

Drivers of foreign and domestic demand for sovereign bonds in developed and emerging economies: fundamentals vs. market sentiment

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Abstract

Using a new large dataset compiled from national sources this paper attempts to explain the determinants of demand for government debt from domestic institutions, private foreign holders and foreign central banks. In Peripheral Eurozone, foreign institutional investors' holdings are significantly associated with less sustainable debt, weaker government effectiveness and higher bond yields, while in the Core Eurozone they purchase debt only if public finances improve. Prior to the crisis rising risk aversion pushed private non-resident investors to purchase bonds issued by Safe Haven and Eurozone countries, whereas from 2008 rising risk aversion pushed investors to buy non-euro Safe Haven assets and sell bonds issued by both core and peripheral Eurozone. In turn, demand of foreign central banks is associated one hand with sound fiscal policies and higher growth rates, but on the other with strong reactivity to interest rates and global market sentiment. Finally, the more government debt is held by domestic banks, the higher the probability for the government to resort to IMF funding due to unsustainable budget situation and high interest rates.

Keywords: Sovereign risk, public domestic debt, credit ratings, debt composition, emerging economies, Eurozone economies

JEL Classification: F34, G15, H63

I. Introduction

This paper sheds new light on the dynamics of the government debt market from the point of view of one of the main actors – bondholders. Lion's share of existing literature on government debt is dedicated to the mechanics of sovereign default and international capital flows, however to this day it remains unclear what drives investors having different investment strategies, horizons and constraints to purchase government debt at home and abroad. The objective of this paper is to identify common and country-specific determinants of demand for local currency debt: macroeconomic and fiscal indicators, yields, sovereign credit ratings, or simply market sentiment. To analyse the differences in investment decisions I introduce a new dataset on government bond holdings in 16 major emerging and developed economies. Within each country I distinguish between private and official non-resident holders and different categories of domestic banks, investment funds, pension funds and insurance companies, central banks and government institutions.

The novelty of this article consists in analysing the evolution of the investor base in countries characterized by different levels of development and stability, different currency regimes, and under different global market conditions. Thanks to significant representation of developing and developed economies, relatively long historical series and relatively high data frequency it is possible to capture medium-term dynamics in the investor base at different levels of financial stress.

In a review of empirical literature on sovereign debt Tomz and Wright (2013) and Krishnamurthy and Vissing-Jorgensen (2007) state that the relationship between sovereign default and composition and dynamics of the investors base remains widely unexplored. Since the beginning of the Eurozone crisis several researchers, Andritzky (2012a), Merler and Pisani-Ferry (2012) and Arslanalp and Takahiro (2012) among others, presented new datasets on developed economies drawing some attention to domestic institutional investors. As for emerging economies, the lion's part of existing reports and academic literature on emerging economies focuses on the impact of foreign purchases on yields or yields volatility, e.g. Peiris (2010), or on foreign-currency debt, see Eichengreen and Mody (1998) among others. The intention of this paper is to gain a broader perspective of the demand for government debt and explain the dynamics of investor behaviour through the prism of observable macroeconomic and fiscal factors, global factors, influence of rating agencies and market sentiment.

The key findings by ascending order of significance are as follows. First, over the last two decades emerging countries developed functioning local currency markets with diversified investor base that is currently at the level similar to developed countries.

Private international investors tend to increase their holdings in countries with higher structural fiscal deficits and higher real yields. In the Peripheral Eurozone, private investors' holdings are significantly associated with less sustainable debt, weaker government effectiveness and higher bond yields, while in the core Eurozone they purchase debt only if public finances improve. Interestingly, prior to the crisis rising risk aversion pushed institutional foreign investors to purchase bonds issued by Safe Haven and Eurozone

countries, whereas from 2008 onwards rising risk aversion pushed investors to buy Safe Haven assets and sell bonds issued by both core and peripheral Eurozone.

Evidence shows that in general foreign central banks are primarily looking for safety and their holdings tend to increase in countries running prudent fiscal policies, implementing fiscal rules and achieving higher growth rates. Contrarily to private non-residents, purchases by foreign official investors are negatively related to bond yields. As the financial crisis escalated foreign central banks suddenly sold bonds of peripheral countries and began to buy Safe Haven and Core Eurozone reaching over 40% of total debt in France and Germany. The sale of peripheral debt, esp. in case of Spain and Ireland, points towards a significant relationship between foreign central bank holdings and global market sentiment.

In general, countries relying to greater extent on bank holdings are confronted with higher real yields, shorter average maturities, lower government effectiveness and lower GDP growth which is consistent with the crowding out effect. On individual country scale, prior to the crisis banks in the Eurozone and Emerging Economies purchased domestic bonds when yields increased and fiscal balance improved. As the uncertainty in economic policy skyrocketed and foreign institutions reduced their exposure, in Eurozone countries domestic banks' participation increased, although domestic debt became less sustainable, real yields increased and the IMF was solicited to step in to provide liquidity.

Given rising importance of sovereign risk and advancing financial integration, monitoring holdings of government debt becomes increasingly relevant for global financial stability.

II. Holders of government debt: new dataset and classification

IV.1. The new dataset

This new dataset has been created using data from national sources, mainly central banks, ministries of finance, statistical authorities and depositories. It includes historical series of holdings of debt instruments issued in local currency by governments in 16 countries located in Europe, North and Latin America, and Asia. Economies covered by this study differ in terms of size, currency of issuance, macroeconomic stability, currency regime, level of indebtedness and level of development of the financial sector. Presence of emerging economies together with non-euro developed countries provides a broader and more universal angle on evolution of the investor base than the existing cross-country datasets constructed by Andritzky (2012a), Merler and Pisani-Ferry (2012) and Arslanalp and Takahiro (2012). Comparison in terms of geographic coverage is included in the Annex Table 2.

In this study I focus on the period 1999 to 2012, which covers several crises in emerging and developed markets, the creation of the Euro Zone and the gradual development of local currency debt markets, so-called graduation, in emerging economies. In terms of historical timespan it is in line with the existing studies which start between 1996 and 2004; in contrast data for all countries is available at monthly or even quarterly frequency, which makes it possible to capture the short-term changes more efficiently than with annual data.

Another strength of this database is presence of the maturity structure of bond holdings. As presented in Table 1, 13 out of 16 countries publish data with distinction for bills and bonds, thereof Poland, Iceland and Peru includes holdings for numerous individual instruments, while historical series from Czech Republic and Denmark shed light on holdings by year of maturity. Two advantages result from applying this distinction rather than aggregate debt. First, viewed from the angle of risk aversion, investors are likely to exhibit different behaviour and apply different strategies at the short and long end of the curve when market and liquidity conditions change. Secondly, short-term debt makes up on average no more than one fifth of total country debt which makes changes in holding structure easier to quantify.

IV.2. Debtholder Classification

The objective of the classification is to distinguish clearly between non-residents in general and various types of domestic holders following broadly the guidelines set by the European Commission¹ and the IMF. The rationale behind classification goes back to inherent differences in interests, knowledge of financial markets and risk aversion. In reality only a handful of 16 countries considered in this study apply similar categorization. Few countries are in position to distinguish between different types of foreign bondholders. Number of investor categories and subcategories varies strongly between countries ranging from two in Portugal to 26 in Czech Republic. To circumvent this lack of consistency² between datasets it is essential to regroup original categories into standardized one according to investor characteristics. As can be seen in Table 1, I developed a proprietary bondholder classification that would ensure most consistent number of categories across countries and focus on key categories: non-residents, banks, general government, insurance and pension funds, mutual funds, households and non-financial companies. While the attribution is straightforward for banks, non-residents and domestic central banks, classifying other domestic actors requires certain assumptions on investor profiles in terms of risk, return and investment horizons. Accordingly, I assume that pension and insurance funds have long-term oriented and less liquidity-driven and can be merged into one group. In contrast, investment and mutual funds, more return-oriented and liquidity-prone, are compatible with objectives of financial auxiliaries like securities brokers.

As for foreign official sector holdings, I use the Coordinated Portfolio Investment Survey (CPIS) dataset to retrieve statistics on holdings of government debt held as reserved assets by foreign central banks³. I convert those series into local currency and split the series of non-resident holdings reported by national sources into foreign official holdings (CIPS) and remaining private official holdings. In turn, data on debt held by domestic central banks is available only in selected countries under analysis. To account for the government bond purchases initiated by the ECB via Securities Market Programme (SMP) in 2010 and 2011,

¹ Further information on European system of national and regional accounts (ESA95) is available on the Eurostat webpage. IMF Dissemination Standards Bulletin Board (DSBB) is available on the IMF website.

² Several datasets include negative figures, i.e. Japan Bonds 1998-1999 for Investment Funds, UK Bonds several observations between 2002 and 2008 for Banks, Denmark bills in 2005, 2011, 2012 for Pension and Insurance Funds, Germany Bills 2006, 2008 and 2009 for Banks. Negative values have been removed from the analysis.

³ I use linear interpolation to convert data from annual to quarterly frequency. Arslanalp and Takahiro (2012) calculate quarterly series using total reserve assets including cash from Cofer, but this approach requires several approximations.

following the approach of Arslanalp and Takahiro (2012), I assume that the composition of purchases corresponded to the share of country's debt in the total debt of countries covered by the program at a given period. I also assume that the bond purchases of Greek, Irish and Portuguese bonds started in 2010Q2, while Italian and Spanish bond acquisitions were launched at the beginning of 2011Q3.

Except for South Africa all countries publish statistics foreign holdings, herein understood as investors with no legal residence in issuer's country. At the time of writing only the United States tracks and publishes the geographic location of holders. Foreign institutional investors operating on national soil are considered as a part of the domestic investor base since their legal status and regulation are constrained by national laws. Series on insurance and pension funds are published by 15 countries, and 14 sources inform on holdings of investment and mutual funds as well as non-bank intermediaries like dealers and brokers. Last but not least, Statistics available for Indonesia, Italy and Mexico include a large share of unattributed holdings. To rectify this incoherence, I assume that each investor group holds an equal amount of residual government bonds and attribute those holdings accordingly. Lynge Nielsen (2011) observes that the methodologies of country classification by the IMF, World Bank and the UN has undergone significant evolution in the last 50 years. What is important with regard to my database is that IMF upgraded Czech Republic to the status of an advanced economy in respectively 1997 and 2009; however financial markets, MSCI indices among others, reclassified Czech Republic is still widely considered as an emerging economy. For consistency reasons I categorize Israel as developed non-euro country and Czech Republic as emerging economy throughout the period of analysis.

IV.3. Data Issues

What can potentially distort the picture of bond holdings are differences in data sourcing and compilation. Interviews with Ministries of Finance, Central Banks and statistical authorities showed that holding data can be obtained either from security depositories where all transactions are registered or through direct reporting of financial institutions to authorities. It is unclear to what extent those difference may affect the robustness and comparability between countries.

Methodological consistency over time is also an issue. Several countries altered the statistical coverage over time, for instance starting from 2007 Brazil has been publishing two historically overlapping datasets with different holder categories that do not match each other. In several smaller economies like Latvia and Czech Republic data is plagued with significant jumps that may result from changes in ownership or legal status of large institutional investors and is not necessarily related to a massive purchases or selloffs of securities. In Bulgaria and Brazil data on foreign holdings seem to be hidden under institutional investors registered in the country as banks or mutual funds. In Peru securities sold to foreign institutional investors eventually remain on the domestic market via structured financial transactions.

Other factors susceptible of blurring the statistical comparison are related to recognition and reporting. In their statistics most authorities refer to central government debt only, four countries publish

compile data at federal level, i.e. including the securities issued by the state, and four countries do not provide any information at all. Several countries, for instance Germany, publish two distinct series with a different time horizon and investor categories. Since debt instruments issued by the regional governments are usually less liquid and less accessible for foreign investors than central government debt I use the central government data wherever possible.

IV.4. Comparison with other datasets

Existing cross-country studies based on national sources Andritzky (2012a) and Merler and Pisani-Ferry (2012) classify domestic investors into banks, public/government sector, and central banks, leaving other domestic institutional investors apart. For the common set of countries their results are consistent with my findings. In turn, Arslanalp and Takahiro (2012) combined several datasets provided by the World Bank, IMF and BIS to estimate the participation of foreign private banks, foreign official sector holders, foreign non-banks as well as domestic banks, domestic central banks and domestic non-banks. Nevertheless authors mention that their work is not free of measurement errors. It is notable that this approach yields significantly different statistical results than using national sources. Comparing the my dataset compiled from national sources to the dataset created using international databases indicates an average absolute difference of 11% for domestic banks and 7% for non-residents. More importantly, the maximum absolute difference for a given period reaches 26% for domestic banks and 33% for non-residents. These differences can be attributed to some extent to the usage of general government debt and market values by the IMF in contrast to central government debt at nominal value in my base. To sum up, although those two approaches to data classification are not perfectly compatible and cannot be used interchangeably, international sources shed some light on non-resident holders which is not negligible in several developed countries. Appendix Table 1 presents differences in coverage between the three datasets.

III. Demand for government debt in light of default risk

IV.1. Discrimination between domestic and foreign investors

For over three decades researchers have been trying to answer the question why governments repay their debt. In the absence of legal punishment and enforcement mechanism, the choice between repayment and repudiation depends not only on actual capacity to service debt, but mainly on the discretionary choice between living with the debt burden or facing consequences of default. Following Eaton and Gersovitz (1981) line of reasoning, in numerous countries where the share of foreign investors holding domestic debt is elevated and potential consequences of external default for domestic financial institutions are limited, government could prefer to default rather than to repay. As suggested by Bulow and Rogoff (1989), government's political willingness to repay depends primarily on the size of debt, currency of denomination and residence of bondholders. However, in a recent review of empirical literature on sovereign debt Tomz

and Wright (2013) conclude that the relationship between government's default incentives and debt composition has not been analysed empirically to this day.

As far as external debt is concerned, in the seminal article on sovereign default Eaton and Gersovitz (1981) initially suggested that governments repay foreign debt out of fear of being excluded from international trade or from lending abroad for a sustained period. Zymek (2012) finds evidence that between 1980 and 2007 in most developed and emerging countries an increase in default risk was followed by a contraction in the exports sectors that were dependent on foreign financing. As for the post-default cost of borrowing, empirical studies, Gelos et al. (2011) among others, find evidence that even serial defaulters are able to return to the markets relatively swiftly and on acceptable conditions. Reinhart and Rogoff (2011) find evidence that domestic and external default are vaguely correlated with each other. Díaz-Cassou and Erce (2010) report that episodes of discrimination between domestic and foreign creditors indeed occurred in the past. Out of ten recent default episodes, four discriminated against foreign creditors, three adopted equal treatment and particularly dramatic default episodes, specifically in Argentina, Russia and Ukraine, afforded preferential treatment to foreign creditors. However in certain cases it may be difficult to identify the type of holder and default selectively on domestic or foreign bondholders, as suggested by Guembel and Sussman (2009) among others, due to high dispersion among investors or due to inability to track holdings.

Hypothesis 1: Non-resident investors may be discriminated in case of an external default and are more likely to be driven by credit risk than domestic investors

IV.2. Role and Mechanics of Domestic Debt

In contrast to external debt where the repayment capacity depends on the state of foreign currency reserves, effective cost of servicing domestic debt depends on the actual inflation rate between inception and maturity. Looking at the post-war history Cagan (1956) spotted that governments that were strict about price increases during tranquil times were keen to tolerate high inflation rates during periods of high public indebtedness. In a theoretical setting Calvo (1978) explains that a government in power of monetary policy wants can initiate a seignorage policy to inflate a part of its debt burden away. In reality, however, several conditions need to be fulfilled to make such policy an effective deleveraging tool. First, inflation would need to persist at high level for long time period or average debt maturity would need to be relatively short. Second, the debt must be denominated in domestic currency and not linked to the price level, which is rarely the case in countries with weak track record on the inflation front. Third, government needs to be in control of the central bank. In a recent study Crowe and Meade (2008) find evidence that over the last two decades most emerging economies have successfully caught up with developed countries in terms of central bank independence and transparency which resulted in lower inflation rates. Summing up, inflation is not a viable way out the debt trap anymore and in practice a financially constrained government can chose between two alternatives to inflation: financial repression and outright default.

i. Between regulation and financial repression

The key role of financial regulation is to prevent excessive risk taking and protect financial systems from internal and external shocks. Taylor and Shaw (1974) observed that governments can also exploit regulation to push financial institutions to increase the share of domestic government debt in their portfolios. These measures include interest rates, capital account restrictions, high reserve and liquidity requirements, and transaction and capital gains taxes and their impact on demand for government debt has been investigated in several studies and reports. For instance Greenwood and Vayanos (2010) argue that the decline in UK yields between 2004 and 2005 was fuelled by the amendment of regulation of pension funds that needed to cover their long-term liabilities. Authors suggest that same motives apply to insurance funds. In turn, Hauner (2009) reports that financial repression in emerging economies may take another form where private banks may be forced to lend to public enterprises. Last but not least, government can refinance itself with help of public companies and institutions, for instance Roman (2013) shows that the share of domestic government bonds in the portfolio of the Spanish Social Security Reserve Fund increased from less than 20% in 2005 to over 90% in 2011

Nouy (2011) argues that regulators have ignored the riskiness of government bonds. Under Basel I, debt issued by OECD member states was assigned zero per cent risk weight. Under Basel II and III, domestic-currency bonds are also assigned zero risk capital weights⁴, while weights for foreign-currency instruments were calculated according to internal or external credit ratings. According to de Santis and Gerard (2006) preferential regulatory treatment euro-denominated government debt blurred the perception of risk and pushed investors' desire to reduce the weight of home assets in favour of instruments issued by other, potentially more risky, Euro members.

Restrictions on foreign investment represent a particular case. Giovannini and De Melo (1993) find evidence that a combination of controls on international capital flows induced a home bias in financial institutions and result in artificially low funding cost for the government; in several countries revenue from financial repression is of the same order of magnitude as seingiorage. Ong and Luengnaruemitchai (2005) report that in Mexico over 85% of pension funds' portfolios consisted of government bonds, while banks in Brazil and Chile are practically banned from investing in corporate bonds. (Chen and Imam, 2012) find similar evidence among emerging economies in Asia and Latin America force. Their results also indicate that limited availability of local assets not only leads to creation of asset price bubbles in equity, housing and government bond markets, but also significantly increases the probability of occurrence of banking, currency or debt crisis.

Hypothesis 2: regulated or repressed domestic investors are forced to increase their holdings when the real interest rate falls

⁴ Except for securities held for trading

ii. Risk of domestic default and the stability of the banking system

It is undeniable that banks and sovereigns are closely tied. In their classical paper on sovereign debt Eaton and Gersovitz (1981) laid foundations for the relationship between sovereign default and stability of the banking sector. According to their line of reasoning, if a large share of debt is held by domestic institutions, government would put more efforts to avoid consequences of default. In result of a sovereign default financial institutions risk losing access to foreign borrowing and may need to ration credit provision to the private sector which would push the economy in a deep recession.

Several empirical studies shed light on the nature of the relationship between sovereign and banking risk. In the seminal work on banking and sovereign crises Kaminsky and Reinhart (1999) point towards the relationship between difficulties in the banking sector and currency crises. Gerlach (2010) finds that Eurozone countries with large and less secure banking sectors experience greater widening of credit spreads in the banking sector when sovereign risk increases. Acharya et al. (2012) find positive relationship between CDS issued on both bank and sovereign debt in Europe for both high and low sovereign credit ratings.

BIS (2011) summarized three channels through which sovereign risk affects bank funding. First, losses on bond holdings weaken banks' balance sheets increasing banks riskiness and making funding more costly and difficult to obtain. Second, rating agencies tend to follow the sovereign ceiling rule and sovereign downgrades generally result in lower ratings for domestic banks, increasing their wholesale funding costs, and potentially impairing their market access. Third, rising doubts about sovereign's solvability reduces the funding benefits that banks derive from implicit and explicit government guarantees. Fourth, higher sovereign risk reduces the value of the collateral banks can use to access interbank or central bank funding.

Hypothesis 3: high participation of banks results in higher country riskiness and lower credit rating. Long-term oriented foreign should avoid investing in countries with high credit growth

iii. Use of government debt as collateral

Bolton and Jeanne (2011) show that as the domestic financial sector develops, government debt takes over the role risk-free, interest-bearing collateral used to access lending at the central bank, contract loans and repurchase agreements in the interbank market and back bank deposits or mutual fund accounts. Krishnamurthy and Vissing-Jorgensen (2012) state that it also finds application in mitigation of counterparty risk and settlement in derivatives transactions. An outright default on domestic debt would erode the value of collateral and launch a chain reaction in bankruptcies among transacting institutions eventually bringing both interbank market and economic activity to a halt. ECB (2012a) reports that during the escalation of the banking crisis in 2008 the uncollateralized interbank market suddenly dried up leaving European banks no choice but to shift towards collateralised borrowing on the interbank market and the central bank standing facilities. Similar capital movement in May 2011 when tensions between sovereigns and banks intensified.

Hypothesis 5: Rise in the uncollateralized lending rate, proxied by spread between Libor and Treasury Bill rates, should push banks to shift to collateralized lending and purchase short-term debt

Years ahead of the European sovereign crisis Buitert and Sibert (2005) were arguing that, considering the differences in competitiveness and fiscal burden, the interest rate differentials were unjustifiably low. Authors criticized the naïve hypothesis that holders of riskier governments bonds were convinced that other euro member states together with the ECB would strive to maintain the coherence of the monetary union and, in fact, institutional investors were aware of the inexistence of explicit and measurable commitment of member states and of the prohibition of the ECB-led bailout. Authors put forward a hypothesis that the ECB artificially contributed to reduction in sovereign credit spreads by providing liquidity to banks at same conditions no matter whether German, Portuguese or Greek bonds were deposited as collateral. What is even more paradoxical is that the ECB regulations did take into account the relatively greater default premium on longer-term securities and liquidity provision was penalising for bonds with long maturities. In consequence, ECB collateral rules were to push banks to purchase higher yielding, short-term government paper.

On the micro level, recent stress tests conducted by the European Banking Authority revealed three interesting patterns in European banks' net exposures to sovereign debt, as presented in Figure 1. First, banks located in Greece, Italy, Portugal and Spain invest between 60% and 85% of their sovereign bond portfolios in bonds issued by their domestic sovereign. Second, banks in Belgium or France are by far less exposed to respective domestic issuers, but hold significant amounts of high-yielding peripheral debt. Third, banks located in the UK and Denmark that could not refinance themselves at the ECB appear to diversify their sovereign debt portfolio to greater extent than their European counterparts. Summing up, in the wake of the crisis banks located in Euro Peripheral countries were holding large positions of relatively risky government debt and scarce amounts of safe assets, which led to financial difficulties the sovereign crisis escalated, as predicted by Bolton and Jeanne (2011).

