The (re)allocation of bank risk

Geert Bekaert

Columbia GSB

Johannes Breckenfelder

European Central Bank

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Abstract

Little is known about the location of bank risk, i.e., which investors in which countries hold bank-issued securities like bonds and stocks. In this paper, we analyze the (re-)distribution of bank risk across asset classes (short- and long-term debt, equity), across investor types and across geographic locations. We also differentiate bank holdings according to riskiness based on credit ratings and yield spreads. We use the Securities Holdings Statistics database for the euro area which contains information on securities holdings at the ISIN level. Our main findings are as follows. First, bank risk is held disproportionately by other banks. Second, households are disproportionally exposed to riskier bank securities. Third, about 30% of bank securities are held outside the euro area, with these percentages larger (smaller) for short term debt and equities (long term debt). Geographically, large issuers of bank risk such as France and Germany, also hold most of the bank risk, with the exception of the Netherlands, which, despite being a top 5 issuer, holds almost no bank securities. Fourth, the holding bank risk is highly concentrated domestically, with the concentration more extreme for countries such as Greece, Italy and Portugal, which hold more than 70% of their bank's securities domestically. The domestic concentration of bank risk is (much) more severe than the domestic concentration of non-bank corporate securities and sovereign debt. Fifth, re-allocation is overall statistically significant but economically more important for bonds than for equities. Finally, we exploit the inclusion of some banks on the list of other systemically important institutions (O-SII) – which makes them subject to more stringent supervisory and regulatory requirements – as a shock to the riskiness of securities issued by those banks. Following the inclusion on the OSII list, bank stock (bond) prices decrease (increase) relative to stock (bond) prices of banks not included on the list. In terms of holdings, other banks increase their holdings of equity and decrease their holdings of bonds issued by the OSII-designated banks. Households and insurances likewise increase holdings of equity issued by the OSII-designated banks. By contrast, investment funds and financial vehicle corporations decrease holdings of equity issued by the OSII-designated banks.

Keywords: bank risk; security holdings; portfolio rebalancing;

JEL Classification: G11, G20, G28

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1. Introduction

The euro area has witnessed several recent crises, including a full blown banking crisis in 2008-2009, and a sovereign debt crisis in 2010–2012. As the adverse realization of bank risk was at the heart of these financial and sovereign debt crises, the policy response has focused on the banking sector, through regulation and monitoring of bank risk (culminating in the establishment of the Single Supervisory Mechanism in 2013), stress tests on banks and unconventional monetary policies designed to address financial impairments. Despite its obvious policy relevance, little is known about the concentration or dispersion of the holdings of bank-issued securities, such as bonds and stocks among certain types of investors or in or across certain countries is of. Our article has three contributions regarding the (re)allocation of bank risk.

First, using a unique new dataset, the Securities Holdings Statistics (SHS) database for the euro area, we characterize the location of bank risk both geographically and across various investor types (banks, various categories of institutional investors, including pension funds, insurance companies and mutual funds, and households). The Securities Holdings database contains securities holdings at the International Security Identification Number (ISIN) level and is comprehensive. This allows us to differentiate the holdings of bank exposure across different securities (debt securities and equities) and across risk categories. We use credit ratings to differentiate bank exposures according to riskiness and examine whether bank holdings are differentially allocated across the risk spectrum.

Second, we characterize the re-allocation of bank risk over time and compare it to the general incidence of rebalancing. Our work here contributes to the general portfolio choice literature and the banking literature. Whether and why agents rebalance portfolio holdings remains a largely unresolved question. For example, Brunnermeier and Nagel (2008) suggest that the portfolio allocations of households are characterized by inertia. However, their findings are based on survey data, not "hard" portfolio holdings data, a problem plaguing much of the literature. Research based on 401K accounts (see Madrian and Shea, 2001; Choi et al. 2002) also suggests inertia, but, in contrast, brokerage data (e.g. Barber and O' Dean, 2000) suggest intense trading. These studies suffer both from a potential unrepresentative sample of households, and an incomplete picture of the household's total portfolio holdings. Calvet, Campbell and Sodini (2009) resolve these problems with Swedish data for 1999-2002, comprising comprehensive year-end data on the holdings of Swedish households. Whereas the data do not contain asset purchases and sales, they observe the ISIN of the household's holdings, allowing relatively reliable computations of actual rebalancing. They also find little aggregate portfolio rebalancing at the household level, but more active rebalancing at the individual household level.

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Compared to Calvet et al. (2009), our data are much more complete covering the whole Euro area, 22 categories of investor types and data at the ISIN level of all securities issued or held in the Euro area. Observing data at the ISIN level and all holdings of the security makes characterizing re-allocation trivial, as we can study the portfolio fractions of different investor types at the security level. The disadvantage of the data is that we only observe information aggregated over various broad investor categories and can therefore not link individual portfolio choices to investor characteristics.

Given the recent crises, the rebalancing of bank risk is of obvious special interest but has received relatively scant attention. Much focus has gone to the nexus between sovereign and bank risk through the bank's holdings of distressed sovereign debt, both empirically (Acharya and Steffen, 2015; Beltratti and Stulz, 2015; Kirschenmann et al., 2016; Popov and Van Horen, 2015) and theoretically (Farhi and Tirole, 2018). The last few years has witnessed a number of large information shocks regarding the outlook of banks, especially in Europe, and various drastic changes in monetary policy, affecting the health of the banking sector.

Our third contribution is to analyze how bank-specific shocks affect the allocation of bank risk in Europe. We consider two types of shocks. First, we analyze how bank risk is reallocated following rating changes. There is a very active literature on "reaching" and "searching" for yield, indicating an investor preference for higher yielding bonds, especially in low interest environments (see e.g. Choi and Kronlund, 2015; Chen and Choi, 2018 and Ammer et al (2018)). Our data facilitates a detailed answer to how riskier (higher yielding) or less risky (lower yielding) bonds are reshuffled across different types of investors around the time of a "shock" to the riskiness. Second, we exploit the inclusion of some banks on the list of other systemically important institutions (O-SII) as a shock to the riskiness of securities issued by those banks.

Banks designated as OSII are subject to more stringent supervision and regulation, including add-ons for Common Equity Tier 1 (CET1) capital of up to 2%. Each national supervisor decided which banks were designated as OSII over 2015-16 (this exercise is since then conducted on a yearly basis but we focus on the first such exercise conducted). Assessment on who is OSII was based on the guidelines from the European Banking Authority (EBA) and the Basel Committee. According to the guidelines, O-SIIs are institutions that, due to their systemic importance, are more likely to create risks to financial stability, entail negative economic externalities and contribute to market distortions. On the first list compiled by the EBA in April 2016 following the input from national authorities, 173 European banks were designated as OSII. This gives us a large number of financial institutions - spread across different countries - to consider in our analysis.

We can ask whether and how the risks of "shocked" banks were re-allocated across investor types, and differentiate the re-allocation across different types of securities, and geographic location. Geographic spillovers of bank risk assume particular relevance given the euro area's plans to complete the banking union, which already consists of single bank supervision and resolution and may be complemented by a common deposit insurance scheme in the future.

Our main results are as follows. First, relative to the distribution of market-wide securities holdings, bank risk is held primarily by banks themselves. Banks hold 28% of all bank-issued securities but only 18% of all securities; investment funds, in contrast, hold only 12% of bank-issued securities but 24% of all securities. The discrepancy between the bank's portfolio and the overall portfolio is most pronounced for long-term bonds. Short-term debt is primarily held by money market funds, but banks still disproportionally hold bank equity. Foreign investors also hold substantially more bank exposure compared to other Euro assets, with the discrepancy being highest in bank equity. Households hold relatively little bank risk directly (6%), close to their direct holding percentage of all securities. However, they hold a much higher proportion of "risky" bank securities (high yield debt or non-investment grade debt). Overall, investment funds and households are relatively overweight in non-investment grade debt; while banks and insurance companies are relatively underweight.

Second, geographically, about 30% of bank securities are held outside the euro area, with these percentages larger (smaller) for short term debt and equities (long term debt). Large issuers of bank risk also hold most of the bank risk, with the exception of the Netherlands, which, despite being a top 5 issuer, holds almost no bank securities. Some small countries, such as Ireland and Luxembourg, hold much more of bank debt than they issue. Italy represents about 20% of the euro area holdings of euro area issued long-term bank debt, but only 8% of the long-term debt issued by non-financial corporations. Third, the holding bank risk is highly concentrated domestically, with the concentration more extreme for countries such as Greece, Italy and Portugal, which hold more than 70% of their bank's securities domestically. The domestic concentration of bank risk is (much) more severe than the domestic concentration of non-bank corporate securities and sovereign debt. Fourth, we find re-allocation of bank risk to be overall statistically significant. However, rebalancing is economically much more important for debt securities than it is for equities. Money market funds, banks and foreign non EMU investors rebalance the most. Investigating which countries re-allocate more, weighting ISINs by their economic importance substantially affects the results. In a standard unweighted regression, countries, such as Luxembourg, Ireland and Malta, which may have a tax haven status, are among the top rebalancers, but when a weighted regression is used, France and Germany top re-

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allocation among bank debt and France and Spain among bank equities.

Fourth, we document that following the inclusion on the OSII list, bank stock (bond) prices decrease (increase) relative to stock (bond) prices of banks not included on the list. In terms of re-allocation of bank securities holdings following the inclusion on the OSII list, other banks increase holdings of equity and decrease holdings of bonds issued by the OSII-designated banks. Households and insurance companies likewise increase holdings of equity issued by the OSII-designated banks. By contrast, investment funds and Other Financial Institutions sector (which includes financial vehicle corporations) decrease their holdings of equity issued by the OSII-designated banks. Other Financial Institutions sector is the sector that increases holdings of bonds issued by the OSII-designated banks.

We further differentiate between banks on the OSII list that become subject to more stringent supervisory and regulatory requirements (increase in the CET1 ratio) and those that are only subject to more stringent supervision (no increase in CET1 ratio). We compare the re-allocation of bank securities holdings between these two types of OSII-designated banks. We find that banks decrease holdings of bonds issued by OSII-designated banks subject to additional capital buffers relative to bonds issued by the other OSII-designated banks. This relative decrease is driven solely by the decrease in bond holdings issued by OSII-designated banks that are subject to additional capital buffers. For equity holdings, banks increase holdings of equity issued by OSII-designated banks subject to an additional capital buffer relative to equity issued by the other OSII-designated banks. By contrast, non-financial corporations increase (decrease) their relative holdings of bonds (equity) issued by OSII-designated banks subject to additional capital buffers relative to bonds issued by the other OSII-designated banks. Households and non-EMU investors sectors both increase their relative holdings of bonds issued by OSII-designated banks subject to additional capital buffers relative to bonds issued by the other OSII-designated banks. For households, this increase is driven solely by the decrease in holdings of bonds issued by banks with no additional capital buffer. For the non-EMU investors, the increase in relative bond holdings is driven both by the decrease in holdings of bonds issued by banks with no additional capital buffer and by the increase in holdings of bonds issued by banks subject to additional capital buffers. While it appears that banks increase their exposure to riskier bank securities, such a conclusion ultimately also depends on effectiveness of the newly imposed regulatory framework for the OSII banks and whether they are viewed as too big to fail.

The remainder of the paper proceeds as follows. In Section 2, we discuss our data set and provide some summary statistics. Section 3 characterizes the location of bank risk across investor types and in geographic terms. Section 4 characterizes re-allocation of bank risk in general terms.

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Section 5 focuses on re-allocation following bank specific shocks, either through credit rating changes or the relation of the results of the CA. `

2.   Data

The Securities Holdings Statistics (SHS), collected on a security-by-security basis, provide information on securities held by selected categories of euro area investors, broken down by instrument type, issuer country and further classifications.

2.1   Securities holdings statistics

The legal basis for collecting SHS data is laid down in Regulation ECB/2012/24. This Regulation is complemented by Guideline ECB/2013/7, which sets out the procedures to be followed by national central banks when reporting to the ECB.

SHS data have been collected in full since the fourth quarter of 2013 and cover the two main types of security: debt securities and equity securities (including investment fund shares). Between the first quarter of 2009 and the fourth quarter of 2013, reporting agencies were not obliged to report the data, but many did. The main feature of these data is that holding information is collected at the level of each individual security, i.e. security by security. The SHS Sector data provides information on holdings by investor types. The SHS Group (SHSG) data provides information on holdings of securities by individual banking groups (26 until the third quarter of 2018 and all SSM supervised banks thereafter). The SHSG Guidance notes further clarify and illustrate the extended data collection.

The SHS by investor type provides aggregate information on the holdings of investor types in line with European regulation. We differentiate in this paper between the following investors: banks, government, money market funds, non-financial corporations, households, insurance companies, investment funds, other investors, pension funds, and non-European Monetary Union investors.

Securities holdings include holdings by (i) investors residing in the euro area, such as banks in Italy or households in France, and (ii) non-resident investors' holdings of euro area securities that are deposited with a euro area custodian, such as US investors' holdings of German securities deposited in Luxembourg. In addition, non-euro area EU countries (Bulgaria, the Czech Republic, Denmark, Hungary, Poland and Romania) also collect SHS investor type data.

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Total holdings by euro area investors amounted to about 38 trillion at the end of 2017, covering holdings of both securities issued by euro area residents and those issued by non-euro area residents.

The holding information is complemented with the Centralised Securities Database (CSDB) that contains information such as price, issuer name and outstanding amount, precise debt type and issuer information for over six million outstanding debt securities, equities and investment fund shares.

To ensure good data quality, SHS data are regularly checked against comparable data sources. In particular, the data is checked against other ECB databases, such as the integrated euro area financial and non-financial accounts (EAA), Monetary, Financial Institutions (MFI) balance sheet statistics, insurance corporations and pension fund statistics, investment fund statistics and securities issues statistics, as well as with consolidated banking data. Nonetheless, the data set is massive and still requires considerable effort before it can be used for research purposes. Recurring errors just to name a few, include the temporary mislabeling of securities in terms of, e.g. asset class, or issuer, a different spelling of issuers over time and other inconsistencies.

We examine long-term debt securities, short term debt securities (defined as having below 2 years of remaining maturity) and equity. Our sample comprises quarterly data, from 2009q1 to 2018q2; with the full data coverage starting in 2013q4. Therefore, our descriptive statistics are based on averages over the 2013q4 – 2018q2 sample period.

2.2   Investor types

The SHS defines 22 different types of investors, which they call "sectors." We group these "sectors" into 10 distinct investor types. Most investor types correspond to the definition in the original dataset. These include banks (e.g., commercial banks, savings banks), investment funds (e.g., open-ended investment funds, closed-ended investment funds, funds of funds, hedge funds), insurance companies, money market funds (MMFs), pension funds and households (direct holdings). We group related and remaining sectors into the following four investor types: government, non-financial corporations, others (less prominent investors, e.g., non-profit, other financial institutions, or social security funds), and non-euro area investors.

3.   Location of bank risk

We have data on both the "production" (issuance) and holdings of bank securities. Our primary

interest is on where bank risk is held, but the information on issuance can be used to illustrate how it is redistributed after issuance. We start by the distribution of bank holdings across investor types, then consider the geographical distribution.

3.1   Who bears bank risk?

Table 1 (and Figure 1) shows the distribution of bank securities across investor types in percent. The numbers are computed every quarter and simply averaged over time. In Panel A, we first compare the holdings of bank securities, with the holding of all securities. The average total bank holdings comprise about EUR 5 trillion, whereas all securities together comprise EUR 36 trillion. The largest asset holders in the euro area are investment funds holding 24% of all securities, followed by banks (18%) and non-Euro area investors (17%). The first column shows the distribution of the holdings of bank risk, showing that banks hold 28% of all bank-issued securities, therefore holding 10% more of bank risk than they do of all securities. In contrast, investment funds hold only 12% of bank-issued securities, 12% less than their holding percentage overall. Figure 1 shows the development over time of banks investing in other banks relative to the overall size of banking sector issued securities. The red solid line is the percentage of bank securities in the portfolio of banks. The blue dashed line is the percentage share of the banking sector's issuance as a whole relative to all issued securities in the market such as securities issued by non-financial corporations or governments. The green dash-dotted line gives the difference. This difference would be zero if banks would invest in banks relative to their share of issued securities in the market. While banks have invested more in other banks over the entire sample period from the first quarter of 2009 to the second quarter of 2018, the difference between investment and issuance has increased from about 5% to about 13%.

