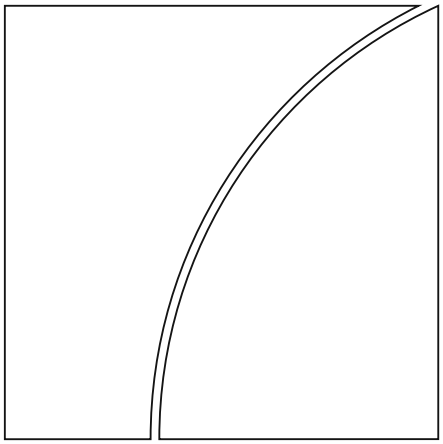

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by Adrian van Rixtel, Luna Romo González and Jing Yang

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The determinants of long-term debt issuance by European banks: evidence of two crises[1]

Adrian van Rixtel,[2] Luna Romo González and Jing Yang

Abstract

This paper is one of the first to investigate the determinants of bond issuance by European banks. We use a unique database of around 50,000 bonds issued by 63 banks from 14 European countries, allowing us to differentiate between different types of long-term debt securities. By investigating at the individual bank level, we are able to test explicitly a broad set of hypotheses from both the corporate finance and banking literature on the drivers of bond issuance. We use both country and bank-specific financial characteristics as explanatory variables. With respect to the country determinants, our findings suggest that "market timing" (low interest rates) drove issuance before but not during the crisis, when access to funding became more important than its cost. Moreover, during the crisis years, country-risk characteristics became drivers of bond issuance, while for banks from the euro area periphery central bank liquidity substituted for unsecured long-term debt. We also show that heightened financial market tensions were detrimental to bond issuance, and more strongly so during crisis episodes. Our results yield strongly significant coefficients for the bank-specific variables, with signs as expected. We find evidence of "leverage targeting" by issuing long-term debt during the crisis years. The positive and significant coefficient for the capital ratio supports the "risk absorption" hypothesis, suggesting that larger capital buffers enhanced the risk-bearing capacity of banks and allowed them to issue more debt. Moreover, banks with deposit supply constraints and relatively large loan portfolios issued more bonds, both before and since the crisis years. We also find that higher rated banks were more likely to issue bonds, also during the crisis period. Stronger banks issued especially unsecured debt, while weaker banks resorted more to issuance of covered bonds. Overall, our results suggest that stronger banks – including those from peripheral countries – maintained better access to longer-term funding markets, even during crisis periods. Our results pass several robustness tests. We present an additional aggregated country analysis in a separate appendix.

JEL classification: G21; G32; E44; E58; F3.

Keywords: bank funding; bond issuance; banking crisis; Europe.

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1. Introduction

Wholesale debt is one of the main funding sources of banks, in addition to retail deposits, equity and central bank liquidity. In recent years, the analysis of developments in banks' wholesale debt funding structures has gained considerable interest in the context of the 2008-2009 global financial crisis. The crisis triggered a large body of applied research on the relation between wholesale debt markets and bank leverage and the impact of leverage on bank performance and risk (Adrian and Shin, 2010; Demirguç-Kunt and Huizinga, 2010; Cornett et al., 2011; Beltratti and Stulz, 2012). The focus has been on short-term wholesale funding in particular, given the important role of repo and unsecured interbank markets first in the levering up of banks' balance sheets and second in the propagation and intensification of the crisis (Adrian and Shin, 2010b; Kalemli-Ozcan et al., 2012). In contrast, long-term wholesale debt funding, such as banks' issuance of medium-term notes (MTN) and bonds, has remained largely outside the scope of analysis.

At the same time, long-term debt is an important source of funding. For example, the share of debt securities (excluding securitisations) with a maturity over one year issued by banks (MFIs) as a percentage of total assets grew strongly in several euro area countries during 2003-2013. Especially banks in Italy and the Netherlands increased their dependence on long-term debt funding during this period (Chart 1). Also banks in Spain expanded their recourse to long-term debt financing from just 5% at end-June 2003 to 12% at end-August 2007, after which it fell to 9% at end-June 2013. At the same time, banks in France maintained a relative stable share of around 10% during the same period, while that of banks in Germany declined sharply from 22% to 15%. The share of total assets funded through long-term debt securities issued by banks in the UK moved between 6% and 8% during the same period.

Despite the importance of long-term debt funding, the determinants of bond issuance by banks have remained largely unexplored. These drivers have been analysed in only a handful of studies, which moreover focused only on selected instruments, such as for subordinated debt issuance by US banks (Covitz et al., 2004; Covitz and Harrison, 2004), covered bond and securitisation issuance (Carbó-Valverde et al., 2011) and debt securities issuance by European banks (Camba-Mendez et al., 2012). Hence, at this juncture, there is almost no empirical evidence available on the significance of bank-specific and macro-economic and financial market factors in shaping the debt issuance decision of banks.

This is in sharp contrast to the elaborate investigation of the drivers of debt issuance by non-financial firms in the corporate finance literature. Theoretical investigations have yielded important determinants of the size and composition of corporate debt financing, such as agency costs (Jensen and Meckling, 1976; Myers, 1977), asymmetric information (Flannery, 1986; Diamond, 1991a), liquidity risk (Diamond, 1991b) and tax benefits of debt (Kane et al., 1985). Many empirical studies have proposed firm-specific variables to test these theories for various dimensions of debt securities issuance. These include the choice of maturity structure (Barclay and Smith, 1995a; Guedes and Opler, 1996; Stohs and Mauer, 1996; Baker et al., 2003; Custódio et al., 2013), secured versus unsecured debt issuance (Berkovitch and Kim, 1990; Barclay and Smith, 1995b) and public versus private issuance (Krishnaswami et al., 1999; Gomes and Philips, 2012). In addition to these firm-specific characteristics, the scope of analysis has been broadened to

include overall market conditions and macro-economic developments as well, (Korajczyk and Levy, 2003; Erel et al., 2012). Investigations have concentrated on the phenomena of market timing and "hot" versus "cold" markets in driving corporate bond issuance (Marsh, 1982; Baker and Wurgler, 2002; Doukas et al., 2011). These theoretical and empirical advances in the corporate finance literature may offer important suggestions for the analysis of the determinants of debt issuance by banks. In fact, recent empirical work on the drivers of bank leverage has showed that standard corporate finance determinants of non-financial firms' capital structure also apply to banks (Gropp and Heider, 2010).

The void in empirical evidence on banks' debt financing has led us to take up the gauntlet and investigate the specific determinants of long-term debt issuance by 63 banks from 14 European countries. We concentrate on long-term debt, i.e. medium-term notes (MTNs)[3] and bonds, and exclude banks' recourse to short-term wholesale debt markets. This is also motivated by severe data-limitations on short-term debt securities issuance at the individual bank level. We follow the trend in the corporate finance literature and include both firm-specific characteristics and macro-economic and financial market indicators as explanatory variables. Moreover, our sample period covers the two major financial crises that caused severe dislocations in banks' funding structures, i.e. the global financial crisis of 2008-2009 and the euro area financial crisis of 2010-2012. We shall compare the determinants of bond issuance during these crisis episodes with those during the non-crisis years. Finally, we analyse the issuance of secured versus unsecured debt by European banks. The former includes covered bonds and government guaranteed debt, which became key sources of bank funding, especially during the crises episodes.

We concentrate on explaining bank-specific issuance, which allows us to exploit the richness of our individual bond issue data. These data are from Dealogic and have been thoroughly cleaned for structural changes at the 63 banks in our sample, such as mergers and acquisitions and attributing issuance to "dead" banks. Data on bank-specific characteristics are from Bankscope and SNL. In addition, we have conducted an aggregate analysis at the individual country level, which we present in Appendix D.

Our main conclusions are as follows. We find that "market timing" played a role in the issuance decision prior to the crisis. Banks were more likely to issue when interest rates were low.[4] This result is in line with recent empirical evidence from the corporate finance literature on the drivers of bond issuance by non-financial firms. However, "market timing" was no longer relevant during the crisis years, when accessibility to longer-term funding became more important for European banks than its cost. We also show that heightened financial market tensions, especially higher stock market volatility, were detrimental to bond issuance. Moreover, country-risk characteristics became additional drivers of bond issuance during the crisis periods, suggested by the significant and negative sign for the sovereign CDS spread. Further analysis showed that this result only applied to unsecured issuance, suggesting that increasing sovereign tensions limited access of banks to unsecured

[3] MTNs are debt securities which are offered continuously under an issuance programme, with a range of different yields and maturities of up to thirty years available to cater to the specific needs of individual investors.

[4] We also tested the term spread, which was not significant throughout the various specifications.

wholesale funding markets. In contrast, sovereign CDS spreads did neither affect secured issuance of euro area banks nor total issuance by European banks headquartered outside the euro area. Moreover, when we exclude government guaranteed bonds and bonds retained as collateral for central bank liquidity operations, the sovereign CDS spread was no longer significant as well. In fact, this "public-sector cleaned" issuance can be explained almost completely by bank-specific characteristics.

We find strongly significant coefficients for the bank-specific variables, with signs as expected. The positive and significant sign for growth of total assets for the crisis period supports "leverage" targeting. Moreover, banks with deposit supply constraints and relatively large loan portfolios issued more long-term debt. The positive and significant coefficient for the capital ratio supports the "risk absorption" hypothesis, suggesting that larger capital buffers expanded banks' risk-bearing capacity, and hence better capitalised banks were able to issue more long-term debt. We also find that higher rated banks were more likely to issue bonds, both before and during the crisis period. The latter two results are especially important, as they suggest that financially stronger banks had better access to longer-term funding markets during both the global financial crisis of 2008-2009 and the euro area financial crisis of 2010-2012. Hence, even though worse country-risk characteristics were detrimental to issuance, individual bank performance mitigated the negative impact of bank nationality on access to wholesale funding. Our results pass several robustness tests, including estimations without government guaranteed and retained issuance. They also hold when we include bond redemptions as an additional explanatory variable, which turns out to be highly significant, supporting the debt "roll-over" hypothesis. Moreover, the Heckman test does not suggest that our results suffer from selection bias.

The remainder of this paper is organised as follows. Section 2 provides a brief overview of the literature on the determinants of banks' debt issuance. Section 3 provides an overview of the hypotheses (3.1) and discusses the empirical methodology (3.2). Section 4 shows our data, including the sample of banks (4.1) and the dependent (4.2) and explanatory variables (4.3). Section 5 concentrates on the bank-specific estimations, first for overall issuance (5.1), followed by those for secured issuance (5.2) and for country groupings (core and peripheral euro area countries and other European countries) (5.3). Robustness tests are conducted in section 5.4. Finally, section 6 summarizes and concludes.

2. Literature review

2.1. Bank-specific determinants of bank's debt issuance

Theoretical investigations of debt issuance by banks are often blurred by the inclusion of deposits, which are usually treated as another form of debt (Gorton and Winton, 2003; Allen et al., 2014). Moreover, there are almost no studies – neither theoretically nor empirically – that investigate the drivers of banks' long-term debt issuance. This is in contrast to the corporate finance literature, where a large number of theoretical hypotheses on the specific determinants of bond issuance by non-financial firms have been tested empirically. As these findings offer interesting lessons for bond issuance by banks, we present an overview in Appendix A. At the

same time, the banking literature does offer bank-level frameworks to analyse the broader debt financing decision. These analyses provide useful guidance for empirical investigations of banks' bond issuance, and hence we discuss them here.

The first set of studies starts from agency costs and asymmetric information.[5] Agency problems in banking are likely to be pronounced, because banks are information specialists that are given control over certain financial assets. Some studies argue that information asymmetries are reflected in the perceived opacity of banks, which suggests that banks are more difficult to understand than non-financial corporations (Morgan, 2002; Dang et al., 2014). At the same time, one needs to be careful in applying conventional corporate finance theories of agency costs and asymmetric information unequivocally to the financing decision of banks. These theories are based on trade-off considerations between debt and equity issuance, which are relevant for non-bank corporations, but much less likely so for banks. When looking at actual equity issuance data for banks, it is clear that there is no pronounced trade-off with debt issuance; even booming stock markets do not induce banks to issue large amounts of equity instead of debt.

In the banking literature, bank debt[6] is treated as a device to ensure market discipline that alleviates agency problems and information asymmetries (Calomiris and Kahn, 1991; Flannery, 1994; Diamond and Rajan, 2001). Traditionally, banking theory took a rather positive view of debt financing by banks, as debt was perceived to enhance bank loan quality and/or liquidity creation through its disciplining effect (Acharya and Thakor, 2012). The models of banking under asymmetric information developed in Gorton and Pennacchi (1990) and Calomiris and Kahn (1991) imply that banks will face strong market pressure to offer low-risk debt (i.e. deposits) to outsiders, because such debt protects depositors from inappropriate bank behaviour (Gorton and Winton, 2003; Calomiris and Wilson, 2004). In this respect, debt issuance helps to resolve agency problems between the bank and depositors, either by limiting the bank's propensity to take on excessive risk or by preventing the bank from absconding with depositors' funds (Calomiris and Kahn, 1991). In Flannery (1994), the disciplining effect is achieved through the issuance of short-term debt instruments, which are considered valuable contracting devices for banks, as changes in bank risk will be promptly reflected in funding costs.

Apart from a cost channel, market discipline would work also through investors' willingness to roll over short-term debt (or not, see Morris and Shin, 2009). This "roll-over" channel is sometimes extended to long-term debt instruments as well, a fraction of which must be renewed periodically (Admati and Hellwig, 2013). In Bank and Lawrenz (2013), deposit funding acts as a commitment device, because, contrary to bonds, deposits are non-negotiable (i.e. are "hard" claims on banks' assets).[7] In practice, banks will choose an optimal mixture of bond and deposit

[5] These analyses tend to emphasize two major problems faced by banks (Calomiris and Wilson, 2004): the potential conflict of interest between bankers and depositors (Diamond, 1984) and banks' role as issuers of transactable media.

[6] Or more specifically, deposit financing: the literature concentrates on extremely short-term, typically demandable low-risk debt, in other words demand deposits (see for example the definition of demandable debt in Calomiris and Kahn, 1991, p.497).

[7] Deposits are a renegotiation-proof claim because of their collective action problem (see also Calomiris and Kahn, 1991, and Diamond and Rajan, 2000).

financing that aligns internal incentives of bank managers, such as potential gains obtained from renegotiations with debt-holders, with external constraints (threat of regulatory intervention).

Due to more pronounced agency costs (as in: Flannery, 1994) and asymmetric information problems (as discussed in: Morgan, 2002; Myers and Majluf, 1984), Gropp and Heider (2010) argue that banks display a higher degree of debt financing than non-financial firms and hence are more leveraged. These agency and informational setbacks may have increased the cost of issuing equity for banks (Allen et al., 2014). This hypothesis is supported by the finding that especially profitable, dividend paying banks with high market-to-book ratios have more equity (i.e. issue less debt) (Gropp and Heider, 2010).

Based on the perceived disciplining effect of debt issuance, several proposals have argued that banks should be forced to issue subordinated debt, as banks' ability in doing so may be considered as a market signal of their viability (Evanoff et al., 2011). From a different angle, banks could also use debt issuance in order to manage private information between them and the market. Hence, they issue debt to convey positive private information and refrain from issuance to hide negative information (Covitz and Harrison, 2004; Billett et al., 1998).

The claim in banking theory that debt funding by banks imposes discipline on banks' management is refuted in Admati and Hellwig (2013), where the reliance on (short-term) debt funding is explained instead by debt overhang and government guarantees and subsidies for debt.[8] These authors find support in the experiences during the global financial crisis, which revealed the limitations of debt as a disciplining device for banks.[9]

A second approach to assess banks' recourse to debt financing concentrates on leverage targeting.[10] This implies that banks actively manage their leverage (i.e. choose their degree of leverage), with various studies emphasizing different sources of funding being used in this process: (short-term) wholesale debt (Adrian and Shin, 2010a; Acharya et al., 2011; Damar et al., 2013), deposits (Berger et al., 2008) and non-deposit liabilities (Gropp and Heider, 2010).[11] Again, long-term debt remains largely outside the scope of analysis. Most studies find that the main driver of bank

8 Brunnermeier and Oehmke (2013) explain the reliance of banks on short-term debt funding as the outcome of a "maturity rat race", where externalities between long-term and short-term debtholders can lead to an inefficient shortening of maturity structures. The incentive to do so may be particularly strong during financial crises.

9 In this respect, a large body of research has emphasized the risks of banks' reliance on funding through short-term wholesale debt markets (Van Rixtel and Gasperini, 2013; FRBNY, 2014). These conclusions are generally not extended to long-term wholesale debt financing by banks. This long-term funding source offers both advantages and potential costs. On the one hand, lengthening the maturity structure of banks' debt tends to make them more resilient to funding shocks by decreasing reliance on short-term debt that can be withdrawn at very short notice (Eisenbach et al., 2014). On the other hand, since long-term debt can be a more costly way of finance compared with short-term debt, the recourse to long-term debt may increase the debt burden and hence the likelihood that the return on the bank's assets will be insufficient to service this debt.

10 Of course, leverage targeting and adjustments in leverage may be caused by (changes in) agency costs and information asymmetries.

11 Non-deposit liabilities in Gropp and Heider (2010) are closely related to long-term debt for firms and include senior long-term debt, subordinated debt and other debenture notes.

leverage is size, i.e. bigger banks are more leveraged (Berger et al., 2008; Brewer et al., 2008; Adrian and Shin, 2010a; Heider and Gropp, 2010; Damar et al., 2013). Additional bank-specific characteristics that are found to explain the degree of leverage are collateral (positive) and the market-to-book ratio, profits and risk (negative). The fact that leverage is very much bank-specific is also reflected in strongly significant time-invariant bank fixed effects.

