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## Market concentration in the euro area bond markets - an application with granular sectoral securities holdings statistics<sup>1</sup>

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<sup>1</sup> This paper was prepared for the meeting. The views expressed are those of the author and do not necessarily reflect the views of the BIS or the central banks and other institutions represented at the meeting.

# Market concentration in the euro area bond markets

## An application with granular sectoral securities holdings statistics

Martijn Adriaan Boermans<sup>1,2</sup>

### Abstract

In 2015 the ECB has made a new granular dataset on securities holdings available for research purposes. In this paper we use security-by-security data to examine the market concentration of bond holdings among euro area investors. The focus of this research is on long-term debt securities issued by euro area residents. To study the distribution of bond ownership, we calculate a Hirschman-Herfindahl Index (*HHI*) for each individual bond held by euro area residents. Using data over the first quarter of 2015 we show that bond ownership is strongly concentrated for about half of the individual bonds. The level of market concentration is highest among sovereign bonds and bank debt securities. We find significant differences in market concentration by issuer country and holder sectors. According to our sectoral measure of market concentration, debt issued by residents from Germany, France and Italy are held in the most concentrated fashion among euro area investors. Furthermore, compared to other holder sectors the European banking sector tends to invest in bonds that are characterized by the highest concentration of bond ownership. These findings have important ramifications for financial stability analysis and the understanding of financial market structures.

Keywords: market concentration, bond ownership, debt holdings, securities statistics.

JEL classification: G11, G12, G23, G32.

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## 1. Introduction

Most economists agree that market concentration hampers not only competition, but leads to price distortions and impedes economic performance. For the functioning of financial markets, high ownership concentration among bond holders also poses various risks. For instance, when government debt from a certain country is mostly financed by domestic insurance corporations, then shocks to this holding sector can have large impact on the government bond prices and thus borrowing costs. Similarly, on the demand side, if there is a high concentration of ownership of an individual bond, then a single potential buyer could at the margin spur the price of the debt instrument with a small trade. Highly concentrated bond holdings can therefore hamper liquidity, as the probability to matched trades of the bond increases with the number of potential sellers and buyers. In recent years, there are strong indications that debt holdings are becoming more concentrated and thus leading to concerns about market liquidity, price shocks and financial stability in the debt market (see Rubin, 2007; Jacoby & Zheng, 2010; Fender & Lewrick, 2015; Boermans et al., 2016; Steins Bisschop et al., 2016).

In this context it is important to enhance our understanding of bond ownership concentration by measuring dispersion of debt holdings. In this study we measure the level of market concentration among bond holders in the euro area debt market. To do so we exploit a unique security-by-security holdings dataset covering the holdings of euro area investors. In order to measure concentration, one needs security-by-security data on bond holdings across a large group of investors. Looking at a too narrow set of investors implies that for only very few bonds large market concentration can be established. Granular holdings information for a wide range of investors is typically hard to come by.

Due to lack of data, the focus in the literature has been on market concentration in quoted shares, because there are disclosure arrangements in place for large equity holders. Using information on quoted share with majority block ownership, Heflin and Shaw (2000) study the impact of ownership blocks for 260 US quoted stocks on market liquidity. They find that high concentration increases the bid-ask spreads for equity, thus suggesting that higher concentration can have negative economic impact. Similar results were found for Canadian stocks (see Attig, Fong, Gadhoun & Lang, 2006).

The Eurosystem collects security-by-security holdings information under a mandatory reporting requirement scheme. These data allow us to get detailed information among investments *per security* by European investors, including of bond holdings. Therefore, we are able to have an unique, new and granular view of the European bond market. However, we only have data on the sectoral holdings. That is, we do not know the individual end-investor in a certain bond but only the aggregate holdings of all individual end-investors for a particular sector from an individual euro area country.

Steins Bisschop *et al.* (2016) use similar data to study the impact of two recent stress periods in the bond market; the Taper Tantrum in 2013 and the Bund Tantrum in 2015. They show that the importance of market concentration in the European bond markets has increased over the past years. In addition, market concentration is one of the key explanations for the high price volatility observed during the Bund Tantrum. In this paper we build on their methodology to measure market

concentration and provide readers a more granular look at market concentration in the bond markets.

The paper proceeds as follows. We start in Section 2 with a description of how our measure of market concentration per individual bond are established. Section 3 provides researchers with some guidance and measures to prepare the large security-by-security dataset for analysis. We also explain what type of data was used using some summary statistics. In general, the observed holdings of euro area bonds in this study are very large, around EUR 5.7 trillion. Section 4 presents our main results and Section 5 concludes.