One possibility is that securities not issued by corporations (such as government bonds) distort the holdings pattern across investor types. In Panel B, we compare the distribution across investor types of bank -issued securities with that of securities issued by non-financial corporations. This accentuates the differences between the industry composition of the portfolios of banks and investment funds. Banks hold 18% more of the securities issued by banks than they hold of securities issued by non-financial corporations. Investment funds hold 38% of the securities issued by non-financial corporations, but only 12% of bank-issued securities. Other investment types holding relatively more bank securities include insurance companies (12% versus 8%); non-euro area investors (23% versus 15%) and, not surprisingly, money market funds (7% versus 1%).

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In additional columns in both panels, we analyze whether this stark difference in holdings distributions differs across security type, splitting up securities in long-term debt, short term debt and equity. Focusing first on comparing bank-issued securities with all securities in Panel A, we find that investment funds hold fewer bank securities in all categories, with the biggest difference, relative to their overall portfolio, observed for equities: they hold 19% of outstanding bank equity but hold 37% of all outstanding equity. For banks, the main difference in allocations occurs for long-term debt, where they hold 34% of bank long -term debt but only 26% of all long-term debt. Their short-term portfolio is in fact under concentrated in bank debt, which represents 45% of the portfolio of money market funds. We get a cleaner picture in Panel B, comparing banks with non-financial corporations. The long-term debt held by banks mostly constitutes government debt, not corporate debt: they hold only 8% of corporate long-term debt (relative to holding 34% of bank long -term debt). Investment funds hold 40% of long-term corporate debt (but only 12% of bank long term debt); insurance companies hold 10% more of non-financial corporate long-term debt than of banks' long term debt (25% versus 15%). The short-term debt of banks is mostly held by money market mutual funds (45%) and non-Euro area investors. Interestingly, this is not "special" for the money market funds as they hold 51% of non-financial short-term debt but represents a large overweighting of bank debt for non-euro investors who hold only 8% of non-financial short-term corporate debt. Because equity is only issued by corporations, the numbers in Panel B are exactly the same as the ones in Panel A.

Of course, not all bank risk is created equally, and it is of interest to locate where the riskier debt securities are held. To this end, we attempt to split up bank debt securities in different risk categories. In Table 2, Panel A, we show a split up based on yield spreads relative to Bunds of similar maturity. The low (high) credit spread is defined as a spread of less than 50 basis points (more than 2%). Defined this way, the middle category represents 55.4% of all bank debt; the low risk category 18.9% and the high-risk category 25.7%. The bank's concentration in bank securities (holding 31% of the total) is more (less) pronounced in the low (high) risk category. Investment funds also hold a slightly higher percentage of low risk than of high-risk bank debt. The most striking result is that households hold 17% of high-risk debt, whereas they only hold 6% of overall bank debt. This suggests that households seek direct exposure to high yield debt, searching for yield. We also investigate the holdings of securities with yields lower than zero, finding that households only hold 1% of such bank debt (versus 6% of all bank securities). Both money market funds and banks themselves hold relatively more of this type of debt. In Panel B, we use an alternative way to determine bank risk, namely the credit rating of the bond. Note that this reduces our total sample from EUR 3.68 trillion for which we

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have spreads to EUR 2.50 trillion, suggesting that many ISINs are either not rated or the rating is not reported/recoverable. We use three categories: AAA debt; other investment grade debt (AA+ to BBB) and non-investment grade ("speculative") debt (below BBB). The speculative debt category only represents 5.84% of the total available market capitalization. We report the portfolio fractions overall and for the three categories, so that we can easily identify the over-and underweighting relative to the overall portfolio. We confirm that households disproportionally invest in risky debt: they hold 13% of all speculative debt but only 2% of all rated debt. It is conceivable that their indirect holdings through investment companies "undo" the bias towards risky bank debt, but this is not the case. In fact, investment fund companies also disproportionally hold more of speculative debt, accounting for 26% of the total, whereas overall they only hold 15% of all rated bank securities. With two investor types holding relatively more of speculative debt, some must hold relatively less. The investor types standing out holding less speculative debt are banks (holding only 18% of speculative debt, but 32% of all bank debt), and insurance companies, which hold only 11% of all non-investment grade debt but 17% of all rated bank debt. Interestingly, insurance companies tilt their portfolios primarily towards the non-AAA investment grade debt and are also underweight in AAA debt. This may reflect a search for yield within the investment grade category.

3.2   Geography

Both the banking crisis in 2008-2009 and the sovereign debt crisis in in 2010-2012 hit certain countries more strongly than others. Much attention has focused on the sovereign-bank nexus, the interdependencies between the financial health of banks and sovereigns through a variety of channels that may entail adverse feedback loops and lead to sovereign and financial crises (See Dell'Ariccia, Ferreira, Jenkinson, Laeven, Martin, Minoiu, and Popov, 2018 for a survey). From an asset holdings perspective, the tendency of banks to hold large portfolios of government debt provides an important transmission mechanism for sovereign risk to travel across countries (see e.g. Acharya and Steffen, 2015). Little is known, however, about how bank risk itself is held across countries. Differentiating between risky and high-quality debt is of policy relevance, because, as we will see below, the distribution of good versus bad risk is, not surprisingly, highly geographically diverse. The degree of geographical diversification of these "bad" bank risks should therefore reflect the geographic diversification of investor's portfolios. The international finance literature has shown that investors are strongly home biased (see Sercu and Van Pee, 2007 for a survey), suggesting that bad bank risks may be geographically concentrated. However, this is not a foregone conclusion, because the literature

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on home bias has several short-comings. For example, it is often based on incomplete or low-quality data, for example the allocations of mutual funds (see Chan, Covrig and Ng, 2005, for example), or survey data (the often-used IMF coordinated survey data; see Bekaert and Wang, 2009 for a discussion of the problems with such data). Moreover, the bulk of the literature focuses on equity holdings, and the evidence on home bias in other asset classes is relatively scarce (Fidora, Fratzscher and Thimann, 2007).

Table 3a, Panel A, gives an overview over the distribution of bank holdings across countries and of bank issued securities across country. It is informative to start with the distribution of the issuance of bank securities across countries, that is, where, in the euro area, is bank risk produced? Here, looking at the columns on the left containing the numbers for all bank securities, there are few surprises. The top 5 countries and how much they account for in terms of issuance are France (27.9%), Germany (22.9%), Italy (15.5%), the Netherlands (11.3%) and Spain (10.7%). The total amount of bank securities issued in the euro area countries is EUR 4.8 trillion. The next column reports the fractions of the total portfolio of bank securities, held by different countries. A first important question is to verify how much of this bank exposure is held outside the euro area. We report what is held in Switzerland, the UK, and other non-EMU countries. Overall, 28.8% of bank risk is "exported" outside the euro area. This makes it misleading to simply compare the portfolio fractions of issuance and holdings, as the holding fractions must be lower, given that about 30% of bank risk is held in non-euro countries. If the countries were to hold 100% of their own issued bank debt, except for the debt held abroad, the predicted fractions for the total portfolio holdings would be approximately the issuance weight times (1- 28.8%). To facilitate this comparison, the fractions reported under bank holdings for the European countries are the relative weights of Euro area held bank securities. It is easy to see that the actual holdings percentages are close to the issuance percentages for the top countries, with one exception. The Netherlands almost holds no bank securities (it accounts for 2.2% of total holdings), even though it represents 11.3% of issuances. Italy and Germany hold slightly more; France slightly less than what is predicted by their bank issuance.

This result continues to hold when we split bank securities into long-term debt, short term debt and equities. Note again that long term debt is by far the largest category in terms of market capitalization. Because of these, the top 5 countries in terms of issuance are the same as what we discussed above for securities overall, with the percentages not too different. However, the picture is very different for short term debt and equities. For short term debt, France issues 46.2% of all bank securities, followed by Germany (18.4%) and the Netherlands (13.0%). In terms of equities, France

dominates again, representing 32.0% of all issuances, now followed by Spain with 25.7%, Italy with 16.2%, Germany with only 8.6% and the Netherlands with 7.7% of all equity issuances. This may simply reflect the overall relative importance of stock markets in the various countries. The international sharing of bank risk with countries outside the Euro area differs across the different types of securities. Only 25.7% of long term bank debt is held by non-euro area countries, but 38.4% of short -term debt is and 37.1% of bank equities.

Some small countries, such as Ireland and Luxembourg, hold much more of bank debt (and in the case of Luxembourg, also equities) than they issue. This deserves further scrutiny as it may have to do with these countries status as tax havens. Panel B, where we benchmark the bank numbers with the same statistics for securities issued by non-financial companies, confirms that Ireland and especially Luxembourg hold more securities in general than they issue, so this is not a banking sector phenomenon.

Panel B does show the banking sector to be special in a number of respects. First, and not surprising, the dominant security issued, is now equity, not debt and short-term debt represents a very small fraction (0.13%) of total securities issued. Second, in terms of issuance, France is by far the largest issuer, issuing 39.1% of all securities issued by non-financial corporations. For the top 5 countries, there is more issuance of bank securities in Spain, Italy and the Netherlands and less in Germany and France, compared to the issuance of securities by non-financial corporations. Third, in terms of holdings, a slightly larger percentage of the securities issued by non-financial corporations is held abroad (33.4%). Every country in the top 5 holds a smaller percentage of the securities issued by non-financial corporations, compared to the issuance percentages, but Luxembourg and Ireland hold comparatively more. The most notable geographical discrepancy is Italy: only 5.8% of all securities issued by non-financial corporations and held in the euro area are held by Italian investors, but they hold 17.3% of European bank risk.

Some of the differences between the statistics for banks and non-financial corporations may have to do with the different mix of securities. For example, the exporting of euro securities to foreign investors is only more prominent for equities in Panel B, and the reverse is true for debt securities. The Italian's overweighting of bank risk is perhaps less surprising once we realize that Italian investors also hold relatively larger fractions of long term debt than they do of equities, but it is still the case that they overweight bank debt in their holdings and underweight debt issued by non-financial corporations, relative to the percent of such debt (held within the euro area) they issue. Comparing issuance with

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holdings of long-term debt issued by non-financial corporations, the largest discrepancies are observed for Germany, France and Luxembourg. Germany represents 20.5% of euro held long term debt, but only 13.9% of debt issued; a larger discrepancy than observed for banks. Similarly, Luxembourg's holdings percentage is 11.6% and its issuance percentage is only 1.8%, where the difference in the two was only 4.5% for banks. France issues a whopping 47.4% of all long term debt by non-financial corporations in Europe, but represents only 37.3% of total euro area holdings, again a much larger discrepancy between issuance and holdings percentages than observed for banks. The Netherlands continues to hold a much lower percentage of all securities issued in Europe compared to the percent it represents in issuance and this is, as in Panel A, true for all three types of securities. This likely reflects the fact that Dutch investors are among the most internationally diversified in Europe (see Bekaert and Wang, 2009, for evidence on home bias in equity markets).

In the previous table, we simply compared the issuance with the holding of bank securities, not differentiating the actual origin of the bank risk being held. Table 3b focuses on the extent of home bias in the holdings of bank risk. We report the percentage of bank securities issued in a particular country held locally, by other EMU countries, or outside the EMU. The table reveals two key results. First, there is indeed almost universal concentration of bank risks in the domestic market. Using the issue percentages as the benchmark, as would be roughly true in a simple CAPM framework, this is strongly suggestive of substantial home bias in the holding of bank securities.[1] France represents the biggest issuer of bank securities representing 27.94% of the total, but only 6 countries out of the 19 countries hold less than 25% of the bank securities issued in their country and only the Netherlands holds less locally than its issue percentage. Second, the extent of local bank concentration differs greatly across countries. There are six countries which hold more than 70% of their bank securities: Cyprus, Estonia, Greece, Italy, Lithuania and Portugal. At the other end of the spectrum are 6 countries holding less than 20% of their own bank risk, including Belgium, Finland, Ireland, Luxembourg, Latvia and the Netherlands. The remaining countries hold around 50% of their own bank risk, with the highest percentage in this category belonging to Spain at 56.97%. It is striking that so many of the countries that were deeply embroiled in the 2010-2012 European sovereign debt crisis fail to share their bank risks with the rest of the world. Figure 2 illustrates the stark differences between countries with high, medium and low domestic bank concentration. Because long term debt is the largest component of bank securities, the conclusions are similar for this sub-category. Portugal and Italy are less home

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[1] A genuine home bias measure would involve all holdings of banks in a particular country and to compute a true World CAPM benchmark, we would also have to consider the market capitalization of securities issued outside the Euro area.

biased with respect to short term debt. The results for equity, the most studied asset class in the home bias literature, are different, with overall less home bias. There are two caveats to these conclusions. First, our measure shows a strong concentration of locally produced bank risk at home. Which is strongly suggestive of severe home bias in bank risks holdings. Yet, what we report is not a standard home bias measure, as such measures consider all the holdings of a particular country in their home securities relative to their overall holdings and compare it to typically a CAPM like benchmark. Second, of course any incidence of home bias is likely to lead to the concentration of locally produced risk at home, so that the domestic concentration of bank risk may not special. It is therefore important to benchmark the findings with non-bank securities. We do so in Table 3c for securities issued by non-financial corporations. First, there is again universal home bias, with all countries holding on to relatively high percentages of locally issued securities, and percentages higher than the percentage they represented in issuances. However, the cross-country variation in the domestic concentration of locally produced securities is smaller than for bank risk. Now, there are only two countries that hold more than 70% of their local securities (Latvia and Slovenia) and there are only three countries that hold less than 20% of their locally produced securities. Most local concentration measures vary between 35% and 55%, and Italy, Portugal and Greece feature towards the lower end of that range. Of course, one reason for the stark differences is that equities are now the dominant asset class, not bonds. Yet even for long term debt we see much less extreme local concentrations with Latvia featuring the highest percentage at 69.33% and with 4 countries showing percentages of local concentration below 20%.

In Table 3d, we document the domestic concentration of government debt. It has been widely documented that large European banks hold sovereign debt portfolios heavily biased toward domestic government debt (see Horvath, Huizinga, Ioannadou (2015), for example), which has in turn played an important role in the rapidly growing literature on the sovereign-bank nexus. The first two columns of the table first show that France and Italy are the largest producers of sovereign debt (both accounting for about 25% of the total amount issued). Luxembourg and the Netherlands hold proportionally more euro area issued debt than they issue, whereas Germany and France hold significantly less than they issue. While domestic concentration of the holdings of government debt should not be a surprise, the table reveals that a) the domestic bias is less severe compared to the domestic bias observed for the holdings of bank risk; b) there is less cross-country variation in the concentration numbers compared to what we observe for bank risk. There are only two countries holding more than 70% of their government debt domestically (Estonia and Malta), and there are only two countries holding less than 20% of their government debt (Germany and Finland). Portugal, Greece, Italy and Spain do hold

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between 50 and 60% of their government debt domestically, but these percentages are invariably lower than what we document for bank risk.

4.   The re-allocation of bank risk

In the portfolio choice literature, focusing mostly on households, whether and why agents rebalance portfolio holdings, is a central research question. Definitive answers are elusive because the data are incomplete or poor quality. For example, Brunnermeier and Nagel (2008) suggest that the portfolio allocations of households are characterized by inertia. However, their findings are based on survey data, not "hard" portfolio holdings data, a problem plaguing much of the literature. Research based on 401K accounts (see Madrian and Shea, 2001; Choi et al. 2002) also suggests inertia, but, in contrast, brokerage data (e.g. Barber and O'Dean, 2000) suggest intense trading. These studies suffer both from a potential unrepresentative sample of households, and an incomplete picture of the household's total holdings. Moreover, they do not necessarily observe actual trades making it necessary to differentiate valuation changes from active rebalancing, which is often difficult.

Calvet, Campbell and Sodini (2009) resolve these problems with Swedish data for 1999-2002, comprising comprehensive year-end data on the holdings of Swedish households. Whereas the data do not contain asset purchases and sales, they observe the ISIN of the household's holdings, allowing relative reliable computations of actual rebalancing. They also find little aggregate portfolio rebalancing at the household level, but more active rebalancing at the individual household level.

Compared to Calvet et al. (2009), our data are much more complete covering the whole Euro area, 22 categories of investor types and data at the ISIN level of all securities issued or held in the Euro area. Observing data at the ISIN level and all holdings of the security makes characterizing re-allocation trivial, as we can study the portfolio fractions of different investor types at the security level. The disadvantage of the data is that we only observe information aggregated over various broad investor categories and can therefore not link an investor's rebalancing choices to her characteristics.