Leverage is closely linked to risk, and banks' balance sheet adjustments have been associated with shifts in risk appetite (Adrian and Shin, 2010). Banks, like non-financial firms, may reduce their reliance on debt when they become more risky, as for example reflected in higher default probabilities. If expected funding costs are sufficiently risk sensitive, then riskier banks may be less likely to issue debt instruments. Covitz et al. (2004) demonstrate that issuance decisions of banks are sensitive to firm-specific risk, just as others have found for non-financial firms (see Appendix A). These authors show that bank-specific risk proxies significantly affect the likelihood of debt issuance (negative sign), especially during periods of financial and economic stress (while issuance is associated positively with size and issuance frequency). Billet et al. (1998) find that banks adjust their funding structure away from risk-sensitive securities and into deposits when they become more risky, predicting a negative relationship between rating strength and deposit financing. Berger and Bouwman (2013) show that banks with higher capital before the crisis displayed higher growth in wholesale debt funding during the crisis. If higher capital improves banks' ability to absorb risk (i.e. the "risk absorption" hypothesis in Berger and Bouwman, 2009), banks with higher capital could experience cheaper and larger access to wholesale debt markets. Hence, according to this hypothesis, equity capital and bond issuance should be associated positively.

A third group of studies concentrates on liquidity in relation to debt issuance. The models of banking under asymmetric information developed in Gorton and Pennacchi (1990) and Calomiris and Kahn (1991) imply that banks will face strong market pressure to offer low-risk debt to outsiders, because it enhances the liquidity of bank claims (Calomiris and Wilson, 2004). This is linked to the liquidity creation function of banks by financing relatively illiquid assets with relatively liquid liabilities. Banks can meet liquidity needs by changing their funding structure (Diamond and Rajan, 2001). In this respect, banks may issue debt to overcome deposit supply constraints, predicting a negative relationship between deposit funding and bond issuance.

Finally, banks, especially in Europe, have been issuing considerable amounts of (long-term) secured debt, which includes debt securities that are backed explicitly by either collateral (such as covered bonds and securitisations) or government (e.g. government guaranteed bonds). Carbó-Valverde et al. (2011) show that collateralised debt securities are issued for different purposes: while covered bonds are used especially to increase bank liquidity, securitisations are more often issued in ways consistent with exploiting certain agency problems. According to the "banking view of secured debt", secured bond issuance of banks is negatively associated with banks' financial strength and size (Berger and Udell, 1990; Erel et al.,

2012). Hence, especially weaker and smaller banks will issue covered bonds or other secured instruments.[12]

An overview of the various bank-specific theories and the variables used to test them is presented in Panel A of Table 1.

2.2. Macroeconomic and financial market determinants of banks' debt issuance

The banking literature has generally paid little attention for the role of macroeconomic and financial market conditions in the (long-term) debt securities issuance decision of banks. Covitz et al. (2004) find that both higher unemployment and implied stock market volatility reduced the likelihood of subordinated debt issuance by US banks. Camba-Mendez et al. (2012) find also a negative impact of (historical) stock market volatility on European banks' bond issuance, while other macroeconomic, financial and monetary policy-related variables are largely insignificant. The major exception is a dummy variable for the ECB's Covered Bond Purchase Programme on collateralised debt issuance. From a broader perspective, several studies have included macro variables as controls in estimations of drivers of bank leverage. Heider and Gropp (2010) find that the term spread (positive), inflation and historical stock market volatility (both negative) are significant in explaining banks' market leverage, while GDP is not. Brewer III et al. (2008) do not obtain significant results for several macroeconomic variables when country fixed effects are included. On the importance of country-specific characteristics, Caruana and van Rixtel (2012) show that during the 2010-2012 euro area financial crisis funding markets became increasingly segmented according to bank nationality, as the access of banks to specific funding instruments was no longer determined primarily by their standalone credit rating but by their country of origin.

Proponents of the "risk-taking channel" argue that banks may be incentivised to take on more risk through excessive leverage when interest rates are low (Rajan, 2005; Borio and Zhu, 2012; Dell'Ariccia and Marquez, 2013; Altunbas et al., 2014). This should be reflected in a negative relationship between (central bank) interest rates and banks' debt issuance.

Finally, the finance literature suggests that "market timing" considerations play an important role in the decision whether or not to issue debt (see Appendix A). Empirical research shows that companies issue bonds when interest rate are low and/or expected to rise (Marsh, 1982; Graham and Harvey, 2001; Doukas et al., 2011).

Panel B of Table 1 provides a summary of the main findings in the banking literature on the relevance of macroeconomic and financial market conditions for debt issuance.

[12] A small but growing, literature concentrates on the tax benefits of debt (see Appendix A) in explaining banks' recourse to debt financing. Recent empirical studies show that this debt bias exists for banks to a similar extent as for non-banks (Keen and de Mooij, 2012; Heckemeyer and de Mooij, 2013). The favourable tax treatment of debt leads to higher bank leverage, but this effect is smaller for the largest banks and for banks featuring higher leverage ratios. However, as tax benefits affect mostly the choice between equity and any form of debt, we do not include tax issues in our analysis of the drivers of long-term debt issuance.

3. Hypotheses and empirical methodology

3.1. Hypotheses

The literature review provides us with a number of testable hypotheses, which are self-evident from the summary in Table 1. We shall restrict ourselves to those hypotheses that we actually can test. For example, as we discuss in section 4.3.2, we face data restrictions on bank-specific performance and stock market variables, such as profits, dividends, stock prices and market value. Hence, we do not discuss possible hypotheses that depend on the testing of the relationship of these variables with bond issuance.

"Agency costs" and "asymmetric information":

Due to existing information asymmetries and agency problems, market pressure will force banks to offer low-risk debt (e.g. deposits) to outsiders, because such debt protects creditors from too risky bank behaviour. Depositors can withdraw their funds at very short notice ("bank run"), in contrast to other debtholders. Hence, banks which face more pronounced asymmetric information problems and agency costs will issue more deposits in order to alleviate these constraints and hence have a lower need to issue bonds.

Hypothesis 1: according to "asymmetric information" and "agency costs" theories, bond issuance of banks is negatively associated with the growth of deposit funding (see Table 1).

"Roll-over" channel of debt:

Hypothesis 2: bond issuance of banks is positively related to their bond redemptions ("roll-over" channel) (Morris and Shin, 2009; Admati and Hellwig, 2013).

"Leverage targeting":

The banking literature suggests that banks actively manage their leverage, through adjusting the size of their debt issuance. Most empirical studies find that bigger banks are more leveraged.

Hypothesis 3: bond issuance of banks is positively associated with size (total assets) and size growth (Adrian and Shin, 2010; Acharya et al., 2011; Damar et al., 2013; Berger et al., 2008; Gropp and Heider, 2010).

Banks' adjustment of their leverage has been associated with shifts in risk appetite. They may reduce their reliance on debt financing when they become more risky, such as reflected in lower credit ratings.

Hypothesis 4: in normal times, bond issuance of banks is associated negatively with bank-specific risk (Adrian and Shin, 2010; Gropp and Heider, 2010; "market discipline": Covitz et al., 2004). During financial crises, bond issuance of riskier banks will be affected more than that of less risky banks.

"Risk absorption":

Stronger capital buffers improve the capacity of banks to absorb risk. Hence, stronger capitalised banks can access bond markets at better terms and consequently will issue more bonds.

Hypothesis 5: bond issuance of banks is positively associated with bank equity (Berger and Bouwman, 2009 and 2013).

"Liquidity needs":

Banks can meet liquidity needs by changing their funding structure, such as issuing debt to overcome deposit supply constraints.

Hypothesis 6: bond issuance of banks is negatively associated with the growth of deposit funding (Diamond and Rajan, 2001).

"Banking view of secured debt":

Especially weaker and smaller banks issue covered bonds and other secured instruments, while stronger and larger banks will signal their strength by issuing at unsecured terms.

Hypothesis 7: secured bond issuance of banks is negatively associated with banks' financial strength and size (Berger and Udell, 1990; Erel et al., 2012). This relationship will be more pronounced for weaker banks during financial crises.

"Market timing":

Banks issue more bonds when long-term interest rates and/or the term spread are low and/or expected to rise.

Hypothesis 8: bond issuance of banks is negatively associated with the level of interest rates and the term spread (Marsh, 2001; Doukas et al., 2011).

"Risk-taking channel of monetary policy":

An accommodative monetary policy stance in the form of low central bank policy rates may incentivise banks to take on more risk by issuing more debt.

Hypothesis 9: bond issuance of banks is negatively associated with the central bank policy rate (Borio and Zhu, 2012; Altunbas et al., 2014).

"Country versus bank characteristics":

Hypothesis 10: banks' bond issuance is associated negatively with country-specific risk factors during financial crises concentrated on these countries. During these episodes, bank-specific characteristics become less significant (Caruana and van Rixtel, 2012; Van Rixtel and Gasperini, 2013).

3.2. Empirical methodology

In order to take into account "zero" issuance observations at the individual bank level, we conduct Tobit estimations, in addition to OLS estimations. The absence of bond issuance by bank *i* in quarter *t* could be due to a lack of demand for longer-term funds by the bank or a lack of supply of funds by investors. We believe that the best practical empirical solution for this issue is using Tobit regressions. The

underlying model assumes that the dependent variable has a number of its values clustered at a limiting value, usually zero (as in our case) (McDonald and Moffitt, 1980). Tobit regressions use all observations, both those at the limit (here zero) and those above it, to estimate a regression line; it is generally to be preferred over alternative estimation models that estimate the relationship only with the observations above the limit (i.e. that ignore the zero values).

The stochastic model underlying the Tobit framework with truncated (or censored) error terms may be expressed as follows:

$$\begin{aligned} Y_t &= X_t\beta + \varepsilon_t \quad \text{if} \quad X_t\beta + \varepsilon_t > 0 \\ &= 0 \qquad\quad \text{if} \quad X_t\beta + \varepsilon_t \le 0 \\ &\qquad\quad t = 1, 2, \ldots, N, \end{aligned} \tag{1}$$

where N is the number of observations, Y_t is the dependent variable, X_t is a vector of independent variables, β is a vector of unknown coefficients, and ε_t is an independently distributed error term assumed to be normal with zero mean and constant variance σ^2. Thus the model assumes that there is an underlying, stochastic variable equal to $X_t\,\beta + \varepsilon_t$ which is observed only when it is positive, and hence qualifies as an unobserved, latent variable (McDonald and Moffitt, 1980).

The regression takes the following specification:

$$\begin{aligned} ISSUANCE\_BS_{it} = {} & \alpha_{it} + \beta_t BANKSPEC_{it-1} + \gamma_t MACRO\_FINANCIAL\_COUNTRY_{jt} + \\ & \delta_t FINANCIAL\_GENERAL_t + \lambda_j + \mu_t + \varepsilon_{it} \end{aligned} \tag{2}$$

The dependent variable $ISSUANCE\_BS_{it}$ is bank-specific bond issuance. We use five different versions of this variable, i.e. the total amount of bonds issued by bank i in quarter t ($TOTAL\_ISSUANCE_{it}$), secured issuance by bank i in quarter t which includes covered bonds and government guaranteed bonds ($SECURED\_ISSUANCE_{it}$), amount issued of unsecured bonds ($UNSECURED\_ISSUANCE_{it}$), covered bond issuance (COV_BONDS_{it}) and issuance of government guaranteed bonds (GOV_GUAR_{it}). In the Tobit estimations, issuance takes the following values. First, if a bank issues bonds in a particular quarter, $ISSUANCE\_BS_{it}$ is equal to the total actual amount of bonds issued by bank i in quarter t scaled by its total assets. Second, in case of no issuance by bank i in quarter t, the dependent variable is equal to zero.

The explanatory variables include bank and country-specific variables as well as overall financial market conditions. $BANKSPEC_{it-1}$ is a set of time-variant variables that are specific to bank i. Following the convention in the literature, firm characteristics are measured the quarter prior to bond issuance (Adrian et al., 2013; Becker and Ivashina, 2014). This lag of one quarter avoids endogeneity problems (Brewer III et al., 2008). $MACRO\_FINANCIAL\_COUNTRY_{jt}$ is a set of time-variant macroeconomic and financial variables that are specific to country j which is the country where the headquarters of bank i is located (and hence the country responsible for its supervision and eventual bailout). $FINANCIAL\_GENERAL_t$ includes two indicators of overall financial market conditions, i.e. stock market implied volatility (VOL_t) and the US dollar Libor-OIS spread ($LIBOR\_OIS_t$). α_{it} is a time variant constant. λ_j and μ_t are country respectively time fixed effects. ε_{it} is the error term.

In addition to this analysis at the bank level, we have conducted estimations at the aggregated country level. The empirical methodology and the results are presented in Appendix D.

4. Data and descriptive analysis

4.1. Bank sample

Our sample consists of the most frequently issuing European banks between 1999 and 2013, as recorded in the Debt Capital Markets (DCM) database of Dealogic. We use a threshold of at least 200 bonds issued per individual bank during this period. The selection of banks is further narrowed down by the availability of quarterly data for the independent variables. In the end, we have a sample of 63 banks from 11 euro area countries (AT, BE, DE, ES, FR, GR, IE, IT, LU, NL and PT) and Sweden, Switzerland and the United Kingdom. A breakdown of the number of banks per country is shown in Chart 2. The full list of the names of the individual banks including bank nationality and bank-type is presented in Appendix B. The largest national sample is the German one with 19 banks, followed by France and the United Kingdom (both seven banks). Our sample is well-represented across countries in terms of national total banking assets and does not have the over-representation of smaller countries that characterises other investigations of European banks such as the 2011 European Banking Authority (EBA) stress test and Camba-Mendez et al. (2012). The sample includes all European global systemically important banks (G-SIBs) which have been identified by the Financial Stability Board (FSB).[13]

Most banks in our sample are commercial banks (37), followed by public savings banks (11), mortgage banks (8) and cooperative banks (7). The large number of public savings banks is due to the importance of public sector banks in Germany. While dropping in recent years, the share of the German banking system in public ownership prior to the crisis amounted to around 40% of total German banking assets (Hüfner, 2010). Especially the publicly owned *Landesbanken* have been large and frequent issuers of long-term debt securities. Traditionally, these banks acted as central institutions for the savings banks (including providing access to capital markets) and main bank of the respective regional (*Länder*) governments (Krahnen and Schmidt, 2004), but increasingly started to operate in similar ways to private commercial banks on an international scale, concentrating on wholesale banking activities. Their international advance was aided by government guarantees, which were abolished in 2005.[14] Mortgage banks are characterised by large portfolios of mortgage-related lending, predominantly financed by market funding, due to the absence of a broad deposit base. Cooperative banks provide banking services to both members as well as non-members, buttressed by significant deposit funding.

13 Our sample includes all European G-SIBs on the list published by the FSB on 11 November 2013.

14 Due to their public ownership, savings banks and *Landesbanken* used to enjoy a guarantee by the public founding entity in the event of default as well as a maintenance guarantee (Hüfner, 2010). These guarantees were especially important for the *Landesbanken* due to their large recourse to market funding. Following a ruling by the European Commission that these guarantees were not in line with state aid regulations, a compromise in February 2002 between the European Commission, the federal government as well as the *Länder* and the Association of Savings Banks and *Landesbanken* required the abolition of the guarantee obligation while existing liabilities were still fully covered, and the replacement of the maintenance guarantee. However, a generous phasing-out period until July 2005 allowed the banks to enter liabilities with government guarantee at a maximum duration until 2015.

They are fully or partly privately owned by their customers and hence often not listed at a stock exchange.

4.2. Dependent variable

We downloaded from Dealogic DCM data on 50,465 long-term debt securities that were issued by the 63 banks in our sample between January 1999 and March 2013. A major complication in compiling the issuance data was the handling of "dead" banks, i.e. banks that disappeared as independent entities because they were taken over by another bank. DCM reclassifies bonds issued backwards in time when the original issuing bank disappears; the acquiring bank becomes the new parent issuer, also of the bonds that were issued by the "dead" bank before the date of the takeover. As we want to link the issuance data to bank-specific information, it is clear that this needs to be corrected, which can be done only manually for each individual bond issue concerned. For our checking we use Bankscope, SNL, bond issue and bank-specific information from the three rating agencies (Fitch, Moody's and S&P) and publications from the banks in our sample. More detailed information on the cleaning of the data is provided in Appendix C.

We include unsecured senior, subordinated, covered and government guaranteed bonds. The latter became a crucial feature of longer-term bank funding in 2008 and 2009 in the context of the policy response to the global financial crisis (Panetta et al., 2009; Muller et al., 2011). Covered bonds and government guaranteed issuance combined are the secured issuance in our analysis. We include medium-term notes (MTNs), which are offered continuously under an issuance programme, with a range of different yields and maturities of up to thirty years available to cater to the specific needs of individual investors. As further explained is Appendix C, we exclude securitisations and bonds issued by SPVs, bond exchanges and short-term debt securities. We concentrate on longer-term debt, which according to the definition used by Dealogic includes debt instruments with an original maturity of 18 months and longer.

The actual evolution of bond issuance by the 63 banks in our sample is shown in Chart 3. German banks dominated European issuance from 1999 to 2005 (Chart 3, top left-hand panel), which was driven by the *Landesbanken*. With the abolishment of the government guarantees in 2005 and the collapse of several *Landesbanken* during the global financial crisis of 2008-2009, this dominance disappeared rapidly. Especially banks headquartered in the UK, France, Spain, Italy and the Netherlands started to increase their bond issuance from 2004-2005 onwards. Notable issuance patterns are concentrated especially in quarters that were affected strongly during the global financial crisis of 2008-2009 and the euro area financial crisis of 2010-2012. With respect to the latter, the peak in Q1 2011 was due to a normalisation of issuance conditions and hence a "catch-up" in issuance after the turbulent market developments in late November and December 2010, when a sharp deterioration of the European sovereign debt crisis (i.e. problems and bailout Ireland) spilled over to banks' funding markets (Anguren-Martín et al., 2012). The troughs in the first half of 2011 and second quarter of 2012 were also linked to this crisis, when both Italy and Spain were increasingly hit. The euro area financial crisis and related bank restructuring and deleveraging resulted in a decline of the share of banks from peripheral euro area countries (ES, GR, IE, IT and PT) as of total euro area issuance to just 25% in Q1 2013, from 35% two years earlier. These developments affected the total amount of bonds issued by European banks as well: this reached a level in Q1

2013 that was similar to that of 13 years earlier. In terms of the number of bonds issued, especially UK banks were relatively frequent issuers, especially when compared with the amounts issued (Chart 3, top right-hand panel).