Gros (2011) states that the use of government bonds as collateral is also the missing puzzle that shapes default probability in a monetary union. On one hand, Eurozone members, unlike countries running independent monetary policies, are not in position to launch the printing press to pay off their debt, domestic debt bears certain resemblance to foreign currency debt. On the other hand, however, should a government declare a default that is detrimental to both domestic and non-resident holders, the ECB would no longer accept any of its bonds as collateral which would result not only in a collapse of the issuer's banking system, but also wreak havoc among fragile institutions abroad that were using sovereign debt as the collateral. Hence, both international and domestic investors could deduct that an insolvent member of a monetary union could count on a cross-country or ECB-initiated bailout.

Hypothesis 6: Banks willing to obtain funding from the central bank need to deposit collateral, hence bank' holdings of government debt should vary with the demand for refinancing.

IV. Motives for holding government debt

IV.1. Global Safe Assets

It is needless to say that rationale for holding global “safe haven” assets, i.e. US, UK, Japan, Germany and France, is different than for other countries. Krishnamurthy and Vissing-Jorgensen (2007, 2012) identify three key motives for holding U.S. government debt:

- 1) *Safety*. Government bonds represent safe return for investors who assess riskiness of private sector securities as excessively elevated or difficult to assess in general. This motive is particularly valid for households and private foreign investors.
- 2) *Neutrality*. Local and state governments as well as foreign central banks are de facto restrained in their choice of private sector assets and can only hold bonds of domestic or foreign governments.
- 3) *Liquidity*. Government bonds are by far the most liquid instruments in the market which is crucial for investors facing short-term liquidity constraints such as households, mutual funds and credit institutions as well as central banks that manage large reserve positions.

Empirical research on aggregate demand confirms these criteria for the United States. Krishnamurthy and Vissing-Jorgensen (2012) find evidence that the supply of US government securities is closely related to the aggregate demand for liquidity on one hand, measured as the spread between Insured Certificates of Deposit and a Treasury bill of comparable maturity, and to the aggregate demand for safety on the other hand, measured as the spread between Baa and AAA-rated instruments of comparable liquidity. Beber et al. (2009) show that in the European Monetary Union, the second largest supplier of reserve currencies, the relationship between liquidity and safety appears to be more complex. Their findings indicate that although in tranquil times sovereign yield spreads can be explained by differences in credit risk, in times of financial stress investors tend chase liquidity and not necessarily quality⁵.

Surprisingly, academic research has hardly investigated the composition of demand for government debt. Krishnamurthy and Vissing-Jorgensen (2007) argue that different groups of government bondholders likely have different motives for holding US Treasuries and have different semi-elasticities to changes in the corporate spread. Their findings show that foreign central banks are least reactive to changes in government bond prices, whereas state governments and private domestic banks are in the middle range. In turn, households, mutual funds, insurance and pension funds as well as foreign private investors adjust their holdings of Treasuries very swiftly rebalance their portfolio as bond credit risk changes. Authors argue that U.S. Treasuries carry certain “convenience value” that rises when the supply of debt is low and falls when it is high. The convenience value is also the missing puzzle explaining why the demand curve for Treasury securities is not perfectly elastic. Also (Bernanke, 2011) points towards strong heterogeneity in investment objectives driving foreign demand for U.S. assets. He presents evidence that between 2003 and 2007 European investors allocated less than one third of their funds into AAA-rated US securities and the two

⁵ It is noteworthy that authors’ analysis timeframe spans from April 2003 to December 2004 where the magnitude of the turbulence was lower than during the banking and sovereign crisis of 2008 and 2010.

thirds in high-yielding stocks as well as corporate and mortgage debt, while over 75% of capital flows from “saving glut” countries to the US was invested in government and agency debt. These findings merely opens the question what other factors drive investors to purchase government bonds issued by safe havens.

Hypothesis 7: in Safe Haven countries and the Core Eurozone, private investors are likely to be driven by returns in normal times and rebalance towards safety and liquidity under financial distress

Hypothesis 8: foreign central banks are likely to seek safety, liquidity and exchange rate stability

IV.2. Global safe assets, international imbalances and asset shortages

In a memorable lecture Bernanke (2005) explained that, although primary motive of those purchases goes back to the objective of foreign currency stability, what also drives demand are excess savings accumulated in emerging economies that are not invested at home. In consequence, interest payments on capital invested in “safe haven” reappear in improving current account balances in investor countries and deteriorating in recipient countries, in other words “savings glut” translates into global imbalances. Caballero and Krishnamurthy (2006) suggested that global imbalances, the low-yield conundrum and speculative bubbles fall in the same basket as asset shortages in emerging economies. Through a theoretical analysis authors show that underdeveloped domestic financial sector leads to emergence of real estate bubbles financed by overexposed domestic institutions and international investors who undervalue the risk. Authors state that government can tame the formation of domestic asset bubbles by opening the capital account or by issuing public debt that crowds out private investment. However, efficiency of sterilization is guaranteed only if debt issuance is large, which can lead to excessive indebtedness in the long run.

Chen and Imam (2013) analyse a large set of emerging economies between 1996 and 2008 and realize that, despite strong economic growth, the development of equity and corporate bond markets has not been commensurate to the rise in domestic savings. Asset shortages, defined as the difference between national savings and capital invested in assets at home and abroad, are more likely to occur in larger countries bearing lower credit rating and facing positive fiscal balances and lower trade openness. Global factors like higher world GDP growth and higher US interest rates tend to reduce asset shortages pushing domestic exporters to seek financing for new projects. Finally, domestic asset bubbles resulting from excess savings are a result of restrained capital openness, lower government stability and higher corruption.

Hypothesis 9: domestic investors are likely to hold more domestic bonds in countries prone to asset shortages, i.e. where level of development, market capitalization and financial openness is lower

IV.3. International investors and risky debt: chasing returns?

Several empirical studies indicate that international investors are in general return chasers. Empirical findings of Bohn and Tesar (1996) show that international equity investors tend to move into markets with high expected future returns that are on average sub-optimal from the risk diversification point of view. In bond markets, however, the causation between yields and foreign participation remains ambiguous.

Warnock and Warnock (2009) revisit Alan Greenspan's statement that, compared to the impact of falling inflation expectations and yield volatility on the long end of the curve, foreign capital inflows contributed only marginally, by less than 50 basis points, to the long-lasting reduction in yields in the United States. Their analysis of long-term yields between 1984 and 2005 indicated that, controlling for other factors, without foreign demand Treasury yields at the end of 2005 would be almost 80 basis points higher, significantly higher than predicted by Alan Greenspan. In a recent cross-country study on bondholders Andritzky (2012a) shows that in developed countries, including large Eurozone members, lower government yields are usually associated with higher participation of foreign investors. Looking at a set of ten emerging economies, Peiris (2010) finds that one per cent increase in foreign participation lowers long-term bond yields by 6 bps on average⁶. However, contrarily to authors' expectations, impact of foreign holdings on bond volatility differs between countries and remains widely unexplained⁷.

Other studies prove the contrary. Tokuoka (2010) focuses on the relationship between low yields on Japanese bonds and participation of foreign investors, central bank and household and corporate sectors⁸. Contrarily to other studies, he finds that one percentage point increase of foreign ownership of JGBs pushes up the yield by ca. 11 basis points, which is non-negligible assuming that Japanese yields oscillated between 1.5% and 2.0% for most of the analysis period 1998 – 2009. In turn, a one percentage point rise in financial wealth of domestic institutions and households lowers bond yields by 2 basis points. Author suggests three Japan-specific factors may be at origin at those findings: large pool of household assets accumulated through high saving rates, strong home bias and risk aversion of the household sector, and existence of large and stable institutional holders⁹. Burger et al. (2010) find that that past bond returns or exchange rate volatility did not influence foreigners' investment decision in emerging economies.

In a comment on the puzzles of the interest rate conundrum Wu (2005) states that what remains unclear is how domestic investors, who after all hold the lion's share of domestic debt, would react if foreign investors started to withdraw funds from the US Treasury market and if the increase in domestic demand would not eventually minimize the net effect on yields. Beltran et al. (2012) remark that analysis of government bond prices and foreign demand can be to some extent biased by autocorrelation, ambiguity of causation between yields and foreign demand and unobservable factors driving long-term yields. Last but not least, except for Krishnamurthy and Vissing-Jorgensen (2007) no study decomposes foreign flows into private and official capital.

⁶ Dataset from Asiabondonline and IMF Country Desk. Authors control for nominal short-term policy rates, inflation, fiscal deficit, current account deficit, US interest rate. They also verify the robustness towards cyclical factors, proxied by GDP growth, and global risk aversion, proxied by VIX

⁷ Results obtained from Garch model are significant only in four out of ten countries and show that, in reaction to increased foreign purchases, bond volatility tends to rise in Korea and fall in Malaysia, Mexico and Turkey.

⁸ Household and corporate sectors are proxied by net financial wealth held by household. Author control for gross debt and participation of Bank of Japan

⁹ Japan Post Bank and the Government Pension Investment Fund were holding over 30% of debt in 2006

IV.4. International investors: sensitivity to fundamentals and global factors

Large discrepancies in the impact of foreign holdings on bond prices have three main implications. First, country-specific factors should be taken into consideration, second, influence of domestic investor groups can play a role, and third that foreign investors are not purely return-oriented and other factors need to be considered. Several studies show that it may indeed be the case.

Kee-Hong Bae et al. (2006) examine bilateral bond holdings across 45 countries using point in time analysis for 2001 and 2002 and, after controlling for level of development, find that stronger property rights are associated with higher foreign investment in country's bond markets relative to GDP¹⁰. Ong and Luengnaruemitchai (2005) argue that foreign investors play an important role in providing liquidity to the market and, due to enhanced monitoring, exert pressure on the authorities to improve governance and transparency. Burger et al. (2010) analyse the allocation of US investment to local-currency emerging market bonds and find that US investors exhibit preference for countries with investor-friendly institutions, lower capital controls and taxation and better creditor rights. Other attractive factors include a larger domestic investor base, represented as share of pension and investment funds, and lower share of foreign denominated debt. Last but not least, according to the BIS (2011) and discussions with managers fundamental of bond funds show that investment criteria include also withholding taxes, issuance at longer maturities, breadth and liquidity of derivatives markets, and effective transaction cost in those markets.

In theory, capital markets should lend only to creditworthy borrowers and limit funding when debt overhang arises. In reality, investors' risk perception and allocation is strongly associated with economic and credit cycles in creditors' countries. In a classical work Fernandez-Arias (1996) argues that since domestic creditworthiness is associated with global interest rates, what matters in the end are the conditions in the creditor country. Kodres et al. (2008) show that in case of emerging markets spread compression between 2002 and 2008 was due not only to improvement in country-specific fundamentals, but also to global liquidity conditions, measured in terms of expectations and volatility of fed funds futures. Gros (2011) states that during boom episodes countries receiving large capital inflows record high growth rates that boost their fundamentals and makes the country risk appear lower than it is in reality. When the bust finally arrives, the slowdown in incoming flows curbs investment and pushes investors to re-evaluate risk. Eichengreen and Luengnaruemitchai (2008) look at the intra-regional investments in bond securities in Europe, Asia and Latin America over 2001-2003. Interestingly, results show that investment is not always directed towards the countries with higher interest rates they usually come from countries with lower rates. Investment rationale also seems to consider level of development, credit rating and financial openness. Chuhan et al. (1998) show that international bond flows react to global factors, proxied by the US interest rate and industrial production, and are particularly sensitive to country-specific credit rating and debt price.

Hypothesis 10: both local and global factors influence demand for government bonds hence investors with global exposure should react to changes in both local and international rates

¹⁰ Authors construct a dataset based on Coordinated Portfolio Investment Survey (IMF) that includes both local and foreign currency bonds issued by corporates and governments

IV.5. Domestic investors: crowding out or crowding in?

The lion's share of the existing literature on domestic holders of government debt is concentrated around banks and effects crowding out. According to Courakis (1984), even in presence of financial repression, financial institutions may prefer to purchase government debt simply because it is more profitable than private sector lending. Bank regulation can also play a role, as lending rate ceilings may prevent banks from charging the premium that would compensate for lower liquidity, monitoring costs and higher default risk pushing banks to invest in liquid and safe assets. In the extreme case, these distortions result in a segmented credit market where banks invest as much as possible in government securities and the remainder flows to the private sector.

Within the neoclassical IS-LM model this effect can be also interpreted as a classical situation where private investment is "crowded out" by the increased supply of government debt. As explained by Spencer and Yohe (1970) among others, in case of high sensitivity of demand for money to interest rates and in absence of accommodative monetary policy, increased budget deficit translates into higher yields on government debt which makes it more attractive for financial institutions. In turn, from the Keynesian standpoint, a debt-financed government spending gives an impulse for a rise in real private spending. In a controversial article by Friedman (1978), a self-proclaimed classical liberal, shows that under consideration of wealth effects, bond financing of government deficits may either increase or decrease private investment spending depending on elasticity of substitution between bonds, money and real capital. The focal point of those two schools is the theorem coined by Aschauer (1989) that although rising public investment induces certain crowding out, eventually increased productivity of public capital boosts productivity in the private sector. Recent empirical studies conducted using cointegration approach, Hatano (2010) among others, affirm the presence of crowding-in effects is observable in certain countries like Japan.

Empirical research on the effects of crowding out proves to be revealing in this context. Hauner (2009) looks at banks' holdings of government debt in over 70 countries between 1980 and 2004 and identifies numerous situations of "lazy banking". It appears that the main motive for domestic institutions to purchase government debt is not safety and liquidity, but greater profitability and lower risk than in typical lending to the private sector. The side effects of "lazy banking" include lower efficiency, slower development of the banking sector and, presumably, in general higher vulnerability to external shocks. Abbas and Christensen (2010) observe that the contribution of domestic financial sector to overall economic growth falls when banks participation in government financing increases. Findings of Andritzky (2012a) broadly indicate that in large developed economies bank holdings are associated with higher yields and higher indebtedness. It is, however, possible that the relationship between debt holdings and yield is not linear; Hoshi and Ito (2012) among others warn of a "saturation point" where financial institutions become technically unable or simply unwilling to absorb more debt.

Hypothesis 11: At higher commercial lending rates banks are less inclined to hold government debt. Under crowding out banks' holdings of government debt are also associated with lower GDP growth.

IV.6. Market Sentiment and Mispricing

In a theoretical setting with domestic and international interbank markets, Freixas (2005) shows that, due to information asymmetry and different valuation of investment risk, cost of foreign borrowing differ from domestic rates. Also empirical studies conducted on different asset classes indicate that domestic and foreign investors are likely to value perceive risk and return differently. Kang et al. (2010) assume that if domestic investors are subject to home bias and foreign investors are return-chasers on global scale, valuation criteria of each group should differ. By applying domestic and global benchmarks to stocks in Korea authors find that, first, domestic or foreign valuations differ, and, second, non-residents hold stocks for which their valuation is higher than that of domestic investors. Andrade and Kohlscheen (2010) analyse the differences in exchange rate forecasts provided by domestic and foreign institutions around presidential elections of 2002 and discover foreign predictions over one to three years were significantly more pessimistic than domestic investors. In a large cross-country study over 2001-2003, Bae et al. (2008) find that the local advantage gains importance in countries with lower quality of information, smoothed earnings, and most importantly, lower presence of foreign and institutional investors.

It is widely assumed that if financial markets are not perfectly efficient, asset valuation is not consistent over time and corrections in valuation may result in sudden and strong price variations. However, empirical studies show also that these variations may at times driven by market sentiment rather than sound analysis.

Eichengreen and Mody (2000) analyse a large set of emerging market corporate and government bonds issued in foreign currencies held between 1991 and 1997 and conclude that changes in spreads are driven mainly by shifts in market sentiment rather than shifts in fundamentals. Their findings indicate that in the aftermath of the Mexican crisis, around 1996 and 1997, markets took a more benign view on fundamentals in emerging markets and, consequently, secondary sovereign spreads fell significantly. Surprisingly, with the escalation of the East Asian crisis yields across emerging economies shot up again while fundamentals in economies outside Asia were almost unaffected which authors describe as irrational exuberance¹¹. Luengnaruemitchai and Schadler (2007) analyse phenomena of bond spread compression in ten new Central and Eastern European members of the European Union that occurred despite economists' warning on rising vulnerabilities and ended in sudden upward revision of risk in 2007. Looking at residuals between fundamentals and bond prices authors hypothesize that the investors irrational exuberance was fuelled by expected improvements in fiscal discipline, implicit guarantee of a EU-initiated bailout in case of sovereign insolvency, and future membership in the European Monetary.

Fratzscher (2012) looks at capital flows between 2005 and 2010 and observes that prior to the crisis and directly afterwards, capital flows were directed to countries with lower credit rating, while between 2007 and 2009 they shifted towards safe havens. Forbes and Warnock (2012) focus on episodes of sudden portfolio in- and outflows in developed and emerging economies in over 50 countries between 1980 and

¹¹ It is noteworthy that at the time liquidity in the emerging market bond sector was significantly lower and transparency and economic coverage weaker than in the subsequent decade, hence the jumps in yields are more remarkable.

2009. Their results indicate that that increases in global risk aversion cause both foreign and domestic investors to exit emerging markets and shift funds to safe havens¹².

De Grauwe and Ji (2012) find that between 2000 and 2008 yields of the Eurozone countries were broadly disconnected from underlying fiscal fundamentals and current account balances and that the escalation of the crisis brought a structural change in the market perception of sovereign risk, while in “stand-alone” countries, notably the UK, US, Denmark and Japan bond yields continuously reflected the underlying data. Authors conclude that government bond markets in a monetary union are structurally more fragile and more susceptible to switch from positive to negative equilibria that end with self-fulfilling crisis, as hypothesized in De Grauwe (2012). Analysing the determinants of bond yields in G7 countries between 1993 and 2012 D’Agostino and Ehrmann (2012) find that in case of French and Italian bond spreads risk factors have been priced in the up-run of the monetary union and following the outbreak of the financial crisis, but not in the first years of the monetary union. Looking at changes in foreign holdings of government bonds across Europe Andritzky (2012a) observed a significant short-term response to shocks in yield that was particularly visible in Greece, Ireland, Portugal and Spain. Decomposition of yields in those countries suggests that non-resident participation is driven to more extent by the residuals than by macroeconomic controls explaining the yields¹³.

Hypothesis 12: foreign investors are more likely to be driven by market sentiment than domestic institutions

Hypothesis 13: demand for government paper in the Eurozone is dissociated from fundamentals

V. Empirical Methodology

Unconstrained investors are likely to analyse investment in government bonds through the prism of potential returns, probability of deterioration in public finances, macroeconomic fundamentals, external vulnerabilities and institutional quality.

IV.1. Debt sustainability

In absence of collateral the recovery value of government debt remains in case of default is almost impossible to estimate, hence the value of government debt depends on the underlying probability of repayment which, in turn, depends on both current liquidity situation and long-term sustainability of public finances. Hence, in the short-term rational investors should monitor and react to changes in the debt burden and current fiscal balances, while investors with a long-term investment horizon are more likely to focus on structural indicators of the future fiscal situation.

To render public debt sustainable in the long-term a government focus should lie on structural variables, such as the trend in economic growth, inflation, structural primary fiscal balances and low cost of

¹² Findings show also that increases in Global Interest Rate, here proxied by the US Treasury Rate, are associated retranchment episodes

¹³ Author uses short-term interest rate, real GDP growth and budget balance

borrowing¹⁴. To capture the change in these variables I follow the general one-period sustainability equation as presented by Blanchard et al. (2010):

$$\Delta b_t = (b_{t-1} * \frac{r_t - \pi_t}{1 + g_t}) + pb_t \quad \text{Eq. 1}$$

Where, b^t is the debt to GDP ratio, pb^t is the cyclically-adjusted primary balance, g^t is the trend in real GDP growth calculating with the Hodrick-Prescott recursive filter, π_t represents inflation and r^t stands for the synthetic interest rate calculated as follows.

Giovannini and De Melo (1993) state that it is almost impossible to calculate the representative interest rate on domestic liabilities due to insufficient data availability. To calculate the cost of borrowing I follow the idea of Reinhart and Sbrancia (2011) who calculated the historical weighted-average yield of all outstanding government bonds. Not being in possession of this dataset, case I assume that the weighted average debt service cost of debt would be equal to the bond yield for maturity at time t corresponding to the weighted-average maturity of total outstanding debt at time t . Hence it is a forward-looking measure

$$r_t = i_t^{M_t^e} \text{ for } M_t^e = \sum_{n=1}^N w_n m_n \quad \text{Eq. 2}$$

where r = effective cost of debt, i = nominal interest rate on a government bond of maturity M_t^e , whereas M_t^e = debt-weighted average maturity of outstanding government debt at time t for the entire maturity range. For the debt-weighted maturity I use the data provided by the BIS or OECD, or if the yield on 5 Year government bond not available. Due to limited data availability for all missing maturities I use linear interpolation between 1 or 2 years, whichever is available, and 10 years. I also assume that the non-marketable debt bears the same cost as the marketable debt. In result, for each period of analysis, the cost of borrowing in the sustainability equation corresponds to the observed yield on government bond of maturity being equal to the weighted average maturity of the entire outstanding government debt. Obviously, it would be precise to calculate the debt-weighted average effective cost, but the composition of debt necessary for this calculation is not available for set of countries.

Sustainability exercise is more complex for developing countries where the share of foreign currency denominated debt oscillates on average between 10% and 30%, and in case of Bulgaria, Hungary, Indonesia and Peru exceeds 40%. Since historical data on the cost of foreign currency borrowing is not available for the countries in the dataset I assume that the covered interest rate parity holds in the long term and that governments hedge to some extent their currency exposures, which is a suitable basis to approximate the cost of foreign currency debt to be comparable with cost of local currency debt. In consequence, I apply domestic interest rate on the total central government debt, in both local and foreign currencies.

While economic growth and primary balance have been adjusted for the cyclical elements, interest rate is taken at the observed market value which makes it more credible knowing that investors apply current

¹⁴ Further considerations include demographic projections, aging trends, dependency ratio, share of working-age population, employment, etc.

metric in their valuation models. Also, in reality to calculate fiscal sustainability professional financial analysts use multi-period models, but unfortunately past forecasts of economic growth and fiscal indicators are not available for the period of analysis¹⁵.