Our general approach is to study the portfolio fractions at the security level. Define $w_{i,t}^{k}$, where k indicates the holder of the security (e.g. banks in Italy). Because our data set contains all holdings, these weights add up to one. Therefore, any changes in such weights must reflect rebalancing. Such an approach is important given our purposes, as we want to contrast rebalancing in bank securities with rebalancing in non-bank securities. However, bank securities underwent considerable valuation changes, and the banking sector was subjected to multiple economic and regulatory shocks, making

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controlling for relative valuation changes very critical. Our benchmark regression considers all bank ISINs and measures the average absolute change in quarterly holdings for a particular holder (investor type, country, …). We run separate regressions for bond ISINs and equity ISINs. In Tables 4 and 5, we focus on investor type, split up over banks, insurance companies, etc. In Tables 6 and 7, we investigate the re-allocation of bank risk geographically.

The regressions are run with and without fixed effects for time, ISIN, and location (investor type). Because there are a large number of ISINs, which represent a small outstanding amount, economically unimportant ISINs may dominate a linear regression. We therefore also report weighted least squares regression results, where the weights are the amount outstanding of individual ISINs relative to the total amount outstanding. Concretely, we multiply the independent and all dependent variables with the square root of the weight. This way, we give more weight to ISINs with large amounts outstanding relative to ISINs with relatively less amount outstanding.

Focusing on the investor type regression in Tables 4 (unweighted) and 5 (weighted), we find that re-allocations are statistically significant for most investor types when investigating bond ISINs. The non-EMU area (2.20%), money market funds (1.79% on average) and banks (0.77%) implement the largest re-allocations of bank risk. The conclusions are identical when fixed effects are introduced. Equity ISINs paint a very different story. The re-allocations are much smaller in general and statistical significance is not always present when fixed effects are introduced. The non-EMU area remains the largest "re-allocator" of equity bank risk (1.32% changes on average); banks the second and investment funds the third largest rebalancers but the average asset holding changes for the latter two are rather small (varying between 0.14% and 0.21%). When all fixed effects are included, rebalancing by households is not significantly different from zero. These results therefore indicate active rebalancing of bank risk, but it is more pronounced for bond securities, and concentrated among certain investor types. In future work, we will contrast the rebalancing of bank securities with the rebalancing of "all" securities, and the securities of non-financial corporations.

The next set of tables examines geographic rebalancing. They show affirmatively that bank risk is re-allocated across countries in a statistically significant fashion. To interpret the numbers, given the presence of fixed effects, a constant in the regression, and absolute changes in asset holdings percentages, the higher the number the more re-allocation took place on average by that particular country. We consider 4 specifications for bonds with different combinations of fixed effects, and three specifications for equities. Investigating which countries re-allocate more, weighting ISINs by their economic importance, as is done in Table 7, substantially affects the results. In a standard unweighted

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regression (see Table 6), countries such Luxembourg, Ireland and Malta, which may have a tax haven status, are among the top rebalancers. However, when a weighted regression is used, France and Germany top re-allocation among bank debt and France and Spain among bank equities. Note that the re-allocation magnitudes tend to decrease substantially when more fixed effects are introduced. This indirectly suggests that large overall rebalancing's may have taken place responding to relatively common shocks. We examine one such shock in Section 5. We plan to use this general framework to conduct some further tests on rebalancing. First, it is conceivable that when securities are issued, they end up disproportionally among certain investor types (for example, banks buy bonds for which they lead managed the distribution, but the securities are later redistributed across different investors). To check whether our findings of active rebalancing are caused by such simple post-issuance redistribution, we plan to control for the age of the security. Second, we can investigate the time effects, and time effects interacted with investor types, to identify periods in which rebalancing was most pronounced.

5.   Re-allocation and shocks

Whether and how economic agents respond to shocks though portfolio rebalancing is at the heart of portfolio choice theory. In our context, the ultimate goal is to trace the reallocation of bank risk after important economic shocks. We consider two examples. In a first example, we trace rating changes for bank securities, and document how bank risk is reshuffled after a rating change. In a second, more policy-relevant example, we analyze in depth the portfolio re-allocations of the securities issued by banks designated as Other Systemically Important Institutions (OSII).

5.1   Rating changes

To examine which investor types or countries change bank holdings when a shock to riskiness occurs, we consider ratings changes at the ISIN level. With data available at the ISIN level, and multiple ISINs available for each bank, we can again provide an in-depth analysis, controlling for a large suite of fixed effects, including bank fixed effects.

To test for portfolio re-allocation around rating changes of bonds, we focus on changes from investment grade ratings to non-investment grade ratings and vice versa. There are 709 rating upgrades and 484 rating downgrades in our sample. There are more rating upgrades than downgrades also because bonds are usually less risky closer to maturity and therefore experience an upgrade. Downgrades, on the other hand, reflect more risk that is not due to any bond maturity effects. We test whether the percentage holding from before the rating change is significantly different from the

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holdings after the rating change. We consider one observation before and one observation after each event in our analysis.

In Table 8, we document the portfolio re-allocation after a rating change. For rating upgrades (column 1), money market funds are the only investor types that increase their holdings significantly, by 3%. This could be because upgrades often concern bonds that are closer to maturity and money market funds have a preference for shorter-term debt. Results are different for rating downgrades (column 2). In this case, the most active investor type is banks, who increase their holdings by 2%. By contrast, insurance companies decrease their holdings by 0.7%.

5.2   Other systemically important institutions: General review

Banks designated as Other Systemically Important Institutions (OSII) are subject to more stringent supervision and regulation, including add-ons for CET1 capital of up to 2%. Each national supervisor decided which banks are designated as OSII over the course of 2015-16. Assessment on which banks are OSII was based on the guidelines from the European Banking Authority (EBA) and the Basel Committee (pursuant to Article 131 (3) of Directive 2013/36/EU). According to the guidelines, O-SIIs are institutions that, due to their systemic importance, are more likely to create risks to financial stability, cause economic negative externalities and contribute to market distortions.

The methodology in the EBA Guidelines requires relevant authorities to identify systemically important institutions in a two-step approach. The relevant authorities initially assess institutions through a predefined set of criteria and indicators, thought to reflect systemic importance, including size, interconnectedness with the financial system, relevance to the economy and/or complexity. In this stage, institutions are given a score from 0 to 10000 representing their systemic riskiness. Institutions with scores above an upper threshold are automatically identified as OSII. In the following stage, relevant authorities further assess institutions, with scores above a lower threshold, and can use a set of alternative, but pre-set quantitative or qualitative factors to identify additional local institutions as O-SIIs. The O-SIIs identification process started in 2015 and takes place on a yearly basis. On the first list compiled by the EBA in April 2016 following the input from national authorities, 173 European banks were designated as OSII.

5.3   O-SII surprises/shocks

In our analysis, we view the public announcements by each national supervisor on which banks in a particular country are designated as OSIIs as unexpected events. Our main goal is to investigate how

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investors re-allocate the holdings of the securities of such systemically important financial institutions following these announcements.

The OSII events provide a cleaner examination of the portfolio choice effects of being designated systemically important, than does the well-known list of Globally Systemically Important institutions, which was made public by the Financial Stability Board and Basel Committee on Banking Supervision on November 4th, 2011 and renewed each year since then. First, it is hard to argue that the inclusion of most of these banks would have surprised markets, making the definition of a surprise event very difficult. In fact, it is well known that the Financial Times leaked a provisional list of banks twice well ahead of its official publication. Second, there are very few European banks on the list (about 20 in year 2015), reducing the power of our tests. The OSII list, in contrast, covers many more institutions; was genuinely a surprise to the markets (as we demonstrate below) and most events are within our sample period. Finally, the O-SII banks also faced differential capital surcharges which can be used to proxy for differences in regulatory costs imposed on O-SII banks.

Before investigating the holdings data, we document the price effects, hereby complementing the recent analysis in Andries et al. (2019). We examine the price effects on bond and equity returns, linking our ISIN data to available market prices price data from the ECB's Consolidated Securities (only securities with data for all quarters considered were retained; and only straight bonds are considered).

For equity returns, we show cumulative returns ranging from -6 to 5 quarters around each event, where the benchmark is one quarter before the event. We split the sample in O-SII banks versus non-OSII banks. While we could use higher frequency data, our re-allocation data are quarterly, making this set-up the natural choice. In addition, our preliminary results do not yet control for market movements around the events, but it unlikely any risk control will change the results. For bonds, we investigate yield changes for the two groups around the event.

From an economic perspective, the expected price reactions are actually unclear. For shareholders, the O-SII designation may have positive or negative effects on profitability. Positive effects may arise because the association of O-SIIs with the too-big-to-fail (TBTF) status increases the probability of future bailouts in the case of collapse and may help such institutions obtain lower funding costs (e.g., Morgan et al., 2014; Gorton and Ordoñez, 2016). A negative price reaction may arise from a "stigma effect," because the O-SII designation publicly reveals that the bank must comply with additional, potentially costly, regulatory requirements, including additional capital buffers, and

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must deal with tighter supervision (see e.g. Dewenter and Riddick, 2018). In addition, if a bank is forced to raise more equity, existing shareholders are diluted.

For bondholders, the positive effects generally arise from the O-SII designation lowering default risk, because OSII banks must strengthen their capital buffers and are subject to more stringent regulation. In addition, the TBTF association implies that bondholders are now more likely to be bailed out following a crisis. Alternatively, negative bond price effects if being designated as an O-SII may push a bank closer to default, and the market believes that bondholders may not be bailed out when a crisis hits, due to new bail-in rules.

We show the results in Table 9 and Figure 3. Let's first focus on equities. The Figure shows the pre-and post-event returns using equally weighed portfolios of O-SII and non-O-SII banks. Pre-event, cumulative returns move similarly for the treated and non-treated banks. Clearly, the price reaction after the event is quite negative for all banks but much more pronounced for the O-SII banks, with the cumulative return reaching a trough of -30%, two quarters after the event. Table 10 shows the cumulative returns, and tests whether the differences are statistically significantly different from zero. The differential effect in the first quarter is -3% and is significant at only the 10% significance level. all the other differences are highly statistically significant, with the maximum difference observed after two quarters at a whopping 19%.

The bond effects are, in contrast, more modest but occur in very low interest rate environment (yields averaged about 2% around the event). Again, the yields on the two bond portfolios move in lockstep before the events but start to diverge afterwards with the yields of O-SII banks declining more steeply than those of the other banks. Table 9 reveals that the difference is small (7 basis points) at impact but still significantly different from zero at the 1% significance level. It peaks at 14 basis points at lag 3 and is statistically significant throughout. We thus document that, for the banks included on the OSII list, bond prices increase (that is yields decrease) while equity prices decrease consistent with more safety for bondholders (higher capital buffers) but lower bank profitability (costly regulation hurting shareholders). These results are not entirely consistent with the recent results in Andries et al. (2019) looking at price effects on CDS spreads and stock returns. These authors find short term negative effects in both markets, which partially reverse over time.

5.4   Methodology and results

Our price effects suggest that the shock was interpreted as providing more stringent regulation by

financial markets. We now analyze whether bank risk was re-allocated following such a regulation shock and how. In terms of data, we employ all bank ISINs between six quarters before and six quarters after any event; the events range from the first quarter of 2015 to the first quarter of 2016. We measure the percentage holdings for various investors, at the ISIN level, quarter to quarter. To measure how their portfolios were affected by the stress test the first model we employ is:

$$holding_{j,inv,t} = \alpha_0 + \sum_{inv} \alpha_1^{inv} \, OSIIinclusion_j * I_{inv} * post_{j,t}$$
$$+ \, LevelControls_{j,inv,t} + \delta_j + \gamma_t + \epsilon_{j,inv,t}$$

The independent variable, $holding_{j,inv,t}$, is the relative holdings of security j of investor type inv at date t. The *OSIIinclusion* is a dummy variable that is 1 for ISINs issued by OSII-designated banks and 0 otherwise. $Post_{j,t}$ is a dummy variable equal to 1 post surprise and 0 otherwise. I_{inv} is a dummy variable that indicates the investor type. δ_j captures bond specific effects and γ_t time specific effects. $LevelControls_{j,inv,t}$ are double interaction terms of all elements of the triple interaction as well as the variables individually. This model tests whether certain investor types rebalanced their bank risk in response to the more stringent capital requirements relative to those bank securities that were not affected. Note that because events are staggered over a period of more than one year, this regression setup is similar to a staggered introduction test with the additional benefit that there is a control group that is never treated. Hence, this helps dispel the possibility that a single external event at the time of one reform could drive the results.[2]

Table 10 presents baseline results for the re-allocation of bank bond holdings (column 1, a regression with no additional controls, and column 2, a regression with additional controls like security fixed effects, time fixed effects, country times time fixed effects) and bank equity holdings (columns 3 and 4, likewise without and with additional controls). We also show results with only ISINs ranked above the median in terms of size to mitigate the concern that our regression results are dominated by a large number of rather smallish issuances. First looking at the standard results, we find that banks increase holdings of equity and decrease holdings of bonds issued by the OSII-designated banks by about 3% (relative to their holdings of non-OSII banks). Households and insurance companies likewise increase holdings of equity issued by the OSII-designated banks. By contrast, investment

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[2] Andries et al. (2019) suffers from this problem by focusing on the date the EBA published the list of OSII banks. It also more than likely that by this time the information had already been incorporated into both prices and holdings.

Electronic copy available at: https://ssrn.com/abstract=3440929

funds and the "Other Financial Institutions" sector (which includes financial vehicle corporations) decrease holdings of equity issued by the OSII-designated banks. Non EMU countries increase holdings of O-SII designated bonds modestly (by about 35 basis points), but "Other Financial Institutions" sector is the sector that increases holdings of bonds issued by the OSII-designated banks the most, by close to 8%. Not all these results are robust to the removal of the smaller ISINs. Banks continue to decrease bond holdings (but by only 1.66%) and increase equity holdings (again by about 2%). Governments decrease their holdings of OSII designated banks by about 0.3 percent. The increase of equity holdings is robust for insurance companies (but a bit smaller at 1%) bit not for households. When focusing on the larger ISINs, insurance companies also significantly reduce their holdings of OSII designated bonds. The reduction in equity holdings for investment funds decreases to 0.63 percent and is no longer statistically significant. The increase of bond holdings for non-EMU investors is larger (almost 0.6%) when focusing on larger ISINs. Finally, "Other Financial Institutions" still decrease their equity holdings by about 2.3% but the increase in their bond holdings is now decreased to 3.78%.

Figure 4 presents the estimates for bank portfolio rebalancing graphically, showing the quarter-by -quarter effects (the estimation was redone splitting the post dummy into various quarters before and after the event).. Cleary, the banking sector's rebalancing away from the bonds of OSII banks and into their equity starts right at the event time. For equities, it appears that no further rebalancing happens whereas for bonds, there is some further decreases of holdings until 4 quarters after the event.

In Tables 10 and 11, we further differentiate between banks on the OSII list that become subject to more stringent supervisory and regulatory requirements (increase in the CET1 ratio) and those that are only subject to more stringent supervision (no increase in CET1 ratio). We compare the re-allocation of bank securities holdings between these two types of OSII-designated banks. Table 11 uses all ISINs, Table 12 removes the smaller size ISINs (below the median). Results for the re-allocation of bank bond holdings are in columns 1-3 (column 1, bonds issued by OSIIs not subject to capital surcharge; column 2, bonds issued by OSIIs subject to capital surcharge; column 3 considers the differential effect between columns 1 and 2). Results for equities are similarly presented in columns 4-6.

Table 11 documents that banks decrease holdings of bonds issued by OSII-designated banks subject to additional capital buffer requirements relative to bonds issued by the other OSII-designated banks. This relative decrease is driven solely by the decrease in bond holdings issued by OSII-designated banks that are subject to the additional capital buffer. For equity holdings, banks increase

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holdings of equity issued by OSII-designated banks subject to the additional capital buffer relative to equity issued by the other OSII-designated banks. By contrast, non-financial corporations increase (decrease) their relative holdings of bonds (equity) issued by OSII-designated banks subject to the additional capital buffer relative to bonds issued by the other OSII-designated banks. Table 12 shows this result to be robust for the larger ISINs, but banks now significantly decrease their holdings of the no buffer banks. Households and non-EMU investors both increase their relative holdings of bonds issued by OSII-designated banks subject to additional capital buffer relative to bonds issued by the other OSII-designated banks. For households, this relative increase is driven solely by the decrease in holdings of bonds issued by banks with no additional capital buffer. Thus, households, which decreased their holdings of systemically important banks modestly by about 25 basis points, do so primarily by decreasing their holdings of the banks not required to hold additional capital. This result also holds true for just the larger ISINs, where we also observe a significant increase of their allocation to banks requiring the additional capital buffer. For the non-EMU investors, the increase in relative bond holdings is driven both by the decrease in holdings of bonds issued by banks with no additional capital buffer and by the increase in holdings of bonds issued by banks subject to additional capital buffer. This result is also robust to focusing on the larger ISINs.