We turn now to the specific types of longer-term debt instruments issued. Unsecured bonds dominated issuance during relatively tranquil periods with expanding banking sectors, such as from early 2004 until the second quarter of 2007 (Chart 3, centre left-hand panel). Unsecured issuance boomed in the first quarter of 2011 (see above), and again in the first quarter of 2012, when the two Longer-Term Refinancing Operations (LTROs) of the ECB of December and February had boosted confidence in European bank funding markets. Covered bond issuance has seen an increasing trend in relative terms, especially by banks headquartered in peripheral euro area countries. The issuance of government guaranteed bonds became an important source of funding during the immediate aftermath of the collapse of Lehman Brothers in September 2008, but has disappeared largely since then. When taking into account the number of bonds issued, banks issued large numbers of unsecured bonds, suggesting relatively small sizes of individual issues (Chart 3, centre right-hand panel). In contrast, the number of government guaranteed bonds issued was very small, while raising relatively large amounts.

Issuance activity was increasingly concentrated at the largest systemic banks in Europe: the share of the 16 European G-SIBs in our sample in total long-term issuance activity expanded strongly from just 12% in the first quarter of 1999 to 55% in the first quarter of 2013 (Chart 3, bottom left-hand panel, red line). As bond issuance is characterised by seasonal patterns, we smoothen G-SIB and overall total issuance as a four-quarter moving average (Chart 3, bottom left-hand panel, blue and green lines). G-SIB issuance fell less strongly than that of all banks during the 2008-2009 global financial crisis. However, this resilience disappeared largely during the worst episode of the European financial crisis starting in the summer of 2011.

The average original maturity (in months) of bonds issued by the 63 European banks in our sample has been increasing in recent years, from a low of around 50 months in the first quarter of 2009 to around 70 months in the first quarter of 2013 (Chart 3, bottom right-hand panel, red line). This is indicative of a growing preference for stable funding sources, both market and regulatory-driven, as debt securities with long maturities constitute stable funding (ECB, 2012). The share of bonds issued with an original maturity of above three years in our sample is between 60% and 80% (Chart 3, centre right-hand panel, blue line). Hence, our analysis concentrates on the longer-term segment of European banks' bond funding.

Inspection of the issuance data for individual banks shows that during a significant number of quarters various banks did not issue long-term debt at all. This phenomenon became more prominent over time (Chart 4). The largest number of banks not issuing (i.e. 15) was recorded in the second quarter of 2012, at the height of the euro area financial crisis. These banks included seven of the 11 banks from peripheral euro area countries in our sample.

Panel A of Table 2 provides the descriptive statistics of the five dependent variables in the bank-specific analysis ($TOTAL\_ISSUANCE_{it}$, $SECURED\_ISSUANCE_{it}$, $UNSECURED\_ISSUANCE_{it}$, COV_BONDS_{it} and GOV_GUAR_{it}). Mean total quarterly issuance per bank before the crisis was around 1% of average total assets (ratio 0.011), with considerable variation across time, as shown by the standard deviation. The largest total quarterly amount issued by any single bank before the crisis was

around 19% of total assets. Since the financial crisis, quarterly issuance amounts of individual banks have increased, as banks started to frontload issuance in quarters when funding markets were accessible or took advantage of government guaranteed issuance programmes. The largest quarterly amount issued by a single bank since the financial crisis was around 11% of total assets.

4.3. Explanatory variables

4.3.1. Country-specific and financial market variables

The country-specific and financial market variables in Equation (2) (see section 3.2) are the following. $MACRO\_FINANCIAL\_COUNTRY_{jt}$ includes $TERM\_SPREAD_{jt}$, LR_{jt}, CB_RATE_{jt}, CB_BS_{jt}, $CBPP_t$, GDP_{jt} and CDS_SOV_{jt}. $FINANCIAL\_GENERAL_t$ includes VOL_t and $LIBOR\_OIS_t$.

$TERM\_SPREAD_{jt}$ is the difference between 10-year government bond yields and country representative 3-month government bill yields of the 14 countries in our sample. It proxies for the cost of borrowing at different maturities, which can affect the choice of debt maturity. The "market timing" hypothesis suggests a negative relation between the issuance of long-term bonds and the term spread. LR_{jt} is the 10-year government bond yield of the respective national sovereign. We expect a negative relationship ("market timing"). CB_RATE_{jt} is the policy interest rate of the respective central bank (ECB, Bank of England, Sveriges Riksbank and Swiss National Bank). The "risk-taking channel" hypothesis predicts a negative relation between the policy rate and bond issuance. CB_BS_{jt} is the size of the balance sheet (total assets) of the respective central bank, which should capture impact of unconventional monetary policy (i.e. effects of the monetary policy stance beyond the policy rate).[15] The "risk taking channel" would predict a positive relationship, while abundance of central bank liquidity could also cause banks to switch from bond issuance to central bank borrowing (negative relationship). $CBPP_t$ is a dummy variable for the ECB Covered Bond Purchase Programme, which was active from June 2009 to June 2010 in its first phase, and reactivated from early November 2011 to end-October 2012 (Camba-Mendez et al., 2012; Beine et al., 2011). This dummy takes the value one when active and zero otherwise. We expect a positive relation with covered bond issuance. GDP_{jt} is the percentage change in real GDP of the respective country. We expect a positive relationship. CDS_SOV_{jt} is the sovereign CDS spread of the respective national sovereign. With the strong interrelationship between the sovereign and the banking sector, we expect a negative relationship, especially during crisis periods. CDS_BANKS_{jt} is the average CDS spread of a representative national sample of banks. Also here we expect a negative correlation. VOL_t is implied stock market volatility (VSTOXX). As several available measures of implied volatilities based on national stock market indices are highly correlated with the VSTOXX, we use the latter for all countries. $LIBOR\_OIS_t$ is the three-month US dollar Libor-OIS spread**.** Summary statistics of the main country-specific and financial market variables are presented in Panel B of Table 2.

[15] We also used central bank assets scaled by GDP, with similar results.

4.3.2. Bank-specific variables

We include six variables capturing essential balance sheet and performance characteristics of individual banks (*BANKSPEC*$_{it-1}$ in Equation (2)). *GR_TA*$_{it-1}$ is the quarterly increase in total assets, scaled by total assets. According to the "leverage targeting" hypothesis, bond issuance of banks is positively associated with the growth of total assets (Hypothesis 5). *K_TA*$_{it-1}$ is the ratio of total equity capital to total assets. The "risk absorption" hypothesis predicts that bond issuance of banks is positively associated with bank equity (Hypothesis 6). *L_TA*$_{it-1}$ is the ratio of total loans to total assets, which captures business model differences between banks. We expect a positive relationship between the loan ratio and bond issuance, indicating that banks with high loan growth need to recourse to bond issuance. *D_TA*$_{it-1}$ is the ratio of total customer deposits to total assets. We expect a negative relationship between this variable and bond issuance (Hypothesis 8). *RATING_AV*$_{it-1}$ is the average of the stand-alone ratings for each bank published by Fitch, Moody's and S&P. The ratings are scaled from "0" to "20", with "0" and "20" representing C respectively AAA in Fitch and S&P and Ca and Aaa in Moody's. This average rating is a proxy for bank-specific risk and is expected to be positively correlated with bond issuance (Hypothesis 4, both "leverage targeting" and "market discipline").

We use the one-quarter lagged values of the balance sheet and rating variables to avoid endogeneity problems. The quarterly data for the balance sheet variables are obtained from Bankscope, and where available, augmented by data from SNL. For several banks for which quarterly data are poorly populated in these databases, we go to original sources such as quarterly and annual reports. Missing quarterly data are estimated by interpolation. Due to the lack of historical quarterly balance sheet data, the estimation including bank-specific variables is conducted for Q1 2005 – Q1 2013 only. Our main bank-specific estimations use 1,627 observations.

Restrictions on data-availability are the reason why we have not included important flow variables such as profits and dividends. Quarterly data for these indicators are available in Bankscope and SNL for the most recent years only. Moreover, given their significant variability across quarters, quarterly interpolations based on annual values fail to provide a realistic picture of actual developments. In addition, a relatively large number of banks in our sample, i.e. the public savings banks and several cooperative banks, are not listed. Hence, we do not have data on stock prices and market value for these banks. All in all, due to these data limitations, we cannot test for the full sample of banks several hypotheses obtained from the literature (in particular Hypotheses 3 and 4, section 3.1). Finally, we do not investigate the tax benefits of debt (Hypothesis 9). Corporate taxes change only sporadically and hence are less suited to be included in empirical analyses of a quarterly frequency.

Descriptive statistics of the bank-specific explanatory variables are reported in Panel B of Table 2. The mean size of the 63 banks in our sample is euro 490 billion, with considerable dispersion across banks: the largest bank (total assets of euro 2.6 trillion) is more than 470 times the size of the smallest bank (euro 5.5 billion). We also find considerable heterogeneity in funding structures, with some banks depending predominantly on deposit funding, while others hold no or very small amounts of deposits. Also asset structures display large variation, such as indicated by large differences in loan-to-total assets ratios. The mean rating of the banks in our sample is 16, or A+ in Fitch and S&P and A1 in Moody's. The lowest rating (4) is below investment grade (CCC+/Caa1), while the highest (20) is AAA/Aaa.

A summary overview of the dependent and explanatory variables used in the estimations is presented in Table 3.

5. Empirical results

5.1. Overall results

Table 4 shows the results of estimating Equation (2) (in section 3.2) for total issuance ($TOTAL\_ISSUANCE_{it}$). In our discussion, we concentrate on the Tobit estimates. Generally, we find strongly significant coefficients for the bank-specific variables, with signs as expected by the formulated hypotheses (see Table 1). The positive and significant sign for total assets' growth (GR_TA_{it-1}) (Table 4, column (4)) for the crisis period supports "leverage targeting" (Hypothesis 3, section 3.1). Interestingly, this variable is not significant in the pre-crisis period, suggesting that banks resorted to long-term wholesale funding to finance balance sheet expansion during the crisis years, but not before. This may be explained by the widely reported use of short-term wholesale markets in the years prior to the crisis; when access to these markets became severely limited for most banks during the crisis, they had to resort to long-term bond issuance. The coefficient estimate on the capital ratio (K_TA_{it-1}) is significantly positive for both crisis and pre-crisis periods, providing support for the "risk absorption" hypothesis (Hypothesis 5). Hence, as capital expands banks' risk-bearing capacity, better capitalised banks are able to issue larger amounts of long-term debt. The coefficient on the deposit ratio (D_TA_{it-1}) is negatively and significantly associated with bond issuance for both periods, supporting the "agency costs" and "asymmetric information and deposit supply constraints hypotheses (Hypotheses 6 and 1). Moreover, bond issuance is positively and significantly associated with the loan ratio (L_TA_{it-1}), both before and after the crisis. As loans are normally the longer maturity assets on banks' balance sheets (for example when compared with capital market-trading and investment activities), this result may point at a certain degree of maturity matching between long-term assets and long-term liabilities. Finally, we also find the expected positive sign (at 10%) on the coefficient of banks' credit ratings ($RATING\_AV_{it-1}$): banks that are perceived to be less risky and hence have a higher credit rating issue more long-term debt than lower rated banks (Hypothesis 4). This result also holds during the crisis period (even more significant at 1%), suggesting that the standalone financial strength of banks remained an important factor in maintaining access to long-term wholesale markets.[16]

Our results also indicate that macroeconomic and financial market conditions are important determinants of bond issuance by European banks, in addition to bank-specific characteristics. Hence, we can extend the empirical results from the corporate finance literature suggesting that these conditions are important drivers of the debt issuance decision of non-bank firms to debt issuance by banks. Sovereign CDS spreads (CDS_SOV_{jt}) are negatively and significantly correlated with bond issuance in the crisis period, suggesting the importance of country-specific

[16] Adrian et al. (2013) find for a large sample of US non-banks that those with better ratings were also more likely to resort to bond financing during the crisis.

risk factors during the crisis (Hypothesis 10). However, we do not find that this finding was accompanied by a decline in the importance of bank-specific characteristics. This is an important result for policy, as it shows that better-performing banks maintained better access to longer-term funding markets during the crisis period. Hence, banks' own policies and management decisions matter, also during financial crises. Furthermore, we find that financial market volatility (VOL_t) was negatively and significantly related to bond issuance throughout our full sample period. Hence, financial market tensions reduced the likelihood that banks issued bonds. The long-term interest rate (LR_{jt}), or our indicator for "market timing" (Hypothesis 8),[17] is no longer significant during the crisis period, as access to long-term debt markets became more important than its cost. Interbank funding costs, proxied by Libor-OIS spreads, are significantly and, as expected, negatively correlated with bond issuance, but only in the pre-crisis period. The sign of this variable turns positive during the crisis years, which may be explained by the issuance of large amounts of government guaranteed and retained bonds during quarters when access to global interbank markets was especially impaired. The issuance of these bonds may also explain the negative and significant coefficient for GDP during the crisis period. To complete our investigation of the importance of general macroeconomic and financial market conditions, we included the central bank policy rate, the size of its balance sheet and the term spread, but these variables were not significant in both periods (not reported in Table 4).

5.2. Secured issuance

Table 5 reports our findings for secured ($SECURED\_ISSUANCE_{it}$) and unsecured issuance ($UNSECURED\_ISSUANCE_{it}$). The former includes covered bonds and long-term debt securities issued under government guaranteed issuance programmes that were established in many European countries after the collapse of Lehman Brothers. Turning first to the Tobit results for secured issuance (columns (3)-(4)), the most notable finding is that the rating sign now turns negative, suggesting that lower rated banks were more likely to issue secured debt. This result supports the "banking view of secured debt" (Hypothesis 7), which expects that secured bond issuance is negatively associated with the issuer's financial strength.[18] Also the sign of the coefficient for the capital ratio (K_TA_{it-1}) turns now negative, but fails to meet the 10% significance level. The deposit and loan ratios (D_TA_{it-1} and L_TA_{it-1}) remain significant with unchanged signs, while the results for GDP and the Libor-OIS spread are unchanged as well. In contrast, the sovereign CDS spread is no longer significant for the crisis period.

The results for unsecured issuance in Table 5 provide further support for the "banking view of secured debt", as the coefficients for both the rating and capital ratio variables are now positive and significant (columns (7)-(8)). Hence, stronger banks seem to want to signal their financial strength to financial markets by demonstrating that they are able to issue on unsecured terms. At the same time, the

[17] We also included the term spread, but this variable was not significant in both periods (not reported).

[18] Erel et al. (2012) find for a sample of US non-financial corporations that higher leveraged firms are more likely to issue secured debt.

sovereign CDS spread is now significant and has the expected negative sign, indicating that banks headquartered in countries affected by sovereign tensions were less likely to issue unsecured bonds.

In order to better understand the drivers of secured bond issuance, we split this sample into its two constituents, i.e. covered bonds (COV_BONDS_{it}) and government guaranteed bonds (GOV_GUAR_{it}). The results are reported in Table 6. The coefficient of the capital ratio (K_TA_{it-1}) is negative and significant for the crisis period (column (4)), indicating that especially less capitalised banks issued covered bonds during the crisis years. With the global and euro area financial crises increasingly turning into crises of bank solvency, investors seem to have required additional security from banks with lower capital ratios. Investor preferences may also explain the negative sign on the coefficient of GDP, indicating that banks headquartered in countries experiencing lower economic growth were more likely to issue covered bonds during the crisis period. Increased financial market volatility reduced the likelihood of European banks issuing covered bonds during the full sample period. The deposit and loan ratios have the expected signs (negative respectively positive) and are both significant for the crisis period.

Turning to government guaranteed bonds, their issuance is completely driven by macro-economic factors; bank-specific factors are no longer significant. GDP is the main determinant, significant at the 1% level and a negative sign. Hence, the significant and negative sign on the coefficient of GDP that we reported in the overall results (Table 4) and in those for secured issuance (Table 5) seems to have been driven largely by government guaranteed issuance, followed by covered bond issuance.

The results of the bank-specific analysis that we have discussed thus far have not included significant findings for central bank policies, both the policy interest rate and the size of the balance sheet. We investigate the role of central banks further by including a dummy for the ECB Covered Bond Purchase Programme (CBPP), which was active from June 2009 to June 2010 in its first phase (CBPP1), and reactivated in early November 2011 until the end of October 2012 in a second phase (CBPP2). The results in Table 7 show that this programme indeed promoted the issuance of covered bonds, with a positive and significant sign (at 5%) for the coefficient on $CBPP_t$ (column (3)). Interestingly, this programme seemed not to have functioned as intended for covered bond issuance by banks headquartered in peripheral euro area countries. We find a negative and significant sign for an interaction term $CBPP\_PERI_t$ (column (3)) which is a dummy variable capturing covered bond issuance by peripheral banks in quarters when the programme was active.

