The impact of sovereign debt ratings on euro area cross-border holdings of euro area sovereign debt

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Abstract

This paper documents how sovereign debt ratings shape euro area cross-border holdings of euro area debt, using granular sectoral security holdings statistics for the period 2009Q4 until 2017Q1. Credit risk is the main risk for bond investors when investing in bonds that are issued in the same currency as the currency of the investor's home country. Sovereign debt ratings provided by rating agencies give investors key information on the creditworthiness of governments. The results in this paper show that investors respond differently to credit ratings. In particular, we find that investors from core euro area countries respond more to credit ratings than investors from peripheral euro area countries. The results show that mainly banks and to a lesser extent insurers and investment funds explain this result. Finally, we find non-linearities in the relationship between bond holdings and credit ratings.

JEL classification: F3, G11, G15, G2
Keywords: euro area; asset allocation; sovereign debt, sovereign debt rating

1. Introduction

The European sovereign debt crisis of 2010-2012 shocked the sovereign bond markets in the euro area. Interest rates of government bonds issued by the so-called peripheral countries, or GIIPS (Greece, Ireland, Italy, Portugal and Spain) countries, surged to levels not seen since the start of EMU (Figure 1, panel A). The increases in interest rates only stopped after ECB president Mario Draghi said that the ECB will do "whatever it takes" to save the euro. During the sovereign debt crisis, rating agencies revised their sovereign ratings multiple times and mostly downwards for these peripheral countries (Figure 1, panel B). Only since 2014 we observe upgrades again.

[Figure 1]

Figure 1 suggests a link between bond yields and bond ratings. Theoretically, when ratings reflect the riskiness of bonds, this riskiness is reflected in yields (i.e. the credit risk spread). A range of studies empirically documents the link between sovereign ratings and yields or yield spreads (e.g., De Vries and De Haan, 2016; El-Shagi and Von Schweinitz, 2016, Afonso et al., 2012). These studies indeed confirm a strong link between ratings and yields. In contrast, Boffelli and Urga (2015) find no significant role for rating agencies during the European sovereign debt crisis. Another line of research examines whether yields reflected fundamentals during the crisis (e.g., De Haan et al, 2014). Other researchers examine the determinants of sovereign ratings and find that ratings are determined by economic fundamentals such as economic growth (e.g. Cantor and Packer, 1996; Mellios and Paget-Blanc, 2006; Brůha et al., 2017; Reusens and Croux, 2017).

A parallel literature studies the holders of sovereign bonds (e.g. Andritzky, 2012). However, only few paper link the sovereign bond holdings to ratings. A notable exception is Arslanalp and Tsuda (2014), who study the holdings of sovereign debt across countries and distinguish between domestic and foreign holdings. The authors document graphically a strong decrease in the foreign holdings of Ireland and Portugal after these countries received several rating downgrades during the sovereign debt crisis.[1] The authors find that in many cases domestic

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[1] Brutti and Sauré (2015) do not explicitly focus on ratings, but also document a shift from foreign to domestic investors during the euro area sovereign debt crisis.

banks or official institutions filled the gap that arose when foreign investors left. However, the authors do not address the magnitude of the impact of rating downgrades on foreign holdings.

Orpiszewski (2015) comes closest to our paper by empirically examining the impact of sovereign ratings on non-resident sovereign bond holdings of a sample of 8 euro area countries, 5 developed economies outside the euro area and 17 emerging economies during 2001-2011, thereby differentiating between sector holdings, as we do. He finds that non-resident investors diminished their holdings of peripheral sovereigns after downgrades.[2]

Our approach is different from Orpiszewski's (2015) in several dimensions. First, Orpiszewski (2015) analyses the aggregate foreign holdings of a country's debt, while we study the foreign holdings of each country in another country's debt. In other words, we have a two-dimensional panel at the holder country – issuer country level, while Orpiszewski's (2015) has a one-dimensional panel at the issuer country level. Second, in our empirical approach we rescale the dependent variable by the total holdings of a holder country, while he considers the log of total holdings. Our rescaling procedure should limit non-stationarity problems when considering longer time series. Third, we focus solely on euro area countries and euro denominated debt which allows us to focus more deeply on the effect of ratings. It allows us to abstract from other investor preferences, e,g., regarding the currency denomination of bonds (see e.g. Boermans and Vermeulen, 2016; Burger et al., 2017; Maggiori et al., 2018).

This paper contributes to the literature by examining the impact of sovereign debt ratings on euro area cross-border holdings of euro sovereign bonds. We look at differences between core versus periphery investors, in order to provide insight into the question whether the euro capital market is a single capital market or a fragmented one. We examine holdings at the country level and distinguish between financial sectors, i.e. banks, pension funds, insurance companies, and investment funds.

The main results are: ratings determine cross-border sovereign bond holdings. There are differences between core and periphery: core investors (notably banks) react strongly to ratings by selling low rated bonds, while periphery investors, notably insurance companies, hardly respond to ratings or even acquire more bonds with low ratings.

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[2] Gande and Parsley (2014) examine the response of international *equity* (i.e., stocks, not bonds) investments of mutual funds to sovereign rating changes during 1996-2002.

The plan of the paper is as follows. Section 2 discusses the data on holdings and ratings. Section 3 presents our hypothesis and methodology. Section 4 presents the results, followed by several robustness tests in Section 5. Section 6 gives an interpretation of the results after which Section 7 concludes.

2. Data

2.1 *Euro area cross border sovereign bond holdings*

We use detailed security holdings statistics to investigate changes in euro area government bond holdings by non-domestic euro area investors. The ESCB's Security Holdings Statistics provides detailed information on the holdings of investors in individual government bonds. This holdings data is disaggregated by holder country and holder sector. For example, the data shows at the quarterly frequency the holdings of German banks in individual Spanish government bonds.

We consider private sector holdings of cross border government bonds and distinguish between four broad holder sectors: banks, insurance companies, pension funds and investment funds. Other sectors such as household direct holdings and government holdings are available as well, but these are relatively small in comparison to the other four holder sectors. Central bank holdings of government debt have become large, especially since the Public Sector Purchase Program (PSPP) started in 2015. However, as we consider private investor behaviour we do not consider these holdings.

The data quality is very high since there is a mandatory reporting requirement for all euro area residents. Data is available at the quarterly frequency as of 2009Q4; however, domestic holdings are incomplete before 2013Q4.[3] For the research question of this paper this is not an issue because we study the non-domestic holdings of euro area investors. The sample runs from 2009Q4 until 2017Q1. The holdings by non-euro area investors are also incomplete, so we do not consider the holdings of non-euro area investors (e.g. US, Japan, UK) in this paper.

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[3] Since 2013Q4 SHS data is collected under a legal mandate (Regulation ECB/2012/24), while data covering 2009Q4 up to 2013Q3 is constructed based on available data collections and the coverage and data quality is necessarily limited. Generally, the coverage of foreign holdings is of high quality during this period.

Our sample contains the eleven (in terms of GDP) largest euro area countries. These are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain. The smaller euro area countries are excluded since their own government's debt markets are relatively small and not always liquid. These countries are Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, Slovenia and Slovakia.

In the sample we consider all government bonds issued by the eleven countries denominated in euros and with an original maturity larger than one year. This amounts to over EUR 6 trillion in sovereign bonds. Note that we cover some two-thirds of total euro area debt with the current country selection. Short term bills and loans are not included in the sample.

We measure the holdings of investors in terms of nominal value. So, suppose a government issued a bond with a nominal value of EUR 1 billion and the current price of the bond is 120%, then the market value of the bond is EUR 1.2 billion. Suppose an investor holds 10% of this bond, then the nominal holdings of the investor are EUR 100 million. Note that the choice for measurement of holdings based on either nominal or market value is not important since we calculate the fraction of a bond an investor holds; as long as both the numerator and denominator is either in nominal or market value the fraction is identical.

Figure 2 shows how the cross-border holdings of euro area debt have evolved over time. At the start of our sample period (2009Q4), euro area investors held about a quarter of the outstanding amount of debt issued by other euro countries. Roughly 1.5 trillion euro. This share dropped to 17% mid-2012 and, after the "Whatever it takes" speech of Draghi, it recovered slightly to 18% in 2016. To give a feeling of the proportion: about 600 billion euro had to be financed in another way, which equals about 10% of total issued euro area government debt.

[Figure 2]

Banks, insurers and investment funds are the main cross border holders (Figure 3). Until 2009 the holdings of all sectors increased, but with the start of the Greek sovereign debt crisis late 2009 we observe a strong decrease, in particular for banks. The graph shows that banks decreased their cross border holdings earlier than insurers and investment funds, but also much

stronger. By late 2009 cross border holdings of banks were well above those of insurers and investment funds, but during mid 2012 the holdings of banks were quite a bit lower. Since early 2013 all sectors expand their cross border holdings again. In nominal terms, insurers, pension funds and investment funds all have higher cross border euro area sovereign debt holdings at the end of the sample compared to the beginning of the sample.

