mineral exports share of total merchandise exports (%); "econf": index of economic freedom;"cpiyy": consumer price inflation, year-on-year change (%);" school": gross secondary school enrollment (%); "gdp/cap": per capita GDP (USD); "gdpgrowth": GDP growth rate, year-on-year (%);"concentration": assets of top 3 banks of total bank assets; "FDI": foreign direct investment inflow to GDP (%); "GSCI": Goldman Sachs Commodity Index. Country specific dummy variables were included in the within model, but not reported. Anderson-Hsiao estimator with second lag of the dependent variable as the instrument.*

Measures of resource-dependence are often criticized when used in identifying the resource curse. There is a risk that resource-dependence is endogenous to the level of economic development (e.g. Frankel 2010). However, the level of overall economic development is controlled for in our regressions by GDP level. Nevertheless, we have other indicators of resource dependence as described in chapter 2.3.1. First, we use the non-manufacturing share of industrial production as the independent variable in explaining the financial sector variables. Results are depicted in Table 7. Again, the regression results for credit to private sector seem robust to earlier results. The coefficients for low and high level of resource dependence are very similar, but always

negative and significant, so it appears that in countries with high non-manufacturing production share of industrial production, the bank lending to private sector is lower relative to GDP.

Table 7 Regressions repeated with non-manufacturing production share as the resource indicator

	Within estimator			**AH-estimator**		
	pcred			*pcred*		
dependent (lag1)	0.825	*0.031*	***	0.348	*0.153*	**
dependent (lag2)	-0.066	*0.030*	**			
mqproxy> 41% (lag1)	-0.086	*0.043*	**	-0.042	*0.049*	
mqproxy≤ 41% (lag1)	-0.091	*0.045*	**	-0.044	*0.051*	
econf	0.182	*0.089*	**	0.173	*0.139*	
cpiyy (lag1)	-0.084	*0.014*	***	-0.087	*0.014*	***
school (lag1)	0.000	*0.043*		0.038	*0.082*	
gdp/cap (lag1)	0.176	*0.060*	***	0.525	*0.225*	**
gdpgrowth (lag1)	0.125	*0.048*	***	0.045	*0.059*	
concentration (lag1)	-0.040	*0.033*		-0.061	*0.045*	
FDI (lag1)	0.035	*0.030*		0.042	*0.035*	
GSCI (lag1)	0.052	*0.020*	**	0.084	*0.031*	***
Obs.	1068			1068		
R^2	0.71					

*Standard errors are next to coefficients in italics. Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variable: "pcred": commercial banks' credit to private sector to GDP (%). Independent variables: "mqproxy": non-manufacturing production share of total industrial production (%); "econf": index of economic freedom;"cpiyy": consumer price inflation, year-on-year change (%);" school": gross secondary school enrollment (%); "gdp/cap": per capita GDP (USD); "gdpgrowth": GDP growth rate, year-on-year (%);"concentration": assets of top 3 banks of total bank assets; "FDI": foreign direct investment inflow to GDP (%); "GSCI": Goldman Sachs Commodity Index. Country specific dummy variables were included in the within model, but not reported. Anderson-Hsiao estimator with second lag of the dependent variable as the instrument.*

Reverse causality cannot totally be ruled out in these regressions, even though we use once lagged independent variables. However, we do have a good exogenous variable for resource wealth, subsoil assets, which can be used at least as a strong argument that financial sector structure yields from the endowment structure, not the other way around. However, as we have only one observation for subsoil assets, we calculate country averages. The results are depicted in Table 8. Again the results seem very robust for private credit, so that a higher ratio of subsoil assets to GDP pairs with a lower level of credit to the private sector. However, we fail to find a significant coefficient for resource-dependence when stock market capitalization is the dependent variable.

Omitted variable bias is tackled by using the fixed effects estimator but obviously remains present. Risk of spurious regression, though existent, is not severe in our view, given that resources must be considered an initial endowment. Of course, resources are valued with market prices, which are often driven by benign global economic developments. Strong global growth is likely to support most countries' growth and thus financial sector development. However, we control for both resource prices business cycle and GDP growth in our regressions.

Table 8. Regression results for country averages

	OLS Estimator for country averages					
	dependent variable is pcred			*dependent variable is stmktcap*		
independent variables	*Coefficient*	*Std. Error*		*Coefficient*	*Std. Error*	
subsoil assets	-0.071	*0.029*	**	0.084	*0.055*	
econf	0.277	*0.617*		0.908	*1.340*	
cpiyy	-0.621	*0.197*	***	0.522	*0.476*	
school	0.528	*0.154*	***	0.381	*0.438*	
gdp/cap	0.231	*0.076*	***	0.136	*0.156*	
gdpgrowth	-0.327	*1.014*		-5.528	*2.301*	*
fdi	-0.793	*0.433*	*	-1.027	*0.953*	
legal	0.279	*0.156*	*	0.408	*0.281*	
M2				1.250	*0.245*	***
Obs.	112			82		
R^2	0.66			0.59		

*Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variables: "pcred": commercial banks' credit to private sector to GDP (%), country average for 1995-2009;"stmktcap": stock market capitalization to GDP (%)country average for 1995-2009. Independent variables: "subsoil": subsoil assets in 2000 to GDP; "econf": index of economic freedom, country average for 1995-2009; "cpiyy": consumer price inflation, year-on-year change (%),country average for 1995-2009; " school": gross secondary school enrollment (%,)country average for 1995-2009; "gdp/cap": per capita GDP (USD), country average for 1995-2009; "gdpgrowth": GDP growth rate, year-on-year (%),country average for 1995-2009; "fdi": foreign direct investment inflow to GDP (%),country average for 1995-2009 ; "legal": binary variable for legal origin with 1=common law, 0=other; "M2": money supply (M2) to GDP(%)*

2.4 Interpretation of the results

Very little research has been done on the link between financial sector and natural resources. Most microeconomic studies on financial needs of firms concentrate on the manufacturing sector (e.g. Cetorelli and Gambera 2001, Rajan and Zingales 1998)). Moreover, while macroeconomic research on resource-dependent economies is extensive, it is focused more on economic growth. Thus, there are plenty of open issues related to financial sector's role in resource-dependent economies. Here we suggest three alternative hypotheses on why the financial sector has the above described characteristics in resource-dependent economies.

2.4.1 Demand hypothesis

The most obvious reason for an underdeveloped banking sector in resource-dependent economies is based on a low level of demand for banking services by resource firms. However, as there has been very little empirical work done on financial needs of big resource firms, this hypothesis remains for future research.

Resource firms tend to be big compared to the size of the economy in developing economies in particular. Again, very little academic research has been done on this rather intuitive issue, but some evidence can be presented by using Forbes Global 2000 list of the biggest public enterprises in the world. Limiting the sample to non-financial firms, the list includes 1431 firms. Further, 203 of those firms or 14% are mineral production firms. When the analysis is limited to the biggest 300 firms or 209 biggest non-financial firms, the share of mineral production companies is already 20%. When removing the companies based in rich countries by the World Bank classification, the percentage share of mineral producing companies is 23% for the full sample and 74% of the sample including the biggest 300 firms globally. Thus, it seems to be the case, that in particular in developing economies, the biggest companies are mineral production firms.

When resource firms invest, their investments can easily be big relative to the banking sector size especially in developing economies due to bulkiness of investments (Berglof, Lehmann 2009). Thus, bank-based finance might be difficult to obtain, as banks might find it difficult to sufficiently diversify their loan portfolios. Due to their size however, resource firms achieve economies of scale in market-based finance (Lin et al. 2009), which would explain the use of equity and debt markets. Firm size also helps in the capital markets due to the fact that big resource firms tend to be well known by international investors. Government involvement might also have an effect on financial sector structure. As government ownership often plays a big role in the resource sector (Wolf 2009), resource firms are likely to have better access to international capital markets.

An interesting implication of this theory is the low level of economic diversification in resource-dependent countries. That is, as Rajan and Zingales (1998) argue, a developed banking sector enhances the development of industries that require a great deal of external funding. These industries tend to be high value added manufacturing sectors such as pharmaceuticals and IT, that is, exactly those industries that would support economic diversification in resource-dependent economies. Following the reasoning by Lin et al. (2009), a financial sector built on the needs of big firms tends not to serve smaller firms well. That is likely to further deter the development of the vital SME sector.

The shortcoming of this demand theory is that the financial sector tends to be subject to significant regulation, especially in developing economies. Typically, there is regulation on capital requirements and other risk monitoring for banks. Also, regulation of entry is not uncommon (Rajan, Zingales 2003a). Thus, we are not convinced that financial markets are formed solely to meet market-determined demand. The financial sector continues to gather substantial political attention even in the most developed countries, so that undistracted development of financial markets in developing economies seems rather unrealistic.

2.4.2 Interest group hypothesis

Rajan and Zingales (2003b) present an interest group theory on financial sector development according to which incumbents in different sectors might want to thwart financial sector development because finance disproportionally supports new entrants and thus spurs competition. However, trade openness reduces incumbent opposition to financial development, as expanding product markets add to incumbents' own funding needs.

Although the interest group theory was not originally designed to describe the behavior of the resource sector, we find this theory useful for analyzing resource-dependent economies. Interestingly, the resource sector is not likely to push for economic developments that are typically needed by the manufacturing sector. Following the reasoning by Rajan and Zingales (2003b),

resource-rich countries are likely to have a strong elite built around the resources, which has very little interest in developing the country so as to favor the manufacturing sector. The resource sector does not need masses of educated labor force or immaterial property rights, as the sector typically does not actively pursue innovation. The elite with access to resource rents have much influence over politicians or are directly involved in politics and have thus no interest in promoting a more democratic state. The legal environment is also of little importance, as once again the elite have sufficient power to advance their own interests, which is perhaps even easier to do with a weaker rule of law. Public protection of property rights is not necessary, as it can be replaced by private protection of property rights (Sonin, 2003). Market conditions are mostly determined exogenously, as the resource sector is highly dependent on global commodity prices.

The threat to the resource elite lies in the fact that it does not require much special knowledge to manage resources. Thus, the incumbents in the resource sector can be displaced at any time, if entrants gain sufficient political and financial power. As Rajan and Zingales (2003a) argue, the financial sector is a significant factor in supporting entrants, thus the development of the financial sector actually creates a threat to incumbents in the resource sector. Moreover, trade openness rarely changes the situation, as international trade barriers usually do not concern minerals, at least not energy products. Moreover, firms in resource sector tend to be big and well-known and thus have access to global financial markets.

Thus, in addition to the fact that the resource sector does not need domestic banking services, it is reasonable to assume that it does not even want a highly developed domestic financial sector. This theory would also extend the grabbing hand theory introduced by Frye and Shleifer (1997). Perhaps not only government, but also an influential group of resource sector firm managers will have little interest in supporting law enforcement.

2.4.3 Volatility hypothesis

Van der Ploeg and Poelhekke (2009) suggest that volatility is an important but overlooked channel of the resource curse. Although macroeconomic volatility is likely to dampen growth through several channels, it is probably also a factor behind underdevelopment of the financial sector in resource-dependent economies. Boyd et al. (2001) provide empirical evidence that even predictable increases in the inflation rate produce disturbances in the financial sector. Similarly, volatility of GDP growth, terms-of-trade and the real exchange rate, caused by significant uncertainty related to commodities prices, could deter financial sector development.

Berglof and Lehmann (2009) note that resource-dependent economies tend to suffer from the bulkiness of investments and thus lack more sustainable demand for financial services. Roe and Siegel (2011) argue that political instability is another major obstacle for financial sector development. Especially in early stages of development, resource-rich countries tend to be particularly vulnerable to political instability. Preliminary study by Hattendorff (2014) shows that export concentration is harmful for banking sector development.

Aghion et al. (2004) use an open economy model to show that countries with intermediate levels of financial development are likely to suffer most from macroeconomic volatility as well as from capital account liberalization. As resource dependent economies[7] are scarce among the financially developed countries, they are likely to be vulnerable to macroeconomic volatility.

However, the causality remains subject to debate, as Van der Ploeg and Poelhekke (2009) show that financially underdeveloped countries are likely to suffer from higher volatility, whereas

[7] *Resource-dependent countries here are countries where mineral export share of total exports is greater than 40% on average in 1995-2009.Those countries in our sample include Algeria, Angola, Australia, Azerbaijan, Bahrain, Bolivia, Botswana, Cameroon, Chile, Republic of Congo, Ecuador, Egypt, Gabon, Guinea, Iran, Kazakhstan, Kuwait, Libya, Mauritania, Mongolia, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Peru, Qatar, Russia, Saudi Arabia, Sudan, Syria, Tajikistan, Trinidad and Tobago, United Arab Emirates, Venezuela, Yemen and Zambia.*

many studies (e.g., Boyd et al., 2001) suggest that the financial sector is not likely to develop in a volatile environment. However, as the main source of volatility in resource dependent economies is commodity prices, which are exogenous, we expect commodity price volatility to cause the overall volatility in these economies.

2.5 Conclusions

This paper presents empirical evidence on the previously neglected question of how resource wealth affects a country's financial sector structure and suggests that the banking sector characteristics might be one of the factors reinforcing the resource curse.

Using an extensive dataset covering 128 countries, we present empirical evidence that the banking sector indeed tends to be smaller in resource-dependent economies, even when controlling for several other factors which have been shown to have a significant effect on financial sector development in previous studies. Intuition says that resource wealth, like any other wealth, should be benign for financial development. Indeed, that seems to be the case at very low levels of resource dependence. We locate a threshold where the country's mineral exports account for about 6% of total exports. With export dependence on minerals above the threshold level, correlation between resource export share and domestic banking sector size turns negative. This phenomenon however, is captured by country fixed effects.

Evidence for a smaller role of domestic credit to private sector and higher stock market capitalization in resource dependent economies is strong, as it is confirmed by several estimation techniques and different indicators of resource dependence.

There are several possible reasons for the underdevelopment of domestic banking sector and bigger role of market-based finance. Theoretically, a country's production structure is formed on the basis of its initial endowments, that is, labor, capital and natural resource wealth. Thereupon, the financial sector is formed on the basis of the needs of the production sector. According to

previous literature, big firms are likely to be best served by big banks or by capital markets, as their financing needs can be large relative to domestic bank assets, especially in developing economies. The literature also suggests that macroeconomic volatility due to volatile resource prices is likely to hamper domestic banking sector development. Thus, our results are well in line with the previous literature.

We suggest three alternative hypotheses for the low level of financial sector development in resource-dependent economies. First, demand hypothesis is based on the assumption that the financial sector is formed according to the needs of the most prominent sector of the economy, the resource sector. Second, interest group hypothesis assumes more imperfect markets, with strong elite hampering the financial sector development to prevent increasing competition. Third, we present volatility hypothesis, which suggests that the macroeconomic volatility caused by cyclical raw materials prices might deter financial sector development.

Whatever the reason behind the financial development in resource-dependent economies, the financial sectors in those countries seem to have characteristics that are unfavorable to small and medium size enterprises and emerging businesses, which tend to be more dependent on the domestic banking lending than are the bigger and more mature firms. Consequently, we argue that financial sector development based on large resource endowments might play a role in the resource curse. A financial sector that is structured to serve large firms is perhaps unable to serve emerging sectors of the economy and thus restrains economic diversification.

However, very little research has been done on the financial sector's role in resource-dependent economies. Both determinants of observed financial sector development and the effect of financial structure for future economic development remain open for study.

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Appendix

Appendix 1. Sample countries and their sample means for mineral exports and private credit

	Country	*Mineral export share of total exports, %*	*Bank credit to private sector/GDP, %*
1	Algeria	97.1	8.9
2	Angola	98.5	6.6
3	Argentina	16.6	17.3
4	Armenia	28.6	8.6
5	Australia	43.2	96.3
6	Azerbaijan	82.7	7.2
7	Bahrain	85.6	67.6
8	Bangladesh	0.6	28.8
9	Belarus	26.2	13.4
10	Belize	16.7	54.8
11	Benin	1.4	13.4
12	Bolivia	53.3	49.7
13	Botswana	84.2	15.7
14	Brazil	14.2	37.0
15	Bulgaria	22.4	34.1
16	Burkina Faso	0.9	13.2
17	Burundi	3.9	22.8
18	Cambodia	0.5	8.8
19	Cameroon	51.6	8.8
20	Canada	22.2	135.9
21	Cape Verde	0.2	41.7
22	Central African Republic	21.5	5.6
23	Chile	51.2	76.1
24	China	4.5	109.5
25	Colombia	39.4	29.9
26	Congo, Rep.	86.9	5.3
27	Costa Rica	1.6	27.9
28	Croatia	13.8	42.8
29	Cyprus	8.7	120.5
30	Czech Republic	5.2	49.3
31	Denmark	7.6	97.2
32	Djibouti	6.8	30.6
33	Dominican Republic	4.1	31.4
34	Ecuador	45.1	26.0
35	Egypt, Arab Rep.	47.4	53.2
36	El Salvador	4.4	41.3
37	Estonia	10.6	50.7
38	Ethiopia	1.4	19.6
39	Fiji	0.8	35.5
40	Gabon	84.8	9.6
41	Gambia, The	2.5	13.4
42	Georgia	27.5	11.9

	Country	Mineral export share of total exports, %	Bank credit to private sector/GDP, %
43	Ghana	34.7	11.4
44	Guatemala	7.0	23.0
45	Guinea	70.8	4.0
46	Guinea-Bissau	0.5	5.9
47	Guyana	37.1	53.9
48	Honduras	6.5	38.2
49	Hungary	4.4	38.9
50	Iceland	21.2	89.6
51	India	11.5	33.6
52	Indonesia	32.1	32.7
53	Iran, Islamic Rep.	83.0	34.9
54	Israel	1.6	80.5
55	Jamaica	13.2	21.9
56	Japan	2.4	195.7
57	Jordan	17.6	79.2
58	Kazakhstan	71.8	22.8
59	Kenya	12.3	28.3
60	Korea, Rep.	6.5	89.0
61	Kuwait	91.7	57.8
62	Kyrgyz Republic	21.1	7.1
63	Latvia	6.7	40.0
64	Lebanon	10.1	63.9
65	Lesotho	0.1	13.7
66	Libya	93.7	20.4
67	Lithuania	21.6	26.5
68	Macedonia, FYR	10.7	24.7
69	Madagascar	7.7	9.6
70	Malawi	0.4	7.8
71	Malaysia	11.9	126.7
72	Mali	2.7	16.8
73	Malta	1.2	108.4
74	Mauritania	60.2	21.2
75	Mauritius	0.5	63.4
76	Mexico	13.4	20.0
77	Moldova	3.3	18.4
78	Mongolia	54.8	20.5
79	Morocco	12.4	54.6
80	Mozambique	47.1	12.9
81	Namibia	49.1	46.2
82	Nepal	1.5	29.1
83	New Zealand	7.5	117.2
84	Nicaragua	2.1	27.5
85	Niger	59.3	6.3