5.3. Regional issuance

The global financial crisis of 2008-2009 and especially the euro area financial crisis of 2010-2012 had profoundly different repercussions for individual countries. In order to have a better understanding of these processes, we divide the sample into three regional groups: the banks headquartered in core euro area countries (DE, FR, NL, BE, AT and LU), peripheral euro area countries (ES, GR, IT, IE and PT) and other European countries (UK, SE and CH). Then we regress total issuance ($TOTAL\_ISSUANCE_{it}$) of the banks in each region on the set of explanatory variables that we have used in the bank-specific regression. Table 8 shows the results. Most

notably, the coefficient for the sovereign CDS spread is negative and significant for banks headquartered in the euro area, i.e. both for the core and peripheral countries (columns (2) and (4)), but is not significant for the three countries outside the euro area (UK, SE and CH) (column (6)). Two conclusions can be drawn from this finding. First, the euro area financial crisis was not affecting just the long-term funding of peripheral banks; also bond issuance by banks from the euro area core countries was negatively correlated with sovereign tensions. Second, European banks headquartered outside the euro area were not affected directly by the sovereign turmoil. Issuance of these banks was driven largely by bank-specific characteristics, such as capital and loan ratios (both positive) and their deposit ratio (negative).

The main difference between the determinants of issuance by core versus peripheral euro area banks is that the former is positively and significantly associated with the credit rating whereas the latter is positively correlated with the capital ratio. On the latter result: we find generally positive coefficients for the capital ratio in the regressions, which is significant for peripheral euro area banks for the full sample (at 5% for pre-crisis and 1% for crisis period; columns (3) and (4)) and for UK-SE-CH banks for the crisis period only (column (6)). Hence, our acceptance of the "risk absorption" hypothesis in section 5.1 seems to be driven largely by banks headquartered in peripheral euro area countries.

Moreover, we find a positive and significant coefficient (at 1%) for the long-term interest rate (LR_{jt}) in the core euro area estimation for the crisis period (column (2)), suggesting that banks from the core were less likely to issue long-term bonds when government bond yields were low. This result may pick-up financial market turmoil related to the euro area financial crisis: "flight to safety" investment flows drove sovereign 10-year government bond yields of the leading core euro area countries to their lowest levels during the most intense episodes of the crisis. But during these times, bond market access of core euro area banks was also severely hampered, which explains the positive sign. We do not observe this relationship for sovereign CDS spreads of core countries, which were generally at their peaks during periods of severe market disruptions (and hence the negative sign). Interestingly, before the crisis, the sign on the coefficient for the long-term interest rate (LR_{jt}) was negative and significant (column (1)), suggesting that in normal times core euro area banks "timed" their issuance to take advantage of lower issuance costs; actually, peripheral area banks followed the same strategy before the crisis (column (3)).

5.4. Additional analysis and robustness tests

In this section, we present further analysis of our results and conduct robustness tests. As our database allows for a detailed breakdown of various types of bonds, we are able to estimate the drivers of more differentiated subsamples of bond issues. These estimations provide additional evidence that helps us to verify our conclusions.

As a first investigation, we exclude all bonds which benefited from direct state support or were issued with the objective to be used as collateral in central bank liquidity operations. That is, we exclude government guaranteed bonds and retained issues, which are both identified in the Dealogic database. Hence, we are able to test to what extent our results were driven by the inclusion of public sector supported issuance. Government guaranteed and retained bonds emerged for the

first time during the global financial crisis of 2008-2009, when state and central bank support for banks became a key element of their wholesale funding structure (see Panel A, Chart 5). At the height of the euro area crisis in the second half of 2011 and first half of 2012, retained issuance returned in significant amounts, as banks needed collateral to obtain liquidity from the ECB. During the global financial crisis, retained bonds were issued mainly by UK banks, which started to issue these instruments from the second quarter of 2008 onwards (see Panel B, Chart 5). This coincided with the start of the Bank of England's Special Liquidity Scheme (SLS) in April 2008, under which banks could swap illiquid debt securities for UK Treasury bills and use the latter as collateral to obtain cash. In contrast, retained issuance during 2011-2012 was dominated by Spanish and Italian banks, which faced growing pressures in accessing wholesale funding markets and became increasingly dependent on ECB liquidity.

The results of the estimations for the reduced sample (excluding government guaranteed and retained issuance) are reported in Table 9. Interestingly, national characteristics are now no longer significant: issuance of bonds can be explained completely by bank-specific factors and overall implied stock market volatility (VSTOXX). Higher rated and better capitalized banks were more likely to issue long-term debt, in line with the "risk-absorption" hypothesis. Bond issuance was also driven by the growth of total assets, suggesting "leverage targeting", while relatively large loan portfolios were also associated with larger issuance.

Next, we further investigate the possible impact of central bank policies on European banks' bond issuance. In our baseline estimations, neither the central bank policy rate nor central bank total assets were significant; to save space, we did not report them. This is remarkable, against the background of the exceptional central bank policy stance during the crisis years, both in terms of conventional and unconventional policies. Hence, we conducted further analysis for smaller samples, focusing on issuance of different types of debt, for different groups of countries. We also included new explanatory variables for liquidity provided by central banks. The main results of this exercise are reported in Table 10. We found that unsecured issuance by banks headquartered in the peripheral countries (ES, GR, IE, IT and PT) was negatively and significantly (at 1%) associated with liquidity provided by the ECB ($ECB\_liquidity_{jt}$). Hence, central bank liquidity became a substitute for unsecured long-term debt during the crisis years for banks from the European periphery.

Furthermore, we tested the importance of bond redemptions in driving new bond issuance. Both market reports and academic literature suggest that this "roll-over" channel (Hypothesis 2) may be important. We approximated for each bank the amount of their quarterly redemptions on the basis of the information provided by Dealogic.[19] We added these redemptions as an additional explanatory variable ($REDEMPTIONS_{it}$) in the baseline regression; results are reported in Table 11. We found indeed evidence that banks rolled over maturing long-term debt by issuing new bonds, with $REDEMPTIONS_{it}$ significant before and since the crisis (at 10% and 1%, respectively). Moreover, the results for the other explanatory variables were robust when compared with the baseline results presented in Table 4, with the only exception being the sovereign CDS spread (which misses just the 10% level).

[19] Dealogic does not provide data on the amounts outstanding, but only on gross issuance. Hence, we approximated redemptions on the basis of the original maturity of the bonds issued.

Finally, we investigated the possible existence of selection bias: some banks are excluded from the sample by self-selection, as they decided not to issue. To test for selection bias, we applied Heckman's 2-stage correction (Heckman, 1974, 1976 and 1979). This approach involves a selection equation considering the portion of the sample that is observed and a regression equation that regresses the outcome variable (i.e. our main dependent variable $TOTAL\_ISSUANCE_{it}$) on a set of explanatory variables. The selection equation is defined as a Probit model, where the dependent variable $ISSUANCE\_OBSERVED_{it}$ takes the value 1 if $TOTAL\_ISSUANCE_{it}$ by bank i in quarter t is positive and 0 if it is zero or not available. We use the Probit model to estimate the following selection equation, using the entire sample:

$$ISSUANCE\_OBSERVED_{it} = X_t\beta + \varepsilon_{1t} \quad (3)$$

where X_t is a set of explanatory variables.

The regression equation is defined as follows:

$$TOTAL\_ISSUANCE_{it} = Y_t\varphi + \varepsilon_{2t} \quad (4)$$

where $TOTAL\_ISSUANCE_{it}$ is the positive (non-zero) amount of bonds issued by bank i relative to its total assets in quarter t. Y_t is also a set of explanatory variables, but $Y_t \neq X_t$. Equation (4) is estimated with ordinary least squares (OLS).

Our analysis suffers from selection bias if the error terms ε_{1t} and ε_{2t} are correlated. We conducted Heckman's 2-stage correction for different sets of Y_t and X_t. Our test results indicate that we cannot reject the null hypothesis that the two equations are independent, suggesting that our results are not affected by selection bias.

6. Summary and conclusions

This paper is one of the first to investigate the determinants of bond issuance by European banks. We use a unique database of around 50,000 bonds, allowing us to differentiate between different types of long-term debt securities. For example, we obtained data on government guaranteed and retained bonds, which became prominent sources of funding for many European banks during the 2008-2009 global and 2010-2012 euro area financial crises. Our database has been manually cleaned for each bond for the impact of mergers and acquisitions, and hence we are confident that we able to match each bond with the characteristics of the correct, actual issuer. Our analysis at the individual bank level allows us to test explicitly a broad set of hypotheses from both the corporate finance and banking literature on the drivers of bond issuance.

Our findings suggest that "market timing" played a role in the issuance decision prior to the crisis. Banks were more likely to issue when interest rates were low. This result is in line with recent empirical evidence from the corporate finance literature on the drivers of bond issuance by non-financial firms. However, "market timing" was no longer relevant during the crisis years, when access to longer-term funding became more important for European banks than its cost. We also show that heightened financial market tensions, especially higher stock market volatility, were detrimental to bond issuance. Moreover, country-risk characteristics became drivers of total bond issuance during the crisis periods, suggested by the significant and

negative sign for the sovereign CDS spread. However, when we exclude government guaranteed bonds and bonds retained as collateral for central bank liquidity operations, this spread is no longer significant. In fact, issuance excluding government guaranteed and retained debt can be explained almost completely by bank-specific characteristics.

Turning to the results for the bank-specific explanatory variables, generally we find strongly significant coefficients with signs as expected. The positive and significant sign for growth of total assets for the crisis period supports "leverage" targeting: as short-term wholesale markets essentially closed down during the crisis, the banks in our sample resorted to long-term debt issuance. Moreover, banks with deposit supply constraints issued more long-term debt. The positive and significant coefficient for the capital ratio supports the "risk absorption" hypothesis: larger capital buffers expanded banks' risk-bearing capacity, and subsequently better capitalised banks were able to issue more bonds. We also find that higher rated banks were more likely to issue bonds, also during the crisis period. The latter two results are especially important, as they suggest that financially stronger banks maintained better access to longer-term funding markets, even during the crises. Hence, even though worse country-risk characteristics were detrimental to issuance, individual bank performance could mitigate the negative impact of bank nationality. Moreover, bond issuance is positively and significantly associated with the relative size of banks' loan portfolios: as these loans are normally the longer maturity assets on banks' balance sheets, this result may point at a certain degree of maturity matching between long-term assets and liabilities.

When distinguishing between secured and unsecured issuance, our results show that stronger banks – higher rated and stronger capitalised banks – were more likely to issue unsecured debt, supporting the "banking view of secured debt" hypothesis (Berger and Udell, 1990; Erel et al., 2012). We find the opposite result for the issuance of secured debt, providing further support for this hypothesis. We also test for the effectiveness of the ECB's Covered Bond Purchase Programme. The results show that indeed it promoted the issuance of covered bonds, but particularly those issued by core euro area countries. When we restrict the sample to unsecured bonds issued by peripheral banks, our findings indicate that this issuance was negatively associated with funds provided by the ECB during the crisis years, pointing at a certain degree of substitution between unsecured debt and ECB liquidity.

We also investigate the drivers of bond issuance by banks from different countries and find that higher country-risk characteristics reduced the likelihood of issuance by banks from the euro area but not by those from outside this area (ie UK, SE and CH). We draw two conclusions from this finding. First, the euro area financial crisis was not affecting just the long-term funding of peripheral banks; also bond issuance by banks from the euro area core countries was negatively correlated with sovereign tensions. Second, European banks headquartered outside the euro area were not affected directly by the sovereign turmoil. Issuance of these banks was driven largely by bank-specific characteristics, such as capital and loan ratios (both positive) and their deposit ratio (negative).

Our results pass several robustness tests, including the Heckman test for selection bias. Bond redemptions turn out to be a significant additional explanatory variable; however, this variable does not affect our baseline results, supporting the robustness of our findings.

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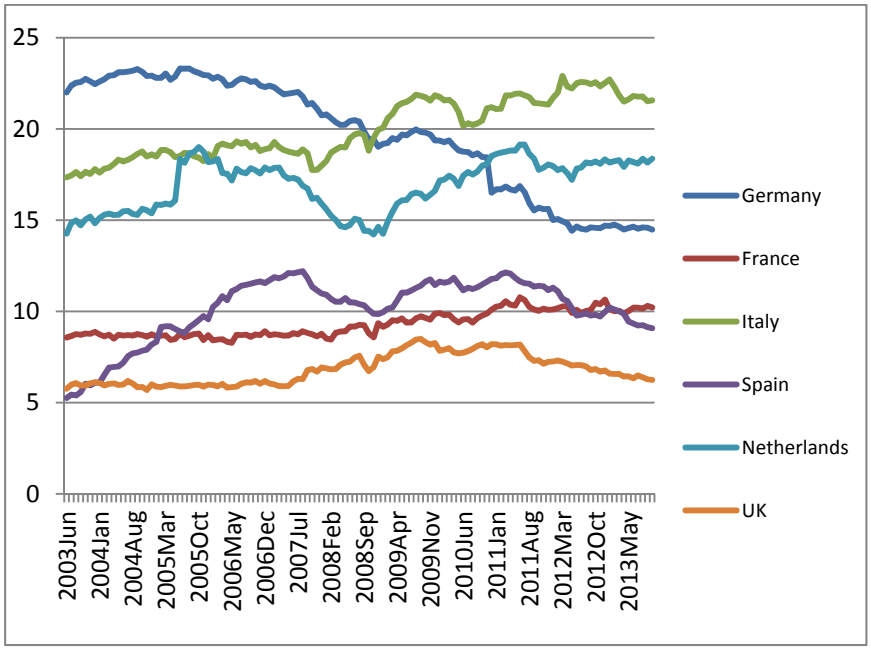
Chart 1: Long-term debt securities as percentage of total assets



Source: ECB MFI balance sheet statistics. Long-term debt securities: amounts outstanding of debt securities issued with an original maturity of above one year. Short-term debt securities: amounts outstanding of debt securities issued with an original maturity of up to one year. The data for banks in the UK are not fully comparable with those of the euro area countries, as data on debt securities issued with a maturity of between one and two years are only available for the domestic sector as counterpart. Hence, the amount of these securities that is held by investors outside the UK is not included.

Chart 2: Sample - Number of banks per country

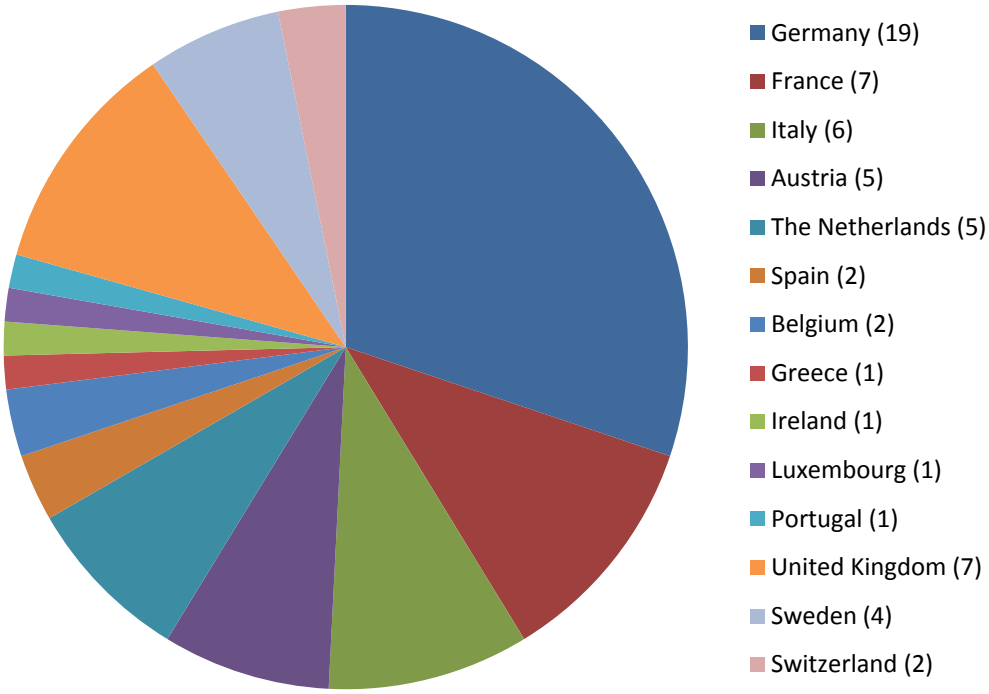


Chart 3: European banks' bond issuance 1999-2013

Based on the 63 banks in our sample.

