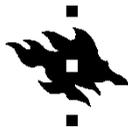# Determinants of Finland-Sweden bond yield spread during 1995-2013

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Tiivistelmä – Referat – Abstract

In this thesis, I study the determinants of Finland-Sweden bond yield spread during 1995-2013 by using the Ordinary Least Squares (OLS) approach. I form different regression models, where Finland-Sweden 10-year bond yield spread is dependent variable and variables, based on the bond pricing theory, are explanatory variables. In addition to the regression analysis, I conduct a plot analysis, in which I aim to study whether there are any certain events that may have affected the bond yield spread. The idea behind the plot analysis is that the EMU membership of Finland may have increased the bond yield spread, mainly due to the lack of a lender of last resort.

The results from the regression analysis suggest that risk aversion was possibly an important determinant of Finland-Sweden bond yield spread developments during the crisis period 07/2007-12/2013. The risk aversion was measured by the VIX-index. The study also finds some support that other things rather than country specific fiscal fundamentals where driving the bond yield spread during 01/1995-12/2013. The plot analysis results suggest that It is possible that the convergence of bond yields across euro countries and Sweden, were one reason for bond yield spread developments before the crisis period. The results also show that the announcement of the new European Central Bank`s Outright Monetary Transactions (OMT) program in 2012, likely started the fall in the bond yield spread. In addition, during the crisis period, Finland`s bond yield may have benefited from the global risk aversion but not as much as Germany and Sweden.

Avainsanat – Nyckelord – Keywords

Bond yield spread – Government bond yield – Determinants of bond yield spread

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1 Introduction

The aim of this thesis is to examine and shed light on why Finland`s and Sweden`s 10-year bond yields differ during 1995-2013. The motivation for the study comes from the fact that the bond yield spread[1] of Finland and Sweden has become tighter and occasionally even sharply positive (see figure 1), although credit ratings for the two have stayed fairly stable[2]. One possible explanation is that Finland`s EMU membership has contributed to a riskier outlook about its ability to serve its debt. This explanation is supported by Paul De Grauwe`s view that the lack of a lender of last resort[3] for euro countries signals that bond repayment at maturity is not guaranteed (De Grauwe 2011). De Grauwe (2011) noticed that bond yields for Spain were rising and started to differ from UK`s bond yield since the beginning of the financial crisis in 2007, although UK:s Debt to GDP ratio rose more rapidly. He concluded that the EMU membership of Spain was the main reason for this.

There are lots of articles regarding the determinants of bond yield spreads of different countries. Especially European debt crisis raised[4] the question whether the financial markets worked rationally when bond spreads surged in European periphery countries such as Greece after the collapse of Lehman Brothers on September, 2008. The majority of research is done by using panel data and studying several countries at the same time. Problem in panel data studies is the assumption of homogeneity (bond yields in every country respond to fiscal fundamentals[5] in a same way) which can be partially relaxed by adding country specific fixed effects, but still the slope coefficients suffer from homogeneity[6]. (Poghosyan 2012). Panel data allows researcher to study so called

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[1] Bond yield spread (bond spread) is a difference between two countries bond yields. Bond spread formula is simply: Country A`s bond yield at time t – Country B`s bond yield at time t. In most of the studies bond spreads are calculated against Germany.

[2] See, for example, the credit ratings from Fitch Ratings Inc. at https://www.fitchratings.com/web_content/ratings/sovereign_ratings_history.xls

[3] Lender of last resort is a lender (typically a central bank), which borrows money to financial institutions when they can`t borrow from the markets. (OECD 2001).

[4] The European debt crisis started in the late 2009 and there is still no clear ending point for it.

[5] Fiscal fundamental is any country specific key figure which gives information about country`s economical situation, for example, gross domestic product (GDP) growth rate or public deficit to GDP.

[6] Nickel et al. (2009) find that expected deficit is important in explaining spreads in five

contagion between countries. According to Roberto De Santis (2012), contagion is a situation in which instability in a particular market transmits to one or many other markets. Measuring contagion is controversial and there are many definitions of how to do it. Studies using different definition and measurement for contagion make results hard to compare. Simply contagion can be some part of the bond yield that is not explained by independent variables. These independent variables are often measuring credit risk, liquidity risk and risk aversion.

My approach, to study the determinants of Finland-Sweden bond spread, is to use time-series data and run a dynamic Ordinary Least Squares (OLS) regression using Finland-Sweden bond yield spread as dependent variable and proxies of theory based bond pricing elements as explanatory variables. Bond pricing elements consist of credit risk, risk aversion and liquidity risk. Also Germany`s 10-year bond yield has been added as explanatory variable because Germany`s bond yield is likely a base of Finland`s bond yield (Germany`s yield is considered as a risk free euro rate). The main issue in the study is that Finland and Sweden bond yields are in different currencies (euro and krona), so the possible changes in expected exchange rates may cause bond yields to change. I take this into account by using Uncovered Interest Rate Parity -theorem[7] and thus, by adding a variable consisting of Germany`s and Sweden`s 6-months treasury bill yield spreads[8]. Although, in theory, a 6-month treasury bill yield difference tells from currency expectations only 6-months forward, it can give information about the exchange rate expectations of investors. Even if the Expected exchange rate variable does not capture all of the real variation, it can be argued that the sharp movements in the bond spread, especially between 2008-2012, were probably not caused by changes in exchange rate expectations because the bond spread movements during that period tend to move together with Finland-Germany 10-year bond spread, which is measured in the same euro currency.

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emerging economies. However, after running separate single-country regressions they can confirm the results for only two countries.

[7] Uncovered interest rate parity is a parity condition which states that any difference in interest rates between two countries is equal to the expected change in exchange rates between the countries. (Investopedia 2015).

[8] Treasury bills with such a short maturities can be considered as bearing no risk, so the difference in yield should mainly tell about currency value expectations.

In addition to the regression analysis, I visually study the effect of Finland`s EMU membership by plotting Finland-Sweden bond spread with events that may have contributed to it such as the ECB`s announcements of SMP and OMT. The main idea is to show how large seems to be the effect of OMT announcement compared to other important announcements. The plot analysis is first applied for the years 2007-2013 as this period contains fast and relatively large movements in euro countries bond spreads that are not likely explained by basic slowly changing fiscal fundamentals such as Deficit to GDP ratio. I also discuss about plots regarding OMT, Risk aversion and Convergence of bond yields. It should be emphasized that the plot analysis is speculative and should not be considered as giving any real information about the causalities between certain events and bond spreads. Rather the plot analysis is here to show that possibly other things than country specific fiscal fundamentals may have affected the bond spread as well. In this study, the crisis period is the period 07/2007-12/2013.

The remainder of the paper is in nine sections. First, I give a literature review from the subject. Second, I discuss about the potential link between the Finland`s EMU membership and the bond spread. Third, I tell about the theoretical approach of the study. Fourth, I discuss about how to measure the theoretical elements of the bond spread. Fifth, I introduce the data and explain how the variables are constructed. Sixth, I present the linear regression model and show the results from the different model specifications. Seventh, I conduct the plot analysis, and eighth, I conclude the study.
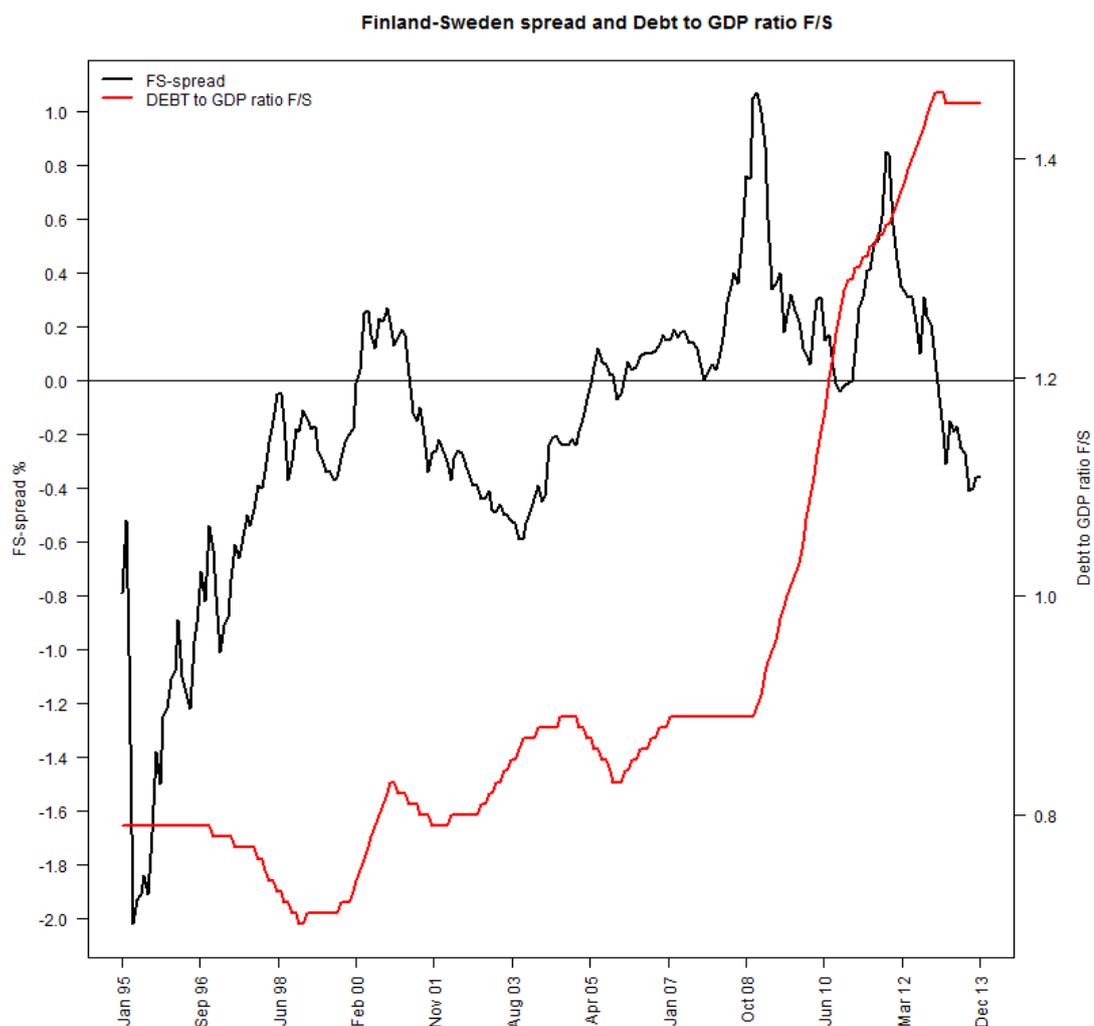
Figure 1. Finland-Sweden 10-year bond spread and Debt to GDP ratio. Time period 01/1995-12/2013. Source. Bank of Finland, Eurostat and Riksbank.

2 Literature review

2.1 Single-country studies

Gibson et al. (2011) aim to explain the reasons which led into financial crisis in Greece in 2009. The authors are especially interested in the connection between growing fiscal imbalances and bond spreads. Paper uses two main empirical approaches to examine the determinants of bond spreads. First, the authors study bonds risk premium[9] by decomposing it into a part which can be explained by credit ratings and a part which is irrational and thus describes the idiosyncratic factors of the markets. Credit ratings are

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[9]Risk premium is here defined: R(GR)=R(GB)+P+E, where R(GR) is interest rate for Greece, R(GB) interest rate for Germany (Considered as risk free rate), P=Risk premium, E=Error term.

assumed to reflect strongly the fiscal fundamentals so the irrational part of the risk premium may be a sign of underpricing or overpricing the risk in the market. Second, they investigate Greek bond spreads relative to Germany`s 10-year bond by using monthly data from the period 2000-2010. Determinants of the bond spreads are studied using time series cointegration techniques such as VAR, and the goal is to find the long-term fiscal fundamentals that affect the spread. Unlike in many other studies, panel data is not used. After the authors have estimated the cointegrating relationship between the macroeconomic determinants and Greek bond spreads, they compare estimates to actual values. They find that markets have undervalued risk from the end of 2004 up to the middle of 2005 and overvalued when the crisis erupted in 2009. De Grauwe and Ji (2012) had similar results suggesting that there was undervaluation of risk in Greece spreads during 2001-2008 and overvaluation of risk during 2010-2011. Also Beirne and Fratzscher (2012) find evidence for such mispricing behavior, however they emphasize that it`s always hard to estimate such mispricing as it would require precise knowledge of what the real equilibrium price should be. Their results suggest that there may have been differences in pricing of the risk between pre-crisis and crisis period. For example, if Greek fiscal fundamentals were priced as in the crisis period then the bond spread would have been higher during the pre-crisis period. They propose that there has been a wake-up[10] call between investor so when the crisis erupted investors began to price the fiscal fundamentals more strongly. De Grauwe and Ji (2012) and Afonso et al. (2012) find similar evidence that the fiscal fundamentals became more important to investors when the crisis started.

The fiscal fundamentals in the Greece study are: measure for fiscal situation (latest estimates of fiscal Deficit to GDP ratio and Debt to GDP ratio), measure for competitiveness[11], measure for economic activity (coincident indicator of economic activity constructed by Bank of Greece), measures for external factors such as oil price[12]. The authors also use a measure for fiscal news and find it significant in explaining spread movements. Also oil prices, economic activity, relative prices (measure for competitiveness) are significant factors. The authors explain that the other

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[10] Wake-up call or fundamental contagion: A sharp rise in the sensitivity of financial markets to fundamentals (Beirne and Fratzscher 2012).

[11] Competitiveness was measured by comparing Greek price level to Germany`s price level. This aimed to catch the real appreciation. Also trade- and current accounts (as percentage of GDP) were used.

[12] Greece is highly dependent on imported oil from outside the Euro Economic Area (European Commission 2013).

factors such as Debt to GDP ratio are insignificant because their effects were captured by the significant factors. For example, the measure for fiscal news is best in capturing the state of government's fiscal situation.

Other relevant single-country studies are Linde (2001), Nickel et al. (2009) and Chinn- and Frankell (2005). Linde finds that higher budget deficit in Sweden lead to higher government borrowing costs in 1982-1996. Nickel et al. (2009) examine emerging economies by using both panel regressions and country specific regressions. They find budget deficits as an important factor for two out of five countries. In their panel regressions they get biased results compared to country specific results so they suggest that the importance of individual explanatory variables varies across countries. Chinn- and Frankell (2005) studied the period 1988-2004, and they find that an increase in Debt to GDP ratio raises bond yields in Germany less than in other European countries (France, UK, Spain, Italy). These results suggest that the homogenous approach (used in panel data studies) towards euro countries should be used with caution.

2.2 Panel data studies

Beirne and Fratzscher (2012) study the determinants of bond spreads and CDS[13] spreads in 31 advanced and emerging countries. They find fiscal fundamentals and the wake-up call as the most important determinants of spreads in the period 2008-2011. Fiscal fundamentals didn`t explain much of the changes in bond spreads of euro countries during pre-crisis period (2000-2007). The authors give three reasons for this different pricing behavior of the investors. First, the investors may have priced the same fiscal fundamentals in different way during crisis period, for example, they may have ignored them before the crisis. Second, a negative shock in other euro country such as Greece may have affected other euro countries bond yields because investors fear the spreading of the shock (Regional contagion). Third, there could have been herding behavior or panic among the investors (Pure contagion). The authors find no support for the Regional contagion in eurozone during the crisis, however, these regional spillovers of risk seem to be more important in pre-crisis period suggesting that euro countries bonds were priced within the region despite the differences in fiscal fundamentals. Pure

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[13]Credit default swap (CDS) is a financial swap which transfers credit risk between seller parties. The buyer of CDS receives credit protection so in the case of default the seller of CDS pays the loan to the buyer.

contagion had a role in bond pricing during the crisis period but it was relatively not as important as the fiscal fundamentals and the wake-up call. Haugh et al. (2009) find that risk aversion interacted with expected Deficit to GDP- and Debt to GDP ratio and amplified their effect on spreads i.e. the wake-up call was due to increased risk aversion.