	Country	Mineral export share of total exports, %	Bank credit to private sector/GDP, %
86	Nigeria	96.2	15.0
87	Norway	66.4	78.9
88	Oman	83.0	35.8
89	Pakistan	3.0	25.4
90	Panama	6.0	88.3
91	Paraguay	0.7	25.4
92	Peru	58.1	22.6
93	Philippines	4.6	41.6
94	Poland	10.1	28.1
95	Qatar	89.1	33.8
96	Romania	11.8	15.3
97	Russian Federation	61.5	20.6
98	Rwanda	26.7	9.7
99	Samoa	0.5	32.7
100	Saudi Arabia	89.6	54.9
101	Senegal	24.7	19.2
102	Slovak Republic	8.6	42.4
103	Slovenia	5.6	38.8
104	South Africa	28.8	132.2
105	Sri Lanka	1.9	30.1
106	Sudan	53.4	5.7
107	Suriname	10.8	16.7
108	Swaziland	1.1	16.7
109	Sweden	6.6	100.0
110	Switzerland	4.9	162.2
111	Syrian Arab Republic	63.6	11.1
112	Tajikistan	69.7	16.9
113	Tanzania	11.1	8.1
114	Thailand	4.2	119.5
115	Togo	23.5	17.3
116	Trinidad and Tobago	61.1	37.3
117	Tunisia	12.4	65.9
118	Turkey	5.2	21.4
119	Uganda	4.0	7.7
120	Ukraine	14.7	23.0
121	United Arab Emirates	79.8	58.2
122	United States	5.4	170.7
123	Uruguay	2.7	35.4
124	Venezuela, RB	87.5	13.9
125	Vietnam	22.3	51.0
126	Yemen, Rep.	94.1	6.0
127	Zambia	76.5	8.7
128	Zimbabwe	20.2	30.6

Appendix 2. Summary statistic for control variables

	Consumer price inflation, % y/y	Index of economic freedom	Foreign direct investments to GDP	GDP growth, % y/y	GDP per capita, USD	Goldman Sachs commodity price index	Secondary school enrollment	Bank concentration	Mineral export share of total exports, %	Bank credit to private sector/GDP, %
Descriptive statistics										
Mean	8.8	58.7	4.1	2.8	5248.2	299.4	67.9	0.70	27.06	39.26
Std. Dev.	12.9	9.9	6.6	4.9	8732.6	142.5	31.1	0.20	30.20	39.10
Min	-9.8	22.7	-16.6	-29.6	80.6	154.2	5.2	0.12	0.00	0.00
Max	128.4	82.6	77.4	65.8	42132.9	640.3	161.8	1	99.67	231.10
Obs	1864	1869	1936	1970	1973	15	1832	1634	1692	1827
Correlations										
CPI	1									
econf	-0.19 ***	1								
FDI	-0.03	0.09 ***	1							
GDP growth	-0.10 ***	-0.09 ***	0.16 ***	1						
GDP per cap	-0.09 ***	0.58 ***	-0.03	-0.11 ***	1					
GSCI	-0.04	0.06 **	0.19 ***	0.21 ***	0.01	1				
school	-0.03	0.46 ***	0.18 ***	0.13 ***	0.57 ***	0.10 ***	1			
concentration	0.04	-0.12 ***	0.15 ***	0.01	-0.06 **	0.00	-0.07 **	1		
mexport	-0.01	-0.18 ***	0.01	0.02	-0.07 **	0.07 **	-0.01	0.11 ***	1	
pcred	-0.12 ***	0.57 ***	0.04	-0.09 ***	0.72 ***	0.08 ***	0.48 ***	-0.15 ***	-0.24 ***	1

*Significance level for Pearson correlations of 10%, 5%, and 1% are indicated by *, ** and *** respectively.*

Appendix 3. Non-dynamic results for additional financial sector variables

	Within estimator					
	intldebt		*nrbloan*		*rate_spread*	
mexport (lag1)	0.119	*0.066* *	0.056	*0.045*	-0.011	*0.008*
econf	0.166	*0.369*	2.091	*0.267* ***	-0.369	*0.067* ***
cpiyy (lag1)	0.070	*0.075*	0.123	*0.057* **	0.072	*0.012* ***
school (lag1)	0.029	*0.264*	-0.915	*0.177* ***	0.068	*0.034* **
gdp/cap (lag1)	0.622	*0.247* **	1.202	*0.185* ***	-0.140	*0.040* ***
gdpgrowth (lag1)	-0.890	*0.186* ***	-0.976	*0.144* ***	-0.105	*0.036* ***
concentration (lag1)	0.447	*0.113* ***	-0.037	*0.090*	0.021	*0.023*
FDI (lag1)	-0.030	*0.132*	0.278	*0.104* ***	-0.006	*0.022*
GSCI (lag1)	-0.008	*0.082*	-0.106	*0.061* *	-0.032	*0.015* **
stmktcap (lag1)	0.058	*0.047*	0.218	*0.034* ***		
Obs.	687		872		1027	
R^2	0.13		0.41		0.21	

*Standard errors are next to coefficients in italics. Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variables: "intldebt": international debt issues to GDP(%); "nrbloan": loans from non-resident banks to GDP (%);"rate spread": interest rate spread between lending and deposit rates(%-points). Independent variables: "mexport": mineral exports share of total merchandise exports (%); "econf": index of economic freedom;"cpiyy": consumer price inflation, year-on-year change (%);" school": gross secondary school enrollment (%); "gdp/cap": per capita GDP (USD); "gdpgrowth": GDP growth rate, year-on-year (%); "FDI": foreign direct investment inflow to GDP (%); "GSCI": Goldman Sachs Commodity Index; "stmktcap": stock market capitalization to GDP (%).Country specific dummy variables were included but not reported.*

Appendix 4. Estimations for liquid liabilities to GDP as the dependent variable

	Within estimator			**AH-estimator**		
	M2			*M2*		
dependent (lag1)	1.015	*0.031*	***	0.206	*0.073*	***
dependent (lag2)	-0.236	*0.030*	***			
mexport> 6.1% (lag1)	-0.001	*0.005*		0.004	*0.006*	
mexport≤ 6.1% (lag1)	-0.006	*0.005*		-0.004	*0.006*	
econf	0.123	*0.044*	***	0.148	*0.062*	**
cpiyy (lag1)	-0.015	*0.008*	*	-0.014	*0.007*	*
school (lag1)	0.010	*0.022*		0.026	*0.042*	
gdp/cap (lag1)	0.070	*0.030*	**	0.436	*0.074*	***
gdpgrowth (lag1)	0.013	*0.025*		-0.048	*0.024*	**
concentration (lag1)	-0.048	*0.016*	***	0.000	*0.023*	
FDI (lag1)	0.007	*0.015*		0.018	*0.015*	
GSCI (lag1)	0.033	*0.010*	***	0.049	*0.016*	***
Obs. Used	1084			1084		
R^2	0.84					

*Standard errors are next to coefficients in italics. Significance level for 10%, 5%, and 1% are indicated by *, ** and *** respectively. Logarithmic transformations are used for both dependent and independent variables. Dependent variable: "M2": ratio of money supply (M2) o GDP (%). Independent variables: "mexport": mineral exports share of total merchandise exports (%); "econf": index of economic freedom;"cpiyy": consumer price inflation, year-on-year change (%);" school": gross secondary school enrollment (%); "gdp/cap": per capita GDP (USD); "gdpgrowth": GDP growth rate, year-on-year (%); "concentration": assets of top 3 banks of total bank assets; "FDI": foreign direct investment inflow to GDP (%); "GSCI": Goldman Sachs Commodity Index. Country specific dummy variables were included in the within model, but not reported. Anderson-Hsiao estimator with second lag of the dependent variable as the instrument*

Appendix 5. Threshold where mineral export share of total exports begins to be harmful for bank credit to private sector for low and middle income countries

	Estimate	95% confidence interval	Obs ≤ γ	Obs > γ
$\log(\gamma_{MEXPORT})$	2.703	[1.786, 3.839]	771	668

Test for the threshold level γ=2.038	
F-statistic	68.811
P-value	0.000

3 Natural resources and capital structure

3.1 Introduction[8]

In countries highly dependent on their mineral resource sectors, the observed lackluster economic development is sometimes characterized as a resource curse. Several factors which are known to be harmful for economic development, such as a lower level of education and poor governance, have been shown to be present in resource-dependent countries. It is not clear, however, whether a resource curse is merely the natural outcome of organizing an economy around its resource sector based on a country's factor endowments. If the resource industry does not need a particularly well educated labor force or a highly developed legal system, it is not surprising that those areas do not develop in countries with a large resource sector.

In this paper, we consider the link between resource sector and finance. Given the dominance of the resource sector in "cursed" countries, we presume that financial institutions there are focused on meeting the needs of the resource sector. Kurronen (2015) notes that resource-dependent economies tend to extend less domestic credit to the private sector and rely more heavily on market-based financial instruments than their non-resource-dependent counterparts. Here, we extend the discussion to firm level and consider how capital structure of a firm differs from other firms when it operates directly in the resource sector or otherwise happens to be located in a resource-dependent country.

[8] Older version of this chapter has been published as a BOFIT discussion paper No 10/2016

Following the reasoning of Lin, Sun & Jiang (2009), we argue that the production structure of a country is based on its factor endowments and its financial sector is based on the production structure. Our hypothesis is that financial sectors in resource-dependent countries are geared to serving large, well-known resource firms with considerable tangible assets. These conditions result in a financial infrastructure that may be challenging for small firms and emerging industries. We test our hypothesis using an extensive micro-level dataset containing financial data for listed firms in 70 countries. Listed firms in g eneral are larger on average than non-listed firms and enjoy easier access to external finance (Baum et al., 2011).

We contribute to the existing literature in two ways. First, we consider how the capital structure of a resource firm might differ from firms in other sectors. We present empirical evidence covering a wide range of countries that suggest resource firms tend to have less debt than other non-financial firms and that that debt has a longer maturity. Second, we show that other firms in resource-dependent countries are less indebted than their counterparts in other countries. For this reason, we argue that mere location in a resource-dependent country is a country-specific determinant of firm capital structure.

The remainder of this paper consists of four sections. Section 2 introduces the related literature. Section 3 discusses the data and methodology. Section 4 presents the empirical results. Section 5 concludes.

3.2 Capital structure of resource firms

Contrary to the classic assumption of Modigliani and Miller (1958), firms do not always choose debt levels optimal to their needs. The literature shows, for example, that, due to supply frictions, observed capital structures differ from those demanded by the firms (Faulkender and Petersen, 2006). Beck (2011) makes a similar assertion based on survey data of firms in resource-dependent countries.

Recent literature highlights firm- and industry-specific factors affecting the capital structure of firms. Frank and Goyal (2009) show that leverage tends to increase with firm size

and more tangible assets. Lower leverage, in turn, is related to higher profitability and high market-to-book ratios. They also find evidence that firms increase leverage when anticipate high inflation.

These results are not unambiguous, however. Considering data for nine Eastern European countries, Jõeveer (2013) finds that firms with a high share of tangible assets have lower leverage.

Fan et al. (2012) demonstrate that country-specific factors are more important in determining firm capital structure than the particular industry in which the firm does business. They also find that legal systems originating in common law are associated with lower debt ratios, whereas higher development level, higher corruption and the existence of an explicit bankruptcy code are related to higher debt ratios. Higher debt ratios are also observed in countries where the tax benefit of leverage is positive. This study further notes that debt maturity tends to be longer in countries with common law legal origins and shorter in more corrupt countries and in countries with large government bond markets. Specifically, the authors suggest that suppliers of capital influence the debt-ratio choices of firms. They find that leverage is higher in countries with deposit insurance, suggesting that the role of banking industry is important.

Jõeveer (2013) finds evidence for emerging countries that a large presence of foreign banks and high level of bank concentration coincide with lower leverage of firms.

Holmstrom and Tirole (1997) argue that lending to large firms is less vulnerable to credit supply shocks than lending to smaller or riskier firms. Further, borrowers facing relatively high agency costs are the first to face limitations in access to finance in a “flight to quality" (e.g. Bernanke et al., 1996). Given that resource firms are typically large, well-known and possess considerable tangible assets, we would expect a certain degree of immunity to supply shocks and easier access to finance for resource firms than other firms in resource-dependent countries.

Recent discussions in structural economics highlight the evolving role of the financial sector at various stages of economic development. As economies develop, they tend to become increasingly reliant on market-based finance. Moreover, a country's deviation from its optimal financial structure is reflected in depressed levels of economic activity (Demirguc-Kunt et al., 2011).

Lin et al. (2009) observe that the optimal mix of banks and markets or big and small banks depends on the economy's factor endowments. The relative composition of labor, capital and natural resources define the optimal structure for production, while the production structure defines the optimal financial sector. Capital- intensive countries tend to have big production firms and are thus better served by a market-based financial system or big banks. Labor-intensive economies, in contrast, have smaller firms better served by small, local banks. Unfortunately for our purposes, the authors merely acknowledge natural resources as an initial factor endowment without delving deeper into the specific role of natural resources.

Engerman and Sokoloff (2002) and Acemoglu et al. (2001) discuss colonial endowments. They note that colonies built around extractive industries or agriculture with large returns to scale tended to have weak property rights. In colonies settled by large groups of immigrants, in contrast, property rights tended to be stronger and levels of education and financial and economic development higher. As a result, beneficial institutions could not be said to be exogenously determined.

To the best of our knowledge, no paper in the literature investigates the capital structure of resource firms or the capital structure of firms in resource-dependent countries using micro-level data. In contributing to the existing literature, our hypothesis is that large resource assets lead to a resource-dependent economy with a financial sector geared to serving large resource firms. Smaller firms and emerging industries thus lack adequate access to financial services, thereby exacerbating the resource curse.

3.3 Data and methodology

3.3.1 Data description

Using firm data from Bloomberg, we gather financial data from companies included in the main equity indices of 73 countries over the period 2007–2013. For the largest equity market, the US, we use firms in the S&P500. A list of all the equity indices used appears in Appendix 6.

Our approach omits fully state-owned companies, which obviously play huge roles in many resource-rich countries. The problem is that financial information on such companies is often quite limited, which makes them anyway difficult to include in the data (Wolf, 2009). Other non-listed firms are also omitted due to data availability.

We also limit the data to non-financial firms and countries with observations for at least three firms. We remove observations with missing values on debt or assets and trim the data by excluding observations where book leverage exceeds four times the median absolute deviation from the median.[9] Our final sample consists of 4,319 non-financial firms over seven years and 25,373 firm-year observations from 70 different countries of domicile.

We measure capital structure with commonly used indicators (Fan et al., 2012). Book leverage, or more precisely, short-term and long-term interest-bearing debt to total assets is used as the main indicator of company leverage as this is the most available indicator on leverage. While ratios based on market values might be more relevant, managers focus on book leverage because debt is better supported by assets in place than by growth opportunities (Myers, 1977). Book leverage is also preferred because financial markets fluctuate considerably (as evidenced during our sample period). We use market leverage, i.e. short- and long-term interest-bearing debt to total market value of the firm as an alternative measure of leverage. To provide a more thorough picture of the capital structure of firms, we separately

[9] As we are very careful in removing outliers as the tails of distribution could contain valuable information, our approach initially excludes only 56 or 0.2% of firm-year observations. Thereafter, we test the robustness of the results with more restricted samples.

consider the ratio of short- and long-term debt to assets and the share of long-term debt to total debt as a measure of debt maturity. As the investments of resource firms tend to be bulky, we expect them to have debt with longer maturity than non-resource firms (Berglof and Lehmann, 2009).

As our firm-specific control variables, we use common measures of firm size, tangibility and profitability (see e.g. Titman and Wessels, 1988). Firm size is measured by taking a natural logarithm of the US dollar value of total assets. As a measure of tangibility, we use the amount of property, plant and equipment relative to total assets. Profitability is measured by cash from operations to total assets as it describes the capability of the firm to generate cash to finance investments. We also use market-to-book ratio as an additional firm-specific variable to describe growth opportunities.

Our country-specific control variables are mostly taken from the World Bank World Development Indicators (WDI). We use variables that the literature finds significantly related to capital structure measures, i.e. GDP growth rate, inflation, bank concentration, domestic lending to private sector, stock market turnover, corruption and profit tax rate.[10] We also include three binary variables: "developed" to indicate a country was classified as high income country by World Bank in 2008, "deposit insurance" to show the country has some sort of deposit insurance scheme, and "common law" to highlight common law origins of the legal system. Credit rating is taken from Standard and Poor's ratings as of 2011.

The summary statistics are presented in Table 9.[11] Both firm and country variables and their sources are described in detail in Appendix 7. The market variables in Table 9, the trading volume of equity markets and market-to-book ratio suffer extensively from missing values. We omit them from our regressions whenever the estimated coefficient for the variable in

[10] For some countries, we have only one observation for profit tax rate in 2013. As tax rates generally do not fluctuate much, we use this observation for all years. In any case, when we test the results without the indicator they remain very similar. For corruption, we have inverted the scale of original data for higher values to indicate more corrupt.
[11] Variable means by country are listed in Appendix 8.

question is insignificant to reduce the loss of observations. We do the same with bank concentration, credit to private sector and tangibility.

Table 9. Summary statistics of selected variables

Statistic	n	Mean	St. Dev.	Min.	Median	Max.
Book leverage	25,373	0.24	0.18	0.00	0.23	1.02
Market leverage	23,506	0.25	0.22	0.00	0.20	1.07
Maturity	25,373	0.53	0.36	0.00	0.62	1.00
St debt	25,373	0.09	0.12	0.00	0.05	1.00
Lt debt	25,373	0.15	0.15	0.00	0.12	1.02
Size	25,230	6.75	2.85	-9.39	7.13	13.59
Tangibility	23,018	0.34	0.24	0.00	0.31	1.02
Profitability	25,223	0.09	0.12	-3.32	0.08	1.68
Market-to-book	23,509	1.44	1.34	0.02	1.04	28.32
Corruption	25,373	-0.43	1.05	-2.53	-0.08	1.28
CPI	25,251	4.29	4.07	-4.86	3.27	40.64
Concentration	24,280	0.61	0.26	0.07	0.60	1.00
Private credit	24,135	1.09	0.58	0.11	1.13	2.24
Market activity	23,647	82.32	90.77	0.02	58.09	952.67
GDP growth	25,373	3.34	3.87	-14.81	2.96	19.59
GDP/cap	25,369	24,099.88	21,622.46	533.17	15,655.08	102,832.3
Profit tax	25,366	0.39	0.14	0.11	0.37	1.19

Variables: "Book leverage" – Total long- and short-term interest bearing debt to total assets; "Market leverage" – Total long- and short-term interest bearing debt to market value of the firm; "Maturity" – Long-term debt total debt; "St debt" – Short-term interest bearing debt to total assets; "Lt debt" – Long-term interest bearing debt to total assets; "Size" – Natural logarithm of assets in US dollars, millions; "Tangibility" – Fixed assets to total assets; "Profitability" – Cash from operations to total assets; "Market-to-book" – Market value to total assets; "Corruption" – Corruption, high value indicates more corrupt, "CPI" – Consumer price inflation, %, year-on-year; "Concentration" – The share of assets of the three largest banks of total bank assets; "Private credit" – Domestic credit to private sector, % of GDP; "Market activity" – Stock market turnover, % of GDP; "GDP growth" – Annual real GDP growth rate, %; "GDP/cap" – Gross domestic product in US dollars per capita; "Profit tax" – Profit tax, % of commercial profits.

We classify resource firms as firms that have GICS classifications in the industrial categories "Metals & Mining" and "Oil & Gas Exploration & Production" or its sub-industry categories "Oil & Gas Drilling," "Integrated Oil & Gas" or "Coal & Consumable Fuels." This gives us 580 individual firms and 3,501 firm-year observations.

Resource-dependent countries are defined as countries where minerals account for more than 40% of total exports on average during the sample period (Nili and Rastad, 2007). Because our purpose is to establish whether or not a given country's competitiveness is based

largely on minerals, we use mineral exports to total exports as our indicator of resource dependence. The alternative measure of mineral exports in excess of 10% of GDP is overbroad here as it captures countries such as Estonia, which has a very large export sector but modest resource endowments. Including such countries as resource-dependent would distort our findings.