## 2. Measuring market concentration

We construct a measure of market concentration using the Hirschman-Herfindahl Index (*HHI*). The idea here is that for each outstanding debt instrument we know the value of the principal on the issuance side, and, on the holdings side we observe all portfolio investments by the key euro area investor sectors *per country*.<sup>3</sup> This means that we can determine the *distribution of ownership*.

We define the *HHI* as follows:

$$(1) \ HHI = \sum_{i=1}^n s_i^2$$

Here,  $s_i$  represents the share of the observed holdings in a bond  $i$  of a particular sector  $k$  in country  $j$ . The *HHI* ranges from 0 to 1, where 1 means complete concentration whereas a score close to zero implies a wide distribution among bondholders across countries and sectors in the euro area.<sup>4</sup> For example, if we only observe a single sector from one country holding a bond, then the *HHI* is equal to 1. Bear in mind two issues with our market concentration measurement.

First, we have sectoral holdings data. Within a particular country  $j$ , the concentration of bond holdings among sector  $k$  could still be held by various individual end-investors (of which, unfortunately, we have no information). For example, if we observe that a German government bond is held only by, let's say, German banks, then for that bond we would observe a maximum concentration of 1. Still, it is well-possible that there are hundreds of German banks holding the particular German government bond in question. We thus do not know the number of individual entities within a sector holding the bond, neither how such holdings are distributed within the holding sector.

Second, we only include bonds in the analysis for which euro area investors have a relative high ownership share. That is, by our selection criteria we only include an individual debt instrument if the aggregated observed level of concentration ranges between 0.5 and 1. We do so because we cannot account for the dispersion of holdings where investments by non-euro area residents are significant. In those cases we miss vital information on the market concentration that cannot be estimated.

<sup>3</sup> A major benefit of granular data is that we can use the holdings information based on International Security Identification Numbers (ISINs) to link it to issuer information. All enrichments are based on the Centralised Securities Database (CSDB).

<sup>4</sup> We distinguish six investor sectors and 19 investor countries. Hence, the lowest concentration score would be obtained if all 114 pairs of investors hold an equal amount, thus giving a *HHI* of 0.0088.

Taking these two issues of sector holding information and non-euro area holdings into account, interpretation of the results needs to be done with care.

Box 1

## Calculating market concentration with the HHI: an illustration

Let us illustrate how market concentration based on the *HHI* is derived. First, let's take a single bond issuance *i*. For example, in November 2008 the Dutch central government issued a debt instrument (with ISIN code NL0006527525) with a (principal) notional amount of EUR 3 billion, denominated in euro's, with a coupon rate of 1.5% and maturing in October 2017. For this individual security we observe, per country *j*, which sector *k* holds this bond, and how much each sector from each country invests in this bond *i*.

Let's assume that there are three holding countries ( $j=3$ ), with investors only from the banking sector ( $k=1$ ). Each investor sector (banks) holds EUR 800 million, so in total EUR 2.4 billion is held by euro area investors. The remaining EUR 0.6 billion is unobserved and thus held by non-euro area investors or by minority investor sectors excluded from our dataset. The euro area holdings are greater than 50% of the bond size so the bond *i* is included in our analysis (majority ownership rule). The share of non-euro area investors is dropped for the measurement of concentration. Hence we get the following:

For each  $k_j$ ,  $s_i$  is  $1/3$  ( $800/2,400$ ). Next we take the squared terms  $(1/3)^2=1/9$ . Then we take the sum of the squared shares of each sector-country holdings, thus  $1/9+1/9+1/9=1/3$ , or 0.33.

### When are market concentrations high?

To give readers some broad guidance on the interpretation of the *HHI* we provide preliminary indications on when the dispersion of bond ownership in our dataset can be considered large. Because we do not observe the end-investors, this is a tricky question because if only one sector in a single country has the full ownership of a particular bond, it could still imply high dispersion of ownership *within* the sector of that country. Nonetheless, there is wide literature on the interpretation of the *HHI*, however applicable to very different contexts.