[Figure 3]

Figure 4 shows that the proportion of government bonds held by non-domestic euro area investors differs widely across countries. At the start of the sample in 2009Q4, it ranges from slightly less than 20% for France and Germany to 60% for Portugal. Greece and Ireland also have about half of their sovereign debt owned by non-domestic euro area investors at the start of the sample. During 2010-2012, the proportions of non-domestic holdings of Greek, Irish and Portuguese debt dropped strongly. The graph shows that the proportion of Greek debt held by non-Greek euro area investors dropped from 50% in 2009 to 0% in 2012. At the end of the sample non-domestic euro area ownership ranges from about 5% for Greece to around 40% for Austria, Belgium and Finland.

[Figure 4]

2.2 *The role of ratings in explaining investment patterns*

Sovereign bond ratings are an important input in investors' portfolio decisions. In many cases, internal rules for portfolio investments by for example banks and pension funds are based on bond ratings.

There are three major rating agencies (S&P, Moody's and Fitch) which provide unsolicited ratings for government debt. In general, the ratings are very close to each other (see Alsakka and Gwilym (2010)). In this paper we use Standard & Poor´s (S&P) long term domestic currency debt ratings, which are arguably the most widely used ratings when considering sovereign debt. The S&P ratings range from AAA down to D, when there is a default. These ratings are often accompanied by an outlook, which can be positive, stable or negative.

Following Gande and Parsley (2014), we convert each country's rating in a Comprehensive Credit Rating (CCR) that takes both the rating itself and the outlook into account. In the first step we convert the actual rating on a scale from 0 until 23, where 0 is the lowest rating (Default) and 23 the highest (AAA). Each notch in between the extremes is assigned an integer. 1 is added to the rating value when a country has a positive outlook and 1 subtracted when the outlook is negative. In case of credit watches 0.5 is added when there is a positive credit watch and 0.5 subtracted in case of a negative credit watch. Panel B of Figure 1 already showed the development of the CCR for every country in our sample.

Figure 5 puts both bond holdings and ratings together. Panel A is for investors from core euro countries, panel B for investors from periphery countries. Overall, there is a strong and positive relationship between holdings and ratings. However, there are some striking differences between investors from the core and the periphery. While investors from the core (Panel A) diminished their holdings of Spanish, Italian and Portuguese bonds in line with the lowering of ratings for these countries, investors from the periphery increased their holdings of Spanish, Italian and Portuguese bonds, contrary what one would expect considering the ratings for these countries.

[Figure 5]

For the sake of brevity, in the following we denote investment behaviour where investors invest less in lower rated bonds and more in higher rated bonds as 'momentum' investment behaviour, while denoting the opposite investment behaviour (where investors invest more in lower rated bonds and less in higher rated bonds) as 'contrarian' investment behaviour.[4]

3. Hypothesis and methodology

The graphical inspection in Section 2 suggested that investors from core countries exhibit momentum investment behaviour, whereas investors from peripheral countries exhibit contrarian investment behaviour. The main difference between core and periphery countries is the yield on their domestic governments' bonds. Yields on domestic sovereign bonds in core

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[4] Momentum investment behaviour is known in the literature as 'buying past winners', versus contrarian investment behaviour which is the opposite, i.e. 'buying past losers'. See, for example, De Haan and Kakes (2011).

countries are lower than in peripheral countries. This yield difference reflects the difference in sovereign credit risk between the core and the periphery. Hence, our hypothesis is that the different investment behaviour between core and periphery reflects differences in domestic sovereign risk and risk attitude. In this section, we proceed by testing this hypothesis formally using regression analysis.

3.1 *Dependent variable*

We start by defining the dependent variable for the regressions. The dependent variable should capture the under- or overweighting of a country in the investor's portfolio relative to a benchmark strategy. We follow Arslanalp and Tsuda (2014) by defining the benchmark strategy as a strategy where the investor spreads his portfolio according to each country's share in total issued debt. Specifically, we define "ratio" as the share of country *j* debt in total cross-border holdings of investors from country *i* (the so-called 'holdershare') divided by the share of country *j* debt in total euro area sovereign debt excluding debt issued by country *i* (the 'issuershare'):

$$Ratio_{ijt} = \frac{Holdershare_{ijt}}{Issuershare_{ijt}} = \frac{Holdings_{ijt}/\sum_{j \neq i} Holdings_{ijt}}{Debt_{ijt}/\sum_{j \neq i} Debt_{ijt}} \qquad (1)$$

When *ratio* equals 1, the investor follows the benchmark strategy. For example, if all countries jointly excluding country *i* issued EUR 5 trillion debt and country *j* issued EUR 1 trillion debt, the representative investor will invest 20% of his portfolio in country *j* debt. Suppose investors from country *i* hold 40% of their portfolio in country *j* debt the variable *ratio* will be equal to 2.[5]

We consider debt in nominal values throughout the paper, but the measure is not sensitive to whether we measure holdings and outstanding amounts either in nominal or market values. Likewise as in Section 2.1, a simple example can illustrate this point. Consider again the above example and assume that the EUR 4 trillion debt issued by all countries except countries *i* and *j* trades at par, i.e. the market value is also EUR 4 trillion. However, the bonds of country *j*

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[5] Arslanalp and Tsuda (2014), instead of using the ratio of holder share to issuer share, take the difference in their graphical analysis (however, they do not perform regression analysis on this variable).

trade at 80%. Then the market value of country j's debt is EUR 800 billion, which implies that the representative investor holds 16.7% of country j debt measured in terms of market value.

Assume investors from country i have a total portfolio of EUR 2 trillion in nominal debt, with 40% invested in country j debt. The market value of the country j debt is EUR 640 billion, while the market value of the debt in the other countries is EUR 1.2 trillion. So, in terms of market value the share of country j is 34.8% in country j's portfolio. The ratio is then 34.8%/16.7%, i.e. close to 2.1. Note that deviations between nominal and market value become larger when bonds trade far away from the par value.

The variable *ratio* for holder country i in issuer country j is, ceteris paribus, independent of the holdings of other countries' investment choices when considering nominal values. Assume again that country j debt is 40% of investor i's portfolio and country j's share in total nominal debt is 20%. As long as country i investors do not change their portfolio and country j does not change the outstanding amount of debt, the variable *ratio* will not be affected by the actions of other countries.

Figure 6 shows the development of *ratio* per issuer country for (in view of space considerations) a selection of three holder countries: two periphery countries Italy and Spain and one core country The Netherlands. The difference in investment behaviour between core and periphery (as reported in Section 2) also shows up clearly in these examples. Spanish investors increase their holdings of Italian, Greek and Portuguese bonds although ratings go down. Italian investors also increase their holdings of Spanish and Portuguese bonds. On the other hand, Dutch investors bring down their holdings of Italian, Greek and Portuguese bonds.

[Figure 6]

Instead of extending the number of panels in Figure 6 to eleven (the number of countries in our sample) to determine the generality of our conjectures, we proceed with regression analysis.

3.2 *Empirical model*

For the first regression, we specify *ratio* as a function of *rating*:

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$$ratio_{ijt} = a_0 + a_1 rating_{jt} + f_i \tag{2}$$

where *ratio* is as defined in (1) and *rating* is the comprehensive credit rating (CCR) of issuer country *j*. Term f_i represents fixed country effects explaining time-invariant factors determining differences in bond holdings between holder countries *i*. We expect $a_1 > 0$ in case of momentum investment behaviour and $a_1 < 0$ in case of contrarian investment behaviour.[6]

As our hypothesis is that the different investment behaviour between core and periphery reflects differences in domestic sovereign risk (as reflected in the level of the yield on domestic government bonds), we define:

yielddif = yield on sovereign bonds of issuer country minus yield on sovereign bonds of holder country (3)

The yields are the interest rates on 10 year government bonds. We define a categorical variable *yielddif_cat* which categorizes the observed values for *yielddif* into four categories:

yielddif_cat = 0, 1, 2, 3, (4)

where each category representing 25% of the sample. *yielddif_cat* = 0 contains the 25% lowest values for the *yielddif*, *yielddif_cat* = 3 the highest. Using *yielddif_cat* as interaction variable, we specify the following interaction model:

$$ratio_{ijt} = a_0 + a_1 rating_{jt} + \sum_{c=0}^{3} a_{2c} rating_{jt} \times yielddif\_cat_{ijt} +$$
$$\sum_{c=0}^{3} a_{3c} yielddif\_cat_{ijt} + f_i \tag{5}$$

For ease of interpretation of (5), we define marginal effects $\frac{\partial(ratio)}{\partial(rating)}$ for each category (Figure 7).

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[6] We do not pose any lags, as we use data with a quarterly frequency, whereas investments flows are known to respond within a few days (see e.g. Ismailescu and Kazemi (2010)). We also tested for exogeneity of rating, using the Davidson-MacKinnon test. Exogeneity could not be rejected with a *p*-value = 0.7689.