While professional investors can forecast the future path of growth and budget balances, projecting the cost of borrowing remains a difficult task. By accounting identity, investment spending financed by budget deficits may must be financed either by national savings or net foreign borrowing. Since borrowing from domestic institutions may result in crowding out of private investment, it is in country's interest to maintain steady access to international borrowing. Analysing the sustainability of the U.S. debt Labonte (2012) states that investors are likely to demand low interest rates as long as they remain convinced by government's fiscal policy. In fact, external financing can be extremely burdensome even at seemingly low levels, Reinhart et al. (2003) find evidence that serial sovereign defaulters frequently were unable to refinance themselves at debt to GDP ratios that were below the euro area's "Maastricht Treaty" upper bound of 60 per cent. A rating downgrade or inconclusive behaviour of the government may be sufficient to change the sentiment among investors would automatically result in higher yields. This goes back to the debt sustainability equation, since effective future cost of borrowing depend on the rates demanded by the market.

Last but not least, what determines the trajectory of is strictly related to the presence of fiscal rules in the domestic legislation. Budina et al. (2012) report that numerous economies adopted fiscal rules in response to the crisis and that their design has been adapted to guarantee sustainability and flexibility in response to unexpected shocks. Wyplosz (2012) suggest that fiscal rules can efficient protection for investors only if they are backed by adequate institutions.

Hypothesis 13: Investors with long-term investment horizon are more likely to follow sustainability indicators such as growth trend, cyclically adjusted primary balances, and presence of fiscal rules

Size and Liquidity. Large institutional investors holding significant shares of debt may be reluctant to alter their positions even if macroeconomic fundamentals or overall risk perception change. Effects of 'captive' or 'sticky' bond holdings are more likely to occur in illiquid or small markets with limited number of actors where large transactions have an important impact on bond prices. For instance, at the beginning of 2012 Franklin Templeton Investments was said to own around 10% of total forint-denominated Hungarian debt¹⁶. In extreme case, large lenders may not be truly in position to withdraw discretely from the market out of fear of provoking a fall in prices that would negatively impact the value of their remaining holdings on one hand and convey a false signal provoking a herd-like selling behaviour among other investors. At the time being, Chinese and Japanese official sector institutions are entrapped in such action-reaction setting vis-à-vis United States.

¹⁵ Publicly accessible past forecasts of GDP growth and fiscal balances provided in the historical editions IMF World Economic Outlook for the entire set of countries start de facto around 2009.

¹⁶ Kenway, Natalie. "Templeton's Hasenstab Defends Hungarian Debt Position". Investment Week, January 2012. <http://www.investmentweek.co.uk/investment-week/news/2135688/hasenstab-defends-hungarian-debt-position>.

Maturity. Maturity composition can be measured in two ways. Firstly, since short-term debt introduces roll-over risk and hence I consider the proportion of bills to total outstanding debt using national sources for analysis at quarterly frequency, and OECD statistics and national data for annual frequency. Secondly, to gauge the interest of different investor groups according to their investment horizon I use remaining weighted-average maturity of outstanding debt.

IMF lending. Last but not least, I control for the liabilities towards not profited-oriented multinational organizations such as the IMF. Jorra (2012) finds evidence that IMF-imposed adjustment programs tend to increase the probability of sovereign default by 1.5% to 2% and that programs that are associated with provision of IMF funds turn out to be particularly detrimental in countries with weak fundamentals. More importantly, Roubini and Setser (2004), among others, mention that in most episodes of debt restructuring supra-sovereign institutions were considered to have a senior claim compared to other bondholders. To analyse how investors react to the presence of these creditors I look at the statistics on loans granted by multinational or the IMF to total debt¹⁷.

Hypothesis 14: non-resident investors should be reluctant to invest in countries under the IMF program

IV.2. *Expected returns*

When analysing investment targets international investors are likely to look at total returns, i.e. coupon rate, potential change in bond prices and currency movements. Banerjee and Singh (2006), among others, report that significant currency movements, measured as deviations from the uncovered purchasing power parity, are particularly likely to occur in emerging economies. A practical approach to combine the total return potential from international investors' perspective has been proposed by Qureshi et al. (2012) to identify macroeconomic factors associated with sudden capital in- and outflows. Instead of looking at each factor separately, they first calculate the differential between country's real interest rate and US real interest rate and subsequently adjust for currency mispricing, expressed as the deviation from the trend in the real effective exchange rate. I calculate the real yield differential as follows:

$$\text{Eq. 3} \quad \Delta r_t^{real} = (r_t^{domestic\ nominal} - CPI\ YoY_t^{domestic}) - (r_t^{US\ nominal} - CPI\ YoY_t^{US})$$

To adjust for the exchange rate misvaluation I apply the deviation from the REER long-term trend :

$$\text{Eq. 4} \quad \Delta r_t^{real\ adjusted} = \Delta r_t^{real} + (REER_t - REER_{trend})$$

Where r_t is the nominal interest rate in country of analysis or the US, CPI is the YoY change in the Consumer Price Index, REER is the Real Effective Exchange Rate for country currency based on a large basket of countries calculated by the BIS. To calculate the approximate equilibrium exchange rate I detrend the series using Hodrick-Prescott filter using standard parameters and subsequently calculate the deviation from equilibrium.

¹⁷ Although IMF loans represent a sub-category of multinational loans, at several instances they are not included in the parent category. This is the case for instance for aid attributed to Greece, Portugal and Ireland via EFSF in the aftermath of the recent Eurozone crisis. In result I need to use both series.

IV.3. *Macroeconomic indicators*

Macroeconomic conditions are a key input for both domestic and foreign actors when taking investment decisions and changes in these conditions affect valuation of their holdings. In turn, domestic investors are directly exposed to changes in growth, inflation as well as interest and exchange rates.

Current account balance – current account encompasses the balance of trade, i.e. net exports or imports, and factor income, i.e. interest or dividend paid or received from abroad. It measures net foreign assets or liabilities incurred over a given period, hence negative current account deficit means that an economy is absorbing more than it is producing and its exposure to currency risk is rising, which may lead to higher default probability for foreign currency debt. Strongly positive current account balances may be a sign of asset shortages, as explained by Caballero (2006) among others.

Financial openness. It appears that financial openness acts as a double-edge sword. On one hand Mehl and Reynaud (2010) found that the removal of capital controls helps lower domestic ‘original sin’, and tilt domestic debt composition towards domestic borrowing. On the other hand in a seminal paper Kaminsky and Reinhart (1999) explain that financial liberalization together with opening of financial account elevate the frequency and the severity of currency and banking crisis. However, in a later study Edwards (2004) shows that financial openness does not necessarily aggravate the effects of capital account reversals. Last but not least, Kaminsky (2008) argues that capital controls protect inefficient domestic financial institutions leading to financial vulnerabilities. To measure the determinants of demand for bonds with regard to the last two factors I use synthetic indices provided by Aizenman et al. (2008) which are well adapted for this dataset for two reasons. On one hand they reflect the path of exchange rate stability and capital account openness pursued in the developing countries, in particularly in the Eurozone, at the cost of reduced monetary independence. On the other hand trilemma indices reflect the development towards intermediate levels of the index observable in emerging markets in the recent years.

Sovereign Credit Ratings – following the linear approach to rating conversion presented by Ferri, Liu and Stiglitz (1999) I attribute each sovereign credit rating provided by Moody’s a numeric value ranging from 5 for Caa, i.e. lowest rating above default, to 100 for AAA, i.e. safest assets. This approach does not reflect the idea that differences between low-grade ratings may have different importance for investors than at high-grades, or that ratings on the verge of investment or non-investment grade, however inconsistencies remain relatively limited.

Institutional quality. I use the Worldwide Governance Indicators based on surveys conducted by the World Bank among citizens and companies in numerous developing and industrialized countries. I look at the political stability and absence of violence, which reflects the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, and government effectiveness, which Reflects perceptions of the quality of public services, the degree of its independence from political pressures and credibility of the government's commitment to implement announced policies.

Liquidity. Gómez-Puig (2006) identified liquidity as an important determinant of sovereign spreads and investor behaviour in general, at least during the tranquil years of the Euro Monetary Union. Author has shown that although both total outstanding debt amount and the bid-ask spreads are good proxies for liquidity in tranquil times, in case of sovereign distress the later one may be prone to significant non-linear jumps and thus may not be representative of the true underlying liquidity risk, as mentioned in D’Agostino and Ehrmann (2012). To measure liquidity on local currency debt instruments at the end of each quarter I calculate averages of daily bid-ask bond spreads for maturities of 2, 5 and 10 years¹⁸. Also to circumvent lacking availability of historical data in several smaller and emerging countries, I construct a synthetic liquidity indicator that choses the maturity with most abundant observations in countries if data is scarce, and uses the 10Y bond maturity if availability is similar across maturities.

Market Sentiment. To gauge market sentiment I use the Citgroup Macro Aversion Index. To measure political uncertainty I use the European Uncertainty Index developed by Baker, Bloom and Davis which is based on non-market data, i.e. newspaper coverage, future changes in the tax code, and disagreement among economic forecasters.

IV.4. *Methodology: Core specification*

Both my objective and methodological approach differ those chosen by Krishnamurthy and Vissing-Jorgensen (2007) and Andritzky (2012b) who concentrated on the impact of changes in debt holding on respectively supply¹⁹ and bond yields. However, by setting the holdings of each investor group in total debt as explanatory variables in one regression, authors need to face endogeneity between groups of holdings and between the spread and each group’s holdings.

In this paper I apply panel specification similar to Mehl and Reynaud (2010) and Baldacci and Kumar (2010) to analyse the macroeconomic, fiscal and market determinants of holdings of different investor groups. Panel data approach is not only efficient with dealing with relatively short time series of quarterly data, but also allows to analyse the impact of country-specific variables across a group of countries with different initial conditions, development of the domestic debt market and access to global capital, level of governance and institutional development, legal systems and financial openness.

Specifically, I intend to explain the share of government debt held by specific investors, namely (i=1) for private non-residents, (i=2) for official non-residents, (i=3) for banks, (i=4) for pension and insurance funds, (i=5) for investment and mutual funds.

$$\text{Eq. 5} \quad y^i = \frac{d^i}{D} \in [0, 1] \text{ for } i \in [1, 2, 3, 4, 5]$$

¹⁸ Data availability is greater at 2 Years Maturity than at 10 Years for Brazil, Czech Republic, Iceland, Israel, Malaysia, Mexico, Poland, Turkey. Data on liquidity is inconsistent between 2002 and 2007 for the US, bid yields are provided at three decimal numbers and ask yields at four decimal numbers leading to negative spreads at several dates which had to be excluded from the sample

¹⁹ Supply is defined as the spread between AAA-rated securities, which includes agency debt and high grade corporates, and Treasuries. It follows Longstaff’s (2004) finding that government debt supply is correlated with the spread between Treasuries and the bonds issued by Refcorp.

Basic reduced-form model, estimated for a panel of 16 economies denominated j and time span t between Q1 1999 and Q3 2011, consist of the following:

$$\text{Eq. 6 } y_{jt}^i = \alpha_j + \beta x_{jt} + v_{jt} + \varepsilon_{jt}$$

Where j and t are the country and time dimensions respectively, y_{jt} measures the share of the investor class in total government debt as specified in Eq. 1, x_{jt} is the vector of explanatory variables and β a vector of estimated parameters. Residuals are split into unobserved country effects; noted v_{jt} and panel level effects ε_{jt} that are independent of v_{jt} .

In the baseline regression the equation takes the following form for all investor types and regions:

Eq. 7

$$\begin{aligned} \text{Share of Government Debt held by Investor Type} = \\ \alpha + \beta_1 \text{Structural Primary Fiscal Balance} + \beta_2 \text{Debt/GDP} + \beta_3 \text{Debt Maturity} + \\ \beta_4 \text{Credit to Private Sector} + \beta_5 \text{Risk Aversion Index} + \beta_6 \text{Real Yield Differential} + \\ \beta_7 \text{Credit Rating} + \beta_8 \text{GDP Size} + \beta_9 \text{GDP Growth} \end{aligned}$$

IV.5. *Methodology: Robustness and Coefficients Stability*

Construction and heterogeneity of the dataset, choice of a turbulent time period and several data issues necessitate commensurate test and estimation. Each of the following tests is conducted separately for each investor class without distinction for country groups.

i. Structural Breaks and Stationarity

The dataset is plagued with structural breaks that are related to two factors. First, as described in the section on data issues, the panel is not entirely free of statistical inconsistencies, changes in classification by the national sources and subjective attribution to investment categories and which is also the reason why structural breaks occur at different time periods for different panels. Second, financial crisis has brought a true structural change in behaviour of several investors. In consequence, the dataset contains structural breaks that are individual for each panel, à priori unknown and can occur at several instances in each panel which has important implications for the of unit root tests. Last but not least, Cavaliere (2005) and Xu and Cavaliere (forthcoming) show that the regular unit root tests applied to bounded variables may also fail to reject the unit root and cointegration hypothesis even if the series are actually stationary.

Analysing the GNP growth in XXth century Perron (1988) shows that, in presence of one-time change in the level or slope of the trend function as it was the case around the 1929 crash and 1973 oil price shock series, by construction standard tests cannot reject the presence of unit root, even asymptotically. Indeed, Annex Table 4 shows that both Im-Pesaran-Shin and Fisher-type unit root tests on levels provide unclear picture on the presence of unit root. This is why for each I implement the test described in Clemente

et al. (1998) which takes into account presence of unknown structural breaks. I run the test for additive (AO) and innovational outlier (IO) unit root for one, or if necessary two, unknown breaks for each country individually and, with extremely few exceptions, state that the dataset is stationary around individual trends.

ii. Panel Homogeneity, Serial Correlation, Cross-section Dependence, Cointegration, Heteroskedasticity,

For each type of investor I test the homogeneity of my panel, as described Hsiao (2003), and find that panel intercepts and coefficients are homogenous and that fixed effects are preferred to random effects.

To verify cross-section dependence under fixed country effect for each investor type I run a Pesaran (2004) test which is adapted for unbalanced panels. I use the procedure in the first row for dependent variable alone, and subsequently for the baseline regression. Results show that even under inclusion of global common factors such as US Interest rate and Global Risk Aversion the cross-section dependence is still present for official non-residents and domestic investment funds. I also detect groupwise heteroskedasticity using standard Wald test for fixed effects models.

To verify the presence of serial correlation I use standard procedure described in Drukker (2003). Although serial correlation does not affect unbiasedness or consistency of the estimators, it can have a significant impact on efficiency and in consequence affect the estimated standard error. Results show that errors are serially correlated for series in levels, but not in first differences. Finally, I perform test for cointegration on independent variables and find no cointegration in levels.

iii. Method of Estimation

In my estimation I am inclined to apply country fixed effects for the full sample and smaller country groups while controlling for cross-section dependence, serial correlation of residuals and heteroskedasticity. If the cross-section dependence is not corrected, the coefficient estimates from standard panel estimators are likely to be consistent, but their efficiency may be very low. The technique of estimation of the variance covariance matrix that is most likely to provide consistent results has been developed by Driscoll and Kraay (1998). The estimation of the matrix is nonparametric and adapted for my case where panels range between 2 and 16 countries for ca. 40 time observations. Hoechle (2006) extends the model for unbalanced panels and shows that calculated standard errors are smaller than under more efficient than standard OLS, Rogers and Newey-West. Author shows that the estimator becomes less efficient when the time dimension is drastically reduced below $T=15$ for cross-section dimension $N=2000$.

To verify the stability of estimated coefficients over time for each investor type I run an expanding window regression based on the baseline model. The first window starts is positioned on the sample 1999Q1 to 2001Q4 and the regression is repeated every quarter into the future. In result, regression coefficients

reflect all the data that the investor had at the time. The list of all Stata commands is provided in the Appendix Table 5.

VI. Results

IV.1. Stylized Facts

Composition of debt holders in developed and emerging markets is characterized by three main features.

First, most recent data indicates private non-residents hold on average around one fifth of government debt in non-euro developed countries, almost 30% in Core Eurozone countries and Emerging Economies and almost 50% in Peripheral Eurozone. This confirms the findings by Schoeneker (2008) and de Santis and Gerard (2006) who observed that high shares of foreign investors among Eurozone countries resulted from the increase in inter-regional investments that followed the creation of the monetary union. Official non-resident holders, i.e. foreign central banks, hold 10% of debt in Safe Havens and Peripheral Europe and over 40% in France and Germany. Domestic banks and Pension and Insurance funds hold respectively around 20% of debt in Emerging nations and Non-Euro developed countries, in the Eurozone it is significantly less. Finally, domestic central bank holdings accumulated during Quantitative Easing and SMP Programs constitute considerable shares in Safe Havens and Peripheral Eurozone.

Second, disparities are strong within each group and within the entire sample. Table 3 indicates that private foreign participation in Emerging Economies ranges between 14% in Bulgaria and 35% in Hungary, in peripheral Eurozone it is between 33% in Ireland and 60% in Greece. Share of banks oscillated between 2% and 57% and pension and insurance between 1% and 40%. Finally, general government holdings comprising social security funds and public companies hold almost 40% of debt in the US and around 10% in Czech Republic, Greece, Spain and Denmark.

Third, investment rationale and constraints differ for bills and bonds. Figure 3 shows that between 2001 and 2011 most countries under analysis succeeded in reducing the share of short-term debt to less than one fifth, most prominent examples being Thailand and Czech Republic. Interestingly, in the last years Germany, the UK and Japan increased the supply of government bills relatively to bonds. This may reflect the rise in demand for collateral in short-term transactions between financial institutions.

Closer look at the evolution of holdings of bills and bonds reveals patterns in investor holdings that are not visible under aggregate analysis. Figures 4 indicates that between 2010 and 2011 foreign investors drastically reduced their short-term exposure to Greek and Portuguese securities from over 70% to less than 20% in the course of a single year. In turn, Figures 5 indicates that the shift in bonds of the same issuers has been much less remarkable. This example shows that different parts of the yield curve attract investors with different return objectives, liquidity constraints and risk aversion and it is generally more probable to see less noticeable shifts in longer maturities that are inhibited to more extent by buy-and-hold investors.

Summing up, Safe Haven countries have on average most diversified investor base where no investor type has more than 20% of debt, debt of Core Eurozone countries is to over 80% by non-residents, whereas

Emerging Markets rely mainly on domestic banks and pension and insurance funds. It is noteworthy that opening of the financial account, stabilization of inflation rates and improved governance resulted in diversification of the investor base in emerging economies and convergence towards the model of developed economies, as indicated by Figures 9, 16 and 20. These last findings partly contradict the results obtained by Hausmann and Panizza (2011), though the sample considered here is significantly smaller.

IV.2. Determinants of Holdings by Investor Type

In this section I attempt to identify the fiscal, macroeconomic and market-related determinants of demand for government bonds in four steps: simple graphical analysis, econometric analysis, verification of stability of estimated coefficients and alternative specification as robustness check. Econometric analysis is conducted separately for each investor group for a baseline model as well as an extended model containing additional indicators. Although country fixed effects are considered in the study I also conduct the tests for the full sample of countries as well as smaller groups of countries, i.e. Peripheral Eurozone, Core Eurozone, Safe Havens and Emerging Markets. Due to limited data availability for certain independent variables some extended models contain fewer observations than the baseline model.

i. Private Non-resident Investors

Graphical Analysis. Holdings of private non-resident investors exhibit strong disparities between countries and country groups. Starting with the Eurozone, Figures 6 to 7 show between 1999 and 2008 foreign demand was consistently rising in Germany, France, Italy and in particular in Greece where it reached almost 80% by the time the Lehman-induced crisis truly escalated. In France private investors have been pushed back by foreign central banks, as explained in the following section. Interestingly, in Spain and Ireland private non-residents began to increase their exposure in 2008 when the bond yields became more appealing and few doubts were raised concerning its' stability. At the same time foreign holdings of safe haven assets remained stable throughout the crisis and actually increased in the United States, with the exception of Denmark where private investors sold almost half of their debtholdings when financial turmoil began, as indicated by Figure 8. Last but not least, during the first years of the new millennium private international investors gained confidence in emerging market debt that reached its high shortly before the subprime crisis. Once the dust settled and central banks in developed economies switched to the zero interest rate policy the demand for emerging country debt picked up again.

Econometric Analysis. Regressions (1) and (2) in Table 3 indicate that, in general, private non-resident investors prefer debt of larger economies and issued at longer maturities which can be interpreted as search for greater stability and credibility on the inflation front. Investment criteria on the fiscal front seem to be more sophisticated; on one hand international investors avoid countries with rising debt to GDP, but on the other hand they finance governments running structural primary fiscal deficits as long as they can obtain higher yields than at home. However, when risk aversion rises they are also likely to cut their exposure. Last

but not least, foreign private investors do not pay much attention to current account deficits, rate of economic growth, credit ratings or actual liquidity of country's bonds.

Different signs of coefficients in regressions (3) to (10) indicate that private investors react differently to changes in variables in different country groups. Coefficients obtained using expanding window presented in Figure 28 suggest that between 2003 and 2008 private international investors would purchase bonds issued by Eurozone and emerging economies when situation of public finances deteriorated. While this trend persisted in Peripheral Eurozone until the end of 2011, private international investors overhauled their criteria with regard to the Core Eurozone and sold French debt when fiscal deficit widened. Figure 29 points towards another interesting pattern appears with regard to risk aversion. Prior to the crisis international investors used to flee into safe haven assets every time risk indicator flashed red, whereas from 2008 onwards rising risk aversion pushes investors to buy safe haven assets and sell peripheral Eurozone bonds. Finally, Figure 30 confirms that private foreign investors were associated with higher yields in peripheral Eurozone consistently throughout the whole decade.

Robustness Checks. Results presented in Table 4 partly confirm the findings. First, participation of non-resident investors rises if debt is sustainable, esp. in Core Eurozone countries, but evidence is weak in other regions. I also find that the number of fiscal rules is negatively related to foreign participation. Second, after adjusting the yield differentials for deviation from the real effective exchange rate I find weak evidence that participation of foreign investors in peripheral Eurozone and Emerging Economies is associated with higher potential returns. The later shows that investment in emerging market local currency bonds is, at least, partly driven by the expected exchange rate appreciation. It is also quite revealing that only in emerging markets foreign participation is significantly related to government effectiveness, while in peripheral Eurozone this relationship is negative. Also rise in uncertainty in European policy is negatively connected with foreign investor holdings in the Eurozone which is consistent with previous findings. Last but not least, increasing tensions on the interbank market are associated with higher demand for Safe Haven debt.

ii. Official Non-resident Investors

Graphical Analysis. It is needless to explain that foreign reserves of central banks have been traditionally allocated to Safe Haven resulting in participation ranging between 3% in Japan and 16% in the US, as presented in Figure 12. In Europe, demand from foreign official institutions started to rise significantly after the establishment of the monetary union exceeding 40% in France and Germany at the end of 2011. In Ireland the participation of foreign official holdings reached nearly 70% at the end of 2008. What is quite striking is that, from the beginning of the crisis, increase in demand for French, German, Spanish and Irish bonds coincided with the global risk aversion, as indicated in Figures 10 and 11. What is remarkable is that while in France and Germany foreign participation kept increasing throughout the crisis, foreign central banks drastically reduced their exposure to Ireland, and to less extent to Spain.