Countries where minerals share of total exports exceeds 40% in our sample include Australia, Bahrain, Chile, Colombia, Egypt, Kazakhstan, Kuwait, Nigeria, Norway, Oman, Peru, Qatar, Russia, Saudi Arabia, South Africa, United Arab Emirates and Venezuela. However, as WDI data omits diamond producers, we follow Kurronen (2015) and add diamond exports data to major diamond producers where data was available. Thus, Botswana was included in the group of resource-dependent countries so we have 18 countries out of 70. The correlation matrix in Table 10 shows that more profitable firms have less debt and that bigger and more tangible firms use more debt, which is in line with Frank and Goyal (2009). Longer debt maturity is associated with larger firm size, jurisdictions with common law legal origins, lower rates of corruption and greater economic development. High rates of GDP growth, inflation and corruption seem to coincide with shorter debt maturity.

Among our control variables, corruption seems to be highly correlated with other explanatory variables. In particular, it is highly and negatively correlated with level of economic development, credit rating and level of bank credit to private sector.

Table 10. Correlation matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	Book leverage		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.08	0.00	0.00	0.22	0.00	0.00	0.01
2	Market leverage	0.79		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.00	0.63	0.00	0.00	0.00
3	Maturity	0.32	0.19		0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	St debt	0.58	0.54	-0.39		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.85	0.00
5	Lt debt	0.76	0.55	0.69	-0.08		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	Size	0.13	0.08	0.43	-0.18	0.30		0.21	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00
7	Tangibility	0.19	0.16	0.21	-0.02	0.25	-0.01		0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00
8	Profitability	-0.21	-0.31	0.06	-0.25	-0.07	0.08	0.10		0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.96	0.09	0.00
9	Market-to-book	-0.17	-0.42	-0.10	-0.12	-0.12	-0.04	-0.08	0.26		0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.53	0.00
10	Resource firm	-0.06	-0.08	0.02	-0.03	-0.05	-0.01	0.17	0.00	0.04		0.00	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.91	0.00	0.00	0.00
11	Resource country	-0.08	-0.10	-0.04	-0.05	-0.06	-0.10	0.07	0.04	0.05	0.03		0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	Corruption	-0.01	0.05	-0.41	0.29	-0.25	-0.51	0.09	-0.06	-0.02	-0.06	0.01		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	CPI	-0.03	0.04	-0.23	0.15	-0.15	-0.38	0.01	-0.03	-0.05	-0.03	0.15	0.54		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00
14	Concentration	-0.03	0.07	-0.05	0.01	-0.04	-0.04	0.05	-0.03	-0.15	-0.05	0.18	-0.20	-0.10		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	Private credit	0.05	0.00	0.27	-0.14	0.17	0.50	-0.17	0.03	0.03	-0.02	-0.32	-0.66	-0.54	0.04		0	0.00	0.00	0.00	0.00	0.00	0.00
16	Market activity	-0.01	-0.12	0.25	-0.18	0.13	0.47	-0.11	0.08	0.14	-0.01	-0.18	-0.46	-0.32	-0.21	0.63		0.00	0.00	0.00	0.00	0.52	0.00
17	Common law	-0.04	-0.14	0.33	-0.28	0.17	0.31	-0.03	0.10	0.11	0.12	-0.03	-0.57	-0.16	-0.08	0.44	0.51		0.00	0.00	0.00	0.00	0.00
18	GDP growth	-0.03	-0.12	-0.23	0.15	-0.16	-0.25	0.03	-0.03	0.17	0.02	0.08	0.45	0.31	-0.30	-0.36	-0.14	-0.24		0.00	0.00	0.00	0.00
19	Developed	0.01	0.00	0.34	-0.26	0.21	0.48	-0.07	0.04	-0.03	0.00	0.08	-0.83	-0.49	0.15	0.54	0.45	0.45	-0.50		0.09	0.00	0.00
20	Deposit insurance	0.04	0.12	0.11	-0.04	0.08	0.00	-0.01	0.00	-0.17	-0.03	-0.44	-0.05	-0.06	-0.06	0.15	-0.04	-0.09	-0.30	0.01		0.00	0.00
21	Profit tax	0.06	0.07	0.07	0.00	0.07	0.12	-0.06	-0.01	0.00	0.04	-0.22	0.03	0.01	-0.12	0.06	0.00	-0.02	-0.05	-0.12	0.13		0.00
22	Rating	-0.02	-0.14	0.32	-0.25	0.18	0.52	-0.06	0.08	0.13	0.09	0.08	-0.79	-0.57	-0.07	0.61	0.56	0.46	-0.18	0.67	-0.19	-0.08	

Notes: Pearson correlation coefficient in lower triangle and corresponding p-values in the upper triangle.Variables– "Book leverage"– Total long- and short-term interest bearing debt to total assets; "Market leverage"– Total long- and short-term interest bearing debt to market value of the firm; "Maturity"– Long-term debt total debt; "St debt"– Short-term interest bearing debt to total assets; "Lt debt"– Long-term interest bearing debt to total assets; "Size"– Natural logarithm of assets in US dollars, millions; "Tangibility"– Fixed assets to total assets; "Profitability"– Cash from operations to total assets; "Market-to-book"– Market value to total assets; "Resource firm"– Binary variable for 1=resource firm; "Resource country"– Binary variable with 1=Resource-dependent country;"Corruption"– Corruption, high value indicates more corrupt, "CPI"– Consumer price inflation, %, year-on-year; "Concentration"– The share of assets of the three largest banks of total bank assets; "Private credit"– Domestic credit to private sector, % of GDP; "Market activity"– Stock market turnover, % of GDP; "Common law"– Binary variable with 1=common law legal origins; "GDP growth"– Annual real GDP growth rate, %; "Developed"– Binary variable with 1=developed country; "Deposit insurance"– Binary variable for deposit insurance with 1=deposit insurance scheme; "Profit tax"– Profit tax, % of commercial profits; "Ratina"– S&P country credit ratina.

Based on our data, resource firms have lower debt levels and that carry debt of longer maturity than other firms. The difference is statistically significant for both leverage variables at 1% level based on the Welch Two Sample t-test (Table 11). Due to the volatile period around the global financial crisis, we also check the variables for each year separately to discover any anomalies that might drive our results. The result for significant difference in both book and market leverage is valid for each year in our sample except for 2013, where we find no significant difference for resource firms and other firms. The result on debt maturity is not as strong; we find statistically significant difference for individual years between the two groups only for 2012 and 2013 at the 10% and 5% significance levels, respectively.

When dividing our sample by country groups, we find the result of significant difference in leverage between resource and non-resource firms robust for rich countries and resource-dependent countries. However, we find no significant difference in developing countries for book leverage for resource and non-resource firms. The leverage for resource firms is clearly higher in developing countries than in developed countries. For developed countries, we find no significant difference in debt maturity for resource and non-resource firms. Summary statistics are presented in Table 11 for various country groups.

Table 11 also shows that resource firms have more tangible assets than other firms in our data *except* such firms in resource-dependent countries. Most empirical evidence has shown (Frank and Goyal 2009) that, like the resource firms in our data, firms with more tangible assets are expected to have more, not less, debt. This finding might be due to the volatile end product prices of raw materials, which heighten uncertainty of cash flow for resource firms, despite their observed asset tangibility. Resource firms are also no larger in terms of assets than other firms except in resource-dependent countries. This finding could be explained by the fact that our sample consists only of firms included in the main equity index of each country. We find no difference in profitability for resource firms and other firms.

We confirm the findings with US data, where the differences in country-specific factors do not disturb the analysis. As US financial markets have size and depth to service the needs

of the firms, we expect firm capital structure in the US to well reflect the demand for capital. Within our sample of 420 non-financial US firms, 41 are classified as resource firms. The results in Table 11 are robust with the cross-country data.

Table 11 also highlights the fact that non-resource firms in resource-dependent countries seem to have less debt than their counterparts in other countries. This could be due to different industrial mixes among surveyed countries or other country-specific factors that do not need to be independent of resource-dependence. While debt maturity is slightly longer for the resource firms than other firms in our full sample, the average maturity is shorter in resource-dependent countries than elsewhere.

Table 11. Summary statistics of the firm variables by groups

	Resource firms						Non-resource firms						
All countries	N	Mean	St. Dev.	Min.	Median	Max.	N	Mean	St. Dev.	Min.	Median	Max.	Welch t-test p-value
Book leverage	3,501	0.21	0.17	0	0.2	0.94	21,872	0.24	0.18	0	0.23	1.02	<0.01
Market leverage	3,193	0.21	0.2	0	0.15	0.95	20,313	0.26	0.22	0	0.21	1.07	<0.01
Maturity	3,501	0.55	0.38	0	0.64	1	21,872	0.53	0.36	0	0.61	1	0.01
Size	3,494	6.71	3.38	-9.39	7.25	13.08	21,736	6.75	2.75	-8.9	7.1	13.59	<0.01
Tangibility	3,001	0.44	0.26	0	0.44	1.02	20,017	0.33	0.23	0	0.29	1	<0.01
Profitability	3,484	0.09	0.15	-3.32	0.09	1.59	21,739	0.09	0.11	-2.45	0.08	1.68	0.99
Developed countries													
Book leverage	1,825	0.19	0.15	0	0.18	0.91	11,378	0.25	0.17	0	0.24	1.01	<0.01
Market leverage	1,697	0.18	0.18	0	0.15	0.89	10,883	0.26	0.21	0	0.22	1.07	<0.01
Maturity	1,825	0.64	0.37	0	0.79	1	11,378	0.65	0.33	0	0.77	1	0.42
Size	1,818	7.75	2.36	-2.33	7.94	13.08	11,242	8.11	2.06	0.39	8.4	13.59	0.01
Tangibility	1,716	0.49	0.28	0	0.51	1.02	10,868	0.3	0.22	0	0.26	1	<0.01
Profitability	1,824	0.09	0.15	-3.32	0.1	1.59	11,357	0.09	0.09	-2.45	0.09	1.1	0.2
Developing countries													
Book leverage	1,676	0.25	0.19	0	0.23	0.94	10,494	0.24	0.19	0	0.22	1.02	0.12
Market leverage	1,496	0.24	0.23	0	0.17	0.95	9,430	0.26	0.24	0	0.2	0.99	0.01
Maturity	1,676	0.44	0.35	0	0.44	1	10,494	0.4	0.35	0	0.37	1	<0.01
Size	1,676	5.57	3.93	-9.39	6.47	12.95	10,494	5.3	2.66	-8.9	5.21	11.76	<0.01
Tangibility	1,285	0.38	0.21	0	0.38	0.94	9,149	0.36	0.24	0	0.32	1	<0.01
Profitability	1,660	0.09	0.15	-1.75	0.08	0.77	10,382	0.08	0.13	-1.62	0.08	1.68	0.2
Resource-dependent countries													
Book leverage	716	0.18	0.16	0	0.15	0.91	3,697	0.21	0.18	0	0.2	0.93	<0.01
Market leverage	668	0.16	0.17	0	0.11	0.89	3,407	0.21	0.2	0	0.17	0.99	<0.01
Maturity	716	0.53	0.37	0	0.65	1	3,697	0.49	0.38	0	0.56	1	0.01
Size	716	6.8	2.32	-0.98	6.71	12.95	3,697	6.03	2.08	-0.71	6.1	11.41	<0.01
Tangibility	697	0.38	0.24	0	0.38	0.89	3,553	0.38	0.24	0	0.35	0.98	0.63
Profitability	703	0.1	0.15	-0.91	0.1	1.59	3,615	0.1	0.12	-1	0.09	1.1	0.87
Non-resource countries													
Book leverage	2,785	0.22	0.18	0	0.21	0.94	18,175	0.25	0.18	0	0.24	1.02	<0.01
Market leverage	2,525	0.23	0.21	0	0.17	0.95	16,906	0.27	0.23	0	0.22	1.07	<0.01
Maturity	2,785	0.55	0.38	0	0.63	1	18,175	0.54	0.36	0	0.62	1	0.04
Size	2,778	6.68	3.61	-9.39	7.42	13.08	18,039	6.9	2.85	-8.9	7.41	13.59	<0.01
Tangibility	2,304	0.46	0.26	0	0.46	1.02	16,464	0.32	0.22	0	0.28	1	<0.01
Profitability	2,781	0.09	0.14	-3.32	0.09	0.77	18,124	0.09	0.11	-2.5	0.08	1.68	0.79
US													
Book leverage	279	0.2	0.1	0	0.21	0.47	2,584	0.24	0.16	0	0.24	1.01	<0.01
Market leverage	267	0.19	0.13	0	0.17	0.73	2,487	0.21	0.17	0	0.16	0.96	0.1
Maturity	279	0.89	0.23	0	0.98	1	2,584	0.8	0.29	0	0.91	1	<0.01
Size	279	9.29	1.68	-0.76	9.26	12.76	2,584	9.29	1.25	1.54	9.24	13.59	0.04
Tangibility	271	0.67	0.19	0.01	0.72	0.96	2,376	0.23	0.19	0	0.16	0.9	<0.01
Profitability	279	0.13	0.08	-0.14	0.13	0.41	2,583	0.12	0.09	-2.45	0.11	0.52	0.02

Variables: "Book leverage"– Total long- and short-term interest bearing debt to total assets; "Market leverage"– Total long- and shor- term interest bearing debt to market value of the firm; "Maturity"– Long-term debt total debt; "Size"– Natural logarithm of assets in US dollars, millions; "Tangibility"– Fixed assets to total assets; "Profitability"– Cash from operations to total assets. Welch two-sample t-test will null hypothesis: no difference in means.

3.3.2 Methodological strategy

To detect the main determinants for capital structure, we follow Jõeveer (2013), performing an analysis of variance (ANOVA) for three categorical regressors: country, industry and year. We then extend the model using analysis of covariance (ANCOVA) to include continuous firm-specific variables: size, tangibility and profitability. This approach allows us to decompose the variation of dependent variable among the independent variables. The model can be written as

$$Y_{ijkt}=\alpha+\beta_j+\gamma_k+\delta_t+\vartheta X_{ijt-1}+\varepsilon_{ijt}, \quad (1)$$

where *i,j,k* and *t* are the indexes of firm, country, industry and year, respectively. Y_{ijkt} is the capital structure indicator of firm *i*, country *j*, industry *k* and year *t*. β_j is the country fixed effect, γ_k is the industry fixed effect and δ_t is the year effect. ϑX_{ijt-1} presents the firm specific one-period lagged variables and ε_{ijt} is the random disturbance.

We then extend the model to include the time-varying country-specific factors. The model becomes

$$Y_{ijkt}=\alpha+\gamma_k+\delta_t+\vartheta X_{ijt-1}+\varphi C_{jt-1}+\varepsilon_{ijt}, \quad (2)$$

where φC_{jt-1} represents the one-period lagged country-specific variables that can vary over time. We do not include country fixed effects here, as it would capture the resource country indicator. We use pooled OLS to detect the effect of different firm and country specific capital structure determinants. Next, we limit our sample to firms with no close link to the resource sector to determine whether location in a resource-dependent country affects the capital structure of the firm.

We use robust standard errors clustered by firm to capture the correlation in regression residuals known to cause bias in OLS estimations using firm panel data (Petersen, 2009). We also cluster standard errors by year to check whether our dummies failed to capture a time effect. The difference in standard errors is very small compared to pooled OLS with White standard errors, and in line with the capital structure example presented by Petersen (2009).

3.4 Results

3.4.1 Variance decomposition

In line with Jõeveer (2013), we see the most important determinant of a firm's book leverage is its industry (Table 12). Country is also an important factor. Despite the fact that a major financial crisis hit the global economy during our sample period, year plays a role only in terms of market leverage.

Debt maturity structure is clearly more dependent on country of domicile than a firm's industry affiliation. This may reflect the fact that some countries have more market-based financial systems, which coincides with long-term debt, while bank-based financial structures are associated more with short-term debt (Demirgüç-Kunt and Maksimovic, 2002).

When we add firm-specific variables, profitability emerges as the most important firm-specific variable in explaining leverage. Profitable firms, not surprisingly, have less need for external debt (Frank and Goyal, 2009). This result is different from Jõeveer (2013), who finds asset tangibility is the most important firm-specific determinant for leverage. Firm size is the most important firm-specific explanatory variable for maturity structure in our data, but our dummies for country and industry remain very important in explaining firm leverage.

For columns 7–9 in Table 12, we replace the country dummy with country-specific fixed and time-variant variables. We also add binary indicators for resource firm and resource country. The assigned country variables capture some, but not all, of the variation related to the country dummies in columns 4–6. In particular, the model is poor at capturing book leverage, something expected from the literature (see e.g. Fan et al., 2012). We break this variable down into short- and long-term debt in the regressions to detect variation in detail.

Notably, the mere fact of being domiciled in a resource-dependent country appears to be one of the most important country-specific determinants of the level of leverage in our sample firms. The resource firm indicator also explains part of the variation in leverage, even after we

control for industry fixed effects. The maturity structure, however, is not explained by our resource indicators when controlling for several other factors.

Table 12. Variance decomposition

	Book Leverage	Market Leverage	Maturity	Book Leverage	Market Leverage	Maturity	Book Leverage	Market Leverage	Maturity
	1	2	3	4	5	6	7	8	9
Country	0.37	0.43	0.73	0.25	0.32	0.46			
Industry	0.62	0.50	0.27	0.30	0.36	0.18	0.34	0.28	0.19
Year	0.01	0.07	0.00	0.00	0.05	0.00	0.01	0.03	0.00
Size				0.07	0.04	0.26	0.07	0.04	0.22
Tangibility				0.16	0.08	0.10	0.18	0.09	0.11
Profitability				0.22	0.26	0.00	0.29	0.30	0.00
Resource firm							0.01	0.01	0.00
Resource country							0.02	0.03	0.00
Private credit							0.01	0.02	0.03
Market activity							0.01	0.05	0.05
Concentration							0.02	0.01	0.04
Deposit insurace							0.01	0.01	0.01
Corruption							0.01	0.01	0.10
CPI							0.00	0.01	0.02
Profit tax							0.01	0.01	0.01
Common law							0.01	0.05	0.07
GDP growth							0.00	0.02	0.02
Developed							0.00	0.01	0.06
Rating							0.01	0.04	0.06
R2	0.13	0.23	0.35	0.21	0.32	0.39	0.17	0.30	0.37
Obs	25373	23506	25373	22753	21083	22753	19001	17569	19001

Notes: Each cell represents the variation that is addressed to the given explanatory variable as a share of total variation explained by the model. Dependent variables: "Book leverage"– Total long- and short-term interest bearing debt to total assets; "Market leverage"– Total long- and short-term interest bearing debt to market value of the firm; "Maturity"– Long-term debt total debt. Independent variables: "Size"– Natural logarithm of assets in US dollars, millions; "Tangibility"– Fixed assets to total assets; "Profitability"– Cash from operations to total assets; "Resource firm"– Binary variable for 1=resource firm; "Resource country"– Binary variable with 1=Resource-dependent country;"Corruption"– Corruption, high value indicates more corrupt, "CPI"– Consumer price inflation, %, year-on-year; "Concentration"– The share of assets of the three largest banks of total bank assets; "Private credit"– Domestic credit to private sector, % of GDP; "Market activity"– Stock market turnover, % of GDP; "Common law"– Binary variable with 1=common law legal origins; "GDP growth"– Annual real GDP growth rate, %; "Developed"– Binary variable with 1=developed country; "Deposit insurance"– Binary variable for deposit insurance with 1=deposit insurance scheme; "Profit tax"– Profit tax, % of commercial profits; "Rating"– S&P country credit rating in numeric scale.

3.4.2 Regression results

Our regression results presented in Table 13show that resource firms and firms in resource-dependent countries tend to have less debt, even when controlling for firm- and country-specific factors. The result is especially clear in the case of short-term debt. The coefficient for debt maturity is positive, but insignificant, for both resource indicators. Firm-specific control variables are similar to the main findings of the previous literature. Bigger and more tangible firms have more debt and that debt carries longer maturity. Profitability is negatively associated with leverage.