[Figure 7]

For the marginal effects, we expect $\frac{\partial(ratio)}{\partial(rating)} > 0$ in case of momentum investment behaviour

and $\frac{\partial(ratio)}{\partial(rating)} < 0$ in case of contrarian investment behaviour. Further, we expect to find

momentum investment behaviour ($\frac{\partial(ratio)}{\partial(rating)} > 0$) more often in case *yielddif_cat* contains

positive values, i.e. when the yield of the issuer country is higher than the yield of the holder

country. Vice versa, we expect to find contrarian investment behaviour ($\frac{\partial(ratio)}{\partial(rating)} < 0$) more

often in case *yielddif_cat* contains negative values, i.e. when the yield of the issuer country is

lower than the yield of the holder country.

4. Results

In this section fixed effects panel regression outcomes for equations (2) and (5) are presented,

respectively. Our sample contains 11 countries, so each panel regression has $n(n - 1) = 110$

holder/issuing country combinations, or 'groups'. Our sample period comprises 29 quarters, so

we have 29 x 110 = 3,190 observations in each panel regression. Table 1, panel A, column (1),

gives the estimated coefficient a_1 of equation (1) and the four marginal effects derived from

equation (4), together with their statistical significance[7], for all holder countries in both the

core and periphery. Columns (2) – (5) presents the results differentiated by holding sector

(banks, insurance companies, pension funds, investment funds).

[insert Table 1]

The results for Eq. (2) for all holders (Table 1, Panel A, column 1) suggest that investors invest

less in sovereigns with lower ratings and vice versa (hence, coefficient $a_1 > 0$). Coefficient a_1

is 0.041 for the Eurozone. We also estimate the equations for two subsamples of euro countries,

namely countries whose sovereign yields surged during the euro debt crisis, the so-called

periphery, and countries whose sovereign yields remained relatively low during the crisis, the

so-called core. Panel B and C give the results for holders in the core and periphery, respectively.

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[7] For ease of interpretation, we denote statistical significance at conventional 1% and 5% levels only, depicted by
** and *, respectively.

The results show that coefficient a_1 is also positive (0.076) for the core, but not for the periphery (-0.010 and insignificant).

The results of estimation of the interaction model, Eq. (5), for all holders (Table 1, Panel A, column 1) show that if the yield on government bonds of the issuer country is substantially higher than that of the holder country ($1.2 \leq$ yielddif < 32.0), investors in the holder country have smaller exposures to issuer countries with the lowest ratings and vice versa greater exposures to issuer countries with the highest ratings (the marginal effect is 0.073). Hence, we conjecture that momentum investment behaviour is present if the holder country is more credit worthy than the issuer country.

To test our hypothesis further, we again re-estimate the equations for the periphery and the core. For the core (panel B) three out of four yield difference classes contain positive values, whereas for the periphery (panel C) three out of four yield difference classes contain negative values.

Panel B, giving the results for the core, suggests that momentum behaviour is significantly present among the core holder countries. a_1 is 0.076 in Eq. (1). Marginal effects of Eq. (5) are significantly positive (0.051 and 0.082, respectively) for two yield difference classes in which holder countries have lower yields than issuer countries.

Panel C, column 1, for the periphery, gives some indications that investment behaviour is contrarian rather than momentum. a_1 is -0.010 but not significant in Eq. (2). Marginal effects of Eq. (5) are negative for three out of four yield difference classes in which holder countries have higher yields than issuer countries. Only for one yield difference class (-3.9 to -1.4) the marginal effect is significantly negative (-0.097).

The sector results (columns 2 to 5) indicate that momentum behaviour in the core is most prominent among banks, and that contrarian behaviour in the periphery is most prominent among insurance companies.

5. Robustness

In the previous section we used the differences in sovereign yields as proxy for the credit worthiness of the issuer country. Another proxy for credit worthiness are CDS premiums.

CDS premiums more or less show the same developments over time as sovereign yields, which are inversely related to ratings (as we saw in Figure 1). Therefore, as a robustness check, we also define differences in credit worthiness between issuer and holder countries using CDS premiums and comprehensive credit ratings (CCRs):

CDSdif = CDS premium issuer – CDS premium holder (5)

CCRdif = CCR issuer – CCR holder (6)

The three proxies, yielddif, CDSdif and CCRdif, are strongly correlated (see Table 2).

[insert Table 2]

We define four difference classes for CDS and CCR, respectively:

$CDSdif\_cat = 0, 1, 2, 3,$ (7)

$CCRdif\_cat = 0, 1, 2, 3,$ (8)

We re-estimate Eq. (2) and (5) substituting yielddif_cat by CDSdif_cat and CCRdif_cat, respectively. The results are presented in Tables 3 and 4.

[insert Tables 3, 4]

The results in Tables 3 and 4 confirm the results in Table 1. Coefficient a_1 and the marginal effects, when significant, are positive for investors from the core and negative for investors from the periphery, indicating momentum behaviour for the core and contrarian behaviour for the periphery, respectively.

6. What explains the differences between core and peripheral investors?

In this section, we propose several potential explanations for the striking difference in investment behaviour between investors from the core and the periphery.

6.1 *Sovereign-bank nexus*

One potential explanation concerns the sovereign-bank nexus, i.e. the government's dependence on funding from banks and banks' dependence on bailout guarantees from the government. For example, Alsakka et al. (2014) find that rating downgrades of governments also lead to rating downgrades of domestic banks during the sovereign debt crisis. Recent research suggests that banks were "persuaded" to invest in their domestic sovereign's debt during the sovereign debt crisis (cf. Beck et al., 2017). This reasoning would explain why banks hold more domestic sovereign debt. However, it does not explain why banks in the periphery would hold more debt issued by governments in other countries in the periphery.

When considering cross border holdings, Acharya and Steffen (2015), for example, argue that before the sovereign debt crisis, European banks' equity returns loaded positively on peripheral government bonds and negatively on German government bonds. These authors coin this finding "the greatest carry trade ever". During the sovereign debt crisis, this relationship changed where in particular banks from core countries reduced their positions in the periphery. The reduction of core banks' holdings in peripheral countries is consistent with our findings and also documented by other researchers in earlier studies (see e.g. Buch et al. (2016) for evidence on German banks).

It is also hard to imagine that a government would be able to convince a foreign bank to hold its debt. Hence, the increase in home bias, which has been stronger in the periphery than in the core as documented by among others Battistini et al. (2013), is unlikely to explain the observed patterns. So, this reasoning seems unlikely to explain the cross border patterns we observe where peripheral countries hold more sovereign debt issued by other peripheral countries.

6.2 *Regulatory influence*

Another potential explanation for the observed patterns is regulatory influence. More specifically, did regulators in core countries push banks, insurers and pension funds to sell

downgraded government bonds, while regulators in peripheral countries did not? Although this channel would be consistent with the observed patterns, it is extremely difficult to identify. Moreover, it is unclear why supervisors in core and peripheral countries would act differently.

Regulation does not yet distinguish between core and peripheral debt. For example, all debt issued by European Union countries receives a zero risk weight in the Basel capital regulations for banks. This preferential treatment of government bonds in capital and liquidity regulations has strong positive effects on banks' demand for government bonds (Bonner, 2016). However, financial institutions' own risk models may attach different risk weights, e.g. by using the ratings of countries.[8] So, the observed behaviour of core financial institutions could be consistent with internal investment decisions based on risk. However, identifying regulatory influence is very challenging in an empirical framework.

Shortages in capital adequacy ratios (CAR) are reported to have led to shrinking of bank balance sheets and flight from high-risk-weighted corporate lending into low-risk-weighted sovereigns (e.g. Van der Kwaak and Van Wijnbergen, 2014). As banks in the periphery had lower capital ratios than in the core (Figure 8, panel B), this might explain part of the patterns we observe.

6.3 Risk shifting

Another explanation could be risk shifting. The risk shifting argument is based on the premise that managers of leveraged firms have incentives to increase the riskiness of the firm's business to increase profits. Asset managers would do so by substituting safe assets with risky assets. Doing so maximizes shareholder value at the expense of debt holders. Several studies document that banks used funding provided by the ECB to purchase riskier sovereign debt during the sovereign debt crisis (see e.g. Acharya and Steffen (2015), Popov and Van Horen (2015) and Drechsler et al. (2016)).

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[8] Note that capital regulations that are solely based on credit rating may also lead to undesirable effects. For example, Becker and Ivashina (2014) show for US insurers that capital requirements based on ratings lead insurers to "reach for yield" by holding the most risky bonds in certain rating class.

As banks and insurance companies in the periphery were more levered than in core countries during our sample period (Figure 8.a), the incentives to engage in risk shifting may also have been higher. Since funding could be obtained at a relatively cheap price, the incentives for peripheral banks to acquire government bonds in other higher yielding peripheral countries could have been stronger as well. The lower leverage for core banks and insurers created a smaller push to shift to higher yielding assets, since profitability was also better in general.

[Figure 8.a and 8.b]

Figure 8.b shows that the share of non-performing loans as a percentage of total loans quadrupled between 2008 and 2014 for banks in the peripheral countries. On the other hand, banks in core countries barely experienced an increase in this fraction. This high fraction of non-performing loans is a further motivation for risk shifting in peripheral countries in order to increase profitability.

