

Llorens, Vanesa; Martin-Oliver, Alfredo

Article

Determinants of bank's financing choices under capital regulation

SERIEs - Journal of the Spanish Economic Association

Provided in Cooperation with:

Spanish Economic Association

Suggested Citation: Llorens, Vanesa; Martin-Oliver, Alfredo (2017) : Determinants of bank's financing choices under capital regulation, SERIEs - Journal of the Spanish Economic Association, ISSN 1869-4195, Springer, Heidelberg, Vol. 8, Iss. 3, pp. 287-309, <https://doi.org/10.1007/s13209-017-0161-1>

This Version is available at:

<https://hdl.handle.net/10419/195259>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Determinants of bank's financing choices under capital regulation

Vanesa Llorens^{1,2} · Alfredo Martin-Oliver¹

Received: 3 February 2016 / Accepted: 7 August 2017 / Published online: 27 September 2017
© The Author(s) 2017. This article is an open access publication

Abstract This paper analyzes the financing choices of banks under capital regulation during the expansion period that preceded the crisis. We use data from Dealogic on the issuances of financial instruments of Spanish banks to test whether financing choices respond to predictions derived from the corporate finance theory and/or to capital regulation. We find that banks financed their exponential growth with debt instruments and covered the additional regulatory capital requirements from higher risk-weighted assets with the issuance of hybrid instruments. We also find that banks choose the financial instruments that minimize asymmetric information costs.

Keywords Banks · Capital regulation · Financing choices · Informational asymmetries · Financial markets

JEL Classification G21

1 Introduction

How does the development of financial markets affect the financing choices of banks that are subject to capital regulation? Prior to the crisis, financial innovation and

We thank Nezi Guner, Editor-in-Chief, and two anonymous referees or their constructive comments, which helped us to improve the manuscript. Alfredo Martín-Oliver acknowledges the financial support from project MEC-ECO2013-44409.

✉ Alfredo Martin-Oliver
alfredo.martin@uib.es

¹ Universitat de les Illes Balears, Ctra. Valldemossa km. 7.5, 07122 Palma de Mallorca, Islas Baleares, Spain

² Unit4 R&D, Granada, Spain

the development of markets allowed banks to decouple the evolution of credit from their capacity to collect deposits. The development of financial instruments, such as securitization, also granted small and medium banks access to financial markets (Almazán et al. 2015). Furthermore, innovation has enabled banks to expand their balance sheets and increase their reliance on financial sources other than deposits. However, banks must comply with capital regulation imposed by the Basel Accords.¹ Thus, the banks' choice of the financial instruments to fund their activity has to be consistent with the fulfillment of the capital ratios set by regulation. Therefore, banks cannot base their growth only on debt securities but must issue instruments that are eligible as regulatory capital if internally generated funds cannot guarantee the bank's target level of regulatory capital. Given that not all the financial instruments that are eligible as regulatory capital have the same capacity to absorb losses, banks' choices on the type of issuances could affect not only the level but also the quality of their capital holdings.

Banks' financing choices and capital structure did not receive much attention in the banking literature until the crisis, possibly because the amount of capital was thought to be determined by capital regulation (Mishkin 2000). The crisis revealed that issues such as leverage, liquidity, and the quality of capital determined financial stability and their deficiencies spread the negative effects of the crisis. Since then, there has been a growing literature on banks' capital structure and liquidity (Acharya and Thakor 2016; Almazán et al. 2015; Adrian and Shin 2010a; Gropp and Heider 2010), short-term wholesale financing (Adrian and Shin 2010b; Kalemly-Ozcan et al. 2012), and the quality and quantity of bank capital (Demirguc-Kunt et al. 2013; Beltratti and Stulz 2012; Berger and Bouwman 2013). However, the literature has not studied the determinants of banks' financing choices in the context of the constraints and incentives introduced by capital regulation. This is the focus of our paper.

Our paper is related to the literature that analyzes the deterioration of bank capital during the years prior to crisis. The literature generally accepts that capital should deter banks from taking bad risks, and instead it should enhance good governance to minimize the exposure of shareholders to risk (Rochet 1992; Morrison and White 2005). Indeed, there is evidence that well capitalized banks could better cope with the severe losses incurred during the crisis (Demirguc-Kunt et al. 2013; Beltratti and Stulz 2012; Berger and Bouwman 2013). However, recent papers provide evidence of a deterioration in bank capital prior to and during the crisis that hurt capital's capacity to act as a corporate governance mechanism (Acharya et al. 2009; Mehran et al. 2011). Furthermore, this deterioration limited the capacity of banks to raise new funds during the crisis (Acharya et al. 2011). Our paper analyzes the determinants of this deterioration in capital.

For our data, we use Dealogic. Our data consist of 4812 financial instruments issued by Spanish banks during the period 1988–2007 and information from banks'

¹ The Basel Accords (Basel I, Basel II and Basel III) are a set of recommendations for regulations in the banking industry that refer to the capital holdings of banks. The target is that riskier banks hold higher amount of capital in order to absorb the higher potential losses of their balance sheet. The Basel Accords recognize different types of regulatory capital in terms of quality, and banks are obliged to cover a part of their capital requirements with high-quality capital.

annual reports for the same period. We use these data to empirically test a set of hypotheses on the decisions to issue different types of financial instruments. We try to understand how capital regulation affects behavior of banks based on insights from the traditional theories of corporate finance (Bradley et al. 1984; Myers and Majluf 1984; Titman and Wessels 1988; Frank and Goyal 2003, 2008). In particular, we use the logic of the pecking order theory to examine whether the banks' choices of financial instruments are related to adverse selection costs. Also, we test whether the choice of financial instruments targets an optimal capital structure. To perform such tests, we look at the expected choices of financial instruments if banks have liquidity needs or have growth opportunities as predicted the different theories. Specifically, we test whether banks have a preference toward debt, as the pecking order predicts, or if banks want to maintain a target capital ratio, as predicted by the trade-off theory. The pecking order theory argues that the issuance of financial instruments responds to informational problems and banks should prefer to issue the type of market instrument that minimizes the adverse selection discount. The trade-off theory states that there is an optimal capital structure for each individual bank and banks should issue those financial instruments that minimize the overall cost of their capital structure. If the pecking order holds, we expect a higher probability in issuing instruments with more information asymmetries (i.e., capital) for those banks that the markets know, such as listed banks. If the trade-off theory holds, banks prefer to combine issuances of different instruments to reach or maintain an optimal capital structure. We also test how the fulfillment of capital regulation affects the choice of financial instruments. Under the pecking order, we hypothesize that banks prefer to issue debt-like capital instruments (from now on, hybrid instruments) rather than capital instruments (i.e., common shares) because the former can also be computed as regulatory capital but suffer from lower costs of asymmetric information as compared to capital instruments. Under a trade-off, we could expect a combination of issuances of hybrid and capital instruments to maintain the relative weight of the different capital instruments.

We use the Spanish banking sector because Spain's financial markets sustained exponential growth in their balance sheet items of around 20% during the expansion period. Further, they have undergone a deep restructuring in part due to the financing decisions made in the pre-crisis period. In addition, the focus on one single country exploits how banks' characteristics affect the financing choices when they are affected by the same macroeconomic and regulatory conditions.