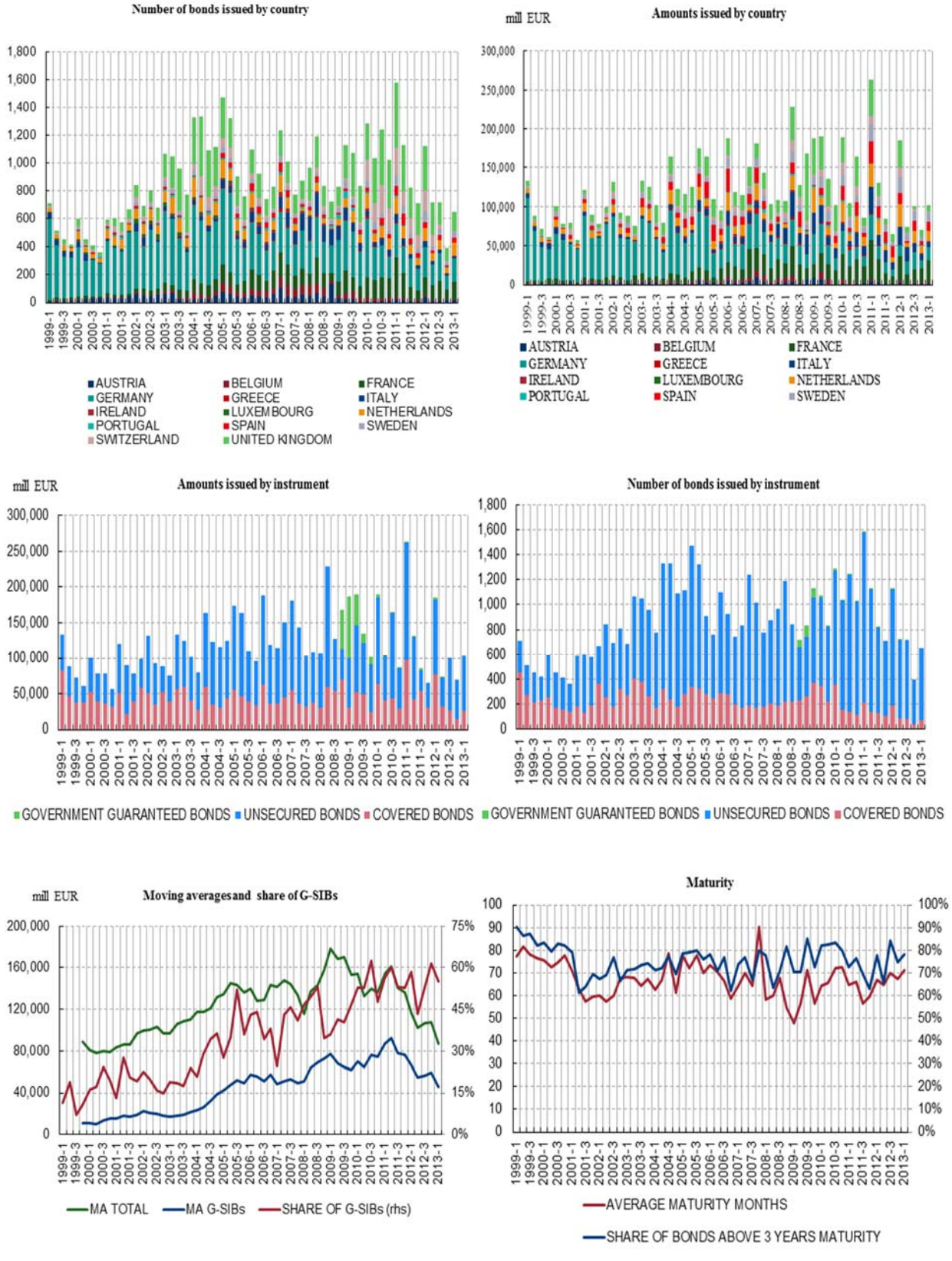


Chart 4: Number of banks not issuing in quarter *t*

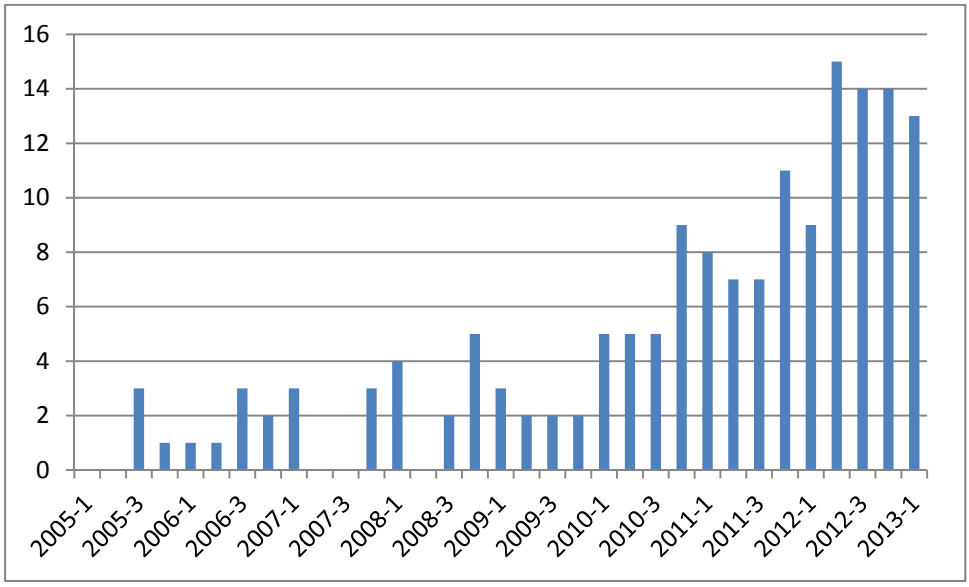
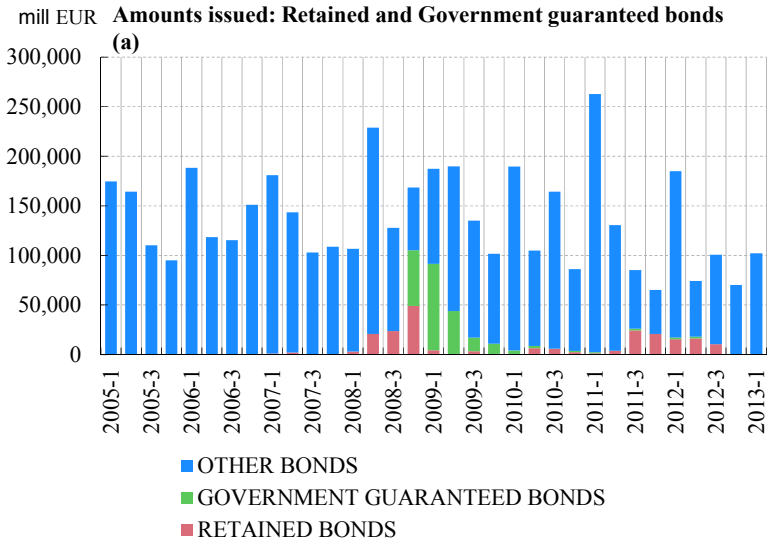


Chart 5: Government guaranteed and retained issuance

Panel A



(a) Only one bond from Alpha Bank was simultaneously both retained and government guaranteed.

Panel B

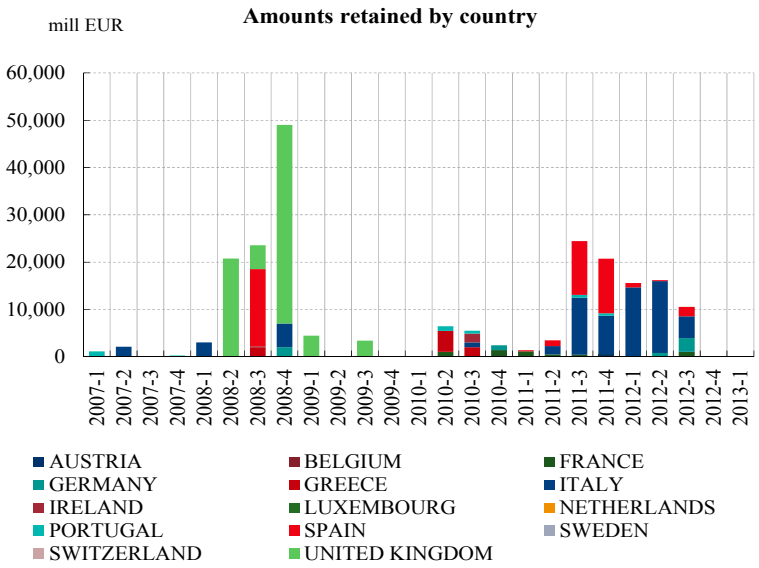


Table 1: Summary literature on the determinants of banks' debt issuance

Variable	Theory	Explanation	Expected sign
Panel A: Bank-specific			
Deposits	Agency costs and asymmetric information (Gorton and Pennacchi, 1990; Calomiris and Kahn, 1991); liquidity needs (Diamond and Rajan, 2001); commitment device (Bank and Lawrenz, 2013).	Banks issue deposits as a device to resolve agency costs and asymmetric information problems (market discipline) and hence have lower need to issue bonds. Banks issue debt to overcome deposit supply constraints.	Negative
Bank performance (profitability and dividends)	Agency costs and asymmetric information (Gropp and Heider, 2010).	More profitable and dividend-paying banks have more equity, i.e. issue less debt	Negative
Market-to-book ratio	Agency costs and asymmetric information (Gropp and Heider, 2010).	Banks with high market-to-book ratios have more equity, i.e. issue less debt.	Negative
Bank performance (as measured by rating migrations and (abnormal) equity returns)	Information revelation (Covitz and Harrison, 2004).	Banks issue bonds to convey positive information to markets	Positive
Size (total assets and growth total assets)	Leverage targeting (Adrian and Shin, 2010a; Acharya et al., 2011; Damar et al., 2013; Berger et al., 2008; Gropp and Heider, 2010); agency costs and asymmetric information.	Leverage targeting banks grow by expanding debt (and hence issue long-term debt, in addition to short-term debt). Larger banks are less prone to agency conflicts and asymmetric information and hence issue long-term debt.	Positive
Bank risk proxies, including credit ratings	Leverage targeting (see above); market discipline (Covitz et al., 2004).	More risky banks have lower leverage and lower recourse to debt issuance, especially during periods of economic and financial stress.	Negative with risk (positive with rating strength)
"Roll-over" ratio of debt	"Roll-over" channel of debt (Morris and Shin, 2009; Admati and Hellwig, 2013)	Investors' willingness to roll over debt provides market discipline	Positive
Equity capital	Risk absorption hypothesis (Berger and Bouwman, 2009 and 2013)	Better capitalised banks (based on book value of equity) issue more debt	Positive
Corporate tax rate	Tax benefits of debt (Keen and de Mooij, 2012; Heckemeyer and de Mooij, 2013)	Tax benefits of debt are associated with higher bank leverage	Positive

Panel B: Macroeconomic and financial market conditions			
GDP/unemployment/	Covitz et al. (2004)	Worse economic conditions are associated with lower debt issuance	Negative
Stock market volatility	Covitz et al. (2004); Camba-Mendez et al. (2012).	Higher volatility is associated with lower debt issuance	Negative
Country-specific risk factors	Caruana and Van Rixtel (2012); Van Rixtel and Gasperini (2013).	Country-specific risk factors become more important drivers of banks' bond issuance during financial crisis than bank-specific factors	Negative
Monetary policy stance (policy rate, central bank balance sheet)	Risk-taking channel (Rajan, 2005; Borio and Zhu, 2012; Dell'Ariccia and Marquez, 2013; Altunbas et al., 2014); "Market timing".	Banks may be incentivised to take on more risk through excessive leverage when interest rates are low. Lower policy rate may spill over to other interest rates, lowering financing costs and increasing bond issuance ("timing").	Policy rate negative; balance sheet positive.
Interest rate and term spread	"Market timing" (Marsh, 1982; Doukas et al., 2011)	Banks issue bonds when interest rates are low or expected to rise	Negative

Table 2: Summary statistics

Panel A: Dependent variable: Bond issuance divided by total assets.				
Variable	Mean	Std. dev.	Min	Max
	Before crisis (Q1 2005 – Q3 2007)			
TOTAL_ISSUANCE	0.0106	0.0160	0	0.1886
SECURED_ISSUANCE	0.0045	0.0093	0	0.1047
UNSECURED ISSUANCE	0.0061	0.0136	0	0.1886
COV_BONDS	0.0034	0.0076	0	0.0825
GOV_GUAR	0.0011	0.0057	0	0.1047
	Since crisis (Q4 2007 – Q1 2013)			
TOTAL_ISSUANCE	0.0070	0.010	0	0.1054
SECURED_ISSUANCE	0.0040	0.0083	0	0.1054
UNSECURED_ISSUANCE	0.0030	0.0057	0	0.0671
COV_BONDS	0.0029	0.0064	0	0.0615
GOV_GUAR	0.0011	0.0054	0	0.1054

Panel B: Explanatory variables

Variable	Mean	Std. dev.	Min	Max
Total assets (m€)	489,999	543,572	5,545	2,586,700
K_TA_{it} (capital ratio)	0.04	0.02	0	0.15
D_TA_{it} (deposits ratio)	0.32	0.14	0.00	0.82
L_TA_{it} (loan ratio)	0.49	0.16	0.08	0.98
$RATING\_AV_{it}$	16.1	1.7	4	20
LR_{jt} (in %)	3.6	1.8	0.5	36.6
$TERM\_SPREAD_{jt}$ (in %)	1.6	1.8	-4.7	34.6
GDP_{jt} (in %)	1.10	2.8	-9.0	8.2
VOL_t (volatility)	24.3	9.1	12.8	50.0
$LIBOR\_OIS_t$ (basis points)	34.8	33.6	2.2	186.8
CDS_SOV_{jt} (in %)	1	5	0	200

Table 3: Summary list of dependent and independent variables

Period	Q1 2005 – Q1 2013	
Dependent variables	$TOTAL\_ISSUANCE_{it}$	Total amount of bonds issued by bank *i* in quarter *t*, scaled by its total assets
	$SECURED\_ISSUANCE_{it}$	Total amount of secured bonds (covered plus government guaranteed) issued by bank *i* in quarter *t*, scaled by its total assets
	$UNSECURED\_ISSUANCE_{it}$	Total amount of unsecured bonds issued by bank *i* in quarter *t*, scaled by its total assets
	COV_BONDS_{it}	Total amount of covered bonds issued by bank *i* in quarter *t*, scaled by its total assets
	GOV_GUAR_{it}	Total amount of guaranteed bonds issued by bank *i* in quarter *t*, scaled by its total assets
Explanatory variables	GR_TA_{it-1}	Quarterly increase in total assets of bank *i*, scaled by total assets
	K_TA_{it-1}	Ratio of total equity to total assets of bank *i* in quarter *t-1*
	L_TA_{it-1}	Ratio of total loans to total assets of bank *i* in quarter *t-1*
	D_TA_{it-1}	Ratio of total customer deposits to total assets of bank *i* in quarter *t-1*
	$RATING\_AV_{it-1}$	Average of the stand-alone ratings published by Fitch, Moody's and S&P for bank *i* in quarter *t-1*
	$TERM\_SPREAD_{jt}$	10-y govt bond yield – 3-m govt bill rate for country *j* in quarter *t*
	LR_{jt}	10-y govt bond yield for country *j* in quarter *t*
	CB_RATE_{jt}	Policy rate central bank responsible for monetary policy in country *j* in quarter *t*
	CB_BS_{jt}	Balance sheet central bank responsible for monetary policy in country *j* in quarter *t*
	$CBPP_t$	Dummy for Covered Bond Purchase Programme ECB in quarter *t*
	GDP_{jt}	GDP country *j* in quarter *t*
	CDS_SOV_{jt}	Sovereign CDS spread country *j* in quarter *t*
	$LIBOR\_OIS_{jt}$	US dollar Libor-OIS spread in quarter *t*
	VOL_t	Implied stock market volatility (VSTOXX) in quarter *t*
	$ECB\_liquidity_{jt}$	ECB lending related to monetary policy operations to credit institutions in country *j* in quarter *t* (section 5.4)
	$REDEMPTIONS_{it}$	Approximated amount of bond redemptions of bank *i* in quarter *t* (section 5.4)

Table 4: General results

Variables	(1) $TOTAL\_ISSUANCE_{it}$ OLS Before crisis	(2) $TOTAL\_ISSUANCE_{it}$ OLS Since crisis	(3) $TOTAL\_ISSUANCE_{it}$ Tobit Before crisis	(4) $TOTAL\_ISSUANCE_{it}$ Tobit Since crisis
GR_TA_{it-1}	-0.0063*	0.0110***	-0.0058	0.0110*
	(0.0035)	(0.0041)	(0.0094)	(0.0057)
K_TA_{it-1}	0.1043*	0.1009***	0.1083**	0.1123***
	(0.0556)	(0.0375)	(0.0438)	(0.0257)
D_TA_{it-1}	-0.0365***	-0.0251***	-0.0366***	-0.0245***
	(0.0070)	(0.0046)	(0.0059)	(0.0031)
L_TA_{it-1}	0.0208***	0.0326***	0.0216***	0.0329***
	(0.0053)	(0.0032)	(0.0050)	(0.0025)
$RATING\_AV_{it-1}$	0.0008	0.0007**	0.0010*	0.0009***
	(0.0008)	(0.0004)	(0.0005)	(0.0003)
LR_{jt}	-0.0101***	-0.0001	-0.0099***	-0.0001
	(0.0032)	(0.0005)	(0.0030)	(0.0003)
GDP_{jt}	-0.0007	-0.0005**	-0.0007	-0.0005***
	(0.0009)	(0.0002)	(0.0007)	(0.0002)
VOL_t	-0.0004***	-0.0001**	-0.0004*	-0.0001**
	(0.0002)	(0.0001)	(0.0002)	(0.0001)
$LIBOR\_OIS_{jt}$	-0.0001**	0.0000*	-0.0001**	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CDS_SOV_{jt}	-0.7010	-0.0231	-1.1857	-0.0281*
	(3.4751)	(0.0172)	(4.0030)	(0.0166)
Constant	0.0445***	-0.0174***	0.0395***	-0.0213***
	(0.0172)	(0.0065)	(0.0145)	(0.0061)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	596	1,031	596	1,031
R-squared	0.2520	0.2918		

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix i refers to bank i, suffix j to country j. Country j is the country where the HQ of bank i is located.