A country's institutional environment matters greatly for firm capital structure. Previous research shows banks tend to provide shorter term debt than debt markets. Our regression here also back up the notion that a higher level of bank credit to private sector is linked to more, but shorter, term debt. Correspondingly, higher stock market activity coincides with less debt and of longer maturity as firms in more market-based financial systems rely more heavily on equity finance and bond issues to raise money. Bank concentration is related to less debt, especially long-term debt. Common law legal origins and deposit insurance schemes are related to less debt and debt with longer maturity.

Table 13. Pooled regression results

	Dependent variable:				
	Book leverage	Market leverage	Short-term debt	Long-term debt	Maturity
Size	0.011***	0.010***	-0.001*	0.013***	0.039***
	(.001)	*(.002)*	*(.001)*	*(.001)*	*(.002)*
Tangibility	0.135***	0.150***		0.125***	0.277***
	(.015)	*(.016)*		*(.011)*	*(.023)*
Profitability	-0.355***	-0.473***	-0.191***	-0.159***	-0.062**
	(.029)	*(.038)*	*(.016)*	*(.016)*	*(.031)*
Market-to-book	-0.004**	-0.040***	-0.004***	-0.003*	-0.017***
	(.002)	*(.003)*	*(.001)*	*(.002)*	*(.004)*
Resource firm	-0.064***	-0.082***	-0.029***	-0.042***	0.047
	(.020)	*(.020)*	*(.011)*	*(.016)*	*(.034)*
Resource country	-0.024**	-0.031***	-0.017***	-0.007	0.021
	(.010)	*(.011)*	*(.005)*	*(.007)*	*(.016)*
Private credit	0.037***	0.059***	0.035***		-0.043***
	(.009)	*(.010)*	*(.005)*		*(.013)*
Market activity	-0.011*	-0.030***	-0.009***		0.019**
	(.006)	*(.006)*	*(.002)*		*(.009)*
Concentration	-0.071***	-0.088***		-0.069***	-0.199***
	(.015)	*(.018)*		*(.009)*	*(.022)*
Deposit insurance	-0.024**	-0.029***	-0.026***	-0.002	0.030*
	(.011)	*(.011)*	*(.005)*	*(.007)*	*(.016)*
Corruption	-0.018**	-0.029***	0.013***	-0.027***	-0.112***
	(.008)	*(.009)*	*(.004)*	*(.005)*	*(.013)*
CPI	0.001	0.003***	0.001***	-0.001***	-0.003***
	(.001)	*(.001)*	*(.001)*	*(.001)*	*(.001)*
Profit tax	0.025	0.041*	-0.013	0.047***	0.085***
	(.020)	*(.023)*	*(.010)*	*(.016)*	*(.032)*
Common law	-0.025***	-0.063***	-0.040***	0.017***	0.089***
	(.009)	*(.010)*	*(.004)*	*(.006)*	*(.014)*
GDP growth	0.001	-0.0003	0.001***	0.000	-0.003***
	(.001)	*(.001)*	*(.0)*	*(.001)*	*(.001)*
Developed	-0.005	0.030**	-0.004	-0.001	-0.056***
	(.012)	*(.013)*	*(.006)*	*(.008)*	*(.018)*
Rating	-0.005***	-0.011***	-0.002***	-0.003***	-0.005**
	(.001)	*(.002)*	*(.001)*	*(.001)*	*(.002)*
Constant	0.190***	0.430***	0.130***	0.063**	0.454***
	(.036)	*(.045)*	*(.015)*	*(.027)*	*(.060)*
Observations	14,457	14,261	16,620	16,457	14,457
R^2	0.19	0.34	0.23	0.29	0.39

*Notes: Robust standard errors clustered by firm below coefficient in parenthesis. Year and industry dummies included in all regressions. *p<0.1; **p<0.05; ***p<0.01. Dependent variables: "Book leverage"– Total long- and short-term interest bearing debt to total assets; "Market leverage"– Total long- and short-term interest bearing debt to market value of the firm; "St debt"– Short-term interest bearing debt to total assets; "Lt debt"– Long-term interest bearing debt to total assets; "Maturity"– Long-term debt to total debt. One period lagged values of independent variables are used. Independent variables: "Size"– Natural logarithm of assets in US dollars, millions; "Tangibility"– Fixed assets to total assets; "Profitability"– Cash from operations to total assets; "Resource firm"– Binary variable for 1=resource firm; "Resource country"– Binary variable with 1=Resource-dependent country;"Corruption"– Corruption, high value indicates more corrupt, "CPI"– Consumer price inflation, %, year-on-year; "Concentration"– The share of assets of the three largest banks of total bank assets; "Private credit"– Domestic credit to private sector, % of GDP; "Market activity"– Stock market turnover, % of GDP; "Common law"– Binary variable with 1=common law legal origins; "GDP growth"– Annual real GDP growth rate, %; "Developed"– Binary variable with 1=developed country; "Deposit insurance"– Binary variable for deposit insurance with 1=deposit insurance scheme; "Profit tax"– Profit tax, % of commercial profits; "Rating"– S&P country credit rating in numeric scale. Independent variables "Tangibility", "Market-to-Book", "Private Credit", "Market activity" and "Concentration" removed from the regressions when the coefficient is not statistically significant at 10% level due to large amount of missing observations.*

Country credit rating is negatively related to leverage, even if we do not control separately the development level in our regressions. That result is in line with Jõeveer (2013) and could reflect the finding of Fan et al. (2012) that government bond markets seem to crowd out firm debt. In our regressions, the level of economic development is positively related to market leverage. Somewhat surprisingly, debt maturity is shorter in developed countries, which contradicts the positive correlation observed between the two variables in Table 10. Overall leverage is lower in more corrupted countries and debt maturity tends to be shorter. Contrary to our result, Fan et al. (2012) find that the level of debt is *higher* in more corrupted countries. They reason that this is due to the widespread use of equity financing in less corrupted countries. However, we also have opposite signs for the coefficient when looking at short- and long-term debt in isolation. The association of higher corruption to more short-term and less long-term debt is in line with results of Fungáčová et al. (2015). In countries with weak institutions, banks seem unwilling to provide long-term financing. Similarly, higher inflation coincides with shorter debt maturity. However, as noted from correlation matrix in Table 10, corruption is also highly correlated to development level and country credit rating, so variables are susceptible to multicollinearity that can lead to instability in the coefficients without compromising the model.

When it comes to short-term debt and total debt relative to assets, our model seems to capture only about a fifth of variation. In contrast, long-term debt and debt relative to firm value are better captured by our model. This level of explanatory power is in line with previous research with similar cross-country firm leverage data (Fan et al., 2012).

Our results are not driven only by flight to quality in the exceptional time of global financial crisis; the results hold for 2007 before the financial crisis hit. Given that we do not have country dummies in our regressions, we confirm that the results are not driven by

individual countries either, by removing one by one countries with a large amount of observations, namely the US, Indonesia, Thailand and China. The results remain robust.[12] We test the interaction of resource firm indicator with firm size, tangibility and profitability with the results presented in Table 14. Larger resource firms have less debt and shorter maturity debt than smaller resource firms. More profitable resource firms have a higher level of market leverage. When the coefficient for the size variable and the resource firm-size interaction term are summed up, size does not seem to be associated with higher leverage for resource firms. This finding directly contradicts the very clear result in the earlier literature of a positive correlation between firm size and leverage (Frank and Goyal, 2009). As our results could reflect a strong positive correlation between size and profitability of resource firms, we test for this. While the correlation is higher in case of resource firms than all firms in our data presented in Table 10, the Pearson correlation coefficient of 0.18 it is not high enough to disturb the result by multicollinearity. We also find no evidence that investment intensity of resource firms declines significantly with size.

[12] Regression results for 2007 and the regression results excluding one-by-one United States, Indonesia, Thailand and China are available on request.

Table 14. Pooled regression results with interaction terms

	Dependent variable:				
	Book leverage	Market leverage	Short term debt	Long term debt	Maturity
Size	0.015***	0.014***	-0.001	0.016***	0.043***
	(.002)	*(.002)*	*(.001)*	*(.001)*	*(.003)*
Tangibility	0.155***	0.169***		0.151***	0.281***
	(.018)	*(.019)*		*(.013)*	*(.025)*
Profitability	-0.360***	-0.504***	-0.199***	-0.154***	-0.060*
	(.034)	*(.047)*	*(.019)*	*(.018)*	*(.034)*
Market-to-book	-0.005**	-0.040***	-0.004***	-0.004***	-0.018***
	(.002)	*(.003)*	*(.001)*	*(.001)*	*(.004)*
Resource firm	0.056	0.026	-0.026	0.086***	0.142**
	(.034)	*(.035)*	*(.016)*	*(.028)*	*(.061)*
Resource country	-0.022**	-0.029***	-0.017***	-0.007	0.024
	(.010)	*(.011)*	*(.005)*	*(.007)*	*(.016)*
Private credit	0.040***	0.063***	0.036***		-0.039***
	(.009)	*(.010)*	*(.005)*		*(.013)*
Market activity	-0.012**	-0.031***	-0.009***		0.017*
	(.006)	*(.006)*	*(.002)*		*(.009)*
Concentration	-0.070***	-0.086***		-0.066***	-0.197***
	(.015)	*(.018)*		*(.009)*	*(.022)*
Deposit insurance	-0.025**	-0.030***	-0.026***	-0.001	0.027*
	(.011)	*(.011)*	*(.005)*	*(.007)*	*(.016)*
Corruption	-0.016*	-0.026***	0.013***	-0.026***	-0.109***
	(.008)	*(.009)*	*(.004)*	*(.005)*	*(.013)*
CPI	0.001	0.003***	0.001***	-0.001*	-0.003**
	(.001)	*(.001)*	*(.001)*	*(.001)*	*(.001)*
Profit tax	0.026	0.043*	-0.013	0.044***	0.086***
	(.020)	*(.023)*	*(.010)*	*(.015)*	*(.032)*
Common law	-0.023**	-0.062***	-0.040***	0.018***	0.091***
	(.009)	*(.010)*	*(.004)*	*(.006)*	*(.014)*
GDP growth	0.001*	-0.0001	0.001***	0.00005	-0.003***
	(.001)	*(.001)*	*(.0)*	*(.001)*	*(.001)*
Developed	-0.007	0.029**	-0.005	-0.003	-0.058***
	(.011)	*(.013)*	*(.006)*	*(.008)*	*(.018)*
Rating	-0.005***	-0.011***	-0.002***	-0.003***	-0.005**
	(.001)	*(.002)*	*(.001)*	*(.001)*	*(.002)*
Size*Resource firm	-0.015***	-0.015***	-0.001	-0.012***	-0.017***
	(.003)	*(.003)*	*(.001)*	*(.003)*	*(.005)*
Tangibility*Resource	-0.035	-0.032		-0.073***	0.058
	(.037)	*(.039)*		*(.025)*	*(.067)*
Profitability*Resourc	0.058	0.176***	0.039	0.009	0.022
	(.055)	*(.066)*	*(.036)*	*(.030)*	*(.078)*
Constant	0.150***	0.392***	0.128***	0.028	0.418***
	(.037)	*(.046)*	*(.015)*	*(.027)*	*(.061)*
Observations	14,457	14,261	16,620	16,457	14,457
R^2	0.20	0.34	0.23	0.30	0.39

*Notes: Robust standard errors clustered by firm below coefficient in parenthesis. Year and industry dummies included in all regressions. *p<0.1; **p<0.05; ***p<0.01. Dependent variables: "Book leverage"– Total long- and short-term interest bearing debt to total assets; "Market leverage"– Total long- and short-term interest bearing debt to market value of the firm; "St debt"– Short-term interest bearing debt to total assets; "Lt debt"– Long-term interest bearing debt to total assets; "Maturity"– Long-term debt/total debt. One period lagged values of independent variables are used. Independent variables: "Size"– Natural logarithm of assets in US dollars, millions; "Tangibility"– Fixed assets to total assets; "Profitability"– Cash from operations to total assets; "Resource firm"– Binary variable for 1=resource firm; "Resource country"– Binary variable with 1=Resource-dependent country;"Corruption"– Corruption, high value indicates more corrupt, "CPI"– Consumer price inflation, %, year-on-year; "Concentration"– The share of assets of the three largest banks of total bank assets; "Private credit"– Domestic credit to private sector, % of GDP; "Market activity"– Stock market turnover, % of GDP; "Common law"– Binary variable with 1=common law legal origins; "GDP growth"– Annual real GDP growth rate, %; "Developed"– Binary variable with 1=developed country; "Deposit insurance"– Binary variable for deposit insurance with 1=deposit insurance scheme; "Profit tax"– Profit tax, % of commercial profits; "Rating"– S&P country credit rating in numeric scale. Independent variables "Tangibility", "Market-to-Book", "Private Credit", "Market activity" and "Concentration" removed from the regressions when the coefficient is not statistically significant at 10% level due to large amount of missing observations.*

Our results suggest that firms domiciled in resource-dependent countries have less debt, especially short-term debt. This could, of course, be due to the fact that, even when industry fixed effects are controlled for in our regressions, resource firms and firms closely linked to resources in general take on less debt which steers the average financial structure of the resource-dependent country where resource firms play a big role.

There are many challenges in finding the right control group when seeking additional evidence that location in a resource-dependent country affects the capital structure of a firm. Many industries such as transportation and certain types of manufacturing are likely to be closely linked to resource firms in resource-dependent countries. Such close relations could affect access to finance for such firms.

We limit the sample to two consumer sectors in the data: Consumer Staples and Consumer Discretionary. We expect the consumer sectors to be less linked to resource sector than many other industries. Consumer sectors are not likely to be involved with mineral extraction supply chains, and even if the consumer sectors serve the employees of resource firms, the resource sector is not usually a major employer in a country.[13] Moreover, this control group is sufficiently large (7,541 firm-year observations, of which 1,236 are from resource-dependent countries). The average debt maturity for these firms is 0.48 and book leverage is 0.23, so these firms have less debt and the debt has shorter maturity than that of non-resource firms in general (see Table 11). Again, the results in Table 15 suggest that overall leverage is lower for firms in countries where mineral exports play a pronounced role.

[13] Employment data from the International Labour Organization database for Australia, Chile, Colombia, Egypt, Kazakhstan, Norway, Peru, Russia, Saudi Arabia, South Africa, United Arab Emirates and Venezuela show that, on average, mining and quarrying activities account for 1.5% of total employment.

Table 15. Firms in consumer sectors

	Dependent variable:				
	Book leverage	Market leverage	Short term debt	Long term debt	maturity
Size	0.013***	0.009**	-0.002	0.014***	0.041***
	(.003)	*(.004)*	*(.002)*	*(.002)*	*(.004)*
Tangibility	0.124***	0.171***	0.009	0.123***	0.288***
	(.027)	*(.030)*	*(.016)*	*(.020)*	*(.040)*
Profitability	-0.355***	-0.645***	-0.236***	-0.146***	-0.185***
	(.049)	*(.071)*	*(.031)*	*(.028)*	*(.055)*
Resource country	-0.060***	-0.056***	-0.030**	-0.026**	0.024
	(.016)	*(.019)*	*(.012)*	*(.011)*	*(.031)*
Private credit		0.042**	0.038***	-0.019**	-0.054***
		(.017)	*(.011)*	*(.009)*	*(.021)*
Market activity		-0.037***	-0.009*		
		(.011)	*(.005)*		
Concentration	-0.083***	-0.101***	-0.032*	-0.065***	-0.189***
	(.022)	*(.031)*	*(.018)*	*(.015)*	*(.035)*
Deposit insurance	-0.02	-0.01	-0.033**	0.007	0.042
	(.019)	*(.022)*	*(.014)*	*(.011)*	*(.031)*
Corruption	-0.053***	-0.087***	-0.021**	-0.037***	-0.109***
	(.013)	*(.019)*	*(.010)*	*(.009)*	*(.023)*
CPI	0.003**	0.004***	0.005***	-0.002*	-0.006***
	(.001)	*(.002)*	*(.001)*	*(.001)*	*(.002)*
Profit tax	0.056	0.027	-0.015	0.081***	0.231***
	(.035)	*(.040)*	*(.019)*	*(.028)*	*(.057)*
Common law	-0.026*	-0.057***	-0.062***	0.037***	0.154***
	(.015)	*(.021)*	*(.010)*	*(.011)*	*(.023)*
GDP growth	-0.001	-0.002	0.001	-0.002**	-0.005***
	(.001)	*(.001)*	*(.001)*	*(.001)*	*(.002)*
Developed	-0.004	0.011	-0.019*	0.01	-0.019
	(.016)	*(.023)*	*(.011)*	*(.012)*	*(.031)*
Rating	-0.009***	-0.016***	-0.004***	-0.005***	-0.008**
	(.002)	*(.003)*	*(.002)*	*(.002)*	*(.003)*
Constant	0.307***	0.511***	0.228***	0.088**	0.274***
	(.055)	*(.075)*	*(.042)*	*(.038)*	*(.092)*
Observations	5,483	4,641	4,927	5,342	5,342
R^2	0.16	0.28	0.21	0.28	0.38

*Notes: Robust standard errors clustered by firm below coefficient in parenthesis. Year and industry dummies included in all regressions. *p<0.1; **p<0.05; ***p<0.01. Dependent variables: "Book leverage"– Total long- and short-term interest bearing debt to total assets; "Market leverage"– Total long- and short-term interest bearing debt to market value of the firm; "St debt"– Short-term interest bearing debt to total assets; "Lt debt"– Long-term interest bearing debt to total assets; "Maturity"– Long-term debt/total debt. One period lagged values of independent variables are used. Independent variables: "Size"– Natural logarithm of assets in US dollars, millions; "Tangibility"– Fixed assets to total assets; "Profitability"– Cash from operations to total assets; "Resource country"– Binary variable with 1=Resource-dependent country;"Corruption"– Corruption, high value indicates more corrupt, "CPI"– Consumer price inflation, %, year-on-year; "Concentration"– The share of assets of the three largest banks of total bank assets; "Private credit"– Domestic credit to private sector, % of GDP; "Market activity"– Stock market turnover, % of GDP; "Common law"– Binary variable with 1=common law legal origins; "GDP growth"– Annual real GDP growth rate, %; "Developed"– Binary variable with 1=developed country; "Deposit insurance"– Binary variable for deposit insurance with 1=deposit insurance scheme; "Profit tax"– Profit tax, % of commercial profits; "Rating"– S&P country credit rating in numeric scale. Independent variables "Tangibility", "Market-to-Book", "Private Credit", "Market activity" and "Concentration" removed from the regressions when the coefficient is not statistically significant at 10% level due to large amount of missing observations.*

We cannot rule out that the link between being domiciled in resource-dependent country and differences in capital structure are due to some omitted variable. However, we control for many of the variables the previous literature has shown important in determining firm capital

structure. Moreover, mineral resources can be considered as an initial factor endowment of a country. Consequently, other country-specific factors are not necessarily independent of its natural resources. The earlier literature has found many institutional factors causing challenges for economic development in resource-dependent economies such as poor governance and rent-seeking behavior (Bardhan, 1997) and low levels of education (Gylfason, 2001).

Resource-dependence might be endogenous to the level of economic development (see e.g. Frankel, 2010) as high resource-dependence could lead to underdevelopment of other sectors. However, our sample resource-dependent countries do not show lower levels of economic development measured in terms of GDP. Endogeneity might also rise as the financial sector influences the development of resource firms as well. However, as shown in Table 11, capital structure of resource firms seems similar across different groups of countries and also in the Unites States, suggesting that the lower debt level of resource firms is not limited to resource-dependent countries.