De Santis (2012) examines euro country bond spreads (against Germany) during the crisis 2008-2011 and finds three reasons for the developments. First, an aggregate regional risk factor (measures risk aversion and flight-to-liquidity), which explains changes in all euro area spreads and was the main reason for Finland`s bond spread changes. Second, a country-specific credit risk, and third, a spillover effect from Greece. Negative spillover from Greece affected mostly countries with weak fundamentals such as Ireland, Portugal and Spain. De Santis (2013) gets similar results for euro countries when studying a longer period 2006-2012. Flight-to-liquidity and flight-to-quality were still the key determinants for Finland. The author measures the aggregate risk factor by German KFW-bond and German bond which are both guaranteed by the government thus carrying the same credit risk. According to Giordano et all. (2012), Finland and other core countries benefited from flight-to-quality during crisis. Also Poghosyan (2012) concludes in a similar way. It may thus be that Finland and Germany both benefited from flight-to-quality but Germany more, partially due to its larger (more liquid) bond markets.

Poghosyan (2012) distinguishes between short-run effects and long-run effects in bond yields using panel cointegration techniques. He uses a potential growth rate variable and a debt to GDP variable as long-run determinants and finds both as significant factors. Both coefficient signs are positive so also a rise in potential growth rate leads to increase in bond spreads. The relationship between long-run determinants and bond spreads has weakened since the start of the EMU. From short-run determinants of real bond yields[14] the author calls important: inflation, short-term interest rate and Debt to GDP ratio. Inflation affected real bond yields negatively, the author suggests that this is due to surprise inflation. The other two variables affected positively on bond spreads. Almost half of the deviation in real bond yields from their long-run equilibrium adjusted in one year.

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[14] Poghosyan (2012) studies real bond yields so he has adjusted bond yields for inflation.

In other relevant studies, Dell`Erba et al. (2013) find that Debt to GDP ratio is statistically significant in explaining Sweden`s bond spreads. In the study of Attinasi et al. (2009), expected Debt to GDP ratio and expected Deficit to GDP ratio are found important determinants for Finland`s bond spread (against Germany), explaining up to 39% of the spread changes.

3 Economic and Monetary Union (EMU) membership as the difference between Finland and Sweden

Finland passed the control of its monetary policy to European Central Bank (ECB) when it joined the third stage of EMU in 1999. According to De Grauwe (2011), losing the capacity to issue debt in a currency one has control of can cause bond yields to rise. He explains that Spain has to pay higher interest rate on its 10-year bond than UK although the deficit and the debt in Spain are much lower than those in UK. This happens because UK has control over its currency and central bank[15], thus UK can implicitly guarantee that it will have the liquidity to pay off the bond at maturity (De Grauwe 2011). According to De Grauwe`s theory, bond spreads should come down if ECB presents itself as the lender of last resort.

In July 2012, the president of ECB, Mario Draghi promised that ECB will do "whatever it takes" to save euro. In addition, in September 2012, ECB announced details from its new program called Outright Monetary Transactions[16] (OMT) which allows ECB to buy bonds (unlimited quantities) of euro countries having difficulties in debt issuing. These announcements were likely to cause falls in bond yields of struggling economies such as Greece, Spain and Italy[17]. Johnson and Santor (2013) find that the announcement of OMT declined the dispersion in government bond yields across the eurozone. According to them, this supports the hypothesis that country specific risk factors (for example, fiscal fundamentals of a country) started to become less relevant and the common

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[15]Bank of England is independent public organization so basically UK government can't force it to buy UK bonds. However during crisis "loyalty" or even a change in legislation could start bond purchases.

[16] Outright Monetary Transactions (OMT) is a bond purchasing program which allows ECB to buy bonds issued by euro countries, under certain conditions, from the secondary bond markets.

[17] See, for example, De Santis 2013, Altavilla et al. 2014, Saka et al. 2014 and Hochstein 2013.

eurozone interest rate factor became relatively more important. This was probably the extreme case in the pre-crisis period when bond yields in eurozone moved very closely to each other so there was a very high integration (See, for example, Tumpel-Gugerell 2005). Beirne and Fratzscher (2012) were unable to find reason for this pre-crisis situation, but they state that it could be due to ignorance of fiscal fundamentals and/or implicit bail-out guarantee which basically means that a member country couldn`t get in a difficulties as other member countries would save it. There is somewhat consensus in the literature that financial markets underpriced the risk in euro area before the crisis (see, for example, ECB (2014)). The OMT program has never been activated so just the presence of it has been remarkable for bond spreads and thus helps countries like Spain to access funding at lower interest rates. De Grauwe (2014) finds that Spain and UK 10-year government bond yields have converged and are almost equal in 2014 although Spain`s Debt to GDP ratio is already higher than UK`s. He concludes that this happened due to OMT. Spain`s 10-year bond yield has even been close to that of US which is normally considered as safe haven. However, inflation rates in Spain are expected to be lower than in US so real yields still differ.

The predecessor of OMT was called Securities Market Program[18] (SMP). According to De Grauwe (2012), SMP didn`t work as planned because it was limited in size and time. However, there is some evidence that SMP program was able to reduce bond yields in countries it was targeted (see, for example, Kilponen et al. 2012 and Ghysels et al. 2014). European Stability Mechanism[19] (ESM) is another safeguard mechanism made for providing liquidity to a member country in financial difficulty. De Grauwe (2012) claims that ESM has the same problem as SMP which had limited resources. When ESM buys bonds from secondary markets, it may give an incentive for the investors to sell their bonds because resources of EMS are limited. De Grauwe explains that situation is similar to the one described in the paper of Paul Krugman (1979), when central bank is trying to keep a fixed exchange rate with limited foreign reserves. Speculators know that central banks foreign reserves are limited so they sell before the reserves end. Greene (2012) thinks that in the case of ESM, it may be possible that creditors benefit more than debtor due to the limited resources. In addition to the limited

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[18] Securities Market Program was a bond puchasing program used by ECB. It was replaced by OMT in 2012.

[19] European Stabilization Mechanism is an organization which provides financial assistance to euro zone member countries in financial difficulties. All euro zone countries are members of EMS

capacity, ESM carries a special feature compared to OMT: its debt is senior.

Steinkamp and Westermann (2012) argue that the share of senior lenders has been important in explaining the part of bond spreads which can`t be explained by fiscal fundamentals. They find evidence that large residuals in the paper of De Grauwe and Ji (2012) can be reduced by adding their proxy variable for senior lending tranche. Seniority means that there are lenders in a better position than others i.e. in the case of default, the senior lenders will get their payment first. However, the amount of senior debt is unlikely to affect bond yields of euro countries like Finland and Germany since they haven`t needed any rescue package.

The several policy steps taken to ease the European debt crisis seem to have affected individual euro countries differently. For example, the decisions related to ESM seemed to raise bond yield of Germany but had no effect on Spain`s yield. These kind of decisions may increase risk in some countries and decrease it in other countries. Especially an announcement of financial support package may be seen as risk sharing between countries and thus raising bond yields in countries with solid fiscal fundamentals such as Germany and Finland. (Kilponen et al. 2012). Attianasi et al. (2009) find that the announcements of rescue packages have led to reassessment of credit risk mainly due to transfer of risk from private sector to government.

4 Theoretical approach

4.1 Bond yield spread

I use a standard definition of bond risk which is determined by credit risk (default risk), liquidity risk and risk appetite (see, for example, Bellas et al. 2010 and Beirne and Fratzscher 2012). Assuming that the investors are risk averse, the relationship between risk free and risky bond can be written as:

1. $P(X_t)\big(1 + r_f\big) + \big(1 - P(X_t)\big)(\mu) = \big(1 + r_g\big) + \theta_t + \gamma_t$

Where, $P(X_t)$ is probability of no default, $\big(1 - P(X_t)\big)$ is probability of default, r_f yield in a risky bond, r_g yield in a risk free bond, μ recovery rate in case of default[20], θ_t risk

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[20] Recovery rate of 0 means that all the money invested in a bond is lost in a case of default.

aversion premium and γ_t liquidity premium. Equation 1 can be solved to approximate a bond yield spread S_t of risky and risk free bond $(S_t = r_{ft} - r_{gt})$ by assuming $(1 - P(X_t))$ and r_f are small. Solving for the spread, we get:

2. $S_t = \left(1 - P(X_t)\right)(1 - \mu) + \theta_t + \gamma_t$

4.2 Relationship between government budget constraint and debt

To understand the link between credit risk and government debt, it is useful to write government annual budget constraint as follows (for example, Contessi 2012 and ECB 2011a):

3. $G_t + i_t D_{t-1} = T_t + (D_t - D_{t-1}) + (M_t - M_{t-1})$

Where, G_t is government spending, $i_t D_{t-1}$ interest on outstanding debt, T_t tax income, $(D_t - D_{t-1})$ net borrowing and $(M_t - M_{t-1})$ change in money stock. I assume that government can finance its expenditures (left-handside) by taxes, issuing new debt or changing money stock (Seigniorage). Let`s define primary balance as $B = T_t - G_t$ and solve the equation for D_t (debt at the end of period t):

4. $D_t = (1 + i_t)D_{t-1} - B - \Delta M$

Let`s divide equation by nominal GDP $(P_t Y_t)$ to get Debt to GDP ratio d_t:

5. $\dfrac{D_t}{P_t Y_y} = \dfrac{(1+i_t)D_{t-1}}{P_t Y_y} - \dfrac{B_t}{P_t Y_y} - \dfrac{\Delta M_t}{P_t Y_t}$

6. $d_t = \dfrac{(1+i_t)}{(1+g_t)(1+\Pi_t)} d_{t-1} - b_t - \Delta m_t$

In equation 6, I have used the known approximation and decomposed nominal growth rate of GDP component[21] into growth component $1 + g_{rt}$ and price component $1 + \Pi_t$ where g_{rt} is real GDP growth rate and Π_t inflation rate. Nominal interest rate

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[21] $1 + g_{nt} = (1 + g_{rt})(1 + \Pi_t)$ where g_{nt} is nominal growth rate of GDP. Similar to Fisher equation.

component can be written as the Fisher equation: $(1 + i_t) = (1 + r_t)(1 + \Pi_t)$ where r_t is real interest rate. Plugging it into equation 6:

7. $\quad d_t = \frac{(1+r_t)}{(1+g_t)} d_{t-1} - b_t - \Delta m_t$

The Dept to GDP ratio depends on real interest rate, real GDP growth rate, primary balance and seigniorage. If interest rate exceeds the GDP growth rate, then the debt accumulates unless budget surplus or seigniorage will fill the gap. Next, I get the change in government Debt to GDP ratio by subtracting d_{t-1} from both sides:

8. $\quad \Delta d_t = \frac{r_t - g_t}{1 + g_t} d_{t-1} - b_t - \Delta m_t$

The primary budget level where debt is stabilized ($\Delta d_t = 0$):

9. $\quad b_t = \frac{r_t - g_t}{1 + g_t} d_{t-1} - \Delta m_t$

Seigniorage is an option for a government with own currency like Sweden to reduce debt to GDP level without primary budget surplus. Reinhard and Sbrancia (2011) estimate that Sweden benefited from negative real interest rate[22], for most of the time, during 1947-1965. Also low nominal interest rates helped to reduce debt servicing costs. Debt to GDP percent dropped from 52% in 1945 to 29.6% in 1955. The authors estimate that debt to GDP percent would have been 59.1% in 1955 without "financial repression[23]". Annual inflation in 1946-1955 averaged 5 %. Also countries such as United States, UK, Australia, Belgium and Italy inflated their debt, for example, US reduced debt to GDP percent from 116% to 66.2% during 1945-1955. The authors argue that inflation is the most effective way in debt liquidating, when interest rates can`t response to rise in inflation or in inflation expectations, for example, when interest rates are predetermined or administered (Financial repression).

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[22]Real value of government debt falls with negative real interest rates.

[23]Financial repression means all the measures taken by which government channels funds to themselves. For example, directed lending to government, caps on interest rates, increased association between banks and government (See, for example, Reinhard and Sbrancia 2011)

5 Measuring theoretical determinants

5.1 Measuring credit risk

Credit risk is commonly measured by variables which explain country`s fiscal situation such as Debt to GDP ratio, Deficit to GDP ratio, credit ratings, Current account balance to GDP ratio and real GDP growth rate. Also measures for: competitiveness, political stability, size of the banking sector, inflation and default history have been used. Widely used "contagion" can also be included into credit risk category as a bad fiscal situation, for example, in Russia is likely to affect on a current account of a country like Finland, and thus its ability to pay back its debt.

Investors make investment decisions on government bonds using all the information they have at the time of buying a bond. This information includes past, present and future so investors use also expected future values (especially regarding the credit risk components mentioned above) in determining the bond`s current value. Using expected values is common in literature but the lack of decent high frequency data is a problem. Although actual country data suffers from the same problem, it is still better available. Credit ratings are considered to carry the necessary information of the countries credit worthiness and are found good in explaining bond spreads (see, for example, De Santis 2012). However, using credit ratings of Finland and Sweden wouldn`t give much information because of the stability of ratings for the two countries.

5.2 Measuring risk aversion

Risk aversion component is the amount of compensation that investors require to buy a risky bond, so when expected bond yield (determined by default probability i.e. fiscal fundamentals) of risky bond equals risk free yield, a risk averse investor wants higher yield to become indifferent between the bonds. In equation 1 the investor requires also liquidity premium in addition to risk aversion premium.

Risk aversion is generally proxied by VIX-index which measures the expected volatility in US stock market`s for next 30-days. Other measures are also used, such as BBB-spreads[24], KFW-bond spreads, Swap spreads, iTraxx-Europe.index and VSTOXX-

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[24]BBB-spread is a yield spread between low grade US corporate bonds and US government bonds. Also AAA-spreads (for example, Attinasi 2009) and High yield-spreads (for example, MacGuire 2003) are used to measure risk aversion.

index. However, the latter two haven`t got much support from empirical studies (see, for example, Kilponen et al. 2012). Swap spreads also carry a problem because in the fall 2008 they plunged while other risk indicators displayed record levels (Gerlach et al. 2010). Schuknecht et al. (2010) find that BBB-spread was an important factor in explaining euro countries bond spreads. The authors suggest that without a rise in BBB-spread (a rise in risk aversion) in the beginning of the crisis, would Finland-Germany bond spread have decreased as financial markets started to discriminate more based on countries fiscal fundamentals (Wake-up call). McGuire et al. (2013) use BBB-spread and VIX among other risk aversion measures and find risk aversion as an important factor in explaining spreads of 15 emerging economies[25]. De Santis (2012) points out, that BBB-spread and VIX-index move together with KFW-bond spread until the end of 2009, and only the latter rises in 2010 when peripheral euro economies spreads continue to rise. He finds that KFW-bond spread is the single most important factor explaining spreads between Finland and Germany. KFW-bond spread should in theory measure only the liquidity preference. However, as suggested by De Santis, higher KFW-bond spread during crisis tells that there has been flight-to-liquidity and flight-to-quality towards German bonds i.e. investors wanted liquid and safe assets, and thus used German bond as a safe haven.

Manganelli and Wolswijk (2009) try to explain what causes the change in risk aversion and find positive connection between short-term interest rates and bond spreads. They suggest this could be due the risk aversion. For example, in line with Rajan (2005), investment managers are more willing to take risk when interest rates are low in order to improve the expected return of their investment. When interest rates are higher investment managers may get the sufficient return by investing in safe assets. The authors also explain that since risk aversion is commonly higher in economic slowdowns, it could be that tighter monetary policy signals for upcoming fall in real activity and future consumption which increases risk aversion and bond spreads. Attinasi et al. (2009) find a link between ECB`s monetary policy and bonds spreads during 2007-2009 and interpret it as risk aversion, similarly to Manganelli and Wolswijk.