For example, the measurement is often applied by anti-trust agencies to determine the degree of market concentration in terms of competition. The market shares are used to calculate the *HHI* scores, where score of 0.25 are considered as high concentration, scores between 0.15 and 0.25 are moderate concentration and scores below 0.15 are unconcentrated. We suggest the following conservative rough interpretations of our *HHI*, taking into account that (i) we observe only the bond holdings are the sector level and not the individual level, and, (ii) we exclude non-euro area holdings (since we have no priors on the ownership dispersion of non-euro area holdings).

<b>HHI</b>	<b>Interpretation for bond holdings</b>
0-0.10:	<i>Low market concentration</i>
0.10-0.25:	<i>Moderate concentration</i>
0.25-0.50:	<i>High concentration</i>
>0.50:	<i>Very high concentration</i>

Scores between 0 and 0.10 suggest that in the case of an equal amount invested by a particular sector-country combination that at least 10 different sector-countries need to hold the bond, and, combined has at least 50 percent of the total amount outstanding. For a score up to 0.25, the number of particular sector-country combinations with equal amounts of holdings rises to a limit of 4, which is considered a moderate level of concentration.

### 3. Granular securities holdings information

#### Data

Data on bond holdings among euro area investors at the sector level were obtained from the sectoral Securities Holdings Statistics from the European System of Central Banks (ESCB). The national central banks from the euro area have a mandatory Eurosystem security-by-security reporting framework in place (ECB Regulation 2012/24). National central banks aggregate the reported data by sector to the ECB. The ECB distributes a carefully checked and high confidential dataset back to national central banks, with all holdings by sector-country per individual bond. Data collection thus requires high efforts by national central banks and the ECB before accomplishment. First data were obtained over 2013Q4 (see ECB, 2015).

We use data for the first quarter of 2015. This period was carefully chosen. It was a period where European bond markets had relatively calmed after the European sovereign debt crisis, thus allowing us a relative free interpretation of the data that is not strongly driven by market circumstances. Note that the data exclude the holdings by monetary authorities (including the ECB). This is in principle not a huge issue as the observed holdings cover the major share of the market. In March 2015 the ECB initiated its Public Sector Purchase Programme (PSPP) with monthly debt purchases of EUR 60 billion. Because this program just took off, the impact on the bond holdings will be limited to the purchases in March 2015. Hence, 2015Q1 data should give a rather complete idea of the levels of market concentration among the holdings of European bonds, defined narrowly as bonds issued by euro area residents.

The data are available for a wide range of holding sectors and in principle cover all debt securities issued by euro area residents. We include investments from the five largest financial sectors (banks, investment funds, insurance corporations, pension funds, and other financial intermediaries excluding financial vehicle corporations)<sup>5</sup> and households.

#### Data preparation

For the data preparation, we use the following criteria. We focus on bonds issued by euro area residents with an original maturity of at least 365 days, that is, long-term debt securities. We only include debt instruments with a principal of more than EUR 10 million, which in practice are almost all bonds. We also exclude third-party holdings information and securities that can have double listings (e.g. under Rule 144A) or those that are not "alive" anymore (e.g. distressed debt). In several cases we have missing information on amount outstanding, which were discarded as this is required information for the calculation of market concentration. Also, all short-positions were dropped as this would make the measurement of the market

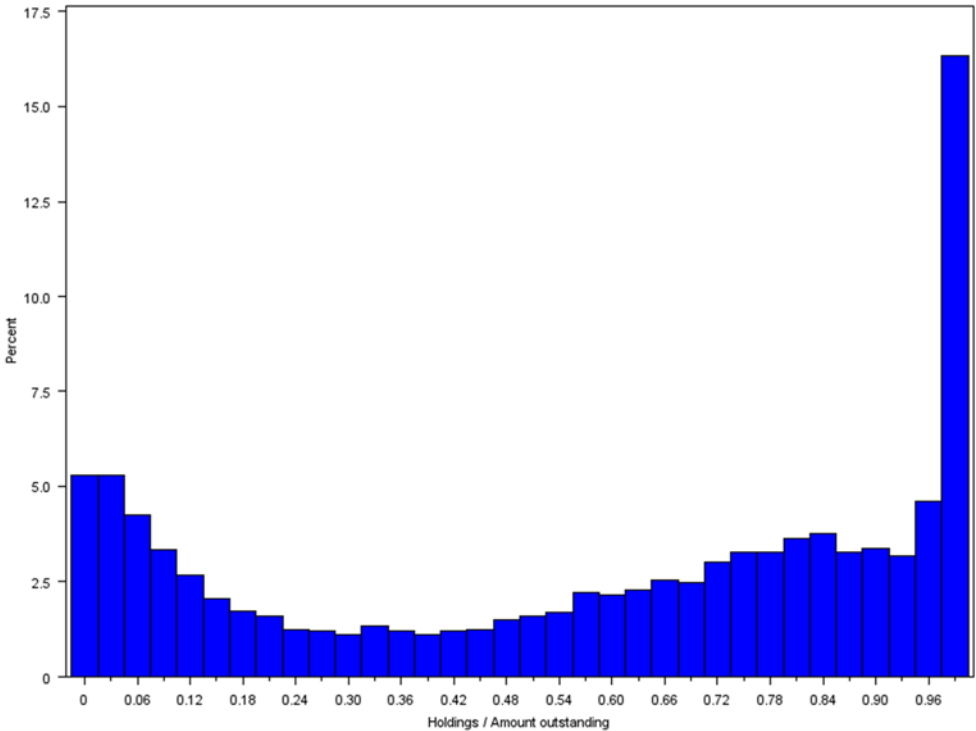
<sup>5</sup> The sector classifications are based on a more detailed version of the European System of Accounts (ESA) 2010. In particular, sector S.125 other financial intermediaries excludes investments by financial vehicle corporations, also known as special purpose vehicles (SPVs). Other financial sectors are based on S.122, S.124, S.128 and S.129. S.14 is classified as households, data that was collected via European custodian reporting.

