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Autor

Alfredo Martín Oliver
Universidad de las Islas Baleares

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BANK'S GROWTH, HYBRID INSTRUMENTS AND CAPITAL REGULATION

Alfredo Martín Oliver
Universitat de les Illes Balears

ABSTRACT

This paper studies the impact of the growth in real-estate loans on the quantity and quality of banks' capital during the pre-crisis period. It presents an approach that combines traditional corporate finance theories, bank capital regulation and an analysis of the determinants to issue debt and capital instruments. Using data of Spanish banks during the period 1999-2007, we provide evidence that bank capital has been deteriorating as a result of a leveraging process within capital (increasing weight of hybrid capital) that responds to the same determinants that explain standard leverage. The reason is that banks financed the growing gap between loans and deposits with new debt issuances and the consequent capital needs were mainly covered with hybrid capital. The paper also presents evidence that capital regulation plays a key role in the decision to issue capital and debt instruments: Debt issuances are preceded by the issuance of capital; capital issuances are substitutes of other internally-generated funds; and banks closer to the regulatory minimum are more likely to issue capital and limit the use of debt.

JEL CLASSIFICATION: G21; G28.
KEYWORDS: Bank capital regulation, leverage, hybrid capital, financial markets.

1. INTRODUCTION

This paper explores how banks financed the expansion of their balance sheets during the years prior the recent financial crisis and how this growth impacted on the composition of bank capital. Using a sample of Spanish banks during the period 1999-2007, we find that bank growth did not significantly affect leverage ratios, but it deteriorated the com-

position of regulatory capital because the weight of hybrid instruments increased with respect to core capital funds (i.e. shares and reserves). This leveraging process in regulatory capital (higher proportion of debt-like instruments) responds to the same determinants that explain standard leverage. We find that banks financed the growing gap between loans and deposits with new debt issuances and the consequent capital needs were mainly covered with hybrid capital. More concretely, during the period 1999-2007 the volume of preferred shares and subordinated debt issued by Spanish banks represented 72.14% of the total volume of regulatory capital issuances.

There is a growing literature that analyzes the causes and consequences of the 2008 crisis and it seems to be a consensus in pointing to financial innovation as responsible of the excessive credit growth and the reduction in credit standards applied by banks at the time of granting loans.[1,2] Within this line of research, there are papers that point the increasing deterioration of bank capital as one of the main culprits of the risky decisions made by banks prior and during the current financial crisis. It is generally accepted that capital should deter banks to take bad risk practices and enhance good bank governance to minimize the exposition of shareholders to the risk of failure (Rochet, 1992; Morrison and White, 2005). Indeed, there is evidence that better capitalized banks have been able to cope better with severe losses derived from the current crisis (Demirguc-Kunt, Detragiache and Morrouche, 2013; Beltratti and Stulz, 2012; Berger and Bouwman, 2013). However, recent papers provide descriptive evidence of a deterioration of bank capital prior and during the crisis that could have dwindled the capacity of capital to act as a corporate governance mechanism, since the participation of owners in potential losses has become smaller (Acharya et al., 2009, Mehran, Morrison and Shapiro, 2012). According to Acharya, Gujral, Kulkarni and Shin (2011) this dwindling weight of common capital could also explain the difficulties of banks to raise new funds, since creditors will only lend if common shareholders are bearing a significant part of the risk.

The previous papers provide descriptive evidence of how the deterioration in quantity and quality of bank capital can be at the core of the excessive risk taken by banks and

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[1] Greenlaw, Hatzius, Kashyap and Shin (2008) estimate the mortgage credit losses and highlight the role of leverage and mark-to-market in propagating the shock. Brunnermeier (2009) explains the economic mechanisms that caused losses in the mortgage market to amplify into the large dislocations and turmoil in the financial markets.