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[25] The authors find that a single common factor (interpreted as risk aversion) accounts for 80% of the common variation which explains one third of the total daily movement in each spread of 15 emerging economies.

5.3 Measuring liquidity

Liquidity is suggested to play a role in debt yields because higher liquidity is likely to guarantee better price for a bond if sold before maturity. Bid-ask rates for bonds are commonly used for measuring liquidity because higher bid-ask rates are considered to correspond lower liquidity. Favero et al. (2007) suggest that smaller debt markets (lower liquidity) may play a role in bond spreads by increasing them. Attinasi et al. (2009) find that size of the government debt markets relative to Germany affects bond yields, for example, they estimate that up to 43% of the spread of France`s bond can be explained by their liquidity proxy. Also Bernoth et al. (2004) and Giordano et al. (2012) find the size of the government bond markets as important determinant of bond spreads in euro area. Gómez-Puig (2006) find that both bid-ask rates and size of government bond markets explained bond spread differences in EMU. In contrast, Codogno et al. (2003) don`t find liquidity as an important factor in euro area. The authors find liquidity significant for Finland-Germany bond spread but its effect is small. They use three measures for liquidity: bid-ask rates, trading volume and turnover ratio, and find trading volume as the most important indicator of liquidity. More recent studies find liquidity as an important determinant for Finland-Germany spread, for example, De Santis (2013), Favero and Missale (2012) and Haugh et al. (2009). In this thesis, I will use the relative size of government bond markets as a measure for liquidity. If Sweden has more bonds on the market relative to Finland one could argue that Sweden bonds are more liquid as its bond markets are bigger.

In addition to credit risk, risk aversion and liquidity, and in line with Poghosyan (2012), I take inflation into account. Inflation is discussed more in the next Data section.

6 Data

In the basic models, I use current values i.e. actual values and not forecasted values of the variables. I use forecasted values only in the special models. The data for basic- and special models is in monthly values. One model utilizes daily bond spread- and VIX-index data.

The study uses mainly monthly data, and because most of the data is published only in yearly aggregates, the linear interpolation[26] is used to derive monthly values. The explanatory variables of the basic models are: Germany`s 10-year bond yield, Expected exchange rate, Inflation, VIX-index, Debt to GDP, Deficit to GDP, GDP growth rate, Current account balance to GDP, Real effective exchange rate and Liquidity. I have used subtraction- or dividing method to get the last six variable to reflect country differences, which method is used and how, is explained in the detailed description of each variable below[27]. Linear interpolation is used to get monthly values for Debt to GDP, Deficit to GDP, GDP growth rate and Current account balance to GDP.

In the special models, I use forecasted values from European commission`s Spring and Autumn forecasts. Forecasted values are: GDP growth rate, Current account balance to GDP, Deficit to GDP and Inflation (Harmonized index of consumer prices (HICP) for the euro area). For each variable, I have two values per year so the linear interpolation is used to get monthly values. The expected coefficient signs for the variables are the same as those for the normal variables described below.

6.1 Government bond yield

The 10-year government bond yield data for Sweden and Finland is in monthly averages and is collected from Riksbank and Bank of Finland, respectively. The monthly 10-year government bond yield data for Germany is collected from Riksbank. Bond spread of Finland and Sweden for each month is calculated by subtracting Sweden`s monthly bond yield value from corresponding Finland`s bond yield value. The daily bond yield data for Finland and Sweden comes from Riksbank.

6.2 Expected exchange rate

The expected exchange rate variable is constructed by subtracting Sweden`s 6-month t-bill (treasury bill) yield at time t from corresponding Germany`s value. The idea is to rely on Uncovered Interest Rate Parity-theorem, so that the expected change in exchange rate is based solely on interest rate differential. For example, if t-bill yield is

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[26] Linear interpolation is used to fill the holes in data. For example, monthly values between two yearly published values can be derived by using linear interpolation. Linear interpolation simply fits a linear line between two observed values and calculates the missing values. It should be emphasized that linear interpolation does not give any extra information about the variables. This method is previously used, for example, by Barrios et.al (2009) and Arslanalp and Poghosyan (2014) and Gibson et al (2011).

[27] Dividing method can`t be used for deriving certain variables. For example, Current account balance to GDP for both countries can be negative and would thus yield to the same variable value as when the values were positive i.e. Finland`s value -3% and Sweden`s values -2% yields the variable value of 1.5 (-3% /- 2%) which is the same as if Finland`s value is 3% and Sweden`s value 2%.

higher in Germany, the euro is expected to depreciate. The variable is expected to have positive coefficient sign because higher Germany`s rate tells that euro is expected to depreciate and thus higher yield is demanded on Finland`s bonds. The variable and Finland-Sweden bond spread is depicted in figure 13 (appendix). Source of the data: Bundesbank (Germany data) and Riksbank (Sweden data)

6.3 Inflation

Inflation variable is calculated by subtracting Sweden`s inflation at time t from Finland`s inflation at time t. The expected sign of the coefficient is positive because: 1.Higher euro area inflation decreases real yields of the bonds, and thus the investors demand for higher yields to get equal real yields between the countries. 2. Higher inflation may signal the investors that ECB is going to raise interest rates soon, which would lead to higher bond yields[28]. 3. According to the Purchasing Power Parity theory[29], a country with higher inflation should experience a currency depreciation, which should increase bond yields as the investors are expecting euro to depreciate against krona. For more, see: Alexopolou et al. (2009). It is important to note that I use Consumer Price Index data for the basic models, and Harmonized Index of Consumer Prices for the special models (using forecasted values)[30]. Source of the data: Consumer price index (OECD) and Harmonized index of consumer prices (European Commission).

6.4 Credit risk variables: Debt to GDP, Deficit to GDP, GDP growth rate, Current account balance to GDP and Real effective exchange rate

Debt to GDP

Debt to GDP variable takes on values of Finland`s government Debt to GDP ratio and Sweden`s government Debt to GDP ratio. The variable is constructed by dividing Finland`s value at time t by Sweden`s value at time t. The coefficient of the variable is expected to be positive i.e. "spread increasing", because higher variable value means

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[28] ECB`s interest rate raise would raise the market rates and thus the "risk free" rate in bond pricing theory would rise.

[29] Purchasing Power Parity (PPP) is a concept which states that an exchange rate between two countries should adjust so that prices of goods measured in a same currency are equal. For example, if a hamburger costs 10 euro in country A and 15 USD in country B, the PPP holds if one euro can buy 1.5 USD. For more detailed description of PPP, see, for example, Lafrance and Schembri 2002.

[30] CPI and HICP are calculated in a different way so forecasted inflation values in this paper are not those of Consumer Price Index. Also HCIP values are for euro area and Sweden, and not for Finland and Sweden as in the CPI-data. This is because the euro are inflation rates weren`t available from 1995.

that Finland has relatively higher amount of future debt liabilities to GDP, compared to a lower variable value. The variable is plotted with Finland-Sweden bond spread in figure 1. Source of the data: Eurostat.

Deficit to GDP

Deficit to GDP variable is constructed by subtracting Sweden`s Deficit to GDP ratio at time t from Finland`s Deficit to GDP ratio at time t. Government surplus takes on positive values and deficit negative values. The coefficient of the variable is expected to be negative as Finland`s higher Deficit to GDP ratio would give it a possibility to pay off debt thus reducing its Debt to GDP ratio. Source of the data: Countryeconomy and European Commission (forecasts).

GDP growth rate

GDP growth rate variable is calculated by subtracting Sweden`s monthly GDP growth rate at time t from Finland`s corresponding growth rate. The sign of the variable`s coefficient is expected to be negative because Finland`s higher GDP growth rate is likely to give investors a signal that the economy is in better shape and tax income is likely to rise while public expenditures fall. Source of the data: OECD and European Commission (forecasts).

Current account balance to GDP

Current account balance to GDP variable is calculated by subtracting Sweden`s monthly Current account balance to GDP ratio at time t from corresponding value of Finland. The sign of the variable`s coefficient is expected to be negative as positive variable value would imply that Finland`s foreign trade is relatively in better shape. Source of the data: OECD and European Commission (forecasts).

Real effective exchange rate

Real effective exchange rate variable is constructed by subtracting Sweden`s monthly real effective exchange rate value at time t from corresponding value of Finland. Expected sign of the coefficient is positive because positive variable value can be interpreted as a sign of weaker competitiveness of Finland. Source of the data: World Bank.

6.5 Risk aversion variable: VIX-index

VIX-index is utilized to capture the possible risk aversion effects on yields. Expected sign of the coefficient is positive based on the fact that Sweden has its own central bank, which shows itself as the lender of last resort. The same reasoning applies also for the pre-euro period 1995-1998, when Finland still had its own monetary policy, since investors were likely expecting that Finland will be chosen to the third stage of EMU and thus giving up its own monetary policy. Source of the data: Yahoo finance.

6.6 Liquidity variable: Bond market size

Liquidity variable consists of relative bond market sizes of the countries (Sweden/Finland). Bond market size of a country is the monetary sum of its long term bonds[31]. Country with larger bond market is likely to have better liquidity as there are more available bonds to trade. The coefficient of the variable is assumed to be positive because investors are likely to prefer bond markets with better liquidity, so an increase in the variable value should lead to an increase in the spread. If the investor has to sell a bond before maturity, he probably gets a better price when there are more buyers in the markets. The data for Sweden is originally in krona so I have calculated the corresponding euro values using timely corresponding exchange rates. Source of the data: Valtiokonttori and Statistics Sweden.

7 Models

7.1 Models for the period 1995-2013

I use the dynamic OLS to estimate the coefficients of the independent variables. The reason for this is that the dependent Spread variable is trending, which leads to large autocorrelation of the error terms and problems of spurious regression. To reduce autocorrelation, I add a lagged Spread variable as an explanatory variable. If autocorrelation exists after the adding of lagged dependent variable, the Newey-West standard errors are used. This also takes care of the potential unit root-problem which arises from the possible non-stationarity of the Spread variable[32] (see, figure 1). I test

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[31] Bonds with maturity over 1 year are considered as long term bonds (Valtiokonttori).

[32] Also De Santis (2012) noticed potential unit root-problems in different countries bond spreads and explanatory variables.

autocorrelation with Breusch-Godfrey test (BG-test) with orders up to 1-5, I also look for the autocorrelation function plot.

I use different model specification to test how different explanatory variable combinations work. As I have many variables for measuring the credit risk, there may appear multicollinearity. For example, the Liquidity variable may be multicollinear with the Debt to GDP variable, due to the similarity in their structure. To take the possible multicollinearity into account, I start with a simple model specification, and add variables carefully. I leave out the Expected exchange rate variable from the first four models so that we can see how the models perform with and without it.

The model specification that contains all the variables is constructed as follows:

$$10.\ Y_t = \beta_0 + \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \beta_4 X_{4t} + \beta_5 X_{5t} + \beta_6 Z_t + \beta_7 \pi_t + \beta_8 \Omega_t + \beta_9 \varphi_t + \beta_{10} \gamma_t + \beta_{11} Y_{t-1} + \varepsilon_t$$

Where: Y_t is Finland-Sweden bond spread, β_0 is constant, X_{1t} is Debt to GDP variable, X_{2t} is Deficit to GDP variable, X_{3t} is GDP growth rate variable, X_{4t} is Current account balance to GDP variable, X_{5t} is the Real effective exchange rate variable, Z_t is VIX-index variable, π_t is Liquidity variable, Ω_t is Germany 10-year bond yield variable, φ_t is Inflation variable, γ_t is Expected exchange rate variable. Y_{t-1} is lagged dependent variable and ε_t is error term. From now on, the variables are called: Debtgdp (X_1), Deficitgdp (X_2),Growthr (X_3), CA (X_4), REER (X_5), VIX (Z_t), Liquidity (π_t), G (Ω_t), Inflation (φ_t), EEXR (γ_t) and Lagspread (Y_{t-1}).

Although I have added the lagged dependent variable into each of the models, the BG-test rejects the null hypothesis (no-autocorrelation) every time. I use Newey-West standard errors with automatic lag-selection criteria to account for autocorrelation and heteroskedasticity (Newey-West 1994).

In the first model, model 1, I use Debtgdp, Deficitgdp, Growthr, Liquidity, VIX, G, Inflation and REER as the explanatory variables. The results are presented at table 1. Growth rate variable is statistically significant at 10% significance level. However, the coefficient sign is positive and thus not as expected.

After testing several models with Debt to GDP variable, I decided to remove it and use Deficit to GDP variable instead. The main reason for this is that Debt to GDP- and Deficit to GDP variables are likely multicollinear[33]. Also the potential multicollinearity with Liquidity variable is no longer a problem. In addition, Debt to GDP variable had constantly the wrong (negative) coefficient sign.

In model 2, I use Deficitgdp, Growthr, Liquidity, VIX, G, Inflation, REER and CA as the explanatory variables. The results show that Growthr is still significant at 10% level but with the wrong sign. Also CA, Deficitgdp and Liquidity do not have the expected signs. In model 3, I leave out Inflation and CA to show the only model specification which has a significant variable at 5% significance level. Now, Deficitgdp is significant at 5% significance level, however, it is not a very robust result as adding inflation or CA, or taking off G or Growthr, drops deficitgdp out of the 5% significance level.

To model 4, I add back CA, and drop out Growthr and Liquidity because the wrong expected coefficient signs are persistent for both. The results show that there are no significant variables. To model 5, I add the Expected exchange rate variable (EEXR) as explanatory variable. The results show that CA is significant at 10% significance level. To model 6, I add Inflation, and CA becomes significant at 5% significance level. However, after dropping out G, CA becomes not significant. Pearson`s correlation coefficient for G and CA is 0.78 which suggest quite strong positive correlation, although Germany`s 10-year bond yield and Finland`s current account balance should not have any apparent relationship[34].

I think that the lack of real data points is one serious problem in the models. The linear interpolation is used for four variables (CA, Debtgdp, Deficitgdp, Growthr) so there are only 18 real data points for each of those variables. This problem is hard to get over with as higher frequency data is not available. The problem for this kind of single-country study is also addressed by Poghosyan (2012). However, later in this paper I try to improve models by using forecasted values (forecast data contains two real data points per year). Second problem is the time period studied. If we look at the figure 2,

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[33] In theory, government budget deficit increases public debt and surplus decreases it. However, having a budget surplus doesn`t automatically mean that government is using it for debt reduction.

[34] If there was a relationship between the two, it would likely be a negative one as higher Germany`s bond yield could imply that Germany`s economy is getting worse, which would then decrease the current account balance of Finland because Germany is an important trade partner for Finland.

we can see how bond yields behave differently before the EMU, before the crisis and during the crisis (see also: Beirne and Fratzscher 2012) This problem can be addressed by estimating models for different time periods.