Table 5: Determinants of secured and unsecured issuance

Variables	*(1)* $SECURED\_ISSUANCE_{it}$ OLS Before crisis	*(2)* $SECURED\_ISSUANCE_{it}$ OLS Since crisis	*(3)* $SECURED\_ISSUANCE_{it}$ Tobit Before crisis	*(4)* $SECURED\_ISSUANCE_{it}$ Tobit Since crisis
GR_TA_{it-1}	-0.0057***	0.0085**	-0.0038	0.0087
	(0.0019)	(0.0036)	(0.0062)	(0.0060)
K_TA_{it-1}	0.0234	0.0236	0.0044	-0.0328
	(0.0177)	(0.0318)	(0.0324)	(0.0273)
D_TA_{it-1}	-0.0096***	-0.0151***	-0.0086**	-0.0165***
	(0.0029)	(0.0042)	(0.0042)	(0.0032)
L_TA_{it-1}	0.0145***	0.0257***	0.0159***	0.0301***
	(0.0032)	(0.0032)	(0.0034)	(0.0026)
$RATING\_AV_{it-1}$	-0.0001	-0.0003	-0.0001	-0.0005*
	(0.0002)	(0.0003)	(0.0004)	(0.0003)
LR_{jt}	-0.0036**	-0.0003	-0.0063***	-0.0005
	(0.0016)	(0.0005)	(0.0023)	(0.0003)
GDP_{jt}	0.0001	-0.0005***	-0.0003	-0.0005***
	(0.0004)	(0.0002)	(0.0005)	(0.0002)
VOL_t	-0.0002**	-0.0000	-0.0002	-0.0001
	(0.0001)	(0.0001)	(0.0002)	(0.0001)
$LIBOR\_OIS_{jt}$	-0.0000	0.0000	-0.0000	0.0000**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CDS_SOV_{jt}	-3.0460	-0.0185	-3.6803	-0.0231
	(2.6386)	(0.0192)	(2.8283)	(0.0162)
Constant	0.0116*	-0.0020	0.0174	-0.0011
	(0.0061)	(0.0059)	(0.0108)	(0.0064)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	596	1,031	596	1,031
R-squared	0.4132	0.2580		

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix i refers to bank i, suffix j to country j. Country j is the country where the HQ of bank i is located.

Continuation Table 5

Variables	(5) $UNSECURED\_ISSUANCE_{it}$ OLS Before crisis	(6) $UNSECURED\_ISSUANCE_{it}$ OLS Since crisis	(7) $UNSECURED\_ISSUANCE_{it}$ Tobit Before crisis	(8) $UNSECURED\_ISSUANCE_{it}$ Tobit Since crisis
GR_TA_{it-1}	-0.0006	0.0026	0.0033	0.0014
	(0.0030)	(0.0032)	(0.0091)	(0.0039)
K_TA_{it-1}	0.0809	0.0773***	0.0902**	0.0877***
	(0.0540)	(0.0241)	(0.0422)	(0.0174)
D_TA_{it-1}	-0.0269***	-0.0100***	-0.0263***	-0.0086***
	(0.0066)	(0.0028)	(0.0057)	(0.0020)
L_TA_{it-1}	0.0062	0.0069***	0.0054	0.0067***
	(0.0043)	(0.0017)	(0.0049)	(0.0017)
$RATING\_AV_{it-1}$	0.0008	0.0011***	0.0013***	0.0014***
	(0.0007)	(0.0002)	(0.0005)	(0.0002)
LR_{jt}	-0.0065**	0.0002	-0.0069**	0.0003
	(0.0029)	(0.0001)	(0.0029)	(0.0003)
GDP_{jt}	-0.0008	-0.0001	-0.0008	-0.0001
	(0.0009)	(0.0001)	(0.0007)	(0.0001)
VOL_t	-0.0002	-0.0001***	-0.0003	-0.0001**
	(0.0002)	(0.0000)	(0.0002)	(0.0000)
$LIBOR\_OIS_{jt}$	-0.0001**	0.0000	-0.0001**	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CDS_SOV_{jt}	2.3449	-0.0046	2.2174	-0.0480*
	(2.3188)	(0.0042)	(3.8518)	(0.0282)
Constant	0.0329**	-0.0154***	0.0254*	-0.0221***
	(0.0164)	(0.0039)	(0.0141)	(0.0042)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	596	1,031	596	1,031
R-squared	0.1908	0.2182		

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix *i* refers to bank *i*, suffix *j* to country *j*. Country *j* is the country where the HQ of bank *i* is located.

Table 6: Determinants of covered and government guaranteed bond issuance

Variables	(1) COV_BONDS_{it} OLS Before crisis	(2) COV_BONDS_{it} OLS Since crisis	(3) COV_BONDS_{it} Tobit Before crisis	(4) COV_BONDS_{it} Tobit Since crisis	(5) GOV_GUAR_{it} OLS Since crisis	(6) GOV_GUAR_{it} Tobit Since crisis
GR_TA_{it-1}	-0.0003	0.0063	0.0019	0.0071		-0.0012
	(0.0031)	(0.0041)	(0.0061)	(0.0057)		(0.0067)
K_TA_{it-1}	0.0225	0.0038	-0.0055	-0.0571**		-0.0319
	(0.0154)	(0.0223)	(0.0354)	(0.0256)		(0.0334)
D_TA_{it-1}	-0.0072***	-0.0110***	-0.0041	-0.0106***		-0.0047
	(0.0027)	(0.0031)	(0.0045)	(0.0030)		(0.0038)
L_TA_{it-1}	0.0146***	0.0232***	0.0211***	0.0286***		-0.0003
	(0.0032)	(0.0032)	(0.0036)	(0.0024)		(0.0034)
$RATING\_AV_{it-1}$	-0.0002	0.0001	-0.0011***	-0.0001		-0.0004
	(0.0001)	(0.0002)	(0.0004)	(0.0003)		(0.0003)
LR_{jt}	-0.0015*	0.0001	-0.0034	0.0000		-0.0007*
	(0.0009)	(0.0003)	(0.0024)	(0.0003)		(0.0004)
GDP_{jt}	-0.0003	-0.0002	-0.0009	-0.0004*		-0.0009***
	(0.0003)	(0.0002)	(0.0006)	(0.0002)		(0.0002)
VOL_t	-0.0002***	-0.0001*	-0.0003*	-0.0001**		-0.0000
	(0.0001)	(0.0000)	(0.0002)	(0.0001)		(0.0001)
$LIBOR\_OIS_{jt}$	-0.0000	0.0000	-0.0000	0.0000		0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		(0.0000)
CDS_SOV_{jt}	-0.6445	-0.0117	-2.0019	-0.0152		-0.0080
	(0.9866)	(0.0112)	(3.2245)	(0.0152)		(0.0174)
Constant	0.0061	-0.0091**	0.0221*	-0.0076		0.0034
	(0.0046)	(0.0038)	(0.0115)	(0.0061)		(0.0075)
Country dummies	Yes	Yes	Yes	Yes		Yes
Year dummies	Yes	Yes	Yes	Yes		Yes
Observations	596	1,031	596	1,031		1,031
R-squared	0.2727	0.2494				

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix i refers to bank i, suffix j to country j. Country j is the country where the HQ of bank i is located.

Table 7: Effect of ECB Covered Bond Purchase Programme (CBPP) on issuance

Variables	(1) $TOTAL\_ISSUANCE_{it}$ Tobit	(2) $SECURED\_ISSUANCE_{it}$ Tobit	(3) COV_BONDS_{it} Tobit	(4) $UNSECURED\_ISSUANCE_{it}$ Tobit
GR_TA_{it-1}	0.0116**	0.0092	0.0051	0.0016
	(0.0058)	(0.0061)	(0.0058)	(0.0040)
K_TA_{it-1}	0.1129***	-0.0322	-0.0561**	0.0880***
	(0.0257)	(0.0273)	(0.0255)	(0.0173)
D_TA_{it-1}	-0.0243***	-0.0164***	-0.0104***	-0.0085***
	(0.0030)	(0.0032)	(0.0030)	(0.0020)
L_TA_{it-1}	0.0329***	0.0301***	0.0288***	0.0067***
	(0.0025)	(0.0026)	(0.0024)	(0.0017)
$RATING\_AV_{it-1}$	0.0009***	-0.0005*	-0.0001	0.0014***
	(0.0003)	(0.0003)	(0.0003)	(0.0002)
LR_{jt}	-0.0002	-0.0006*	-0.0001	0.0003
	(0.0003)	(0.0003)	(0.0003)	(0.0003)
GDP_{jt}	-0.0005***	-0.0005***	-0.0003	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0001)
VOL_t	-0.0002**	-0.0001	-0.0001**	-0.0001**
	(0.0001)	(0.0001)	(0.0001)	(0.0000)
$LIBOR\_OIS_{jt}$	0.0000**	0.0000**	0.0000*	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
CDS_SOV_{jt}	-0.0264	-0.0218	-0.0137	-0.0517*
	(0.0170)	(0.0165)	(0.0154)	(0.0286)
$CBPP_t$	-0.0000	-0.0001	0.0024**	0.0001
	(0.0011)	(0.0011)	(0.0010)	(0.0007)
$CBPP\_PERI_t$	-0.0017**	-0.0013	-0.0016*	-0.0009
	(0.0008)	(0.0009)	(0.0008)	(0.0006)
Constant	-0.0213***	-0.0012	-0.0090	-0.0222***
	(0.0061)	(0.0064)	(0.0061)	(0.0042)
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	1,031	1,031	1,031	1,031

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix i refers to bank i, suffix j to country j.

Country j is the country where the HQ of bank i is located.

Table 8: Regional analysis

	(1) Banks from core euro area countries	(2) Banks from core euro area countries	(3) Banks from peripheral euro area countries	(4) Banks from peripheral euro area countries	(5) Banks from UK/SE/CH	(6) Banks from UK/SE/CH
Variables	$TOTAL\_ISSUANCE_{it}$ Tobit Before crisis	$TOTAL\_ISSUANCE_{it}$ Tobit Since crisis	$TOTAL\_ISSUANCE_{it}$ Tobit Before crisis	$TOTAL\_ISSUANCE_{it}$ Tobit Since crisis	$TOTAL\_ISSUANCE_{it}$ Tobit Before crisis	$TOTAL\_ISSUANCE_{it}$ Tobit Since crisis
GR_TA_{it-1}	-0.0010	0.0140	0.0019	0.0532*	0.0022	-0.0008
	(0.0160)	(0.0087)	(0.0192)	(0.0300)	(0.0108)	(0.0065)
K_TA_{it-1}	0.1311	0.0386	0.1646**	0.2529***	0.0240	0.1031**
	(0.0922)	(0.0365)	(0.0729)	(0.0615)	(0.0479)	(0.0506)
D_TA_{it-1}	-0.0446***	-0.0271***	-0.0108	-0.0072	-0.0277***	-0.0173***
	(0.0091)	(0.0045)	(0.0206)	(0.0095)	(0.0068)	(0.0059)
L_TA_{it-1}	0.0187**	0.0364***	-0.0108	0.0083	0.0243***	0.0254***
	(0.0077)	(0.0031)	(0.0249)	(0.0314)	(0.0045)	(0.0048)
$RATING\_AV_{it-1}$	0.0015**	0.0011***	-0.0007	0.0010	-0.0016***	0.0002
	(0.0007)	(0.0003)	(0.0020)	(0.0007)	(0.0006)	(0.0006)
LR_{jt}	-0.0120**	0.0057***	-0.0149**		-0.0033	
	(0.0046)	(0.0014)	(0.0074)		(0.0022)	
GDP_{jt}	-0.0027**	0.0000	0.0019	-0.0011**	0.0002	-0.0006*
	(0.0013)	(0.0003)	(0.0014)	(0.0005)	(0.0006)	(0.0003)
VOL_t	-0.0004	0.0001	-0.0003	-0.0001	-0.0002	-0.0002*
	(0.0004)	(0.0001)	(0.0005)	(0.0002)	(0.0002)	(0.0001)
$LIBOR\_OIS_{jt}$	-0.0002***	0.0000	-0.0000	0.0000	-0.0000	0.0001***
	(0.0001)	(0.0000)	(0.0001)	(0.0001)	(0.0000)	(0.0000)
CDS_SOV_{jt}	10.5123	-0.3606*	0.8205	-0.0353**	-8.0443	-0.0175
	(11.4271)	(0.1901)	(5.5903)	(0.0178)	(4.9873)	(0.2901)
Constant	0.0397*	-0.0555***	0.0952**	-0.0068	0.0412***	-0.0084
	(0.0215)	(0.0108)	(0.0412)	(0.0279)	(0.0143)	(0.0117)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	345	581	111	198	140	252

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix i refers to bank i, suffix j to country j. Country j is the country where the HQ of bank i is located.

Table 9: Robustness test 1 – Total issuance excluding government guaranteed and retained issues

Variables	(1) $TOTAL\_ISSUANCE_{it}$ *excluding government guaranteed issuance* Tobit Since crisis	(2) $TOTAL\_ISSUANCE_{it}$ *excluding government guaranteed and retained issuance* Tobit Since crisis
GR_TA_{it-1}	0.018**	0.0191***
	(0.0071)	(0.0067)
K_TA_{it-1}	0.0703***	0.0769***
	(0.0189)	(0.0176)
D_TA_{it-1}	-0.0036	-0.0031
	(0.0028)	(0.0026)
L_TA_{it-1}	0.0086***	0.007***
	(0.0026)	(0.0024)
$RATING\_AV_{it-1}$	0.0005**	0.0006***
	(0.0002)	(0.0002)
LR_{jt}	-0.0003	-0.0004
	(0.0003)	(0.0003)
GDP_{jt}	-0.0002	-0.0002
	(0.0002)	(0.0002)
VOL_t	-0.0002**	-0.0002***
	(0.0001)	(0.0001)
$LIBOR\_OIS_{jt}$	0.0000	0.0000
	(0.0000)	(0.0000)
CDS_SOV_{jt}	-0.0041	0.0009
	(0.0096)	(0.0098)
Constant	-0.0074	-0.0074
	(0.005)	(0.0048)
Country dummies	Yes	Yes
Year dummies	Yes	Yes
Observations	913	913

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Suffix i refers to bank i, suffix j to country j. Country j is the country where the HQ of bank i is located.

Table 10: Robustness test 2 – Unsecured issuance by banks from peripheral countries

Variables	(1) *UNSECURED_ISSUANCE$_{it}$* *banks from peripheral countries only* Tobit Since crisis
GR_TA$_{it-1}$	0.01387
	(0.02229)
K_TA$_{it-1}$	-0.01481
	(0.03913)
D_TA$_{it-1}$	0.00479
	(0.00532)
L_TA$_{it-1}$	0.00475
	(0.00555)
RATING_AV$_{it-1}$	0.00065
	(0.0005)
LR$_{jt}$	-0.00184***
	(0.00059)
GDP$_{jt}$	-0.00135***
	(0.00051)
VOL$_t$	-0.00014
	(0.00017)
LIBOR_OIS$_{jt}$	0.00004
	(0.00005)
CDS_SOV$_{jt}$	0.00815
	(0.01299)
ECB_liquidity	-0.00453***
	(0.00164)
Constant	0.00575
	(0.0110)
Country dummies	No
Year dummies	Yes
Observations	205

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Suffix i refers to bank i, suffix j to country j.

Country j is the country where the HQ of bank i is located.

Table 11: Robustness test 3 – Significance of redemptions in driving total issuance

	$TOTAL\_ISSUANCE_{it}$	$TOTAL\_ISSUANCE_{it}$
	Tobit	Tobit
	Before crisis	Since crisis
GR_TA_{it-1}	0.00166	0.01172**
	(0.00942)	(0.00571)
K_TA_{it-1}	0.10988**	0.10233***
	(0.04358)	(0.02563)
D_TA_{it-1}	-0.03368***	-0.02038***
	(0.00596)	(0.00320)
L_TA_{it-1}	0.02092***	0.02857***
	(0.00513)	(0.0027)
$RATING\_AV_{it-1}$	0.001**	0.00086***
	(0.00050)	(0.00026)
LR_{jt}	-0.01002***	-0.00022
	(0.00299)	(0.00034)
GDP_{jt}	-0.00078	-0.00054***
	(0.00073)	(0.0002)
VOL_t	-0.00042*	-0.00015***
	(0.00024)	(0.00006)
$LIBOR\_OIS_{jt}$	-0.00008**	0.00004**
	(0.00004)	(0.00002)
CDS_SOV_{jt}	-1.46646	-0.0027
	(3.99059)	(0.01696)
$REDEMPTIONS_{it}$	0.13031*	0.15023***
	(0.06998)	(0.03801)
Constant	0.03744**	-0.01943***
	(0.01457)	(0.00608)
Country dummies	Yes	Yes
Year dummies	Yes	Yes
Observations	596	1031

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Suffix i refers to bank i, suffix j to country j. Country j is the country where the HQ of bank i is located.

Appendix A: Corporate finance literature on determinants bond issuance

Gropp and Heider (2010) have shown that the standard determinants of non-financial firms' leverage that are used in empirical corporate finance studies also apply to large banks in the US and Europe. Hence, this section provides an overview of the drivers of debt issuance such as established in the corporate finance literature, both from a theoretical and empirical perspective. We concentrate on the determinants of long-term debt issuance, as this segment of debt financing is the focus of our investigation of bond issuance by European banks.

2.1.1. Firm-specific factors

The choice for long-term debt is shaped by various factors at the firm level, which include agency costs, asymmetric information, liquidity risk and tax benefits of debt.

Agency costs arise because of conflicts of interest between various groups of the firm's stakeholders, such as management, debt-holders and shareholders, and affect the capital structure of the firm. These costs also influence the maturity of corporate debt. Myers (1977) argues that firms with growth options will not issue long-term debt in order to avoid committing the firm to share the benefits of exercising those options with debt-holders ("underinvestment" problem). Jensen and Meckling (1976) suggest that shareholders have an incentive to undertake riskier projects and may replace low-risk assets by high-risk ones ("asset substitution"), which can be detrimental to the firm's bondholders as it increases the possibility of default. Particularly risky and smaller firms (Smith and Warner, 1979) can control these agency problems by shorten debt maturity, through making renegotiation more frequent. Firms may also schedule debt repayments to match the decline in value of assets ("maturity matching") as a strategy to lower the agency costs of debt (see also: Diamond, 1991b; Hart and Moore, 1995; Emery, 2001; Graham and Harvey, 2001). Hence, firms with more long-term assets can support more long-term debt. The importance of agency costs has been validated in a large number of empirical studies (Barclay and Smith, 1995a; Guedes and Opler, 1996; Stohs and Mauer, 1996; Datta et al., 2005).