[2] The main focus of this literature is on analyzing how financial innovation has impacted on banks' performance and how it sustained the excessive growth in loans Almazán, Martín-Oliver and Saurina (2015), Loutskina (2011), Loutskina and Strahan (2009).

of the subsequent credit crunch that impedes them to lend. However, little is known about the reasons why banks decide to increase the proportion of hybrid capital within their regulatory capital. This paper posits two new approaches to analyze this phenomenon, a static approach and a dynamic approach. In the static approach, the paper explores the determinants of the *leverage within capital*, that is, the growing importance of debt-like instruments (i.e., preferred shares and subordinated debt) within regulatory capital. To do so, we study the determinants of the ratio one minus core capital (common capital and reserves) with respect to regulatory capital and we analyze if this leveraging process within capital has some parallelism with the standard theories on leverage. In the dynamic approach, the paper studies the dynamics of the leverage ratio, exploring the driving forces of the issuance of debt and capital instruments. This dynamic approach enables to study decisions and elements that can be hidden or overlooked in the analysis of the evolution of leverage ratios and that are essential to understand the process of leveraging within capital. This approach will let us explore the timing in the issuances of debt and capital and the effect of variables such us credit growth, maturity of past issuances or a potential herd behavior on the banks' decision to issue financial instruments.

The static approach posited in this paper adopts the standard theories of the corporate finance literature to explore the reasons of capital deterioration. We first study whether bank capital structure can be explained with the theories accepted for non-financial firm and then we will explore if these findings can be applied to understand the leveraging process within capital. The limited number of studies on bank capital structure contrasts with the extensive literature[3] that analyzes the determinants of leverage for non-financial firms, with papers by Bradley et al. (1984), Long and Malitz (1985), Titman and Wessels (1988), Crutchley and Hansen (1989), Smith and Watts(1992), Rajan and Zingales (1995) and Frank and Goyal (2007). Summing up the findings of this literature, it is generally accepted that there is a limited list of factors that are correlated with cross-sectional differences in leverage (Frank and Goyal, 2008): leverage is positively related with size and tangibility of assets and it is negatively related with profits, growth and dividends. More recently, Lemmon, Roberts and Zender (2008) found that leverage ratios are mainly explained by time invariant, unobservable factors that are idiosyncratic for each firm.

For the bank firm, there is little evidence of how banks choose their level of leverage. It has been argued that the corporate finance theory cannot be applied to banks becau-

[3] See Harris and Raviv (1991) and Frank and Goyal (2008) for a survey.

se they have the obligation to fulfill capital regulation and, thus, leverage ratios are exogenously determined. The strict interpretation of this statement would impose a unique leverage ratio that would only respond to external regulation rather than to corporate finance incentives (Mishkin, 2000), though this theory is not supported by data, given the dispersion observed in leverage ratios. Gropp and Heider (2010) found for a sample of large US and European banks that cross sectional determinants of non-financial firms' leverage also applied to banks' leverage, being the role of capital regulation and the role of deposit insurance of second-order importance. In this paper, we reconcile both approaches, since we find that the differences in leverage ratios across banks respond to corporate finance predictions, but bank regulation also affects decisively the decisions on bank capital structure. As well, we find that the predictions of leverage can be applied to explain the leveraging process in the regulatory capital. This suggests that banks do not perceive all the components of regulatory capital as homogeneous, and they adjust its composition considering that hybrid instruments have debt properties different to common capital.

The dynamic approach of the paper studies the driving forces in the banks' decision to issue debt and capital, and it enables us to focus on decisions not observable in the static approach. From this analysis, we find that the leveraging process in capital is the result of the financing of the growing gap between loans and deposits through debt issuances and the issuance of hybrid instruments to cover the consequent regulatory capital needs. This approach also provides some understanding on how the decision to issue capital and/or debt instruments is made, analyzing the timing of debt and capital issuances (i.e., whether the issuance of debt is preceded, followed or not related with capital issuances), whether capital issuances complement or substitute accumulated profits and other sources of internal funds, whether they depend on decisions of financing made in the past (maturity of previous issuances, having issued other instruments previously), on characteristics of banks (savings banks, to be listed in the stock market,) or whether they depend on macro conditions (GDP, interest rates). Additionally, we also explore several hypotheses that might explain the excessive growth of banks balance sheets, as a potential herd behavior in determining the issuances of financial instruments in the markets or the potential influence of favorable market and macro conditions.