According to the models 1-6 results, there are no statistically significant determinants of the spread. Aside from the real data points problem, the results should not be too surprising as even Greece`s bond yield moved tightly together with Germany`s bond yield although the fiscal fundamentals were very different. De Grauwe (2012) and Beirne and Fratzscher (2012) suggest that financial markets have neglected fiscal fundamentals before the start of the crisis. Figure 2 depicts the way the EMU countries bonds were priced after the start of the EMU membership. The bonds seem to be priced as in one big EMU country, so country specific fundamentals were probably not important until from the start of euro crisis in the late 2007.
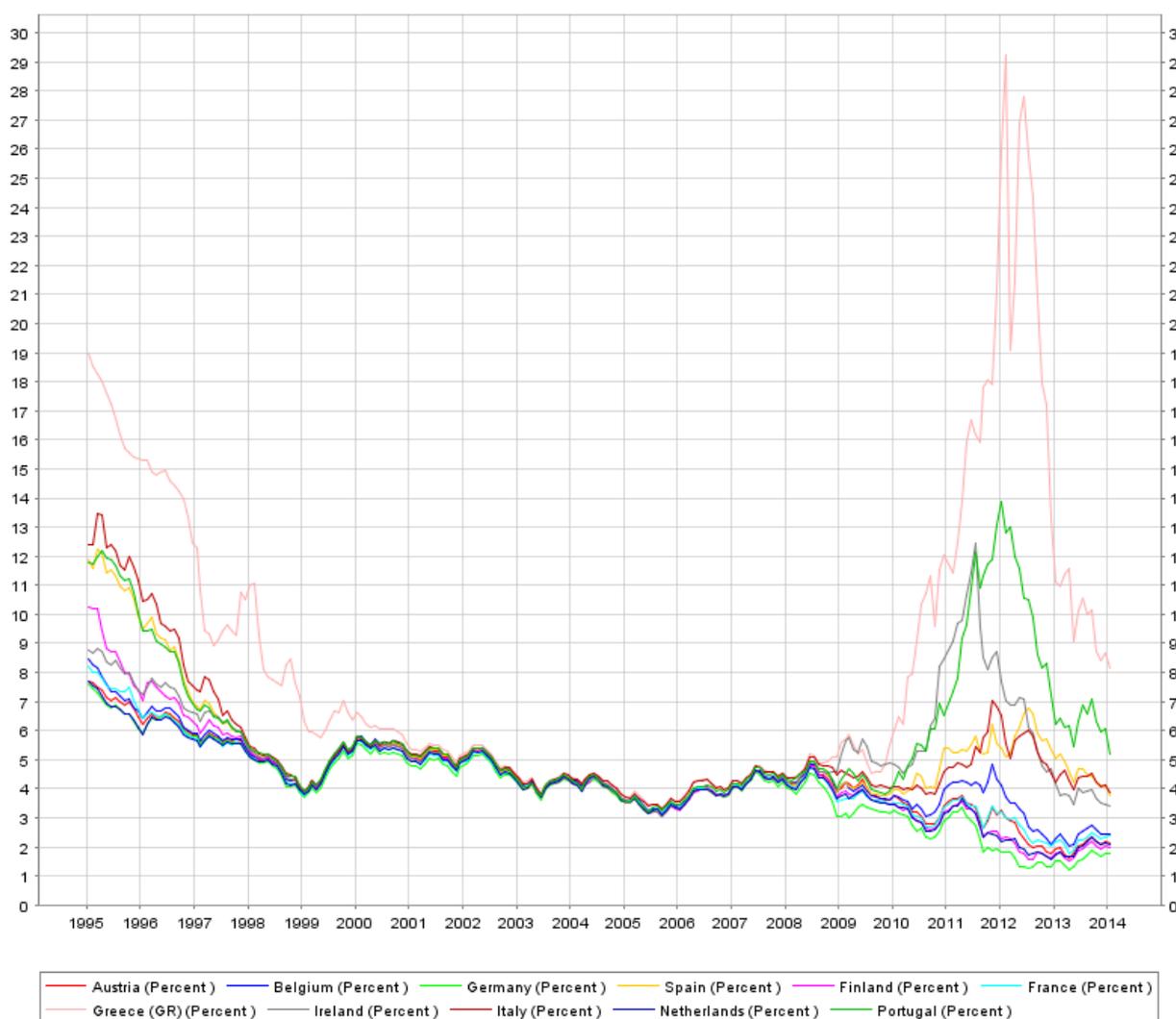

Figure 2. Euro area 10-year bond yields. Time period 01/1995-12/2013. Source: ECB

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Spread					
VIX	0.001	0.001	0.001	0.002	0.004	0.003
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)
Debtgdp	-0.044					
	(0.079)					
Deficitgdp	-0.011	-0.009	-0.016**	-0.001	-0.001	0.004
	(0.008)	(0.013)	(0.008)	(0.006)	(0.006)	(0.007)
Growthr	0.032*	0.035*	0.030			
	(0.019)	(0.021)	(0.021)			
Liquidity	-0.061	-0.057	-0.070*			
	(0.045)	(0.052)	(0.041)			
REER	0.779	0.856	0.251	-0.006	-0.021	0.312
	(0.560)	(0.580)	(0.343)	(0.163)	(0.188)	(0.350)
Inflation	0.037	0.038				0.027
	(0.028)	(0.027)				(0.020)
CA		0.002		-0.011	-0.049*	-0.056**
		(0.037)		(0.042)	(0.029)	(0.028)
EEXR					0.039	0.035
					(0.031)	(0.029)
G			0.011	-0.003	0.003	0.006
			(0.022)	(0.025)	(0.020)	(0.019)
lag(Spread, 1)	0.834***	0.834***	0.882***	0.948***	0.858***	0.833***
	(0.078)	(0.077)	(0.054)	(0.024)	(0.082)	(0.091)
Constant	0.147	0.099	0.071	-0.021	-0.047	-0.056
	(0.122)	(0.085)	(0.102)	(0.065)	(0.055)	(0.054)
Observations	227	227	227	227	227	227
R^2	0.950	0.950	0.948	0.946	0.949	0.950
Adjusted R^2	0.948	0.948	0.947	0.944	0.947	0.948

Note: $^{*}p<0.1;$ $^{**}p<0.05;$ $^{***}p<0.01$

Table 1. Results from the models 1-6. Newey-West standard errors in parentheses. Period studied 01/1995-12/2003.

7.2 Pre-crisis and crisis models

Next, I show the results from two different periods: pre-crisis and crisis. I decided to leave out REER-, GROWTH- and G variables from the rest of the models that I show. Main reason for this is the poor performance in the previous models and the potential multicollinearity problems.

First, I study the pre-crisis period 01/1995-06/2007. The BG-test suggests autocorrelation so I use NW-standard errors. I decided to address the potential multicollinearity of Deficitgdp and CA, and I show results only when they are not in the same model[35]. The results of the models 7-10 are presented at table 2 (appendix). In model 7, I use Deficitgdp and VIX as the explanatory variables, and there are no significant variables. To model 8, I add EEXR and Inflation, and Inflation is significant at 1% significance level. It stays significant at 5% significance level after removing EEXR, but without VIX in the model, it`s no longer significant. To model 9, I change Deficitgdp to CA so that we can see how VIX, CA, EEXR and Inflation perform. Now, Inflation is significant at 10% significance level, and stays that way without VIX in the model. In the final model, model 10, I drop out EEXR, and Inflation becomes significant at 5% significance level.

Next, I examine the crisis period 07/2007-12/2013. I form four models which are exactly the same as the models 7-10 for the pre-crisis period. The BG-test suggests autocorrelation for the models 11 and 14, so I use NW-standard errors for the models. At table 3 (appendix), I present the results of the models 11-14. In the first model, model 11, the results suggests that VIX is significant at 1% significance level. In the second model, model 12, VIX and EEXR are significant at 5% significance level. Interestingly, the coefficient sign of EEXR is negative. This may depict the risk aversion effect that Germany has experienced (see, for example, De Santis 2012), so as Germany`s yield has decreased due to risk aversion, Finland`s yield has risen, stayed level or decreased (by lower speed). Model 13`s results show that again EEXR is significant at 5% significance level, but now VIX is no longer significant. CA is significant at 10% significance level but with wrong expected sign. In the last model, model 14, VIX becomes significant again. The results from the models 11-14 give some support for that

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[35] Small open economies like Finland and Sweden are strongly dependent on exports. In 2013, exports of goods and services (% of GDP) was 38.2% for Finland and 43.8% for Sweden (World bank 2015). Potential multicollinearity problem arises from the assumption that exports affect GDP, and GDP affects government budget balance.

risk aversion was behind the Finland-Sweden bond spread development during the crisis period. De Santis (2012) and Barrios et al. (2009) have suggested that risk aversion was the main reason for Finland-Germany bond spread developments during the crisis.

In figure 3, EEXR is plotted with Finland-Sweden bond spread. From the figure we can see how the Germany-Sweden t-bill spread (GS-spread) moves roughly together with the Finland-Sweden spread (FS-spread) until the crisis period, starting in the late 2007. Since then, the GS-spread tends to move sharply down when the FS-spread moves sharply up. This suggests that the risk aversion could be one reason for the relatively large movements in FS-spread during the crisis period[36]. To study the role of risk aversion during the crisis more precisely, I form a new model and use weekly VIX- and Finland-Sweden bond spread data.
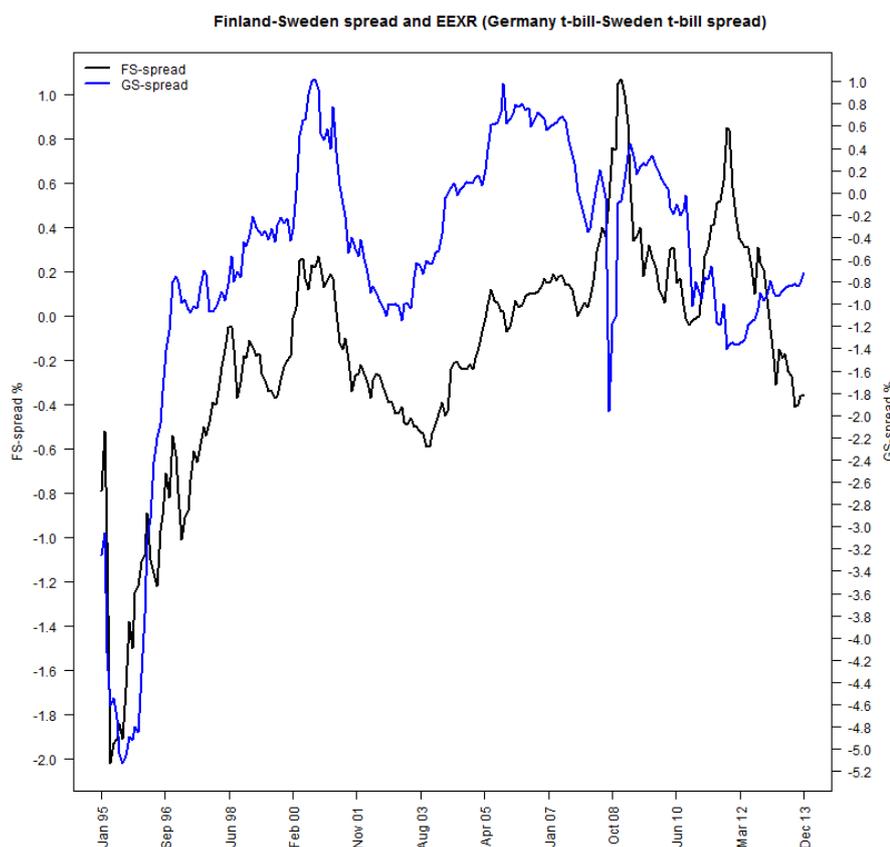

Figure 3. Finland-Sweden 10-year bond spread and Expected exchange rate variable (EEXR). EEXR equals the spread of Germany`s and Sweden`s 6-month treasury bill yields. Time period 01/1995-12/2013. Source. Bundesbank and Riksbank.

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[36] According to De Santis (2012), the risk aversion benefited most the safe and liquid assets during the crisis. The sharp decline of EEXR in 2008 seems to be caused by a sharp increase in the demand of Germany`s t-bills, possibly due to the increased risk aversion.

7.3 Model with weekly data

To examine more accurately the role of VIX-index (risk aversion) during the crisis period, I use weekly bond spread- and VIX-index data for the new regression model: model 15. The results are presented at table 3 (appendix). In this model, I regress the spread on VIX-index and a lag of the spread. I don't include any other variables for two reasons: First, the weekly data is not available for common fiscal fundamentals such as Deficit to GDP ratio. Second, VIX-index is a measure of expected US stock market volatility so it should not bear any omitted variable bias stemming from slowly evolving country specific fiscal fundamentals. BG-test p-value suggest autocorrelation so I use NW-standard errors. The results show a strong relationship (significant at 1% significance level) between the spread and VIX-index. I also run the same model with daily data, and interestingly the coefficient (significant at 1% significance level) of VIX comes down from 0.002 to 0.001.

7.4 Models with forecast data

Next, I form models using forecasts of Growth rate, Deficit to GDP- and Current account to GDP ratio. The data is not available for the whole period 1995-2013 so I study the period 2002-2013 instead. In addition to the benefits of more real data points[37], the forecasted values may also depict better the information that the investors are using for decision making (see, for example, Laubach 2003 and Poghosyan 2012). I study the full period 2002-2013 and also two subperiods (01/2002-06/2007 and 07/2007-12/2013). For each period, I show results from the same four model specifications: 1) VIX and DeficitgdpF. 2) VIX, DeficitgdpF, EEXR, Inflation. 3) VIX, CAF (Current account variable), EEXR, Inflation. 4) VIX, CAF, Inflation.

First, I discuss about the results from the period 01/2002-12/2013. The results from the models 16-19 are presented at table 4 (appendix). I have used Newey-West standard errors as BG-test suggested autocorrelation. The only statistically significant variable (5% significance level) is Inflation in model 16. The results may give some information about the role of country specific fiscal fundamentals during 2002-2013 i.e. fiscal fundamentals were likely not important during the period. However, again it`s important to remember the potential different pricing behavior in pre-crisis- and crisis period

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[37] Forecast data has two observations per year compared to one per year when the actual values were used for Current account balance to GDP, Growth rate to GDP and Deficit to GDP.

which may bias the results. Also the limitation of real data points is good to bear in mind.

Next, I go through the results from the models 20-23 (period 01/2002-06/2007). The results are presented at table 5 (appendix). I have used normal standard errors for all models as BG-test didn`t suggest autocorrelation. Inflation is statistically significant in all model specifications where it has been included, however, the coefficient sign is negative. EEXR is statistically significant in model 22 but not in the model 23. VIX-index is statistically significant in the models 20 and 23 but has the wrong coefficient sign. CAF is statistically significant at 5% significance level in the model 23 but not in the model 22. It seems that there is still no support for the role of the fiscal fundamentals.

Finally, I present the results from the period 07/2007-12/2013. The results from the models 24-27 are presented at table 5 (appendix). I have used normal standard errors for models 25-27. NW-standard errors are used for model 24 because BG-test suggested autocorrelation. The model specifications here are similar to those of the models 11-14. The difference is the use of forecasted values instead of the actual values[38]. This makes a careful comparison between the models possible.

VIX-index is statistically significant in the first two models. These results are slightly different to those of the models 11-14 (table 3, appendix) when VIX was significant in three out of the four model specifications. The results for EEXR stayed similar so the coefficient was statistically significant but with the negative sign. Now, the Current-account balance variable (CAF) is statistically significant but the coefficient sign is wrong. Using the forecasted values does not seem to change the significance of EEXR and VIX notably during the crisis period.

To summarize the results from the models 16-27, it seems that in the pre-crisis period the models didn`t have any robust[39] statistically significant variables, and during the

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[38] However, as described in the data section, the Inflation variable in the models 11-14 consists of Finland-Sweden CPI-values, and Inflation forecast variable consists of euro area-Sweden forecasted HICP-values, so the forecasted values are not those made for Inflation variable in the models 11-14.

[39] Statistically significant variables had either wrong expected coefficient sign or they became insignificant after adding/dropping variables that shouldn't matter to them in theory.

crisis, VIX and EEXR may have played a role. However, VIX was not statistically significant in two out of the four crisis period models. VIX tends to become insignificant when CAF is added to the model. Because CAF is significant with the wrong coefficient sign, it may well be that the lack of real data points of CAF is the reason for the results.