concentration more difficult. In addition, observations where the total holdings exceeded the amount outstanding were excluded.<sup>6</sup> After these actions, the coverage of the security-by-security data used in the analysis is still very good.<sup>7</sup> In other words, these data preparation measures are highly advised to ensure high quality data while not dropping too many observations from the analysis.

### Summary statistics of the sample

To get a first sense of the dispersion of ownership in the sample, Figure 1 shows the dispersion across all individual holders per sector and country as a ratio to the amount outstanding of the bond. That is, we simply divide the observed value of the portfolio investment position by the principal value.

**Figure 1: A simple look at bond holder dispersion**



*Note: sample of 11,139 European bonds. Data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings.*

<sup>6</sup> There are three explanations for this: first, short positions; second, quality issues on the holdings side; third, quality issues on the amount outstanding side. Still, this occurs in less than 1 percent of the observations.

<sup>7</sup> The ECB has calculated that the coverage of the security-by-security holdings data for debt securities is 92% for debt instruments issued in the euro area if one includes the observed non-euro area holdings for the dataset as well. However, they find a coverage of 60% among euro area residents; a figure highly comparable to ours although we incorporated strict data cleaning measures (see ECB, 2015 for detailed). Hence, the coverage of the securities holdings information of our sample is very good and our data cleaning exercises seem to have caused only minor adjustments.

The problem of this measure as shown in Figure 1 is that it does not take into account how other investor sectors from other countries hold positions in a particular bond. The *HHI* does pick up the structure of the dispersion by taking the sum of the squared investment shares in a single bond.

We conduct our analysis on the subset of bonds that are predominantly held by euro area investors. Hence, we exclude a set of bonds for which the total holdings of the euro area investors are less than 50 percent. In practice this leads us to drop about a third of the individual bonds (see Figure 1). The reason for this is that we do not have information on the dispersion of holdings by non-euro area residents.

Let us explain the implications. For example, a bond with, say, 40 percent ownership in our dataset could be held for the residual 60 percent by either say, a single American hedge fund, thus having a very high degree of market concentration, or, the bond ownership could potentially be widely dispersed across investors in various non-euro area countries. Because we have no priors on the unobserved dispersion of bond holdings, we prefer to exclude these bonds.

The majority observed ownership rule leads to a final sample of 6,935 uniquely observed bonds and 105,731 holder sector, holder country observations, compared to 11,139 bonds before this criterion. In terms of market concentration, we find that for 57.8 percent of the bonds issued by euro area residents, euro area investors own at least half of bond. In other words, we show that European bonds are primarily owned by European investors. The total holdings at nominal value of the sample is EUR 5.7 trillion.