6.4 *Market segmentation*

A reason for differences between core and peripheral investors could be market segmentation. Segmentation means that there is not a single euro area government bond market, but that the euro area government bond market is fragmented. One can roughly split the market in "safe" core government bonds and "risky" peripheral bonds.[9] Investors will then have different demand for bonds from each market and this demand differs per country.

At the country level a financial institution will view the interest rate its government pays as the risk free interest rate. From the perspective of a core investor, the domestic interest rate is low. While the peripheral bond offers a higher return, this goes with increased risk from the core investor's perspective. Only a fraction of the core investors are willing to increase their risk profile. When investing in other core countries, they can retain a similar risk profile as their domestic bonds, but gain from some diversification benefits.

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[9] Battistini et al. (2013) argue that one needs to control for credit risk when aiming to identify market segmentation using yield data. When referring to market segmentation in this paper we focus on different investor clienteles for core and peripheral bonds, credit risk may be an important reason for differences in investors holding the bonds.

The perspective of the peripheral investor is different. He can hold domestic government bonds, which he considers as a safe asset. By investing in other peripheral countries he is able to retain a similar risk profile, obtain similar returns and obtain diversification benefits. Core bonds offer a lower return and can be considered safer. However, is it really safer from the perspective of a peripheral bank to hold core government debt instead of domestic government debt? It would diversify risks, but since a large part of the banks' portfolio is connected to the domestic economy (mortgages, corporate loans), holding foreign bonds will not shield the bank from problems when the domestic sovereign comes into trouble.

Another argument why levered peripheral investors do not increase their positions in core bonds is related to funding costs. The yield on assets needs to at least cover the funding costs, which are higher for peripheral banks and insurers. So, by purchasing a low yielding German bond, they would make losses on the investment.

7. Conclusion

This paper documents an important role for debt rating in explaining cross-border sovereign debt holdings. We use cross-border holdings of euro area government bonds by euro area investors from the ESCB's Security Holdings Statistics during 2009 until 2016 to establish these findings. The results show that the effects of ratings are heterogeneous across countries and non-linearities exist.

We also find important differences between investors from core and peripheral euro area countries. Core investors react strongly to ratings by selling low rated bonds. This effect is strongest for core banks. In contrast, investors from the periphery barely react to ratings. If anything, peripheral insurers acquire more bonds with low ratings. These results survive several robustness checks as documented in Section 6.

We discuss four potential explanations for the differences between core and peripheral investors: 1) Sovereign-bank nexus, 2) Regulatory influence, 3) Risk shifting and 4) Market segmentation. The first explanation seems unlikely to be valid because we investigate cross border holdings. It would seem farfetched to assume that foreign governments would be able

to persuade foreign banks to hold their debt. The incentives for banks and other investors to agree to this would be small.

The case for risk shifting is stronger, since risk shifting incentives are larger for the more levered peripheral investors and in particular peripheral investors faced strong increases in their funding costs. This reduces the incentives to hold core debt. For core investors the increase in risk signaled by downgrades trigger a shift to safer core bonds.

Identification of the influence of regulators on core holdings of riskier peripheral bonds seems challenging. Nevertheless, this potential explanatory factor needs to be taken into account.

Market segmentation may play a role since bond markets have become more fragmented in the euro area. It may well be that core government bonds serve a different investor clientele than peripheral government bonds. A good example are bond investment funds that only invest in AAA- and AA-rated government bonds.

Our results show the importance of ratings in the foreign investment decisions of private investors, especially from core countries. Since 2015, the European Central Bank (ECB) has bought close to EUR 2 trillion in government bonds of euro area countries. The ECB does not base its purchases on the ratings of specific countries, apart from the rule that it does not acquire bonds with a non-investment grade rating. The importance of ratings for private investors may become more visible when the ECB decides to shrink its balance sheet again, potentially leading to increasing spreads between countries with a high and lower credit rating.

The findings in this paper relate also to recent discussions on whether prudential risk weights need to be applied to sovereign debt. Despite a zero risk weight in Basel capital regulations, core banks still sold many peripheral government bonds. When deciding on whether to apply risk weights in new regulations, it is important to take into account which investors are affected and which ones not. It is also important to ensure that risk weights do not introduce increased pro-cyclicality in the financial system.

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TABLES

Table 1 Marginal effects of *j* issuing countries' ratings on cross-border sovereign bond holdings of holder countries *i*

	Total	By holder sector:			
		Banks	Insurance companies	Pension funds	Investment funds
	(1)	(2)	(3)	(4)	(5)
A. Holder country in Core + Periphery					
Equation (2)	0.041**	0.069*	0.013	-0.005	0.970**
Equation (5), Yield difference class:					
1) -32 –< -1.2	-0.064	-0.011	-0.086**	-0.062*	-0.059
2) -1.2 –< 0.0	-0.060	-0.039	-0.051	-0.046	-0.117**
3) 0.0 –< 1.2	-0.037	-0.065	-0.011	-0.062*	-0.127**
4) 1.2 –< 32.0	0.073**	0.108**	0.034*	-0.013	0.032*
#Observations	3190	3190	3190	3190	3190
#Groups	110	110	110	110	110
R^2	0.044	0.004	0.026	0.002	0.013
B. Holder country in Core					
Equation (2)	0.076**	0.106**	0.033**	-0.015	0.043**
Equation (5), Yield difference class:					
1) -2.5 –< 0.0	-0.082	-0.181	-0.066	-0.295	0.119
2) 0.0 –< 0.5	-0.021	-0.071	0.028	-0.107	-0.064
3) 0.5 –< 2.0	0.051**	0.063**	0.002	-0.161*	-0.025
4) 2.0 –< 32.0	0.082**	0.136**	0.042**	-0.037	0.052**
#Observations	1740	1740	1740	1740	1740
#Groups	60	60	60	60	60
R^2	0.197	0.030	0.108	0.023	0.088
C. Holder country in Periphery					
Equation (2)	-0.010	0.015	-0.016	0.008	-0.054
Equation (5), Yield difference class:					
1) -32.0 –< -3.9	-0.030	-0.016	-0.082**	-0.011	-0.027
2) -3.9 –< -1.4	-0.097*	0.000	-0.116*	-0.082	-0.057
3) -1.4 –< -0.3	-0.073	-0.035	-0.086	-0.018	-0.091
4) -0.3 –< 28.7	0.012	0.035	0.016	0.026	-0.058
#Observations	1450	1450	1450	1450	1450
#Groups	50	50	50	50	50
R^2	0.116	0.063	0.071	0.011	0.024

Explanatory note. All regressions are country fixed effects panel regressions, and include a constant. Marginal effects = dx/dy where x = holdership and y is rating. Ownership = Ratio of holders' share to issuers' share. Yield difference = yield issuer minus yield holder. Groups = number of holder/issuing country combinations. Core countries = Austria, Belgium, Denmark, Finland, France, Germany, Netherlands. Periphery countries = Greece, Ireland, Italy, Portugal, Spain. Groups = number of holder-issuer country combinations. R^2 = overall R-squared. **, * = 1%, 5% significance levels based on robust standard errors.

Table 2   Correlation coefficients

	yielddif	CDSdif
cdsdif	0.558	
CCRdif	-0.831	-0.513

Yield difference = yield issuer minus yield holder. CDSdif = CDS premium issuer minus CDS premium holder. CCRdif = Comprehensive Credit Rating issuer minus Comprehensive Credit Rating premium holder.

Table 3 Marginal effects of *j* issuing countries' ratings on cross-border sovereign bond holdings of holder countries *i*

	Total	By holder sector:			
	(1)	Banks (2)	Insurance companies (3)	Pension funds (4)	Investment funds (5)
A. Holder country in Core + Periphery					
Equation (2)	0.041*	0.069*	0.013	-0.005	0.003
Equation (5), CDS difference class:					
1) -370.1 –< -1.0	-0.046	-0.006	-0.071*	-0.049	-0.047
2) -1.0 –< 0.0	-0.044	-0.059	-0.037	-0.024	-0.087
3) 0.0 –< 1.0	-0.025	-0.003	-0.001	-0.053*	-0.121**
4) 1.0 –< 370.1	0.068**	0.109**	0.027	-0.013	0.030*
#Observations	3190	3190	3190	3190	3190
#Groups	110	110	110	110	110
R^2	0.036	0.006	0.035	0.003	0.015
B. Holder country in Core					
Equation (2)	0.076**	0.106**	0.033**	-0.015	0.043**
Equation (5), CDS difference class:					
1) -2.4 –< 0.0	0.059	0.073	0.074	-0.004	0.057
2) 0.0 –< 0.4	0.037	0.043	0.075	-0.226	-0.049
3) 0.4 –< 1.8	0.045**	0.062**	-0.006	-0.183	-0.018
4) 1.8 –< 370.1	0.083**	0.130**	0.047**	-0.010	0.053**
#Observations	1740	1740	1740	1740	1740
#Groups	60	60	60	60	60
R^2	0.197	0.028	0.097	0.051	0.178
C. Holder country in Periphery					
Equation (2)	-0.010	0.051	-0.016	0.008	-0.054
Equation (5), CDS difference class:					
1) -370.1 –< -3.8	-0.071	-0.032	-0.123**	-0.087**	-0.010
2) -3.8 –< 1.1	-0.048	0.009	-0.085	-0.001	-0.094
3) -1.1 –< -0.2	-0.068	-0.052	-0.085	-0.001	-0.101*
4) -0.2 –< 369.8	-0.012	0.043	0.022	0.032	-0.063
#Observations	1450	1450	1450	1450	1450
#Groups	50	50	50	50	50
R^2	0.069	0.053	0.072	0.010	0.022

Explanatory note. All regressions are country fixed effects panel regressions, and include a constant. Marginal effects = dx/dy where x = holdership and y is rating. Ownership = Ratio of holders' share to issuers' share. CDS difference = CDS issuer minus cds holder, in percentage points. Groups = number of holder/issuing country combinations. Core countries = Austria, Belgium, Denmark, Finland, France, Germany, Netherlands. Periphery countries = Greece, Ireland, Italy, Portugal, Spain. Groups = number of holder-issuer country combinations. R^2 = overall R-squared. **, * = 1%, 5% significance levels based on robust standard errors.