Thus, while reverse causality cannot be ruled out, we argue it is more likely that the financial infrastructure and firm capital structure are organized on the basis of the factor endowments in the economy and not that resource dependence emerges *because* of the financial sector structure. We also use lagged values of independent variables to reduce the risk for contemporaneous correlation between independent variables and the error term.

We encounter a significant survival bias as our sample includes only listed firms included in the main equity index of a given country. Even so, we would expect our results to be weaker than when smaller firms are included, because larger firms are less constrained by the practices of the domestic banking sector.

Whether the finding of less debt, especially shorter maturity debt is due to the fact that financial sector in resource dependent countries does not provide services that firms need, or due to the idea that certain types of firms thrive in resource-dependent countries, our results suggest that a major sector in the country might steer the economy in a direction unfavorable

for firms needing different services. Being domiciled in resource-dependent country seems to be a previously undetected country-specific determinant for capital structure. In particular, short-term debt is used by emerging industries, so the unavailability of financial services might hamper the rise of new businesses and exacerbate the resource curse.

3.5 Conclusions

Our hypothesis is that financial services in countries with large resource sectors are organized to serve large resource firms at the expense of other firms that may have different financial needs. The lack of access to finance for small firms and firms in emerging industries hampers growth and exacerbates the effects of the resource curse.

We present empirical evidence that resource firms tend to have lower debt loads than other non-financial firms. This finding remains robust when several firm- and country-specific factors are introduced into our regressions. We also find evidence of longer debt maturity for resource firms. Our results also indicate that the level of leverage of the resource firms does not increase with firm size as it does for other firms.

Notably, firms in other sectors in resource-dependent countries exhibit capital structures similar to resource firms. Their overall leverage is lower. Short-term debt, in particular, is less commonly used in resource-dependent countries than in other countries. This suggests that the existence of a large resource sector might affect other industries through some financial channel. While we cannot verify whether the channel is through the financial sector or other unobserved institutional factors, it is clear that the simple fact of being located in a resource-dependent country affects the capital structure of a firm.

These results are hardly exhaustive. Data limitations prevent us from finding more detailed information on what kinds of firms or industries thrive or fail in resource-dependent economies. Moreover, we have only considered large listed firms included in the main equity index of each sample country. Such firms are survivors. They have grown and flourished in

the given environment and are perhaps no longer restricted in their access to finance. Still, we observe that the capital structure of these firms is tilted towards the capital structure of the resource sector in resource-dependent countries. It would be therefore interesting to extend this study to small and mid-sized companies that are more likely to be affected negatively by a domestic financial sector geared to serving the needs of large resource firms.

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Appendix

Appendix 6. Equity indices included

	Country	Index in Bloomberg		Country	Index in Bloomberg
1	Argentina	Argent Merval	37	Malaysia	FTSE Malay KLCI
2	Australia	ASX200	38	Mexico	MEX IPC
3	Austria	ATX Austria Trd	39	Mongolia	MSE top 20
4	Bahrain	Bahrain All Share	40	Namibia	FTSE/Namibia
5	Belgium	BEL 20 index	41	Netherlands	AEX-index
6	Botswana	Botswana Gab	42	New Zealand	NZX 50
7	Brazil	IBOVESPA	43	Nigeria	Nigeria SE All
8	Bulgaria	BSE Sofix	44	Norway	OBX Stock
9	Canada	TSX	45	Oman	Muscat SM 30
10	Chile	Chile SM Select	46	Pakistan	KARACHI 100
11	China	CSI300	47	Peru	Peru Lima Gen
12	Colombia	Colom COLCAP	48	Philippines	PSEi Philippine
13	Croatia	Zagreb CROBEX	49	Poland	WIG 20
14	Czech Republic	Prague SE index	50	Portugal	PSI General POR
15	Denmark	OMX Copenhagen 20	51	Quatar	QE index
16	Egypt	Egypt Hermes	52	Romania	Bucharest BET
17	Estonia	OMX Tallinn index	53	Russia	RTS Index
18	Finland	OMX Helsinki 25	54	Saudi Arabia	Tadawull
19	France	CAC 40 Index	55	Singapore	FTSE Straits Tim
20	Germany	DAX Index	56	Slovakia	Slovak Share Index
21	Ghana	GSE Comp	57	Slovenia	Slovenia Blue Chip
22	Greece	Athex Composite	58	South Africa	FTSE/JSE Africa Top 40
23	Hong Kong	Hang Seng	59	South Korea	KRX 100
24	Hungary	Budapest SE index	60	Spain	IBEX35 ESP
25	India	S&P BSE SENSEX 30	61	Sweden	OMX STKH30
26	Indonesia	Jakarta Comp	62	Switzerland	Swiss Market Index
27	Ireland	ISEQ Overall	63	Taiwan	Taiwan TAIEX
28	Israel	Tel Aviv 25	64	Tanzania	Tanzania all sh
29	Italy	FTSE MIB ITA	65	Thailand	SE Thai Index
30	Japan	Nikkei 225	66	Tunisia	Tunis SE
31	Kazakhstan	KASE	67	Turkey	BIST 100 Index
32	Kenya	Nairobi SE 20	68	Ukraine	PFTS Index
33	Kuwait	Kuwait SE Weighted	69	United Arab Emirates	DFM General Index
34	Latvia	OMX Riga index	70	United Kingdon	FTSE 100 Index
35	Lithuania	OMX Vilnius index	71	United States	S&P500
36	Luxembourg	LuxX	72	Venezuela	Venezuela SM
			73	Vietnam	Ho Chi Minh Stk
	Index compositions as of November 2013				

Appendix 7. Data description and sources

Firm variables	**Description**	**Source**	**Bloomberg code**
Sector	Global Industry Classification Standard (GICS)	Bloomberg	GICS_SECTOR_NAME
Industry	by MSCI and Standard & Poor's including 10 sectors,	Bloomberg	GICS_INDUSTRY_NAME
Sub-industry	67 industries and 156 sub-industries	Bloomberg	GICS_SUB_INDUSTRY_NAME
Country	Country of domicile	Bloomberg	COUNTRY_OF_DOMICILE
Assets	Total assets	Bloomberg	BS_TOT_ASSET
Market capitalization	Market capitalization	Bloomberg	HISTORICAL_MARKET_CAP
Long-term debt	All interest-bearing financial obligations that are not current	Bloomberg	BS_LT_BORROW
Short-term debt	Includes bank overdrafts, short-term debts and borrowings, repurchase agreements	Bloomberg	BS_ST_BORROW
Cash From Operations	Cash From Operations	Bloomberg	CF_CASH_FROM_OPER
Capital Expenditures	Capital Expenditures	Bloomberg	CAPITAL_EXPEND
Fixed assets	Property, plant and equipment	Bloomberg	ARD_PROPERTY_PLANT_EQUIP_NET
Value	Market capitalization + long and short term debt + preferred equity and minority interest	Bloomberg	HISTORICAL_MARKET_CAP+BS_LT_BORROW+BS_ST_ BORROW+PREFERRED_EQUITY_&_MINORITY_INT
Market-to-book	Value/Total assets	Bloomberg	
Size	Natural logarithm of Total asset in USD	Bloomberg/World DataBank	
Profitability	Cash From Operations/Total assets	Bloomberg	
Tangibility	Property, plant and equipment/Total assets	Bloomberg	
Book leverage	Total debt/Total assets		
Market leverage	Total debt/Value		
Country variables	**Description**	**Source**	
GDP USD	Gross domestic product in US dollars	World DataBank	
GDP lcu	Gross domestic product in local currency unit	World DataBank	
GDP per capita	Gross domestic product in US dollars per capita	World DataBank	
GDP growth	Annual GDP growth rate, %	World DataBank	
Developed	Binary variable with 1 indicating high-income economy by World Bank country rank in 2008	The World Bank country income classification	
CPI	Annual change in consumer price index, %	World DataBank	
Corruption	Corruption index by country ranking in standardized normal distribution higher values indicating less corrupt. We use inverted scale.	World DataBank	
Common law	Binary variable with 1 indicating common law legal origins	La Porta et al. (1999)	
Deposit insurance	Binary variable with 1 indicating that country has a deposit insurance	Demirguc-Kunt et al. (2005)	
Profit tax rate	Profit tax, % of commercial profits	World DataBank	
Bank concentration	Assets of three largest banks as a share of total commercial banking assets, %	World DataBank	
Private credit	Domestic credit to private sector, % of GDP	World DataBank	
Market activity	Stock market turnover, % of GDP	World DataBank	
Exchange rate	Exchange rate USD per local currency	World DataBank	
Fuel exports	Fuel exports, % of merchandise exports	World DataBank	
Metal exports	Ores and metals exports, % of merchandise exports	World DataBank	
Diamond exports	Diamond exports, % of merchandise exports	Central Statistics Office of Botswana, Ghana statistical service, Statistics Namibia	
Rating	We change it into numeric with best AAA rating at 21 and worst in our sample CC at value 5.	Standard & Poor's	

Appendix 8. Variable means by country

	n	Book leverage	Market leverage	Maturity	Size	Tangibility	Profitability	Market-to-book	Mineral exports	Corruption	CPI	Concentration	Private credit	Market activity	Common law	GDP growth	Deposit insurance	Profit tax	GDP/cap, USD	Rating	Resource country
Argentina	55	0.23	0.33	0.66	7.76	0.54	0.15	1.00	0.12	0.45	9.23	0.56	0.13	0.01	0	4.6	1	1.09	11611.89	6	0
Australia	994	0.22	0.19	0.66	6.98	0.25	0.10	1.96	0.62	-2.01	2.69	0.86	1.23	0.88	1	2.82	0	0.48	55006.93	21	1
Austria	98	0.25	0.31	0.74	8.54	0.36	0.10	0.97	0.07	-1.67	2.21	0.59	1.16	0.15	0	1.03	1	0.51	48898.95	21	0
Bahrain	98	0.06	0.06	0.17	4.99	0.33	0.09	1.03	0.87	-0.30	2.46	0.86	0.66	0.03	0	4.64	1	0.14	21920.59	12	1
Belgium	81	0.28	0.29	0.73	8.86	0.27	0.09	1.41	0.13	-1.47	2.27	0.63	0.91	0.28	0	0.91	1	0.57	45855.86	18	0
Bermuda	19	0.46	0.43	0.92	8.85	0.36	0.06	1.12	0.06	-1.31		0.98		0.01	1	-1.9	1	0.41	88601.1	17	0
Botswana	59	0.11	0.05	0.44	3.39	0.40	0.20	2.30	0.73	-0.95	8.04	0.83	0.28		0	5.15	0	0.2	6305.7	14	1
Brazil	397	0.31	0.31	0.74	8.73	0.30	0.07	1.52	0.24	0.04	5.36	0.67	0.58	0.37	0	3.9	1	0.46	10408.74	12	0
Bulgaria	67	0.17	0.23	0.50	5.41	0.50	0.06	1.02	0.31	0.25	4.86	0.69	0.69	0.03	0	1.71	1	0.3	7107.11	12	0
Canada	1287	0.21	0.20	0.73	7.60	0.50	0.10	1.48	0.35	-1.99	1.70	0.68	1.25	0.90	1	1.54	1	0.3	48070.33	21	0
Chile	215	0.29	0.25	0.77	5.47	0.43	0.09	1.40	0.62	-1.44	3.19	0.52	1.00	0.20	0	4.09	1	0.26	12912.7	16	1
China	1749	0.25	0.19	0.32	7.74	0.39	0.07	2.42	0.03	0.52	3.40	0.30	1.24	1.12	0	9.77	0	0.45	4772.05	17	0
Colombia	59	0.20	0.18	0.78	7.99	0.30	0.08	1.26	0.60	0.33	3.87	0.85	0.44	0.08	0	4.53	1	0.79	6459.72	11	1
Croatia	134	0.28	0.39	0.51	6.09	0.46	0.06	0.93	0.18	0.00	2.97	0.64	0.68	0.03	0	-0.81	1	0.21	14105.49	11	0
Czech Republic	42	0.20	0.17	0.62	6.32	0.42	0.14	1.33	0.05	-0.26	2.63	0.62	0.51	0.12	0	0.89	1	0.51	20222.5	17	0
Denmark	97	0.24	0.18	0.77	8.13	0.24	0.14	2.25	0.10	-2.45	2.10	0.39	2.06		0	-0.49	1	0.28	59580.32	21	0
Egypt, Arab Rep.	166	0.19	0.21	0.43	6.09	0.38	0.08	1.33	0.41	0.60	11.00	0.64	0.35	0.26	0	4.31	0	0.43	2580.08	7	1
Estonia	82	0.28	0.33	0.63	5.00	0.36	0.09	1.03	0.17	-0.94	4.51	0.96	0.89		0	0.49	1	0.52	16863.92	17	0
Finland	147	0.23	0.27	0.69	8.56	0.26	0.09	1.22	0.14	-2.29	2.21	0.89	0.90		0	0.09	1	0.43	48956.88	21	0
France	224	0.24	0.31	0.73	10.67	0.22	0.08	0.93	0.07	-1.42	1.55	0.31	1.09	0.59	0	0.64	1	0.66	42376.58	21	0
Germany	175	0.27	0.33	0.73	10.69	0.23	0.08	1.07	0.05	-1.74	1.70	0.57	1.02	0.59	0	1.02	1	0.47	43797.51	21	0
Ghana	77	0.21	0.23	0.27	4.06	0.38	0.09	1.54	0.30	0.01	12.20	0.64	0.16	0.00	1	8.28	0	0.32	1423.36	6	0
Greece	338	0.29	0.44	0.51	6.53	0.39	0.05	0.85	0.35	0.05	2.40	1.00	1.08	0.17	0	-3.83	1	0.46	26742.64	1	0
Hong Kong	143	0.25	0.25	0.71		0.33	0.09	1.49	0.13	-1.84	3.28	0.94	1.77	6.31	1	3.24	0	0.23	33677.13	21	0
Hungary	60	0.19	0.24	0.58	6.36	0.44	0.11	0.96	0.05	-0.34	4.90	0.82	0.63	0.17	0	-0.44	1	0.53	13663.62	10	0
India	176	0.20	0.17	0.62	8.85	0.27	0.14	2.50	0.23	0.50	9.57	0.26	0.49	0.58	1	7.3	1	0.44	1285.54	11	0
Indonesia	2240	0.26	0.28	0.40	2.95	0.38	0.07	1.41	0.39	0.67	5.98	0.29	0.31	0.14	0	5.84	1	0.39	2952.41	10	0
Ireland	274	0.21	0.22	0.62	6.51	0.22	0.06	1.44	0.02	-1.64	1.10	0.87	1.96	0.05	1	0.2	1	0.25	53666.34	13	0
Israel	111	0.34	0.28	0.65	7.15	0.27	0.14	1.82	0.02	-0.78	2.54	0.77	0.91	0.36	0	3.87	0	0.31	30832.28	16	0
Italy	171	0.31	0.35	0.69	9.32	0.29	0.09	1.15	0.06	-0.10	2.07	0.29	1.12	0.48	0	-1.05	1	0.69	37098.82	15	0
Japan	1350	0.28	0.36	0.58	9.35	0.32	0.07	0.89	0.05	-1.47	-0.09	0.95	1.80	0.98	0	0.46	1	0.41	40845.84	17	0
Kazakhstan	26	0.11	0.15	0.46	8.05	0.52	0.22	1.10	0.84	0.92	8.41	0.52	0.43	0.02	0	5.56	1	0.33	9967.61	13	1
Kenya	98	0.19	0.22	0.49	5.63	0.48	0.12	1.16	0.06	1.01	11.09	0.57	0.28	0.02	1	5.05	1	0.47	1028.69	7	0
Korea, Rep.	584	0.21	0.24	0.50	8.57	0.30	0.08	1.26	0.10	-0.46	2.92	0.51	1.39	1.45	0	3.48	1	0.33	22677.4	15	0
Kuwait	556	0.19	0.23	0.32	5.34	0.28	0.08	1.05	0.95	-0.23	5.11	0.90	0.68	0.17	0	2.29	0	0.11	45822.47	18	1
Latvia	171	0.20	0.36	0.39	3.39	0.44	0.05	0.53	0.10	-0.18	4.85	0.93	0.85		0	0.08	1	0.37	13732.31	10	0
Lithuania	145	0.24	0.35	0.45	5.55	0.51	0.09	0.83	0.24	-0.20	4.25	0.91	0.58		0	2.21	1	0.44	13680.97	12	0
Malaysia	138	0.23	0.16	0.71	8.49	0.41	0.16	2.28	0.20	-0.17	2.37	0.77	1.11	0.46	0	4.69	1	0.35	9344.33	14	0
Mexico	199	0.25	0.20	0.72	8.23	0.36	0.12	1.75	0.18	0.35	4.26	0.55	0.25	0.10	0	2.09	1	0.44	9276.85	12	0
Netherlands	128	0.28	0.25	0.80	9.53	0.24	0.10	1.17	0.15	-2.15	1.99	0.97	1.85	0.82	0	0.43	1	0.39	52079.9	21	0
New Zealand	211	0.23	0.22	0.74	6.50	0.41	0.09	1.59	0.09	-2.36	2.45	0.96	1.44	0.03	1	1.43	0	0.35	35292.23	18	0
Nigeria	577	0.18	0.22	0.25	3.93	0.45	0.08	1.47	0.89	1.05	10.73	0.73	0.21	0.03	0	5.98	1	0.4	2109.38	7	1
Norway	117	0.23	0.22	0.71	7.70	0.35	0.10	1.52	0.73	-2.09	1.88	0.92		0.49	0	0.99	1	0.41	93556.44	21	1
Oman	104	0.20	0.20	0.36	5.51	0.39	0.13	1.44	0.84	-0.21	4.81	0.71	0.41	0.09	0	4.79	1	0.22	19904.41	15	1
Pakistan	439	0.24	0.28	0.38	5.45	0.42	0.10	1.22	0.06	0.97	11.81	0.89	0.21	0.15	1	3.11	0	0.39	1130.23	5	0
Peru	146	0.24	0.24	0.58	6.55	0.50	0.12	1.49	0.64	0.31	3.14	0.67	0.27	0.03	0	6.51	1	0.37	5170.54	12	1
Philippines	140	0.32	0.27	0.68	7.12	0.35	0.11	1.65	0.08	0.67	4.28	0.63	0.31	0.12	0	5.28	1	0.46	2193.37	9	0
Poland	81	0.14	0.20	0.59	8.48	0.52	0.12	0.93	0.09	-0.42	3.15	0.48	0.50	0.14	0	3.56	1	0.42	12881.95	14	0
Portugal	259	0.43	0.57	0.62	7.04	0.29	0.04	0.83	0.10	-0.99	1.77	0.70	1.74	0.25	0	-0.72	1	0.42	22665.28	11	0
Qatar	66	0.30	0.26	0.72	7.53	0.36	0.08	1.40	0.89	-1.25	3.74	0.87	0.42	0.21	0	12.65	0	0.11	80995.32	18	1
Romania	24	0.15	0.25	0.67	7.17	0.63	0.11	0.91	0.11	0.20	5.64	0.67	0.43	0.01	0	1.77	1	0.45	8858.46	10	0
Russia	264	0.25	0.29	0.61	7.79	0.55	0.13	1.21	0.73	1.03	8.82	0.14	0.45	0.42	0	2.68	1	0.43	11755.36	12	1
Saudi Arabia	660	0.22	0.17	0.44	6.23	0.48	0.10	1.87	0.89	0.09	5.18	0.54	0.39	0.75	0	5.53	0	0.15	20568.45	17	1
Singapore	109	0.22	0.17	0.64	8.85	0.28	0.11	1.51	0.18	-2.19	3.46	0.91	1.04	1.26	1	5.72	0	0.22	47034.86	21	0
Slovak Republic	30	0.14	0.27	0.52	5.93	0.48	0.04	0.64	0.08	-0.19	2.60	0.87	0.43	0.00	0	2.73	1	0.49	17324.99	16	0
Slovenia	35	0.31	0.45	0.61	7.66	0.52	0.09	0.95	0.09	-0.88	2.59	0.71	0.84	0.02	0	0.08	1	0.34	24288.74	17	0
South Africa	181	0.18	0.14	0.66	8.11	0.38	0.16	1.90	0.40	-0.05	6.59	0.99	1.47	0.68	1	2.51	0	0.32	6836.64	13	1
Spain	176	0.35	0.39	0.70	9.57	0.32	0.09	1.20	0.09	-1.00	2.20	0.80	1.94	0.92	0	-0.62	1	0.52	31572.59	17	0
Sweden	147	0.26	0.22	0.73	9.02	0.22	0.12	1.62	0.12	-2.27	1.45	0.43	1.27		0	1.04	1	0.53	54909.39	21	0
Switzerland	161	0.21	0.16	0.70	9.58	0.22	0.12	1.70	0.07	-2.13	0.39	0.44	1.60	1.61	0	1.71	1	0.29	76388.7	21	0
Tanzania	20	0.05	0.04	0.36	4.90	0.60	0.30	1.48	0.26	0.62	10.15	0.53	0.12		1	6.67	1	0.44	754.68		0
Thailand	2320	0.22	0.25	0.32	4.82	0.38	0.09	1.17	0.07	0.33	2.72	0.88	1.30	0.56	0	3.51	1	0.36	5062.82	13	0
Tunisia	159	0.20	0.21	0.32	4.17	0.31	0.07	1.43	0.17	0.14	4.34	0.75	0.68	0.03	0	3.15	0	0.62	4186.31	11	0
Turkey	519	0.23	0.25	0.44	6.85	0.30	0.08	1.24	0.09	-0.09	8.08	0.90	0.48	0.46	0	3.59	1	0.42	10099.74	9	0
Ukraine	130	0.15	0.19	0.45	6.64	0.40	0.06	1.01	0.13	0.95	10.27	0.69	0.76	0.01	0	0.71	1	0.56	3407.46	7	0
United Arab E.	103	0.18	0.25	0.41	7.00	0.38	0.07	0.96	0.66	-1.09		0.59	0.68	0.13	0	2.73	0	0.14	39990.78	18	1
United Kingdom	572	0.26	0.23	0.78	9.36	0.33	0.11	1.46	0.16	-1.64	3.03	0.44	1.81	1.08	1	0.69	1	0.35	41923.26	21	0
United States	2863	0.24	0.20	0.80	9.29	0.27	0.12	1.73	0.12	-1.31	2.09	0.34	1.92	2.51	1	1.06	1	0.41	49458.28	19	0
Venezuela, RB	22	0.11	0.25	0.45	6.17	0.41	0.04	0.49	0.92	1.14	28.93	0.47	0.23		0	2.81	1	0.59	10719.08	7	1
Vietnam	1508	0.27	0.36	0.29	3.61	0.22	0.07	0.95	0.14	0.60	11.57	0.47	0.99	0.11	0	5.85	1	0.38	1457.95	8	0

