



# European bond markets: Do illiquidity and concentration aggravate price shocks?



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## HIGHLIGHTS

- We analyze the effects of market liquidity and ownership structure on European bond price volatility.
- Market liquidity is an important driver in stress and tranquil periods.
- Market concentration of bond holdings increased price shocks during the Bund Tantrum in 2015Q2.

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## ABSTRACT

We study the effects of market liquidity and ownership concentration of European bonds on price volatility during periods of market stress. Specifically, using security-by-security data from euro area investors we examine if market illiquidity and concentrated holdings explain the large price shocks witnessed during the 2013 Taper Tantrum and 2015 Bund Tantrum. Results suggest that market illiquidity, as measured by bid–ask spreads and a new Bloomberg liquidity measure, is a strong and statistically significant driver of price volatility in European bonds during both periods. Concentrated bond holdings have a significant upward effect on volatility only during the Bund Tantrum.

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## 1. Introduction

Market liquidity is a well-known determinant of market volatility. In liquid markets buyers and sellers can easily execute large orders at low transaction costs without significant price distortions. In the aftermath of the recent global financial crisis, there are growing concerns about illiquidity and volatility in bond markets. There is evidence of a “bifurcation” of market liquidity as some sovereign bonds have become more liquid while other bonds have become less liquid (Fender and Lewrick, 2015).

Meanwhile, the investor base in fixed income markets has shifted since the crisis. Banks as market makers have partially retreated while large mutual funds have become more dominant. A higher degree of market concentration could trigger market stress (IMF, 2015). Therefore, understanding how the ownership structure in bond markets has changed is essential for financial stability analysis.

In this paper we study the effects of market liquidity and concentrated holdings of bonds on price shocks during two recent periods of stress: (i) the 2013 “Taper Tantrum” and, (ii) the 2015 “Bund Tantrum”. We use of a new and unique security-by-security holdings dataset from the European System of Central Banks (ESCB) which allows us to examine the impact of both market liquidity and concentration on price shocks. Before this dataset became available, data on securities holdings in the bond markets were scarce, making it difficult to monitor levels of concentration and

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gauge the impact on systemic risk, particularly in the euro area. Our paper contributes to the literature by analyzing the well-known effects of market liquidity on volatility and also including ownership concentration at the level of individual bonds. The empirical results confirm the importance of market liquidity throughout the periods studied, while the impact of concentrated holdings on price volatility is only positive during the 2015 Bund Tantrum in European bond markets.

## 2. Related literature

Bond markets are inherently more illiquid than equity markets. Bonds are heterogeneous as individual issuers often have a large number of different bonds outstanding with varying contractual conditions. In bond markets, trades in individual bonds are often “infrequent and lumpy”. Bond investors often hold assets to maturity, such that transactions in individual bonds occur less frequently than in equity markets (Fender and Lewrick, 2015). Mismatches between potential buyers and sellers must be sufficiently mitigated by intermediaries (market makers) that temporarily are willing to hold bonds at their own risk. If the ownership of an individual bond is strongly concentrated, market makers will demand a larger return, thus increasing the potential price shock. Such market frictions may be particularly acute in stress periods. Investors may become more risk averse and face higher holding and search costs, for example due to financial constraints and more stringent capital requirements.

Various studies show that more illiquid bonds experience larger price movements during periods of market stress (Houweling et al., 2005; Mahanti et al., 2008). In volatile markets, the importance of liquidity increases because the pressure to change the portfolio allocations among market participants also intensifies (Acharya et al., 2013).

The literature on ownership structure has focused on mainly equity markets. Several empirical studies find that large shareholder blocks negatively affect market liquidity (Heflin and Shaw, 2000; Attig et al., 2006). In addition, Rubin (2007) shows that concentrated holdings are associated with greater price volatility. Two closely related papers to ours on bond markets suggest that market liquidity is a significant driver of US bond prices and that this impact is larger during the crisis periods (Dick-Nielsen et al., 2012; Friewald et al., 2012). Similar work on the impact of concentration of bond holdings has not yet been performed, most likely because of granular data on bond holdings are scarce.<sup>1</sup> New ESCB data allow us to fill this gap.

## 3. Data and method

### 3.1. Data

We use the ESCB securities holdings statistics at the sectoral level (SHS-S). The data contains quarterly holdings information at the security-by-security level of euro area investors, aggregated by sector and country (see ECB, 2015 and Steins Bisschop et al., 2016 for details). We use a subset of the data covering bond holdings for the relevant quarters in 2013 and 2015. The holdings are enriched with bond reference data identified by ISIN codes.