Table 4 Marginal effects of *j* issuing countries' ratings on cross-border sovereign bond holdings of holder countries *i*

|	Total (1)	By holder sector:			
		Banks (2)	Insurance companies (3)	Pension funds (4)	Investment funds (5)
A. Holder country in Core + Periphery					
Equation (2)	0.041*	0.069*	0.013	-0.005	0.003
Equation (5), CCR difference class:					
1) -21 −< -4.5	0.075**	0.120**	0.044**	0.022	0.042**
2) -4 −< -0.5	-0.071	-0.071	-0.065	-0.099*	-0.110
3) 0 −< 3.5	-0.110**	-0.168**	-0.099**	-0.080*	-0.099
4) 4 −< 21	-0.075	-0.012	-0.093*	-0.077*	-0.052
#Observations	3190				
#Groups	110				
R^2	0.095	0.040	0.031	0.000	0.007
B. Holder country in Core					
Equation (2)	0.076**	0.106**	0.033**	-0.015	0.043**
Equation (5), CCR difference class:					
1) -21 −< -7	0.100**	0.170**	0.057**	0.059*	0.090**
2) -6.5 −< -2.5	0.038	0.037	0.013	-0.070	-0.002
3) -2 −< -0.5	0.004	-0.083	-0.143	-0.327*	-0.062
4) 0 −< 3	-0.138	-0.083	0.034	-0.365	0.040
#Observations	1740				
#Groups	60				
R^2	0.172	0.015	0.009	0.001	0.070
C. Holder country in Periphery					
Equation (2)	-0.010	0.015	-0.016	0.008	-0.054
Equation (5), CCR difference class:					
1) -17 −< 0.5	0.034	0.045	0.029	0.053*	-0.037
2) 1 −< 4	-0.145**	-0.189	-0.099*	-0.042	-0.142*
3) 4.5 −< 7.5	-0.094	0.019	-0.143*	-0.120**	-0.052
4) 8 −< 21	-0.017	0.115	-0.067**	-0.061	-0.049
#Observations	1450				
#Groups	50				
R^2	0.104	0.077	0.052	0.014	0.025

Explanatory note. All regressions are country fixed effects panel regressions, and include a constant. Marginal effects = dx/dy where x = holdership and y is rating. Ownership = Ratio of holders' share to issuers' share. CCR difference = CCR issuer minus CCR holder, in percentage points. Groups = number of holder/issuing country combinations. Core countries = Austria, Belgium, Denmark, Finland, France, Germany, Netherlands. Periphery countries = Greece, Ireland, Italy, Portugal, Spain. Groups = number of holder-issuer country combinations. R^2 = overall R-squared. **, * = 1%, 5% significance levels based on robust standard errors.

FIGURES

Figure 1. Sovereign yields and ratings

A. Sovereign yields (%)
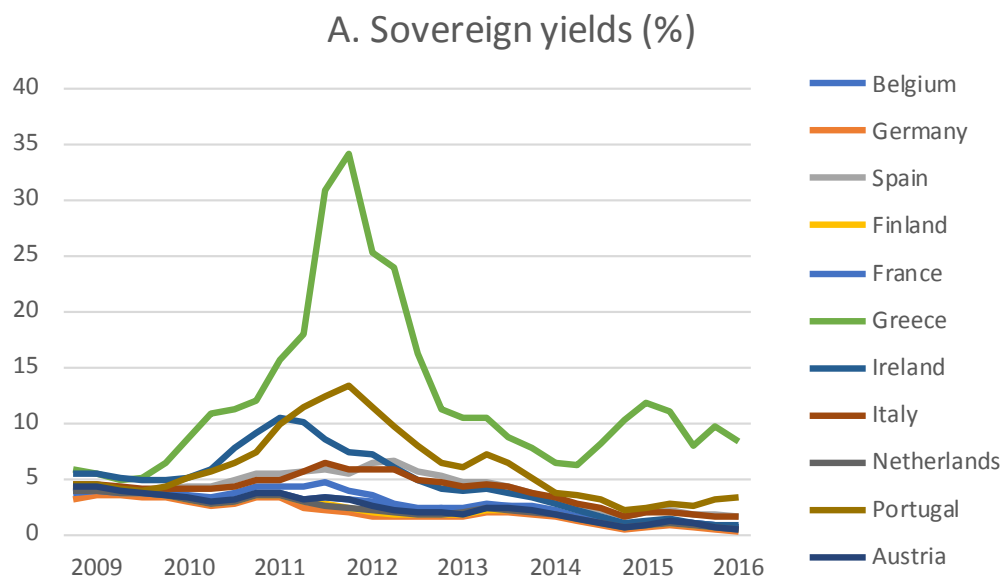
Source: Datastream.

B. Sovereign ratings (CCR)
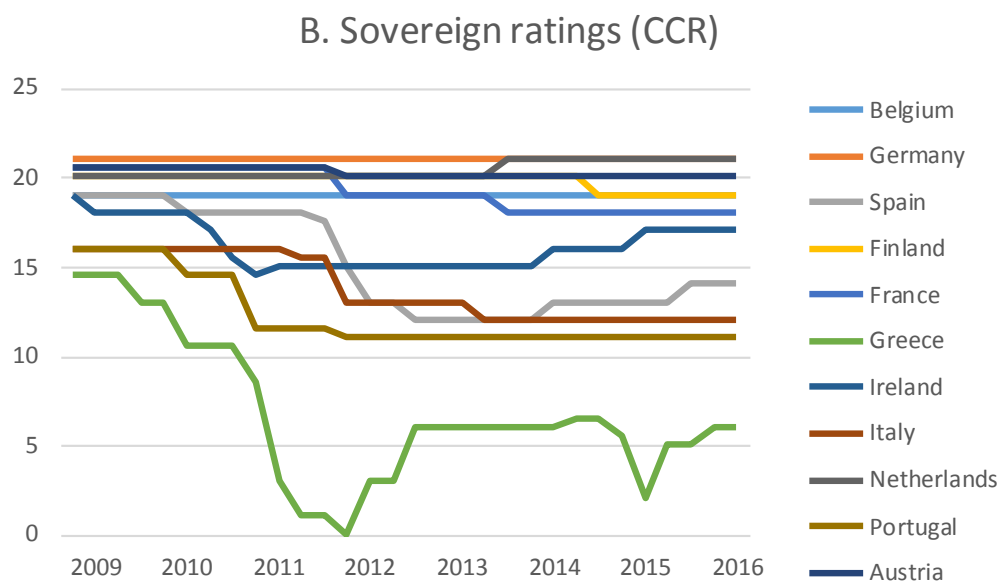
Source: Standard & Poors. Comprehensive Credit Ratings (CCR) defined as in Gande and Parsley (2014).