Other notable results include governments decreasing and investment funds increasing their holdings of OSII designated banks without capital buffer requirements. This result is robust to using the larger ISINs in the regression (See Table 12). Because the re-allocation of buffer banks is relatively small, the difference is statistically significant. The significant difference between reallocation for buffer and non-buffer banks observed for non-financial corporations is driven by the smaller ISINs and disappears in Table 12. On the equity side, in contrast, non-financial corporations increase their exposure to zero buffer banks but decrease their exposure to buffer banks, with the difference amounting to almost 3%, which drops to 1.50% in Table 11. Insurance companies decrease (increase) exposure to bonds (equities) of OSII banks, with no significant differences between buffer and non-buffer banks, both in the full sample and for larger ISINs.

A headline result is that banks increase holdings of the riskiest asset class issued by banks now designated as systemically important by national supervisors. At the same time, banks decrease their exposure to bonds of OSII designated banks. Those bonds appear to be perceived as safer by the market, either because of the additional regulatory requirements OSII banks are subject to or because these banks are now perceived as too-big-too-fail. These results would at first glance appear inconsistent with a pure information story were banks know more about the prospects of the bank

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assets as a whole as an "insure insider," in the spirit of Van Nieuwerburgh and Veldkamp (2010). Without knowing the identity of the banks dominating the re-allocation and much additional empirical work, it is difficult to ascertain whether the re-allocation could also reflect agency problems in the banking sector which, overall, seems to load up on riskier securities.

While we defer a more thorough analysis to future work, we dig a bit deeper in Table 13. We consider the re-allocation of bonds issued by the OSII-designated banks, distinguishing between higher- and lower-rated investment grade bonds. We find that banks increase holdings of lower-rated bonds and reduce holdings of higher-rated bonds issued by the OSII-designated banks. By contrast, non-financial corporations, other financial institutions, and non-EMU investors reduce holdings of lower-rated bonds and increase holdings of higher-rated bonds issued by the OSII-designated banks. This result is intriguing because it suggests that, following the OSII designation, banks increase their holdings of riskier bank securities, and decrease their holdings of the safest bank securities. One possibility is that banks view the differently rated banks as equally risky given their systemic importance designation and potential too-big-to-fail status, rendering their equity securities also less risky than the bank's ratings would indicate. If the market does not have the same interpretation of the implications of the OSII designation, the price reactions make lowly rated bonds and the equities of the riskier OSII designated banks relatively cheap.

6.   Conclusions

In this paper, we analyze the (re-)distribution of bank risk in the euro area across asset classes (short- and long-term debt, equity), across investor types and across geographic locations. To do so, we use the Securities Holdings Statistics database for the euro area which contains information on securities holdings at the ISIN level. Our data is therefore much more comprehensive than typical studies on asset holdings, but we only have information across larger categories of investor types.

Our main findings are as follows. First, bank risk is held disproportionately by other banks. Banks hold only 18% of all securities but 28% of all bank-issued securities with the over-allocation to bank risk most pronounced for long-term bank debt. Second, households are disproportionally exposed to riskier bank securities. Third, about 30% of bank securities are held outside the euro area, with these percentages larger (smaller) for short term debt and equities (long term debt). Large issuers of bank risk also hold most of the bank risk, with the exception of the Netherlands, which, despite being a top 5 issuer, holds almost no bank securities. Fourth, we document a very marked "home bias" in the holding

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of bank risk. The domestic concentration of bank risk varies greatly across countries and is particularly severe for countries such as Greece, Italy and Portugal. Fifth, we find evidence for statistically significant rebalancing of bank risk for most investor types. However, rebalancing is much more economically important for debt securities than for equities.

Finally, we exploit the inclusion of some banks on the list of other systemically important institutions (O-SII) as a shock to the riskiness of securities issued by those banks. We document that following the inclusion on the OSII list, bank stock (bond) prices decrease (increase) relative to stock (bond) prices of banks not included on the list. In terms of re-allocation of bank securities holdings following the inclusion on the OSII list, banks increase holdings of equity and decrease holdings of bonds issued by the OSII-designated banks. Households and insurances likewise increase holdings of equity issued by the OSII-designated banks. By contrast, investment funds and Other Financial Institutions sector (which includes financial vehicle corporations) decrease holdings of equity issued by the OSII-designated banks. Other Financial Institutions sector is the primary sector that increases holdings of bonds issued by the OSII-designated banks. With banks increasing their exposure to riskier bank securities, these results beg the question of whether the re-allocation of bank risk after many banks were designated systemically important is not increasing the risk in the banking sector. We plan to further test the re-allocation of bank risk following shocks to information and regulation, so that we can try to differentiate theories that emphasize agency problems in the banking sector versus superior information of the banking sector regarding their sector's prospects, or regarding the effects of regulatory and bail-out policies (see Bekaert, Breckenfelder, and Hoerova, 2019).

Our results are preliminary and there is much work to do to finalize the current paper and much work to follow it up with. For example, we are also planning to study home bias and foreign investment bias more generally with this data set.

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Figure 1: Bank versus market holdings of bank securities

This figure shows the share of banks invested in other banks over time (red solid line), the fraction of bank issued securities of the entire market (dashed blue line), and the difference between these two (dash-dotted green line). The vertical axis reports percentages and the horizontal the sample period from 2009q1 to 2017q4.

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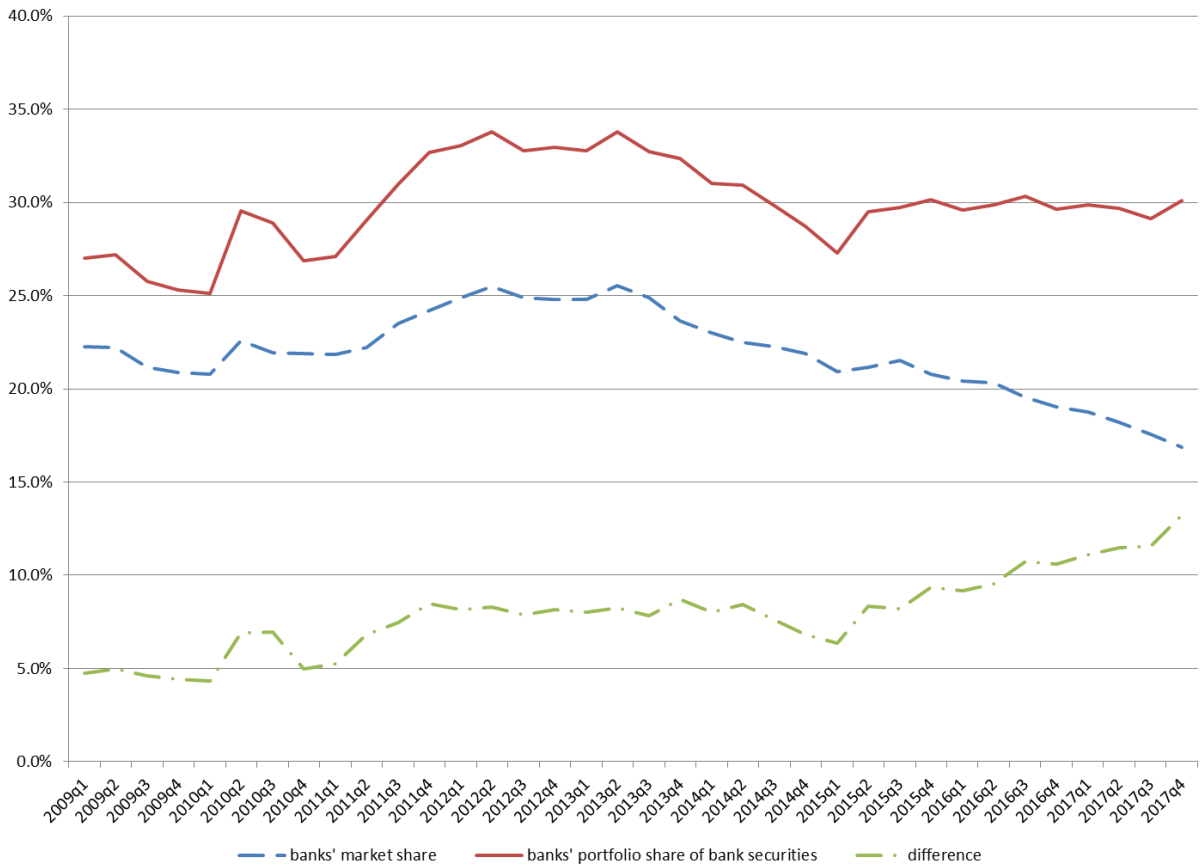
Figure 2: Local holdings

This graph shows percentages of local holdings by country of bank securities (upper panel), public debt, and non-financial securities (bottom panel). Countries are sorted by the percentage of local holdings of bank securities.
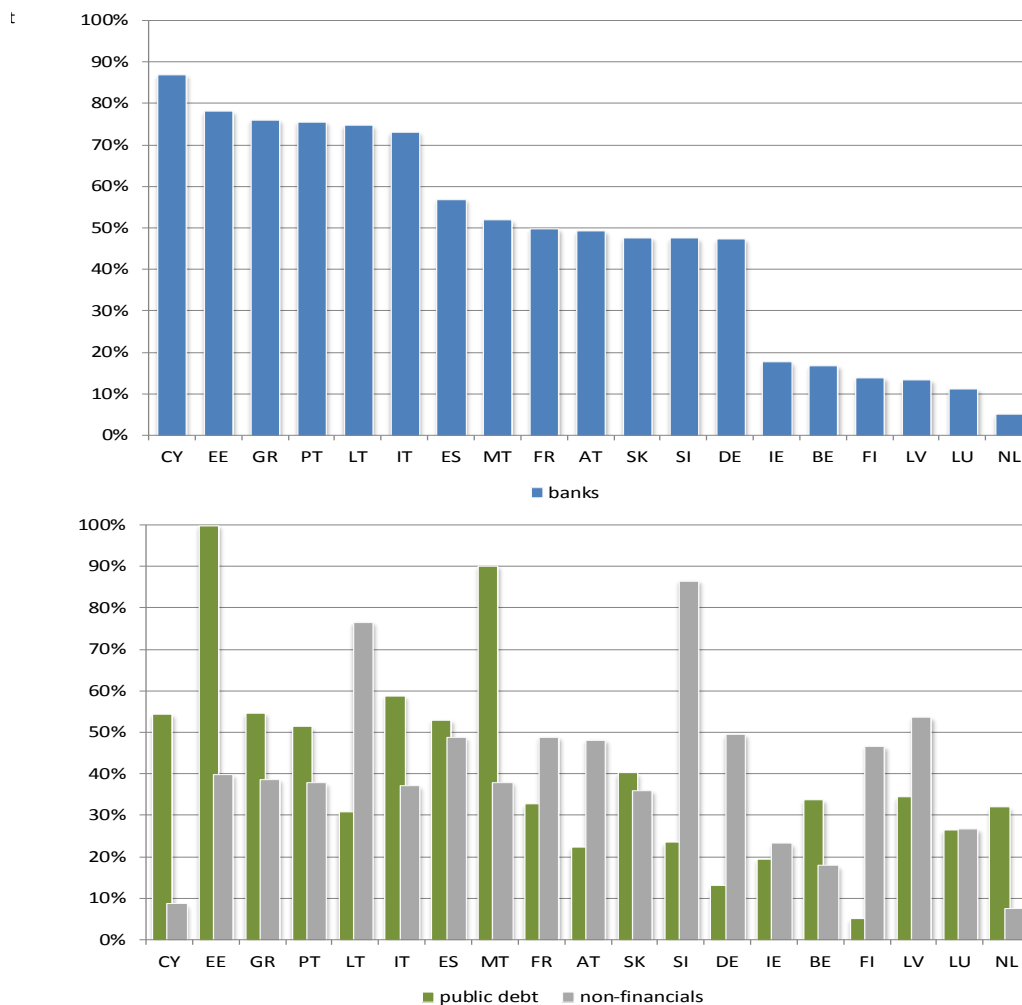
Figure 3: Other systemically important institutions - market reaction

This figure shows the market reactions of equity around the announcements of O-SII banks, six quarters before and six quarters after the each event. Equity returns are cumulative events relative to the days prior to the events (distance -1). The red solid line shows equity returns for non-O-SII banks and the blue solid line for O-SII banks. The vertical axis reports percentages and the horizontal the quarter distances to each event.

Equity prices:

Bond yields:

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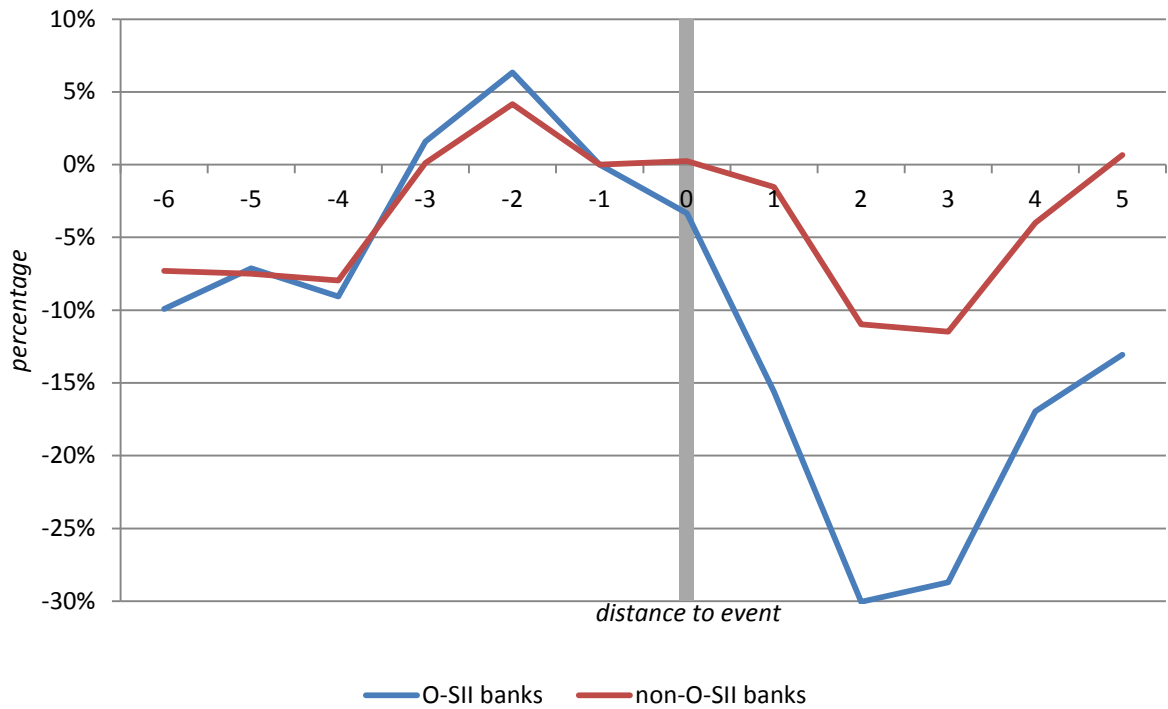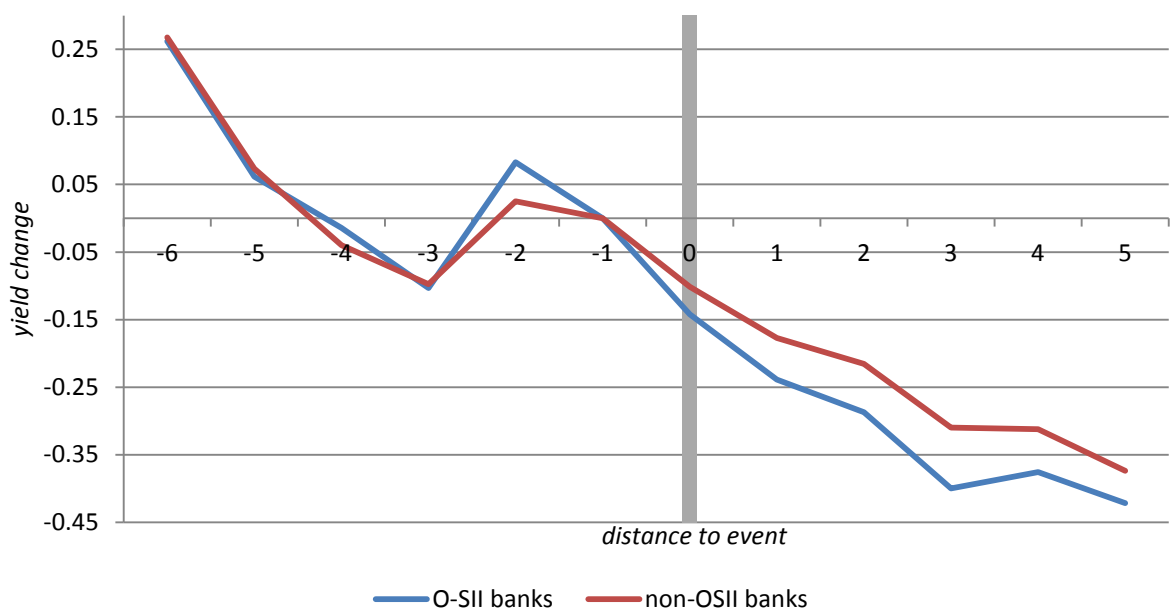
Figure 4: Other systemically important institutions - portfolio rebalancing