Five findings emerge from our analysis. First, we find that banks issue financial instruments to cover liquidity needs and growth opportunities during the sample period. The choices among the available instruments respond to a combination of capital regulation and the costs of asymmetric information. Indeed, banks' preferred choice to finance growth is debt, in line with the pecking order. Second, to comply with capital regulation given the growth of assets, banks prefer to issue hybrid instruments rather than capital instruments, which is also in line with the existence of discount costs from asymmetric information. This finding is supported by the evidence that banks close to the regulatory minimum are more likely to issue hybrid instruments than common shares. We find that the probability of issuing debt increases after the issuance of hybrid instruments during the last 12 months, and the decision to issue hybrid instruments is also positively affected by the issuance of debt during the previous 12 months. Third,

the preference for issuing debt and hybrid capital explains the constant distribution of Basel capital ratios while the weight of core capital over the total regulatory capital decreases. Fourth, the issuance of capital instruments is more likely in banks listed in the stock markets and banks operating internationally, possibly because they are well-known to the markets and suffer from a lower (if any) discount at issuance due to asymmetric information. Fifth, banks might raise capital instruments to improve their soundness if the level of loan loss provisions is low and/or the risk of their assets (loans) is high.

This paper contributes to a variety of fields. First, it explores the driving forces in the deterioration of bank capital during the pre-crisis period. [Mehran et al. \(2011\)](#) and [Acharya et al. \(2011\)](#) provide evidence of this phenomenon, but there has not been any empirical analysis that explains the determinants of such deterioration. Second, it is the first analysis to our knowledge that analyzes the determinants of banks' financing choices by accounting for the corporate finance theories and the role of capital regulation. There are a handful of studies that study issuances of financial instruments, but they focus only on a subset, such as long-term debt in European banks ([Rixtel et al. 2016](#)), subordinated debt in the United States ([Covitz and Harrison 2004](#)), or bonds and securitization in European countries ([Carbó-Valverde et al. 2017](#); [Almazán et al. 2015](#)). Third, it provides policy arguments to justify a tougher definition of regulatory capital in Basel III, since banks have incentives to comply with capital regulation through the financing alternative of lowest cost that is recognized as eligible capital. This incentive indicates that the problem of credit expansions or recessions in capital are not only due to procyclicality ([Repullo and Suárez 2012](#); [Repullo et al. 2010](#); [Ayuso et al. 2004](#)), but also because of the composition of the capital.

The rest of the paper is structured as follows. Section 2 presents the database and some statistics on the variables. Section 3 analyzes the theoretical setup applied to banks and what determines the issuances of debt, hybrid, and capital instruments. Section 4 presents the main results for the decision of issuing and for the amount issued, and Sect. 5 concludes of the paper.

2 Database and characteristics of the sample

The database comprises 4812 issuances of financial instruments from Dealogic. We collect the issuances on a monthly basis from 1988 to 2007. We match these data with information from banks' annual reports during the period of 1998 to 2007. This period covers the boom and expansion years of the Spanish and global economies that were funded mainly with the issuance of financial instruments in the financial markets ([Brunnermeier 2009](#)). We exclude subsequent years of the financial crisis when financial markets did not operate normally. Figure 1 shows that the total assets of Spanish banks increased at an average growth rate of 12.9% during the whole period of study. They increased 17.6% during the period of maximum growth from 2004 to 2007, with peaks of around 20% in 2005 and 2006.

We classify the issuances as debt instruments, capital instruments, and hybrid instruments, attending to the capacity to absorb losses without risking the viability of the bank ([Acharya et al. 2011](#)). The first group, debt instruments, comprises the long-

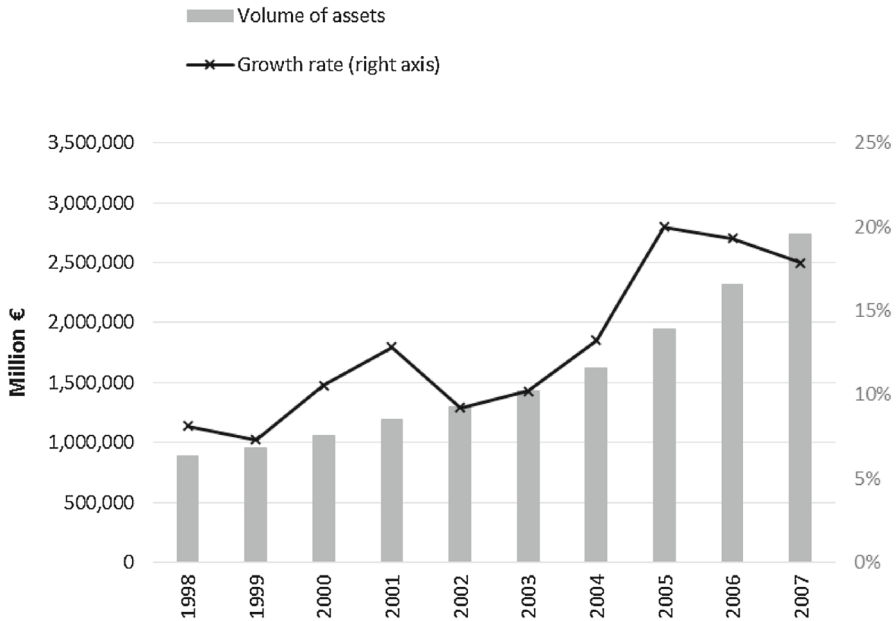


Fig. 1 Volume of assets (m€) and asset growth rate of Spanish banks, 1998–2007

term instruments that share the characteristics of typical debt contracts whose value and proceeds do not absorb any kind of losses for the bank. More concretely, we include standard senior debt issuances; the so-called *cédulas hipotecarias*, which are covered bonds backed by a portfolio of high-quality mortgages; and securitization issuances, which gather MBS and ABS.² There are papers that study the determinants of issue securitization (Loutskina 2011; Loutskina and Strahan 2009). They provide evidence that it is the financial innovation that has enabled banks to decouple the evolution of credit from deposit collection. Securitization has decreased the problems of asymmetric information in the markets for small and medium banks that could issue securities backed by a common portfolio of loans from different banks participating in the issuance (Almazán et al. 2015). The second group, capital instruments, includes the claims held by the owners of the bank who have control over the bank’s operations (i.e., common shares), that is, what it is defined as “pure equity capital” in Acharya et al. (2011). These instruments present the highest capacity to absorb losses, and it is the ultimate shareholder that assumes the loss of value. The last group, hybrid instruments, comprises the issuances of preferred shares and subordinated debt, which are considered hybrid capital since they present characteristics of both capital and debt. For instance, preferred shares are issued in perpetuity, and subordinated debt is not

² Securitized bonds are backed by a pool of assets and will not absorb losses coming from other concepts (i.e., losses from loans not belonging to that pool of assets, losses from tradable securities, etc). As well, Almazán et al. (2015) show that Spanish banks deployed securitization not to transfer risks (they offered credit enhancements and kept the worst tranches) but to exclusively obtain liquidity as a complement instrument to debt. Indeed, Spanish banks accounted the liability counterpart of securitization as deposits because Spanish regulation did not let them remove securitized assets from their balance sheet.