Econometric Analysis. Table 5 indicates that official central banks in general invest in countries with healthy fiscal balances, positive growth, lower yields and negative current account balances. Results for individual

countries and expanding window present a more sophisticated picture. Figures 31 and 34 show that prior to 2008 foreign official holders would tolerate widening fiscal deficits in Peripheral Eurozone as long as growth was positive. The crisis brought a paradigm change. First, with regard to fiscal balances foreign central banks began to sell bonds of peripheral countries and began to buy Core Eurozone and Safe Haven bonds, although their public finances deteriorated and GDP growth decelerated. Second, the sale of peripheral debt significantly coincided with the fall in risk aversion. These results suggest that foreign central banks react not only to changes in fiscal indicators, but also to market sentiment.

Robustness Checks. Coefficients of debt sustainability indicator and exchange rate-adjusted yields differential in Table 6 implies confirm previous findings. Also, foreign central banks seem to purchase more debt of countries that implement fiscal rules, have more effective governments. Together with the positive coefficient sign for credit ratings in Table 5 it is possible to conclude that foreign central banks primary looking for safety. Finally, insignificant coefficients for bid-ask spreads and total outstanding debt give no backing for the liquidity motive.

iii. Domestic Banks

Graphical Analysis. Banks represent a large fraction of demand for bonds, their holdings range from 3% in the US to 35% in Japan. Two patterns deserve particular attention. First, starting from the creation of the Euro monetary zone banks' participation was on a downward trend that that suddenly reversed when the financial crisis began to spread. Second, in emerging economies reliance on banks financing decreased to the level comparable to developed countries, not to mention that the trend reversal around the crisis was also visible in Poland, Hungary and Malaysia.

Econometric Analysis and Robustness Check. Regression results in Tables 7 and 8 indicate that domestic banks tend to invest in domestic debt when it actually becomes unsustainable, average maturities shorten and the IMF is solicited to step in to provide funding. Figure 34 and results for REER-adjusted real yields in Table 8 imply that larger bank holdings are also associated with higher real yields, lower government effectiveness and lower GDP growth. What is slightly perplexing is that higher cost of borrowing on the interbank market is reflected in lower demand for government debt in Peripheral Eurozone and higher in Safe Haven countries, which does not provide a clear answer to hypothesis X.

While refinancing from the ECB does not seem to have a significant impact on demand for domestic government bonds. Finally, higher uncertainty concerning policy actions in the European union is associated with higher participation of banks.

iv. Domestic Insurance and Pension Funds

Graphical Analysis. Figures 17 to 20 convey a twofold picture. In France and the UK the weight of insurance and pension funds in debt financing diminished significantly over the last decade, in other developed countries it has been broadly stable. Second, participation of pension and insurance funds in emerging economies has approached the levels observed in developed economies.

Econometric Analysis. Results in Table 9 suggest that in general holdings of pension funds and insurance companies are associated with lower ratings, smaller GDP size and higher debt burden. In Core Eurozone, notably France, falling exposure to domestic debt is significantly correlated with worsening public finances. In general higher holdings of pension and insurance funds, due to their buy-and-hold approach, are associated with lower market liquidity. Interestingly, presence of insurance and pension funds is associated with higher yields in the Eurozone and safe havens, and lower yields in emerging economies, which is visible in Figure 39. Finally, in the Eurozone and emerging economies their participation tends to fall under rising risk aversion.

Robustness Checks. Table 10 shows that in emerging markets higher participation of pension and insurance funds is associated with lower financial openness and weaker government effectiveness. These results complete the findings concerning negative yields and suggest that pension and insurance funds in emerging world may be subject to either heavy regulation or lack of alternatives due to asset shortages.

v. *Domestic Investment Funds*

Graphical Analysis. Figures 6 to 9 show that domestic investment funds represent the smallest fraction of demand for government debt, usually below 10%. In all Eurozone countries investment funds significantly reduced their exposure to domestic government which is consistent with findings of Santis and Gerard (2006) who showed that since the creation of the monetary zone European investment funds diversified their assets across the region.

Econometric Analysis. Regression results in Table 11 show that investment funds' holdings are associated with smaller economies with better credit ratings and longer maturities. In turn, in Safe Havens and Peripheral Eurozone investment funds are also related to higher debt burdens.

Robustness Checks. Results in Table 12 confirm that, with exception of emerging economies, investment funds tend to increase their exposure when debt becomes less sustainable. Finally, similarly to pension and insurance funds, in emerging economies investment funds purchase domestic debt when exchange-rate adjusted yields are lower than in developed economies and government effectiveness is weaker.

vi. Results Summary

Following table presents the interpretation of results in context of the previously set hypothesis.

Nb.	Hypothesis	Results	Explanation
1	<i>Non-resident investors may be discriminated in case of an external default and are more likely to be driven by credit risk than domestic investors</i>	Unclear	Private non-resident holdings are positively related to external debt in the core eurozone and negatively in emerging economies.
2	<i>Regulated or repressed domestic investors are forced to increase their holdings when the real interest rate falls</i>	Partly Confirmed	In Emerging Economies pension and insurance funds as well as investment funds purchase domestic government debt even if interest rates are lower than abroad.
3	<i>High participation of banks in government financing results in higher country riskiness. If foreign investors are conscious of potential banking crisis should avoid investing in countries with high credit growth</i>	Partly Confirmed	Foreign participation is significantly associated with credit growth. Private non-resident holdings are negatively related to credit-intensive economies while foreign central banks are more likely to increase exposure when credit growth picks up.
4	<i>Rise in the uncollateralized lending rate, proxied by spread between Libor and Treasury Bill rates, should push banks to shift to collateralized lending and purchase short-term government debt</i>	Unclear	Interbank lending rate is significantly related to demand from domestic banks; however the relationship is negative in Eurozone Periphery and positive in Safe Havens. Only in Safe Havens foreign private investors is significantly related to the interbank market rate.
5	<i>Banks willing to obtain funding from the central bank need to deposit collateral, hence bank' holdings of government debt should vary with the demand for liquidity.</i>	Rejected	Bank borrowing from the ECB is not related to demand for government debt.
6	<i>In Safe Haven countries and the Core Eurozone, private investors are likely to be driven by returns in normal times and rebalance towards safety and liquidity under financial distress</i>	Partly Confirmed	Prior to the crisis rising risk aversion pushed institutional foreign investors to purchase bonds issued by Safe Haven and Eurozone countries, whereas from 2008 onwards rising risk aversion pushed investors to buy Safe Haven assets and sell bonds issued by both core and peripheral Eurozone. Evidence for interest rates is not conclusive.
7	<i>Foreign central banks are likely to seek safety, liquidity and exchange rate stability</i>	Partly Confirmed	Foreign central banks' exposure is positively associated with credit ratings, GDP growth and government effectiveness on one hand, and with current account deficits on the other hand. There is no clear evidence to the liquidity argument. More importantly, evidence shows that foreign central banks are driven by global market risk aversion.
8	<i>Domestic investors are likely to hold more domestic bonds in countries prone to asset shortages, i.e. where level of development, market capitalization and financial openness is lower</i>	Partly Confirmed	Financial openness has a significant and positive impact on share of foreign holdings in emerging economies, impact on individual domestic investors is unclear

Nb.	<i>Hypothesis</i>	Results	Explanation
9	<i>Sensitivity to potential returns depends not only on the type of international investor, but also on the riskiness of the destination country</i>	Confirmed	Share of institutional non-resident investors is positively associated with higher interest rates spreads in Periphery Eurozone and Emerging Economies and lower in Core Eurozone countries.
10	<i>Both local and global factors influence demand for government bonds hence investors with global exposure should react to changes in both local and international rates</i>	N/A	Not tested explicitly
11	<i>At higher commercial lending rates banks are less inclined to hold government debt. Under crowding out banks' holdings of government debt are also associated with lower GDP growth.</i>	Partly Confirmed	In general bank holdings of government debt are negatively associated with GDP growth
12	<i>Foreign investors are more likely to be driven by market sentiment than domestic institutions</i>	Confirmed	Both private and official non-official investors are significantly related to global market sentiment. Domestic investors are indifferent except for banks and pension and insurance funds in the Eurozone and investment funds in the Safe Havens.
13	<i>Investors with long-term investment horizon are more likely to follow sustainability indicators such as growth trend, cyclically adjusted primary balances, and presence of fiscal rules</i>	Confirmed	Non-resident institutional investors and domestic banks tend to purchase domestic debt when interest rates at home rise, budget deficits deteriorate and fewer fiscal rules are in place. In turn foreign central banks and domestic investment funds increase their exposure when structural fiscal balances improve, fiscal rules are in place and credit ratings are higher.
14	<i>Non-resident investors should be reluctant to invest in countries under the IMF program</i>	Confirmed	Share of private non-resident investors in emerging economies and official investors in general tends to fall when the country agrees to resort to IMF funding.

VII. Conclusions

Building on a new broad dataset this study aims to explain what factors drive demand for government bonds among different investor groups, namely private and official non-residents, domestic banks, domestic pension funds and insurance companies, domestic investment and mutual funds in developed and emerging countries. Results show that in most countries demand from foreign private investors, non-euro central banks and domestic is rather disconnected from macroeconomic variables and driven mainly by yields, fiscal situation, market sentiment and policy uncertainty.

Private international investors tend to increase their holdings in countries with higher structural fiscal deficits and higher real yields. In the Peripheral Eurozone, private investors' holdings are significantly associated with less sustainable debt, weaker government effectiveness and higher bond yields, while in the core Eurozone they purchase debt only if public finances improve. Interestingly, prior to the crisis rising risk aversion pushed institutional foreign investors to purchase bonds issued by Safe Haven and Eurozone countries, whereas from 2008 onwards rising risk aversion pushed investors to buy Safe Haven assets and sell bonds issued by both core and peripheral Eurozone.

Evidence shows that in general foreign central banks are primarily looking for safety and their holdings tend to increase in countries running prudent fiscal policies, implementing fiscal rules and achieving higher growth rates. Contrarily to private non-residents, purchases by foreign official investors are negatively related to bond yields, though the causality between the demand and yields is not investigated at this stage. Prior to 2008 foreign official holdings would tolerate widening fiscal deficits and buy more debt issued in the Peripheral Eurozone as long as growth was positive. As the financial crisis escalated foreign central banks suddenly sold bonds of peripheral countries and began to buy Safe Haven and Core Eurozone reaching over 40% of total debt in France and Germany. The sale of peripheral debt, esp. in case of Spain and Ireland, which points towards a significant relationship between foreign central bank holdings and market sentiment.

In general, countries relying to greater extent on bank holdings are confronted with higher real yields, shorter average maturities, lower government effectiveness and lower GDP growth which is consistent with the crowding out effect. On individual country scale, prior to the crisis banks in the Eurozone and Emerging Economies purchased domestic bonds when yields increased and fiscal balance improved. As the uncertainty in economic policy skyrocketed and foreign institutions reduced their exposure, in Eurozone countries domestic banks' participation increased, although domestic debt became less sustainable, real yields increased and the IMF was solicited to step in to provide liquidity. In result the feedback loop between banks and sovereigns tightened which presumably made the situation of banks and sovereigns even more difficult. I find no evidence that the collateral requirement behind the ECB refinancing program significantly pushed banks' demand. This shows that stability of domestic monetary institutions may be crucial in moments of high uncertainty.

Results for emerging economies indicate that demand for debt stemming from pension and investment funds is negatively related to yields and government effectiveness which is consistent with high regulation and limited availability of domestic assets. Last but not least, rising financial openness observed in emerging economies in recent years is significantly connected with higher participation of foreign private investors and lower of domestic pension and insurance companies and investment funds. From a policy perspective, better statistical reporting and monitoring of holders of government debt will become increasingly important for financial stability. Timely and consistent statistical coverage as well as coherent and universal framework capturing different investor classes is fundamental for efficient risk monitoring. Also, to follow the pace of advancing financial integration, risk monitoring should increasingly focus on the structure of non-resident holdings and hence global cooperation between individual authorities is essential.

Academic research encompassing domestic and foreign debt holdings has been very limited until now leaving broad scope for further research. Potential research direction could focus on reaction of global or trans-regional factors on different investor groups in countries with different degree of financial integration, for instance impact of the Eurozone crisis on holdings in emerging market economies. Further unexplored fields include the short-term causality between credit risk, yields and investor classes seen at different levels of maturity.

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Tables

Table 1 Holdings of Government Debt Across Countries as of End 2011

	Private Non-residents	Official Non-residents	Banks	Investment Funds	Pension and Insurance Funds	General Government	Central Bank	Households and Enterprises
Developed Economies								
Denmark	0.20	0.16	0.12	-	0.40	0.11	-	0.01
Iceland	0.24	-	0.35	0.13	0.21	-	-	0.02
Israel	0.10	-	0.22	0.16	0.46	-	0.05	-
Emerging Asia								
India	0.01	-	0.42	0.11	0.24	0.08	0.14	-
Indonesia	0.33	-	0.40	0.07	0.19	-	0.01	-
Malaysia	0.38	-	0.15	-	0.42	0.04	0.01	-
Thailand	0.15	-	0.20	-	0.34	0.17	0.10	0.02
Emerging Europe								
Bulgaria	0.01	-	0.55	0.22	0.22	-	-	-
Czech Republic	0.14	-	0.42	0.03	0.26	0.08	0.02	0.02
Hungary	0.35	-	0.32	0.05	0.16	0.01	0.02	0.08
Latvia	0.04	-	0.76	-	-	0.20	-	0.00
Poland	0.31	0.00	0.23	0.07	0.37	-	-	0.02
Turkey	0.17	-	0.57	0.04	-	-	0.02	0.02
Emerging Latin America								
Brazil	0.12	-	0.33	0.26	0.20	0.09	-	-
Mexico	0.36	0.00	0.13	0.17	0.34	-	-	-
Peru	0.46	-	0.11	0.02	0.39	0.03	-	0.00
South Africa	-	-	0.54	-	0.44	-	0.02	-
Eurozone Core								
France	0.28	0.34	0.14	0.03	0.20	-	-	-
Germany	0.52	0.39	0.02	0.05	0.01	-	-	0.02
Netherlands	0.35	0.30	0.09	0.03	0.22	-	-	0.01
Eurozone Periphery								
Greece	0.60	-	0.26	-	-	0.11	-	0.01
Ireland	0.33	0.12	0.18	0.01	0.01	0.01	0.33	0.00
Italy	0.53	0.03	0.22	0.05	-	-	0.16	-
Portugal	0.54	0.06	-	-	-	-	0.40	-
Spain	0.39	0.06	0.12	0.06	0.10	0.12	0.10	0.01
Safe Havens								
Japan	0.08	0.00	0.38	0.04	0.21	0.10	0.10	0.08
UK	0.21	0.11	0.10	0.09	0.24	0.00	0.21	0.03
US	0.19	0.16	0.02	0.06	0.07	0.38	0.12	0.01

Note: Data as of 2011 for all countries except of France and Latvia where it is reported as of 2010. Data has been collected from national sources except for official non-resident holdings that are provided by the IMF within the CPIS framework.

Table 2 Information on the Dataset

Region	Country	Frequency	Data Availability	Maturity	Form and Valuation	Coverage	Source
Eurozone Core	France	Monthly	10/1999 - 11/2011	Government bonds	Stocks, N/A	N/A	All data has been provided by national sources. Please email the author for detailed information.
	Germany	Quarterly	12/1999 - 03/2012	Bills and bonds	Stocks, nominal value	Central Government	
Eurozone Periphery	Greece	Quarterly	12/1997 - 03/2012	Bills and bonds	Stocks, nominal value	Central Government	
	Ireland	Monthly	09/2001 - 04/2012	Only government and central bank bonds	Stocks, nominal value	Central Government	
	Italy	Monthly	01/1997 - 02/2012	1. Bills, 2. Bonds, 3. Zero Coupon Bonds, 4. Variable rate treasury credit certificates	Stocks, market value	Central Government	
	Portugal	Quarterly	12/2007 - 04/2012	Bills and bonds	Stocks, market value	Central Government	
	Spain	Monthly	12/1996 - 04/2012	Bills and bonds	Stocks, nominal value	N/A	
	Denmark	Monthly	12/1999 - 04/2012	1. Bills and bonds 2. Bills, bonds 1y to 5y, 5 to 10y	Stocks, market value	Federal Government	
Safe Havens	Japan	Quarterly	12/1997 - 03/2012	Bills and bonds	Stocks, market value	Central Government	
	UK	Quarterly	03/1987 - 12/2011	Bills and bonds	N/A	Tradable Government Securities	
	US	Quarterly	03/2001 - 12/2011	Total marketable debt	Stocks, nominal value	Central Government	

Table 2 Information on the Dataset, continued

Region	Country	Frequency	Data Availability	Maturity	Form and Valuation	Coverage	Source
Emerging Economies	Indonesia	Monthly	05/1999 - 06/2012	Total marketable debt	Stocks, market value	Central Government	All data has been provided by national sources. Please email the author for detailed information.
	Malaysia	Quarterly	03/1996 - 03/2012	Bills and bonds	N/A	N/A	
	Czech Republic	Monthly	12/1996 - 03/2012	1. Bills and bonds 2. By maturity: T-bills to 50y bonds	Stocks, nominal value	Central Government	
	Hungary	Quarterly	12/1997 - 12/2012	Bills and bonds	Stocks, N/A	Federal Government	
	Poland	Monthly	01/1996 - 04/2012	1. Bills and bonds 2. By instrument, i.e. year of maturity	Stocks, market value	Central Government	
	Mexico	Monthly	01/1999 - 06/2012	Bills and bonds	Stocks, nominal value	Central Government	

Table 3 Determinants of Government Bondholdings. Dependent variable: Private Non-Resident Investors

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Structural Primary Fiscal Balance / GDP	-0.49** (0.20)	-0.43** (0.21)	-0.93*** (0.26)	-0.67** (0.28)	3.30*** (0.61)	4.01*** (0.52)	0.11 (0.08)	-0.00 (0.11)	0.09 (0.28)	0.56 (0.35)
Debt / GDP	-0.23*** (0.07)	-0.23*** (0.07)	-1.07*** (0.32)	-0.56** (0.26)	-0.20 (0.40)	-0.33 (0.41)	-0.12*** (0.03)	-0.13*** (0.02)	-0.60** (0.29)	-0.62** (0.28)
Wght-Av. Debt Maturity	0.02* (0.01)	0.02* (0.01)	0.08*** (0.01)	0.07*** (0.01)	0.07 (0.04)	0.04 (0.04)	-0.02** (0.01)	-0.02** (0.01)	-0.01 (0.01)	-0.01 (0.01)
Credit to Private Sector / GDP	-0.14*** (0.03)	-0.13*** (0.03)	-0.13*** (0.04)	-0.12*** (0.03)	0.26*** (0.08)	0.28*** (0.08)	0.05** (0.02)	0.04* (0.02)	-0.10 (0.11)	-0.04 (0.09)
Risk Aversion Index	-0.01*** (0.00)	-0.01*** (0.00)	-0.03*** (0.00)	-0.03*** (0.01)	-0.01 (0.01)	-0.01 (0.01)	0.01** (0.00)	0.01*** (0.00)	-0.01** (0.00)	-0.01* (0.00)
Real Yield Differential	0.84*** (0.15)	0.81*** (0.23)	1.84*** (0.42)	2.61*** (0.34)	0.04 (0.55)	-0.30 (0.61)	-0.29 (0.44)	-0.23 (0.45)	-0.01 (0.15)	0.13 (0.18)
Fitch Long-Term Credit Rating	0.03 (0.03)	0.03 (0.03)	0.03 (0.15)	-0.61** (0.28)	-1.54*** (0.26)	0.00 (.)	0.06*** (0.01)	0.06*** (0.01)	0.13 (0.20)	0.08 (0.20)
GDP Size	0.21*** (0.02)	0.21*** (0.02)	0.21*** (0.06)	0.16*** (0.05)	0.19** (0.07)	0.25*** (0.09)	0.19*** (0.03)	0.18*** (0.03)	0.32*** (0.08)	0.32*** (0.08)
GDP Growth YoY	-0.03 (0.05)	-0.02 (0.06)	-0.19*** (0.05)	-0.06 (0.06)	0.46 (0.27)	0.52 (0.33)	0.13 (0.10)	0.17** (0.07)	0.29*** (0.09)	0.17** (0.07)
Current Account Balance / GDP		0.02 (0.14)		0.11 (0.36)		-0.75* (0.42)		-0.47* (0.26)		-0.10 (0.32)
IMF Loans / GDP		-0.03 (0.30)		-2.54 (2.02)		0.00 (.)		0.00 (.)		-0.80** (0.37)
Average Bid-Ask Spread		0.04 (0.06)		-0.07 (0.11)		0.73 (1.23)		0.01 (0.66)		-0.40** (0.17)
R-squared	0.38	0.38	0.72	0.77	0.73	0.74	0.62	0.63	0.51	0.55
Nb of Observations	549.00	545.00	154.00	150.00	77.00	77.00	147.00	147.00	171.00	171.00
Nb of Countries	16.00	16.00	4.00	4.00	2.00	2.00	4.00	4.00	6.00	6.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Risk Aversion is measured using Citi Global Risk Aversion Macro Index where rising index values indicate higher aversion to risky assets 2. Real Yield Differential refers to the difference between 10-year government bond yields in the target country and the US adjusted for respective inflation rates in both countries 3. GDP Size is calculated as natural logarithm of GDP in USD.