## 4. Results

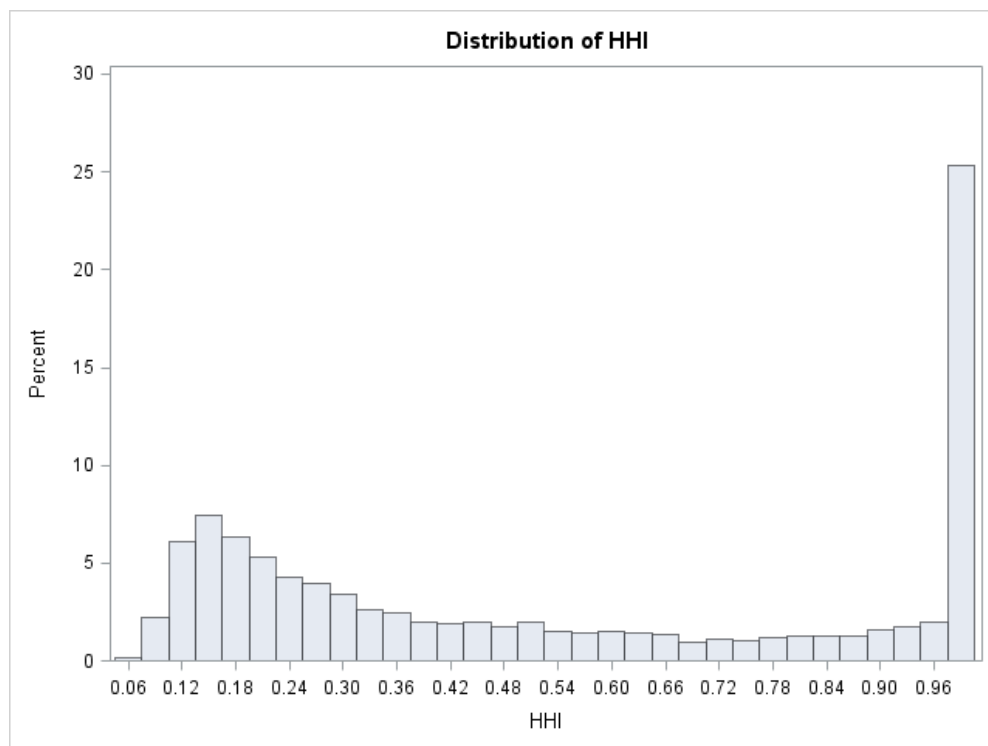
### Low dispersion in bond ownership?

Figure 2 presents the distribution of the *HHI* based on securities holdings information among euro area investors in debt securities issued by euro area residents. In general, the results indicate a rather low level of dispersion among bond ownership. In some cases, the levels of concentration are very high. In 22.3 percent of the cases we find a *HHI* of 1, indicating complete concentration. This is a significant amount of cases (1,546 bonds).<sup>8</sup> In other words, for these bonds we know that there is full ownership in one particular sector in a single euro area country. In addition, in another 25.5 percent of the cases the *HHI* ranges between 0.5 and 1, suggesting that a single sector from one country holds the large majority of the bonds. Hence, we find that for 47.5 percent of the bonds the concentration levels among euro area investors is very high, with an *HHI* above 0.5 (see Figure 2).

<sup>8</sup> This is also visible in Figure 1, where about 17 percent of the bonds are held by one investor sector from a single country. The difference in percentages points arises from the majority ownership rule required for the calculation of the *HHI* (see Box 1).



**Figure 2: Market concentration in the European bond market**



*Note: Distribution of concentration across 6,935 bonds issued by euro area residents and held by euro area investors (105,731 holder sector-country combinations). Data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings.*

We find that the average *HHI* is 0.54 with a standard deviation of 0.35. This can be considered as a very high level of concentration, however, the average is skewed by the complete concentration figures (with *HHI*=1). In only 1.7 percent of the cases we find low levels of market concentration with a *HHI* below 0.10. In general, this implies that for those instances there is a wide dispersion among investors in those bonds. Figure 2 also shows a bump between 0.10 and 0.25, suggesting moderate levels of concentration. Here we find moderate concentration for 29.6 percent of the bonds, with a *HHI*. Note that the median is 0.46, thus suggesting that about half of the bonds have high to very high levels of concentration while the other half low to moderate levels of concentration.

Let us emphasize that not all bonds show high concentration levels. The selection of bonds already implies that we have to exclude all debt instruments with a high degree of ownership outside the euro area. Hence, we cannot conclude that there is a low dispersion of bond ownership, yet we can say that a significant proportion of bonds is concentrated among a single sector-country holder (about 47 percent).