Variables:"Book leverage" – Total long- and short-term interest bearing debt to total assets; "Market leverage" – Total long- and short-term interest bearing debt to market value of the firm; "Maturity" – Long-term debt total debt; "Size" – Natural logarithm of assets in US dollars, millions; "Tangibility" – Fixed assets to total assets; "Profitability" – Cash from operations to total assets; "Market-to-book" – Market value to total assets; "Mineral exports" – Mineral exports share of total merchandise exports; "Corruption" – Corruption, high value indicates more corrupt, "CPI" – Consumer price inflation, %, year-on-year; "Concentration" – The share of assets of the three largest banks of total bank assets; "Private credit" – Domestic credit to private sector, % of GDP; "Market activity" – Stock market turnover, % of GDP; "Common law" – Binary variable with 1=common law legal origins; "GDP growth" – Annual real GDP growth rate, %; "GDP/cap, USD" – Per capita GDP in USD; "Deposit insurance" – Binary variable for deposit insurance with 1=deposit insurance scheme; "Profit tax" – Profit tax, % of commercial profits; "Rating" – S&P country credit rating in numeric scale; "Resource country" – Binary variable with 1=Resource-dependent country.

4 Oil price collapse and firm leverage in resource-dependent countries

4.1 Introduction

In the recent past, we have seen an oil price collapse twice, the first time in 2008 in conjunction with the global financial crisis, and the second time in 2014 due to several factors related to both the demand and supply of oil. These periods have caused severe economic challenges for countries dependent on the production and export of mineral resources. In this study, we look for a financial channel between oil price volatility and the resource curse by using micro-level data. As suggested by Gilbert and Mork (1986), oil price changes cause some costly resource reallocation. That could be particularly harmful for the non-resource related sectors in resource-dependent economies and thus enhance the resource curse.

Along with the rest of the economy, the financial sector in resource-dependent countries is expected to face distress following a drop in commodity prices. Holmstrom and Tirole (1997) show that a credit crunch, collateral squeeze and savings squeeze all lead to flight to quality in lending. We have at least two types of tightening of capital in our time period. First, the financial crisis in 2008-2009 caused a global credit crunch. Second, due to the decline in oil price in 2008 and 2014, resource firms experienced a collateral squeeze, which could have a significant effect for the whole banking sector in countries with a very large resource sector. According to Bernanke, Gertler et al. (1996), borrowers who face significant agency costs of borrowing are likely to bear the brunt of an economic downturn. In practice, smaller, younger

and less capitalized firms are the first to suffer from a credit crunch. This "flight to quality" is associated with a reduction in overall economic activity (Lang and Nakamura 1995).

We expect that, as the end product prices of commodity producers decline, these firms will gradually reduce investments and borrowing. Lower commodity prices also make resource firms riskier for lenders. On the one hand, that could lead to banks preferring other borrowers and supporting non-resource sectors in the economy. On the other hand, large and tangible resource firms might be considered by banks to be safe borrowers even during a financial distress, especially in resource-dependent countries despite the low commodity prices. Whether this flight-to-quality effect dominates is an empirical question which we address in this paper.

Based on previous theoretical and empirical literature, we present two hypotheses:

1) A sharp decline in commodity price has an adverse effect on the borrowing of the resource firms in all the countries.

2) In resource-dependent countries, a collapse in the oil price causes a significant collateral squeeze to the banking sector, leading to flight to quality in lending. Consequently, non-resource sectors face the adverse effect in borrowing as well.

We test these hypotheses empirically, using annual firm-level data from 65 different countries for the period 2005-2015, including approximately 3000 non-financial firms. Using difference-in-differences methodology, we show evidence of reallocation of financial resources following the oil price collapses in 2008 and 2014. We present empirical evidence that, in resource-dependent countries, not only resource firms but other firms as well reduce their borrowing after a collapse in oil price. The results suggest that oil price volatility harms economic diversification in resource-dependent countries through a financial channel.

The remainder of this paper consists of four sections. Section 2 introduces the related literature. Section 3 discusses the data and methodology. Section 4 presents the empirical results. Section 5 concludes.

4.2 Oil price volatility and financial channel in the previous literature

Using microeconomic data to explain macroeconomic fluctuations has recently gained popularity due to greatly improved data availability (e.g. Mian, Sufi 2010). To the best of our knowledge, this is the first paper to provide firm-level empirical evidence on changes in firm borrowing in resource-dependent countries following an oil price collapse. Our contribution to the previous literature is twofold. We present evidence that following a major decline in oil price, the fall in outstanding debt is more severe for resource firms in resource-dependent countries than in other countries. Further, we show that, while in non-resource-dependent countries only the resource firms reduce their leverage, in resource-dependent countries the other sectors follow as well. These results suggest that firm finance might play a part in hampering economic diversification in resource-dependent countries, thus enhancing the resource curse.

There is a relatively extensive branch of empirical literature that shows the adverse effect of the oil price on economic growth, equity returns or industry growth (Hamilton 1983, Nandha, Faff 2008, Lee, Ni 2002, Scholtens, Yurtsever 2012). Although the relationship is positive for resource firms and commodity producing countries, the negative effect on other industries and countries outweighs the benefits for oil producers in a global perspective (IEA 2004).

Asymmetry in the reaction to oil price has been detected by Mork (1989), showing that the negative effects of a rise in oil price are greater than the positive effects followed by a decline in price. The rationale of Gilbert and Mork (1986) is that, while price movements up and down have opposite and symmetric effects on the production possibility frontier, any oil price change causes some costly resource reallocation.

Van der Ploeg and Poelhekke (2009) argue that the resource curse or the development failure of resource abundant countries is caused by the volatility in commodity prices. They

show that, controlling for the volatility, resource wealth supports growth and that a developed financial sector can mitigate the price shocks. We take this finding to the firm level and detect whether a rapid fall in commodity prices causes reallocation of financial resources.

Khwaja and Mian (2008) present empirical evidence from an emerging market that large firms are twice hedged from liquidity shocks occurring in the financial sector. Banks reduce lending less to large firms, and large firms also have alternative borrowing channels. However, a global credit crunch creates an environment where alternative sources of financing can be limited for large firms as well. According to evidence from syndicated loans, the flight home effect reduces the availability of loans even for good borrowers, as banks withdraw to their home markets (Giannetti, Laeven 2012). Using evidence from Russia, Fungáčová, Herrala et al. (2013) show that foreign-owned banks reduced lending more than other banks during the 2008-2009 financial crisis. Lemmon and Roberts (2010) show that even large firms with access to public credit markets are susceptible to fluctuations in the supply of capital. Due to worsening investor sentiment, bond issues could also become less available for firms. Deterioration in investor sentiment can further reduce the availability of bank loans, as securitization becomes harder for banks (Shleifer, Vishny 2010). Zeitun, Temimi et al. (2016) argue, based on empirical evidence from CCG countries, that corporate capital structure was determined based on demand prior to the financial crisis in 2008, whereas after the crisis the supply side, i.e. banks, has increased in importance.

Despite the collateral squeeze caused by the decline in commodity prices, resource firms may well remain quality borrowers. Kurronen (2016), using micro-level data, shows that resource firms on average have less debt and a higher level of tangible assets than other firms, which could suggest that resource firms are prepared for the fluctuations in commodity prices by conservative leverage levels.

There is a rapidly growing branch of literature on the effects of the 2008-2009 financial crisis on firm capital structure. With US data, Harrison and Widjaja (2014) show that the role of assets tangibility increased after the financial crisis as a determinant for leverage. Using

data from Western Europe, Iqbal and Kume (2014) show that firm leverage ratios first increased during the financial crisis but decreased again after the crisis. However, the effects of the recent financial crisis on resource-dependent countries has received very limited attention.

4.3 Data and methodology

4.3.1 Data

Our firm data is from Bloomberg, from which we have gathered financial data from the companies included in the main equity indices of 73 countries in 2005-2015. The equity indices used are listed in Appendix 9. For the United States, we use the firms included in the S&P500 index. We limit the data to non-financial firms. We remove firms with missing values on debt or assets. We also remove observations from countries that do not have information on their fuel and metal exports for any of the years in our sample, as we are not able to determine their resource dependence. Country-specific variables are from The World Bank DataBank.

As the variable of interest we use annual real change in the amount of outstanding short- and long-term interest-bearing debt of a firm relative to the start period total assets. We use consumer price inflation (CPI) to deflate the nominal change in the debt amount. Although CPI is not a perfect measure of changes in price level, it is the most available one. We use the change in the amount of debt rather than the debt level, as Lemmon and Roberts (2010) have shown that the debt levels do not react strongly to changes in the supply of capital, since firms reduce investments accordingly. Moreover, using the current period assets in debt ratios would not give meaningful results, as the value of those assets for resource firms is changed due to the oil price drop and the effects on the amount of debt would not be visible.

As controls we use firm-specific variables which previous literature has shown to be important for firm leverage (see e.g. Titman and Wessels 1988; Rajan and Zingales 1995). We use the ratio of the firm's property, plant, and equipment to total assets as a measure of the

firm's tangibility, and we use the market-to-book ratio as a control for growth opportunities. Firm size is measured by the logarithm of total assets in US dollars and profitability by cash from operations to total assets, as that describes a firm's capability to generate cash to finance investments. We also use the book leverage to control for the leverage level. We trim the firm variables, removing observations that are more than four median absolute deviations from the median[14]. This reduces the risk of outliers or errors in the data driving the results, but it only removes clear outliers and not systematically the tails of the distribution, which might contain valuable information.

Based on GISC classification, we define resource firms as firms with the sector name "Energy" or the industry name "Metals & Mining". However, we exclude the sub-industry "Oil & Gas Refining & Marketing" from the energy sector, as Lee and Ni (2002) show that, contrary to the energy sector in general, the refining industry, which uses commodities as an input, is adversely affected by the rise in the price of oil. Resource-dependent countries are those where the share of metals and fuels (later minerals) in total exports exceeds 40% on average during the sample period. [15] Descriptive statistics of key variables and their correlation matrix are presented in Table 16. The variables are described in more detail in Appendix 10.

[14] We limit the maximum amount of trimmed observations to 1.5% for each variable. Consequently, for the real change in debt we increase the multiplier from 4 to 10, as it has a peaked distribution.
[15] In our sample, resource-dependent countries are: Australia, Bahrain, Chile, Colombia, Egypt, Kazakhstan, Kuwait, Nigeria, Norway, Oman, Peru, Qatar, Russia, Saudi Arabia, South Africa, the United Arab Emirates and Venezuela.

Table 16. Upper panel: Descriptive statistics of selected variables. Lower panel: Pearson correlation coefficient (lower triangle) and corresponding p-values (upper triangle)

	Descriptive statitistics												
		N	Mean	St. Dev.	Min	Median	Max						
	Real change in debt	33 364	0.02	0.1	-0.52	0	0.52						
	Size	39 654	9 508	30 617	0	1 193	877 551						
	Profitability	38 792	0.09	0.09	-0.22	0.08	0.38						
	Tangibility	35 536	0.35	0.24	0	0.31	1						
	Market-to-book	35 932	0.14	0.64	-2.27	0.06	2.39						
	Book leverage	38 994	0.24	0.18	0	0.23	1.02						
	GDP/cap USD	36 175	23 584	21 514	446	14 582	116 613						
	GDP growth	36 183	3.63	3.65	-14.81	3.35	27.5						
	CPI	39 451	4.05	4.01	-4.86	3.04	62.17						
	Corruption	36 184	0.44	1.05	-1.38	0.09	2.55						
	Resource firm	39 889	0.16	0.36	0	0	1						
	Resource country	39 889	0.16	0.37	0	0	1						
	Correlation matrix												
		1	2	3	4	5	6	7	8	9	10	11	12
1	Real change in debt		0.13	0.00	0.76	0.00	0.00	0.03	0.00	0.70	0.06	0.00	0.58
2	Size	0.01		0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	Profitability	-0.20	0.02		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00
4	Tangibility	0.00	-0.01	0.12		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	Market-to-book	0.06	-0.08	0.37	-0.06		0.00	0.00	0.00	0.00	0.00	0.02	0.00
6	Book leverage	0.21	0.06	-0.24	0.19	-0.11		0.13	0.00	0.00	0.78	0.00	0.00
7	GDP/cap USD	-0.01	0.24	0.10	-0.12	0.10	-0.01		0.00	0.00	0.00	0.00	0.00
8	GDP growth	0.08	-0.13	-0.03	0.03	0.16	-0.03	-0.44		0.00	0.00	0.01	0.00
9	CPI	0.00	-0.15	-0.04	0.03	-0.11	-0.02	-0.49	0.28		0.00	0.01	0.00
10	Corruption	-0.01	0.22	0.10	-0.10	0.11	0.00	0.88	-0.44	-0.54		0.00	0.00
11	Resource firm	0.03	0.04	0.01	0.19	0.01	-0.04	0.08	0.01	-0.01	0.08		0.00
12	Resource country	0.00	-0.09	0.02	0.06	0.05	-0.07	0.11	0.08	0.15	-0.02	0.04	

Notes: Pearson correlation coefficient in lower triangle and corresponding p-values in the upper triangle.Variables: "Real change in debt": Real annual change in short and long term interest bearing debt divided by the start of the period assets;"Size": Natural logarithm of assets in US dollars, millions; "Profitability": Cash from operations to total assets; "Tangibility": Fixed assets to total assets; "Market-to-book": Market value to total assets; "Book leverage": Total long and short term interest bearing debt to total assets; "GDP/cap USD": GDP per capita in US dollars; "GDP growth": Annual real GDP growth rate, %; "CPI": Consumer price inflation, %, year-on-year; "Corruption": Corruption, high value indicates less corrupt;"Resource firm": Binary variable for 1=resource firm; "Resource country": Binary variable with 1=Resource-dependent country.

Oil price developments for 2005-2015 are depicted in Figure 2. Two major price falls occurred during the sample period, the first one during the second half of 2008 and the second during the second half of 2014. However, the reasons behind the price declines were quite different. In 2008 the fall started due to deteriorating global growth outlook, but accelerated in September after the bankruptcy of Lehmann Brothers initiated a global financial crisis. In 2014, the demand for oil was subdued, mostly due to slowing growth in China, but no major recession was in sight. Simultaneously, the supply of oil continued to increase due to US shale oil investments, the re-entrance of Iran to the market and increasing stability in Libya. Consequently, the supply of oil exceeded demand (IEA 2016). Moreover, neither the oil cartel

OPEC nor other big producers showed any interest in limiting the supply of oil despite the fall in prices. Metals prices declined at a much more moderate pace than the oil price, which indicates that supply issues mattered more in the oil price decline in 2014 (Baumeister, Kilian 2016). All in all, the fall in oil price in 2014 improved the global economic outlook, as the economic growth in most countries is supported by lower energy prices. As the price falls were so large and rapid in our sample period, the "normal" time periods consist mostly of rising or relatively stable prices. That should amplify the effect we find following a sudden price shock.

Even though we study the effects of the oil price change, the strong co-movement of oil and many other commodities warrants our broader definition of resources, which is energy and metals. Prices of both energy and industrial commodities react to global business cycles (Barsky, Kilian 2002). Ohashi and Okimoto (2016) show that, due to financialization of commodities, there has been an increasing trend of excess co-movement in commodities since 2000.

Figure 2 Brent crude oil price in 2005-2015

Data limitations are well known in empirical studies on liquidity shocks. As Khwaja and Mian (2008) discuss, due to the lack of links between banks and individual firms over time, it is difficult to separate the effect of a shock on bank lending and on firm borrowing. We approach this issue from the firm's side and compare the change in leverage of four groups of firms: resource and non-resource firms based on their location in resource or non-resource-dependent countries.

Table 17 presents the descriptive statistics for these four groups of firms, showing strong heterogeneity. Firms in resource countries are smaller than in other countries, especially non-resource firms. The market-to-book ratio is higher in resource countries, and resource firms are more tangible than other firms. Interestingly, the GDP per capita is higher in resource countries than in other countries in our data.

We have annual data, which does not allow very detailed analysis of changes in firm leverage. In particular, immediately after the start of the global financial crisis, some firms might have used their existing credit facilities to insure their liquidity even without an actual need for debt. Ivashina and Scharfstein (2010) show evidence of such behavior by US firms during late 2008. Due to data limitations, we nevertheless focus on what happened during the next 1-2 years after the fall in oil prices. As shown by e.g. Gertler and Gilchrist (1994), it takes time for firms to adjust their lending after a downturn. This is also shown by Iqbal and Kume (2014), using data on Western European countries around the time of the financial crisis in 2008-2009. Based on a large sample of empirical studies, Jones et al. (2004) also show the largest impacts of oil prices on output in the 3rd and 4th, and even later, following quarters, so a one-to-two-year lag is expected to give reasonable results.