Table 4 Determinants of Government Bondholdings. Dependent variable: Private Non-Resident Investors

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Debt Sustainability	0.18 (0.15)	0.69** (0.33)	0.43 (0.35)	0.33 (0.50)	2.72*** (0.83)	3.36*** (1.08)	0.25 (0.40)	0.26 (0.35)	0.60* (0.30)	0.39* (0.22)
Total External Debt / GDP	-0.02 (0.03)	0.03 (0.03)	-0.27*** (0.10)	-0.18** (0.08)	0.34*** (0.09)	0.41*** (0.05)	0.04 (0.03)	0.06** (0.02)	-0.09*** (0.03)	-0.10*** (0.02)
Total Outstanding Government Debt	0.10*** (0.02)	0.13*** (0.02)	0.25*** (0.08)	0.37*** (0.09)	-0.13* (0.07)	-0.18*** (0.06)	0.03 (0.04)	-0.03 (0.04)	0.10*** (0.03)	0.02 (0.02)
Government Effectiveness	-0.09 (0.07)	-0.17** (0.07)	-0.99*** (0.22)	-0.79** (0.30)	1.65 (1.01)	0.15 (0.64)	-0.64 (0.57)	-0.02 (0.40)	0.57** (0.25)	-0.16 (0.24)
REER-adj Real Yield Differential	0.09* (0.05)	0.06 (0.05)	0.75** (0.34)	0.22 (0.34)	-0.45 (0.28)	-0.70*** (0.23)	0.08 (0.08)	0.22 (0.13)	0.15* (0.08)	0.17*** (0.06)
Inflation (CPI)	-0.27 (0.18)	-1.11** (0.49)	-0.67 (0.46)	0.33 (1.06)	-2.87* (1.46)	-2.35** (0.92)	-0.04 (0.76)	0.87 (0.97)	-0.38 (0.28)	0.07 (0.21)
European Policy Uncertainty	-0.02** (0.01)	-0.02 (0.01)	-0.04* (0.02)	-0.06*** (0.02)	-0.07*** (0.02)	-0.05* (0.02)	-0.01 (0.01)	-0.03*** (0.01)	0.00 (0.02)	-0.00 (0.01)
Number of Fiscal Rules		-0.06*** (0.01)		-0.23*** (0.04)		0.03 (0.02)		-0.00 (0.01)		-0.02** (0.01)
Market Capitalization / GDP		2.01*** (0.54)		-0.67 (0.74)		-0.16 (1.28)		1.71* (0.86)		0.54* (0.30)
Domestic Interbank - Bill Rate		0.00 (0.01)		-0.03 (0.05)		-0.00 (0.01)		0.04** (0.02)		-0.01 (0.01)
Financial Openness		0.21 (0.19)		-0.19 (0.45)		1.03** (0.50)		0.21 (0.28)		0.59*** (0.13)
R-squared	0.13	0.19	0.24	0.65	0.56	0.86	0.27	0.64	0.31	0.45
Nb of Observations	511.00	347.00	142.00	114.00	76.00	62.00	139.00	84.00	154.00	87.00
Nb of Countries	16.00	14.00	4.00	4.00	2.00	2.00	4.00	3.00	6.00	5.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Government total debt is calculated as natural logarithm of domestic and international Debt in USD 2. Exchange Rate Stability and Government Effectiveness are indices measured between minimum score of 0 and maximum of 1. 3. Total Banking Refinancing at the ECB refers to total amount of refinancing provided to banks against collateral in all euro-zone countries

Table 5 Determinants of Government Bondholdings. Dependent variable: Official Non-resident Investors

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Structural Primary Fiscal Balance / GDP	0.53** (0.20)	0.58*** (0.19)	0.96*** (0.24)	0.78*** (0.27)	-2.58*** (0.58)	-3.67*** (0.65)	-0.31*** (0.04)	-0.26*** (0.06)	-0.05** (0.02)	-0.04 (0.02)
Debt / GDP	0.00 (0.02)	-0.01 (0.03)	2.12*** (0.36)	2.07*** (0.32)	-0.53 (0.33)	-0.08 (0.29)	0.00 (0.01)	0.01 (0.01)	0.04*** (0.01)	0.03** (0.01)
Wght-Av. Debt Maturity	-0.02* (0.01)	-0.02** (0.01)	-0.05*** (0.01)	-0.05*** (0.02)	-0.04 (0.03)	0.02 (0.05)	0.01** (0.00)	0.01* (0.00)	0.00** (0.00)	0.00*** (0.00)
Credit to Private Sector / GDP	0.14*** (0.03)	0.13*** (0.02)	0.13*** (0.03)	0.12*** (0.03)	-0.22** (0.08)	-0.24*** (0.08)	-0.03*** (0.01)	-0.03*** (0.01)	-0.02** (0.01)	-0.02** (0.01)
Risk Aversion Index	0.01*** (0.00)	0.01*** (0.00)	0.04*** (0.00)	0.03*** (0.01)	0.01 (0.01)	0.01 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.00** (0.00)	-0.00** (0.00)
Real Yield Differential	-0.74*** (0.17)	-0.55*** (0.20)	-2.75*** (0.48)	-2.85*** (0.56)	-1.58*** (0.39)	-1.05*** (0.34)	-0.26* (0.13)	-0.28** (0.14)	0.03* (0.01)	0.03* (0.02)
Fitch Long-Term Credit Rating	0.06** (0.02)	0.05* (0.03)	-0.28** (0.14)	-0.16 (0.15)	-1.09*** (0.17)	0.00 (.)	-0.00 (0.01)	-0.00 (0.01)	-0.03** (0.01)	-0.03** (0.01)
GDP Size	0.05*** (0.01)	0.06*** (0.02)	-0.20* (0.10)	-0.22** (0.09)	0.30*** (0.06)	0.13 (0.09)	0.03* (0.01)	0.03* (0.02)	-0.00 (0.00)	-0.00 (0.00)
GDP Growth YoY	0.11** (0.05)	0.05 (0.05)	0.17*** (0.05)	0.10** (0.05)	-0.41*** (0.15)	-0.39* (0.20)	-0.05 (0.04)	-0.06 (0.04)	-0.01 (0.01)	-0.01 (0.01)
Current Account Balance / GDP		-0.39*** (0.11)		-0.35 (0.32)		0.87 (0.53)		0.18 (0.17)		-0.00 (0.02)
IMF Loans / GDP		-0.45* (0.23)		-0.97 (1.22)		0.00 (.)		0.00 (.)		-0.01 (0.05)
Average Bid-Ask Spread		-0.11 (0.07)		0.18* (0.10)		-2.60* (1.36)		-0.01 (0.27)		-0.00 (0.01)
R-squared	0.31	0.34	0.80	0.80	0.74	0.79	0.53	0.54	0.31	0.32
Nb of Observations	549.00	545.00	154.00	150.00	77.00	77.00	147.00	147.00	171.00	171.00
Nb of Countries	16.00	16.00	4.00	4.00	2.00	2.00	4.00	4.00	6.00	6.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Risk Aversion is measured using Citi Global Risk Aversion Macro Index where rising index values indicate higher aversion to risky assets 2. Real Yield Differential refers to the difference between 10-year government bond yields in the target country and the US adjusted for respective inflation rates in both countries 3. GDP Size is calculated as natural logarithm of GDP in USD

Table 6 Determinants of Government Bondholdings. Dependent variable: Official Non-resident Investors

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Debt Sustainability	0.52** (0.22)	-0.51 (0.36)	0.97*** (0.35)	-0.47 (0.45)	-1.35 (0.81)	-1.19 (0.94)	-0.11 (0.13)	-0.26 (0.20)	-0.06*** (0.02)	0.02 (0.02)
Total External Debt / GDP	0.06*** (0.01)	0.04** (0.02)	0.60*** (0.08)	0.27*** (0.08)	-0.13* (0.07)	-0.17*** (0.05)	0.02** (0.01)	0.00 (0.01)	-0.00 (0.00)	-0.00 (0.00)
Total Outstanding Government Debt	0.00 (0.02)	-0.00 (0.03)	-0.22*** (0.07)	-0.15* (0.09)	0.21*** (0.06)	0.23*** (0.06)	0.02 (0.01)	0.05** (0.02)	0.00** (0.00)	-0.00 (0.00)
Government Effectiveness	0.02 (0.07)	0.25*** (0.09)	1.29*** (0.31)	1.04*** (0.36)	-0.21 (0.81)	1.01** (0.42)	0.38 (0.27)	-0.10 (0.26)	-0.05** (0.02)	-0.03** (0.02)
REER-adj Real Yield Differential	-0.23** (0.09)	-0.27** (0.12)	-1.43*** (0.39)	-1.22*** (0.35)	-0.37 (0.23)	-0.06 (0.17)	-0.14*** (0.03)	-0.20*** (0.05)	-0.01** (0.01)	-0.01 (0.00)
Inflation (CPI)	-0.15 (0.38)	1.30** (0.54)	-0.32 (0.67)	1.95* (1.04)	1.21 (1.24)	0.24 (1.20)	0.13 (0.16)	0.70* (0.36)	-0.00 (0.03)	-0.07** (0.03)
European Policy Uncertainty	0.02 (0.01)	-0.01 (0.01)	0.09** (0.04)	0.06*** (0.01)	0.09*** (0.01)	0.07** (0.03)	0.02** (0.01)	0.01 (0.01)	-0.00*** (0.00)	-0.00 (0.00)
Number of Fiscal Rules		0.05*** (0.01)		0.19*** (0.04)		-0.01 (0.02)		0.02* (0.01)		0.00* (0.00)
Market Capitalization / GDP		-0.82* (0.43)		0.58 (1.04)		-0.28 (0.53)		-0.88* (0.45)		-0.00 (0.03)
Domestic Interbank - Bill Rate		0.02** (0.01)		0.03 (0.05)		0.01 (0.02)		-0.01 (0.01)		0.00** (0.00)
Financial Openness		-0.99*** (0.16)		-0.69 (0.52)		-2.11*** (0.48)		-0.20 (0.24)		0.04*** (0.01)
R-squared	0.15	0.25	0.54	0.78	0.68	0.75	0.50	0.64	0.35	0.68
Nb of Observations	511.00	347.00	142.00	114.00	76.00	62.00	139.00	84.00	154.00	87.00
Nb of Countries	16.00	14.00	4.00	4.00	2.00	2.00	4.00	3.00	6.00	5.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Government total debt is calculated as natural logarithm of domestic and international Debt in USD 2. Exchange Rate Stability and Government Effectiveness are indices measured between minimum score of 0 and maximum of 1. 3. Total Banking Refinancing at the ECB refers to total amount of refinancing provided to banks against collateral in all euro-zone countries

Table 7 Determinants of Government Bondholdings. Dependent variable: Domestic Banks

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Structural Primary Fiscal Balance / GDP	-0.05 (0.13)	-0.55** (0.24)	-0.05 (0.17)	-0.13 (0.19)	-1.44*** (0.32)	-2.06*** (0.59)	-0.62*** (0.22)	-1.20*** (0.16)	-0.45** (0.19)	-0.37 (0.58)
Debt / GDP	-0.13*** (0.05)	-0.18** (0.07)	-0.96*** (0.16)	-1.15*** (0.21)	0.14 (0.19)	-0.27 (0.42)	-0.18*** (0.03)	-0.21*** (0.03)	0.68*** (0.17)	0.78*** (0.18)
Wght-Av. Debt Maturity	-0.01*** (0.00)	-0.02*** (0.01)	-0.00 (0.01)	0.00 (0.01)	-0.05** (0.02)	-0.06** (0.03)	0.00 (0.00)	-0.02*** (0.01)	0.00 (0.01)	-0.02 (0.02)
Credit to Private Sector / GDP	0.04* (0.02)	-0.01 (0.01)	0.09*** (0.02)	0.09*** (0.03)	0.07* (0.04)	0.01 (0.05)	-0.09*** (0.02)	-0.10*** (0.02)	0.16 (0.12)	0.03 (0.10)
Risk Aversion Index	0.00 (0.00)	-0.00 (0.00)	-0.01** (0.00)	-0.01*** (0.00)	0.01 (0.00)	0.00 (0.01)	-0.01*** (0.00)	-0.00 (0.00)	0.01** (0.01)	0.01 (0.01)
Real Yield Differential	0.23 (0.14)	0.03 (0.27)	0.46** (0.19)	0.36 (0.22)	0.01 (0.33)	0.25 (0.51)	-0.18 (0.20)	0.09 (0.12)	-0.04 (0.21)	-0.31 (0.32)
Fitch Long-Term Credit Rating	-0.02 (0.03)	-0.00 (0.02)	-0.02 (0.07)	0.10 (0.11)	0.63*** (0.09)	0.46** (0.20)	0.01 (0.02)	-0.01 (0.02)	-1.08*** (0.11)	-1.16*** (0.13)
GDP Size	-0.11*** (0.02)	-0.07** (0.03)	0.03 (0.04)	0.11** (0.05)	-0.06* (0.03)	0.03 (0.08)	-0.11*** (0.02)	-0.05** (0.02)	-0.35*** (0.05)	-0.28*** (0.06)
GDP Growth YoY	-0.16*** (0.06)	-0.15*** (0.04)	-0.08** (0.04)	-0.06* (0.03)	-0.01 (0.15)	0.03 (0.21)	-0.12 (0.10)	-0.39*** (0.09)	0.33*** (0.11)	0.30 (0.21)
Current Account Balance / GDP		-0.14 (0.16)		0.68*** (0.20)		0.51 (0.35)		0.47 (0.34)		-0.30 (0.37)
IMF Loans / GDP		1.71*** (0.41)		0.00 (.)		0.00 (.)		0.00 (.)		0.56 (0.61)
Average Bid-Ask Spread		0.25 (0.24)		0.20 (0.25)		0.58 (0.57)		-0.58 (0.52)		0.29 (0.25)
R-squared	0.31	0.40	0.55	0.72	0.60	0.73	0.72	0.86	0.71	0.70
Nb of Observations	528.00	403.00	154.00	130.00	77.00	66.00	126.00	78.00	171.00	129.00
Nb of Countries	16.00	15.00	4.00	4.00	2.00	2.00	4.00	3.00	6.00	6.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Risk Aversion is measured using Citi Global Risk Aversion Macro Index where rising index values indicate higher aversion to risky assets 2. Real Yield Differential refers to the difference between 10-year government bond yields in the target country and the US adjusted for respective inflation rates in both countries 3. GDP Size is calculated as natural logarithm of GDP in USD

Table 8 Determinants of Government Bondholdings. Dependent variable: Domestic Banks

Sample of the Estimation	All Countries		Peripheral Eurozone			Core Eurozone			Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Debt Sustainability	-0.22** (0.10)	-0.22** (0.10)	-0.40** (0.18)	-0.35* (0.20)	-0.27** (0.13)	-2.22*** (0.42)	-2.22*** (0.44)	-2.22*** (0.42)	0.08 (0.25)	-0.02 (0.26)	-0.74** (0.33)	-0.74** (0.33)
Total External Debt / GDP	0.03 (0.02)	0.04* (0.02)	-0.11*** (0.02)	-0.12*** (0.03)	-0.09*** (0.01)	-0.12*** (0.04)	-0.13*** (0.04)	-0.12*** (0.04)	-0.10*** (0.02)	-0.11*** (0.02)	0.19*** (0.04)	0.19*** (0.04)
Total Government Debt	-0.05** (0.02)	-0.05** (0.02)	-0.03 (0.03)	-0.02 (0.04)	-0.00 (0.03)	0.09** (0.04)	0.09** (0.04)	0.09** (0.04)	0.12*** (0.02)	0.12*** (0.01)	-0.13*** (0.04)	-0.13*** (0.04)
Government Effectiveness	-0.33*** (0.10)	-0.36*** (0.09)	-0.61*** (0.11)	-0.63*** (0.10)	-0.67*** (0.11)	-0.48 (0.45)	-0.48 (0.45)	-0.46 (0.49)	-0.47* (0.26)	-0.50* (0.27)	-0.32 (0.22)	-0.32 (0.22)
REER-adj Real Yield Diff.	0.03 (0.09)	0.02 (0.09)	0.35*** (0.11)	0.33*** (0.12)	0.36*** (0.09)	0.27*** (0.09)	0.27*** (0.10)	0.27*** (0.09)	0.13* (0.08)	0.14* (0.07)	-0.12 (0.10)	-0.12 (0.10)
Inflation (CPI)	-0.06 (0.22)	0.07 (0.21)	-0.25 (0.23)	-0.31 (0.29)	-0.05 (0.16)	2.31*** (0.48)	2.32*** (0.54)	2.36*** (0.47)	-0.03 (0.52)	0.05 (0.50)	0.66* (0.38)	0.66* (0.38)
European Policy Uncertainty	0.01 (0.01)	0.01 (0.01)	0.01 (0.02)	0.01 (0.02)	0.03* (0.02)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	-0.04*** (0.01)	-0.05*** (0.01)	-0.01 (0.02)	-0.01 (0.02)
Interbank - Bill Rate		-0.03** (0.01)			-0.05*** (0.01)			-0.00 (0.01)		0.01*** (0.00)		
Borrowing from the ECB / Total Bank Assets				0.09 (0.16)			0.05 (0.38)					
R-squared	0.09	0.12	0.47	0.47	0.56	0.53	0.53	0.53	0.49	0.51	0.34	0.34
Nb of Observations	492.00	480.00	142.00	142.00	142.00	76.00	76.00	76.00	120.00	120.00	154.00	154.00
Nb of Countries	16.00	16.00	4.00	4.00	4.00	2.00	2.00	2.00	4.00	4.00	6.00	6.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Risk Aversion is measured using Citi Global Risk Aversion Macro Index where rising index values indicate higher aversion to risky assets 2. Real Yield Differential refers to the difference between 10-year government bond yields in the target country and the US adjusted for respective inflation rates in both countries 3. GDP Size is calculated as natural logarithm of GDP in USD 4. Refinancing at the Central Bank refers to short-term borrowing from the ECB to Total Liabilities

Table 9 Determinants of Government Bondholdings. Dependent variable: Domestic Pension and Insurance Funds

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Structural Primary Fiscal alance / GDP	0.05 (0.12)	0.15 (0.10)	0.09 (0.05)	-0.01 (0.04)	1.79*** (0.16)	1.92*** (0.26)	0.13 (0.56)	0.34 (0.42)	0.48** (0.22)	-0.05 (0.28)
Debt / GDP	0.38*** (0.10)	0.39*** (0.10)	-0.31** (0.12)	-0.29*** (0.09)	-0.07 (0.13)	-0.05 (0.12)	0.37*** (0.12)	0.33*** (0.08)	0.71*** (0.20)	0.75*** (0.19)
Wght-Av. Debt Maturity	0.01 (0.01)	0.01 (0.01)	-0.00 (0.00)	-0.01** (0.00)	-0.03*** (0.01)	-0.04*** (0.01)	0.01 (0.01)	0.01 (0.01)	0.04*** (0.01)	0.04*** (0.01)
Credit to Private Sector / GDP	-0.05*** (0.01)	-0.04** (0.01)	-0.02* (0.01)	-0.02*** (0.01)	-0.09*** (0.02)	-0.09*** (0.02)	-0.09 (0.07)	-0.07 (0.06)	-0.01 (0.06)	-0.04 (0.04)
Risk Aversion Index	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	0.00 (0.01)	-0.00 (0.01)	-0.01*** (0.00)	-0.01* (0.00)
Real Yield Differential	-0.21** (0.10)	-0.20 (0.12)	0.02 (0.08)	0.17** (0.06)	0.73*** (0.19)	0.66** (0.25)	1.42* (0.71)	1.36* (0.71)	-0.63*** (0.10)	-0.66*** (0.12)
Fitch Long-Term Credit Rating	-0.11*** (0.03)	-0.11*** (0.03)	-0.01 (0.03)	-0.05* (0.03)	1.44*** (0.08)	0.00 (.)	-0.07 (0.05)	-0.09** (0.04)	0.14 (0.08)	0.15* (0.09)
GDP Size	-0.06** (0.03)	-0.06** (0.02)	0.05* (0.03)	0.03 (0.02)	-0.11*** (0.02)	-0.11*** (0.03)	0.07 (0.06)	0.03 (0.06)	-0.13** (0.06)	-0.14** (0.05)
GDP Growth YoY	-0.08 (0.08)	-0.07 (0.08)	-0.13** (0.05)	-0.09* (0.05)	0.03 (0.09)	0.06 (0.06)	-0.16 (0.46)	-0.48** (0.23)	-0.01 (0.13)	0.14 (0.13)
Current Account Balance / GDP		0.55** (0.22)		-0.33*** (0.04)		-0.19 (0.30)		1.78** (0.78)		0.53*** (0.18)
IMF Loans / GDP		-0.59*** (0.21)		0.11 (0.24)		0.00 (.)		0.00 (.)		0.22 (0.16)
Average Bid-Ask Spread		0.12*** (0.03)		-0.04** (0.02)		-0.13 (0.53)		3.90** (1.45)		0.16*** (0.06)
R-squared	0.28	0.32	0.62	0.75	0.92	0.92	0.45	0.55	0.56	0.64
Nb of Observations	505.00	501.00	117.00	113.00	77.00	77.00	147.00	147.00	164.00	164.00
Nb of Countries	15.00	15.00	3.00	3.00	2.00	2.00	4.00	4.00	6.00	6.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Risk Aversion is measured using Citi Global Risk Aversion Macro Index where rising index values indicate higher aversion to risky assets 2. Real Yield Differential refers to the difference between 10-year government bond yields in the target country and the US adjusted for respective inflation rates in both countries 3. GDP Size is calculated as natural logarithm of GDP in USD

Table 10 Determinants of Government Bondholdings. Dependent variable: Domestic Pension and Insurance Funds

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Debt Sustainability	-0.05 (0.10)	-0.06 (0.10)	-0.00 (0.07)	0.11 (0.21)	1.43*** (0.27)	1.23*** (0.29)	-1.21* (0.66)	0.01 (0.54)	-0.12 (0.22)	-0.09 (0.22)
Total External Debt / GDP	-0.05*** (0.01)	-0.04*** (0.01)	0.02*** (0.01)	0.03*** (0.01)	-0.10*** (0.02)	-0.04** (0.02)	-0.03 (0.03)	0.06* (0.03)	0.02 (0.02)	0.02 (0.01)
Total Outstanding Government Debt	-0.02 (0.02)	-0.01 (0.02)	-0.03* (0.02)	-0.02 (0.02)	-0.02 (0.03)	-0.03* (0.02)	-0.11*** (0.04)	-0.21*** (0.07)	0.01 (0.02)	0.04*** (0.01)
Government Effectiveness	-0.29*** (0.08)	-0.11 (0.10)	0.12* (0.06)	0.07 (0.06)	0.13 (0.19)	-0.17 (0.10)	2.68*** (0.86)	1.59 (1.16)	-0.83*** (0.11)	-0.44** (0.19)
REER-adj Real Yield Differential	0.01 (0.07)	0.09*** (0.03)	0.10*** (0.03)	0.15*** (0.05)	0.38*** (0.04)	0.30*** (0.06)	0.14 (0.23)	0.11 (0.12)	-0.20*** (0.07)	-0.13*** (0.04)
Inflation (CPI)	-0.05 (0.11)	0.20 (0.16)	-0.08 (0.08)	-0.21 (0.32)	-1.41*** (0.40)	-0.92** (0.37)	-0.13 (1.13)	-1.18 (0.97)	0.35 (0.23)	-0.15 (0.22)
European Policy Uncertainty	-0.01 (0.01)	0.02* (0.01)	-0.00 (0.00)	0.00 (0.01)	-0.03*** (0.01)	-0.01** (0.00)	0.05* (0.03)	0.06* (0.03)	-0.04*** (0.01)	0.00 (0.00)
Number of Fiscal Rules		0.02** (0.01)		-0.01 (0.01)		-0.03** (0.01)		0.05*** (0.02)		0.01* (0.01)
Market Capitalization / GDP		-0.28 (0.36)		0.60*** (0.12)		0.46 (0.30)		-3.59*** (1.27)		0.57 (0.34)
Domestic Interbank - Bill Rate		-0.04*** (0.01)		-0.01 (0.01)		-0.02** (0.01)		-0.07*** (0.02)		-0.01** (0.00)
Financial Openness		0.35*** (0.09)		0.05 (0.14)		0.75*** (0.13)		0.08 (1.03)		-0.19** (0.09)
R-squared	0.09	0.31	0.46	0.47	0.85	0.95	0.30	0.65	0.28	0.75
Nb of Observations	468.00	311.00	106.00	85.00	76.00	62.00	139.00	84.00	147.00	80.00
Nb of Countries	15.00	13.00	3.00	3.00	2.00	2.00	4.00	3.00	6.00	5.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Government total debt is calculated as natural logarithm of domestic and international Debt in USD 2. Exchange Rate Stability and Government Effectiveness are indices measured between minimum score of 0 and maximum of 1. 3. Total Banking Refinancing at the ECB refers to total amount of refinancing provided to banks against collateral in all euro-zone countries