We use a database of Spanish banks during the period 1999-2007 that merges the information of monthly issuances of debt and capital instruments from Dealogic with information of relevant financial variables drawn from Bankscope. The reason why we focus on Spanish banks is because they have been one of the most important issuers of new financial instruments, especially securitization (Almazán, Martín-Oliver and Saurina,

2015), and they have also experimented one of the larger growths in bank balance sheets around the world. Also, the focus on one single country will allow us to study a delimited universe of banks, to take into account how heterogeneity across banks might affect to the decisions of raising funds from the markets (i.e., differences in size, legal nature; commercial versus savings banks,…).

This paper contributes to the literature in a variety of fields. First, it explores the driving forces of the deterioration of bank capital during the pre-crisis period. Mehran et al.(2012) and Acharya et al. (2011) provide descriptive evidence of the phenomenon, but there is no empirical analysis of the reasons that explain this deterioration. In this paper we provide two new approaches to address the issue: a static approach, that explores the determinants of the ratio of leverage in capital; and a dynamic approach that enables us to study decisions that can be overlooked in the static approach. Second, it contributes to capital regulation to justify the tougher definition of regulatory capital in Basel III, since we provide evidence that banks have maintained their regulatory capital ratio at constant levels in the last period of expansion through the issuance of hybrid instruments that deteriorated the quality of regulatory capital. This implies that the problem of credit expansions/recessions on capital are not only of pro-cyclicality (Repullo and Suárez, 2013; Repullo, Saurina and Trucharte, 2010; Ayuso, Pérez and Saurina, 2004), but also of the composition of the capital. Third, we reconcile the approaches given by corporate finance and capital regulation of the decisions of leverage made by banks. We find that, whereas the differences in leverage observed across banks can be explained with the same factors that apply to-non financial firms (as in Gropp and Heider, 2010), the decision to issue capital and debt instruments respond to an active management of leverage and regulatory capital ratios, which is more pronounced for banks close to the regulatory minimum. Finally, we provide evidence that the leveraging process of banks within the capital can also be explained by the same forces that explain total leverage ratios of non-financial firms. This result can be interpreted as evidence that the components of regulatory capital are not homogeneous for banks and they have increased the leverage in capital (i.e. increase weight of hybrid instruments) following the same patterns than in the choice of the debt-to-capital ratio.

The rest of the paper is structured as follows. Section 2 analyzes the theoretical setup of the leverage equation applied to banks and the determinants of the issuances of debt and capital instruments. Section 3 presents the database and some descriptive statistics of the variables. Section 4 presents the empirical model and the main results and, finally, Section 6 contains the conclusions of the paper.

2. STATIC AND DYNAMIC APPROACHES OF THE BANK LEVERAGE

This section explores the decisions that affect the leverage of banks from two different approaches. On the one hand, the static approach, in which we review the main theories to explain leverage ratios in non-financial firms and how we apply them for the bank firm. On the other hand, the dynamic approach, in which we analyze the determinants of the decision to issue capital and debt instruments in the financial markets taking into account that banks have optimal levels of leverage and regulatory capital towards which they want to converge.