Table 1 Descriptive statistics of the issuances of Spanish banks, 1998–2007

	Volume of issuance (in millions €)							
	Total	Mean	Std. dev.	P10th	P25th	P50th	P75th	P90th
<i>Total sample</i>								
1998–2002	334,892	1053	2090	54	135	301	1000	2478
2003–2007	1,136,303	1211	3256	75	150	326	1000	2913
<i>Debt</i>								
1998–2002	285,205	954	1981	60	140	325	1000	2065
2003–2007	1,061,911	1181	3037	74	150	330	1000	2913
<i>Hybrid instruments</i>								
1998–2002	33,308	529	604	54	135	333	700	1070
2003–2007	58,270	525	882	75	150	300	608	1028
<i>Capital instruments</i>								
1998–2002	16,379	780	1000	99	158	348	902	1976
2003–2007	16,122	1612	2112	63	210	998	1999	5000

The rows under “Total sample” group the total volume issued regardless of the instrument. In the remaining groups, the statistics of the respective type of issuance are shown. Data on volume of issuances is expressed in millions of euros

obligated to pay interest unless the bank has profits. As commented in the introduction, these instruments can absorb losses, but they present a lower capacity to absorb losses compared to core capital, although Basel I and Basel II Accords consider them as eligible capital. During the sample period, preferred shares account for 50% of Tier I capital, which is the definition of maximum quality. The rest of the preferred shares and hybrid instruments (subordinated debt) count as Tier II capital. However, under Basel I, banks could issue preferred shares and decrease the weight of common equity within the total regulatory capital that increases the quality of their capital. Table 1 shows the figures for the issuances of debt and capital instruments drawn from Dealogic. We split the period in two: 1998 to 2002, where the assets’ growth rate remained fairly stable between 5 and 10%; and 2003 to 2007 where the slope of total assets became sharply steep. If we compare the two time periods, then the total amount of debt and hybrid capital increased exponentially whereas common equity had relatively low growth. More concretely, total debt issuances increased from a yearly average of 57,040 million euros during 1998 to 2002 to 212,382 million euros during 2003 to 2007, that is, a growth rate of 272%. The growth in the volume of total hybrid capital issuances was lower but still almost doubled from a yearly average of 6661 million euros during the first period to 11,654 million euros in the second period (growth rate of 74.94%). The yearly average of common capital issuances remained stable between 3275 and 3224 million euros.

The data that capture the essential characteristics of individual banks are mainly drawn from the information that Bankscope³ has on balance sheets, income statement, and regulatory capital. We complete this information by using the annual reports

³ Global database published by Bureau van Dijk that provides information of spreadsheet data (balance sheet and income statements) of financial institutions around the globe.

of banks in cases of missing values. This information is merged with the Dealogic database on a yearly basis. Thus, we attribute the values of the financial variables at the end of the period to the issuances of the bank that take place during the months of the following year, since it is sensible to assume that the decisions during a given year will depend on the financial situation at the beginning of the year. Our database includes commercial and savings banks (the so-called *cajas*)⁴ operating in Spain during the period from 1998 to 2007. Commercial banks differ from savings banks in their governance, ownership structure, and purpose. Commercial banks are for-profit organizations that belong to shareholders. Savings banks, on the other hand, are nonprofit entities controlled by regional and local governments. The numbers of both types of banks decrease during the sample mainly because of the concentration of the sector through M&As; the number of commercial banks decreases from 40 in 1998 to 25 in 2007 and the number of cajas decreases from 52 in 1998 to 45 in 2007.

Table 2 presents the statistics on the bank variables obtained from Bankscope that we use as explanatory variables in our empirical models.

3 Determinants of issuing financial instruments

Apart from traditional deposits, banks can choose among different tools in the financial markets to finance their growth. The aim of this section is to explore which are the driving factors behind the decision on one instrument (if any) among the available list of possibilities. We draw insights from the theories that are related to the issuing of financial instruments and capital structure and apply them to the case of banks in order to derive some testable hypotheses about the types of issuances by banks. In particular, we hypothesize that the issuances of financial instruments could be affected (1) by a targeted leverage ratio that minimizes the cost of financing (trade-off theory), (2) by asymmetric information and adverse selection (pecking order theory) and (3) by the statutory requirement to fulfill the capital regulation.

The predictions that can be extracted from the trade-off theory and the pecking order theory (Bradley et al. 1984; Myers and Majluf 1984; Titman and Wessels 1988; Frank and Goyal 2003, 2008) are common to nonfinancial firms. The pecking order theory argues that the issuance of financial instruments responds to informational problems. Thus, firms (banks) prefer to issue the type of market instrument that minimizes the adverse selection discount. In this sense, debt instruments mitigate adverse selection compared to capital instruments. To examine whether this theory explains the issuance of financing instruments, we analyze whether banks more affected by the costs of adverse selection are those that are more likely to raise market funds through debt instruments. The trade-off theory states that there is an optimal capital structure for each individual bank. This theory argues that banks issue those financial instruments that enable them to minimize the overall cost of their capital structure. If banks have access to new financial markets, then those that are financially constrained could decide to issue large amounts of money through new financial instruments, although they would still be issuing traditional capital instruments to maintain a target capital

⁴ We exclude credit cooperatives because of missing data for key variables in the empirical analysis.

Table 2 Descriptive statistics of explanatory variables. Spanish banks, 1998–2007

	Mean	Median	Std. dev.	P25th	P75th
<i>Capital regulation</i>					
Low capital	0.159	0	0.365	0	0
Loan loss reserve/loans (100×)	2.063	1.932	1.010	1.559	2.474
NPL ratio (100×)	1.621	1.100	1.570	0.600	2.100
Issuer capital instruments in $t-1$ to $t-3$	0.009	0	0.095	0	0
Issuer capital instruments in $t-4$ to $t-12$	0.021	0	0.144	0	0
Issuer hybrid instruments in $t-1$ to $t-3$	0.042	0	0.202	0	0
Issuer hybrid instruments in $t-4$ to $t-12$	0.086	0	0.280	0	0
Issuer debt in $t-1$ to $t-3$	0.239	0	0.427	0	0
Issuer debt in $t-4$ to $t-12$	0.365	0	0.482	0	1
<i>Liquidity needs and growth opportunities</i>					
Loans / deposits	0.804	0.824	0.321	0.673	0.952
ROA (100×)	0.769	0.828	1.096	0.584	1.088
Assets growth rate	0.135	0.129	0.113	0.070	0.191
<i>Market access</i>					
Total assets (million €)	11,379	4732	17,636	1573	11,023
Ln assets	8.270	8.462	1.813	7.361	9.308
International bank	0.025	0	0.155	0	0
Issuer in past	0.276	0	0.447	0	1
Maturity past issuance	0.175	0	0.380	0	0
<i>Asymmetric information</i>					
Savings bank	0.582	1	0.493	0	1
Listed in the stock markets	0.139	0	0.346	0	0
<i>Macroeconomic variables</i>					
GDP	0.036	0.036	0.006	0.030	0.040
Real interbank 12 m	0.008	0.004	0.011	−0.002	0.014

Definition of variables in the appendix

structure. To identify those banks that are financially constrained, we use two indicators: (a) the liquidity position of the bank and (b) the growth rate opportunities in the bank's loan portfolio.

However, banks have additional drivers in their financing choices compared to nonfinancial firms because they have to comply with the capital regulation from the Basel Accords. This is not an alternative theory, but a requirement from regulation that can be perfectly compatible with the stated corporate finance theories. To fulfill the capital requirement, banks are obliged to hold 8% of their risk-weighted assets in the form of capital.⁵ The observed high growth rates in banks' balance sheets during the sample period should reflect an increase in risk-weighted assets and, thus, in higher capital requirements. Therefore, banks cannot base their growth only on the issuance

⁵ The 8% corresponds to Basel I regulation that applied during the whole sample period.

of debt instruments but must increase their capital holdings at the same pace if they want to maintain their capital ratio above the regulatory minimum. Therefore, we expect banks to issue hybrid or capital instruments simultaneously to debt issuances if their internal funds are not enough to guarantee their target Basel ratio. Whether banks decide to issue hybrid instruments, capital instruments, or both could be determined by the corporate finance theories. On the one hand, we could expect that banks issue a combination of hybrid and capital instruments if they want to maintain a target capital structure. On the other hand, banks could issue hybrid instruments if they want to minimize the adverse selection discount, given that hybrid capital presents characteristics of debt and, thus, it is less affected by costs of adverse selection.

The rest of this section presents the dependent variables and proxies that are used in the empirical strategy to determine the drivers of banks' financing choices, and an explanation of the empirical methodology used in the analysis. Depending on the different predictions of each possible theory, we detail the expected effect of each explanatory variable on each financing decision.