This figure shows the rebalancing of banks invested in other banks around the O-SII events for bond and equity holdings. The model employed is:

$$holding_{j,inv,t} = \alpha_0 + \sum_{inv,dist} \alpha_t^{inv,dist} \, OSIIinclusion_j * I_{inv} * distance_{j,dist}$$
$$+ \, LevelControls_{j,inv,t} + \delta_j + \gamma_t + \epsilon_{j,inv,t}$$

The independent variable, $holding_{j,inv,t}$, is the relative holdings of security j of investor type inv at date t. The OSIIinclusion is a dummy variable that is 1 for O-SII designated banks and zero otherwise. The $distance_{j,dist}$ dummy is one for a specific distance to the events and zero otherwise. I_{inv} is a dummy variable that indicates the investor type. δ_j captures bond specific effects and γ_t time specific effects. $LevelControls_{j,inv,t}$ are double interaction terms of all elements of the triple interaction as well as the variables individually. The solid purple line gives the development of bank holdings of bank O-SII designated issued bonds around the events and the solid blue line that of bank equities. The dotted lines indicate p-value 0.05 of the estimates. The vertical axis reports percentages and the horizontal the quarter distances to each event.
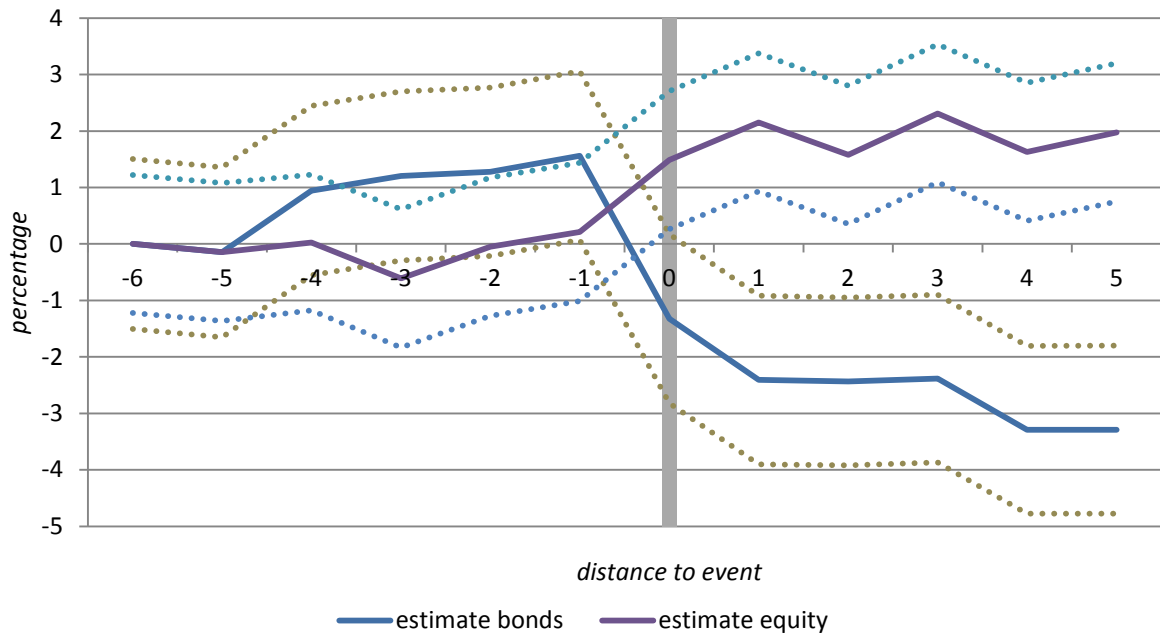
Table 1: Holdings distribution among investor types

This table presents the allocation of issued securities by banks and non-financial corporations among investor types. Panel A shows the allocation for securities issued by banks relative to the total market. Panel B gives the allocation for securities issued by non-financial corporations relative to the total market. Both panels show percentages and the total amount in trillions euros separating security types into long-term debt, short-term debt and equity.

PANEL A

	bank issued	all issued	diff	long-term debt bank issued	long-term debt all issued	long-term debt diff	short-term debt bank issued	short-term debt all issued	short-term debt diff	equity bank issued	equity all issued	equity diff
bank holdings	28%	18%	10%	34%	26%	8%	11%	14%	-3%	14%	11%	3%
invest fund holdings	12%	24%	-12%	12%	21%	-9%	5%	10%	-5%	19%	37%	-18%
insurance holdings	12%	14%	-2%	15%	18%	-2%	3%	2%	1%	5%	3%	2%
household holdings	8%	7%	1%	8%	4%	5%	1%	0%	0%	12%	8%	4%
MMF holdings	7%	2%	5%	2%	1%	1%	45%	37%	8%	0%	0%	0%
non-fin corp holdings	2%	5%	-3%	2%	1%	0%	2%	2%	0%	3%	12%	-9%
government holdings	1%	2%	-1%	1%	1%	-1%	0%	0%	0%	3%	2%	1%
pension fund holdings	1%	5%	-4%	1%	2%	-1%	0%	0%	0%	1%	2%	-1%
other inv holdings	5%	6%	-1%	4%	4%	0%	3%	3%	0%	14%	9%	5%
non-ea invest holdings	23%	17%	6%	20%	22%	-1%	31%	31%	0%	28%	15%	13%
	100%	100%		100%	100%		100%	100%		100%	100%	
total (bn)	5027	36213		3603	18355		640	1668		784	8120	

PANEL B

	bank issued	non fin issued	diff	long-term debt bank issued	long-term debt non fin issued	long-term debt diff	short-term debt bank issued	short-term debt non fin issued	short-term debt diff	equity bank issued	equity non fin issued	equity diff
bank holdings	28%	10%	18%	34%	8%	26%	11%	16%	-5%	14%	11%	3%
invest fund holdings	12%	38%	-25%	12%	40%	-28%	5%	7%	-2%	19%	37%	-18%
insurance holdings	12%	8%	4%	15%	25%	-10%	3%	4%	-1%	5%	2%	3%
household holdings	8%	6%	2%	8%	3%	6%	1%	1%	0%	12%	7%	5%
MMF holdings	7%	1%	7%	2%	1%	2%	45%	51%	-6%	0%	0%	0%
non-fin corp holdings	2%	11%	-9%	2%	1%	0%	2%	7%	-5%	3%	15%	-11%
government holdings	1%	2%	-1%	1%	1%	0%	0%	0%	0%	3%	2%	1%
pension fund holdings	1%	2%	-1%	1%	3%	-2%	0%	1%	-1%	1%	2%	-1%
other inv holdings	5%	7%	-2%	4%	5%	-1%	3%	5%	-3%	14%	8%	6%
non-ea invest holdings	23%	15%	8%	20%	13%	7%	31%	8%	23%	28%	15%	13%
	100%	100%		100%	100%		100%	100%		100%	100%	
total (bn)	5027	8644		3603	1975		640	77		784	6592	

Table 2: Bank debt risk: low/medium/high credit spread and rating

This table shows the allocation of issued securities by banks corporations among investor types and risk categories. Panel A gives the allocation for debt securities issued by banks for three different credit spread categories: low credit spread (below or equal to 0.5%), medium credit spread (between 0.5% and 2%), and high credit spread (equal or above 2%). Panel B shows the allocation for debt securities issued by banks for three different rating categories: AAA, BBB- to AA+ and below investment grade rating (BBB-). Both panels show percentages and the total amount in trillion euros.

PANEL A		low credit spread (<=.5)		medium credit spread (.5<y<2.0)		high credit spread (>=2.0)	
	bank issued	bank issued	diff	bank issued	diff	bank issued	diff
bank holdings	31%	38%	6%	31%	0%	27%	-4%
invest fund holdings	11%	11%	0%	12%	1%	9%	-2%
insurance holdings	13%	15%	2%	13%	1%	9%	-4%
household holdings	6%	1%	-5%	3%	-3%	17%	10%
MMF holdings	10%	4%	-6%	12%	2%	9%	-1%
non-fin corp holdings	2%	1%	-1%	2%	0%	3%	1%
government holdings	1%	1%	1%	1%	0%	1%	0%
pension fund holding	1%	1%	0%	1%	0%	1%	0%
other inv holdings	4%	2%	-2%	4%	0%	5%	2%
non-ea invest holding	22%	25%	3%	21%	-1%	22%	0%
	100%	100%		100%		100%	
total (bn)	3681	695		2042		945	

PANEL B		AAA rating		BBB- to AA+ rating		below BBB- rating	
	bank issued	bank issued	diff	bank issued	diff	bank issued	diff
bank holdings	32%	33%	1%	33%	1%	18%	-14%
invest fund holdings	15%	10%	-5%	16%	1%	26%	12%
insurance holdings	17%	11%	-5%	20%	3%	11%	-6%
household holdings	2%	0%	-2%	2%	0%	13%	10%
MMF holdings	2%	0%	-2%	3%	1%	0%	-2%
non-fin corp holdings	1%	1%	0%	1%	0%	3%	2%
government holdings	1%	1%	1%	0%	0%	0%	-1%
pension fund holding	1%	1%	0%	1%	0%	1%	0%
other inv holdings	3%	2%	-2%	4%	1%	4%	1%
non-ea invest holding	25%	40%	15%	19%	-6%	25%	-1%
	100%	100%		100%		100%	
total (bn)	2498	711		1641		146	

Table 3a: The allocation across countries

This table shows the allocation of euro area issued securities and holdings of these securities among geographic locations. Panel A contains the distribution among geographic locations for euro area bank issued securities and Panel B gives the distribution among geographic locations for euro area issued non-financial securities. The table shows mean percentages and mean total amounts in trillion euros from 2013 Q4 to 2018 Q2 splitting security types into long-term debt, short-term debt and equity.

				long-term debt			short-term debt			equity		
	issued	holdings	diff	issued	holdings	diff	issued	holdings	diff	issued	holdings	diff
PANEL A: euro area bank securities												
AT	3.29%	3.30%	0.01%	3.63%	3.71%	0.07%	1.37%	0.46%	-0.90%	3.02%	2.93%	-0.09%
BE	1.88%	1.94%	0.07%	1.02%	1.65%	0.63%	6.36%	0.86%	-5.50%	2.81%	4.32%	1.51%
CY	0.05%	0.06%	0.02%	0.04%	0.08%	0.03%	0.07%	0.02%	-0.05%	0.04%	0.03%	-0.01%
DE	22.93%	24.74%	1.81%	26.65%	29.76%	3.11%	18.42%	2.89%	-15.53%	8.57%	11.51%	2.94%
EE	0.00%	0.01%	0.01%	0.00%	0.02%	0.01%	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%
ES	10.74%	9.59%	-1.15%	8.74%	8.11%	-0.62%	2.77%	2.94%	0.17%	25.70%	22.30%	-3.40%
FI	1.71%	0.83%	-0.88%	1.83%	0.90%	-0.93%	2.93%	0.46%	-2.48%	0.29%	0.67%	0.38%
FR	27.94%	26.40%	-1.54%	24.38%	22.42%	-1.96%	46.23%	53.18%	6.95%	32.01%	30.51%	-1.50%
GR	0.76%	0.71%	-0.05%	0.23%	0.24%	0.01%	3.00%	3.13%	0.13%	1.74%	1.73%	-0.01%
IE	1.30%	4.33%	3.03%	1.34%	2.62%	1.28%	1.39%	20.87%	19.48%	1.03%	2.68%	1.65%
IT	15.53%	17.43%	1.90%	17.60%	20.61%	3.01%	0.56%	0.34%	-0.22%	16.17%	11.21%	-4.95%
LT	0.00%	0.01%	0.00%	0.00%	0.01%	0.01%	0.01%	0.01%	0.00%	0.02%	0.02%	0.00%
LU	1.16%	6.73%	5.57%	1.00%	5.53%	4.53%	3.87%	13.26%	9.39%	0.05%	9.02%	8.97%
LV	0.01%	0.02%	0.01%	0.01%	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
MT	0.01%	0.05%	0.04%	0.00%	0.06%	0.06%	0.00%	0.00%	0.00%	0.03%	0.03%	0.00%
NL	11.35%	2.23%	-9.12%	11.89%	2.27%	-9.62%	12.97%	1.45%	-11.52%	7.67%	2.50%	-5.18%
PT	1.19%	1.43%	0.24%	1.47%	1.76%	0.29%	0.04%	0.06%	0.02%	0.66%	0.49%	-0.17%
SI	0.02%	0.05%	0.03%	0.03%	0.06%	0.03%	0.01%	0.04%	0.03%	0.00%	0.02%	0.02%
SK	0.12%	0.13%	0.01%	0.12%	0.16%	0.04%	0.00%	0.00%	0.00%	0.18%	0.02%	-0.16%
	100%	100%		100%	100%		100%	100%		100%	100%	
CH		2.40%			2.69%			1.56%			1.62%	
GB		8.07%			6.44%			13.36%			12.17%	
other non EMU		18.36%			16.57%			23.43%			23.33%	
total (bn)	4796.4			3528.0			519.2			749.2		
PANEL B: non-financial securities												
AT	2.07%	2.11%	0.03%	4.02%	2.89%	-1.13%	0.64%	0.50%	-0.14%	1.61%	1.92%	0.31%
BE	3.97%	2.92%	-1.05%	4.87%	4.17%	-0.70%	6.31%	2.32%	-3.98%	3.71%	2.58%	-1.13%
CY	0.04%	0.10%	0.06%	0.08%	0.03%	-0.04%	0.03%	0.00%	-0.02%	0.03%	0.12%	0.09%
DE	24.06%	23.75%	-0.31%	13.98%	20.47%	6.49%	9.68%	5.16%	-4.52%	26.82%	25.07%	-1.75%
EE	0.06%	0.05%	-0.01%	0.14%	0.04%	-0.11%	0.01%	0.01%	0.00%	0.05%	0.05%	0.01%
ES	8.44%	7.53%	-0.91%	2.47%	2.77%	0.31%	2.75%	2.18%	-0.56%	10.03%	8.97%	-1.06%
FI	3.54%	2.86%	-0.68%	2.89%	2.07%	-0.81%	0.61%	0.36%	-0.25%	3.75%	3.13%	-0.62%
FR	39.12%	35.24%	-3.89%	47.36%	37.28%	-10.09%	58.59%	56.76%	-1.83%	36.74%	34.21%	-2.53%
GR	0.39%	0.25%	-0.14%	0.04%	0.09%	0.05%	0.00%	0.00%	0.00%	0.49%	0.30%	-0.18%
IE	0.96%	3.58%	2.62%	0.61%	5.13%	4.52%	0.40%	7.40%	6.99%	1.06%	3.06%	2.00%
IT	7.92%	5.82%	-2.10%	12.38%	7.91%	-4.47%	0.06%	0.06%	0.01%	6.93%	5.35%	-1.58%
LT	0.06%	0.07%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%	0.00%	0.07%	0.09%	0.02%
LU	1.19%	11.73%	10.54%	1.75%	11.61%	9.86%	0.66%	10.19%	9.53%	1.06%	11.80%	10.74%
LV	0.01%	0.02%	0.00%	0.02%	0.04%	0.02%	0.00%	0.00%	0.00%	0.01%	0.01%	0.00%
MT	0.01%	0.03%	0.02%	0.04%	0.07%	0.04%	0.00%	0.02%	0.01%	0.01%	0.02%	0.01%
NL	6.70%	2.91%	-3.78%	7.53%	3.72%	-3.81%	8.05%	1.13%	-6.92%	6.47%	2.72%	-3.74%
PT	1.28%	0.84%	-0.44%	1.43%	1.32%	-0.10%	12.01%	13.67%	1.66%	1.07%	0.43%	-0.64%
SI	0.09%	0.14%	0.05%	0.08%	0.14%	0.06%	0.15%	0.18%	0.02%	0.09%	0.14%	0.05%
SK	0.07%	0.06%	-0.01%	0.32%	0.21%	-0.11%	0.05%	0.06%	0.01%	0.01%	0.01%	0.00%
	100%	100%		100%	100%		100%	100%		100%	100%	
CH		3.29%			4.20%			3.16%			3.07%	
GB		8.82%			9.92%			4.40%			8.61%	
other non EMU		21.30%			13.31%			7.59%			23.53%	
total (bn)	5552.0			1099.9			70.4			4381.7		