Using Bloomberg we select Dutch, French and German sovereign bonds and senior unsecured and subordinated bonds of the largest European banks. Using Dealogic, we add corporate bonds from firms residing in the EU. We only include debt denominated in euro and with a face value of at least EUR 100 million. We

then compile Bloomberg data on yields and bid–ask spreads and match this with the SHS-S data on holdings by euro area investors. Consequently, for 2015Q1 the holdings information for 3800 bonds were matched and contained all the relevant information on other variables. The total amount outstanding of these bonds was EUR 4.3 trillion. Similarly, for 2013Q1 we obtain data for 1743 bonds with a total amount outstanding of EUR 3.6 trillion.

### 3.2. Market stress periods

We study two recent periods with severe bond market volatility as defined by sudden and persistent upward shifts in yields. The first is the “Taper Tantrum” (2013Q2), which began after the Federal Reserve officials began discussing a possible end to the “quantitative easing” (QE) program, i.e. a tapering off of large-scale bond purchases. This tapering talk had a sharp negative impact on global bond market (Eichengreen and Gupta, 2014).

The second market stress period was preceded by the ECB announcement in January 2015 of its QE program, which led to unprecedented low yield on European bonds. However, in mid-April 2015, amid market rumors that there were insufficient bonds for the ECB to purchase, yields suddenly surged. This continued to late June 2015, in an episode referred to as the “Bund Tantrum” (2015Q2).

### 3.3. Method

To study the effect of market liquidity and concentrated holdings on volatility during periods of market stress we use two measures of market liquidity  $L$ . The first is the average daily bid–ask spread over the preceding quarter. For some securities such daily data were missing, and we instead took average monthly bid–ask spreads (see Mahanti et al., 2008 and Acharya et al., 2013). The second measure is the new and proprietary Bloomberg Liquidity Assessment (LQA) score, which provides a more holistic view of a bond’s liquidity using trading volume and other indicators derived from machine learning.

Concentration of holdings  $C$  is derived from the SHS-S data. For individual bond we observe the final position of holding sector  $s$  in holding country  $k$ . To measure concentration (see Greenwood and Thesmar, 2011) in bond  $i$ , we construct a Herfindahl–Hirschman Index ( $HHI_{i,t}$ ), which is the sum of the squared market share of each holder sector in each country, defined as the position of a particular sector in a euro area country divided by the amount outstanding of the bond. Unfortunately, we do not observe the dispersion of individual bond holders, but only aggregated holdings per sector  $s$  from country  $k$  in an individual bond. To ensure consistency, we only include bonds for which euro area investors hold at least 50% of the amount outstanding.

Next, we regress price volatility of bonds against measures of illiquidity and concentrated holdings:

$$\Delta P_{i,t} = \beta_1 * L_{i,t-1} + \beta_2 * C_{i,t-1} + \beta_3 * X_{i,t-1} + \gamma_j + \varepsilon_{i,j,t}$$

where  $\Delta P_{i,t}$  is price volatility, measured as the difference between the maximum and minimum spread of bond  $i$  in quarter  $t$  over the benchmark rate (as quoted by Bloomberg);  $L_{i,t-1}$  is a vector of market liquidity characteristics of bond  $i$  at the end of the previous quarter  $t - 1$ ;  $C_{i,t-1}$  is a measure of concentration of holdings of bond  $i$  in the previous quarter;  $X_{i,t-1}$  is a vector of bond-specific controls—including geographic distance between holder and issuer country, residual maturity, coupon rate, and new (“off-

<sup>1</sup> An exception at the macro level is Broos and de Haan (2012), who show that foreign ownership concentration of euro area sovereign debt affects bond yields.

**Table 1**  
Overview of the variables.

	Taper Tantrum (Q2 2013)				Bund Tantrum (Q2 2015)			
	Mean	St.Dev.	Min	Max	Mean	St.Dev.	Min	Max
Price volatility (%)	0.58	0.34	0.00	1.89	0.48	0.39	0.00	1.99
Bid–ask–spread (%)	0.12	0.10	0.00	0.97	0.12	0.18	0.00	1.99
Bloomberg LQA score					47.47	26.49	1	100
Concentration (HHI)	0.30	0.40	0.00	1.00	0.24	0.35	0.00	1.00
Distance (km)	663	1726	19	16,975	636	1620	19	16,975
Residual maturity (days)	2071	2730	72	67,998	1836	3070	1	67,267
Coupon rate (%)	3.29	1.91	0.04	10.00	2.65	1.80	0.00	10.00
New bond (dummy)	0.06	0.24	0	1	0.05	0.21	0	1
Observations			1743				3800	