3.1 Dependent variable

The dependent variable identifies the banks' decision to issue one of the three types of instruments (if any) during a given month during the period from 1998 to 2007. It takes the value of zero if the bank does not issue any financing instrument at month t and the value of 1, 2, or 3 if the bank issues debt, hybrid, or capital instruments, respectively. An alternative dependent variable also considered is the total amount of each instrument at every point in time in order to explore whether the determinants that drive the decision to issue also can explain the volume of each instrument.

3.2 Explanatory variables

We distinguish four groups of explanatory variables related to the potential reasons to raise funds in the financial markets: (1) proxies related to capital regulation, (2) proxies related to liquidity needs, (3) variables related to asymmetric information, and (4) variables of market access.

Further, we add macroeconomic variables as control variables in the estimation, namely GDP growth and the real interbank 12-month interest rate.

3.2.1 Capital regulation

We argue that banks have to actively manage their regulatory capital ratio by assessing how new issuances of instruments effect their capital requirements. During our sample period, banks had to comply with Basel I, and this regulation determined the definitions of eligible capital during our whole sample.⁶ Tier I mainly comprised common shares,

⁶ Basel II came into force in 2008. Despite that banks could have adapted to Basel II during the years before its implementation, we consider that this possibility does not affect the decision to issue different financing instruments given that the changes mainly affect the computation of risk-weighted assets and not the definitions of Tier I and Tier II.

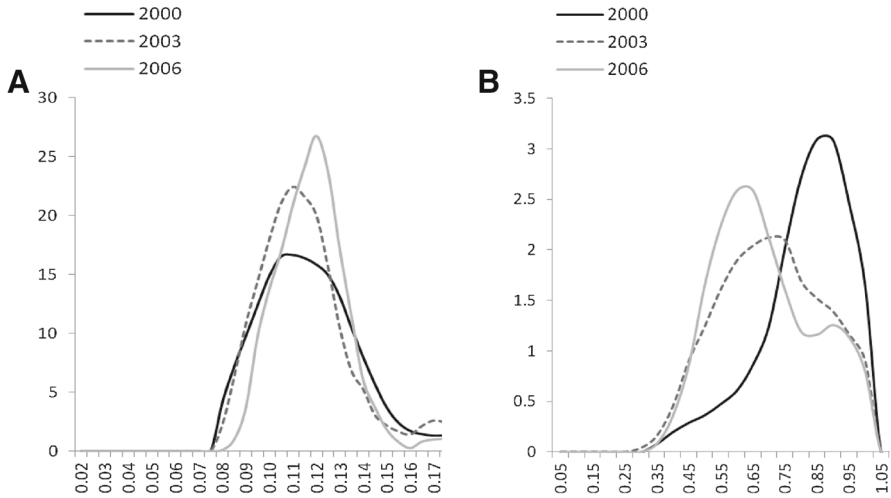


Fig. 2 Distribution of capital ratios of Spanish banks, selected years

reserves, and preferred shares (up to a maximum), and Tier II comprised the rest of the hybrid instruments. During the sample period, banks had to keep a minimum of 4% of their risk-weighted assets in the form of Tier I and 8% in Tier I+Tier II.

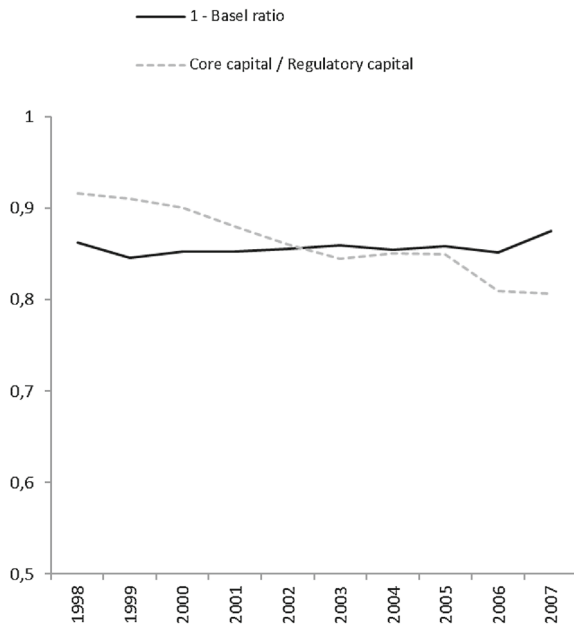
Figure 2a shows that the distribution of the Basel ratio remains practically unchanged over time, in spite of the large growth of assets shown in Fig. 1. This lack of change could indicate active management of the regulatory capital ratio, possibly resulting from the combination of issuances of debt and capital instruments to keep the capital ratio constant. Nonetheless, we observe in Fig. 2b that the distribution of capital with respect to total regulatory capital shifts leftwards, which indicates that the weight of common capital decreases generally for all banks over time. This is consistent with Fig. 3 that shows that the quality of the regulatory capital decreases over time because the weight of core capital to regulatory capital constantly diminishes.

To test whether any of these hypotheses hold, we define a group of variables whose effect on the issuance of instruments could be attributed only to capital regulation.

1. *Low Capital* is a dummy variable that takes the value of one if the bank has a Basel capital ratio below 10% and zero otherwise. Banks closer to the regulatory limit are less likely to finance their growth based only on debt issuances compared with banks with a capital buffer over the minimum because this financing would deteriorate their capital ratio even more. In this case, we expect that the coefficient of this variable will be negative for the issuances of debt and/or positive for the issuances of instruments considered regulatory capital. If the pecking order holds, we should observe a positive and statistically significant sign only in hybrid issuances, whereas the statistical significance of both hybrid and capital instruments would support the trade-off theory.

2. *Loan Loss Reserve/Loans (LLR)* can be used up to a limit as regulatory capital. Thus, banks with higher LLR are less likely to issue hybrid or common capital, because the LLR acts as a substitute and softens the need for capital issuances.

Fig. 3 Basel ratio and composition of regulatory capital. Average across banks



3. *NPL ratio* is the total amount of capital requirements that depends on the size of the risk-weighted assets of the bank, which increases with the size of the bank and the risk of the assets. We consider the ratio of the nonperforming loans as a proxy for the risk in the bank’s assets. Thus, we expect that banks will be more (less) likely to issue hybrid and/or common capital (debt) issuances as the ratio increases.

4. *Issuance behavior* identifies the type of issuances made by the bank (if any) during the last 12 months. More concretely,

a. *Issuer Capital Instruments in months $t-x$ to $t-y$* : Dummy variable that takes the value of one if the bank has issued capital instruments during the months $t-x$ to $t-y$.

b. *Issuer Hybrid Instruments in months $t-x$ to $t-y$* : Dummy variable that takes the value of one if the bank has issued hybrid instruments during the months $t-x$ to $t-y$.

c. *Issuer Debt in months $t-x$ to $t-y$* : Dummy variable that takes the value of one if the bank has issued debt during the months $t-x$ to $t-y$.

We expect the issuance of debt instruments to be positively correlated with the recent issuance of hybrid instruments, and vice-versa, if banks only use hybrid instruments to cover the increase in capital requirements originated by the growth of debt. If this is the case, we expect a lower correlation or nil correlation of the issuance of debt instruments and the issuance of capital instruments. If banks use both hybrid and capital instruments to compensate for debt growth, we should observe that the probability of issuing both types of instruments increases right after the issuance of debt, and vice-versa.

3.2.2 *Liquidity needs and growth opportunities*

Banks with higher liquidity constraints could be subject to tougher investment constraints, so they can be more likely to issue financial instruments to finance their growth. We use variables related to the dependence of the bank on traditional funds to finance its activity and to its capacity to generate internal funds as proxies for the bank's liquidity constraints. As for growth opportunities, we expect that banks with higher opportunities are more likely to issue financial instruments.