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Table 3b: The allocation across countries: local versus foreign

This table shows the allocation of euro area issued securities and holdings of these securities among geographic locations. The table contains the distribution among geographic locations for euro area bank issued securities. Local holdings are securities issued and held in the same country. Other European Monetary Union (EMU) holdings are securities issued locally and held in other EMU countries. Non-EMU holdings are holdings outside the EMU. The table shows mean percentages and mean total amounts in trillion euros from 2013 Q4 to 2018 Q2 splitting security types into long-term debt, short-term debt and equity.

	issued	local holdings	other EMU holdings	non EMU holdings	long-term debt issued	local holdings	other EMU holdings	non EMU holdings	short-term debt issued	local holdings	other EMU holdings	non EMU holdings	equity issued	local holdings	other EMU holdings	non EMU holdings
AT	3.29%	49.37%	36.06%	14.57%	3.63%	51.19%	36.99%	11.82%	1.37%	14.48%	42.39%	43.14%	3.02%	49.97%	28.81%	21.21%
BE	1.88%	16.98%	70.35%	12.67%	1.02%	17.11%	72.25%	10.63%	6.36%	2.20%	84.58%	13.22%	2.81%	39.91%	44.80%	15.29%
CY	0.05%	87.02%	10.69%	2.30%	0.04%	88.66%	8.42%	2.91%	0.07%	147.47%	5.06%	-52.53%	0.04%	14.69%	27.63%	57.68%
DE	22.93%	47.40%	25.95%	26.65%	26.65%	51.38%	24.31%	24.32%	18.42%	5.70%	44.03%	50.27%	8.57%	51.20%	23.13%	25.67%
EE	0.00%	78.22%	17.77%	4.02%	0.00%	75.72%	19.38%	4.90%	0.00%	95.68%	6.49%	-2.16%				
ES	10.74%	56.97%	30.35%	12.68%	8.74%	60.66%	31.92%	7.41%	2.77%	56.89%	29.40%	13.71%	25.70%	51.07%	27.90%	21.03%
FI	1.71%	14.04%	58.06%	27.90%	1.83%	12.69%	57.75%	29.57%	2.93%	8.28%	67.22%	24.50%	0.29%	93.52%	4.06%	2.42%
FR	27.94%	49.85%	34.36%	15.78%	24.38%	48.37%	36.25%	15.38%	46.23%	55.86%	34.26%	9.89%	32.01%	49.17%	27.71%	23.12%
GR	0.76%	76.15%	14.34%	9.51%	0.23%	66.46%	30.26%	3.28%	3.00%	92.98%	9.10%	-2.07%	1.74%	62.05%	10.74%	27.22%
IE	1.30%	17.76%	70.25%	11.99%	1.34%	20.43%	65.28%	14.29%	1.39%	7.56%	85.76%	6.68%	1.03%	10.90%	86.28%	2.82%
IT	15.53%	73.19%	21.16%	5.65%	17.60%	79.81%	17.64%	2.55%	0.56%	14.54%	86.03%	-0.57%	16.17%	40.67%	37.64%	21.69%
LT	0.00%	74.81%	10.69%	14.50%	0.00%	71.85%	15.78%	12.37%	0.01%	123.93%	1.30%	-25.23%	0.02%	64.74%	11.89%	23.37%
LU	1.16%	11.36%	53.67%	34.96%	1.00%	9.96%	59.53%	30.50%	3.87%	13.76%	43.22%	43.02%	0.05%	14.80%	62.22%	22.98%
LV	0.01%	13.52%	7.88%	78.60%	0.01%	13.61%	7.91%	78.48%	0.00%	0.00%	4.47%	95.53%				
MT	0.01%	52.03%	47.58%	0.39%	0.00%	82.63%	16.23%	1.14%					0.03%	38.32%	61.62%	0.06%
NL	11.35%	5.25%	62.47%	32.28%	11.89%	5.34%	64.59%	30.06%	12.97%	1.54%	59.35%	39.10%	7.67%	8.92%	50.63%	40.45%
PT	1.19%	75.69%	18.42%	5.89%	1.47%	79.92%	15.48%	4.59%	0.04%	48.24%	109.81%	-58.05%	0.66%	32.73%	44.97%	22.30%
SI	0.02%	47.59%	40.51%	11.90%	0.03%	45.82%	40.55%	13.63%	0.01%	50.56%	56.30%	-6.86%	0.00%	98.09%	0.49%	1.41%
SK	0.12%	47.79%	50.98%	1.23%	0.12%	61.42%	36.96%	1.63%	0.00%	100.00%	0.00%	0.00%	0.18%	5.43%	94.56%	0.01%
	100%				100%				100%				100%			
total (bn)	4796.4				3528.0				519.2				749.2			

Table 3c: The allocation across countries: benchmark non-financial corporations

This table shows the allocation of euro area issued securities and holdings of these securities among geographic locations. The table contains the distribution among geographic locations for euro area securities issued by non-financial corporations. Local holdings are securities issued and held in the same country. Other European Monetary Union (EMU) holdings are securities issued locally and held in other EMU countries. Non-EMU holdings are holdings outside the EMU. The table shows mean percentages and mean total amounts in trillion euros from 2013 Q4 to 2018 Q2 splitting security types into long-term debt, short-term debt and equity.

	issued	local holdings	other EMU holdings	non EMU holdings	long-term debt issued	local holdings	other EMU holdings	non EMU holdings	short-term debt issued	local holdings	other EMU holdings	non EMU holdings	equity issued	local holdings	other EMU holdings	non EMU holdings
AT	2.07%	48.31%	37.95%	13.74%	4.02%	31.86%	58.11%	10.03%	0.64%	63.88%	32.86%	3.26%	1.61%	58.51%	25.35%	16.13%
BE	3.97%	18.00%	60.96%	21.04%	4.87%	18.53%	69.63%	11.84%	6.31%	19.10%	76.66%	4.25%	3.71%	17.80%	57.67%	24.53%
CY	0.04%	8.76%	72.52%	18.72%	0.08%	4.83%	66.32%	28.85%	0.03%	9.86%	75.38%	14.76%	0.03%	11.38%	76.62%	12.00%
DE	24.06%	49.58%	26.57%	23.85%	13.98%	34.47%	52.87%	12.66%	9.68%	34.78%	58.85%	6.37%	26.82%	51.64%	22.94%	25.41%
EE	0.06%	39.98%	45.48%	14.54%	0.14%	10.42%	77.33%	12.25%	0.01%	96.10%	5.54%	-1.63%	0.05%	63.05%	20.56%	16.39%
ES	8.44%	48.91%	33.54%	17.55%	2.47%	27.79%	61.02%	11.18%	2.75%	62.23%	34.82%	2.95%	10.03%	50.16%	31.84%	18.00%
FI	3.54%	46.74%	31.71%	21.55%	2.89%	33.03%	50.20%	16.77%	0.61%	49.40%	44.17%	6.43%	3.75%	49.38%	28.10%	22.52%
FR	39.12%	48.96%	30.97%	20.06%	47.36%	39.94%	47.33%	12.72%	58.59%	68.60%	23.60%	7.80%	36.74%	51.38%	25.87%	22.75%
GR	0.39%	38.85%	36.89%	24.26%	0.04%	42.42%	47.04%	10.54%	0.00%	69.23%	11.94%	18.83%	0.49%	38.77%	36.67%	24.56%
IE	0.96%	23.37%	67.58%	9.06%	0.61%	21.39%	59.93%	18.68%	0.40%	42.83%	133.81%	-76.65%	1.06%	23.53%	68.28%	8.18%
IT	7.92%	37.23%	45.70%	17.07%	12.38%	25.80%	61.91%	12.30%	0.06%	61.42%	37.42%	1.16%	6.93%	42.36%	38.44%	19.21%
LT	0.06%	76.58%	8.16%	15.25%	0.01%	13.77%	89.25%	-3.02%	0.01%	94.32%	12.19%	-6.51%	0.07%	78.18%	6.06%	15.76%
LU	1.19%	26.88%	57.78%	15.33%	1.75%	19.97%	67.31%	12.72%	0.66%	11.82%	82.34%	5.84%	1.06%	29.90%	53.59%	16.51%
LV	0.01%	53.69%	38.50%	7.81%	0.02%	69.33%	28.05%	2.62%					0.01%	47.06%	42.94%	10.01%
MT	0.01%	38.12%	56.35%	5.53%	0.04%	28.16%	63.58%	8.25%	0.00%	0.00%	100.00%	0.00%	0.01%	55.85%	43.46%	0.70%
NL	6.70%	7.78%	56.93%	35.29%	7.53%	5.87%	70.81%	23.31%	8.05%	1.82%	75.55%	22.63%	6.47%	8.46%	52.49%	39.05%
PT	1.28%	37.94%	44.19%	17.87%	1.43%	51.39%	43.45%	5.17%	12.01%	95.99%	3.24%	0.77%	1.07%	23.03%	51.79%	25.18%
SI	0.09%	86.62%	7.86%	5.53%	0.08%	65.32%	28.53%	6.16%	0.15%	98.36%	3.40%	-1.76%	0.09%	91.37%	3.05%	5.58%
SK	0.07%	36.12%	54.86%	9.02%	0.32%	32.64%	57.61%	9.75%	0.05%	99.93%	0.11%	-0.04%	0.01%	70.45%	28.29%	1.26%
	100%				100%				100%				100%			
total (bn)	5552.0				1099.9				70.4				4381.7			

Table 3d: The allocation across countries: benchmark central government

This table shows the allocation of euro area issued securities and holdings of these securities among geographic locations. The table contains the distribution among geographic locations for euro area securities issued by central governments. Local holdings are securities issued and held in the same country. Other European Monetary Union (EMU) holdings are securities issued locally and held in other EMU countries. Non-EMU holdings are holdings of locally issued securities outside the EMU. The table shows mean percentages and mean total amounts in trillion euros from 2013 Q4 to 2018 Q2 splitting security types into long-term debt, short-term debt and equity.

	holding	issued	diff	local holdings	other EMU holdings	non EMU holdings	long-term debt issued	long-term local holdings	long-term other EMU holdings	long-term non EMU holdings	short-term issued	short-term local holdings	short-term other EMU holdings	short-term non EMU holdings
AT	2.33%	3.62%	1.29%	22.59%	61.49%	15.91%	3.80%	23.05%	62.37%	14.58%	1.10%	0.38%	18.84%	80.78%
BE	5.37%	6.13%	0.76%	33.93%	50.77%	15.30%	6.10%	35.83%	50.94%	13.23%	6.56%	9.07%	48.46%	42.47%
CY	0.11%	0.10%	-0.01%	54.55%	30.53%	14.92%	0.10%	52.34%	32.00%	15.66%	0.07%	99.92%	0.31%	-0.22%
DE	11.14%	16.48%	5.34%	13.15%	45.15%	41.70%	16.82%	13.70%	44.96%	41.33%	11.71%	2.06%	48.88%	49.06%
EE	0.02%	0.00%	-0.02%	100.00%	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%				
ES	11.88%	11.92%	0.04%	53.16%	30.60%	16.25%	11.77%	54.73%	30.89%	14.38%	13.99%	34.49%	27.12%	38.39%
FI	0.67%	1.39%	0.71%	5.30%	67.68%	27.03%	1.44%	5.44%	68.69%	25.87%	0.64%	0.66%	35.47%	63.87%
FR	19.81%	24.49%	4.67%	32.84%	30.76%	36.40%	24.05%	34.56%	30.20%	35.24%	30.73%	13.81%	37.02%	49.17%
GR	0.56%	0.53%	-0.03%	54.77%	22.26%	22.97%	0.39%	43.41%	26.97%	29.62%	2.54%	79.44%	12.02%	8.54%
IE	3.09%	1.65%	-1.43%	19.62%	67.00%	13.38%	1.73%	19.78%	68.07%	12.16%	0.59%	12.99%	22.52%	64.50%
IT	25.93%	25.06%	-0.86%	58.98%	27.58%	13.44%	25.07%	60.55%	27.39%	12.07%	24.92%	36.70%	30.28%	33.02%
LT	0.08%	0.13%	0.05%	30.99%	61.95%	7.06%	0.14%	29.98%	62.85%	7.17%	0.03%	99.09%	1.56%	-0.64%
LU	6.42%	0.09%	-6.33%	26.67%	66.29%	7.03%	0.10%	26.72%	66.24%	7.04%	0.00%	0.00%	100.00%	0.00%
LV	0.06%	0.08%	0.02%	34.54%	62.20%	3.27%	0.08%	32.98%	63.59%	3.43%	0.03%	97.24%	5.99%	-3.22%
MT	0.09%	0.05%	-0.04%	90.24%	9.61%	0.15%	0.05%	89.42%	10.41%	0.16%	0.05%	100.00%	0.00%	0.00%
NL	10.35%	5.73%	-4.62%	32.16%	44.23%	23.62%	5.82%	33.14%	43.61%	23.25%	4.35%	13.57%	55.77%	30.65%
PT	1.91%	1.71%	-0.20%	51.49%	41.06%	7.44%	1.66%	48.38%	43.75%	7.87%	2.47%	80.98%	15.61%	3.41%
SI	0.20%	0.38%	0.18%	23.61%	54.88%	21.51%	0.39%	22.43%	55.70%	21.87%	0.10%	86.90%	10.89%	2.20%
SK	0.00%	0.47%	0.46%	40.33%	0.06%	59.61%	0.49%	40.46%	52.73%	6.80%	0.11%	31.69%	63.25%	5.05%
	100%	100%					100%				100%			
total (bn)		4603.7					3315.7				529.8			

Table 4: Reallocation by investor type

This table shows the reallocation of euro area issued bank securities among investor types. The table shows percentages for debt securities and equity. Reallocation is defined as the absolute percentage change on security - investor type - country level. The sample period is from 2013q4 to 2017q4.

	(1) bond	(2) bond	(3) bond	(4) bond	(5) equity	(6) equity	(7) equity
| Δ holdings |							
banks	2.86***	2.90***	1.31***	1.20***	0.90***	0.02	0.03
	(0.02)	(0.03)	(0.03)	(0.03)	(0.10)	(0.16)	(0.15)
government	0.72***	0.81***			0.63***		
	(0.03)	(0.04)			(0.16)		
MMFs	4.82***	4.90***	1.29***	1.03***	0.14**	-0.57**	-0.73**
	(0.08)	(0.08)	(0.07)	(0.07)	(0.06)	(0.25)	(0.34)
NFCs	4.23***	4.34***	0.13***	0.14***	0.63***	-0.25*	-0.20
	(0.03)	(0.04)	(0.03)	(0.03)	(0.07)	(0.15)	(0.15)
households	3.76***	3.78***	-0.49***	-0.48***	0.74***	-0.39***	-0.35**
	(0.01)	(0.03)	(0.03)	(0.03)	(0.07)	(0.15)	(0.15)
insurance	1.84***	1.91***	0.45***	0.34***	0.61***	-0.10	-0.21
	(0.03)	(0.04)	(0.03)	(0.03)	(0.09)	(0.14)	(0.15)
invest funds	2.85***	2.92***	0.76***	0.60***	1.33***	0.44***	0.38**
	(0.03)	(0.04)	(0.03)	(0.03)	(0.11)	(0.16)	(0.16)
other inv	4.43***	4.43***	0.14***	0.06**	0.86***	0.03	0.04
	(0.02)	(0.04)	(0.03)	(0.03)	(0.08)	(0.15)	(0.15)
pernsion funds	0.55***	0.60***	0.07**	0.12***	0.40***	-0.26	-0.33*
	(0.02)	(0.03)	(0.03)	(0.03)	(0.08)	(0.16)	(0.17)
non EMU	5.59***	5.57***	0.70***	0.54***	2.29***	1.28***	1.52***
	(0.03)	(0.04)	(0.04)	(0.05)	(0.18)	(0.20)	(0.21)
Observations	8,214,266	8,214,266	8,214,266	8,214,266	147,875	147,875	147,875
R-squared	0.0645	0.0661	0.5441	0.5442	0.0273	0.1677	0.1716
-	-	-	-	-	-		
TIME FE	NO	YES	YES	YES	NO	NO	YES
ISIN FE	NO	NO	YES	YES	NO	YES	YES
AREA FE	NO	NO	NO	YES	NO	NO	YES
-	-	-	-	-	-	-	-
Clustered Std. Err.	Security	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Reallocation by investor type (weighted)

This table shows the reallocation of euro area issued bank securities among investor types. The table shows percentages for debt securities and equity. Reallocation is defined as the absolute percentage change on security - investor type - country level. The sample period is from 2013q4 to 2017q4.