Table 17. Descriptive statistics by four groups based on resource indicators

Descriptives for resource firms in resource countries

Statistic	N	Mean	St. Dev.	Min	Median	Max
Real change in de	987	0.02	0.11	-0.44	0.00	0.51
Size	1 240	8335	33649	0	544	421711
Profitability	1 169	0.09	0.10	-0.20	0.09	0.38
Tangibility	1 167	0.39	0.26	0.00	0.39	1.00
Market-to-book	1 074	0.22	0.67	-1.48	0.17	2.35
Book leverage	1 201	0.20	0.18	0.00	0.18	0.91
GDP/cap USD	1 127	36319	27518	804	36085	102832
GDP growth	1 129	3.72	3.20	-7.82	3.41	26.17
CPI	1 215	4.81	4.42	-4.86	3.23	62.17
Corruption	1 129	0.76	1.29	-1.38	1.13	2.29

Descriptives for non-resource firms in resource countries

Statistic	N	Mean	St. Dev.	Min	Median	Max
Real change in de	4 161	0.02	0.10	-0.51	0.00	0.52
Size	5 335	2304	6525	0	382	95445
Profitability	5 099	0.09	0.10	-0.21	0.09	0.38
Tangibility	5 073	0.37	0.24	0.00	0.35	0.99
Market-to-book	4 645	0.21	0.65	-2.16	0.15	2.38
Book leverage	5 100	0.21	0.18	0.00	0.20	0.93
GDP/cap USD	4 848	26949	22704	804	21164	102832
GDP growth	4 854	4.41	3.41	-7.82	4.40	26.17
CPI	5 200	5.55	4.40	-4.86	4.14	62.17
Corruption	4 854	0.31	1.12	-1.38	0.06	2.29

Descriptives for resource firms in non-resource countries

Statistic	N	Mean	St. Dev.	Min	Median	Max
Real change in de	4 269	0.03	0.11	-0.49	0.00	0.52
Size	5 017	13503	43048	0	1692	480161
Profitability	4 879	0.09	0.09	-0.22	0.09	0.38
Tangibility	4 169	0.47	0.25	0.00	0.46	1.00
Market-to-book	4 504	0.14	0.61	-2.24	0.08	2.39
Book leverage	4 957	0.23	0.18	0.00	0.21	0.96
GDP/cap USD	4 592	25265	22406	502	14443	116613
GDP growth	4 592	3.75	3.75	-14.81	3.07	14.19
CPI	4 991	3.71	3.79	-4.48	2.63	48.72
Corruption	4 592	0.59	1.12	-1.09	0.28	2.55

Descriptives for non-resource firms in non-resource countries

Statistic	N	Mean	St. Dev.	Min	Median	Max
Real change in de	23 947	0.02	0.10	-0.52	0.00	0.52
Size	28 062	10216	30365	0	1614	877551
Profitability	27 645	0.09	0.09	-0.22	0.08	0.38
Tangibility	25 127	0.32	0.22	0.00	0.28	1.00
Market-to-book	25 709	0.12	0.64	-2.27	0.04	2.39
Book leverage	27 736	0.25	0.18	0.00	0.24	1.02
GDP/cap USD	25 608	22085	20517	446	11307	116613
GDP growth	25 608	3.45	3.68	-14.81	3.03	27.50
CPI	28 045	3.80	3.89	-4.48	2.96	48.72
Corruption	25 609	0.42	1.01	-1.09	0.08	2.55

Notes: Variables: "Real change in debt": Real annual change in short and long term interest bearing debt divided by the start of the period assets;"Size": Natural logarithm of assets in US dollars, millions; "Profitability": Cash from operations to total assets; "Tangibility": Fixed assets to total assets; "Market-to-book": Market value to total assets; "Book leverage": Total long and short term interest bearing debt to total assets; "GDP/cap USD": GDP per capita in US dollars; "GDP growth": Annual real GDP growth rate, %; "CPI": Consumer price inflation, %, year-on-year; "Corruption": Corruption, high value indicates less corrupt.

The averages of the dependent variable, real change in debt, are depicted in Figure 3 for firms in resource and non-resource-dependent countries with a 95% confidence interval. It seems that the reaction in 2009 was much stronger for firms in resource-dependent countries than in other countries. Moreover, after the oil price collapse in 2014, debt growth seems to have accelerated in non-resource countries but decelerated in resource countries, as expected based on previous knowledge about the effects of oil price fluctuations.

Figure 3. Real change in debt and 95% confidence intervals shown for firms in resource-dependent and other countries

4.3.2 Methodology

We use difference-in-differences (DiD) regression to disclose whether the real change in debt was different for firms in resource countries (the treatment group) than for firms in other countries (the control group) during the years immediately after after a commodity price drop. Next, we estimate the regressions separately for resource-dependent and other countries and look for evidence of whether the change in debt was different for resource firms (the treatment group) and other firms (the control group). Our motivation is to determine whether the fall seen in change in debt in Figure 3 is due to resource firms or whether other sectors follow.

Difference-in-differences is a quasi-experimental approach well suited to estimating the effects of a sudden exogenous change in the economic environment (Angrist, Krueger 1999). The key assumption is that, without the shock (the oil price collapse), the treatment and control groups would have had a similar development path, i.e. parallel growth trends. Before proceeding to regressions, we make sure that the parallel trend assumption holds for the two pre-crisis periods by testing the similarity in growth rates of the dependent variable.

The difference-in-differences regression equation becomes

$$Y_{ijkt} = \beta_0 + \beta_1 I_{ijkt}(Treat) + \beta_2 I_{ijkt}(year \in 2009{,}2010) + \beta_3 I_{ijkt}(year \in 2015) +$$

$$\beta_4 I_{ijkt}(Treat) \times I_{ijkt}(year \in 2009{,}2010) + \beta_5 I_{ijkt}(Treat) \times I_{ij}(year \in 2015) +$$

$$\varphi_j + \gamma_k + \delta_t + \vartheta X_{ijt-1} + \varepsilon_{ijt},$$

where *i,j,k* and *t* are the indexes of firm, country, industry and year, respectively. Y_{ijkt} is the real change in debt of firm *i*, country *j*, industry *k* and year *t*. $I_{ijkt}(Treat)$ is the indicator function, which receives the value 1 if the observation belongs to the treatment group, and 0 otherwise. Similarly, indicator functions $I_{ijkt}(year \in 2009{,}2010)$ and $I_{ijkt}(year \in 2015)$ indicate whether the observation is from the post-shock years 2009-2010 or 2015, respectively. $I_{ijkt}(Treat) \times I_{ijkt}(year \in 2009{,}2010)$ and $I_{ijkt}(Treat) \times I_{ij}(year \in 2015)$ are the difference-in-differences terms indicating whether the observation belongs to both the treatment group and the post-shock years. φ_j is the country fixed effect, γ_k is the industry fixed effect and δ_t is the year effect. ϑX_{ijt-1} presents the firm-specific one-period lagged variables, and ε_{ijt} is the random disturbance.

The main interest in the difference-in-differences estimator here lies in the coefficients β_4 and β_5 which are the differences in post-treatment differences between the treatment and control groups. They describe whether the treatment group's reaction to the shock is different from that of the control group. The interpretation of the other key parameters is the following: β_0 is the pre-treatment coefficient for the control group, and β_1 is the pre-treatment difference

of the treatment group from the control group. β_2 and β_3 are the post-treatment differences of the coefficient for the control groups from their pre-treatment coefficients.

Our choice for using two years to indicate the post-shock period after the beginning of the financial crisis in 2008 is data-driven, as the negative effect seems to carry on to 2010 despite the oil price recovery. However, we also test the regressions while limiting the post-crisis years to 2009 and 2015, and the results are similar but slightly weaker.

4.4 Results

4.4.1 Matching

Due to heterogeneous groups (Table 17) we follow the approach of Lemmon and Roberts (2010) and use nearest neighbor propensity score matching, introduced by Rosenbaum and Rubin (1983), to determine the appropriate control group for each of our treatment groups in the pre-shock period of 2006-2008. Each treatment group with their corresponding control group is listed in Table 18.

Table 18. Treatment and control groups

	Treatment	Control
(1)	Resource firms in resource countries	Resource firms in non-resource countries
(2)	Non-resource firms in resource countries	Non-resource firms in non-resource countries
(3)	Resource firms in resource countries	Non-resource firms in resource countries
(4)	Resource firms in non-resource countries	Non-resource firms in non-resource countries

The goal of this nonparametric preprocessing approach is to adjust the data prior to the parametric analysis in order to reduce or even eliminate the relationship between the treatment group and the independent variables without causing bias or too much inefficiency. In our case, for example, resource firms are smaller in resource-dependent countries than elsewhere. That is, the treatment group (resource firms in resource countries) is linked to the independent variable (firm size). As we cannot know the true relationship between the treatment group and independent variables, we need to make strong assumptions when choosing the parametric model. The goal of the preprocessing of the data

by sample matching is to eliminate the model dependence of the later parametric estimations. To be clear, matching does not mean pairing observations, but distributions need to be matched as closely as possible. Even if some relationship remained between the treatment group and the independent variables, the procedure can greatly reduce the model dependence, which is a valuable feature given that we have no knowledge of the true parametric model. (See thorough discussion on propensity score matching in Ho, Imai et al. (2007)).

The matching begins with a logit regression with the binary variable indicating whether a firm is located in a resource country (pairs (2) and (3) in Table 18) or whether the firm is a resource firm (pairs (1) and (4)). That is, we have four logit regressions to find the best possible control group for our treatment groups. Given that the pool of control firms is significantly larger than the treatment group in all of the four cases, we choose two control firms for each treatment firm. We use matching with replacement, meaning that each control firm can be matched to more than one treatment firm. The matching process also drops firms when they fall outside the support range of the distance score before matching, which reduces the effect of outliers. In the four cases, 2-11 treatment firms are dropped, or a maximum of 3.6 % (Table 19).

First, we want the parallel trend assumption to be satisfied in the pre-shock era, so we include the growth in the change in real debt in the matching process. To be specific, we do not include the dependent variable of our later parametric regressions, but only its growth rate. In addition to that, we include the control variables of firm size, profitability, tangibility and market-to-book ratio, which are the most commonly used explanatory variables for firm leverage. We also use book leverage as a firm-specific control variable, as we expect the leverage level to be an important determinant for debt growth. Further, we look for matches from within a country and industry, so we include these fixed effects. When looking for the control group for firms in resource-dependent countries from non-resource countries, country fixed effects is not feasible, but we use binary variables indicating whether the country is

developed[16] and whether it has a developed banking sector (above median in our sample). We also include the level of corruption as a country-specific control variable, as it has been shown to be an important determinant for firm leverage (Fan, Titman et al. 2012). We use pre-shock era (2006-2008) averages of our variables in the matching process.

Propensity score matching considerably reduces the relationship between the treatment group and the independent variables in our data, but it does not remove it completely. Thus, model dependence is not totally eliminated with the matching process in this case. Propensity score matching results in Table 19 and corresponding logit regressions before and after matching in Table 20 show that firm size, market-to-book ratio and tangibility remain significant in some of the post-matching logit regressions. Moreover, a country's income level and the development level of the banking sector remain significant for the sample of non-resource firms in Table 20's post-match regression (2). Consequently, we will continue to include these variables in the parametric regressions with the matched sample by using country fixed effects instead of development indicators. The mean difference for real change in debt growth between the treatment and control groups increased in group (2) in Table 19. However, the group means remain economically similar, and the Wilcoxon test with the null hypothesis that the groups have the same median cannot be rejected (p-value 0.91), verifying that the parallel trend assumption also holds in this case.

It worth noting that, despite these shortcomings, most of the variable coefficients are not only insignificant but also clearly smaller in the post-match logit regressions, indicating that the improvement is not merely due to the decrease in degrees of freedom. Also, industry and country fixed effects are no longer significant in the post-match regressions, although not reported in the table. Despite the fact that not all variables in the treatment group are well matched, the Pseudo-R^2 has dropped considerably. In sum, the matching process has greatly

[16] Classification is based on World Bank world income ranking in 2008, and developed countries are the ones belonging to the high income group according to the World Bank classification.

reduced the differences in the variables between the treatment and control groups and has also insured that the parallel trend assumption holds.

Next, we test whether we can also use these matched firms in the later event. We conduct a two-sided Wilcoxon test for the matched treatment and control groups to verify the parallel trend assumption for the 2012-2014 period. All the tests reported in Table 21 fail to reject the null hypothesis of a similar trend, and we can pursue difference-in-differences regression for the whole sample period with our matched firms.

Table 19. Propensity score matching results

	Resource firms in resource vs. non-resource countries				**Non-resource firms in resource vs. non-resource countries**			
		(1)				**(2)**		
	Means treated	Means control	Mean difference	%-balance improvement in mean difference	Means treated	Means control	Mean difference	%-balance improvement in mean difference
Real change in debt growth	0.000	0.003	-0.003	75.2	-0.003	-0.005	0.002	-48.8
Size	6.494	6.797	-0.304	49.0	6.011	6.057	-0.046	96.0
Profitability	0.091	0.079	0.013	21.9	0.102	0.103	-0.002	80.2
Market-to-book	0.225	0.131	0.094	-14.5	0.238	0.240	-0.002	98.6
Tangibility	0.391	0.373	0.017	82.9	0.364	0.356	0.008	85.0
Book leverage	0.231	0.220	0.011	-46.1	0.217	0.222	-0.004	88.3
Developed	0.682	0.677	0.006	93.6	0.642	0.619	0.023	74.2
Developed banks	0.471	0.482	-0.012	94.5	0.247	0.236	0.011	96.9
Corruption	0.881	0.896	-0.016	84.1	0.470	0.561	-0.091	-4.2
All Obs	88	309			330	1876		
Matched	85	112			324	386		
	Resource vs. non-resource firms in resource countries				**Resource vs. non-resource firms in non-resource countries**			
		(3)				**(4)**		
	Means treated	Means control	Mean difference	%-balance improvement in mean difference	Means treated	Means control	Mean difference	%-balance improvement in mean difference
Real change in debt growth	0.006	0.010	-0.004	60.3	-0.004	-0.005	0.001	28.8
Size	6.435	6.564	-0.129	70.9	7.016	7.104	-0.088	23.7
Profitability	0.090	0.095	-0.005	64.4	0.103	0.096	0.008	36.8
Market-to-book	0.239	0.280	-0.041	-55.9	0.142	0.122	0.021	64.1
Tangibility	0.383	0.401	-0.018	-5.7	0.472	0.475	-0.003	98.5
Book leverage	0.230	0.234	-0.004	73.2	0.224	0.234	-0.010	67.0
All Obs	88	330			309	1876		
Matched	86	107			298	394		

Variables: "Real change in debt growth": Growth of real annual change in short and long term interest bearing debt divided by the start of the period assets;"Size": Natural logarithm of assets in US dollars, millions; "Profitability": Cash from operations to total assets; "Tangibility": Fixed assets to total assets; "Market-to-book": Market value to total assets; "Book leverage": Total long and short term interest bearing debt to total assets; "Developed": Binary variable with value 1 if the country is a high income country in 2008 based on World Bank classification and 0 otherwise; "Developed banks": Binary variable with value 1 if bank credit to private sector/GDP is above median in our sample, 0 otherwise; "Corruption": Corruption, high value indicates less corrupt.

Table 20. Logit regressions before and after matching

	Dependent variable:				*Dependent variable:*			
	Resource country				**Resource firm**			
	Pre-match	Post-match	Pre-match	Post-match	Pre-match	Post-match	Pre-match	Post-match
	Resource firms		Non-resource firms		Resource countries		Non-resource countries	
	(1)		(2)		(3)		(4)	
Real change in debt growth	1.391	-0.624	-0.026	0.299	1.51	0.279	-0.503	-0.3
	(1.31)	(1.54)	(0.81)	(0.96)	(1.42)	(1.62)	(0.88)	(1.07)
Size	-0.018	-0.018	-0.259***	-0.112***	-0.196**	-0.064	-0.113***	-0.023
	(0.05)	(0.06)	(0.03)	(0.04)	(0.09)	(0.10)	(0.04)	(0.04)
Profitability	-1.115	1.013	-2.203**	-1.299	-2.790*	-0.678	-0.351	0.654
	(1.69)	(1.95)	(1.07)	(1.20)	(1.66)	(1.78)	(1.17)	(1.31)
Market-to-book	0.371	0.389	0.876***	0.281*	-0.18	-0.138	-0.05	-0.026
	(0.26)	(0.31)	(0.14)	(0.16)	(0.28)	(0.31)	(0.15)	(0.17)
Tangibility	-1.463**	-0.524	1.145***	0.349	1.199*	-0.288	3.419***	1.267***
	(0.62)	(0.72)	(0.38)	(0.43)	(0.67)	(0.76)	(0.33)	(0.39)
Book leverage	0.706	0.959	-1.058**	-0.564	0.475	0.894	-2.270***	-0.907
	(0.89)	(1.10)	(0.47)	(0.56)	(0.95)	(1.10)	(0.49)	(0.58)
Developed banks	-1.878***	-0.491	-1.939***	-0.554**				
	(0.40)	(0.51)	(0.19)	(0.24)				
Developed	1.020*	0.282	1.439***	0.684***				
	(0.56)	(0.63)	(0.21)	(0.24)				
Corruption	0.332	0.016	0.274**	0.042				
	(0.28)	(0.30)	(0.11)	(0.13)				
Constant	-0.711	-0.441	-15.477	0.536	0.599	0.41	-1.519	14.221
	(0.58)	(0.70)	(766.09)	(0.77)	(0.66)	(0.73)	(1.25)	(882.74)
Industry fixed effects	yes	yes	yes	yes	no	no	no	no
Country fixed effects	no	no	no	no	yes	yes	yes	yes
Observations	397	197	2 206	710	418	193	2 185	692
Pseudo R^2	0.17	0.02	0.20	0.05	0.12	0.02	0.24	0.05
Akaike Inf. Crit.	393	289	1558	1043	401	298	1537	993

*Notes: *p<0.1; **p<0.05; ***p<0.01 Variables: "Real change in debt growth": Growth of real annual change in short and long term interest bearing debt divided by the start of the period assets;"Size": Natural logarithm of assets in US dollars, millions; "Profitability": Cash from operations to total assets; "Tangibility": Fixed assets to total assets; "Market-to-book": Market value to total assets; "Book leverage": Total long and short term interest bearing debt to total assets; "Developed": Binary variable with value 1 if the country is a high income country in 2008 based on World Bank classification and 0 otherwise; "Developed banks": Binary variable with value 1 if bank credit to private sector/GDP is above median in our sample, 0 otherwise; "Corruption": Corruption, high value indicates less corrupt.*

Table 21. Wilcoxon test for parallel trends in 2012-2014 for the matched sample

Wilcoxon two sample test with null hypothesis that the samples are from population with the same median. The tested variable is the average growth rate of real change in debt of the firms.

	2012-2014				
	Treatment	**Mean**	**Control**	**Mean**	Wilcoxon p-value
(1)	Resource firms in resource countries	-0.014	Resource firms in non-resource countries	-0.008	0.299
(2)	Non-resource firms in resource countries	-0.003	Non-resource firms in non-resource countries	-0.002	0.761
(3)	Resource firms in resource countries	-0.014	Non-resource firms in resource countries	-0.003	0.188
(4)	Resource firms in non-resource countries	-0.008	Non-resource firms in non-resource countries	-0.002	0.836

4.4.2 Difference-in-differences

Difference-in-differences results in Table 22 show that resource firms and firms in resource-dependent countries fared worse after an oil price shock than their counterparts in non-resource industries or non-resource countries. Our main interest in these regressions lies in the DiD coefficients for 2009-2010 and 2015.