7.5 Summary of the results

Potentially important determinants of Finland-Sweden bond spread
Period:
01/1995-12/2013: No important determinants
01/1995-06/2007: Inflation (+ coeff. sign)
01/2002-12/2013: No important determinants
01/2002-06/2007: Inflation forecast (- coeff. sign) & EEXR (+ coeff. sign)
07/2007-12/2013: VIX-index (+ coeff. sign) & EEXR (- coeff. sign)

Inflation (01/1995-06/2007 & 01/2002-06/2007)
Inflation may have affected the spread during 01/1995-06/2007 but the different coefficient signs of Inflation and Inflation forecast (InflationF) are confusing. Inflation stays statistically significant (positive coeff.) when I replace Inflation forecast with it in models 20-23 (period 01/2002-06/2007). I also test models 20-23 with a new inflation variable consisting of differences of the actual HICP-values between euro area and Sweden. Now, the new Inflation variable has positive coefficient sign but it`s statistically significant (10 % significance level) only in one model specification. Intuitively, the inflation in euro area should matter more than the inflation in Finland because of the theoretical relationships between inflation and bond yields. For example, the Purchasing Power Parity theory takes account euro area inflation rather than the inflation of a small country like Finland. Taken all the results together, I think that there is not enough statistical support for considering inflation as an important determinant of Finland-Sweden bond spread.

EEXR (01/2002-06/2007)
EEXR variable has got some statistical support from the model 21, but there is not enough statistical support for stating it as an important determinant of Finland-Sweden bond spread. However, from the figure 13 (appendix), we can see that there is probably some kind of relationship between the two before the crisis. It seems that when the t-bill

spread of Germany and Sweden (EEXR) turns positive, then the Finland-Sweden bond spread turns positive as well. In figure 14 (appendix), where I have plotted Germany-Sweden 10-year bond spread and EEXR, we can see that similar pattern is visible before the crisis. Also Germany-Sweden 10-year bond spread development looks similar to the Finland-Sweden spread developments before the crisis i.e. there is an upward trend for both before the crisis. This suggests that rather than country specific fiscal fundamentals, the euro area specific yield requirements such as exchange rate expectations may have been important. Also convergence in bond yields across countries may have happened. That would partly explain the pre-crisis developments in the Finland-Sweden- and Germany-Sweden bond spreads i.e. bond yields have become closer together just like happened in euro area[40]. The possible convergence is discussed more in the plot analysis section 8.4.

VIX-index and EEXR (07/2007-12/2013)

The results suggest that the only important determinants during 07/2007-12/2013 where VIX-index and EEXR. Interestingly, EEXR had the wrong expected coefficient sign which may have been caused by the increased risk aversion. Also VIX-index is a measure of risk aversion so these two results taken together, it seems that the increased risk aversion may have been behind the Finland-Sweden spread developments during the crisis period. This result is similar to what previous studies have found as the reason for Finland-Germany bond spread developments during the crisis (see, for example, De Santis 2012, Schuknecht et al. 2010).

To sum up the results from the regression analysis, the VIX-index (during the crisis) is the only statistically significant variable which has the correct expected coefficient sign. Also VIX-index stays statistically significant in most of the model specifications. It only becomes insignificant in few models when a linearly interpolated variable such as CAF has been added into the model. Linearly interpolated variables seem to have caused problems in the study, so for a single-country study like this, it`s important to address the lack of data for fiscal fundamentals. As suggested by Poghosyan (2012): although a single-country study enables for more country specific results, it suffers from the lack of

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[40] Convergence of bond yields in euro area during EMU period is supported by studies such as Ehrmann (2007) and Beirne and Fratzscher (2012). See, also figure 2.

data. It is thus understandable why the majority of the studies regarding bond spreads are done by using panel data.

8 Plot analysis

In 8.1.1 and 8.1.2, I represent plots of daily bond spreads (Finland-Sweden- and Germany-Sweden bond spreads), special events and VIX-index from the crisis period 02.07.2007-30.12.2013. The aim is to see whether there are any strong reactions in spreads after a certain event. The period is divided into two subperiods so that the plots are clearer and easier to follow. First, I go through the special events and reaction of Finland-Sweden- and Germany-Sweden bond spread for the period 02.07.2007-01.07.2010. After this, the period 02.07.2010-30.12.2013 is analyzed in a similar way.

In 8.2, 8.3, 8.4, I go briefly through plots regarding OMT, Risk aversion and Convergence of bond yields, respectively.

8.1 Finland-Sweden bond yield spread and special events during 02.07.2007-30.12.2013

8.1.1 Period 02.07.2007-01.07.2010

Main events:

09.08.2007 *BNP-Paribas*: BNP-Paribas was the first major bank to freeze certain funds related to subprime-mortgage markets. At the same time BNP-Paribas gave implicitly information about the riskiness of subprime related investments. The bank claimed that the subprime-mortgage markets related assets were too hard to value and that the liquidity was missing in those markets. (Kingsley 2012, NYtimes 2007, Boyd 2007).

15.09.2008 *The collapse of Lehman brothers*: Lehman brothers was a large American bank that was strongly exposed to subprime mortgage markets, and collapsed causing a panic in financial markets (see, for example, Boyd 2007).

08.10.2008 *ECB`s decrease of interest rates on the main refinancing operations from 4.25 to 3.75*: ECB decreases interest rate for the first time in the period studied.

17.02.2009 *The recovery pack (ARRA):* The US government stimulus packages of approximately 840$ billion consisting of spending and tax cuts. The congress passed the package on 13.02.2009 and it was four days later approved by the president. (Recory.gov 2015).

10.05.2010 *SMP*: ECB announced The Securities Market Program to ensure depth and liquidity in dysfunctional private and public debt security markets. SMP purchased mainly government bonds on the secondary markets and was later replaced by OMT. (ECB 2010 and Bundesbank 2015).

07.06.2010 *EFSF*: The European Financial Stability mechanism was a temporary crisis resolution mechanism guaranteed by the eurozone member countries. The member countries guaranteed EFSF:s loans so that it could borrow money to a member country in financial difficulties. EFSF was later followed by ESM. (EFSF 2015).
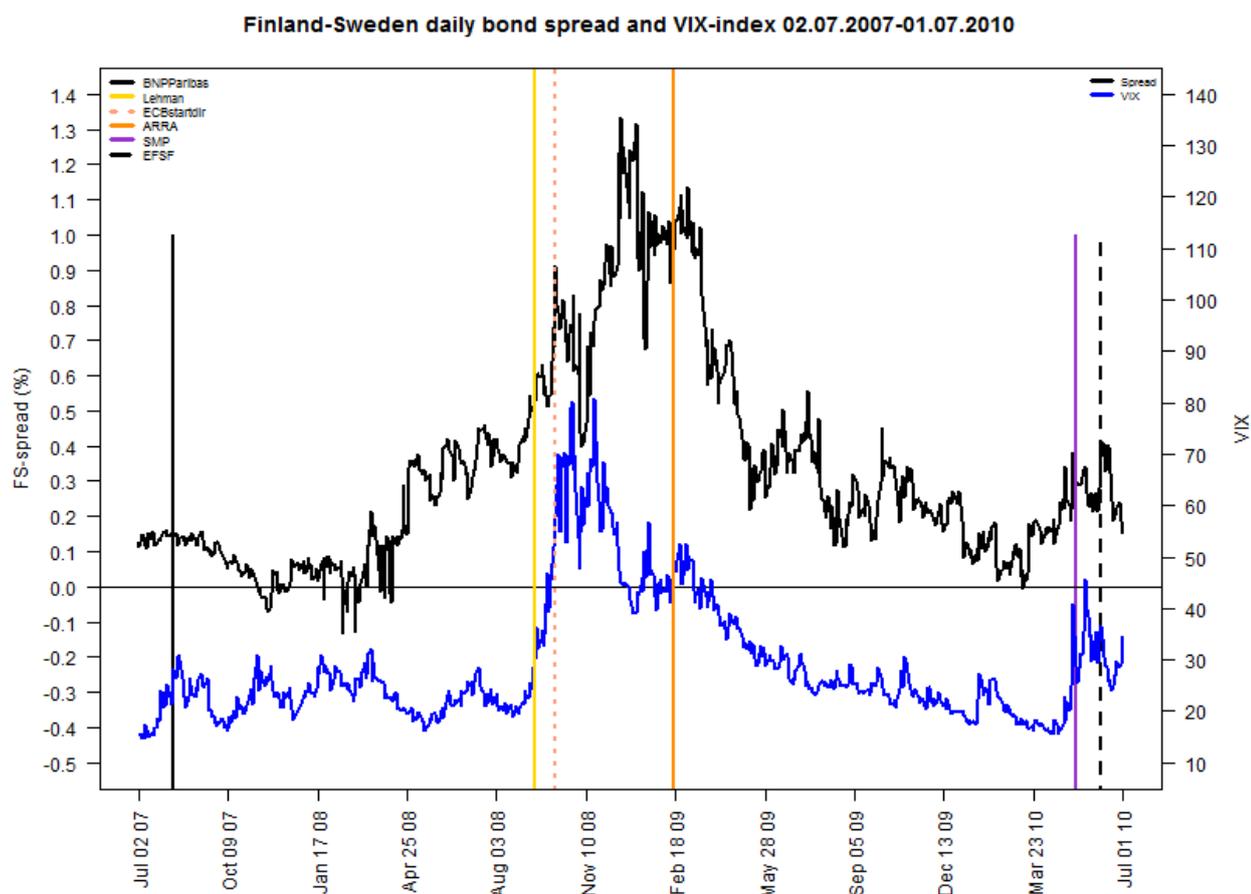

Figure 4. Finland-Sweden daily 10-year bond spread and VIX-index. Time period 02.07.2007-01.07.2010. Source. Riksbank and Yahoo Finance.
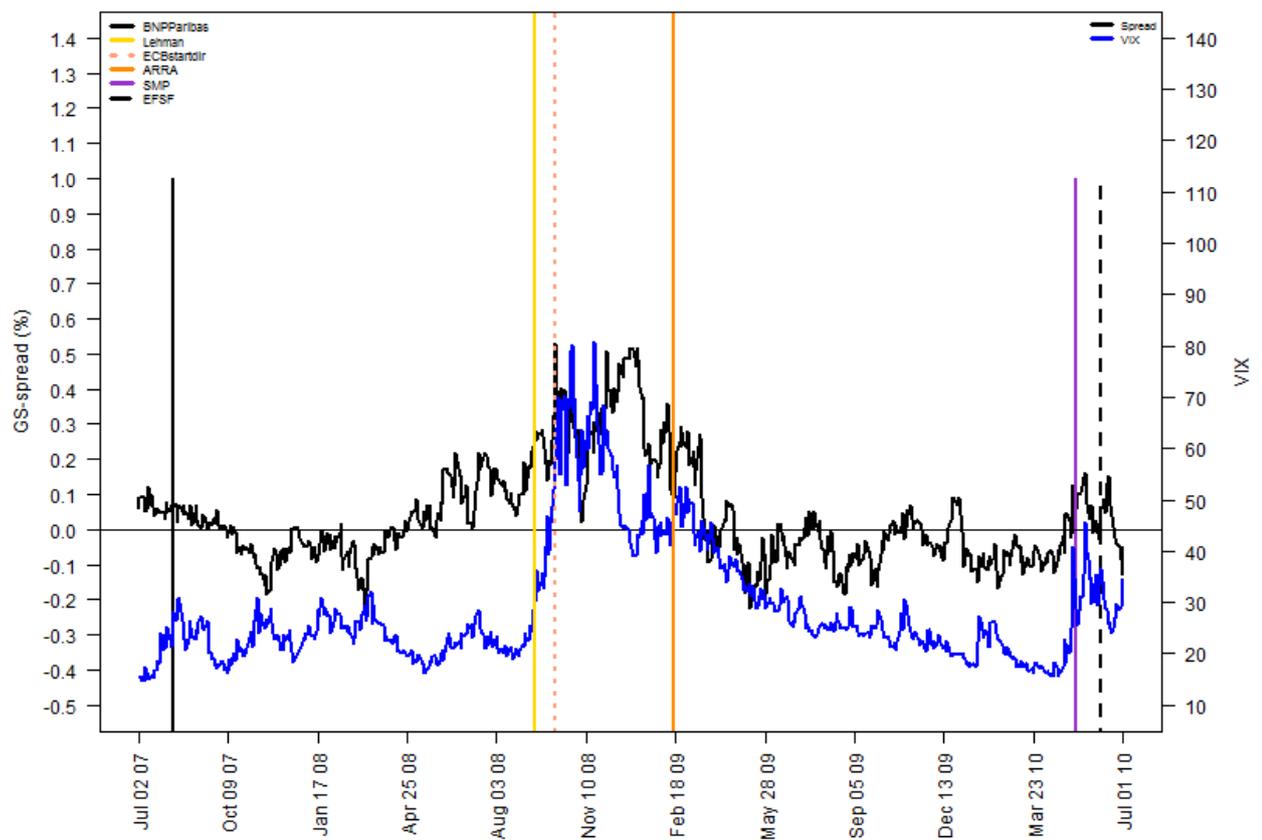
Figure 5. Germany-Sweden daily 10-year bond spread and VIX-index. Time period 02.07.2007-01.07.2010. Source. Riksbank and Yahoo Finance.

Since the start of the crisis (BNP-Paribas), we can see how FS-spread is decreasing until the end of 2007, so the BNP-Paribas event didn`t apparently have any direct positive impact on the spread. There is clearly an upward pressure on FS-spread and GS-spread starting in April 2008, but it looks like that VIX-index didn`t move along until the collapse of Lehman brothers, so markets were likely fearing that something bad could happen, but the expected volatility in US stock markets (VIX-index) wasn`t noticeably affected. The collapse of Lehman brothers is clearly the starting point of the increased expected stock market volatility and the stock market slide in US and Europe. ECB responded to worsened economic outlook by decreasing its interest rate by 0.5 percent points to 3.75, however, this does not seem to have a long lasting downward impact on the spread. The announcement of ARRA may be one reason for the spread decline of FS and GS in 2009, as it seems that it`s the turning point when US stock markets bottomed and started to rise while also VIX-index declined. In the early 2010, FS-spread started its upward trend again, right after hitting the zero-line first time since April 2008. Upward trend stopped apparently due to the ECB announcements of SMP and EFSF.

Kilponen et al. (2012) found evidence that SMP announcement did have downward impact on some euro countries spreads. But as we can see next, the SMP and EFSF were supposedly not strong enough solutions for bond investors.

8.1.2 Period 02.07.2010-30.12.2013

Main events:

28.10.2010 *ESM first discussed*: The European Stability Mechanism (ESM) was discussed for the first time. ESM provides financial assistance to the euro area member states, and it replaced EFSF in 2013. The establishment of ESM required funds from euro members. (ESM 2015a).

07.04.2011 *ECB increases interest rate on the main refinancing operations*: The first interest rate increase made in 02.07.2007-30.12.2013 by ECB.

17.05.2011 *Financial support for Portugal announced*: Counsil of the European Union approved aid to Portugal. The aid of 78 billion came from EU, EFSM, ESFS and IMF. (Counsil 2011).

23.11.2011 *Germany`s bond auction fails*: Germany was unable to sell approximately 35% of its 10-year bonds in the bond auction. (Dopson 2011).

08.12.2011 *ECB announces LTRO:s*: ECB decided to conduct two longer-term refinancing operations to euro area banks with a maturity of 36 months. LTRO:s are a way to provide liquidity to banks. (ECB 2011b).

25.06.2012 *Cyprus requests for financial support*: Cuprys requested financial support from the president of the Eurogroup. (ESM 2015b).

26.07.2012 *Draghi`s speech "Whatever it takes"*: ECB:s president Mario Draghi told in his speech that: "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro". The financial markets started to speculate whether the speech was a promise to start purchase government bonds of the euro countries more strongly. (Black, Randow 2012).

06.09.2012 *OMT*: The technical features of Outright Monetary Transactions were released. On the same day SMP was terminated. OMT was first discussed in 02.08.2012. (ECB 2012).