### Concentrations by issuer sector

We are interested if certain type of bonds are more concentrated than others. A good starting point for the analysis is to differentiate bonds by issuer sector. Table 1 shows that the levels of concentration are the greatest in the European bank bonds. The average *HHI* is 0.34, indicating high levels of concentration of debt issued by European banks. We also find high levels of market concentration among government related bonds with an average *HHI* of 0.31. The results show moderate levels of

concentration for non-bank financial bonds and non-financial corporate bonds, combined called corporate bonds. Here the *HHI* ranges between 0.23 and 0.24.

These outcomes from Table 1 are important for the understanding of the European bond markets, where we find that ownership of sovereign and bank debt are generally strongly concentrated compared to corporate debt securities. Specifically, European bank bonds and government related bonds show high market concentration in terms of ownership among euro area investors.

**Table 1: Bond ownership, breakdown by issuer sector**

Issuer sector	HHI		No. of observations
	mean	std. dev.	
Bank bonds	0.34	0.21	31,033
Government related bonds	0.31	0.18	19,601
Non-bank financial bonds	0.23	0.18	26,960
Non-financial corporate bonds	0.24	0.16	28,137

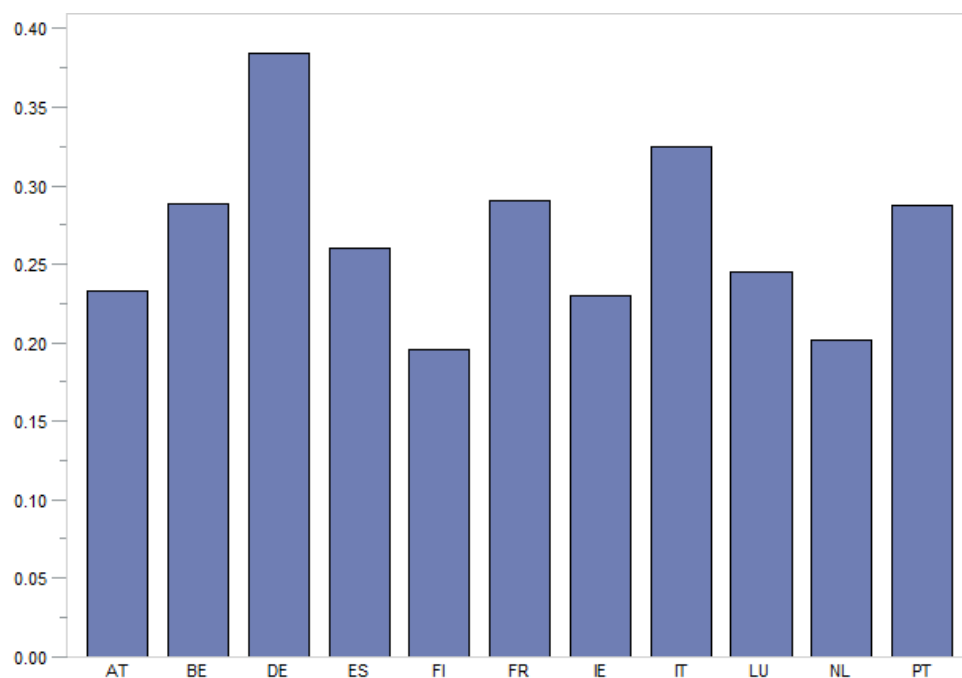
*Note: Classifications based on ESA2010. Non-financial corporate bonds consists of issuer sector S.11; bank bonds comprise S.122; non-bank bonds include all S.12 sectors except for S.122 (MFI's); government related bonds are from S.13. Data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings. Distribution of concentration are calculated for 6,935 bonds issued by euro area residents and held by euro area investors (105,731 observations of holder sector-country combinations).*

## Concentrations by issuer country

In this section we elucidate how the concentration of bond holdings varies by issuer country. Note that we only have a partial view of the bond holdings for those with high ownership among euro area investors. Figure 3 displays the average concentration scores per issuer country for which we have at least 1,000 debt securities

In general, we find that German, French and Italian bonds that are held for at least 50 percent by euro area investors are held to a large extent in a very concentrated fashion. That is, for German bonds, that average market concentration score is 0.38 (S.D. = 0.24), which we consider a high level of concentration. The scores for France (0.29) and Italy (0.33) can also be considered high. Other countries with high concentration scores are Belgium (0.29), Portugal (0.29) and Spain (0.26).