Regressions (1) and (2) in Table 22 compare firm performance in resource-dependent countries to that in other countries. In regression (1) the DiD coefficients are negative and also statistically significant for the 2009-2010 crisis, indicating that the resource firms in resource-dependent countries reduced the amount of outstanding debt after the oil price shock. For the resource firms in non-resource countries, the change was close to zero, which is shown by the crisis year dummies in regression (1). Similarly, non-resource firms experienced stronger reduction in debt if they were located in a resource-dependent country (column (2)).

When looking at the relative performance of resource firms vs. non-resource firms within a country group in columns (3) and (4), we can conclude that both resource and non-resource firms performed poorly in resource-dependent countries. In contrast, in non-resource countries the resource-sector reduced its leverage significantly more than the non-resource sector in 2015, when the oil price collapse was not accompanied by a global financial crisis. We also verify the results with a non-matched sample and find the results robust.[17]

[17] The regression results for the unmatched sample are available on request.

Table 22. Difference-in-differences regression results for matched samples

	Dependent variable:			
	Real change in debt			
Treatment	Resource firms in resource countries	Non-resource firms in resource countries	Resource firms in resource countries	Resource firms in non-resource countries
Control	Resource firms in non-resource countries	Non-resource firms in non-resource countries	Non-resource firms in resource countries	Non-resource firms in non-resource countries
	(1)	(2)	(3)	(4)
Oil crisis 09-10	0.006	-0.017**	-0.028**	-0.008
	-0.014	-0.007	-0.013	-0.006
Oil crisis15	0.002	-0.016**	-0.017	0.006
	-0.013	-0.007	-0.015	-0.007
Resource country	0.003	0.032**		
	-0.006	-0.015		
Resource firm			-0.001	0.008***
			-0.007	-0.003
DiD 2009-2010	-0.024*	-0.014**	0.004	0.003
	-0.013	-0.006	-0.013	-0.006
DiD 2015	-0.021	-0.013*	-0.008	-0.024***
	-0.015	-0.008	-0.016	-0.007
Constant	0.021**	-0.024	0.031***	0.009*
	-0.01	-0.016	-0.01	-0.005
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1 754	5 978	1 644	6 275

*Notes: *p<0.1; **p<0.05; ***p<0.01. Robust standard errors clustered by firm. Dependent variable: "Real change in debt": Real annual change in short and long term interest bearing debt divided by the start of the period assets. Independent variables: "Oil crisis 09-10": Binary variable with value 1 if the observation is from year 2009 or 2010, 0 otherwise; "Oil crisis 15": Binary variable with value 1 if the observation is from year 2015; "Resource firm": Binary variable for 1=resource firm; "Resource country": Binary variable with 1=Resource-dependent country.*

Our results suggest that the oil price collapse harms the leverage growth of both resource and non-resource firms in resource-dependent countries. Based on these results, we cannot, however, tell whether the non-resource sector merely reduces its demand for debt due to the worsened growth opportunities or whether the supply of debt plays a role too.

4.4.3 The role of banks

To detect whether the supply of finance plays a role, we look into the firms in resource-dependent countries in more detail, using a difference-in-differences approach without sample matching. We do not have data on the source of leverage of the firms, but we use the

knowledge from previous literature that smaller firms tend to be more dependent on banks than bigger firms and that banks provide shorter maturity debt than capital markets (Gertler, Gilchrist 1994, Demirgüç-Kunt, Maksimovic 2002). Thus, we dummy out firms in resource-dependent countries which are below the median by size in our sample, which have debt maturity below median and which had some amount of debt in 2007 and 2013 before the two crises. This classification yields 113 firms in the earlier period, and 149 in the later period, which we classify as bank-dependent. The reaction of these bank-dependent firms could reveal whether the domestic banking sector fared worse after the crises than international capital markets did.

Similarly, we look for evidence of a flight-to-quality phenomenon. From previous literature we know that smaller, younger and less capitalized firms are the first to suffer from flight to quality, as banks find bigger and more tangible firms more attractive (Bernanke, Gertler et al. 1996). We dummy out firms in resource-dependent countries, firms which are bigger and more tangible than the median firm and which had an existing book leverage below the median in 2007 and 2013. This results in 49 and 55 firms for the earlier and later period, respectively, and we name these groups bank-attractive. We confirm that the parallel trend assumption holds (Table 23) where all the tests fail to reject the null hypothesis of population with the same median. However, there is a clear difference in the mean values of the group in the second and third rows, a fact which could be economically significant. We will thus also use a matched sample later on to test the robustness of the regression results.

Bank-attractive firms reduced their borrowing less than other firms in resource-dependent countries in the 2009 crisis (column (3) in Table 24), whereas for the later crisis the difference-in-differences coefficient is close to zero. The results suggest a flight to quality in lending when the oil price collapse coincided with a global financial crisis. This result is in line with the theoretical underpinning that, in the event of a credit crunch, flight to quality leads to reallocation of financial resources, which favors bigger and more tangible firms with a strong balance sheet. However, although the coefficient is also positive for the difference-in-

differences term for 2015, it is very small and insignificant. Thus, we find no evidence that an oil price decline alone in late 2014 would have caused a similar reaction. In fact, when looking at the performance of bank-dependent firms in 2015 in column (2), it seems that they were better off than other firms in the resource-dependent countries after the collapse in oil price in 2014, although the coefficient is not significant at the 10% level. That could indicate that financial resources from banks became more available when the oil price drop reduced the borrowing of resource firms. We verify the results, using a matched sample for the results in columns (2) and (3) in Table 24, and find the results robust.[18]

Table 23. Wilcoxon test for bank-dependent and bank-attractive firms

Wilcoxon two sample test with null hypothesis that the samples are from population with the same median. The tested variable is the average growth rate of real change in debt of the firms during the two periods: 2006-2008 and 2012-2014.

2006-2008

Treatment	**Mean**	**Control**	**Mean**	Wilcoxon p-value
Bank-dependent firms in resource countries	0.002	Non-bank-dependent firms in resource countries	0.001	0.8396
Firms attractive for banks in resource countries	0.012	Firms not attractive for banks in resource countries	0.000	0.273

2012-2014

Treatment	**Mean**	**Control**	**Mean**	Wilcoxon p-value
Bank-dependent firms in resource countries	-0.018	Non-bank-dependent firms in resource countries	-0.008	0.4668
Firms attractive for banks in resource countries	-0.004	Firms not attractive for banks in resource countries	-0.011	0.4022

[18] These regression results, as well as the statistics on the matching procedure, are available on request.

Control variables in all regressions are, as expected, based on previous literature. Larger and more tangible firms and firms with higher market-to-book ratio have higher real debt growth rates, whereas more profitable firms and firms with a higher debt level have slower growth in debt. Our model captures only a relatively small part of the variance in leverage growth, which, however, is typical for leverage regressions on large firm data (see e.g. Lemmon, Roberts 2010). The results remain robust if we remove the shock years 2008 and 2014 from the estimations, or if we only use the year 2009 as the first crisis indicator instead of the two-year period of 2009-2010.

We must highlight that these results cannot be directly extrapolated, which is a shortcoming in the difference-in-differences approach and particularly relevant for the matched data. The results are valid for the used data and, although that data is extensive, small firms in the sample are small only among firms included in the main equity indices: unlisted small firms might face very different circumstances. That is, even the small firms in our sample might belong to the group of quality borrowers from the banks' perspective.

There is theoretical and empirical work as well as surveys to further support our results that supply frictions play a role in the contraction of firm borrowing after the oil price shocks in resource-dependent countries and that not all of the reaction can be attributed to demand factors. As the oil price drop and the global credit crunch cause a collateral squeeze in resource-dependent countries in particular, some reallocation of financial resources and flight to quality is expected (Holmstrom, Tirole 1997). Further, Beck (2011) uses survey data to argue that the availability of financing is an obstacle for firms in resource-dependent countries. Zeitun et al. (2016) show, from the Gulf Cooperation Council (GCC) -countries, that credit supply constraints have been apparent after the financial crisis in 2008-2009.

Table 24. Difference-in-differences regression results for bank-dependent and bank-attractive firms

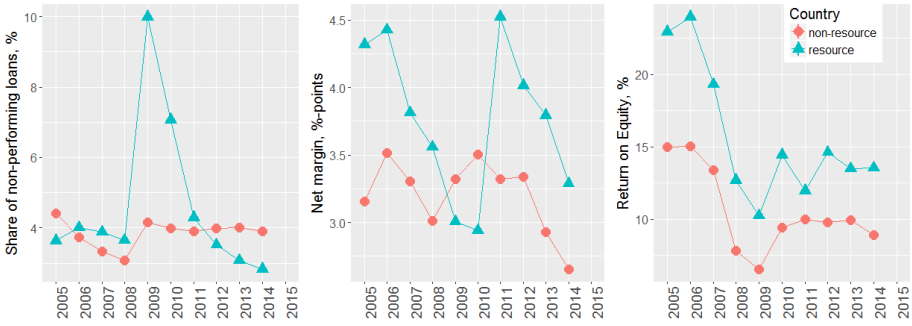
	Dependent variable:			
	Real change in debt			
Treatment	Bank-dependent firms in 2007	Bank-dependent firms in 2013	Firms attractive for banks in 2007	Firms attractive for banks in 2013
Control	Non-bank-dependent firms in 2007	Non-bank-dependent firms in 2013	Firms not attractive for banks in 2007	Firms not attractive for banks in 2013
	(1)	(2)	(3)	(4)
log(lagassetsUSD)	0.002	0.006***	0.004**	0.007***
	(0.002)	(0.001)	(0.002)	(0.001)
lagprofitability	-0.013	-0.038	-0.002	-0.034
	(0.031)	(0.030)	(0.030)	(0.030)
lagtangibility	0.015	0.006	0.022	0.013
	(0.014)	(0.011)	(0.015)	(0.012)
laglogmarkettobook	0.011**	0.015***	0.013***	0.014***
	(0.005)	(0.004)	(0.005)	(0.004)
lagdebttoassets	-0.128***	-0.076***	-0.141***	-0.088***
	(0.022)	(0.016)	(0.023)	(0.017)
oilcrisis0910	-0.033***		-0.039***	
	(0.009)		(0.006)	
oilcrisis15		-0.013**		-0.008
		(0.006)		(0.006)
bank-dependent	-0.001	0.005		
	(0.011)	(0.006)		
bank-attractive			-0.032***	-0.030***
			(0.012)	(0.007)
D-i-D	-0.011	0.018	0.023*	0.002
	(0.012)	(0.011)	(0.014)	(0.015)
Constant	-0.011	-0.026*	-0.021	-0.028**
	(0.028)	(0.014)	(0.028)	(0.014)
Observations	1,821	2,125	1,844	2,131
R^2	0.118	0.07	0.116	0.073
Note:	*p<0.1; **p<0.05; ***p<0.01			
	Robust standard errors clustered by firm. Country, year and industry dummies included in all regressions.			

There is a possibility that the regressions are biased due to endogeneity. However, we use country, industry and year fixed effects to reduce the risk of endogeneity rising from omitted variables. We use lagged values of control variables, which reduces the risk for contemporaneous correlation between the independent variables and the error term. Sample matching reduces the dependence on the parametric model chosen, but results are robust when using the whole unmatched data as well.

All in all, the oil price drop causes negative growth in firm leverage in resource-dependent countries for all firms and in both crisis times in our sample. That supports the idea that there is a volatility curse (van der Ploeg, Poelhekke 2009), that volatility is a key channel of the resource curse and that the financial sector works as a part of that channel. Van der Ploeg and Poelhekke (2009) further argue that a developed financial sector can mitigate the harmful effects of oil price volatility. Country fixed effects should capture the development level of the financial sector in our regression, given the relatively short time period we have.

Our data also shows strong implications of bank distress after the beginning of the financial crisis in 2008, a fact which further supports our hypothesis that the supply of credit was particularly limited in resource-dependent countries. The chart on the left in Figure 4 shows the share of non-performing loans for resource and non-resource countries weighted by the number of firms in each country in our sample. Non-performing loans increased (left chart), whereas net margin (middle chart) and return on equity (right chart) squeezed in both groups in our data, but more in the resource-dependent countries in 2009. Unfortunately, we do not yet have the figures for 2015.

Figure 4. Financial sector was under distress during financial crisis 2008-2009 in resource-dependent countries



Our sample consists only of firms included in the main equity index of each country. So, even though we do not find evidence that non-resource sectors in resource-dependent countries would have suffered more than resource firms from the oil price drop, the results are not even nearly exhaustive. It could be the case that large listed firms are all considered quality

borrowers in each economy, so that the firms suffering from the flight-to-quality or flight-to-liquidity phenomenon in the economy are smaller and unlisted. However, the volatility of the oil price seems to affect the leverage of listed firms in resource-dependent countries, confirming that the financial sector is one channel though which the resource curse operates.

4.5 Conclusions

We present the hypothesis that an oil price collapse hinders not only resource firms but also all firms in resource-dependent countries through a financial channel. We presume that the collateral squeeze in the financial sector following a drop in resource firms' asset values leads to reduced lending by banks and flight to quality in lending.

Using an extensive micro-level dataset, we show that, indeed, after the two recent collapses in oil price in 2008 and 2014, firms in resource-dependent countries reduced their borrowing and that the effect was similar for resource and non-resource firms. In non-resource countries we find no evidence that firms in non-resource sectors would have faced slower leverage growth, whereas resource firms did have slower growth in leverage following the oil price drop in 2014. Further, we find evidence that flight to quality played its part in resource-dependent countries, as large and tangible firms with low debt ratios did not reduce their borrowing after the oil price collapse and the beginning of the financial crisis in 2008. However, when the oil price drop in 2014 was not accompanied by a global financial crisis, we do not find evidence of flight to quality with our sample firms.

Due to data limitations we cannot verify to what extent the negative change in debt by non-resource firms in resource-dependent countries is attributed to the demand and supply of credit. However, our results show clear support for the volatility hypothesis behind the resource curse. A collapse in oil price leads to an adverse effect on firm borrowing in resource-dependent countries for both resource and non-resource firms.

Our results are not exhaustive and not easily extrapolated to other types of firms. The consequence of an oil price fall could be very different for small unlisted firms or state-owned enterprises, and that would be an interesting path for future research.

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Appendix

Appendix 9. Equity indices

	Country	Index in Bloomberg		Country	Index in Bloomberg
1	Argentina	Argent Merval	37	Malaysia	FTSE Malay KLCI
2	Australia	ASX200	38	Mexico	MEX IPC
3	Austria	ATX Austria Trd	39	Mongolia	MSE top 20
4	Bahrain	Bahrain All Share	40	Namibia	FTSE/Namibia
5	Belgium	BEL 20 index	41	Netherlands	AEX-index
6	Botswana	Botswana Gab	42	New Zealand	NZX 50
7	Brazil	IBOVESPA	43	Nigeria	Nigeria SE All
8	Bulgaria	BSE Sofix	44	Norway	OBX Stock
9	Canada	TSX	45	Oman	Muscat SM 30
10	Chile	Chile SM Select	46	Pakistan	KARACHI 100
11	China	CSI300	47	Peru	Peru Lima Gen
12	Colombia	Colom COLCAP	48	Philippines	PSEi Philippine
13	Croatia	Zagreb CROBEX	49	Poland	WIG 20
14	Czech Republic	Prague SE index	50	Portugal	PSI General POR
15	Denmark	OMX Copenhagen 20	51	Quatar	QE index
16	Egypt	Egypt Hermes	52	Romania	Bucharest BET
17	Estonia	OMX Tallinn index	53	Russia	RTS Index
18	Finland	OMX Helsinki 25	54	Saudi Arabia	Tadawull
19	France	CAC 40 Index	55	Singapore	FTSE Straits Tim
20	Germany	DAX Index	56	Slovakia	Slovak Share Index
21	Ghana	GSE Comp	57	Slovenia	Slovenia Blue Chip
22	Greece	Athex Composite	58	South Africa	FTSE/JSE Africa Top 40
23	Hong Kong	Hang Seng	59	South Korea	KRX 100
24	Hungary	Budapest SE index	60	Spain	IBEX35 ESP
25	India	S&P BSE SENSEX 30	61	Sweden	OMX STKH30
26	Indonesia	Jakarta Comp	62	Switzerland	Swiss Market Index
27	Ireland	ISEQ Overall	63	Taiwan	Taiwan TAIEX
28	Israel	Tel Aviv 25	64	Tanzania	Tanzania all sh
29	Italy	FTSE MIB ITA	65	Thailand	SE Thai Index
30	Japan	Nikkei 225	66	Tunisia	Tunis SE
31	Kazakhstan	KASE	67	Turkey	BIST 100 Index
32	Kenya	Nairobi SE 20	68	Ukraine	PFTS Index
33	Kuwait	Kuwait SE Weighted	69	United Arab Emirates	DFM General Index
34	Latvia	OMX Riga index	70	United Kingdon	FTSE 100 Index
35	Lithuania	OMX Vilnius index	71	United States	S&P500
36	Luxembourg	LuxX	72	Venezuela	Venezuela SM
			73	Vietnam	Ho Chi Minh Stk
	Index compositions as of November 2013				

Appendix 10. Description of the variables

Firm variables	**Description**	**Source**	**Bloomberg code**
Sector	Global Industry Classification Standard (GICS) by MSCI and Standard & Poor's including 10 sectors, 67 industries and 156 sub-industries	Bloomberg	GICS_SECTOR_NAME
Industry		Bloomberg	GICS_INDUSTRY_NAME
Sub-industry		Bloomberg	GICS_SUB_INDUSTRY_NAME
Country	Country of domicile	Bloomberg	COUNTRY_OF_DOMICILE
Assets	Total assets	Bloomberg	BS_TOT_ASSET
Market capitalization	Market capitalization	Bloomberg	HISTORICAL_MARKET_CAP
Long term debt	All interest-bearing financial obligations that are not current	Bloomberg	BS_LT_BORROW
Short term debt	Includes bank overdrafts, short-term debts and borrowings, repurchase agreements	Bloomberg	BS_ST_BORROW
Cash From Operations	Cash From Operations	Bloomberg	CF_CASH_FROM_OPER
Capital Expenditures	Capital Expenditures	Bloomberg	CAPITAL_EXPEND
Fixed assets	Property, plant and equipment	Bloomberg	ARD_PROPERTY_PLANT_EQUIP_NET
Value	Market capitalization + long and short term debt + preferred equity and minority interest	Bloomberg	HISTORICAL_MARKET_CAP+BS_LT_BORROW+BS_ST_BORROW+PREFERRED_EQUITY_&_MINORITY_INT
Market-to-book	Value/Total assets	Bloomberg	
Size	Natural logarithm of Total asset in USD	Bloomberg/World Databank	
Profitability	Cash From Operations/Total assets	Bloomberg	
Tangibility	Property, plant and equipment/Total assets	Bloomberg	
Book leverage	Total debt/Total assets		
Market leverage	Total debt/Value		
Country variables	**Description**	**Source**	
CPI	Annual change in consumer price index, %	World databank	
Exchange rate	Exchange rate USD per local currency	World databank	
Fuel exports	Fuel exports, % of merchandise exports	World databank	
Metal exports	Ores and metals exports, % of merchandise exports	World databank	
Private credit	Domestic credit to private sector, % of GDP	World databank	