24.04. 2013 *ESM board government approves financial support for Cuprys*: Financial package for Cyprus was approved by the ESM board government. On 08.05.2013 the package was also approved by the directors of ESM. The package size was up to 10 billion and financed by ESM (approx.9 billion) and IMF (1 billion). (ESM 2015b).
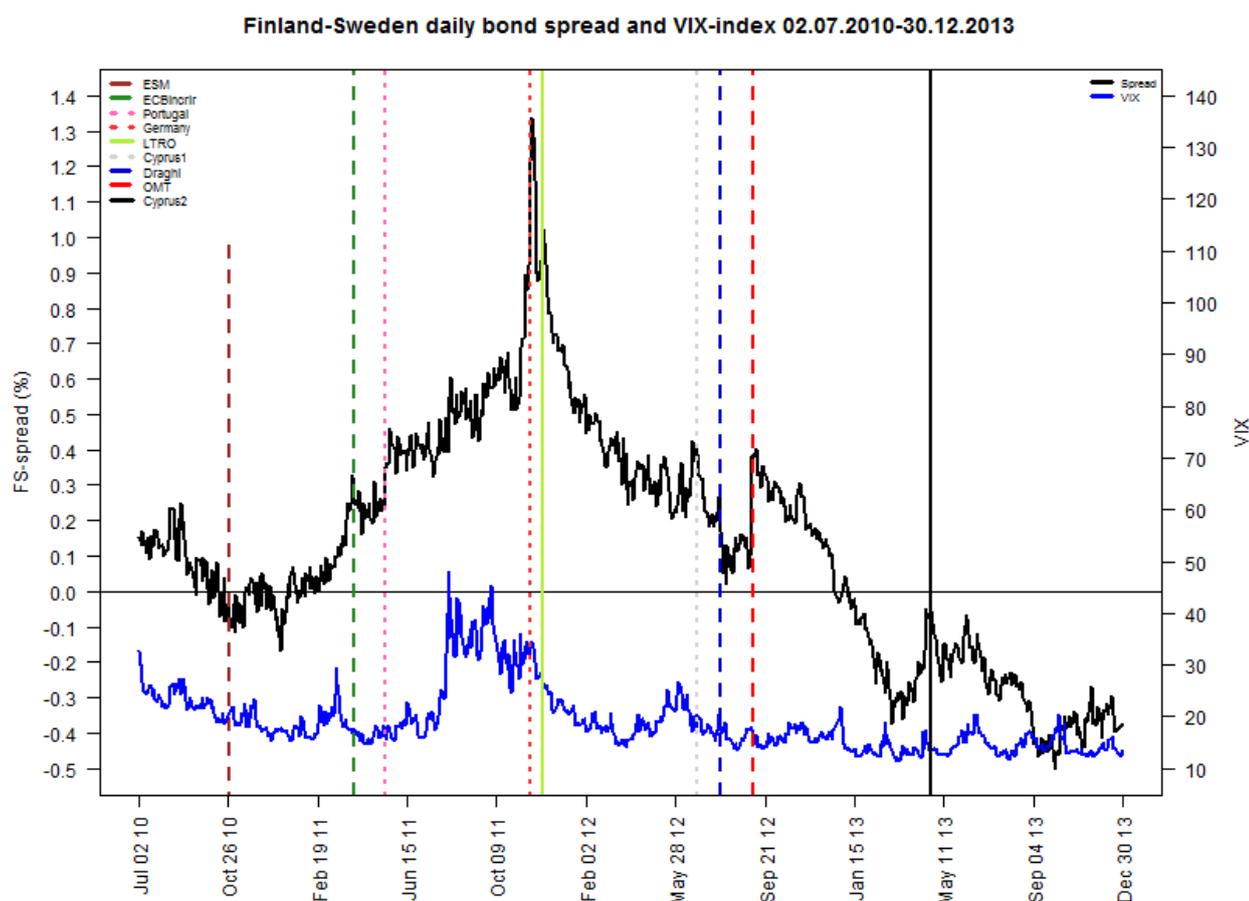

Figure 6. Finland-Sweden daily 10-year bond spread and VIX-index. Time period 02.07.2010-30.12.2013. Source. Riksbank and Yahoo Finance.
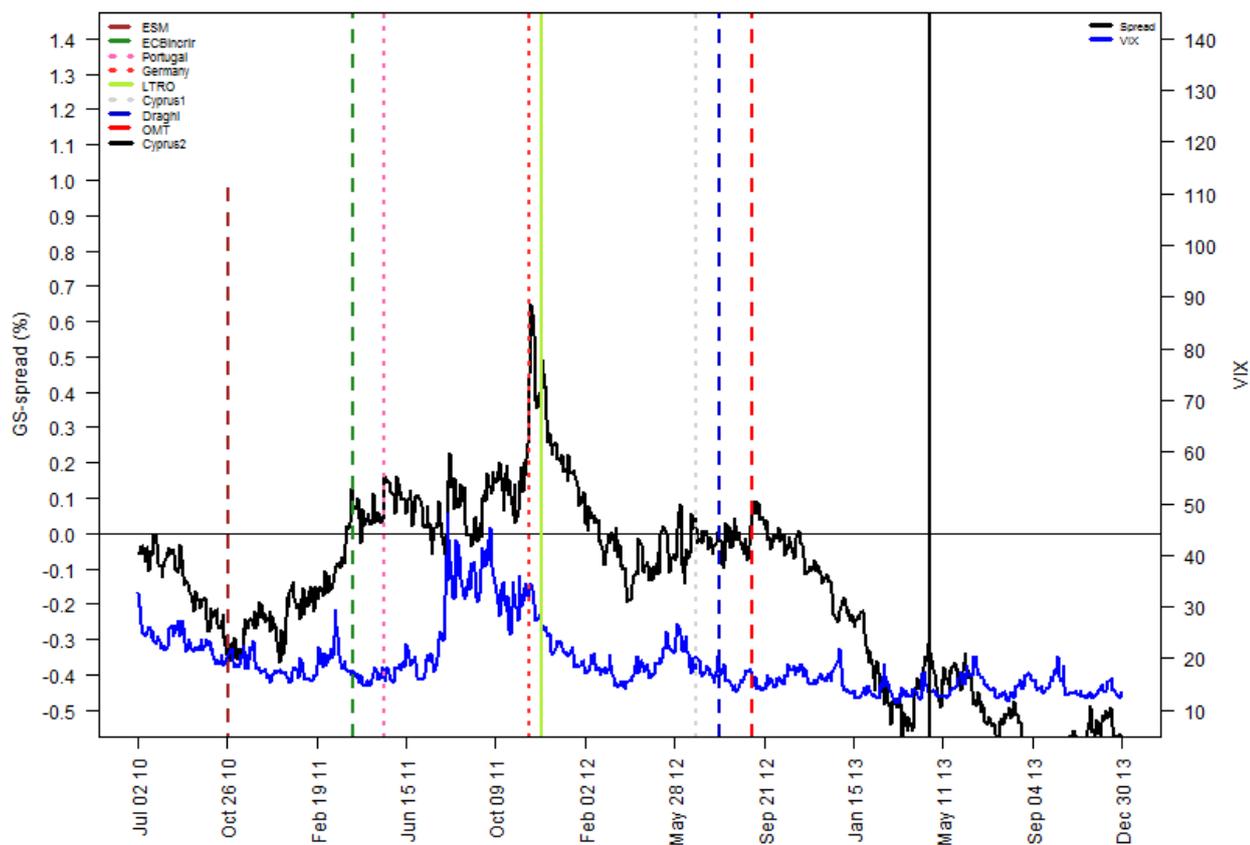
Figure 7. Germany-Sweden daily 10-year bond spread and VIX-index. Time period 02.07.2010-30.12.2013. Source. Riksbank and Yahoo Finance.

After the SMP and ESFS announcements, the next important announcement was the ESM. The ESM meant that the liabilities for Finland and Germany were about to increase, but at the same time the stability of eurozone was supported by the new financial support providing program. It seems that the liability burden outweighed the benefits, and the bond spreads started to increase. The increase in the spreads was maybe magnified by the Portugal financial support package announcement. On 17.05.2011, when Portugal financial support package was announced, FS-spread was 0.265% and GS-spread 0.068%, and the day after the spreads were 0.352% and 0.164%, respectively. Although ECB interest rate increase, preceding Portugal financial support packages, was speculated to be the reason for FS-spread increase in 2011 by Paul Krugman (2011), the FS-spread does actually decrease in the next two trading days after the announcement, also the GS-spread decreases one day after the announcement. However, the effects from the interest rate increase may have come with a longer lag.

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After the Portugal financial support announcement, FS-spread kept increasing, while also the VIX-index increased and stayed at higher levels. The bond spread developments in 2011 culminated in November, when Germany failed to sell part of its bonds. This led to sharp rises in bond yields in the eurozone as Germany is the largest economy in the EMU, and if it struggles in getting money from markets, the other member countries will struggle as well. The bond yield spike didn`t last long, for example, Finland`s bond yield was back at pre-Germany auction fail levels in a week. For Germany it took a bit longer, three weeks. After the Germany auction shock and ECB`s LOTR announcement, FS-spread started to decline sharply. Even The Cyprus financial support request did not have any clear short term impact on yields. The next event: Mario Draghi`s speech supposedly affected FS-spread in the short-term, as it came down from 0.241% on 25.07.2012 to 0.135% on 27.07.2012. Interestingly, the OMT announcement didn`t have such an immediate impact on FS-spread, although it seems to be the most significant event affecting all eurozone yields. On 05.09.2012, the day before the OMT announcement, FS-spread came up from previous days spread of 0.134% to 0.38%, so financial markets were fearing the upcoming announcement. Although the OMT was announced, which basically meant that ECB will behave as the lender of last resort, the financial markets reacted with a lag and there wasn`t any sudden drop in FS-spread, but a steady persistent decline. The OMT has never been activated, so it seems that only the ECB`s dedication to behave in a lender of last resort-manner, has been able to calm the financial markets[41], and eurozone bonds are now priced in more similar way to developed countries, who have control over their own currency.

8.2 OMT, Credit rating downgrade and bond yield spreads during 01/2002-03/2015

To see OMT:s possible contribution to Finland`s bond spread against Sweden and Germany more clearly, I use monthly data and plot the bond spreads from the period 01/2002-03/2015. In figure 8, FS-spread and FG-spread (Finland-Germany bond spread) moved closely together during the crisis period, which should terminate any exchange rate-explanation for the two "humps" i.e. a possible change in exchange rate expectations seems not likely to explain the drastic spread movements during 2008-2012. Although the FS-spread has turned negative after the OMT announcement, it`s

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[41] This was the scenario of Paul De Grauwe (2011)

noticeable how the GS-spread has stayed on higher levels compared to the pre-crisis. However, there seems to be some downward trend in the FG-spread, despite the credit rating downgrade of Standard & Poor's in October 2014.

In figure 9, it seem that after OMT, FS-spread is again moving as before the crisis (before BNP-Paribas) and starting to follow the t-bill spread of Germany and Sweden. Interestingly during the crisis, the t-bill spread started to move in opposite directions from the long term spreads. Even Germany-Sweden 10-year bond spread didn't follow it. In 2008, GS-spread in figure 5 (GS-10-year bond spread) drastically increased while t-bill spread in figure 9 decreases.
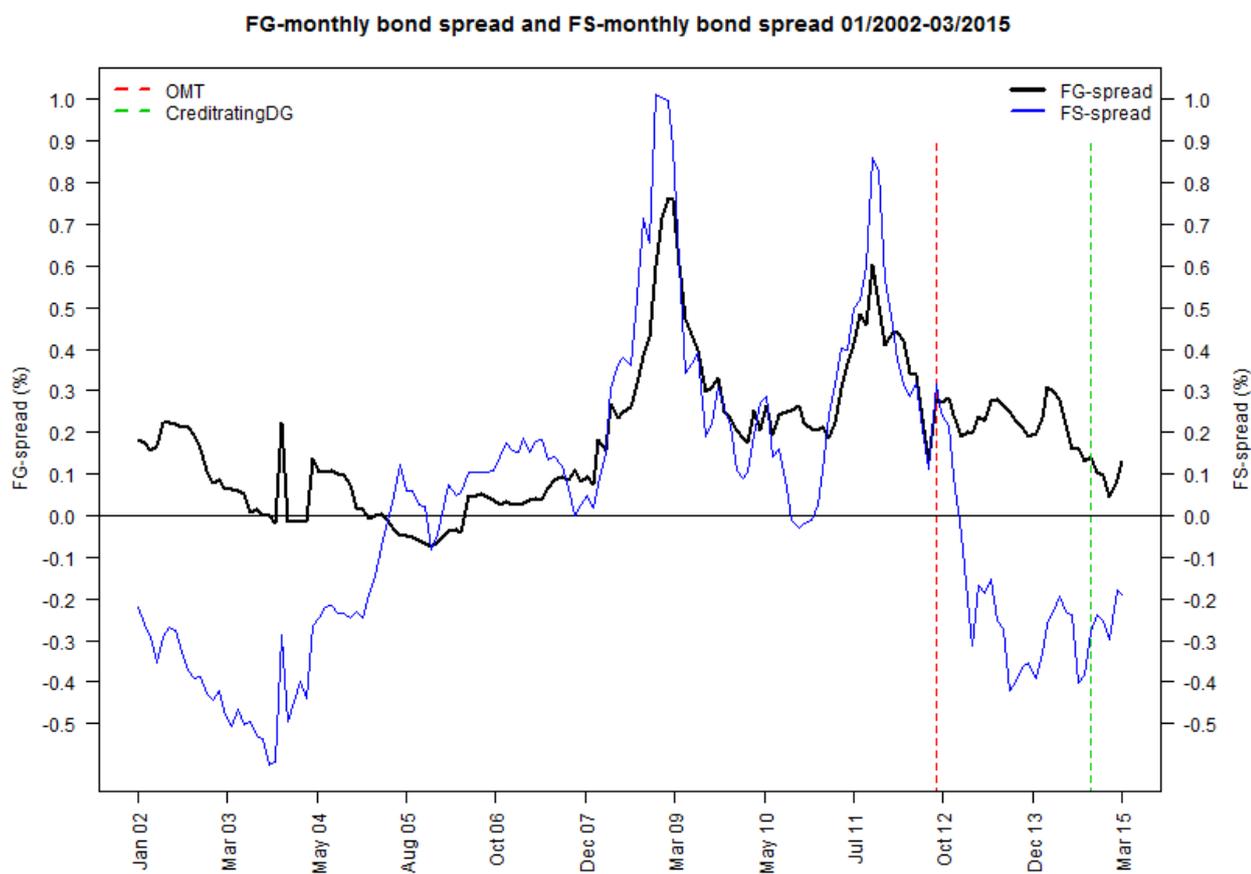

Figure 8. Finland-Germany bond spread and Finland-Sweden bond spread. Time period 01/2002-03/2015. Source. Riksbank.
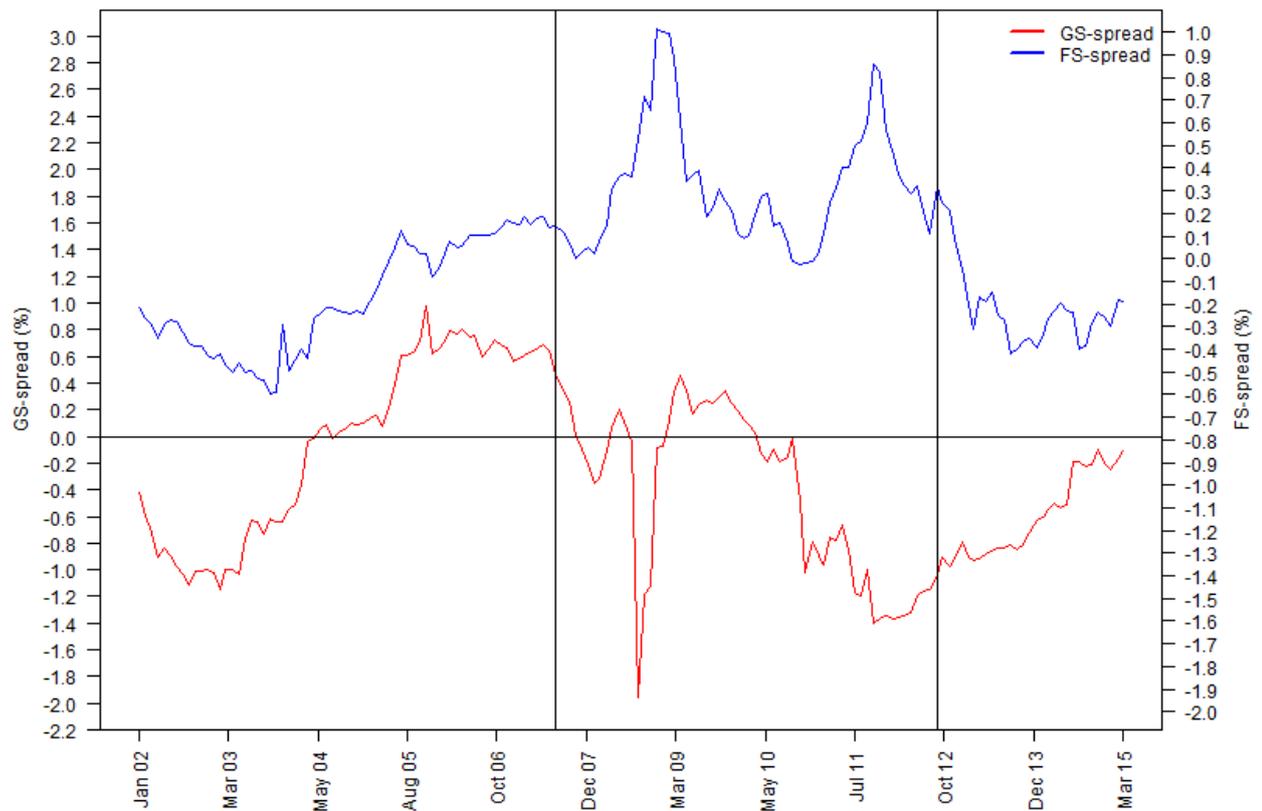
Figure 9. Germany-Sweden 6-month treasury bill spread and Finland-Sweden 10-year bond spread. Time period 01/2002-03/2015. Vertical lines: BNP-paribas (left) & OMT (right). Source. Bundesbank and Riksbank.