Figure 2. Total share of euro area government bonds held by non-domestic euro area investors
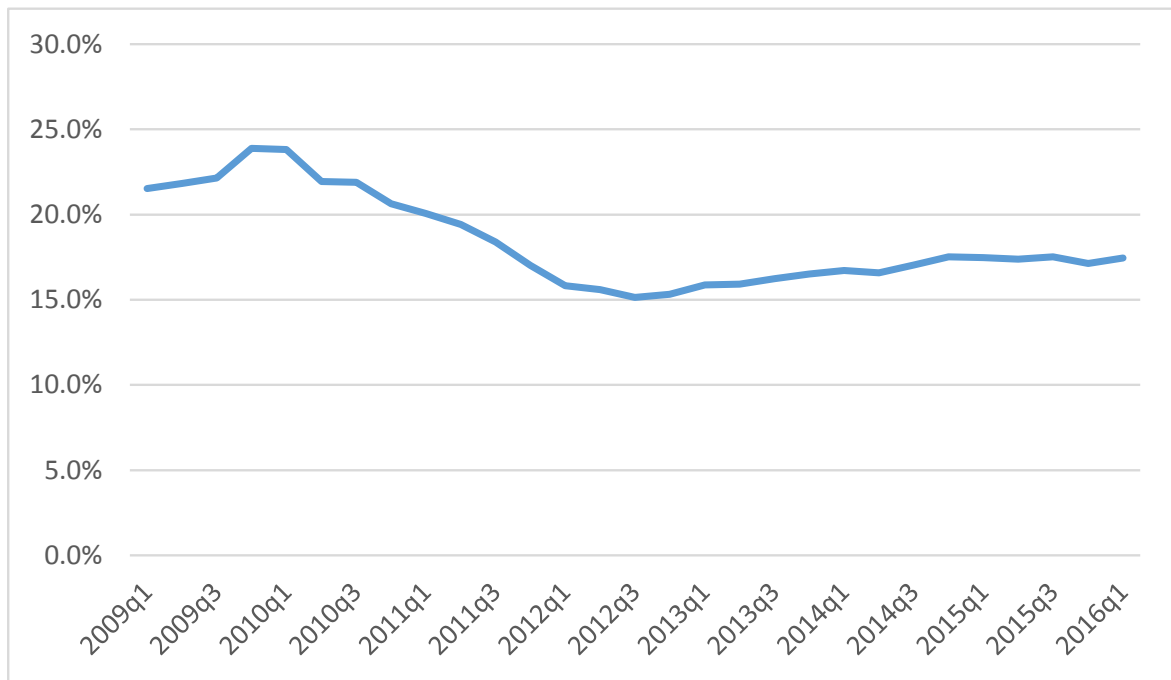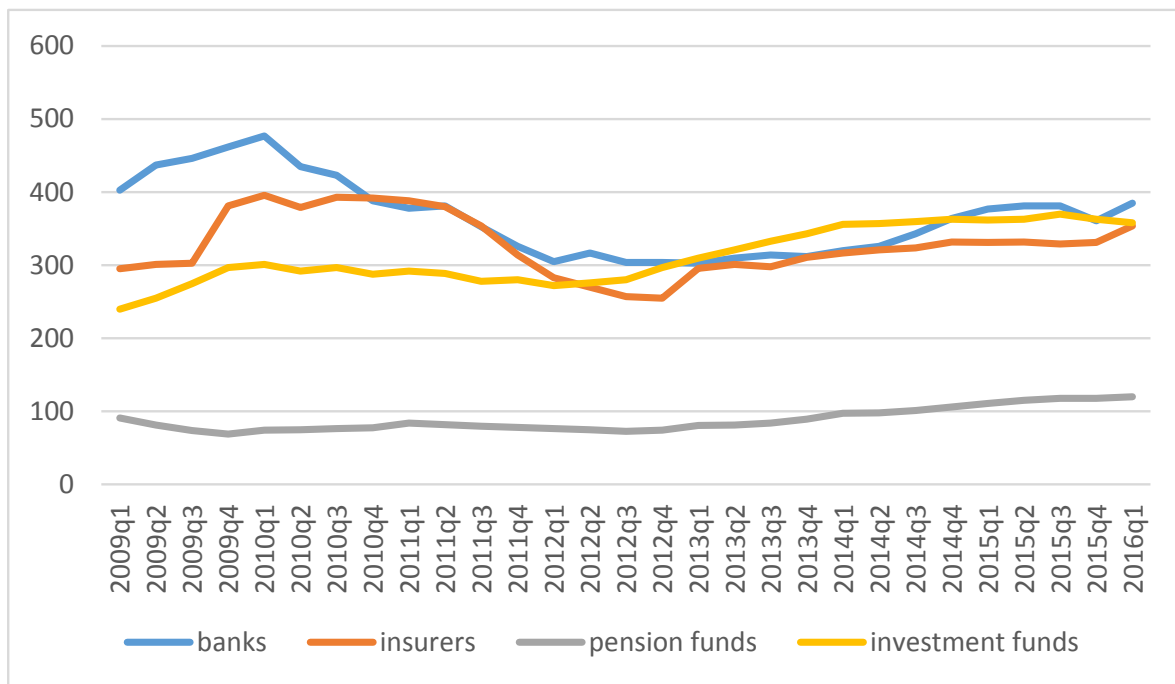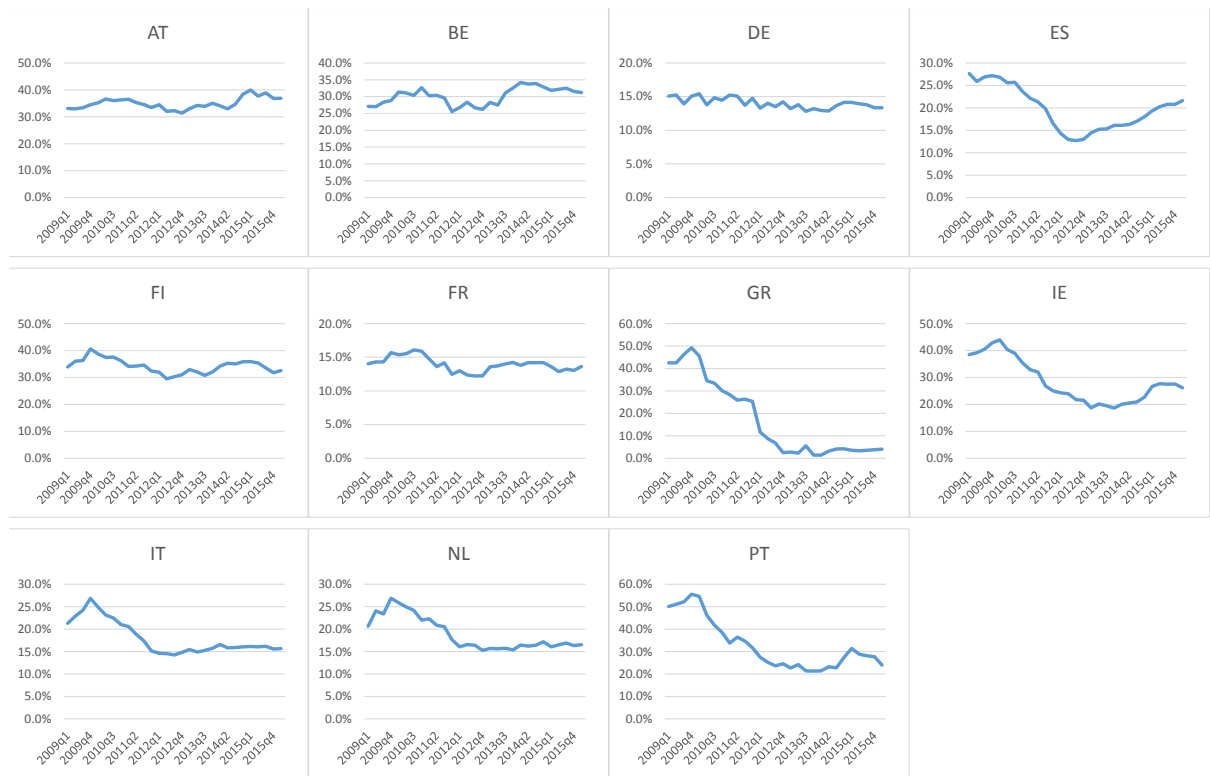
Figure 3. Euro area government bonds held by non-domestic euro area investors, by holder sector (in EUR billion)

Source: ESCB Securities Holdings Statistics and own calculations.

Figure 4. Share of euro area government bonds held by non-domestic euro area investors by issuer country

Source: ESCB Securities Holdings Statistics and own calculations.

Figure 5. Fraction of government bonds held by non-domestic EA investors from core and periphery