Debt financing decisions are also influenced by information asymmetries (Myers and Majluf, 1984). In "adverse selection" models, firms do not reveal private information about their credit quality. If information costs are high and deter equity issuance (for example due to different beliefs between managers and outside investors), firms will issue less informationally sensitive securities such as bonds. Furthermore, because of adverse selection costs, firms also choose a debt maturity that minimizes the effects of private information on the cost of financing. These models predict that firms with a higher level of information asymmetry will issue short-term debt to avoid locking in their cost of financing with long-term debt, as they expect to borrow at more favourable terms later (Guedes and Opler, 1996; Custódio et al., 2013). By contrast, in "signalling models" investors infer private information held by the borrowing firm from its financing decisions, such as the choice of debt maturity. Flannery (1986) and Kale and Noe (1990) argue that, since long-term debt is more sensitive to firm value, long-term debt can potentially be more mispriced than short-term debt. Therefore, high quality firms are more likely to issue less under-valued short-term debt, and low quality firms are more likely to issue more overvalued long-term debt (Datta et al., 2000). If this is correct, rating

strength should be associated negatively with long-term debt issuance. Empirical evidence largely supports the hypothesis that firms with larger information asymmetries (such as smaller firms) issue more short-term debt (Barclay and Smith, 1995a; Stohs and Mauer, 1996; Berger et al., 2005; Custódio et al., 2013).

Firms may also decide to issue long-term debt due to time-varying liquidity risk. Diamond (1991a) and Rajan (1992) note that short-term debt may be difficult to refinance, which may lead to costly financial distress. Although issuing short-term debt reduces a firm's borrowing costs in the presence of information asymmetries, it exposes the firm to liquidity risk, as the debt will have to be refinanced This suggests that when liquidity risk is higher, the preference for long-term debt will be higher. Diamond (1991a) argues that firms with high or very low credit ratings use shorter-term debt, while medium-quality firms use longer-term debt[20]; this hypothesis is supported by Guedes and Opler (1996) and Stohs and Mauer (1996). Diamond's model also predicts that liquidity risk increases with leverage, and so firms with higher leverage would be expected to use more long-term debt, all else being equal. Apart from liquidity risk, firms may also prefer to issue more liquid (i.e. short-term) debt, because it has the lowest current interest cost (Baker et al., 2003).

Long-term debt financing may be preferable also because of the tax benefits of debt. This debt bias is caused by interest payments being deductible from corporate income tax, while dividend payments are not. Managers may accelerate tax deductions by issuing more long-term debt, especially when long-term rates are relatively high or when interest rates are particularly volatile. Empirical research offers little support for this hypothesis.

Finally, firms have the option to issue secured or unsecured long-term debt, i.e. debt that is backed explicitly by collateral or not. Erel et al. (2012) find that firms issuing secured debt tend to be smaller and much more highly levered than are unsecured issuers. These firms also tend to hold more cash, which indicates that firms issuing secured debt are concerned about liquidity constraints in the future. These findings are consistent with the "banking" view of secured debt developed in Berger and Udell (1990), which focuses on the effect of the supply of capital and catering to investors' demands on financing decisions. Here, poor-quality firms have little choice but to issue secured debt, as investors are more likely to require direct collateral of firms with weaker balance sheets.

An overview of the various firm-specific theories plus the variables used to test them is presented in Panel A of Table A.1.

2.1.2. Macroeconomic and financial market conditions

Traditionally, modern finance theory suggested that market "timing" considerations should be irrelevant for debt issuance decisions in efficient markets. However, empirical research increasingly has found support for the hypothesis that companies are heavily influenced by macroeconomic and financial market conditions and the past history of security prices in choosing between debt and

[20] Very low rated firms with insufficient cash-flows to support long-term debt have no choice and issue short-term debt. Intermediate quality firms do have a choice between short and long-term debt; these borrowers tend to issue long-term debt because they face a higher liquidity risk than very high rated firms. The latter firms, which face very little liquidity risk, will issue short-term debt. See also Stohs and Mauer (1996).

equity and between short and long-term debt (Marsh, 1982; Baker et al., 2003; Baker, 2009). Indeed, these factors appear in studies for US and European firms to be far more significant than a firm's financial structure, e.g. firm-specific characteristics.

On the choice between equity and debt, companies issue debt when interest rates are low and/or expected to rise (Marsh, 1982; Doukas et al., 2011). In fact, surveys of managers show that debt market timing is an explicit strategy in corporate financing decisions (Graham and Harvey, 2001). Firms issue also more debt when debt markets are "hot", i.e. when large numbers of issuers choose to turn to the debt market exploiting favourable market conditions relative to other forms of capital (Doukas et al., 2011). Empirical research finds support for the presence of countercyclical debt issuance: when economic conditions are bad (good), firms will resort to the issuance of less (more) information-sensitive securities, and hence issue debt (equity) (Choe et al., 1993; Korajczyk and Levy, 2003; Dittmar and Dittmar, 2008; Erel et al., 2012). Apart from this demand channel, increased economic uncertainty and volatility[21] will make investors (e.g. supply capital and demand bonds) more risk averse ("flight-to-quality"), shifting their demand towards higher credit quality bonds (Caballero and Krishnamurthy, 2008; Erel et al., 2012). Hence, during recessions, lower-rated firms will face greater difficulties in selling their debt. There is also evidence that firms' financial strength is associated with the composition of their funding mix, with firms that experience higher degrees of financial constraints do not exhibit a pronounced counter-cyclical debt issue pattern (Korajczyk et al., 2003). In these investigations, the term spread – measured by the difference between the yields on long and short-term government debt securities – is often used as a measure of future macroeconomic performance: a high term spread is indicative of good economic prospects, and hence firms issue equity while reducing their issuance of debt.[22]

Macroeconomic conditions affect also the composition of corporate debt borrowing, i.e. the choice between bank debt (indirect finance) and debt issued in capital markets (direct finance). Adrian et al. (2013) show that bond issuance of the non-financial corporate sector increased during the 2008-2009 financial crisis, as firms substituted bank credit for bond financing. Their findings suggest that financial crises may cause fundamental changes in the composition of corporate debt issuance.

The maturity structure of debt issuance is sensitive to macroeconomic and financial market conditions as well. Firms tend to shorten the maturity of new debt in responses to increases in the level of interest rates and in the term spread and to higher inflation (see discussion in Baker et al., 2003). The results on the importance of the credit spread, measured as the spread between the yield on high and medium credit quality corporate bonds, are mixed. While Baker et al. (2003) find no

[21] Schwert (1989) and (2002) conclude that stock market volatility is a leading indicator for economic activity, with increasing volatility being associated with economic downturns. Casalin and Dia (2009) explicitly test the impact of both stock and bond market volatility on corporate bond issuance in the US, but fail to find a significant relationship.

[22] US recessions have been preceded by declines in the term spread (Wheelock and Wohar, 2009). At the same time, the likelihood that firms issue debt increases during bad economic times. Hence, the term spread and debt issuance should be correlated negatively.

significant importance for this variable, Bali et al. (2006) show when controlling for different rating categories that the credit spread is significant but with different signs for different ratings: they find a positive relationship between the credit spread and maturity for newly issued investment-grade bonds, but a negative relationship for below investment-grade bonds. Erel et al. (2012) show that firms are more likely to issue short-term debt instruments when financial and economic conditions are poor. This may be linked to increasing investor demand for debt at shorter maturities during such episodes (Custódio et al., 2013). There is some debate over the persistence of the impact of macroeconomic and financial market developments on debt issuance and its maturity structure (Baker, 2009). While Baker and Wurgler (2002) and Huang and Ritter (2008) argue that there is significant long-term impact on firms' capital structure, others claim only temporary or weak effects (Leary and Roberts, 2005; Alti, 2006; Kayhan and Titman, 2007).

Panel B of Table A.1 provides a summary of the main findings in the corporate finance literature on the relevance of macroeconomic and financial market conditions for (long-term) debt issuance.

Table A.1: Summary corporate finance literature on the determinants of long-term debt issuance

Variable	**Theory**	**Explanation**	**Expected sign**
Panel A: Firm-specific			
Market-to-book value	Agency costs (Myers, 1977)	Underinvestment problem controlled by issuing short-term debt	Neg
Firm size (total assets, market value)	Agency costs (Smith and Warner, 1979); asymmetric information	Larger firms are less prone to agency conflicts and asymmetric information and hence issue long-term debt	Pos
Maturity assets	Agency costs (Myers,1977; Emery, 2001; Hart and Moore, 1995)	Maturity matching of assets and liabilities to control agency conflicts	Pos
Abnormal earnings	Asymmetric information, signalling (Flannery, 1986; Kale and Noe, 1990)	High performing and high rated firms issue short-term debt	Neg
Credit ratings	Asymmetric information; liquidity risk (Diamond, 1991)	Low and high rated firms issue short-term debt	Neg
Firm leverage	Liquidity risk (Diamond, 1991; Rajan, 1992)	Higher leveraged firms issue long-term debt	Pos
Firm corporate tax rate	Tax benefits debt (Kane et al., 1985)	Firms lengthen debt maturity as tax advantage of debt decreases	Neg
Empirical evidence	*Barclay and Smith, 1995a; Stohs and Mauer,1996; Guedes and Opler, 1996; Datta et al.,2000; Graham and Harvey, 2001; Baker et al.,2003; Datta et al., 2005; Custódio et al.,2013.*		
Panel B: Macroeconomic and financial market conditions			
Term spread	Market timing; maturity matching (Emery, 2001).	Firms shorten maturity of new debt in response to increases in term spread	Neg
Interest rate	Market timing	Firms shorten maturity of new debt in response to increases in interest rates	Neg
Credit spread	Market timing	Different effect on issuance LT debt for IG and BIG firms	+ IG, - BIG
Inflation	Market timing	Firms shorten maturity of new debt in response to higher inflation	Neg
GDP/business cycle variables	Market timing (Choe et al., 1993; Dittmar and Dittmar, 2008); macroeconomic impact (Erel et al., 2012).	Economic expansion reduces the cost of equity relative to the cost of debt, inducing firms not to issue debt, but equity ("financing waves").	Neg
Stock market performance	Market timing	Firms issue equity when stock markets perform well	Neg
Volatility	Market timing; reduced market access (Caballero and Krishnamurthy, 2008; Erel et al., 2012).	High volatility indicative of economic downturn and reflection of poor access to debt issuance markets; not supported in Casalin and Dia (2009).	Neg
Hot-cold markets index	"Hot-cold" markets (Doukas et al., 2011)	Firms tend to issue debt when debt issuance markets are "hot"	Pos
Further empirical evidence	*Marsh, 1982; Barclay and Smith, 1995; Stohs and Mauer, 1996; Guedes and Opler, 1996; Baker and Wurgler, 2002; Baker et al., 2003; Korajczyk and Levy, 2003; Leary and Roberts, 2005; Kayhan and Titman, 2007; Huang and Ritter, 2008; Dittmar and Dittmar, 2008; Baker, 2009; Casalin and Dia, 2009; Custódio et al., 2013.*		

Appendix B: Sample of banks

Name	Country	Type
1.Landesbank Baden-Wuerttemberg (LBBW)	Germany	Public savings bank
2.Barclays plc	UK	Commercial bank
3.HSBC Holdings plc	UK	Commercial bank
4.Commerzbank AG	Germany	Commercial bank
5.Lloyds Banking Group plc	UK	Commercial bank
6.UBS AG	Switzerland	Commercial bank
7.Royal Bank of Scotland Group plc	UK	Commercial bank
8.Rabobank Nederland	The Netherlands	Cooperative bank
9.BPCE SA	France	Cooperative bank
10.Norddeutsche Landesbank Girozentrale	Germany	Public savings bank
11.UniCredit SpA	Italy	Commercial bank
12.BNP Paribas SA	France	Commercial bank
13.Landesbank Hessen-Thueringen Girozentrale	Germany	Public savings bank
14.Banco Santander SA	Spain	Commercial bank
15.BayernLB Holding AG	Germany	Public savings bank
16.Deutsche Bank AG	Germany	Commercial bank
17.DZ Bank AG Deutsche Zentral-Genossenschaftsbank	Germany	Cooperative bank
18.Intesa Sanpaolo SpA	Italy	Commercial bank
19.Credit Agricole SA	France	Cooperative bank
20.KBC Group NV	Belgium	Commercial bank
21.Societe Generale	France	Commercial bank
22.HSH Nordbank AG	Germany	Public savings bank
23.WGZ BANK AG Westdeutsche Genossenschaftsbank	Germany	Cooperative bank
24.Raiffeisenlandesbank Oberoesterreich AG	Austria	Public savings bank
25.Swedbank AB	Sweden	Commercial bank
26.Groupe Credit Mutuel CEE	France	Cooperative bank
27.Credit Suisse Group	Switzerland	Commercial bank
28.Muenchener Hypothekenbank eG	Germany	Mortgage bank
29.Banque et Caisse d'Epargne de l'Etat Lux	Luxembourg	Commercial bank
30.Banco Bilbao Vizcaya Argentaria SA (BBVA)	Spain	Commercial bank
31.SNS Reaal NV	The Netherlands	Commercial bank
32.Nordea Bank AB	Sweden	Commercial bank
33.Bank of Ireland	Ireland	Commercial bank
34.Skandinaviska Enskilda Banken AB (SEB)	Sweden	Commercial bank
35.NIBC Holding NV	The Netherlands	Commercial bank
36.Raiffeisen Zentralbank Oesterreich AG	Austria	Cooperative bank
37.Oberoesterreichische Landesbank AG	Austria	Public savings bank
38.Caixa Geral de Depositos SA (CGD)	Portugal	Commercial bank
39.Mediobanca - Banca di Credito Finanziari	Italy	Commercial bank

40.Banco BPI SA	Italy	Commercial bank
41.Standard Chartered plc	UK	Commercial bank
42.Aareal Bank AG	Germany	Mortgage bank
43.Banca Carige SpA	Italy	Commercial bank
44.Alpha Bank AE	Greece	Commercial bank
45.Erste Group Bank AG	Austria	Commercial bank
46.Nationwide Building Society	UK	Mortgage bank
47.Svenska Handelsbanken AB	Sweden	Commercial bank
48.ABN AMRO Bank NV	The Netherlands	Commercial bank
49.Hypo Tirol Bank AG	Austria	Mortgage bank
50.Banca Monte dei Paschi di Siena SpA	Italy	Commercial bank
51.Caisse Centrale du Credit Immobilier de	France	Mortgage bank
52.Hypo Real Estate Holding AG	Germany	Mortgage bank
53.ING Groep NV	The Netherlands	Commercial bank
54.Fortis group	Belgium	Commercial bank
55.Dresdner Bank AG	Germany	Commercial bank
56.Deutsche Schiffsbank AG	Germany	Mortgage bank
57.HBOS plc	UK	Commercial bank
58.Landesbank Sachsen Girozentrale - Sachsen	Germany	Public savings bank
59.WestLB AG	Germany	Public savings bank
60.Depfa Bank plc	Germany	Mortgage bank
61.LBB Holding AG-Landesbank Berlin Holding	Germany	Public savings bank
62.Dekabank Deutsche Girozentrale	Germany	Public savings bank
63.Groupe Caisse d'Epargne	France	Commercial bank

Appendix C: Detailed description of bond issuance data

We include unsecured senior and subordinated bonds, covered bonds, government guaranteed bonds, hybrid bonds (such as CoCos) and medium-term notes (MTN), but exclude securitisations. Our investigation of the Dealogic DCM database showed that a considerable number of securitisations have SPVs of which it was not clear with which bank they are affiliated. Moreover, our analysis of the data showed that banks' private placements of bonds are important. Hence, we include both publicly issued bonds as well as private placements. We exclude bond exchanges, as our analysis of Dealogic showed that they could lead to double-counting of bonds. We have conducted an in-depth analysis of available original maturities. Dealogic has poor coverage of short-term debt. Essentially, it covers only short-term debt instruments issued in international markets and excludes domestically issued short-term debt. Hence, we concentrate on longer-term debt, which according to the definition used by Dealogic includes debt instruments with an original maturity of 18 months and longer.

We concentrate on European banks, i.e. banks headquartered in the euro area, UK, Sweden and Switzerland. Our investigation and cross-checking with other data-sources revealed that covered bonds issued by Danish banks are not represented well in Dealogic. Hence, we exclude these banks.

The identification of which specific bank issued a particular bond is a rather complex issue in Dealogic. This because banks are reclassified backwards in time when they are taken over by another bank. For example, Commerzbank took over Dresdner Bank in December 2009. This resulted in a reclassification of all bonds issued by Dresdner Bank, with Commerzbank listed as the parent issuer of these bonds. As we want to use bank-specific information in our analysis, we need to identify the bonds issued by Dresdner Bank, in order to be able to link them to Dresdner bank-specific information. This adjustment needs to be made also for mergers and acquisitions involving relatively small banks (which issue few bonds), of which there have been many in Europe (SNL lists around 1,400 mergers and acquisitions involving European banks during our sample period of 1999-2013). As the bonds issued by these banks are registered under the name of the acquiring parent bank also for the years before the merger, they need to be excluded from the sample of the acquiring bank.

The reclassification of bonds by issuing-banks is especially cumbersome for banks that were taken over several times by other banks. For example, Antonveneta was initially taken over by ABN AMRO, and then purchased by Banco Santander, which subsequently sold it to Monte dei Paschi di Siena. So in each case, backwards in time, the bonds that are classified as having been issued by the acquiring bank need to be corrected for the ones that actually were issued by Antonveneta.