8.3 Risk aversion

Some authors (Giordano.et al 2012 and Poghosyan 2012) suggest that European countries such as Finland, have benefited from risk aversion. To study whether this is true, I plot VIX-index and bond yields of three European countries with AAA-credit rating (Germany, Sweden, Finland) and countries with weaker fiscal fundamentals (Spain, Portugal, Italy). The idea is to see how Finland`s bond yield develops when VIX-index rises sharply. The rising bond spread of Finland and Sweden in the crisis period does not give us any information whether Finland`s yield is rising, decreasing or staying level, so we have to look how the yield itself behave. From the figure 10, we can see that when VIX-index gets large values of over 40, then at points A and B Sweden bond yield drops below Germany`s levels. Those points are also in the immediate vicinity when Finland`s bond spread against Germany and Sweden is on its highest levels. If we look closely to the bond spreads before events A and B, when VIX-

index started its sharp climb, we can see that Finland`s bond yield follows Germany and Sweden in both cases, so Finland`s bond yield is decreasing. In addition to VIX-index, the risk aversion can be seen from the slopes of the AAA-countries yields, which are steepest right before points A and B. To see that this yield development is not just some common trend in euro area, I have also added bond yields of Spain, Portugal and Italy, to show how the yields in economically weaker European countries moved in the proximity of points A and B. Obviously, the dispersion between AAA-countries and other countries starts before point A, near the point when VIX-index starts to rise. After that, when VIX-index rises sharply again (point B), the yields moved strictly to other directions. Thus, one could speculate that Finland has benefited from the risk aversion, although Germany and Sweden have benefited more[42].
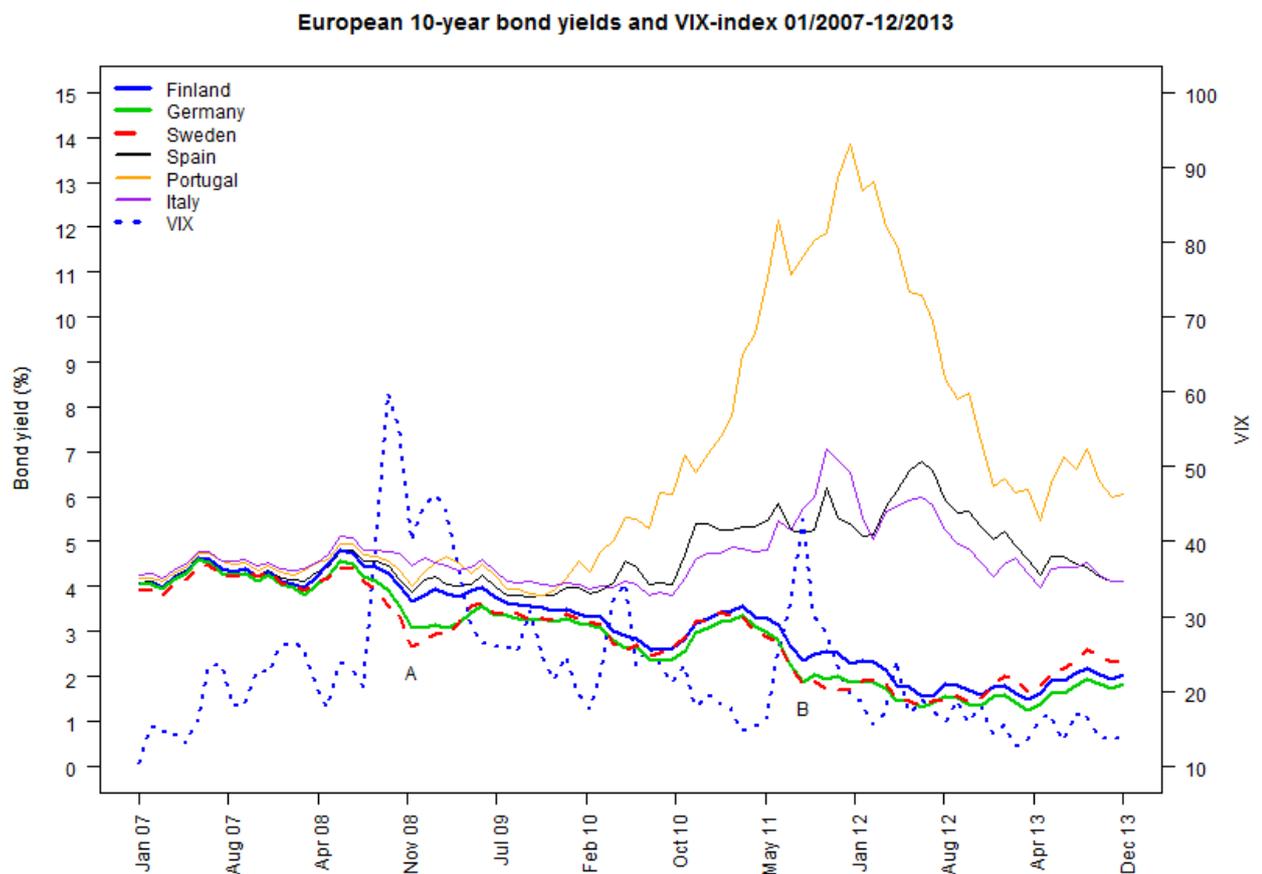

Figure 10. European 10-year bond yields and VIX-index. Time period 01/2007-12/2013. Source. ECB and Yahoo Finance.

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[42] Previous studies have found that Germany has benefited from risk aversion during the crisis period. (See, for example, De Santis 2012 and Schuknecht et al. 2010).

8.4 Convergence of bond yields

It is plausible that the Finland-Sweden bond spread developments before the crisis were partly caused by the convergence of bond yields across countries. Without trying to find a reason for this possible convergence, I have plotted Finland`s, Germany`s, UK`s and Sweden`s bond yields in figure 11, just to show how all the bond yields (even Greece) start to closely co-move before the year 2002.

Finland-Sweden- and Germany-Sweden bond spread are plotted in figure 12. From the figure, we can see that Germany-Sweden bond spread has evolved in a similar way to Finland-Sweden bond spread before the crisis i.e. both bond spreads were moving towards the zero line where the bond yields are equal. It seems that the bond spread developments before the crisis can be partly explained by the convergence of Sweden and Finland bond yields because the co-movement with Germany-Sweden bond spread suggests that the Finland-Sweden bond spread developments weren`t caused solely by the changes in the theoretical bond pricing elements such as credit risk. This supports the results from the regression analysis that the fiscal fundamentals were not important during the period 01/1995-12/2013.
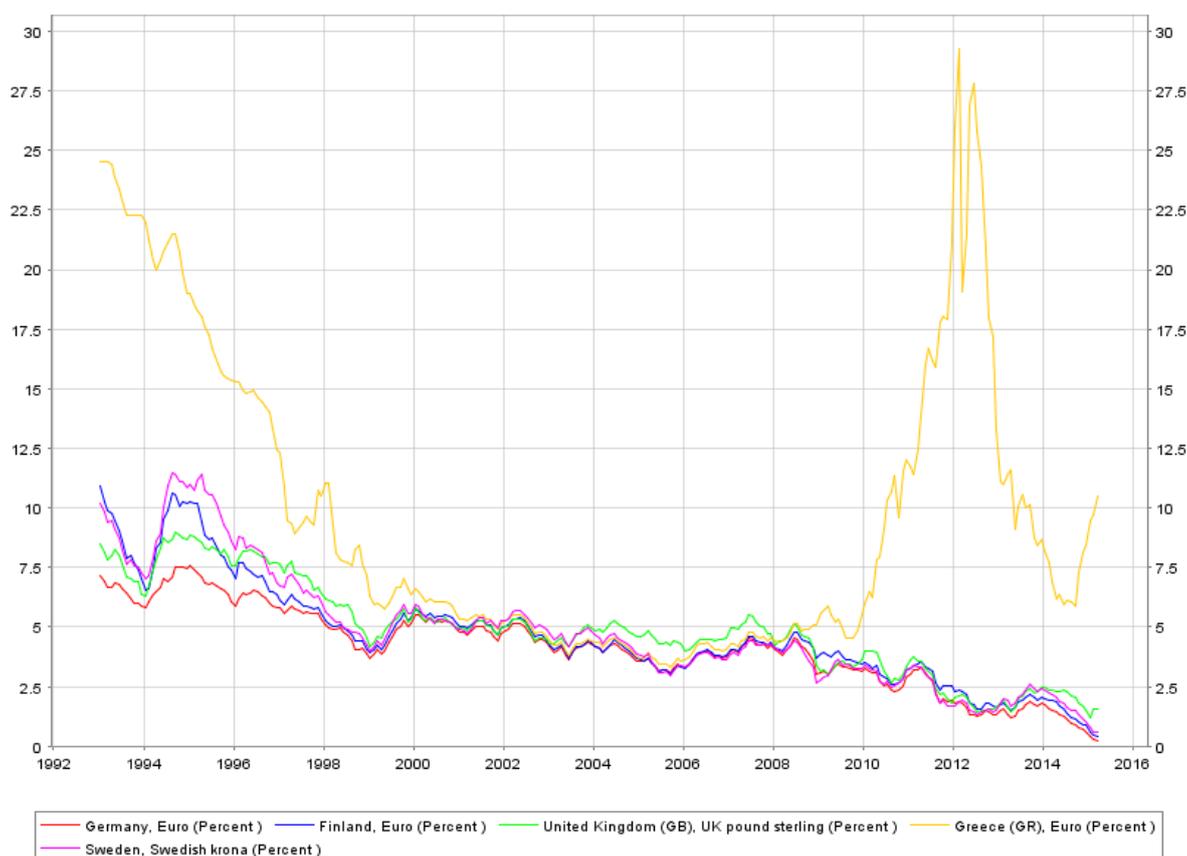
Figure 11. Finland`s, Germany`s, United Kingdom`s and Sweden`s 10-year bond yield. Time period 01/1993-03/2015. Source. ECB
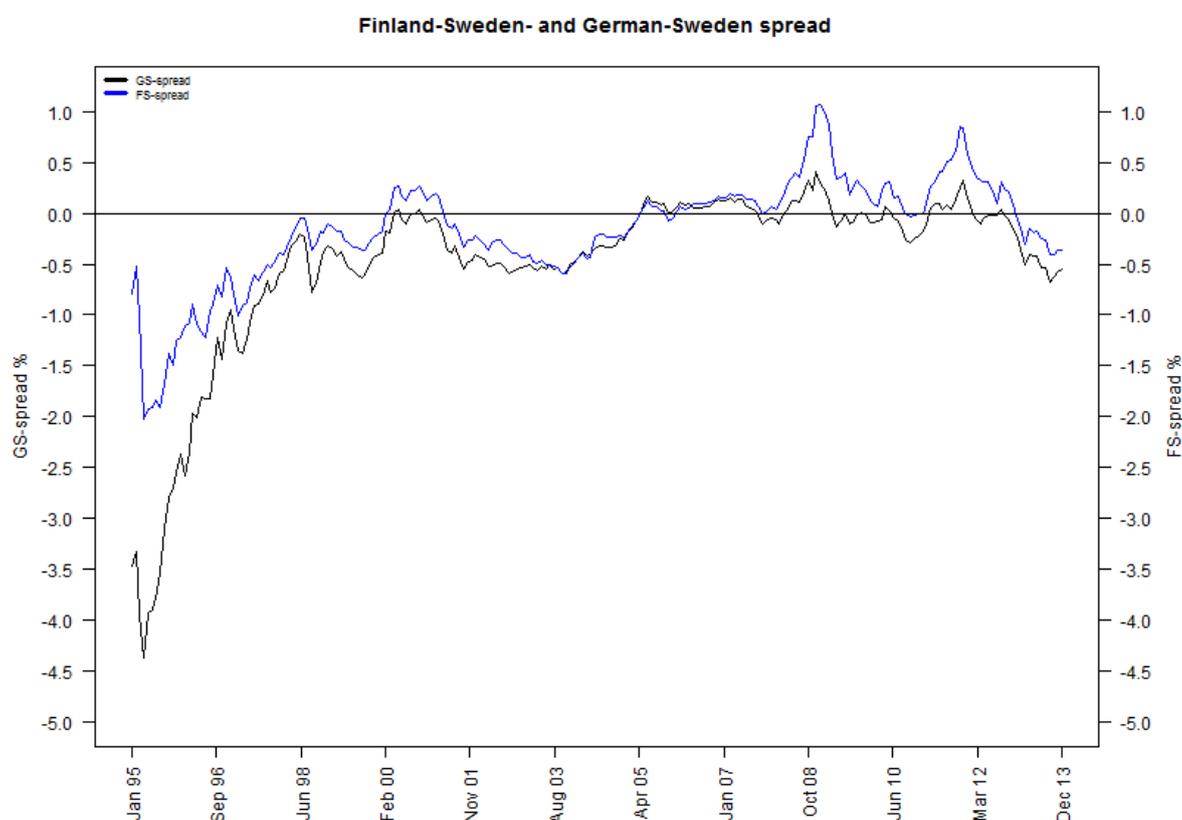
Figure 12. Finland-Sweden bond spread and Germany-Sweden bond spread. Time period 01/1993-03/2015. Source. Bank of Finland and Riksbank

9 Conlusions

In the thesis, I have tried to find the reasons for the Finland-Sweden 10-year bond yield spread developments during 1995-2013. I have used linear regression models to study the determinants of the bond spread. The results suggest that the country specific fiscal fundamentals have not played an important role in the bond spread developments. This is in line with the euro area bond spread developments before the crisis period, when countries with weak fiscal fundamentals such as Greece, were able to borrow at nearly same rates as Germany. However, the low frequency data for the fiscal fundamentals is a problem in the study. To account for the credit risk more effectively, one could use, for

example, CDS spreads since the data is available in higher frequencies[43]. I have also studied different subperiods and the results suggest that during 07/2007-12/2013, VIX-index may have been important determinant of the Finland-Sweden bond spread. This result suggests that increased risk aversion has affected the bond spread.