Table 11 Determinants of Government Bondholdings. Dependent variable: Domestic Investment Funds

Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Structural Primary Fiscal Balance / GDP	0.01 (0.07)	-0.10 (0.10)	-0.07 (0.11)	-0.24*** (0.08)	-0.46 (0.31)	0.14 (0.45)	-0.03 (0.14)	0.09 (0.10)	0.12 (0.13)	0.26 (0.16)
Debt / GDP	0.03 (0.03)	0.01 (0.03)	0.67*** (0.17)	0.44** (0.18)	0.46** (0.21)	0.23 (0.15)	0.18*** (0.02)	0.17*** (0.02)	0.19*** (0.07)	0.18*** (0.07)
Wght-Av. Debt Maturity	0.01*** (0.00)	0.01*** (0.00)	0.01 (0.00)	0.00 (0.00)	0.03*** (0.01)	0.00 (0.01)	0.01 (0.00)	0.00 (0.00)	-0.00 (0.01)	-0.01 (0.01)
Credit to Private Sector / GDP	-0.02 (0.01)	-0.03** (0.01)	-0.05*** (0.02)	-0.07*** (0.01)	-0.03 (0.05)	-0.01 (0.04)	0.01 (0.02)	0.01 (0.02)	-0.08*** (0.03)	-0.05** (0.03)
Risk Aversion Index	-0.00 (0.00)	-0.00 (0.00)	0.00* (0.00)	0.00 (0.00)	-0.00 (0.01)	0.00 (0.00)	0.01*** (0.00)	0.01*** (0.00)	-0.00 (0.00)	-0.00 (0.00)
Real Yield Differential	-0.02 (0.05)	-0.17* (0.09)	-0.08 (0.09)	-0.02 (0.09)	0.65*** (0.23)	0.36 (0.25)	-0.25 (0.24)	-0.41 (0.26)	-0.22** (0.09)	-0.17** (0.08)
Fitch Long-Term Credit Rating	0.02 (0.03)	0.17*** (0.04)	-0.07 (0.05)	0.10 (0.07)	1.24*** (0.15)	0.00 (.)	-0.27** (0.10)	-0.12 (0.13)	0.00 (0.04)	-0.03 (0.04)
GDP Size	-0.06*** (0.01)	-0.06*** (0.01)	-0.18*** (0.03)	-0.16*** (0.03)	-0.23*** (0.04)	-0.14*** (0.03)	0.11*** (0.02)	0.11*** (0.02)	-0.05** (0.02)	-0.04** (0.02)
GDP Growth YoY	0.03 (0.05)	0.02 (0.06)	0.09** (0.04)	0.05** (0.03)	0.03 (0.18)	0.03 (0.17)	-0.13 (0.09)	-0.15** (0.07)	0.02 (0.09)	-0.02 (0.09)
Current Account Balance / GDP		-0.17* (0.09)		-0.55*** (0.10)		-0.49* (0.29)		0.70*** (0.19)		-0.07 (0.11)
IMF Loans / GDP		0.62** (0.25)		1.79*** (0.51)		0.00 (.)		0.00 (.)		-0.24* (0.13)
Average Bid-Ask Spread		0.03* (0.02)		-0.10** (0.04)		1.34* (0.66)		0.68** (0.31)		-0.10*** (0.04)
R-squared	0.25	0.29	0.62	0.73	0.81	0.85	0.71	0.77	0.41	0.46
Nb of Observations	485.00	481.00	154.00	150.00	77.00	77.00	110.00	110.00	144.00	144.00
Nb of Countries	14.00	14.00	4.00	4.00	2.00	2.00	3.00	3.00	5.00	5.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Risk Aversion is measured using Citi Global Risk Aversion Macro Index where rising index values indicate higher aversion to risky assets 2. Real Yield Differential refers to the difference between 10-year government bond yields in the target country and the US adjusted for respective inflation rates in both countries 3. GDP Size is calculated as natural logarithm of GDP in USD

Table 12 Determinants of Government Bondholdings. Dependent variable: Domestic Investment Funds

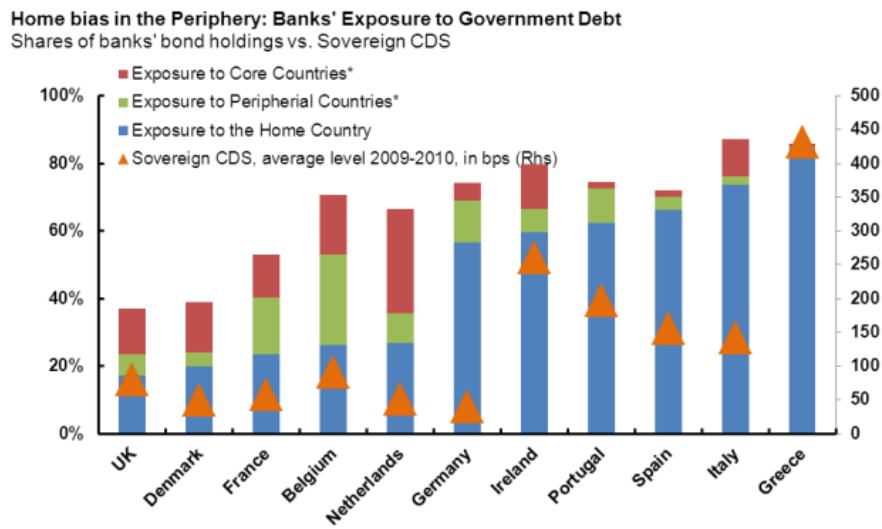
Sample of the Estimation	All Countries		Peripheral Eurozone		Core Eurozone		Safe Havens		Emerging Economies	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Debt Sustainability	-0.12*** (0.04)	-0.17* (0.10)	-0.26*** (0.06)	-0.01 (0.17)	-0.28 (0.24)	-0.28 (0.32)	-0.55* (0.29)	-1.07*** (0.24)	0.30*** (0.07)	0.35*** (0.07)
Total External Debt / GDP	0.03*** (0.01)	0.03* (0.01)	0.06*** (0.02)	0.06** (0.03)	-0.01 (0.02)	0.01 (0.03)	0.06*** (0.02)	0.05 (0.04)	-0.03*** (0.01)	-0.04*** (0.01)
Total Outstanding Government Debt	-0.05*** (0.01)	-0.06*** (0.01)	-0.08*** (0.02)	-0.04 (0.02)	- (0.10***)	- (0.12***)	- (0.07***)	-0.06 (0.05)	-0.01 (0.01)	0.00 (0.01)
Government Effectiveness	0.39*** (0.09)	0.37*** (0.08)	0.57*** (0.10)	0.51*** (0.04)	-0.65** (0.31)	-0.72* (0.36)	0.82*** (0.29)	0.62** (0.24)	-0.03 (0.07)	-0.29** (0.14)
REER-adj Real Yield Differential	0.07 (0.06)	0.04 (0.06)	0.12*** (0.04)	0.10 (0.07)	0.12** (0.06)	0.07 (0.09)	-0.10 (0.09)	0.01 (0.08)	-0.06 (0.04)	-0.04 (0.03)
Inflation (CPI)	0.08 (0.11)	0.20 (0.18)	0.10 (0.10)	-0.05 (0.38)	0.52** (0.25)	0.75 (0.46)	0.37 (0.41)	1.80*** (0.34)	-0.27* (0.13)	-0.49*** (0.07)
European Policy Uncertainty	-0.01 (0.00)	-0.00 (0.01)	-0.02*** (0.01)	-0.01 (0.01)	-0.02** (0.01)	-0.01 (0.01)	0.04** (0.02)	0.01 (0.01)	-0.02*** (0.01)	-0.02*** (0.00)
Number of Fiscal Rules		0.01* (0.00)		-0.02** (0.01)		0.01 (0.01)		0.01** (0.01)		0.00 (0.00)
Market Capitalization / GDP		0.54** (0.25)		0.66 (0.43)		-0.54 (0.53)		0.90** (0.42)		0.69*** (0.18)
Domestic Interbank - Bill Rate		0.00 (0.01)		-0.01 (0.01)		-0.00 (0.02)		0.03** (0.01)		0.01 (0.00)
Financial Openness		0.02 (0.10)		-0.16 (0.14)		1.59*** (0.40)		-0.28 (0.33)		-0.11 (0.07)
R-squared	0.32	0.30	0.70	0.72	0.85	0.82	0.33	0.71	0.40	0.68
Nb of Observations	449.00	312.00	142.00	114.00	76.00	62.00	104.00	56.00	127.00	80.00
Nb of Countries	14.00	13.00	4.00	4.00	2.00	2.00	3.00	2.00	5.00	5.00
Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Wald Test Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Estimates of the constant not presented in the table.

Note: 1. Government total debt is calculated as natural logarithm of domestic and international Debt in USD 2. Exchange Rate Stability and Government Effectiveness are indices measured between minimum score of 0 and maximum of 1. 3. Total Banking Refinancing at the ECB refers to total amount of refinancing provided to banks against collateral in all euro-zone countries

Figures

Figure 1

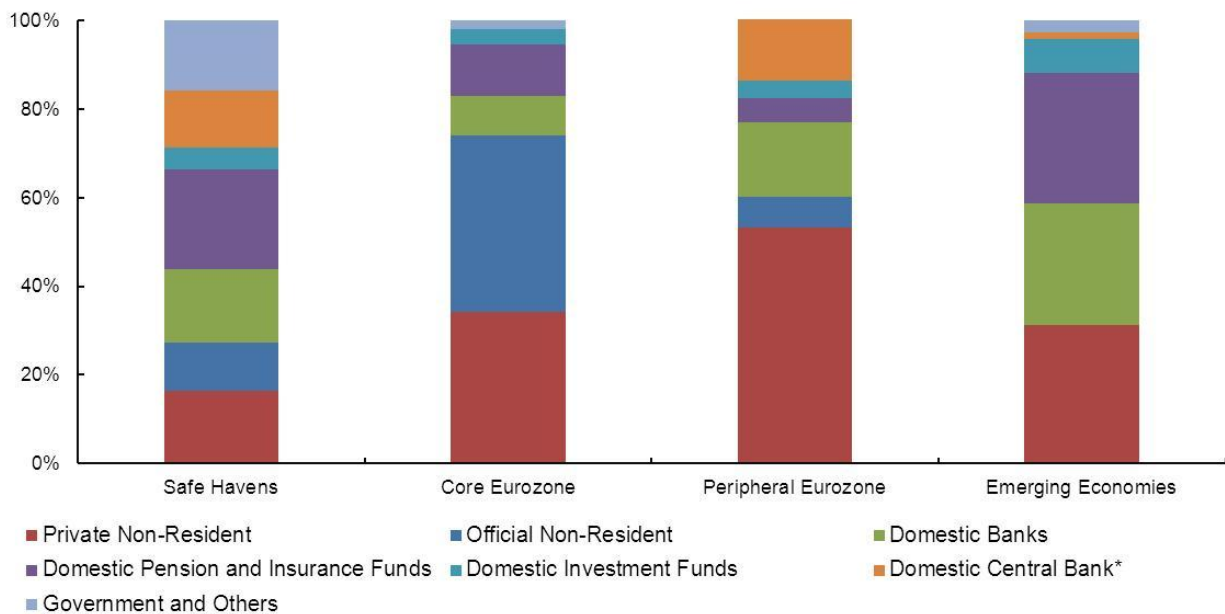


Source: EBA Stress Test 2011, based on 2010 balance sheets data

Figure 2

Investor Base

Unweighted Average Share of debt held by investor class to Total Government Debt as of 2011Q3



Note: *In the Eurozone countries the ECB is considered to be the domestic central bank

Figure 3

Debt Maturity | Proportion of Bills in Total Marketable Outstanding Debt

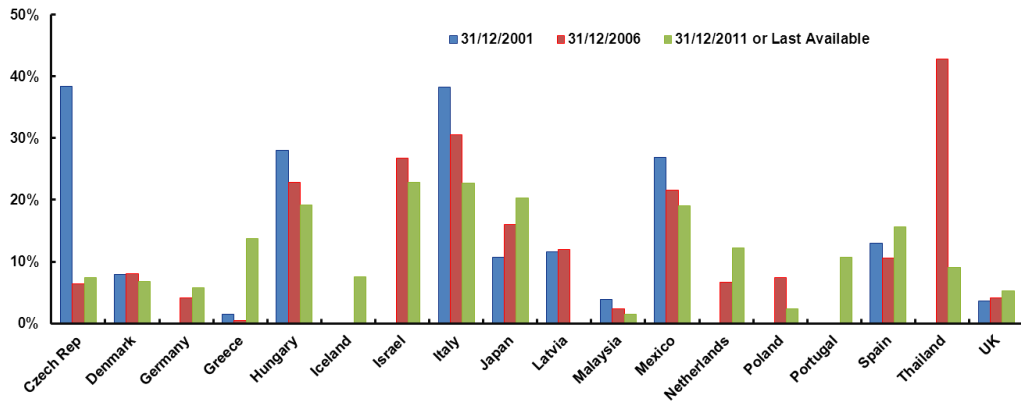


Figure 4

Sovereign Debtholdings by Maturity - Foreign Investor's Share in % of Total Marketable Outstanding Bills per Country

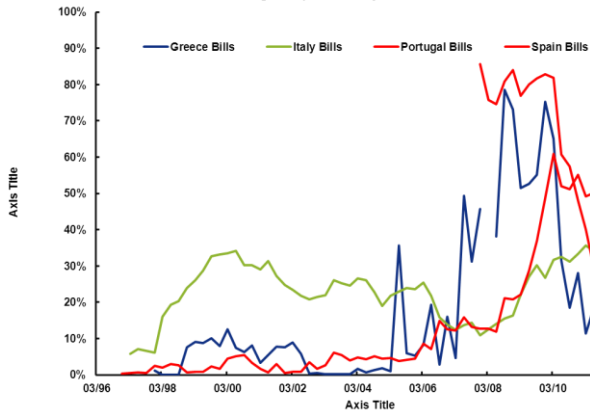
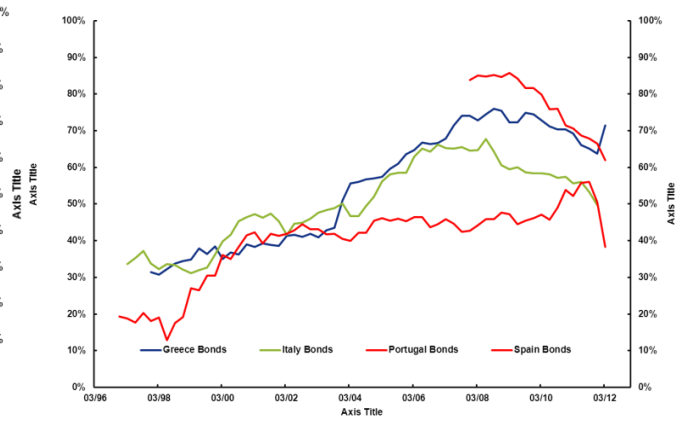


Figure 5

Sovereign Debtholdings - Foreign Investors' Share in % of Total Marketable Outstanding Bonds per Country



Note: Graphs are based on national data for bonds and bills. It is not possible to distinguish between for private and official non-resident holders for bills and bonds as the IMF CPIS does not provide detailed data for reserve holdings by maturity.

Figures 6 to 9 represent the share of Private Non-resident Investors in total debt for different country groups:

Figure 6

Private Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

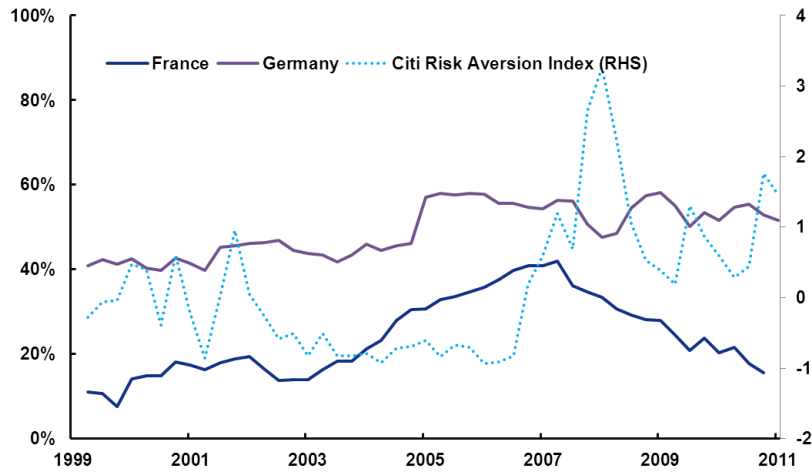


Figure 7

Private Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

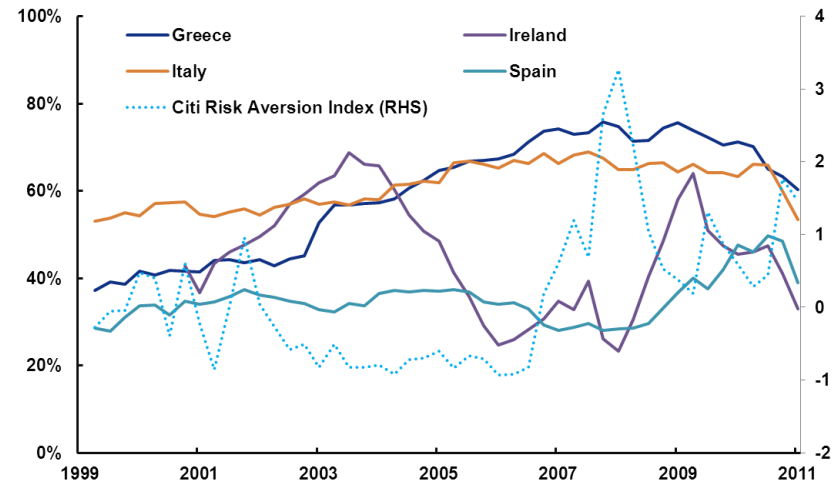


Figure 8

Private Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

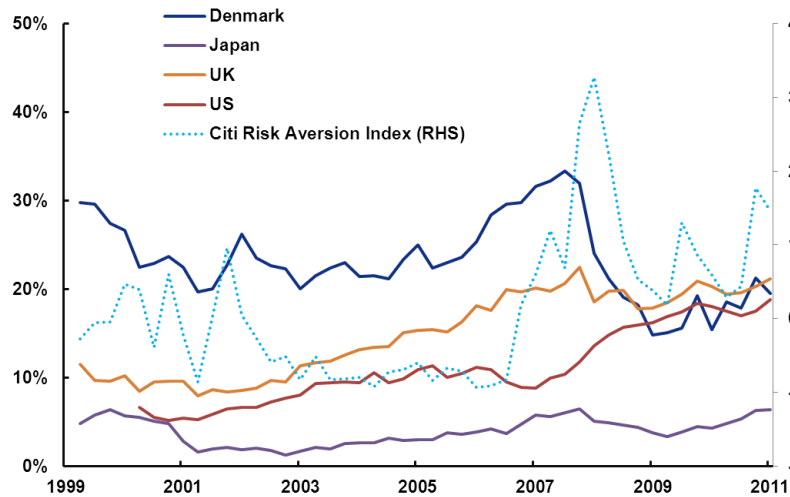
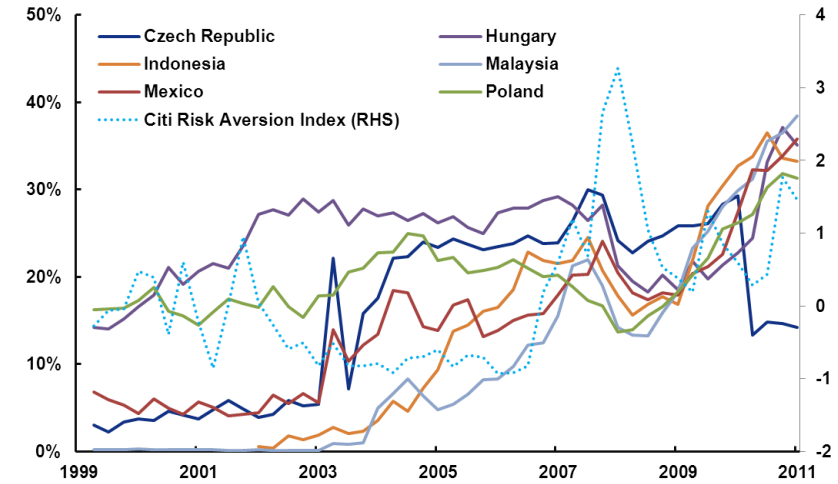


Figure 9

Private Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index



Note: Private non-resident holdings are determined on the basis of total non-resident holdings provided by the national sources adjusted for official non-resident holdings provided in IMF CPIS.