A. Non-domestic investors from core
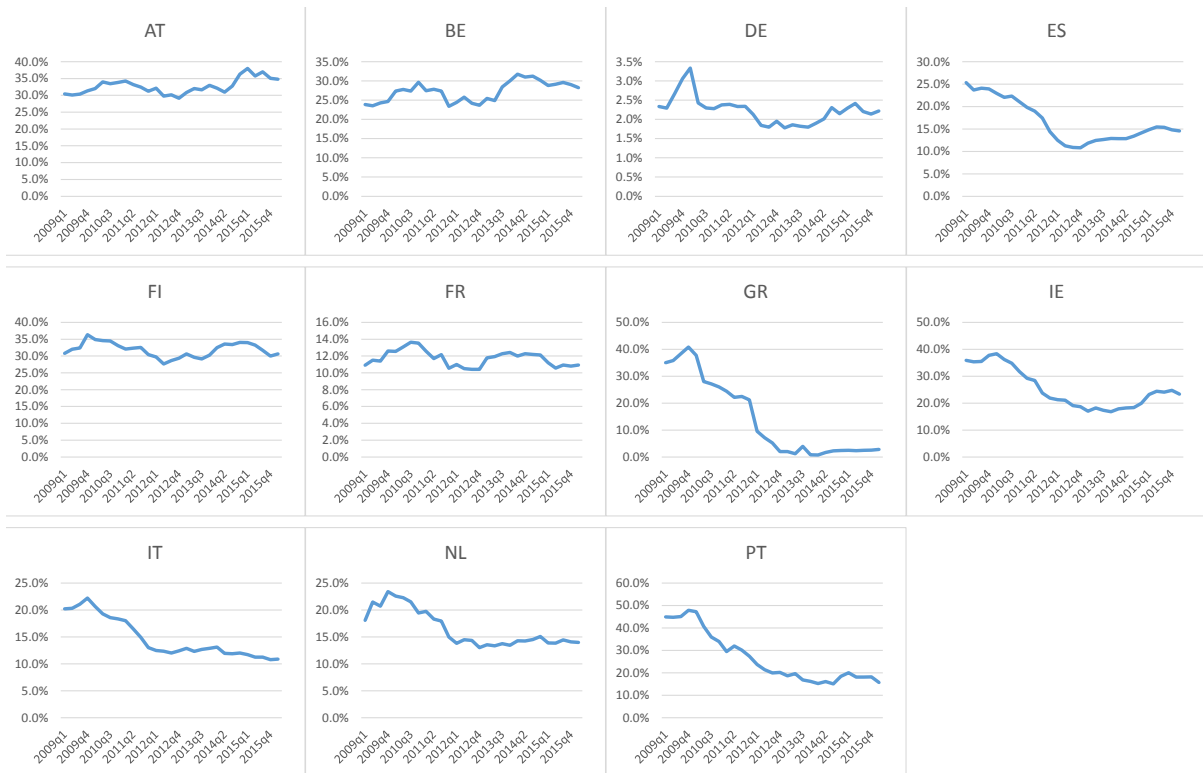
B. Non-domestic investors from periphery
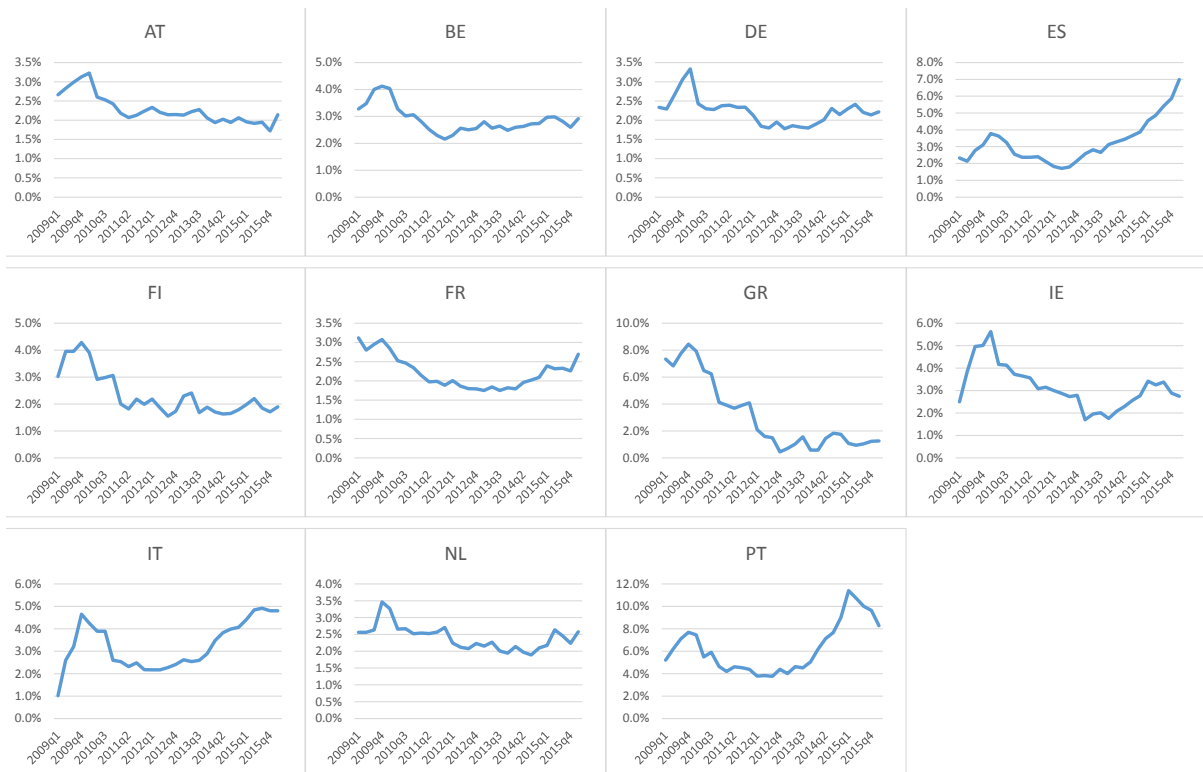
Source: ESCB Securities Holdings Statistics and own calculations.