	⎮ Δ holdings ⎮	(1) bond	(2) bond	(3) bond	(4) bond	(5) equity	(6) equity	(7) equity
banks		0.77***	0.77***	0.82***	0.75***	0.14***	0.21***	0.13*
		(0.01)	(0.01)	(0.04)	(0.04)	(0.02)	(0.07)	(0.07)
government		0.18***	0.18***	0.34***	0.27***	0.06**	0.15**	0.05
		(0.01)	(0.01)	(0.04)	(0.04)	(0.03)	(0.08)	(0.08)
MMFs		1.79***	1.79***	1.01***	0.92***	0.01**	0.09	0.09
		(0.06)	(0.06)	(0.05)	(0.05)	(0.00)	(0.08)	(0.07)
NFCs		0.15***	0.15***	0.25***	0.16***	0.04***	0.12	0.05
		(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.07)	(0.07)
households		0.18***	0.18***	0.30***	0.26***	0.06***	0.14*	0.08
		(0.01)	(0.01)	(0.03)	(0.03)	(0.01)	(0.07)	(0.07)
insurance		0.27***	0.27***	0.43***	0.38***	0.05***	0.13*	0.05
		(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.07)	(0.07)
invest funds		0.47***	0.47***	0.55***	0.49***	0.19***	0.26***	0.19***
		(0.01)	(0.01)	(0.04)	(0.04)	(0.01)	(0.07)	(0.07)
other inv		0.20***	0.20***	0.31***	0.23***	0.11***	0.18***	0.13*
		(0.01)	(0.01)	(0.04)	(0.04)	(0.02)	(0.07)	(0.07)
pernsion funds		0.12***	0.12***	0.29***	0.23***	0.02***	0.10	0.03
		(0.00)	(0.00)	(0.04)	(0.04)	(0.00)	(0.07)	(0.07)
non EMU		2.20***	2.20***	2.11***	2.12***	1.32***	1.39***	1.39***
		(0.04)	(0.04)	(0.07)	(0.06)	(0.10)	(0.13)	(0.13)
Observations		8,214,266	8,214,266	8,214,266	8,214,266	147,875	147,875	147,875
R-squared		0.0500	0.0500	0.2348	0.2368	0.0263	0.0259	0.0306
-		-	-	-	-	-		
TIME FE		NO	YES	YES	YES	NO	NO	YES
ISIN FE		NO	NO	YES	YES	NO	YES	YES
AREA FE		NO	NO	NO	YES	NO	NO	YES
-		-	-	-	-	-	-	-
Clustered Std. Err.		Security	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Reallocation by country

This table shows the reallocation of euro area issued bank securities among countries. The table shows percentages for debt securities and equity. Reallocation is defined as the absolute percentage change on security - investor type - country level. The sample period is from 2013q4 to 2017q4.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	bond	bond	bond	bond	equity	equity	equity
| Δ holdings |							
IT	1.34***	-1.77***	-0.42***	-0.06*	0.68***	-0.31***	0.36***
	(0.01)	(0.02)	(0.02)	(0.03)	(0.07)	(0.08)	(0.08)
AT	4.11***	0.89***	-0.37***	0.02	0.38***	-0.77***	-0.12
	(0.04)	(0.04)	(0.03)	(0.04)	(0.07)	(0.09)	(0.08)
BE	2.10***	-1.09***	-0.78***	-0.31***	0.55***	-0.65***	0.02
	(0.03)	(0.04)	(0.03)	(0.04)	(0.09)	(0.08)	(0.07)
CY	2.26***	-0.98***	-0.85***	-0.38***	1.19***	-0.41**	0.28*
	(0.13)	(0.13)	(0.09)	(0.09)	(0.34)	(0.16)	(0.17)
DE	3.93***	0.64***	-0.85***	-0.46***	1.04***	-0.38***	0.24***
	(0.01)	(0.02)	(0.03)	(0.03)	(0.09)	(0.08)	(0.07)
EE	0.57***	-2.55***	-1.26***	-0.86***	0.09*	-0.86***	-0.14
	(0.07)	(0.07)	(0.07)	(0.07)	(0.05)	(0.10)	(0.09)
ES	1.57***	-1.65***	-0.20***	-0.02	1.00***	0.29*	0.90***
	(0.04)	(0.05)	(0.03)	(0.04)	(0.17)	(0.15)	(0.16)
FI	1.71***	-1.38***	-0.50***	-0.33***	0.22***	-0.66***	-0.05
	(0.05)	(0.05)	(0.04)	(0.04)	(0.06)	(0.07)	(0.06)
FR	4.88***	1.56***	0.40***	0.54***	1.08***	-0.09	0.51***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.10)	(0.10)	(0.10)
GR	0.95***	-2.24***	-1.06***	-0.45***	0.97***	-0.07	0.58***
	(0.06)	(0.06)	(0.03)	(0.04)	(0.24)	(0.20)	(0.21)
IE	2.54***	-0.79***	0.01	0.17***	1.44***	0.06	0.61***
	(0.05)	(0.05)	(0.04)	(0.05)	(0.15)	(0.10)	(0.10)
LT	1.47***	-1.64***	-1.13***	-0.64***	0.16	-0.65***	0.07
	(0.15)	(0.15)	(0.12)	(0.12)	(0.10)	(0.11)	(0.10)
LU	3.96***	0.75***	0.07**	0.23***	1.48***	0.19*	0.75***
	(0.04)	(0.04)	(0.03)	(0.04)	(0.13)	(0.10)	(0.10)
LV	0.82***	-2.29***	-1.18***	-0.85***	0.06*	-0.76***	-0.01
	(0.09)	(0.09)	(0.07)	(0.08)	(0.03)	(0.10)	(0.08)
MT	1.41***	-1.93***	-0.34***	-0.22***	1.02***	-0.02	0.64***
	(0.09)	(0.09)	(0.08)	(0.08)	(0.25)	(0.21)	(0.21)
NL	3.81***	0.61***	-0.69***	-0.32***	0.82***	-0.33***	0.35***
	(0.06)	(0.06)	(0.03)	(0.04)	(0.14)	(0.12)	(0.13)
PT	1.14***	-2.03***	-0.78***	-0.33***	0.50***	-0.61***	0.05
	(0.04)	(0.05)	(0.03)	(0.04)	(0.15)	(0.09)	(0.08)
SI	1.87***	-1.29***	-1.00***	-0.62***	0.34***	-0.72***	-0.09
	(0.09)	(0.10)	(0.05)	(0.06)	(0.12)	(0.10)	(0.09)
SK	2.34***	-0.92***	-0.62***	-0.12	0.96***	-0.61***	0.09
	(0.10)	(0.10)	(0.08)	(0.08)	(0.28)	(0.15)	(0.14)
Observations	8,214,266	8,214,266	8,214,266	8,214,266	147,875	147,875	147,875
R-squared	0.0545	0.0634	0.5430	0.5442	0.0237	0.1662	0.1716
-	-	-	-	-	-		
TIME FE	NO	YES	YES	YES	NO	YES	YES
ISIN FE	NO	NO	YES	YES	NO	YES	YES
INVESTOR FE	NO	NO	NO	YES	NO	NO	YES
-	-	-	-	-	-		
Clustered Std. Err.	Security	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Reallocation by country (weighted)

This table shows the reallocation of euro area issued bank securities among countries. The table shows percentages for debt securities and equity. Reallocation is defined as the absolute percentage change on security - investor type - country level. The sample period is from 2013q4 to 2017q4.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
| Δ holdings |	bond	bond	bond	bond	equity	equity	equity
IT	0.37***	0.33***	-0.40***	0.12***	0.12***	-0.14***	0.10***
	(0.01)	(0.01)	(0.04)	(0.02)	(0.03)	(0.03)	(0.03)
AT	0.11***	0.07***	-0.61***	-0.16***	0.03**	-0.22***	-0.01
	(0.00)	(0.00)	(0.04)	(0.01)	(0.01)	(0.02)	(0.01)
BE	0.08***	0.04***	-0.59***	-0.08***	0.04***	-0.20***	0.02**
	(0.00)	(0.00)	(0.04)	(0.01)	(0.01)	(0.02)	(0.01)
CY	0.04***	0.01	-0.60***	-0.09***	0.00***	-0.24***	-0.00
	(0.01)	(0.01)	(0.04)	(0.01)	(0.00)	(0.02)	(0.01)
DE	0.46***	0.42***	-0.32***	0.19***	0.12***	-0.13***	0.10***
	(0.01)	(0.01)	(0.03)	(0.01)	(0.03)	(0.03)	(0.03)
EE	0.06***	0.02***	-0.63***	-0.10***	0.00**	-0.24***	-0.01*
	(0.01)	(0.01)	(0.04)	(0.02)	(0.00)	(0.02)	(0.01)
ES	0.45***	0.41***	-0.34***	0.11***	0.29***	0.05	0.28***
	(0.01)	(0.01)	(0.03)	(0.02)	(0.09)	(0.10)	(0.10)
FI	0.25***	0.21***	-0.48***	-0.06***	0.01**	-0.23***	-0.01**
	(0.01)	(0.01)	(0.03)	(0.01)	(0.01)	(0.02)	(0.01)
FR	0.79***	0.76***	-0.12***	0.33***	0.34***	0.08	0.30***
	(0.02)	(0.02)	(0.03)	(0.01)	(0.05)	(0.06)	(0.05)
GR	0.10***	0.07***	-0.60***	-0.09***	0.02**	-0.22***	0.00
	(0.02)	(0.02)	(0.04)	(0.02)	(0.01)	(0.02)	(0.01)
IE	0.43***	0.40***	-0.42***	0.02	0.09***	-0.16***	0.07***
	(0.01)	(0.01)	(0.04)	(0.02)	(0.02)	(0.02)	(0.01)
LT	0.03***	0.01	-0.64***	-0.21***	0.00*	-0.24***	-0.04**
	(0.01)	(0.01)	(0.04)	(0.03)	(0.00)	(0.02)	(0.02)
LU	0.50***	0.46***	-0.37***	0.08***	0.21***	-0.04	0.18***
	(0.01)	(0.01)	(0.03)	(0.01)	(0.03)	(0.03)	(0.03)
LV	0.11***	0.08***	-0.64***	-0.32***	0.00***	-0.24***	-0.00
	(0.01)	(0.01)	(0.04)	(0.03)	(0.00)	(0.02)	(0.01)
MT	0.06***	0.03***	-0.64***	-0.25***	0.00**	-0.24***	-0.00
	(0.00)	(0.00)	(0.03)	(0.02)	(0.00)	(0.02)	(0.01)
NL	0.31***	0.27***	-0.42***	0.05	0.06***	-0.19***	0.03***
	(0.03)	(0.03)	(0.06)	(0.04)	(0.01)	(0.02)	(0.01)
PT	0.10***	0.07***	-0.60***	-0.07***	0.01***	-0.24***	-0.01
	(0.01)	(0.01)	(0.04)	(0.01)	(0.00)	(0.02)	(0.01)
SI	0.04***	0.01**	-0.63***	-0.19***	0.00***	-0.24***	-0.02***
	(0.00)	(0.00)	(0.04)	(0.02)	(0.00)	(0.02)	(0.01)
SK	0.11***	0.08***	-0.57***	-0.06***	0.00**	-0.24***	-0.02***
	(0.01)	(0.01)	(0.04)	(0.01)	(0.00)	(0.02)	(0.01)
Observations	8,214,266	8,214,266	8,214,266	8,214,266	147,875	147,875	147,875
R-squared	0.0183	0.0186	0.2201	0.2368	0.0087	0.0118	0.0306
-	-	-	-	-	-		
TIME FE	NO	YES	YES	YES	NO	YES	YES
ISIN FE	NO	NO	YES	YES	NO	YES	YES
INVESTOR FE	NO	NO	NO	YES	NO	NO	YES
-	-	-	-	-	-		
Clustered Std. Err.	Security	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

TABLE 8: Rating changes

This table presents the regression results for changes among in holdings by investor type in case of bond upgrades/downgrades by rating agencies. The surprise is a dummy variable that captures whether a specific bond is downgraded to non-investment grade and vice versa. Post is a dummy for the period after the change in rating on security level. The left-hand-side is in percentage holdings on sector-country-security level. The sample period is 2013 Q4 through 2018 Q2.

	(1)	(2)
	<u>upgrade to</u>	<u>downgrade from</u>
	investment grade	
*change invest grade * post * **MMFs***	3.252**	-0.644
	(1.637)	(0.815)
*change invest grade * post * **NFCs***	0.408	-0.058
	(0.732)	(0.740)
*change invest grade * post * **banks***	-0.677	2.002**
	(0.511)	(0.953)
*change invest grade * post * **government***	0.002	-0.003
	(0.002)	(0.016)
*change invest grade * post * **households***	0.401	-0.836
	(0.350)	(1.084)
*change invest grade * post * **insurance***	0.782	-0.676*
	(0.703)	(0.367)
*change invest grade * post * **invest funds***	-0.108	0.281
	(0.600)	-0.55
*change invest grade * post * **other fin inv***	-1.280	0.089
	(1.584)	(0.161)
*change invest grade * post * **other inv***	0.609	-0.019
	(0.630)	(0.280)
*change invest grade * post * **pension funds***	-0.190	-0.243
	(0.202)	(0.192)
*change invest grade * post * **non EMU***	-0.357	-0.678
	(0.364)	(0.961)
Observations	1,418	968
R-squared	0.8381	0.8228
-	-	-
Level Controls	YES	YES
-	-	-
Security FE	YES	YES
-	-	-
Clustered Std. Err.	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

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Table 9: Other systemically important institutions price and yield reactions

This table shows cumulative bond yields and cumulative equity returns relative to the periods before the events both for Other Systemically important Institutions (O-SII) and non O-SII banks. The differences are t-tests on the difference between the non O-SII banks and non O-SII banks of cumulative bond yields and equity returns.

	cumulative bond yields					cumulative equity price changes				
	non O-SII banks		O-SII banks		difference	non O-SII banks		O-SII banks		difference
distance (quarter)	mean	sd	mean	sd		mean	sd	mean	sd	
-6	0.23	0.35	0.33	0.35	0.106**	-0.07	0.14	-0.10	0.19	-0.026
					(0.042)					(0.055)
-5	0.05	0.32	0.11	0.29	0.057	-0.07	0.13	-0.07	0.11	-0.004
					(0.039)					(0.047)
-4	-0.03	0.25	0.04	0.26	0.072**	-0.08	0.12	-0.09	0.11	-0.011
					(0.031)					(0.045)
-3	-0.10	0.22	-0.08	0.23	0.017	0.00	0.13	0.02	0.07	0.015
					(0.026)					(0.046)
-2	0.01	0.21	0.06	0.23	0.056**	0.04	0.08	0.06	0.07	0.022
					(0.027)					(0.030)
-1	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	-
0	-0.07	0.24	-0.14	0.21	**-0.075***	0.00	0.07	-0.03	0.07	**-0.036***
					(0.027)					(0.021)
1	-0.15	0.27	-0.23	0.26	**-0.080**	-0.02	0.13	-0.16	0.09	**-0.141***
					(0.032)					(0.046)
2	-0.18	0.32	-0.28	0.29	**-0.099***	-0.11	0.16	-0.30	0.19	**-0.191***
					(0.036)					(0.060)
3	-0.25	0.35	-0.39	0.34	**-0.141***	-0.11	0.16	-0.29	0.21	**-0.172***
					(0.041)					(0.061)
4	-0.25	0.36	-0.35	0.38	**-0.107**	-0.04	0.13	-0.17	0.27	**-0.130**
					(0.044)					(0.060)
5	-0.31	0.39	-0.43	0.40	**-0.122***	0.01	0.15	-0.13	0.21	**-0.137**
					(0.048)					(0.059)
N	155		193		348	29		48		77

Table 10: Other systemically important institutions baseline regression

This table shows the results for the baseline regression setup and regression results for both various investor types and security types. The model has the following specification:

$$holding_{j,inv,t} = \alpha_0 + \sum_{inv} \alpha_1^{inv} \, OSIIinclusion_j * I_{inv} * post_{j,t}$$
$$+ \, LevelControls_{j,inv,t} + \delta_j + \gamma_t + \epsilon_{j,inv,t}$$

The independent variable, $holding_{j,inv,t}$, is the relative holdings of security j of investor type inv at date t. The OSIIinclusion is a dummy variable that is 1 for ISINs issued by OSII-designated banks and 0 otherwise. $Post_{j,t}$ is a dummy variable equal to 1 post surprise and 0 otherwise. I_{inv} is a dummy variable that indicates the investor type. δ_j captures bond specific effects and γ_t time specific effects. $LevelControls_{j,inv,t}$ are double interaction terms of all elements of the triple interaction as well as the variables individually. Column 1 and 2 report results on bonds with and without additional controls. Column 4 and 5 show results on equity with and without additional controls. . Column 3 and column 6 show results for bonds and equities with above median amount outstanding.