**Table 2**  
Main results.

	Stress			Tranquil		
	(1) <i>Taper Tantrum</i>	(2) <i>Bund Tantrum</i>	(3) <i>Bund Tantrum</i>	(4) <i>Q1 2013</i>	(5) <i>Q1 2015</i>	(6) <i>Q1 2015</i>
Bid–ask spreads	0.786*** (0.113)	0.492*** (0.051)	0.360*** (0.075)	1.062*** (0.114)	0.553*** (0.041)	0.291*** (0.069)
Bloomberg LQA score			−0.001*** (0.000)			−0.002*** (0.000)
Concentration (HHI)	−0.085*** (0.022)	0.131*** (0.019)	0.111*** (0.024)	−0.008 (0.019)	0.062*** (0.012)	0.017 (0.014)
Log distance	0.045*** (0.009)	0.027*** (0.007)	0.028*** (0.007)	0.010 (0.010)	0.005 (0.007)	0.006 (0.007)
Log residual maturity	0.179*** (0.015)	0.165*** (0.008)	0.163*** (0.011)	−0.002 (0.014)	0.041*** (0.006)	0.009 (0.008)
Last coupon rate	0.061*** (0.005)	0.019*** (0.004)	0.014*** (0.004)	0.033*** (0.005)	0.032*** (0.003)	0.025*** (0.004)
New bond	0.117*** (0.027)	0.181*** (0.029)	0.233*** (0.034)	0.067*** (0.013)	0.084*** (0.011)	0.074*** (0.012)
$r^2$	0.349	0.313	0.327	0.490	0.439	0.406
Observations	1743	3800	3105	1666	3369	2731

OLS regressions with Huber–White standard errors.

\*  $p < 0.1$ .\*\*  $p < 0.05$ .\*\*\*  $p < 0.01$ .

the-run”) bonds, defined as those have been issued in the last year;  $\gamma_j$  are issuer (governments, banks or corporates) and country fixed effects; and  $\varepsilon_{i,j,t}$  is the error term. Table 1 presents an overview of the variables used (Appendix Table A.1 shows the correlation matrix).

#### 4. Results

Table 2 presents the main results. We find that illiquid bonds, measured by bid–ask spread, experience larger price volatility during the Taper Tantrum and the Bund Tantrum. These results are robust when including the LQA measure of liquidity (only available during the Bund Tantrum). Regarding concentration of bond holdings, we find a positive effect on price volatility only during the Bund Tantrum. During the Taper Tantrum concentrated ownership of bonds is associated with lower price volatility.

To put these results in perspective, we run the same regressions for the immediately preceding quarters – i.e. 2013Q1 and 2015Q1 – when spreads were generally declining and volatility was low, henceforth tranquil periods. We again find a significant association between market liquidity and price volatility. For concentration, we find a positive effect on price volatility in 2015Q1; however, this effect appears much smaller than during the Bund Tantrum and is not significant when including the LQA score. It is not significant in 2013Q1.

The results are generally robust when using alternative specifications of price volatility (such as the standard deviation of spreads) and concentration (such as the maximum share by any single sector). Notably, the positive effect of concentration on price volatility during the Bund Tantrum remains significant in these estimations, while the negative effect during the Taper Tantrum is not.

#### 5. Conclusion

This study highlights the vital role of market liquidity and ownership structure on systemic stability in European bond markets. We observe that illiquid bonds are more prone to price volatility during the 2013 Taper Tantrum and the 2015 Bund Tantrum. The concentration of bond holdings by any one sector only had a significant positive effect during the Bund Tantrum.

Together, these episodes underline how structural shifts in European bond markets could interact to increase systemic risk. If illiquidity and concentration amplify future market shocks, this could increase funding costs, undermine market functioning or impact systemically important financial institutions. This offers a warning on potential transmission channels for market shocks to spread to the financial system and impact the real economy.

## Appendix

**Table A.1**

Correlation matrix.

	Taper Tantrum (Q2 2013)						Bund Tantrum (Q2 2015)						
	Bid–ask	HHI	Dist.	Res. Mat.	Coup.	New bond	Bid–ask	LQA	HHI	Dist.	Res. Mat.	Coup.	New bond
Price volatility	0.20	−0.16	0.14	0.29	0.40	0.05	0.16	−0.33	−0.04	0.09	0.37	0.17	0.13
Bid–ask–spread		−0.17	0.01	−0.38	0.35	−0.13		−0.40	−0.16	−0.09	−0.29	0.24	−0.07
Bloomberg LQA score									−0.04	0.138	−0.33	−0.29	−0.03
Concentration (HHI)			−0.16	0.13	−0.44	0.04				−0.17	−0.04	−0.27	−0.01
Log distance				0.01	0.12	−0.02					0.14	0.00	0.08
Log residual maturity					−0.01	0.13						0.10	0.17
Coupon rate (%)						−0.17							−0.17

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