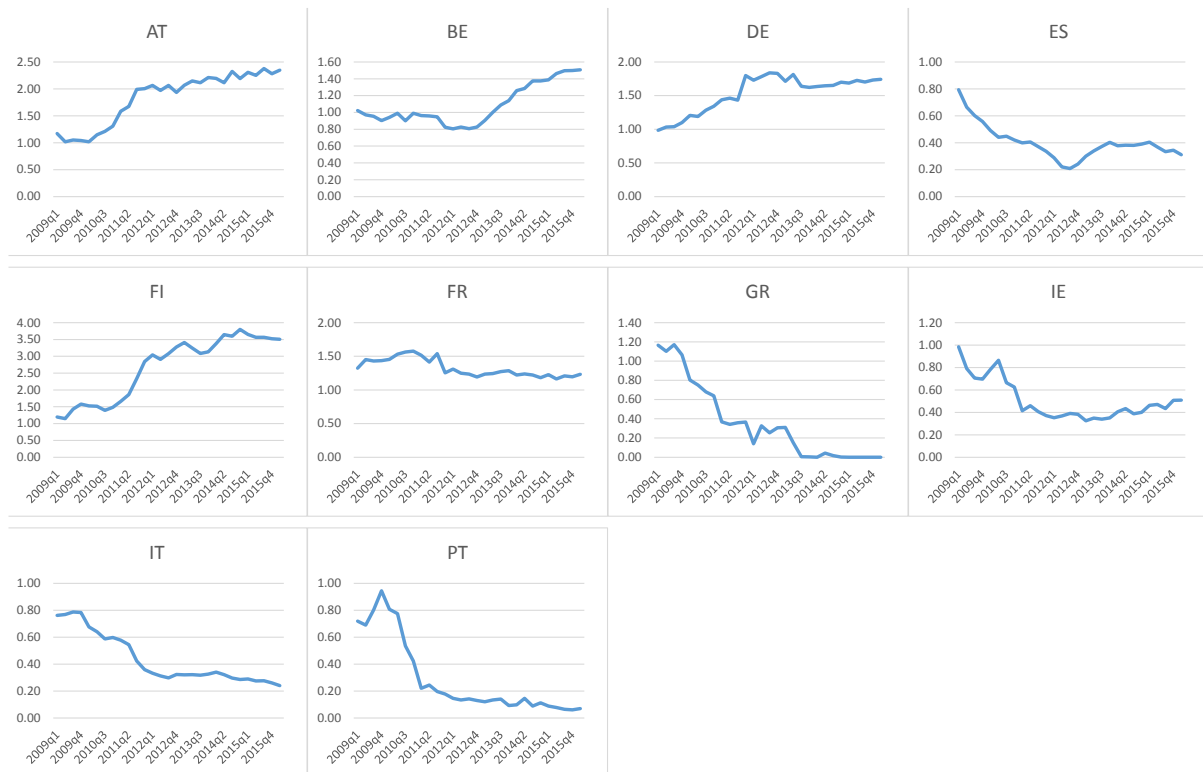# Figure 6. Ratio and ratings for Italy, Spain and The Netherlands
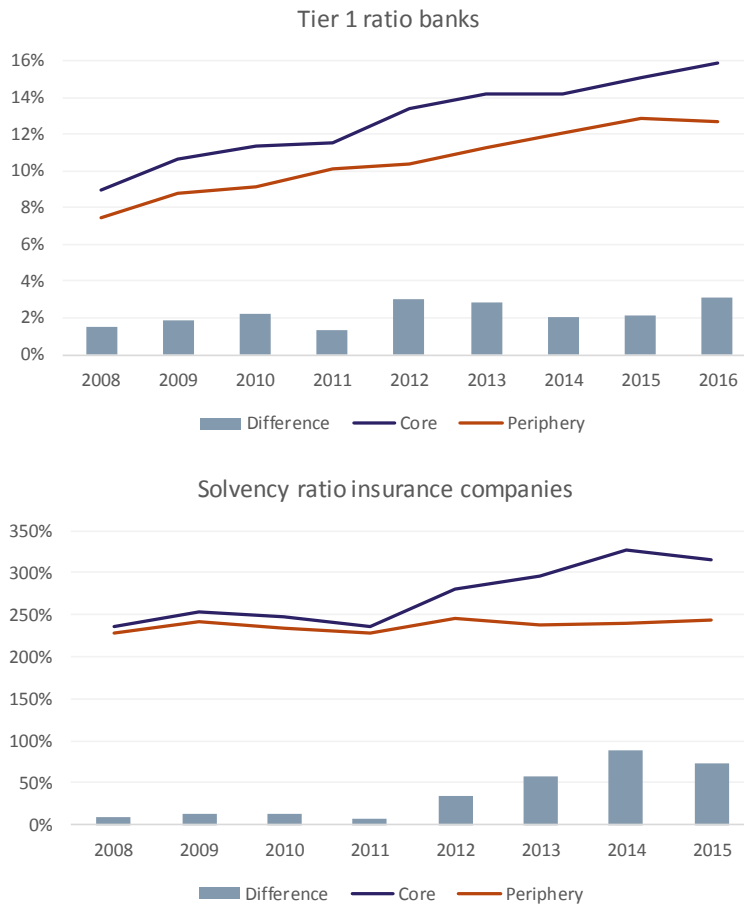
A. Italy
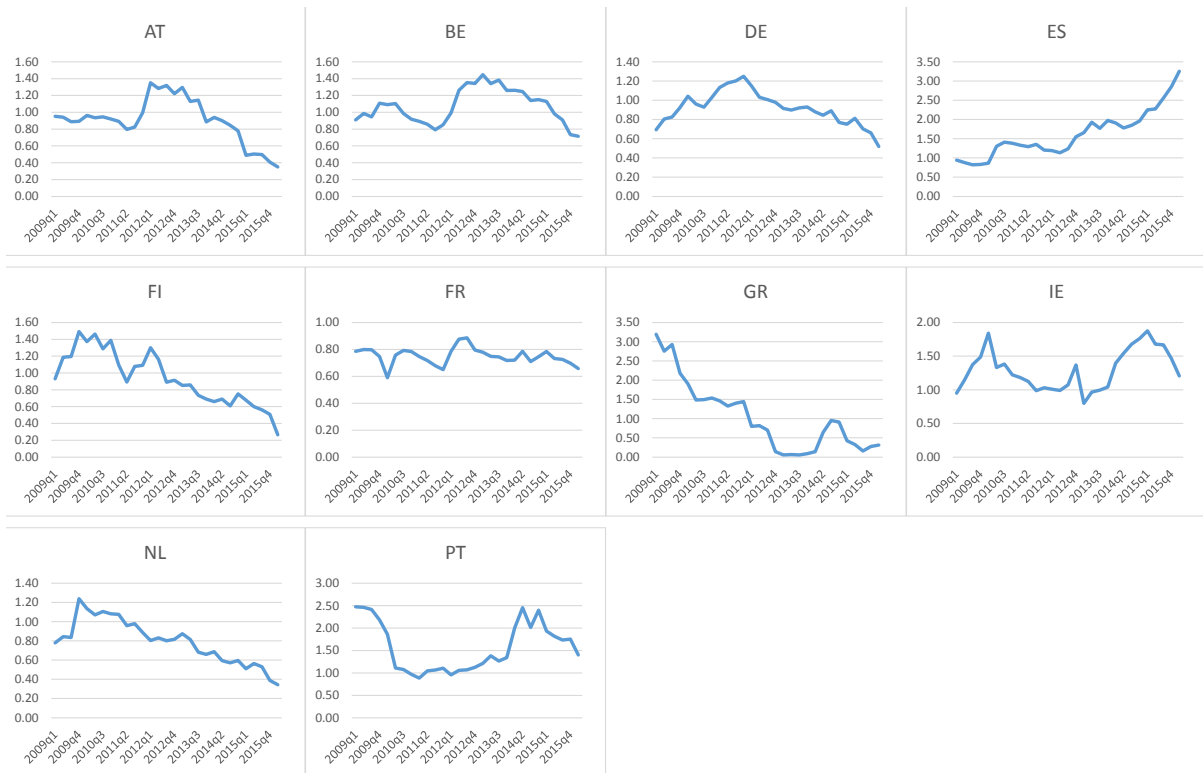
B. Spain
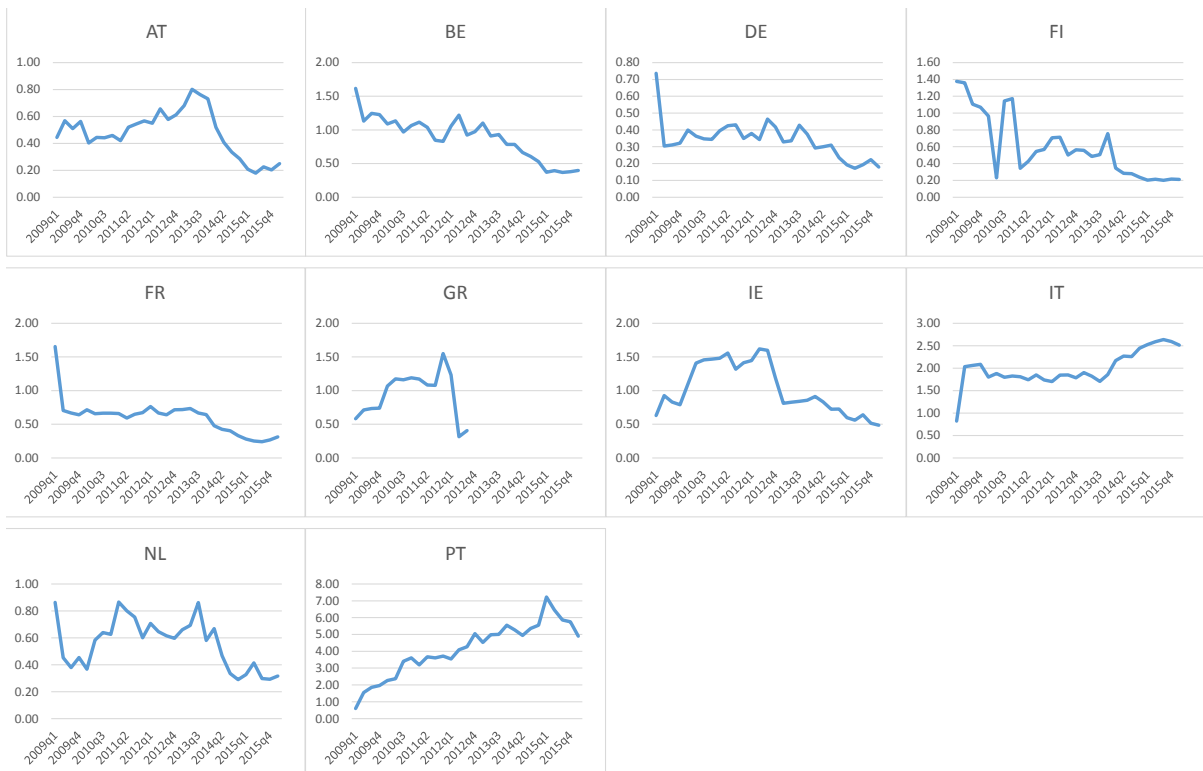
C. The Netherlands

Source: ESCB Securities Holdings Statistics and own calculations.
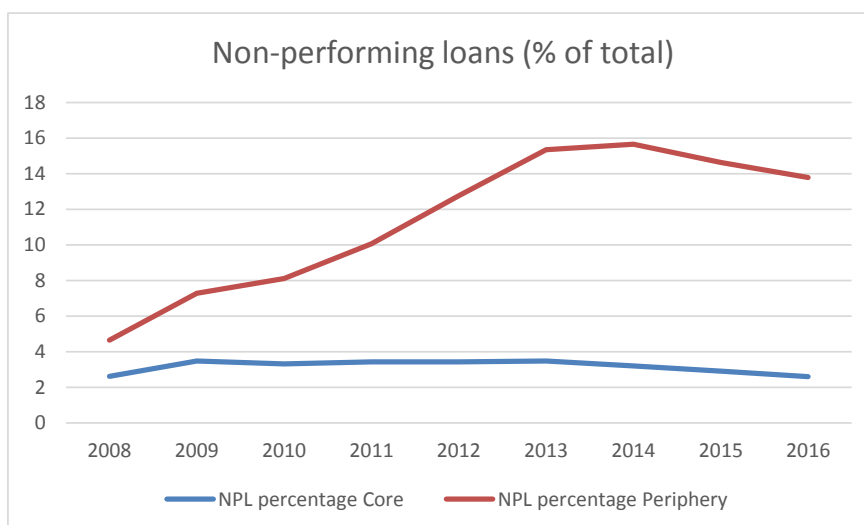
Figure 7 Marginal effects

Yielddif_cat	$\dfrac{\partial(ratio)}{\partial(rating)}$
0	a_1
1	$a_{21} + a_1$
2	$a_{22} + a_1$
3	$a_{23} + a_1$

Figure 8.a. Capital ratio banks and solvency ratio insurance companies, core vs. periphery

Source: IMF Financial Stability Indicators and own calculations.

Figure 8.b. Non-performing loans (% of total), core vs. periphery

Source: World Bank World Development indicators and own calculations.