Besides the effect on the pure decision of issuing versus not issuing, we analyze which instruments banks choose to respond to liquidity needs. If the decision on the instrument follows the pecking order, banks would only issue debt instruments to minimize the cost of asymmetric information and, therefore, the liquidity and growth variables would only be significant for debt issuances. If the decision on the instruments follows the trade-off theory, we should observe significant coefficients in all financial instruments because the banks have to combine the issuances of all types of financial instruments to maintain the same proportion of each component. This result could be consistent with the fulfillment of capital regulation, if banks issue both hybrid and capital instruments to keep their regulatory capital levels constant. Nonetheless, if the issuances of eligible capital instruments are meant to fulfill capital regulation at the lowest possible cost, we could observe issuances of debt and hybrid instruments only, but not capital instruments.

Taking into account the previous predictions, we consider the following variables to analyze the determinants of the choice of funding for banks attending to liquidity needs and growth opportunities:

1. *Loans/Deposits* is the ratio of the total balance of loans to the total balance of deposits of the bank. A higher imbalance between loans and deposits indicates higher needs for financing resources beyond those provided by traditional banking. Thus, the higher this ratio, the higher the probability of issuing financial instruments.
2. *ROA* Return on assets is a measure of the bank's capacity to generate internal funds. Banks with higher profitability have lower liquidity needs because they can use their earnings to finance new operations. In this case, higher ROA means a lower probability of issuing fresh financial instruments.
3. To capture potential growth, the corporate finance literature has used the price-to-book ratio. However, since a large part of the banks in our sample are not listed in the stock markets, we consider the growth rate of bank's assets during the previous year, assets growth rate, as a proxy of future growth opportunities.

3.2.3 *Market access*

The accessibility of banks to financial markets affects their decision to issue new financial instruments. On the one hand, a bank that has access to the market can issue fresh financial instruments without high transaction costs or big investments in recognition in that market. On the other hand, banks that issue instruments in the market that are about to reach maturity could find it easier to refinance them.

The following variables are included to estimate these effects:

1. In *Assets*. Larger banks are more likely to have low transaction costs of accessing the markets, and thus they are more likely to issue financial instruments.
2. *Issuer in Past*. Dummy variable that takes the value of one if the bank has issued any type of instrument in the financial markets since 1988. We expect that banks that managed to issue in the past present lower transactional costs and, thus, the probability to issue new securities is higher.
3. *Maturity Past Issuance*. Dummy variable that takes the value of one if the bank issued a security since 1988 that is reaching maturity at month t of the database. We have constructed this variable by using detailed information of banks' issuances since 1988 according to the Dealogic database. We expect a higher probability of issuing securities in the current month to refinance the operation that is reaching maturity.
4. *Savings bank*. [Almazán et al. \(2015\)](#) find that the development of securitization, which we define as a debt instrument, reduces the adverse selection faced by cajas. Therefore, we expect a positive and statistically significant coefficient for this variable in the decision to issue debt instruments.

3.2.4 Asymmetric information

Banks more subject to informational problems will be more reluctant to issue instruments with high discounts due to asymmetric costs. In our definition of groups, capital instruments would suffer higher discounts because of asymmetric information, followed by hybrid instruments and debt instruments. We use two variables to identify this effect:

1. *Listed in the stock markets*. Banks that are listed in the stock markets are less subject to asymmetric information and, thus, they are more likely to issue capital instruments, compared to the rest of banks.
2. *International bank*. Related with the previous argument, international banks are likely to have lower transaction costs when accessing markets to issue any type of security.

4 Empirical strategy and results

We perform two sets of tests. First, we estimate a multinomial logit to investigate the determinants of the banks' decision to issue (or not to issue) the different types of available financial instruments (i.e., *extensive margin*). We examine both the sign and significance of the coefficient of each option (i.e., issuing debt, capital, or hybrid instruments) with respect to the decision of not issuing and the cross-differences between the different options. We consider this first approach to account for the possibility that the decisions to issue different types of securities is affected by the different theories. Second, we estimate a Tobit model to explore the determinants of the amount issued by banks in each type of financial instrument (i.e., *intensive margin*) and analyze whether they are different from the determinants that govern the decision to issue each type of instrument.

4.1 Decision to issue financial instruments

Table 3 presents the results from the multinomial logit of the decision to issue instruments that takes the decision of not to issue as the reference group. Columns (1), (2) and (3) display the results for the option to issue debt, hybrid, or capital instruments, respectively. Table 4 presents the cross-tests of statistical differences between the coefficients for the same variable across columns (i.e., in the first column of Table 4, the coefficient *LowCapital* is statistically different for debt and hybrid issuances with a p value of 4.6%)

From Table 3, the coefficients for the variables *Loans/Deposits* and *Assets growth rate* show that banks with liquidity needs are more likely to issue debt to finance their growth, but they do not directly affect the issuance of hybrid or capital instruments. This means that the exponential growth in banks' balance sheets observed in Fig. 1 is largely financed with issuances of debt, which would be consistent with the pecking order theory. As for ROA, high profits negatively affect the issuance of hybrid instruments but not debt or capital. While this is consistent with lower liquidity needs, this result could also be explained by a lower need to issue capital instruments to comply with the Basel ratio because the retained earnings compute as Tier I capital.

Focusing on the timing variables, the issuance of debt (Column 1) is preceded by issuances of debt (*Issuer Debt in t-4 to t-12* statistically significant) and hybrid instruments (both *Issuer Hybrid Instruments in t-4 to t-12* and *Issuer Hybrid Instruments in t-4 to t-12* statistically significant), but not issuances of capital. Similarly, issuances of hybrid instruments are preceded by other issuances of hybrid instruments and by issuances of debt. However, the probability of issuing capital is not correlated with the issuance of debt but increases with the issuances of hybrid instruments during the last three months. Table 4 shows that the coefficients that are statistically different from zero are also statistically different across types of issuances. Therefore, banks that finance their growth with issuances of debt also increase their issuances of hybrid instruments, which indicates that they are managing their regulatory capital holdings using hybrid instruments to comply with the higher requirements due to the increase in debt holdings. Further evidence for this finding is provided by the variable *Low Capital*, which is positive and statistically significant at 10% in hybrid instruments whereas it is not statistically significant for capital, which indicates that banks whose regulatory capital is close to the minimum are likely to issue hybrid instruments but not capital instruments. Given that the threshold of 8% is exogenous, the issuance of capital instruments might be a response to maintain or increase their Basel ratios by using only hybrid capital, which means they want to minimize the cost of regulatory compliance.

The coefficients for *Loan Loss Reserves/Loans* show that loan loss reserves act as a substitute for capital issuances: banks with higher LLR are less likely to issue hybrid capital and core capital, whereas it does not affect the probability of issuing debt. Furthermore, the *NPL ratio* shows that banks with higher risk tend to issue less debt and more capital, but it does not affect the issuance of hybrid instruments. These results indicate that banks with higher risks are more likely to issue capital instruments to absorb losses, although this effect is mitigated if they have accumulated sufficient LLR to absorb such losses. Thus, we find partial evidence that banks can respond

Table 3 Multinomial logit estimation of the decision to issue (or not to issue) among debt, hybrid instruments, or capital instruments