**Figure 3: Variation in bond holdings concentration across issuer country**



*Note: data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings. Distribution of concentration are calculated for 6,935 bonds issued by euro area residents and held by euro area investors (105,731 observations of holder sector-country combinations).*

We find moderate concentration scores for debt issued by residents from the Finland and the Netherlands, with *HHI* below 0.20. Also moderate scores are found for Austria (0.23), Ireland (0.23) and Luxemburg (0.24).

To interpret these market concentrations, one needs to take into account that concentrated holdings within a large country by a single sector could potentially still mean there the actual dispersion is higher than observed (as mentioned before). However, from a financial stability perspective this still means that the holdings of German, French and Italian bonds for a significant part rely on investors from a single country and sector, which does signal potential market concentration risks. In contrast, Finnish and Dutch bonds have a much wider range of holder sector, holder country investors.

To conclude, we find that there is wide issuer country heterogeneity that in part is explained by the type of data and threshold criteria for non-euro area investments. For financial stability such differences between countries are important as they may affect the efficiency of different transmission channels. That is, a crisis in a certain sector of a large country could potentially have large aggregate effects because of the concentrated nature of the bond ownership. Nonetheless, the findings indicate that large European economies such as France, Germany and Italy tend to have the highest bond holder concentrations at the sector-country holder level. Debt issued in the Netherlands, Finland, Ireland and Luxembourg show the greatest dispersion of ownership among euro area investors.

## Concentrations by holding sector

For each holding sector we calculate the levels of concentration separately. There is significant sector heterogeneity in the average levels of bond dispersion, depending on the holding sector. We find that banks typically hold bonds with the highest *HHI* (on average 0.34), see Table 2. In other words, the European banking sector tends to hold debt securities that are less dispersed in sector-country ownership.

All other sectors, with the exception of pension funds also tend to invest in bond that have high market concentration of ownership. Because of the large number of observations, the differences between each sector are still significant (with the exception of investment funds and households), however, in economic terms we suggest only to conclude that we find that European banks invest much more strongly in bonds with high market concentration compared to other sectors.

These results are important for the understanding the potential risks and transmission channels among investor sectors in the European bond markets. Banks are potentially most at risk for bond market shocks, while pension funds seem most resilient.

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**Table 2: Bond ownership, breakdown by sector of the holder**

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Investor sector	HHI		No. of observations
	mean	std. dev.	
Banks	0.34	0.27	20,655
Investment funds	0.27	0.18	28,605
Other financial intermediaries	0.28	0.21	8,701
Insurance corporations	0.26	0.16	23,844
Pension funds	0.24	0.15	10,105
Households	0.27	0.20	13,773

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*Note: Classifications based on ESA2010. Non-financial corporate bonds consists of issuer sector S.11; bank bonds comprise S.122; non-bank bonds include all S.12 sectors except for S.122 (MFI's); government related bonds are from S.13.*

## 5. Conclusion

We propose a measurement of market concentration based on the well-known Hirschman-Herfindahl index. European bonds are by majority owned by European investors. Yet, we show that there is wide variation in the level of ownership dispersion across *individual* European debt instruments.

The analysis is based on a large set of security-by-security data on bond holders of euro area investors in 2015Q1. We show that the average market concentration in individual bonds is generally high, especially among sovereign debt and bank bonds. We also find that the European banking sector tends to hold bonds with the lowest levels of dispersion of ownership.

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## Annex 1: Market concentrations by bond size

We divide the bonds in four categories based on the size of the principal, measured in nominal values (in euro). The groupings are based on the observed size by quantiles (see Table 3). Here we are interested if the market concentration differs by the size of the individual bonds. It appears that the market concentration decreases with the bond size.

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**Table 3: Bonds by size of the principal (in EUR)**

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Bond size category	Size cut-off		<i>HHI</i>
Small	10 million	200 million	0.78
Medium	200 million	500 million	0.57
Medium to large	500 million	1 billion	0.40
Large	1 billion	max	0.38