% holdings	(1)	(2)	(3) above median size	(4)	(5)	(6) above median size
		bonds			equity	
OSII inclusion * post * **banks**	-3.01***	-3.00***	-1.66***	2.02***	2.04***	1.97**
	(0.246)	(0.249)	(0.268)	(0.624)	(0.631)	(0.876)
OSII inclusion * post * **NFCs**	0.22	0.23	-0.17	-0.40	-0.41	1.19
	(0.158)	(0.160)	(0.148)	(1.224)	(1.239)	(1.204)
OSII inclusion * post * **government**	-0.38**	-0.33**	-0.32**	-0.41	-0.42	-0.44
	(0.153)	(0.156)	(0.138)	(0.281)	(0.289)	(0.322)
OSII inclusion * post * **households**	-0.25*	-0.24	0.20	1.49**	1.48**	0.06
	(0.150)	(0.154)	(0.172)	(0.680)	(0.696)	(0.472)
OSII inclusion * post * **insurance**	-0.25	-0.22	-0.62**	1.72**	1.73**	1.00*
	(0.277)	(0.281)	(0.289)	(0.689)	(0.701)	(0.499)
OSII inclusion * post * **invest funds**	-0.05	-0.05	-0.02	-2.02**	-2.01**	-0.63
	(0.251)	(0.256)	(0.251)	(0.825)	(0.833)	(0.481)
OSII inclusion * post * **pernsion funds**	-0.07	-0.07	0.24	-0.57	-0.57	0.31
	(0.315)	(0.320)	(0.268)	(0.607)	(0.617)	(0.334)
OSII inclusion * post * **other fin inv**	7.90***	7.94***	3.78***	-2.55***	-2.56***	-2.34**
	(0.500)	(0.511)	(0.411)	(0.744)	(0.752)	(1.127)
OSII inclusion * post * **other inv**	-0.08	-0.07	0.00	0.93	0.91	-0.60
	(0.118)	(0.120)	(0.122)	(0.908)	(0.916)	(0.425)
OSII inclusion * post * **non EMU**	0.32*	0.34*	0.57***	-0.26	-0.26	-0.40
	(0.172)	(0.176)	(0.201)	(0.524)	(0.531)	(0.591)
Observations	572,820	572,820	349,320	9,780	9,780	5,352
R-squared	0.2278	0.7864	0.7813	0.0902	0.1006	0.1666
Level Controls	YES	YES	YES	YES	YES	YES
Security FE	NO	YES	YES	NO	YES	YES
Time FE	NO	YES	YES	NO	YES	YES
Country * Time FE	NO	YES	YES	NO	YES	YES
Clustered Std. Err.	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Table 11: Other systemically important institutions buffer regression

This table shows the results for a capital buffer regression setup and regression results for both various investor types and security types. An O-SII designated bank faces additional capital requirement of up to 2%, but can also be required to hold 0% additional capital. This table differentiates these two groups of O-SII banks. The model has the following specification:

$$holding_{j,inv,t} = \alpha_0 + \sum_{inv} \alpha_1^{inv} \, OSIIinclusion_j * I_{inv} * post_{j,t}$$
$$+ \, LevelControls_{j,inv,t} + \delta_j + \gamma_t + \epsilon_{j,inv,t}$$

The independent variable, $holding_{j,inv,t}$, is the relative holdings of security j of investor type inv at date t. The OSIIinclusion is a dummy variable that is 1 for ISINs issued by OSII-designated banks and 0 otherwise. $Post_{j,t}$ is a dummy variable equal to 1 post surprise and 0 otherwise. I_{inv} is a dummy variable that indicates the investor type. δ_j captures bond specific effects and γ_t time specific effects. $LevelControls_{j,inv,t}$ are double interaction terms of all elements of the triple interaction as well as the variables individually. Column 1 and 2 report results on bonds for the group of O-SII banks without additional capital requirement and the group with additional requirements. Column 3 and 4 show results on bonds with and without additional controls.

	(1)	(2)		(3)	(4)	
	bonds			**equity**		
% holdings	buffer 0%	buffer (0% 2%]	differential	buffer 0%	buffer (0% 2%]	differential
OSII inclusion * post * **banks**	-0.03	-3.26***	-3.23***	0.78**	2.37***	1.60**
	(0.496)	(0.253)	(0.477)	(0.380)	(0.722)	(0.637)
OSII inclusion * post * **NFCs**	-0.43	0.31*	0.73**	1.85**	-0.98	-2.83**
	(0.268)	(0.171)	(0.299)	(0.786)	(1.444)	(1.404)
OSII inclusion * post * **government**	-0.57***	-0.28*	0.32**	-0.00	-0.52	-0.52
	(0.126)	(0.167)	(0.124)	(0.020)	(0.349)	(0.348)
OSII inclusion * post * **households**	-5.77***	0.25	5.99***	1.72	1.41*	-0.31
	(0.421)	(0.156)	(0.429)	(1.245)	(0.788)	(1.412)
OSII inclusion * post * **insurance**	-0.44	-0.17	0.35	0.97	1.91**	0.95
	(0.495)	(0.295)	(0.498)	(0.591)	(0.837)	(0.985)
OSII inclusion * post * **invest funds**	0.53*	-0.13	-0.64**	-1.22**	-2.21**	-0.99
	(0.314)	(0.271)	(0.307)	(0.555)	(0.989)	(0.952)
OSII inclusion * post * **pernsion funds**	-0.16	-0.04	0.17	0.13	-0.76	-0.88
	(0.338)	(0.345)	(0.314)	(0.248)	(0.750)	(0.727)
OSII inclusion * post * **other fin inv**	7.82***	7.99***	0.24	-2.74***	-2.52***	0.22
	(0.591)	(0.523)	(0.415)	(1.027)	(0.777)	(0.892)
OSII inclusion * post * **other inv**	-0.57**	-0.01	0.55**	-0.50	1.26	1.77
	(0.240)	(0.127)	(0.259)	(0.362)	(1.109)	(1.116)
OSII inclusion * post * **non EMU**	-0.63*	0.46**	1.13***	-0.95	-0.10	0.85
	(0.324)	(0.187)	(0.354)	(0.762)	(0.589)	(0.860)
Observations	341,832	545,544	567,432	7,824	9,300	9,672
R-squared	0.8067	0.7854	0.7867	0.1093	0.0972	0.1115
Level Controls	YES	YES	YES	YES	YES	YES
Security FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Country * Time FE	YES	YES	YES	YES	YES	YES
Clustered Std. Err.	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Table 12: Other systemically important institutions buffer regression (large securities)

This table shows the results for a capital buffer regression setup and regression results for both various investor types and security types. An O-SII designated bank faces additional capital requirement of up to 2%, but can also be required to hold 0% additional capital. Here, only securities with amount outstanding above the median within security types are considered. This table differentiates these two groups of O-SII banks. The model has the following specification:

$$holding_{j,inv,t} = \alpha_0 + \sum_{inv} \alpha_1^{inv} \, OSIIinclusion_j * I_{inv} * post_{j,t}$$
$$+ \; LevelControls_{j,inv,t} + \delta_j + \gamma_t + \epsilon_{j,inv,t}$$

The independent variable, $holding_{j,inv,t}$, is the relative holdings of security j of investor type inv at date t. The OSIIinclusion is a dummy variable that is 1 for ISINs issued by OSII-designated banks and 0 otherwise. $Post_{j,t}$ is a dummy variable equal to 1 post surprise and 0 otherwise. I_{inv} is a dummy variable that indicates the investor type. δ_j captures bond specific effects and γ_t time specific effects. $LevelControls_{j,inv,t}$ are double interaction terms of all elements of the triple interaction as well as the variables individually. Column 1 and 2 report results on bonds for the group of O-SII banks without additional capital requirement and the group with additional requirements. Column 3 and 4 show results on bonds with and without additional controls.

% holdings	(1) bonds buffer 0%	(2) bonds buffer (0% 2%]	(3) differential	(4) equity buffer 0%	equity buffer (0% 2%]	differential
	bonds			equity		
	buffer 0%	buffer (0% 2%]	differential	buffer 0%	buffer (0% 2%]	differential
OSII inclusion * post * **banks**	1.31**	-2.06***	-3.41***	0.93	2.32**	1.39*
	(0.508)	(0.274)	(0.493)	(0.681)	(0.988)	(0.734)
OSII inclusion * post * **NFCs**	-0.17	-0.14	0.01	2.30*	0.81	-1.50**
	(0.116)	(0.167)	(0.168)	(1.236)	(1.237)	(0.731)
OSII inclusion * post * **government**	-0.60***	-0.24	0.37***	-0.03	-0.54	-0.52
	(0.114)	(0.149)	(0.108)	(0.021)	(0.399)	(0.399)
OSII inclusion * post * **households**	-4.92***	1.17***	6.08***	0.92	-0.23	-1.16
	(0.443)	(0.159)	(0.438)	(1.256)	(0.379)	(1.249)
OSII inclusion * post * **insurance**	-0.60	-0.60**	0.02	1.19*	0.94*	-0.26
	(0.479)	(0.308)	(0.498)	(0.685)	(0.533)	(0.659)
OSII inclusion * post * **invest funds**	0.61*	-0.13	-0.76**	-0.63	-0.63	-0.01
	(0.315)	(0.273)	(0.336)	(0.476)	(0.565)	(0.575)
OSII inclusion * post * **pernsion funds**	0.10	0.28	0.19	0.20	0.34	0.15
	(0.277)	(0.305)	(0.331)	(0.351)	(0.336)	(0.132)
OSII inclusion * post * **other fin inv**	3.26***	3.93***	0.68**	-2.50*	-2.29*	0.21
	(0.462)	(0.422)	(0.303)	(1.314)	(1.165)	(0.958)
OSII inclusion * post * **other inv**	-0.32	0.08	0.38	-0.77	-0.55	0.22
	(0.244)	(0.133)	(0.265)	(0.501)	(0.421)	(0.272)
OSII inclusion * post * **non EMU**	-0.53*	0.77***	1.31***	-1.58*	-0.01	1.57*
	(0.314)	(0.219)	(0.349)	(0.794)	(0.644)	(0.885)
Observations	210,720	324,708	349,320	3,912	4,884	5,352
R-squared	0.7993	0.7819	0.7827	0.1686	0.1474	0.1815
Level Controls	YES	YES	YES	YES	YES	YES
Security FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Country * Time FE	YES	YES	YES	YES	YES	YES
Clustered Std. Err.	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Table 13: Other systemically important institutions bond ratings

This table shows regression results differentiating between lower rated investment grade bonds and higher rated investment grade bonds. The model has the following specification:

$$\text{holding}_{j,inv,t} = \alpha_0 + \sum_{inv} \alpha_1^{inv}\, \text{OSIIinclusion}_j * I_{inv} * \text{post}_{j,t}$$
$$+ \text{LevelControls}_{j,inv,t} + \delta_j + \gamma_t + \epsilon_{j,inv,t}$$

The independent variable, $\text{holding}_{j,inv,t}$, is the relative holdings of security j of investor type inv at date t. The OSIIinclusion is a dummy variable that is 1 for ISINs issued by OSII-designated banks and 0 otherwise. $\text{Post}_{j,t}$ is a dummy variable equal to 1 post surprise and 0 otherwise. I_{inv} is a dummy variable that indicates the investor type. δ_j captures bond specific effects and γ_t time specific effects. LevelControls$_{j,inv,t}$ are double interaction terms of all elements of the triple interaction as well as the variables individually. Column 1 reports results on bonds with lower investment grade ratings. Column 2 shows results higher investment grade ratings: and Column 3 gives the differential effect between these two groups. Columns 4 – 6 show results for bonds with above median amount outstanding.

% holdings	(1)	(2)	(3)	(4)	(5)	(6)
	bond ratings *full sample*			bond ratings *above median size bonds*		
	[BBB-, A+]	[AA-, AAA]	differential	[BBB-, A+]	[AA-, AAA]	differential
*rating (AA- or better) * OSII inclusion * **banks** * post*	3.83***	-1.37**	-4.74***	3.87***	-1.46**	-4.80***
	(0.539)	(0.574)	(0.813)	(0.640)	(0.595)	(0.923)
*rating (AA- or better) * OSII inclusion * **NFCs** * post*	-1.14***	0.63*	2.13***	-1.10***	0.62*	2.14***
	(0.359)	(0.325)	(0.594)	(0.321)	(0.320)	(0.572)
*rating (AA- or better) * OSII inclusion * **government** * post*	-0.69**	-0.65	0.33	-0.22	-0.57	-0.01
	(0.288)	(0.460)	(0.555)	(0.229)	(0.473)	(0.543)
*rating (AA- or better) * OSII inclusion * **households** * post*	-0.40	-0.35	0.44	-0.57	-0.13	0.87
	(0.566)	(0.387)	(0.834)	(0.537)	(0.274)	(0.692)
*rating (AA- or better) * OSII inclusion * **insurances** * post*	-0.83	0.60	1.74**	-0.69	0.12	1.19
	(0.584)	(0.556)	(0.858)	(0.589)	(0.549)	(0.855)
*rating (AA- or better) * OSII inclusion * **invest funds** * post*	-1.74***	-0.18	1.89**	-1.51**	0.12	2.03**
	(0.634)	(0.597)	(0.951)	(0.668)	(0.587)	(0.978)
*rating (AA- or better) * OSII inclusion * **pension funds** * post*	0.57	-0.18	-0.43	0.53*	-0.02	-0.16
	(0.384)	(0.254)	(0.469)	(0.270)	(0.208)	(0.369)
*rating (AA- or better) * OSII inclusion * **other fin inv** * post*	-0.48*	0.76***	1.54***	-0.25	0.59***	1.21***
	(0.269)	(0.206)	(0.394)	(0.254)	(0.199)	(0.390)
*rating (AA- or better) * OSII inclusion * **other inv** * post*	-1.01**	0.19	1.56**	-1.36***	0.42	2.20***
	(0.415)	(0.342)	(0.649)	(0.380)	(0.322)	(0.617)
*rating (AA- or better) * OSII inclusion * **non EMU** * post*	-0.23	0.84**	1.38**	-0.11	0.75*	1.23**
	(0.412)	(0.425)	(0.619)	(0.393)	(0.413)	(0.595)
Observations	110,862	92,807	203,669	88,436	85,358	173,794
R-squared	0.7751	0.8453	0.8072	0.7728	0.8303	0.8006
Level Controls	YES	YES	YES	YES	YES	YES
Security FE	YES	YES	YES	YES	YES	YES
Time FE	YES	YES	YES	YES	YES	YES
Country * Time FE	YES	YES	YES	YES	YES	YES
Clustered Std. Err.	Security	Security	Security	Security	Security	Security

*** p<0.01, ** p<0.05, * p<0.1

Appendix

Table Appendix 1: Ratings overview

ECAI credit assessment			Credit quality steps 1	2	3
Short-term	**DBRS**			R-1H, R-1M	R-1L, R-2H, R-2M, R2-L
	FitchRatings			F1+, F1	F2
	Moody's			P-1	P-2
	Standard & Poor's			A-1+, A-1	A-2
Long-term	**DBRS**		AAA/AAH/AA/AAL	AH/A/AL	BBBH/BBB/BBBL
	FitchRatings		AAA/AA+/AA/AA-	A+/A/A-	BBB+/BBB/BBB-
	Moody's		Aaa/Aa1/Aa2/Aa3	A1/A2/A3	Baa1/Baa2/Baa3
	Standard & Poor's		AAA/AA+/AA/AA-	A+/A/A-	BBB+/BBB/BBB-