Figures 10 to 12 represent the share of Official Non-resident Investors in total debt for different country groups:

Figure 10

Official Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

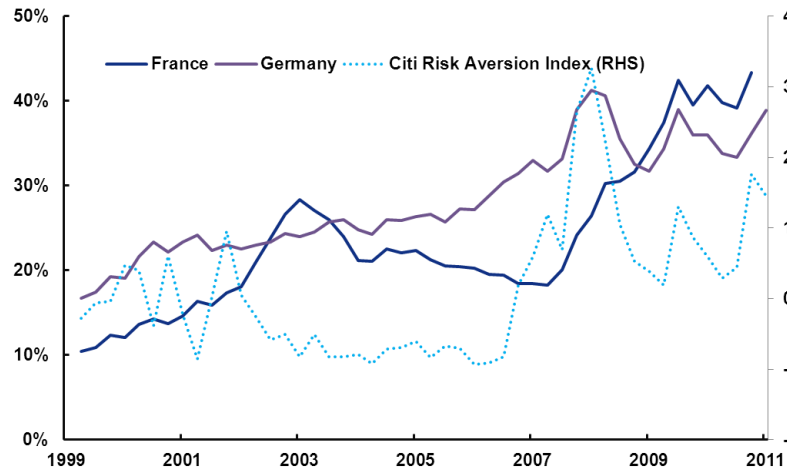


Figure 11

Official Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

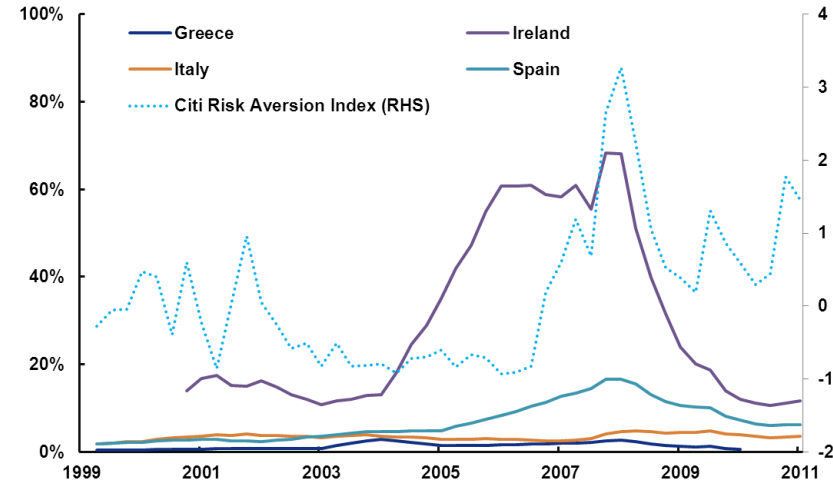
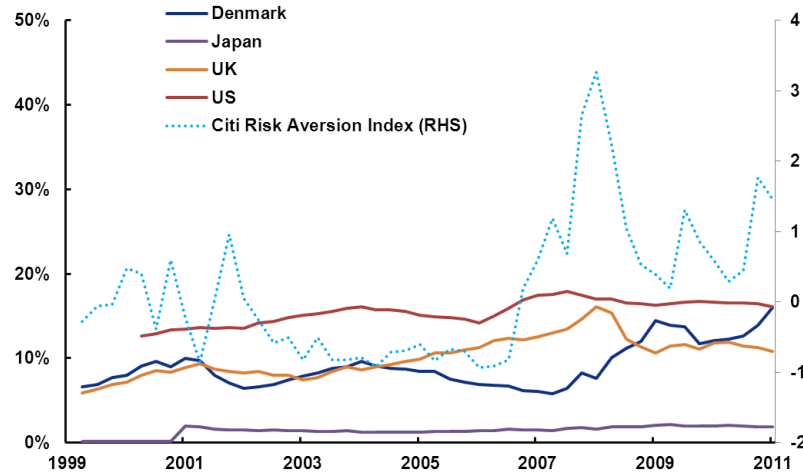


Figure 12

Official Non-Resident Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index



Note: Official non-resident holdings are provided by IMF within the CPIS and recalculated into local currency. In the Eurozone official non-resident holdings exclude bond purchases by the ECB.

Figures 13 to 17 represent the share of Domestic Banks in total debt for different country groups.

Figure 13

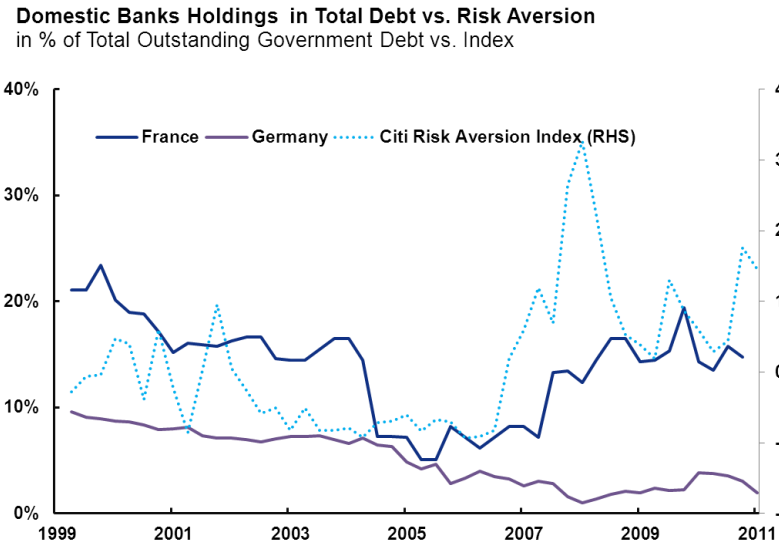


Figure 14

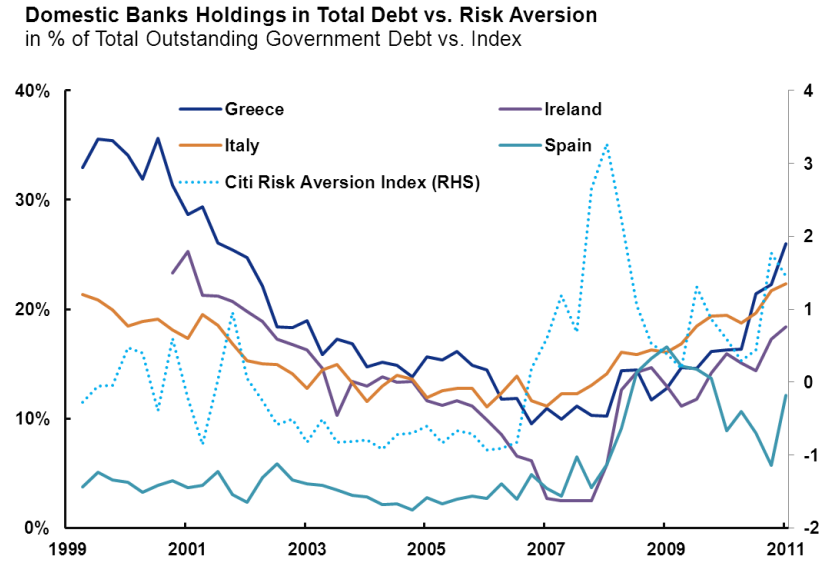


Figure 15

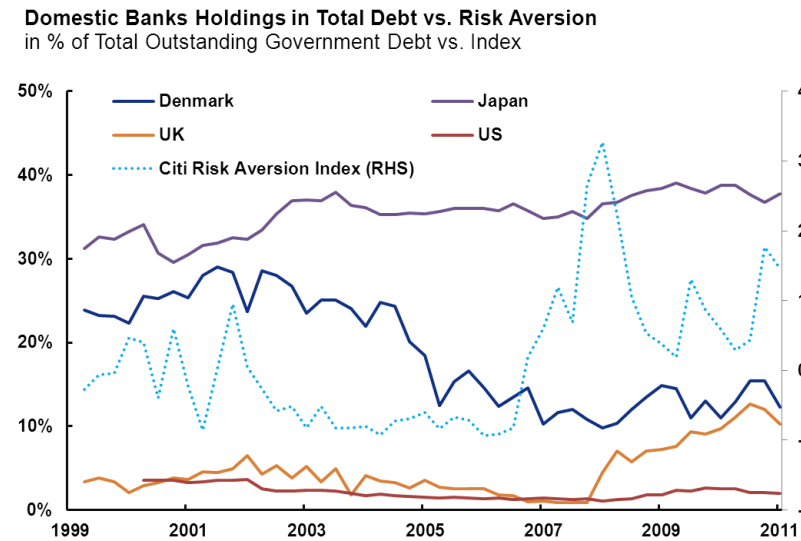
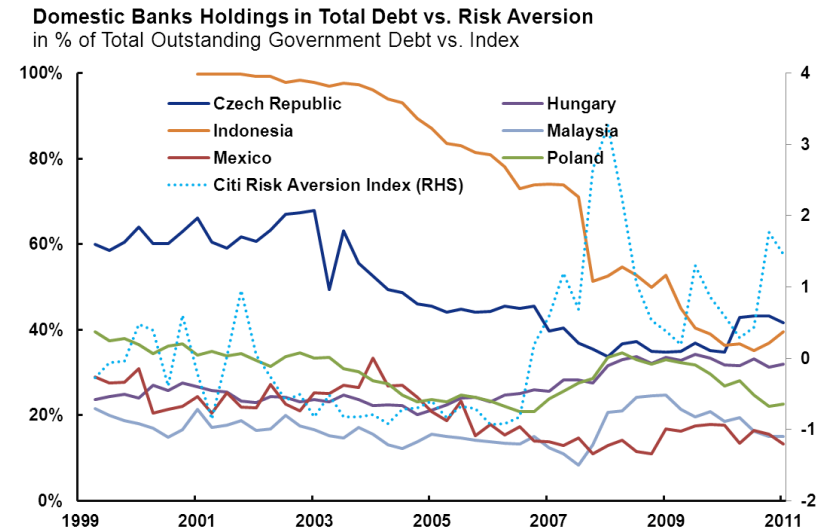


Figure 16



Figures 17 to 20 represent the share of Domestic Pension and Insurance Funds in total debt for different country groups.

Figure 17

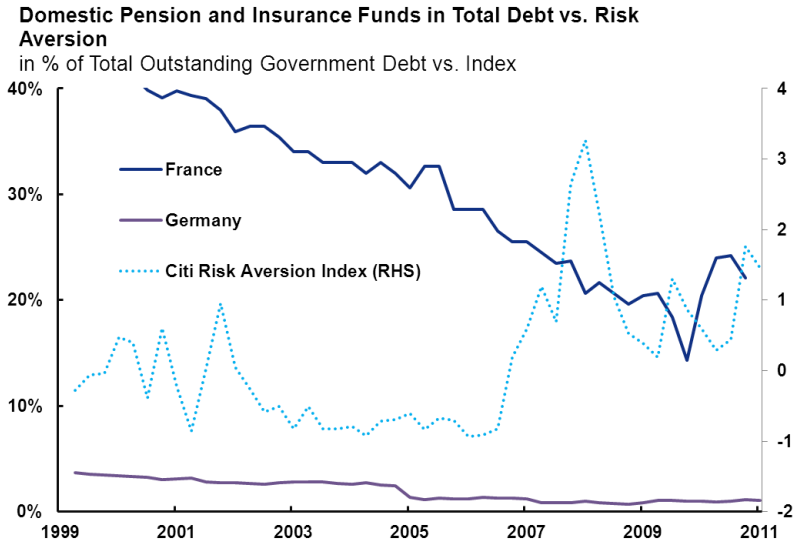


Figure 18

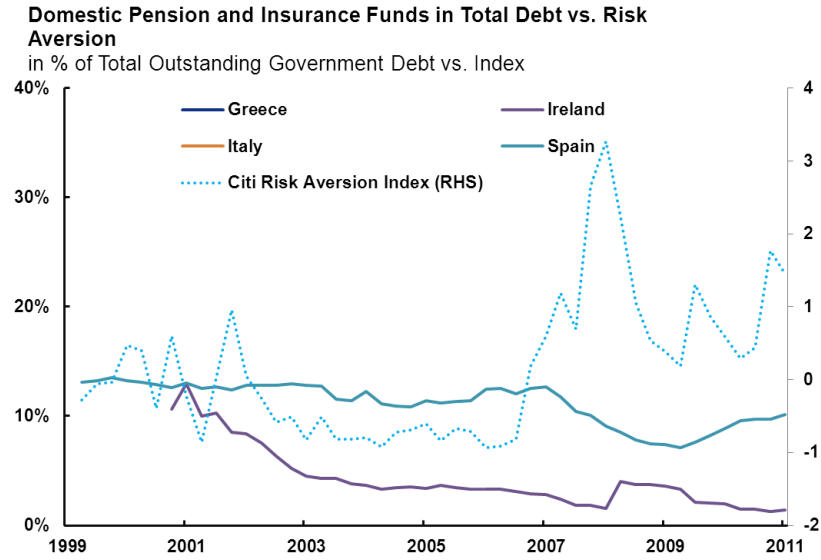


Figure 19

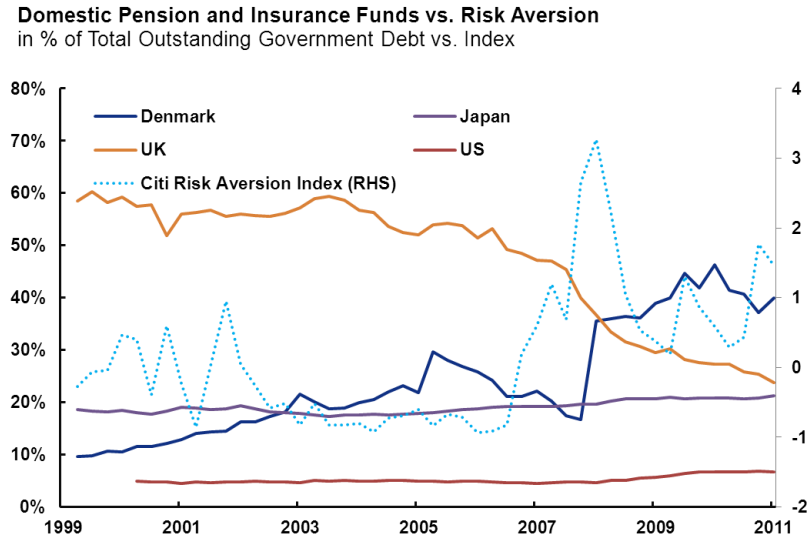
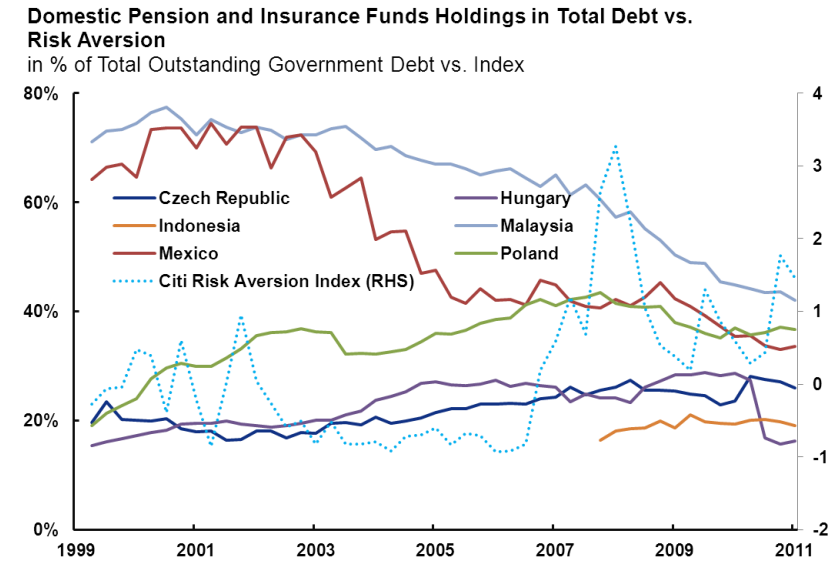


Figure 20



Figures Represent 21 to 24 represent the share of Domestic Investment Funds in total debt for different country groups.

Figure 21

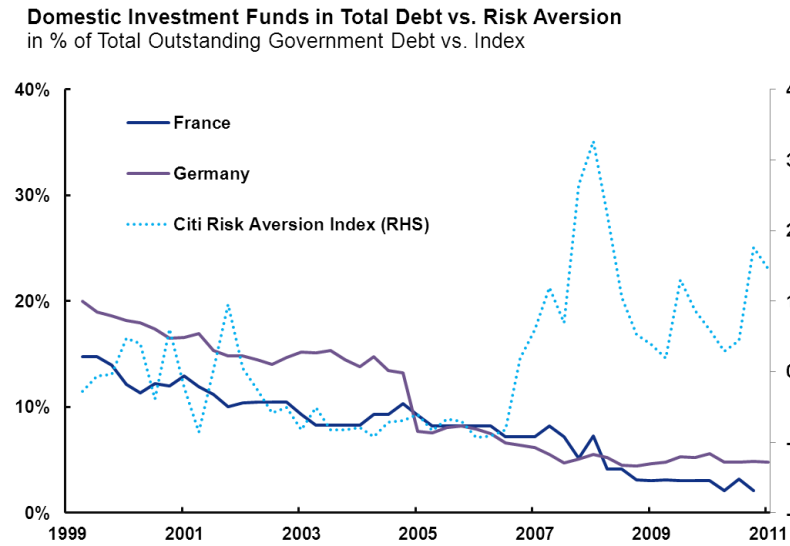


Figure 22

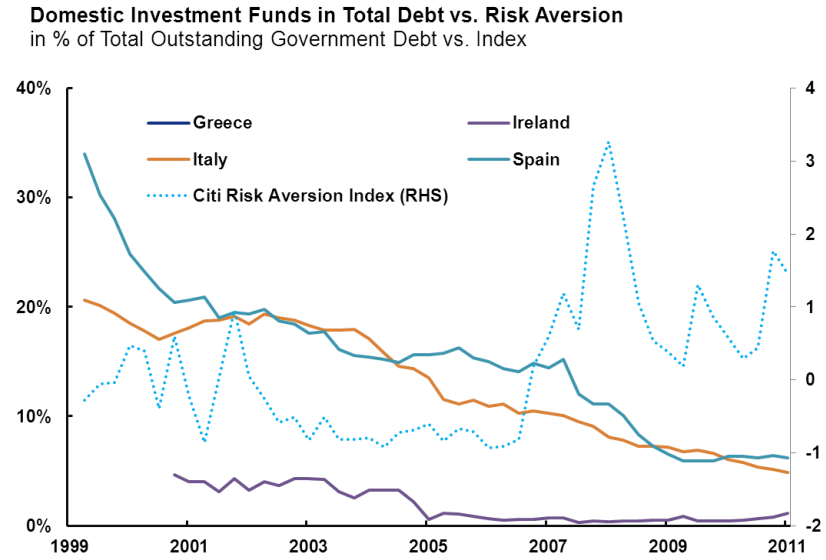


Figure 23

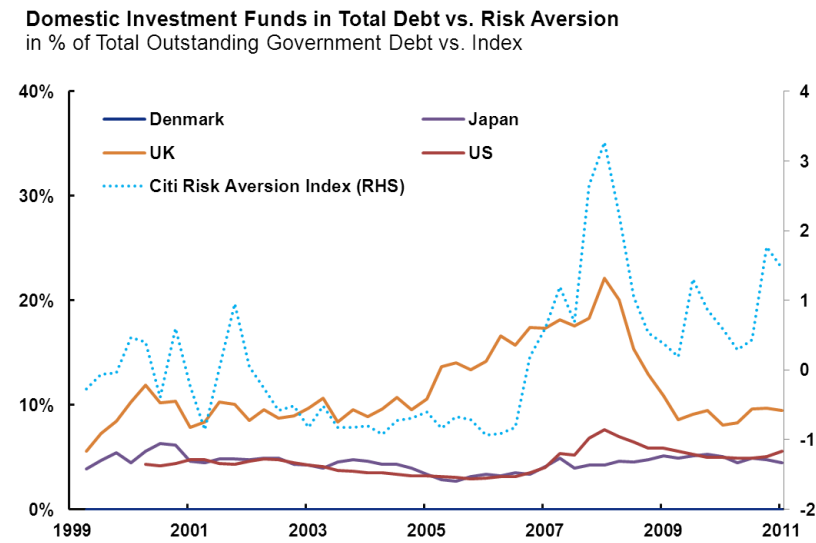
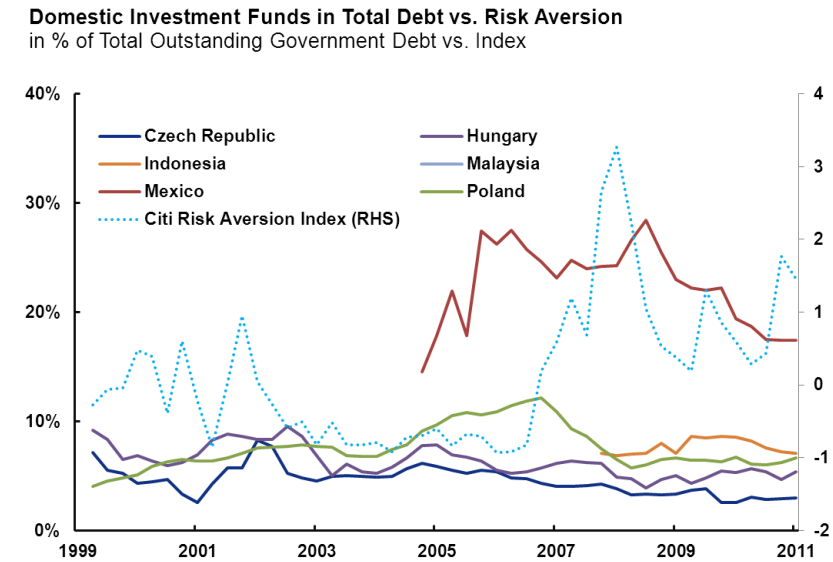


Figure 24



Figures represent 25 to 27 represent the share of Domestic Central Banks in total debt for different country groups.