	(1)		(2)		(3)	
	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error
<i>Capital regulation</i>						
Low capital	−0.116	(0.129)	0.605*	(0.323)	0.556	(0.335)
Loan loss reserve/loans (100×)	0.068	(0.087)	−0.726***	(0.207)	−1.231**	(0.434)
NPL ratio (100×)	−0.270***	(0.073)	0.157	(0.174)	0.581**	(0.265)
Issuer capital instruments in <i>t</i> -1 to <i>t</i> -3	−0.076	(0.148)	−0.495	(0.311)	−1.444***	(0.174)
Issuer capital instruments in <i>t</i> -4 to <i>t</i> -12	−0.115	(0.290)	−0.198	(0.341)	−0.548	(0.407)
Issuer hybrid instruments in <i>t</i> -1 to <i>t</i> -3	0.298*	(0.155)	0.434**	(0.204)	0.851**	(0.344)
Issuer hybrid instruments in <i>t</i> -4 to <i>t</i> -12	0.213*	(0.125)	0.474	(0.325)	0.703	(0.863)
Issuer debt in <i>t</i> -1 to <i>t</i> -3	−0.143	(0.103)	0.609**	(0.303)	1.675	(1.370)
Issuer debt in <i>t</i> -4 to <i>t</i> -12	1.224***	(0.152)	1.407**	(0.548)	1.321	(0.992)
<i>Liquidity needs and growth opportunities</i>						
Loans / deposits	0.888***	(0.197)	0.577	(0.483)	−1.224	(1.608)
ROA (100×)	−0.001	(0.119)	−0.310*	(0.164)	−0.869	(0.662)
Assets growth rate	1.316**	(0.417)	0.431	(0.825)	0.786	(1.480)
<i>Market access</i>						
Ln assets	0.409***	(0.067)	0.588***	(0.161)	0.808	(0.850)
International bank	2.605***	(0.663)	3.563***	(0.914)	3.078*	(1.634)
Issuer in past	0.160	(0.103)	−0.188	(0.195)	−0.384	(0.455)
Maturity past issuance	0.289**	(0.132)	−0.014	(0.316)	0.025	(0.536)
<i>Asymmetric information</i>						
Savings bank	1.103**	(0.403)	1.211	(0.955)	−0.255	(3.453)
Listed in the stock markets	0.435	(0.414)	1.363	(0.889)	15.163***	(3.595)
<i>Macroeconomic variables</i>						
GDP	−20.267**	(9.234)	−21.615	(23.484)	49.356	(50.884)
Real interbank 12 m	−16.156*	(8.254)	−9.995	(17.648)	4.026	(16.039)
Constant	−7.642***	(0.742)	−10.691***	(1.379)	−28.877***	(5.192)
<i>No. of observations</i>	10,282		10,282		10,282	
<i>Pseudo-R2</i>	0.3305		0.3305		0.3305	

The results are from multinomial logit. The dependent variable is a categorical variable that takes the value of one if the bank issues debt [Column (1)], two if it issues hybrid instruments [Column (2)], three if it issues capital instruments [Column (3)], and zero if it does not issue during that month; the latter is the reference group. The explanatory variables refer to the value in month *t*, except for the financial variables that are drawn from annual reports that refer to the previous' year end. Definition of variables can be found in the appendix

The robust standard errors that are corrected for clustering at the bank level are in parenthesis

$p < 0.01 = ***$, $p < 0.05 = **$, $p < 0.1 = *$

Table 4 Cross-tests of equality of coefficients between equations

	(1) versus (2)		(2) versus (3)		(1) versus (3)	
	chi2(1)	Prob > chi2	chi2(1)	Prob > chi2	chi2(1)	Prob > chi2
<i>Capital regulation</i>						
Low capital	3.98**	(0.046)	0.02	(0.893)	3.54*	(0.060)
Loan loss reserve/loans (100×)	14.42***	(0.000)	1.14	(0.286)	8.85***	(0.003)
NPL ratio (100×)	5.53**	(0.019)	2.32	(0.128)	11.40***	(0.001)
Issuer capital instruments in <i>t</i> -1 to <i>t</i> -3	1.86	(0.172)	18.89***	(0.000)	79.40***	(0.000)
Issuer capital instruments in <i>t</i> -4 to <i>t</i> -12	0.12	(0.727)	1.20	(0.274)	1.33	(0.249)
Issuer hybrid instruments in <i>t</i> -1 to <i>t</i> -3	0.49	(0.486)	1.30	(0.254)	3.55*	(0.059)
Issuer hybrid instruments in <i>t</i> -4 to <i>t</i> -12	0.51	(0.474)	0.06	(0.802)	0.33	(0.567)
Issuer debt in <i>t</i> -1 to <i>t</i> -3	6.88***	(0.009)	0.63	(0.428)	1.82	(0.177)
Issuer debt in <i>t</i> -4 to <i>t</i> -12	0.13	(0.718)	0.01	(0.923)	0.01	(0.923)
<i>Liquidity needs and growth opportunities</i>						
Loans / deposits	0.40	(0.525)	0.97	(0.324)	1.64	(0.201)
ROA (100×)	2.45	(0.117)	0.75	(0.386)	1.70	(0.192)
Assets growth rate	1.31	(0.252)	0.09	(0.765)	0.13	(0.721)
<i>Market access</i>						
Ln assets	2.00	(0.158)	0.07	(0.799)	0.22	(0.638)
International bank	3.87**	(0.049)	0.09	(0.770)	0.11	(0.744)
Issuer in past	4.28**	(0.039)	0.19	(0.661)	1.55	(0.213)
Maturity past issuance	0.92	(0.338)	0.01	(0.924)	0.24	(0.623)
<i>Asymmetric information</i>						
Savings bank	0.02	(0.878)	0.17	(0.681)	0.15	(0.696)
Listed in the stock markets	2.00	(0.157)	12.89***	(0.000)	16.70***	(0.000)
<i>Macroeconomic variables</i>						
GDP	0.00	(0.952)	1.41	(0.235)	2.01	(0.157)
Real interbank 12 m	0.16	(0.692)	0.83	(0.362)	2.11	(0.146)

This table presents the results from the test for the equality of the coefficients for the variables across financial instruments based on the results presented in Table 3. Columns (1) and (2) compare the coefficients obtained for debt issuances presented in Column (1) of Table 3 with the coefficients obtained for hybrid issuances presented in Column (2) of Table 3 respectively. Columns (2) and (3) compare the coefficients obtained for hybrid issuances presented in Column (2) of Table 3 with the coefficients obtained for capital issuances presented in Column (3) of Table 3 respectively. Column (1) and (3) compare the coefficients obtained for debt issuances and presented in Column (1) of Table 3 with the coefficients obtained for capital issuances presented in Column (3) of Table 3 respectively

with high-quality capital issuances to compensate for the risk embedded in their loan portfolios. However, given the evidence presented in Fig. 3, this is not enough to compensate for the deterioration in regulatory capital.

Related to the access to financial markets, we find a positive and significant coefficient on the variable $\ln Assets$ for debt and hybrid instruments. We also find that banks with a past issuance of an instrument that is now maturing at time t , *Maturity Past Issuances*, are more likely to issue debt to rollover. The fact of having previously issued in financial markets, *Issuer in the Past*, does not seem to positively affect the probability of issuing any type of financial instrument. Finally, we also find that, *ceteris paribus*, *cajas* are more likely to issue debt, which is consistent with [Almazán et al. \(2015\)](#). The effect of being a *caja* does not affect the probability of issuing either hybrid or capital instruments.

In line with the pecking order theory, banks that are *Listed in the stock markets* suffer lower costs from informational asymmetries and they are more likely to issue capital. Our other proxy of asymmetric information, *International bank*, has positive and statistically significant coefficients for the three types of instruments that shows that these banks with previous records of issuances can issue financial instruments at lower costs

We perform a number of tests to assess the robustness of our results. First, we add time dummy variables to all specifications to better capture potential cyclical effects, and the results remain unchanged. Second, we also substitute the measure of risk in the loan portfolio, *NPL ratio*, with the *Z-score*. The coefficient is not statistically significant in any specification, so it does not capture the risk better than the *NPL*. But, the rest of the coefficients do not change noticeably. Third, we reestimate the model by substituting *Asset Growth Rate* with a *Q-Tobin* that we construct using an estimation of market value (based on a discount of forecasted future profits) for those banks that are not listed in the stock markets. The coefficient for this variable remains statistically significant for debt issuances (though at 10%), and the rest of results do not change.