I also examined the bond spread developments by plotting the bond spread with special events that have taken place during 07/2007-12/2013. In addition, I looked for other bond spreads such as the Germany-Sweden- and Finland-Germany bond spread, to see whether the special events have affected these bond spreads differently. There seems to have been some kind of convergence in bond yields across Finland, Germany and Sweden, which is likely to account for part of the spread developments before the crisis. The OMT announcement is the most notable event that has probably affected the bond spread. It seems that the OMT was the program needed to calm the financial markets, and thus Finland is again able to borrow money for lower rates compared to Sweden[44].

To answer to the question whether the EMU membership has affected on Finland`s bond yields, I would conclude that during the crisis period, Finland`s bond yield has been negatively affected by the EMU membership, but mainly because it could have benefited more from the increased risk aversion[45]. Finland`s bond yield has decreased during the crisis, although the bond spreads against Germany and Sweden have occasionally increased. However, it seems that if Finland wouldn`t have been a strong AAA-credit rating country during the crisis, it would have experienced the destiny of rising bond yields like Spain and Italy did, probably due to the lack of lender last resort.

 To summarize the results, the main reasons affecting Finland-Sweden bond spread before the crisis were not likely the country specific fundamentals but rather the convergence of bond yields across Sweden and euro countries. During the crisis, the increased risk aversion and the lack of lender of last resort (until the OMT), may have played the key roles in the bond spread developments.

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[43] For example, Kilponen et al. (2012) and Barrios (2009) use CDS spreads in their study.

[44] Studies that support OMT`s effect on euro area bond yields: De Santis (2013), Altavilla et al. (2014), Saka et al. (2014) and Hochstein (2013)

[45] Countries with own currency and thus with a lender of last resort such as UK and Sweden benefited from risk aversion during the crisis, so it`s likely that Finland would have experienced the same, for example, if OMT was announced earlier.

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Appendix
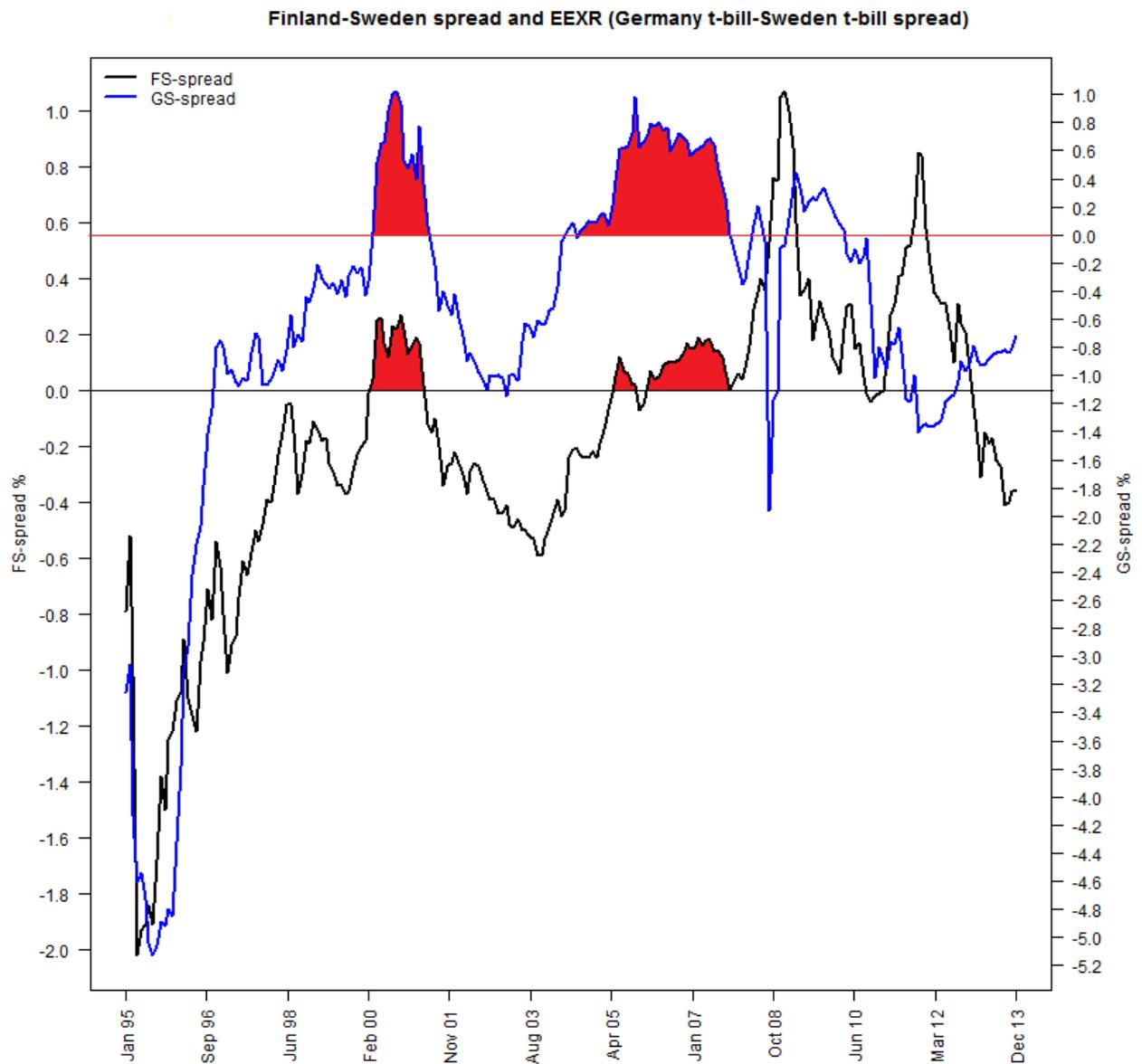
Figure 13. Finland-Sweden 10-year bond spread and Expected exchange rate variable (EEXR). EEXR equals the spread of Germany`s and Sweden`s 6-month treasury bill yields. Positive values for both variables (before the crisis) are on the red areas. Red horizontal line is zero-line for EEXR. Black horizontal line is zero-line for FS-spread. Time period 01/1995-12/2013. Source. Bank of Finland and Riksbank.
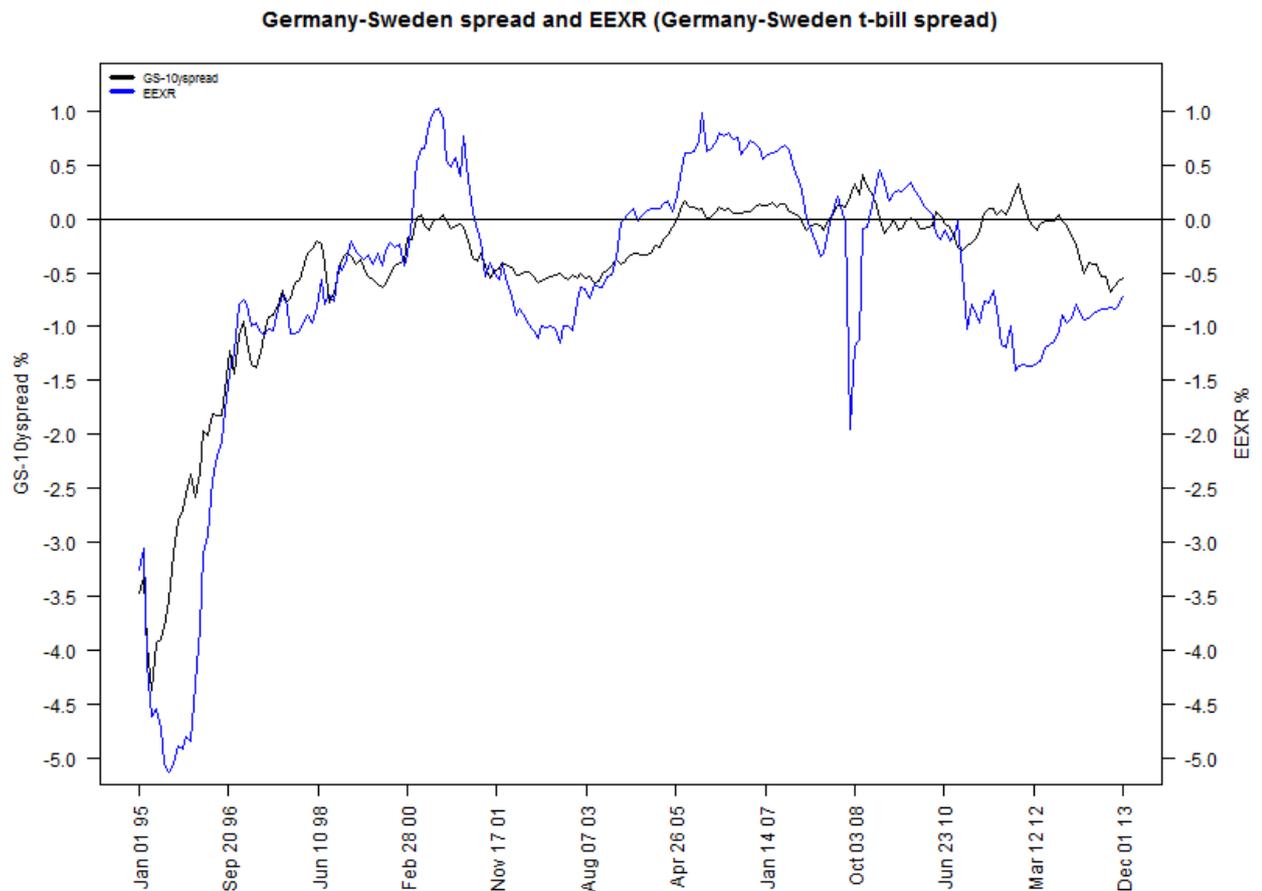
Figure 14. Germany-Sweden 10-year bond spread and Expected exchange rate variable (EEXR). EEXR equals the spread of Germany`s and Sweden`s 6-month treasury bill yields. Time period 01/1995-12/2013. Source. Bundesbank and Riksbank.

Data sources:

1. BOND YIELDS

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2. CREDIT RISK

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Sweden. Eurostat.
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Deficit to GDP

Finland: Countryeconomy. http://countryeconomy.com/deficit/finland

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GDP growth rate

Finland: OECD. http://stats.oecd.org/index.aspx?queryid=60702#

Sweden: OECD. http://stats.oecd.org/index.aspx?queryid=60702#

Current account balance to GDP

Finland: OECD. http://stats.oecd.org/index.aspx?queryid=60702

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Real effective exchange rate

Finland*:* World bank. http://data.worldbank.org/indicator/PX.REX.REER
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3. RISK AVERSION

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Sweden: Statistics Sweden

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5. EXPECTED EXCHANGE RATE

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Table 2: Results from the models 7-10 (NW-standard errors)

	Dependent variable:Spread			
	(7)	(8)	(9)	(10)
VIX	-0.0004	-0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.002)	(0.004)
Deficitgdp	-0.009	0.005		
	(0.006)	(0.006)		
CA			0.031	-0.030
			(0.029)	(0.045)
EEXR		0.083	0.089	
		(0.051)	(0.054)	
Inflation		0.024^{***}	0.017^{*}	0.031^{**}
		(0.009)	(0.009)	(0.014)
lagspread	0.973^{***}	0.707^{***}	0.707^{***}	0.928^{***}
	(0.026)	(0.127)	(0.132)	(0.019)
Constant	0.021	-0.041	-0.045	0.019
	(0.039)	(0.053)	(0.056)	(0.037)
Observations	149	149	149	149
R^2	0.932	0.944	0.944	0.934
Adjusted R^2	0.930	0.942	0.942	0.932

Note: *p<0.1; **p<0.05; ***p<0.01

Table 2. Results from the models 7-10. Newey-West standard errors in parentheses. Period studied 01/1995-06/2007.

Table 3: Results from the models 11-15

	(11)	(12)	(13)	(14)	(15)
	Dependent variable: Spread				
					(Models 11,14,15 NW-SE)
VIX	0.005***	0.005**	0.003	0.005***	0.002***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.0004)
Deficitgdp	0.005	0.012			
	(0.009)	(0.009)			
CA			0.181*	-0.013	
			(0.099)	(0.116)	
EEXR		-0.057**	-0.089***		
		(0.024)	(0.032)		
Inflation		-0.024	0.001	-0.004	
		(0.018)	(0.020)	(0.035)	
lagspread	0.854***	0.858***	0.887***	0.854***	
	(0.07)	(0.050)	(0.052)	(0.075)	
lag(Spread, 1)					0.951***
					(0.014)
Constant	-0.088**	-0.084*	-0.124***	-0.096*	-0.027***
	(0.035)	(0.044)	(0.041)	(0.051)	(0.009)
Observations	77	77	77	77	338
R^2	0.902	0.909	0.911	0.901	0.963
Adjusted R^2	0.898	0.902	0.904	0.896	0.963

Note: $^*p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table 3. Results from the models 11-15. Standard errors in parentheses (Models 11, 14 and 15 with Newey-West standard errors). Period studied 07/2007-12/2013.

Table 4: Results from the models 16-19 (NW-standard errors)

	Dependent variable: Spread			
	(16)	(17)	(18)	(19)
VIX	0.001	0.002	0.001	0.001
	(0.001)	(0.002)	(0.002)	(0.002)
DeficitgdpF	0.004	0.0003		
	(0.009)	(0.010)		
CAF			0.003	0.003
			(0.003)	(0.002)
EEXR		0.004	0.0005	
		(0.018)	(0.018)	
InflationF		0.050*	0.049	0.049
		(0.029)	(0.031)	(0.031)
lag(Spread, 1)	0.964***	0.939***	0.963***	0.963***
	(0.037)	(0.039)	(0.042)	(0.035)
Constant	-0.022	-0.048	-0.025	-0.024
	(0.027)	(0.036)	(0.046)	(0.038)
Observations	143	143	143	143
R^2	0.942	0.943	0.944	0.944
Adjusted R^2	0.941	0.941	0.941	0.942

Note: *p<0.1; **p<0.05; ***p<0.0

Table 4. Results from the models 16-19. Newey-West standard errors in parentheses. Period studied 01/2002-12/2013.

Table 5: Results from the models 20-27

				Dependent variable: Spread				
							(Model 24 NW-SE)	
	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
VIX	-0.003**	-0.001	-0.002	-0.003**	0.005***	0.005***	0.003	0.003
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
DeficitgdpF	-0.018	-0.027			0.002	0.009		
	(0.018)	(0.017)			(0.011)	(0.010)		
CAF			-0.004	-0.009**			0.023***	0.016***
			(0.005)	(0.004)			(0.006)	(0.006)
EEXR		0.085***	0.061			-0.045*	-0.070***	
		(0.030)	(0.039)			(0.026)	(0.022)	
InflationF		-0.094***	-0.086***	-0.067**		-0.034	-0.108*	-0.007
		(0.031)	(0.031)	(0.029)		(0.071)	(0.062)	(0.056)
lagspread	0.939***	0.789***	0.836***	0.914***	0.855***	0.859***	0.894***	0.871***
	(0.030)	(0.061)	(0.061)	(0.031)	(0.07)	(0.053)	(0.049)	(0.051)
Constant	0.060***	0.041	0.026	0.056**	-0.094**	-0.105**	0.069	0.040
	(0.018)	(0.034)	(0.033)	(0.028)	(0.034)	(0.045)	(0.061)	(0.064)
Observations	65	65	65	65	77	77	77	77
R^2	0.970	0.975	0.974	0.973	0.901	0.906	0.923	0.912
Adjusted R^2	0.969	0.973	0.972	0.971	0.897	0.899	0.917	0.907

Note: *p<0.1; **p<0.05; ***p<0.0

Table 5. Results from the models 20-27. Period studied: 01/2002-06/2007 (Models 20-23) and 07/2007-12/2013 (Models 24-27). Standard errors in parentheses. Model 24 with Newey-West standard errors.