Figure 25

Estimates of ECB Holdings of Total Government Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

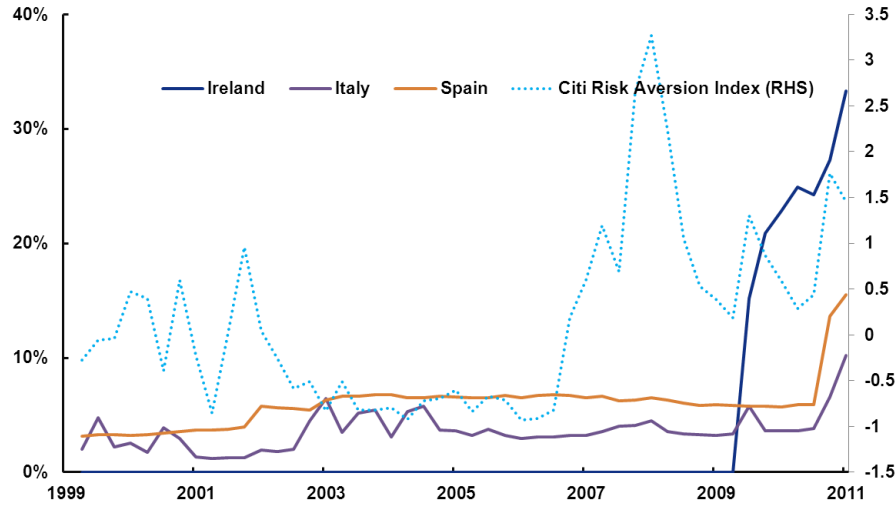


Figure 26

Domestic Investment Funds in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index

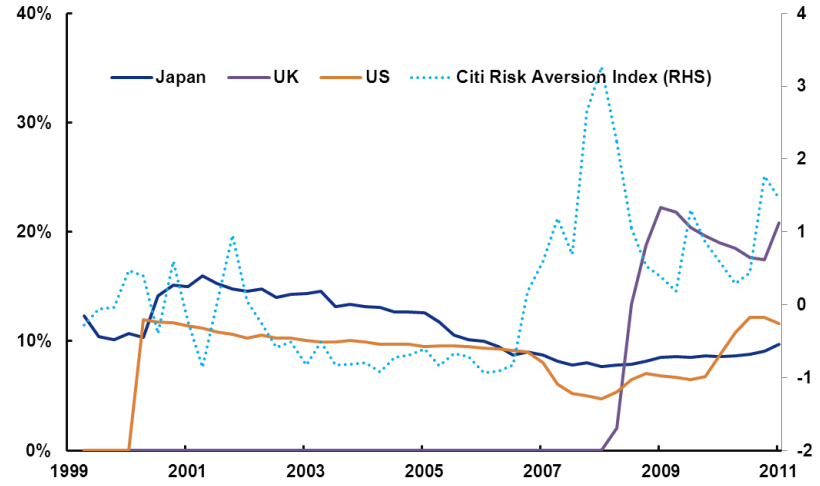
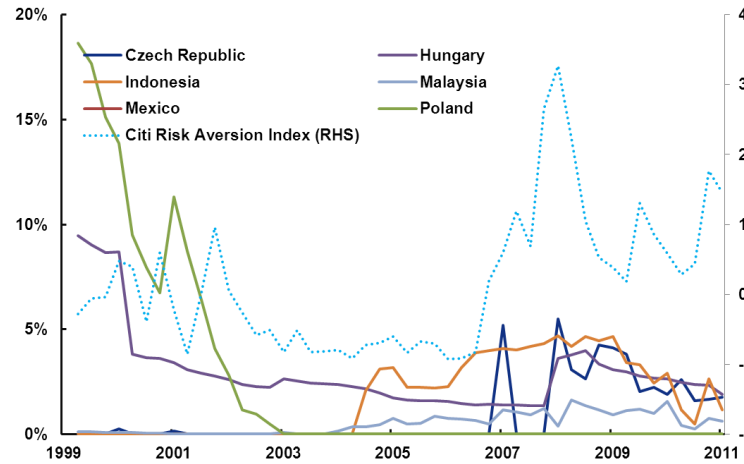


Figure 27

Domestic Central Bank Holdings in Total Debt vs. Risk Aversion
in % of Total Outstanding Government Debt vs. Index



Figures 25 to 27: Determinants of demand from Private Non-resident Investors. Graphs illustrate estimated coefficients obtained under expanding window for multivariate panel regression explained in Eq. 7

Figure 28

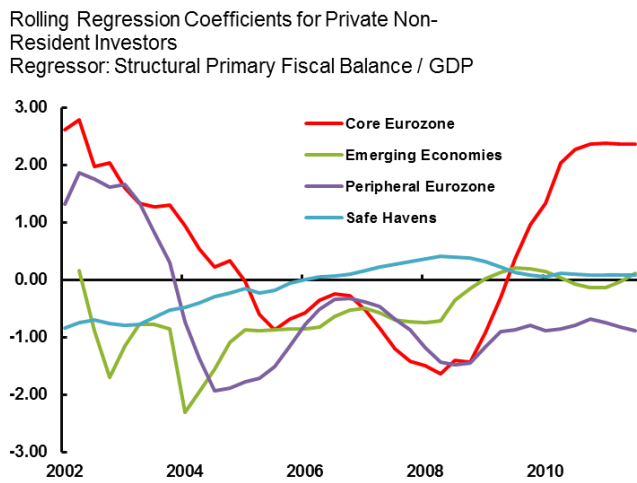


Figure 29

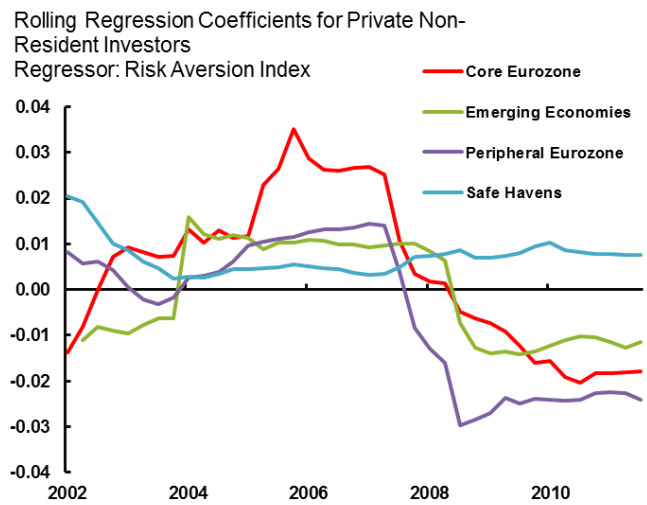
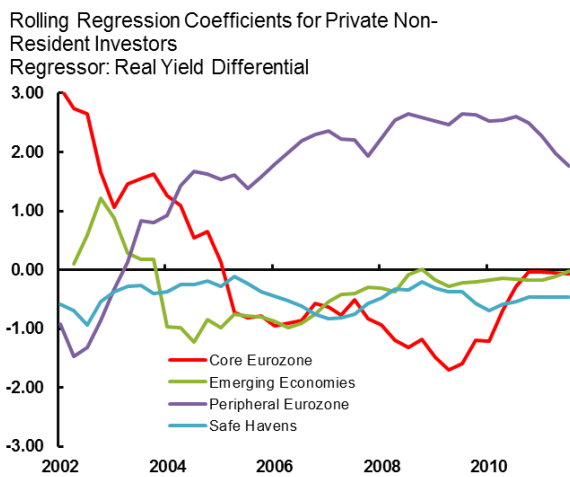


Figure 30



Note: Expanding window is applied on panel regressions with country fixed effects. It begins in 1999Q1 and ends in 2011Q3, encompasses 12 quarters at the outset, regressions are repeated each quarter for an expanding time window.

Figures 28 to 31: Determinants of demand from Official Non-resident Investors. Graphs illustrate estimated coefficients obtained under expanding window for multivariate panel regression explained in Eq. 7

Figure 31

Rolling Regression Coefficients for Official Non-Resident Investors
 Regressor: Structural Primary Fiscal Balance / GDP

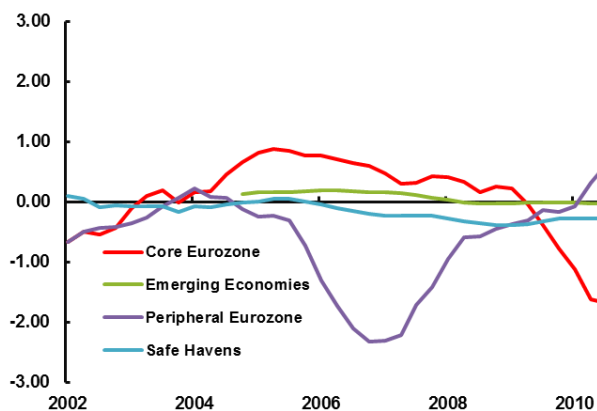


Figure 32

Rolling Regression Coefficients for Official Non-Resident Investors
 Regressor: Real Yield Differential

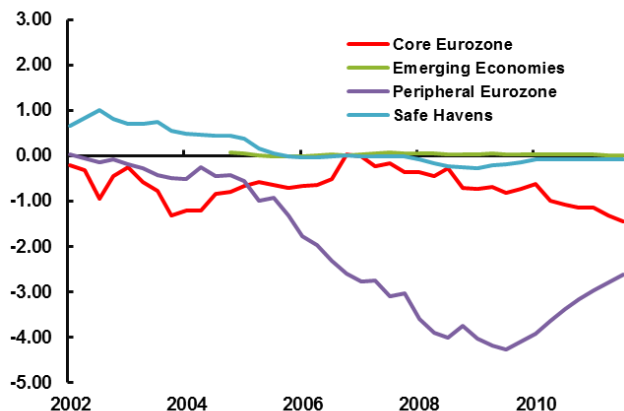


Figure 33

Rolling Regression Coefficients for Official Non-Resident Investors
 Regressor: GDP Growth YoY

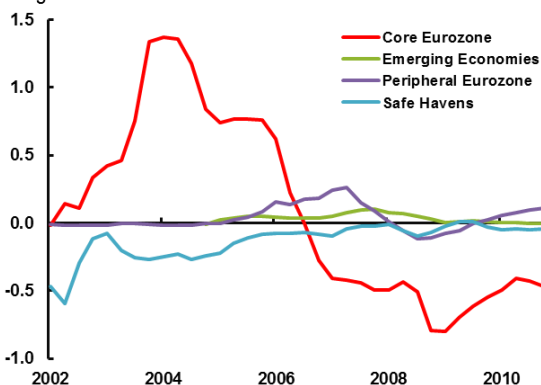
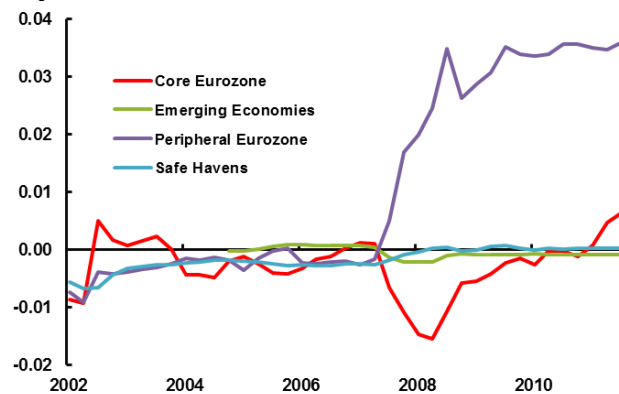


Figure 34

Rolling Regression Coefficients for Official Non-Resident Investors
 Regressor: Risk Aversion



Note: Expanding window is applied on panel regressions with country fixed effects. It begins in 1999Q1 and ends in 2011Q3, encompasses 12 quarters at the outset, regressions are repeated each quarter for an expanding time window.

Figures 32 to 34: Determinants of demand from Domestic Banks, Domestic Pension and Insurance Funds, and Domestic Investment Funds. Graphs illustrate estimated coefficients obtained under expanding window for multivariate panel regression explained in Eq. 7

Figure 35

Rolling Regression Coefficients for Domestic Banks
Regressor: Structural Primary Fiscal Balance / GDP

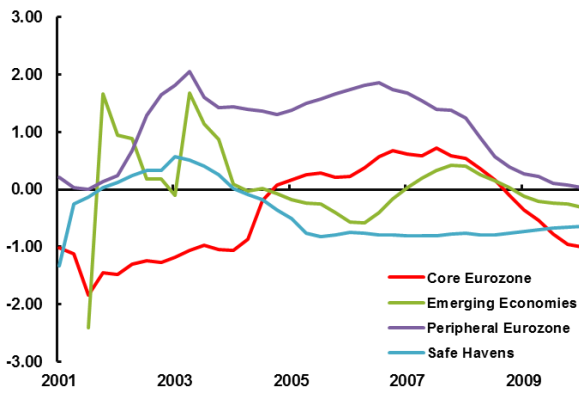


Figure 36

Rolling Regression Coefficients for Domestic Banks
Regressor: Risk Aversion Index

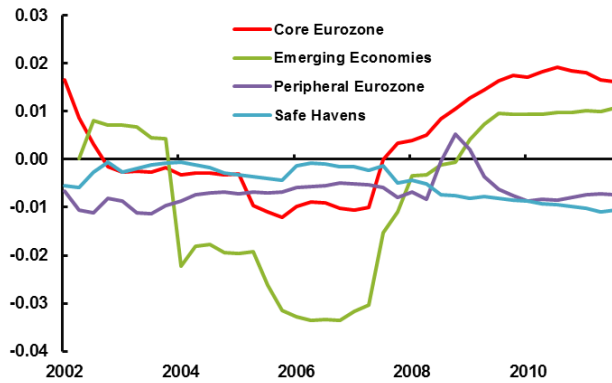


Figure 37

Rolling Regression Coefficients for Domestic Banks
Regressor: Real Yield Differential

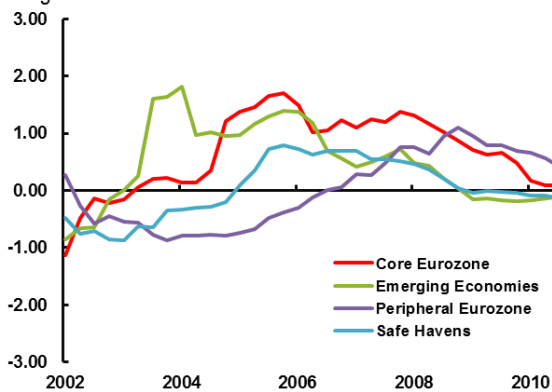


Figure 38

Rolling Regression Coefficients for Domestic Pension and Insurance Funds
Regressor: Structural Primary Fiscal Balance / GDP

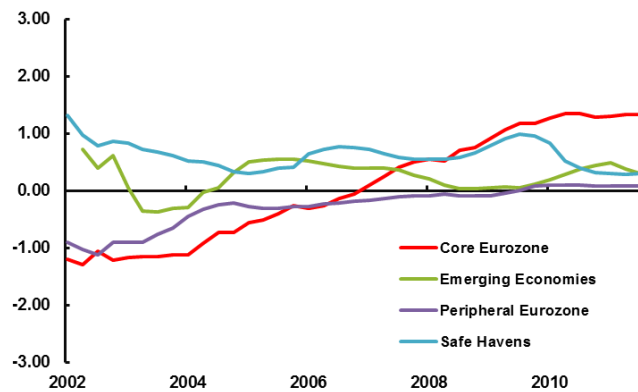


Figure 39

Rolling Regression Coefficients for Domestic Pension and Insurance Funds
Regressor: Real Yield Differential

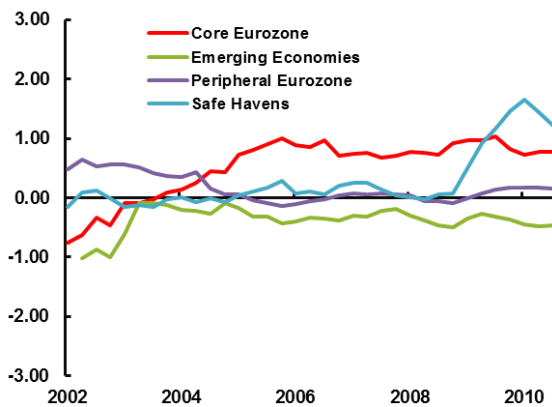
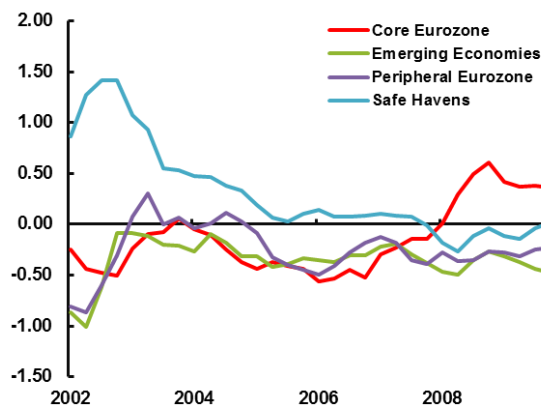


Figure 40

Rolling Regression Coefficients for Domestic Investment Funds
Regressor: Real Yield Differential



Note: Expanding window is applied on panel regressions with country fixed effects. It begins in 1999Q1 and ends in 2011Q3, encompasses 12 quarters at the outset, regressions are repeated each quarter for an expanding time window.

Appendix

Appendix Table 1 Classification of Investor Categories

Tomasz Orpiszewski (2012)	Brugel (2012)	IMF (2012)
Non-residents	Non-Residents	Non-resident investors
Banks	Resident Banks	Banks
General Government	Other Public Institutions	Public sector
Central Bank	Central Bank	
Insurance and Pension Funds		Private non-bank financial institutions
Investment/Mutual Funds		
Households		
Non-financial corporations		
Other	Other Residents	

Note: At several instances the dataset compiled by Brugel includes further country-specific distinctions for insurance and pension funds, households and related non-profit institutions, investment institutions, monetary financial institutions, etc.

Appendix Table 2: Classification differences in datasets

Country	AXA Tomasz Orpiszewski	Brugel	IMF
Italy	Bank of Italy BOP Statistics mention only central government	General Government	General Government
Italy	Bank of Italy BOP Statistics mention nominal valuation		Market Rate
Germany	Series starting from 2005	Series starting from 1992	
Portugal	Central Government Debt	General Government	General Government
Spain	Notes attached to the dataset provided by the Bank of Spain indicate nominal valuation		
Spain		Inconsistencies found in reporting of the debt stock held by the central bank	
US	General Government		Federal Government Debt reported as Central Government Debt

Appendix Table 3: Dataset coverage

Country	Orpiszewski (2013)	Merler and Pisani-Ferry, Bruegel (2012)	Andritzky, IMF (2012)	Arslanalp and Takahiro, IMF (2012)
Australia	-	-	Quarterly	Quarterly
Austria	-	-	-	Quarterly
Belgium	-	Annual	-	Quarterly
Brazil	Monthly	-	-	Quarterly
Canada	-	-	Quarterly	Quarterly
Czech Republic	Monthly	-	-	Quarterly
Denmark	Monthly	-	-	Quarterly
Finland	-	Annual	-	Quarterly
France	Monthly	Quarterly	Quarterly	Quarterly
Germany	Quarterly	Quarterly	Quarterly	Quarterly
Greece	Quarterly	Quarterly	Quarterly	Quarterly
Ireland	Quarterly	Quarterly	Quarterly	Quarterly
Italy	Monthly	Quarterly	Quarterly	Quarterly
Japan	Quarterly	-	Quarterly	Quarterly
Korea	-	-	Quarterly	Quarterly
Netherlands	Quarterly	Quarterly	Quarterly	Quarterly
New Zealand	-	-	-	Quarterly
Norway	-	-	-	Quarterly
Portugal	Quarterly	Annual	Quarterly	Quarterly
Slovenia	-	-	-	Quarterly
Switzerland	-			Quarterly
UK	Quarterly	Quarterly	Quarterly	Quarterly
US	Quarterly	Quarterly	Quarterly	Quarterly
Spain	Monthly	Quarterly	Quarterly	Quarterly
Hungary	Quarterly	-	-	-
Iceland	Monthly	-	-	-
India	Quarterly	-	-	-
Indonesia	Monthly	-	-	-
Israel	Monthly	-	-	-
Latvia	Monthly	-	-	-
Malaysia	Quarterly	-	-	-
Mexico	Monthly	-	-	-
Peru	Monthly	-	-	-
Poland	Monthly	-	-	-
South Africa	Monthly	-	-	-
Thailand	Monthly	-	-	-
Turkey	Monthly	-	-	-
Bulgaria	Quarterly	-	-	

Appendix Table 4 Fitch Sovereign Ratings conversion Table

Rating	Score				
AAA	100	BBB+	67	B-	29
AA+	95	BBB	62	CCC+	24
AA	90	BBB-	57	CCC	19
AA-	86	BB+	52	CCC-	14
A+	81	BB	48	CC	10
A	76	BB-	43	C	5
A-	71	B+	38	DDD and below	0
		B	33		

Appendix Table 5

		Official Non-residents	Private Non-residents	Banks	Insurance and Pension Funds	Investment/Mutual Funds	General Government
AUTOCORRELATION							
Wooldridge test for autocorrelation in panel data	F-statistic	76.75	113.87	29.19	99.34	60.39	20.46
H0: no first-order autocorrelation	Prob > F	0	0	0	0	0	0
Presence of Autocorrelation		Yes	Yes	Yes	Yes	Yes	Yes
TIME TREND							
Time Trend on Least Squares Dummy Variable	Chi2	51.76	95.05	33.75	67.53	135.82	133.77
H0: All years coefficients are equal zero	Prob > Chi2	0.737	0	0.99	0.21	0	0
Time fixed effects needed		No	Yes	No	No	Yes	Yes
UNIT ROOT							
A. Test in Level							
Fisher-type unit-root test based on augmented Dickey-Fuller tests under consideration of panel means	Chi2	42	17	91	126	75	50
H0: All panels contain unit roots							
Ha: At least one panel is stationary	P-value with time trend	0.86	1	0	0	0	0.03
	P-value without time trend	0.51	0.95	0.09	0.05	0	0.33
Im-Pesaran-Shin unit-root test under consideration of panel means	Z-t-tilde-bar	-1.52	4.83	-3.9	-3.8	-2.66	-3.75
H0: All panels contain unit roots							
Ha: Some panels are stationary	P-value with time trend	0.06	1	0	0	0	0
	P-value without time trend	0.52	1	0.11	0.75	0.58	0.9
Presence of Unit Root		Yes	Yes	Yes	Yes	No	No
B. Test in First Difference							
Fisher-type unit-root test based on augmented Dickey-Fuller tests under consideration of panel means							
H0: All panels contain unit roots							
Ha: At least one panel is stationary	P-value with time trend	0	0	0	0	0	0
	P-value without time trend	0	0	0	0	0	0
Im-Pesaran-Shin unit-root test under consideration of panel means	P-value with time trend	0	0	0	0	0	0
H0: All panels contain unit roots							
Ha: Some panels are stationary	P-value without time trend	0	0	0	0	0	0
Presence of Unit Root		No	No	No	No	No	No
CROSS-SECTION							
Cross-section dependence Average correlation coefficients & Pesaran (2004) CD test							
H0: cross-section independence CD ~ N(0,1)							
Dependent variable (xtcd)	P-value	0	n/a	0	n/a	n/a	n/a
All variables (xtcsd) under fixed effects	P-value	0.01	0	n/a	0.12	0.18	0.02
All variables (xtcsd) under LSDV	P-value	0.43	0	0.43	0.45	0.39	n/a
All variables (xtcsd) under LSDV and time effects	P-value	0.33	0	0	0	0	0.12
Cross-section independence present		Unclear	Unclear	Unclear	Unclear	Unclear	Unclear