Given these reclassification issues for banks involved in mergers and acquisitions, we decided to adopt the following identification process. First, we collected institutional information for each issuing bank, such as history, information on mergers and acquisitions, member banks of the same bank group, etc. For these bank-by-bank investigations, we used largely information from Bankscope, SNL, Fitch, Moody's and S&P and individual banks' websites (annual and quarterly

reports, etc.), augmented where needed by other sources (Google-based searches, etc.).[23] Second, we then checked for all the issuing parents ("issuer parent type" in Dealogic) the specific issuers ("issuer type") and where needed (i.e. based on the institutional information obtained) we corrected the classification. Third, we double-checked the classification of the bonds with other sources (SNL and Bloomberg).

This process was very time-consuming, as it can only be done manually. In fact, the reclassification of bond issues from banks that have disappeared ("dead banks") due to takeovers etc. is such an extensive job that other papers refrain from it. For example, Camba-Mendez et al. (2012) state (p.23) that "… Attributing issuance to dead banks would have been an enormous task. Subsidiary firms for the banking group would have had to be identified and added up". This is exactly what we have done.

Another issue with Dealogic is the specific way it classifies banks. It distinguishes between "banks" and "other financial companies", but the latter group includes several issuers that in fact are banks. Examples are ING (due to its insurance arm it is classified as "other financial company") and Hypo Real Estate. When double-checking the group of "other financial companies" with other sources (such as the sample group of the EBA stress test, member overviews of various banking associations and other empirical studies), we found in total nine issuers that in fact are banks and should be included in our analysis.

Furthermore, we extended our sample with several banks that have disappeared due to mergers, acquisitions or failures, but which were important bond issuers before those events. Examples are Dresdner Bank and Fortis. Some of these are complex cases: for example, some of the bonds that were issued by Fortis were classified after its collapse under the parent name of the acquiring or new entities (Belgian/Luxembourg operations were acquired by BNP Paribas, while the Dutch operations were renamed ABN AMRO).

For several large European (parent) banks we found bonds issued by SPVs (i.e. not securitisations). It most instances it was not possible to identify if these bonds were issued by a SPV of a bank that had been acquired by the parent bank (and hence would have to be reclassified for the years before the merger/takeover; we found one example of a bond issued by a SPV of Deutsche Postbank which is now classified under the parent bank Deutsche Bank). Due to this uncertainty, and the fact that there were only a few cases of SPVs issuing bonds (excluding securitisations), we decided to exclude them (less than 1% of all bonds issued by European G-SIBS was through SPVs).

To have sufficient data available for econometric analysis, we include banks that were taken over only if we have at least four years of data. Moreover, given the enormous task of cleaning up the database, we decided to include only banks that issued more than 200 bonds during 1999-2013. Including "dead" banks, this gave us a preliminary sample group of 77 banks. Of these 77 banks, we dropped 14 due to data constraints with respect to the explanatory variables. In the end, we settled for

[23] Other papers have the same experience with the construction of bank samples. For example, Rose and Wieladek (2012) conducted also extensive bank-by-bank investigations (including Google searches) for certain institutional characteristics in order to construct their sample group.

a sample group of 63 banks which issued a total of 50,465 bonds during Q1 1999 - Q1 2013.

Appendix D: Aggregated analysis at the country-level

D.1 Empirical methodology

Our empirical approach is primarily focused on bank-specific estimations, but is extended to incorporate country-specific analysis as well. We believe the latter analysis is an important completion of the investigation, for various reasons. Our main conviction is that an aggregated country analysis allows us to use a much longer estimation horizon, given limitations on historical data for certain banks. Hence, we can compare much better issuance determinants during the 2008-2009 and 2010-2012 financial crises with those during "normal" times. Another advantage is, since we do not use bank-specific balance sheet information in the country analysis, that we can use data with a monthly frequency. This allows us to pick-up large swings in monthly bond issuance patterns that were a key feature of developments in bank funding markets during the 2008-2009 global financial crisis and the 2010-2012 euro area financial crisis. In addition, the development of the relative importance of long-term debt issuance of European banks depicts rather divergent trends across countries. Moreover, there has been considerable discussion of the fact that especially during the euro area financial crisis, bank nationality became the defining criterion for access to bank funding markets instead of individual bank financial strength (Caruana and van Rixtel, 2012). Finally, there are almost no studies on the drivers of bond issuance for multi-country samples.

The country-specific analysis uses the following regression:

$$ISSUANCE\_CS_{jt} = \alpha_{jt} + \beta_t MACRO\_FINANCIAL\_COUNTRY_{jt} + \delta_t FINANCIAL\_GENERAL_t + \lambda_j + \mu_t + \varepsilon_j \quad \text{(D.1)}$$

The dependent variable $ISSUANCE\_CS_{jt}$ is the total amount (log) of bonds issued by banks headquartered in the same country j in month t. $MACRO\_FINANCIAL\_COUNTRY_{jt}$ is a set of time-variant macroeconomic and financial variables that are specific to country j which is the country where the headquarters of bank i is located (and hence the country responsible for its supervision and eventual bailout). $FINANCIAL\_GENERAL_t$ includes two indicators of overall financial market conditions, i.e. stock market implied volatility (VOL_t) and the US dollar Libor-OIS spread ($LIBOR\_OIS_t$). α_{it} is a time variant constant. λ_j and μ_t are country respectively time fixed effects. ε_{it} is the error term.

The explanatory variables that are included in Equation (D.1) are the following. $MACRO\_FINANCIAL\_COUNTRY_{jt}$ includes $TERM\_SPREAD_{jt}$, LR_{jt}, CB_RATE_{jt}, CB_BS_{jt}, $CBPP_t$, $BANK\_STOCK_{jt}$, $T\text{-}ASSETS_{jt}$, $GR\_T\text{-}ASSETS\_C_{jt}$, $K\_TA\_C_{jt}$, GDP_{jt}, CDS_SOV_{jt} and CDS_BANKS_{jt}. $FINANCIAL\_GENERAL_t$ includes VOL_t and $LIBOR\_OIS_t$.

$TERM\_SPREAD_{jt}$ is the difference between 10-year government bond yields and country representative 3-month government bill yields of the 14 countries in our sample. It proxies for the cost of borrowing at different maturities, which can affect the choice of debt maturity. The "market timing" hypothesis suggests a negative relation between the issuance of long-term bonds and the term spread. LR_{jt} is the

10-year government bond yield of the respective national sovereign. We expect a negative relationship ("market timing"). CB_RATE_{jt} is the policy interest rate of the respective central bank (ECB, Bank of England, Sveriges Riksbank and Swiss National Bank). The "risk-taking channel" hypothesis predicts a negative relation between the policy rate and bond issuance. CB_BS_{jt} is the size of the balance sheet (total assets) of the respective central bank, which should capture impact of unconventional monetary policy (i.e. effects of the monetary policy stance beyond the policy rate). The "risk taking channel" would predict a positive relationship, while abundance of central bank liquidity could also cause banks to switch from bond issuance to central bank borrowing (negative relationship). $BANK\_STOCK_{jt}$ is a representative stock market index for national banking sectors. Higher bank stock prices increase the market value of bank equity and may induce banks to issue more equity; consequently, the "risk absorption" hypothesis also predicts a positive relationship between stock prices and bond issuance. $T\text{-}ASSETS_{jt}$ is total assets of the respective national banking sector. We use the ECB MFI balance sheet statistics for the EU member states (and national sources for Switzerland), as this allows us to use monthly data for a long time horizon (instead of aggregating total assets of the banks in our national samples). Larger banks are less prone to "agency conflicts" and "asymmetric information" and hence issue long-term debt (positive relation). $GR\_T\text{-}ASSETS\_C_{jt}$ is the monthly increase in national banking systems' total assets. "Leverage targeting" suggests that banks expand by issuing debt (positive coefficient). $K\_TA\_C_{jt}$ is the capital ratio, i.e. total amount of capital of the national banking sector over its total assets. We use the ECB MFI balance sheet statistics for the EU member states and national data for Switzerland. The "risk absorption" hypothesis predicts that better capitalised banks issue more debt (positive relation). GDP_{jt} is the percentage change in real GDP of the respective country. We expect a positive relationship. CDS_SOV_{jt} is the sovereign CDS spread of the respective national sovereign. With the strong interrelationship between the sovereign and the banking sector, we expect a negative relationship, especially during crisis periods. CDS_BANKS_{jt} is the average CDS spread of a representative national sample of banks. Also here we expect a negative correlation. VOL_t is implied stock market volatility (VSTOXX). As several available measures of implied volatilities based on national stock market indices are highly correlated with the VSTOXX, we use the latter for all countries. $LIBOR\_OIS_t$ is the three-month US dollar Libor-OIS spread**.**

We obtain these data from Thomson Reuters Datastream, Bloomberg and Markit. The estimations are conducted for the period before the crisis (January 1999 – September 2007) and since the crisis (October 2007 – March 2013). Depending on the specification used, we have between 1,740 and 1,884 observations.

Although the banking literature suggests that tax reasons may drive debt issuance of banks as well, the monthly frequency of our country-analysis is less suited to test the tax hypothesis, as corporate tax rates change rather infrequently. Hence, we do not test the tax benefits of debt hypothesis (Hypothesis 4 in section 3.1). An overview of the dependent and explanatory variables is presented in Table D.1.

D.2 Results

Table D.2 reports the results of the OLS regressions of total bond issuance at the country level ($ISSUANCE\_CS_{jt}$) on the relevant explanatory variables, as formulated by Equation (D.1). Columns (1)-(3) display the coefficient estimates for various

specifications for the pre-crisis episode (January 1999-September 2007), while columns (4)-(6) show the results for the crisis period and its aftermath (October 2007-March 2013). In our discussion of the results, we shall refer to the various hypotheses (in brackets) that we formulated in section 3.1.

Consistent with the "market timing" hypothesis (Hypothesis 13), the coefficient estimates for the term spread are significant and have the correct (negative) sign, but only for the pre-crisis period (columns (1)-(3)). Hence, "timing" arguments were no longer relevant during the crisis years, as accessibility to longer-term funding became more important than its cost. Also the central bank policy rate (CB_RATE_{jt}) is significantly and negatively correlated with issuance in the pre-crisis period, supporting the "risk-taking" hypothesis (Hypothesis 14). This variable is no longer significant in the crisis episode as well, which may be due to the fact that policy rates were reduced rapidly early on in the crisis and have been kept at very low levels ever since. We do not find significant results for the importance of unconventional monetary policy actions during the crisis, proxied by the size of central bank balance sheets (CB_BS_{jt}).

Furthermore, we find evidence that heightened financial market tensions were negatively associated with lower long-term debt issuance (Hypothesis 10). This was the clearest for implied stock market volatility, with significant estimates for both periods, and a much larger coefficient for the crisis-period. The results for Libor-OIS spreads are significant and have the correct (negative) sign for the pre-crisis period, but have a counter-intuitive positive (and significant) sign during the crisis (Table D.2, columns (4) and (5)). The latter result may be caused by large issuance of government guaranteed and retained bonds during quarters when banks' funding markets were essentially closed (and hence when Libor-OIS spreads spiked). Retained bonds have been issued primarily to serve as collateral to obtain central bank liquidity. When we exclude government guaranteed and retained bonds (column (6)), the Libor-OIS sign turns negative (but is insignificant).

Country-risk characteristics became a main driver of issuance during the crisis years (Hypothesis 11), as shown by the significantly negative coefficients for sovereign CDS spreads (CDS_SOV_{jt} in columns (5) and (6)). In contrast, we find no significant results for average bank CDS spreads (CDS_BANKS_{jt}) during this period, suggesting that credit risk concerns were reflected in sovereign spreads, as sovereign and banking sectors became increasingly intertwined (and hence their credit risk) (Caruana and Van Rixtel, 2012). The significant and positive coefficient for the capital ratio ($K\_TA\_C_{jt}$) in specifications (2) and (3) supports the "risk absorption" hypothesis (Hypothesis 8) that better capitalised banking systems issued more long-term debt. In contrast, this coefficient turns negative in specification (5) for the crisis period, suggesting that poorer capitalised banking systems issued more long-term debt. This may be driven by the issuance of government guaranteed and retained bonds during the crisis, which became important sources of funding for weaker banking systems in particular. Indeed, when we exclude these bonds from the analysis, the capital ratio is no longer significant for the crisis years (column (6)).

The regressions provide strong support for "leverage targeting" (Hypothesis 5) before the crisis. Both the level of total assets ($T\text{-}ASSETS_{jt}$) as well as its monthly

increase (*GR_T-ASSETS _C$_{jt}$*) are significant and positively associated with bond issuance in this period, which provides support for the view that banks resorted to long-term debt issuance to lever up their balance sheets in the run-up to the crisis.[24] During the crisis period, the coefficient on total assets turns negative, indicating that especially larger banking systems started to delever (Table D.2, column (4)). *T-ASSETS$_{jt}$* is no longer significant, however, when we include CDS spreads; the sovereign CDS spread is now significant instead (columns (5) and (6)). We find a positive relationship between stock market performance (*BANK_STOCK$_{jt}$*) and bond issuance in the pre-crisis period as well. In our view, this can be seen as additional support for "leverage targeting": higher stock prices increased the market value of banks' equity and reduced their market-based leverage; to correct for this decline, banks issued more long-term debt.

Table D.1: Summary list of dependent and independent variables

Country-specific analysis	January 1999-March 2013; monthly data.	
Dependent variable	*ISSUANCE_CS$_{jt}$*	(Log) aggregate total amount of bonds issued by banks (in our sample) headquartered in the same country *j* in month *t*
Explanatory variables	*TERM_SPREAD$_{jt}$*	10-y govt bond yield – 3-m govt bill rate for country *j*
	LR$_{jt}$	10-y govt bond yield for country *j*
	CB_RATE$_{jt}$	Policy rate central bank responsible for monetary policy in country *j*
	CB_BS$_{jt}$	Balance sheet central bank responsible for monetary policy in country *j*
	CBPP$_t$	Dummy for Covered Bond Purchase Programme ECB
	BANK_STOCK$_{jt}$	Stock market index banking sector country *j*
	T-ASSETS$_{jt}$	Total assets banking sector country *j*
	GR_T-ASSETS _C$_{jt}$	Monthly growth total assets banking sector country *j*
	K_TA_C$_{jt}$	Capital ratio banking sector country *j*
	GDP$_{jt}$	GDP country *j*
	CDS_SOV$_{jt}$	Sovereign CDS spread country *j*
	CDS_BANKS$_{jt}$	Banking sector CDS spread country *j*
	LIBOR_OIS$_t$	US dollar Libor-OIS spread
	VOL$_t$	Implied stock market volatility (VSTOXX)

[24] The result for total assets is also supportive of the importance of agency costs and asymmetric information; large banks are less prone to these problems and hence issue long-term debt.

Table D.2: Country-specific results (OLS)

	(1) $ISSUANCE\_CS_{it}$ Before crisis	(2) $ISSUANCE\_CS_{jt}$ Before crisis	(3) $ISSUANCE\_CS_{jt}$ Before crisis	(4) $ISSUANCE\_CS_{it}$ Since crisis	(5) $ISSUANCE\_CS_{it}$ Since crisis	(6) $ISSUANCE\_CS_{it}$ *excl.** Since crisis
$TERM\_SPREAD_{jt}$	-0.2241***	-0.1577**	-0.1448*	-0.0715	0.0282	0.1011
	(0.0788)	(0.0791)	(0.0790)	(0.0662)	(0.0754)	(0.0618)
$LIBOR\_OIS_{t}$	-0.0168***	-0.0136**	-0.0128**	0.0064*	0.0064*	-0.0008
	(0.0057)	(0.0058)	(0.0059)	(0.0033)	(0.0033)	(0.0035)
CB_RATE_{jt}	-0.2268***	-0.1340**	-0.1271**	-0.0740	-0.0244	0.1244
	(0.0599)	(0.0608)	(0.0604)	(0.0775)	(0.0806)	(0.0757)
$BANK\_STOCK_{jt}$		2.1965**	2.0608**	0.9248	1.2938	1.3416
		(0.9183)	(0.9179)	(1.1531)	(1.1378)	(1.1809)
VOL_{t}		-0.0146***	-0.0148***	-0.0251**	-0.0289**	-0.0237**
		(0.0056)	(0.0057)	(0.0116)	(0.0118)	(0.0118)
$GR\_T\text{-}ASSETS\_C_{jt}$			6.6803***			
			(2.0501)			
$K\_TA\_C_{jt}$	7.8603	11.5314*	12.4522**	-5.9606	-16.5531**	-10.1909
	(6.2841)	(6.2857)	(6.1814)	(7.0033)	(8.4271)	(7.9987)
$T\text{-}ASSETS_{jt}$	2.1954***	2.0505***	2.0064***	-1.7608**	-0.1935	-1.0865
	(0.4532)	(0.4489)	(0.4420)	(0.8428)	(1.0458)	(1.0479)
GDP_{jt}	0.0611**	0.0205	0.0134	-0.0335	-0.0265	0.0013
	(0.0272)	(0.0285)	(0.0284)	(0.0274)	(0.0275)	(0.0248)
CB_BS_{jt}				-0.0009	-0.0009	-0.0005
				(0.0006)	(0.0006)	(0.0006)
CDS_SOV_{jt}					-5.4266*	-7.7618***
					(3.1197)	(2.3780)
CDS_BANKS_{jt}					-0.8861	-2.7689
					(4.0933)	(3.8025)
Constant	-17.5936***	-15.7762***	-15.3162***	36.0198***	15.2600	17.5196
	(6.0441)	(5.9971)	(5.9040)	(11.8266)	(14.4850)	(14.4787)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,165	1,165	1,120	719	633	620
R-squared	0.7010	0.7073	0.7221	0.6140	0.5775	0.627

The dependent variable is the log of bond issuance. In column (6), issuance excludes government guaranteed and retained bonds. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Suffix j refers to country j (or central bank implementing monetary policy for country j).

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