4.2 Results on the amounts issued

Table 5 displays the results for the models of the volume issued in each type of financial instrument (that is, *intensive margin*). We estimate these models with a Tobit specification⁷ with standard errors robust to heteroscedasticity and clustered at the bank level. The dependent variable is the log of the amount issued at month t , taking the value of zero if the bank does not issue. Each regression has been estimated separately, but the results in Table 5 follow the same structure as the results in Tables 3, 4. The explanatory variables are the same as in the multinomial logit that were explained in Sect. 3.2. For columns (1), (2), and (3), the dependent variable is the log of the amount issued in the form of debt, hybrid, or capital instruments, respectively. For Column (4), the dependent variable is the log of the total amount of funds issued under any form of financial instrument.

The explanatory variables in Column (1) of Table 5 show that the proxies for liquidity needs and growth opportunities, market access, asymmetric information,

⁷ Results for capital instruments have been estimated using OLS because of the lack of convergence using the Tobit model.

and capital regulation maintain their sign and statistical significance. However, the coefficient for *Issuer Capital Instruments in t-1 to t-3* is now positive and statistically significant with a similar magnitude as the coefficients of the two variables for *Issuer Hybrid Instruments*. This result indicates that even when the decision to issue capital and debt are not mutually dependent (Tables 3, 4), once the bank has decided to issue capital instruments in the near past, this decision provides a capital buffer that enables the bank to issue an amount of debt even higher than in the case of not having issued. Furthermore, *Issuer in Past* becomes statistically significant, in line with the predictions. Overall, we can claim that the determinants of the issuance of debt present similarly qualitative effects in the extensive and the intensive margins.

The conclusions about the effect of the explanatory variables are also comparable to the issuances of hybrid and capital instruments but not all of the coefficients are equal across specifications. Focusing on the differences, the amount issued now does not depend on the issuances of hybrid capital in the near past, whereas the coefficient of *Listed Stock Market* becomes statistically significant with the expected positive sign. For the issuances of capital, the amount issued does not depend on having issued hybrid capital during the last three months or on the risk variables and *Loan Loss Reserves*.

As a robustness exercise, Column (4) of Table 5 presents the results for the total amount issued under any kind of financial instrument. The results are similar to those of debt issuances, possibly because they represent the main volume of issuances during the sample period (from Table 1, 85.16% in 1998–2002 and 93.45% in 2003–2007)

5 Conclusions

The transition of Spanish banks to a business model more dependent on market financing has enabled them to decouple the evolution of the loan activity from the capacity to collect deposits. The high demand of international markets for financial products issued by Spanish banks enabled and fueled the high demand for loans with the consequent growth of banks' balance sheets during the years prior to the crisis. In this study we find that the financial development and the access of banks to financial markets has increased the vulnerability of the banking sector, not only to shocks in the financial markets (Almazán et al. 2015) but to deterioration in the capital meant to absorb losses. More concretely, we find that banks with higher expansion in their balance sheets finance their liquidity needs with issuances of debt instruments. At the same time, we find that the issuances of debt are correlated with the issuances of hybrid instruments because hybrids were the instrument used by banks to comply with the higher regulatory capital requirements derived from the expansion of the (risk-weighted) assets.

We find that information asymmetries can explain the choice of debt/hybrid instruments by banks. That is, banks decide to issue the market instrument that more resembles debt in order to minimize the adverse selection discount. This decision can explain why banks finance growth with debt and raise hybrid capital instead of common equity if they are close to the regulatory minimum or have low levels of provisions or earnings that compute as eligible capital. We find little support for the

Table 5 Tobit estimation of the amount issued by banks in debt, hybrid, and capital instruments

	(1)		(2)		(3)		(4)	
	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error
<i>Capital regulation</i>								
Low capital	-1.073	(1.377)	9.376**	(4.770)	0.041	(0.034)	-0.631	(1.280)
Loan loss reserve/loans (100×)	0.975	(0.983)	-7.281**	(2.501)	-0.002	(0.010)	0.595	(0.963)
NPL ratio (100×)	-3.241***	(0.867)	1.990	(2.023)	0.004	(0.004)	-3.013***	(0.857)
Issuer capital instruments in t-1 to t-3	2.978**	(1.146)	-2.545	(5.108)	-0.770***	(0.161)	1.985	(1.271)
Issuer capital instruments in t-4 to t-12	0.198	(2.640)	3.203	(4.410)	0.424	(0.564)	1.425	(2.234)
Issuer hybrid instruments in t-1 to t-3	3.308**	(1.523)	3.598	(3.392)	0.198	(0.123)	3.351**	(1.476)
Issuer hybrid instruments in t-4 to t-12	2.967**	(1.466)	5.172	(4.908)	0.046	(0.056)	3.284**	(1.349)
Issuer debt in t-1 to t-3	-1.293	(1.303)	10.077**	(4.071)	0.030	(0.020)	-0.493	(1.284)
Issuer debt in t-4 to t-12	14.014***	(1.804)	14.977**	(6.156)	0.019	(0.015)	14.188***	(1.819)
<i>Liquidity needs and growth opportunities</i>								
Loans / deposits	10.937***	(2.675)	3.298	(6.058)	-0.043	(0.036)	10.226***	(2.568)
ROA (100×)	-0.636	(1.276)	-4.146**	(1.954)	-0.001	(0.002)	-0.711	(1.190)
Assets growth rate	13.439**	(4.950)	5.706	(11.223)	0.107	(0.116)	14.472**	(4.729)
<i>Market access</i>								
Ln assets	4.973***	(0.875)	6.668**	(2.334)	-0.005	(0.004)	4.951***	(0.878)
International bank	20.132***	(4.155)	24.595***	(6.539)	1.920***	(0.131)	17.419***	(3.593)
Issuer in past	2.185**	(1.114)	-1.563	(2.639)	0.030	(0.025)	2.304**	(1.119)
Maturity past issuance	4.380**	(1.672)	-1.748	(3.967)	0.001	(0.023)	4.111**	(1.636)
<i>Asymmetric information</i>								
Savings bank	11.995**	(4.027)	12.541	(9.514)	-0.015**	(0.008)	11.567**	(4.113)
Listed in the stock markets	4.150	(4.350)	16.726*	(9.110)	0.041	(0.025)	4.868	(4.285)

Table 5 continued

	(1)		(2)		(3)		(4)	
	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error	Coeff	Std. error
<i>Macroeconomic variables</i>								
GDP	-260.675**	(103.163)	-104.600	(314.369)	2.100	(2.623)	-234.225**	(101.820)
Real interbank 12 m	-148.714	(94.353)	33.096	(224.910)	2.706	(1.690)	-134.429	(95.754)
Constant	-90.561***	(11.652)	-149.300***	(33.213)	-0.060	(0.099)	-89.220***	(11.229)
<i>No. of observations</i>	10,282		10,282		10,282		10,282	
<i>Pseudo-R2</i>	0.155		0.211		0.101		0.156	

(1) represents the dependent variable as the amount of debt issued by a bank in that month (in logs). (2) represents the dependent variable as the amount of hybrid instruments issued by a bank in that month (in logs). (3) represents the dependent variable as the amount of capital instrument issued by a bank in that month (in logs). (4) represents the dependent variable as the total amount issued, regardless of the financial instrument, by a bank in that month (in logs). The explanatory variables refer to the value in month t , except financial variables that are drawn from annual reports that refer to the previous' year end. The definitions of variables are in the Appendix. The robust standard errors that are corrected for clustering at the bank level are in parenthesis

Symbols $p < 0.01 = ***$, $p < 0.05 = **$, $p < 0.1 = *$

trade-off theory because banks do not seem to target an optimal level of capital structure during the sample period because liquidity and capital needs are covered with debt and hybrid instruments. Additional evidence in support of the asymmetric information theory is that only banks better known by investors can issue common equity without suffering a discount due to informational asymmetries.