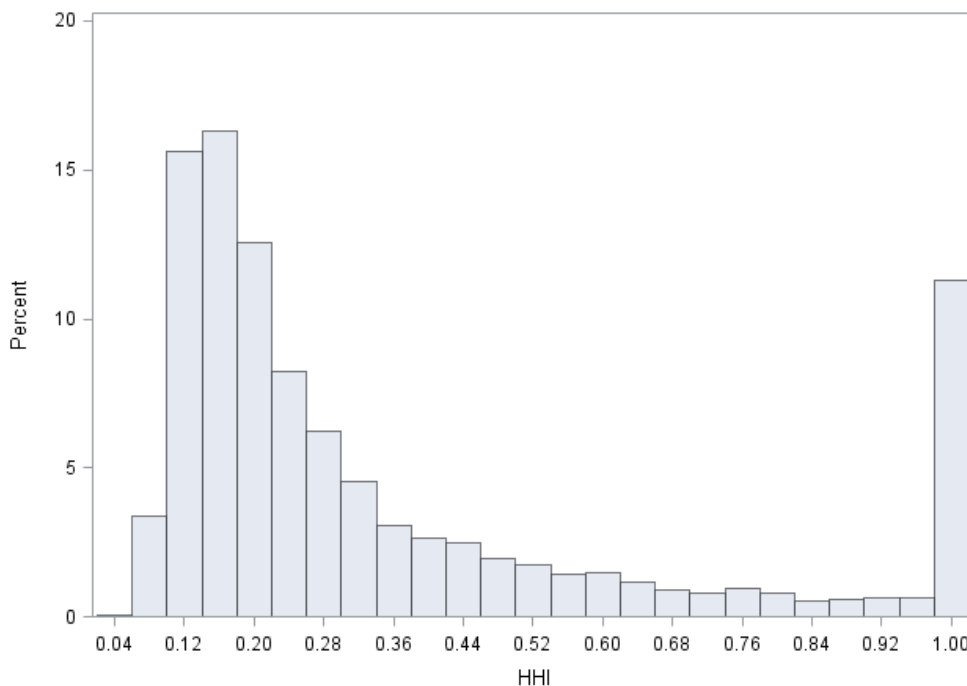
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*Note: Data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings. Distribution of concentration are calculated for 6,935 bonds issued by euro area residents and held by euro area investors (105,731 observations of holder sector-country combinations).*

## Annex 2: Worldwide bond issuance

In this annex we replicate the result, but with two important generalizations. First, we look at all bond holdings, regardless of the residence of the issuer. That is, we take the full scope of the world wide bond market on the liabilities side of the market. Second, we restrict the minimum bond size to EUR 500 million instead of EUR 10 million. We do so because the data quality of foreign bonds, defined as those issued by non-euro area residents may be of lower data quality. Such possible issue will not be a grave for larger bonds. In this way we are left with 17,699 bonds and observe a total number of 233,719 holder country by holder sector combinations.

**Figure A2: Market concentration of global bonds for euro area holders**



*Note: Data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings. Distribution of concentration are calculated for 17,699 bonds issued worldwide and held by euro area investors (233,719 observations of holder sector-country combinations).*

For the global bond market, concentration levels are much lower (as expected). The average  $HHI$  is 0.36 (S.D. = 0.29) compared to 0.55 (S.D. = 0.35) for European bonds. Still, this marks a high level of concentration. Figure A2 shows that for 10.6 percent of the bond holdings, there is full market concentration with a  $HHI=1$ . In addition, for 12.3 percent we find a  $HHI$  between 0.5 and 1, also indicating very high market concentration. Hence, for the global bond market, 22.3 percent of the bonds show very high market concentration, compared to 47.5 percent for the European bonds.

Hence, our general findings that there is relative high market concentration in the ownership of European bonds applies to a much lesser extent to non-euro area issuances. That is, our euro area investor perspective does not allow us to pick up the full dynamics of the global bond market, and therefore we find much lower market

concentration. Still, for the bonds included we again find high concentration among government bonds and near high concentration for bonds issued by global banks.

Table A2 further tests the heterogeneity of ownership concentration by issuer sector. Here we also find the highest market concentration in sovereign bonds and bank debt securities. Compared to Table 1 for European bonds, the concentrations are somewhat lower, although in economic terms the difference for government securities are rather low.

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**Table A2: Bond ownership, breakdown by issuer sector**

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Issuer sector	HHI		No. of observations
	mean	std. dev.	
Government related bonds	0.28	0.16	20,045
Bank bonds	0.24	0.16	36,043
Non-bank financial bonds	0.19	0.14	29,902
Non-financial corporate bonds	0.21	0.11	29,281

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*Note: Classifications based on ESA2010. Non-financial corporate bonds consists of issuer sector S.11; bank bonds comprise S.122; non-bank bonds include all S.12 sectors except for S.122 (MFI's); government related bonds are from S.13. Data were obtained from the ESCB SHS-S, own calculations based on 2015Q1 holdings. Distribution of concentration are calculated for 17,699 bonds issued worldwide.*