Our findings support the stricter requirements in Basel III in terms of core capital requirements. During our sample period, banks could comply with Basel I by basically issuing hybrid instruments because they were included in the definition of Tier I. Because of the lower relative cost of debt-like instruments compared to capital instruments, banks preferred to issue hybrid capital to offset the increase in risk-weighted assets during the expansion period, which deteriorated the quality of regulatory capital. The new Basel standards prevent this regulatory capital arbitrage so compliance can only be achieved with high-quality capital. This compliance could be a challenge for small-medium banks less known by the markets because they face the risk of higher discounts when issuing common shares. But an opportunity exists to control the potential excessive growth in these types of banks with access to almost unlimited financing in the form of debt, but with serious difficulties (from the supply and/or demand side) in raising high-quality capital.

Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

Appendix: Definition of explanatory variables

Capital regulation

Low Capital Dummy variable that takes the value of one if the bank has a Basel capital ratio below 10% and zero otherwise.

Loan Loss Reserve/Loans ($100\times$) It is the ratio of the loan loss provision to the total balance of loans. Since this variable is not available for all banks, we capitalize the volume of impairment provisions of the last three years and substitute this amount in the numerator. It provides a reasonable adjustment for the cases of banks with actual data on LLR. The variable is winsorized at 1% and expressed in percent.

NPL ratio ($100\times$) Ratio of the nonperforming loans in the balance sheet to the total amount of loans, winsorized at 1% and expressed in percent.

Issuer Capital Instruments in months $t-x$ to $t-y$ Dummy variable that takes the value of one if the bank has issued capital instruments during the months $t-x$ to $t-y$.

Issuer Hybrid Instruments in months $t-x$ to $t-y$ Dummy variable that takes the value of one if the bank has issued hybrid instruments during the months $t-x$ to $t-y$.

Issuer Debt in months $t-x$ to $t-y$ Dummy variable that takes the value of one if the bank has issued debt during the months $t-x$ to $t-y$.

Liquidity needs and growth opportunities

Loans / Deposits Ratio of the total balance of loans to the total balance of deposits of the bank, winsorized at 1%.

ROA (100×) Ratio of the after-tax profit and the assets of the bank, winsorized at 1% and expressed in percent.

Assets growth rate Annual growth rate of bank's assets, winsorized at 5%.

Market access

Ln Assets Book value of the bank's assets at the end of the year, in logs and winsorized at 1%.

International bank Dummy variable that takes the value of one if the bank has access to international markets and zero otherwise.

Issuer in Past Dummy variable that takes the value of one if the bank has ever issued any instrument in the financial markets and zero otherwise. We use monthly information since 1988.

Maturity Past Issuance Dummy variable that takes the value of one if there is a past issuance of the bank that is maturing in the current month, the previous month, or the next month and zero otherwise. We use monthly information of debt and capital issuances since 1988 to construct this variable.

Asymmetric information

Savings bank Dummy variable that takes the value of one if the bank is a savings bank and zero if it is a commercial bank.

Listed in the stock markets Dummy variable that takes the value of one if the bank is listed in the stock market and zero otherwise.

Macro variables

GDP GDP growth.

Real Interbank 12m Real interbank 12-month interest rate.

References

- Acharya V, Carpenter JN, Gabaix X, John K, Richardson M, Subrahmanyam MG, Sundaram RK, Zemel E (2009) Corporate governance in the modern financial sector. In: Acharya V, Richardson M (eds) Restoring financial stability. Wiley Finance, Hoboken, pp 185–196
- Acharya V, Gujral I, Kulkarni N, Shin HS (2011) Dividends and bank capital in the financial crisis of 2007–2009. NBER Working Paper 16896
- Acharya VV, Thakor AV (2016) The dark side of liquidity creation: leverage and systemic risk. *J Financ Intermed* 28:4–21
- Adrian T, Shin H (2010a) Liquidity and leverage. *J Financ Intermed* 19:418–437
- Adrian T, Shin H (2010b) The changing nature of financial intermediation and the financial crisis of 2007–2009. *Annu Rev Econ* 2:603–618
- Almazán A, Martín-Oliver A, Saurina J (2015) Securitization and banks' capital structure. *Rev Corp Financ Stud* 4:206–238
- Ayuso J, Pérez D, Saurina J (2004) Are capital buffers pro-cyclical? Evidence from Spanish panel data. *J Financ Intermed* 13:249–264
- Beltratti A, Stulz RM (2012) The credit crisis around the globe: Why did some banks perform better? *J Financ Econ* 105:1–17
- Berger AN, Udell G, Udell M (2013) How does capital affect bank performance during financial crises? *J Financ Econ* 109:146–176
- Bradley M, Jarrell G, Kim EH (1984) On the existence of an optimal capital structure: theory and evidence. *J Financ* 39:857–878
- Brunnermeier MK (2009) Deciphering the liquidity and credit crunch 2007–2008. *J Econ Perspect* 23:77–100

- Carbó-Valverde S, Rosen RJ, Rodríguez-Fernández F (2017) Are covered bonds a substitute for mortgage-backed securities? *J Econ Policy Reform* 20(3):238–253. doi:[10.1080/17487870.2017.1293537](https://doi.org/10.1080/17487870.2017.1293537)
- Covitz DM, Harrison P (2004) Do banks time bond issuance to trigger disclosure, due diligence, and investor scrutiny? *J Financ Intermed* 13:299–323
- Demirguc-Kunt A, Detragiache E, Morrouche O (2013) Bank capital: lessons from the financial crisis. *J Money Credit Bank* 45:1147–1164
- Frank MZ, Goyal VK (2003) Capital structure decisions: which factors are reliably important? *Financ Manag* 38:1–37
- Frank MZ, Goyal VK (2008) Trade-off and pecking order theories of debt. In: Eckbo BE (ed) *Handbook of corporate finance: empirical corporate finance*, vol 2. *Handbook of finance series*. Elsevier, Amsterdam
- Gropp R, Heider F (2010) The determinants of bank capital structure. *Rev Financ* 14:587–622
- Kalemly-Ozcan S, Sorensen B, Yesiltas S (2012) Leverage across firms, banks and countries. *J Int Econ* 88:284–298
- Loutskina E (2011) The role of securitization in bank liquidity and funding management. *J Financ Econ* 100:663–684
- Loutskina E, Strahan PE (2009) Securitization and the declining impact of bank finance on loan supply: evidence from mortgage originations. *J Financ* 64:861–889
- Mehran H, Morrison A, Shapiro J (2011) *Corporate governance and banks: have we learned from the crisis. The crisis aftermath: new regulatory paradigms*, Centre for Economic Policy Research
- Morrison AD, White L (2005) Crisis and capital requirements in banking. *Am Econ Rev* 95:1548–72
- Mishkin F (2000) *The economics of money, banking and financial markets*, 6th edn. Addison Wesley, New York
- Myers SC, Majluf NS (1984) Corporate financing and investment decisions when firms have information that investors do not have. *J Financ Econ* 13:187–221
- Rauh J, Sufi A (2010) Capital structure and debt structure. *Rev Financ Stud* 23:4242–4280
- Repullo R, Saurina J, Trucharte C (2010) Mitigating the procyclicality of basel II. *Econ Policy* 25(64):659–702
- Repullo R, Suárez J (2012) The procyclical effects of bank capital regulation. *Rev Financ Stud* 26:452–490
- Rixtel AV, Romo L, Yang J (2016) The determinants of long-term debt issuance by European banks: evidence of two crises. Bank of Spain Working Paper 1621
- Rochet J (1992) Capital requirements and the behavior of commercial banks. *Eur Econ Rev* 36:1137–1170
- Titman S, Wessels R (1988) The determinants of capital structure choice. *J Financ* 43:1–19

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.