2.1. Some evidence on leverage in banks

There is an extensive literature that has studied the determinants of leverage in non-financial firms.[4] However, there are few papers that have explored whether these theories are also applicable for banks mainly because it has been argued that bank leverage is determined by regulation: Since they have the obligation to fulfill the capital regulation set at supra-national level, it had been admitted that the leverage ratio of banks responded to external regulation rather than to corporate finance incentives (Mishkin, 2000). However, the empirical data shows that, far from being homogeneous, there is dispersion in the leverage of banks. Figure 1A presents the distribution of the book capital ratio for Spanish banks for a selection of years in the sample. We observe a wide dispersion in the levels of leverage across banks for any of the years, so there is room to study how these leverage ratios are determined and how decisions are made. Further, we also present in Figure 1B the dispersion of the Basel ratio for Spanish banks during the same period and we also observe that, apart from being above the minimum 8% set by the Basel accord, banks hold different buffers above this minimum that discard the hypothesis of one unique and common ratio for all banks.

Nonetheless, if we observe the evolution of the distributions of the capital ratios over time, we can see that both the distribution of the book capital ratio and the Basel capital ratio have remained fairly stable over time, though the former is concentrated in values smaller than 10%. This constant distribution of ratios over the years can suggest the existence of a constant heterogeneity across banks in optimal capital structures, that is, capital ratios are different across banks, but these differences are maintained over time.

[4] Titman and Wessels (1988), Crutchley and Hansen (1989), Smith and Watts(1992), Rajan and Zingales (1995) and Frank and Goyal (2007), among others.

FIGURE 1. YEARLY DISTRIBUTION OF CAPITAL RATIOS

FIGURE 1A: EQUITY / ASSETS

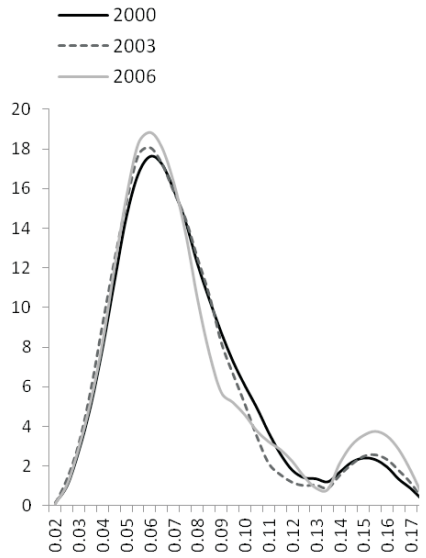


FIGURE 1B: BASEL COEFFICIENT

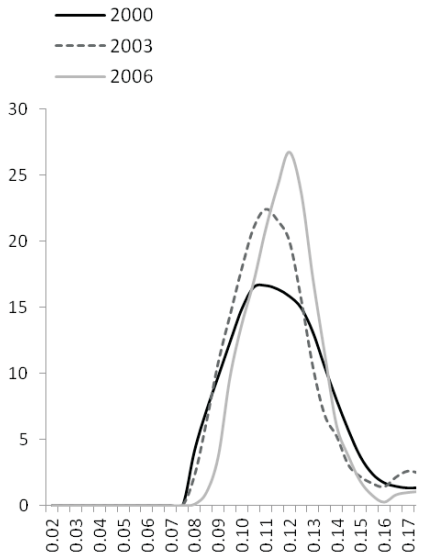


FIGURE 1C: (EQUITY+PREF.SHARES+SUBORD. DEBT)/ASSETS

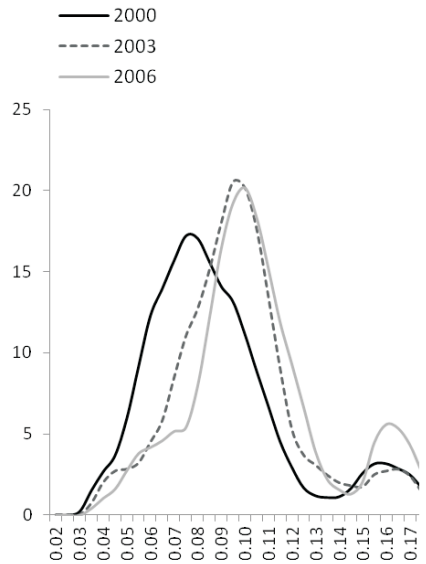
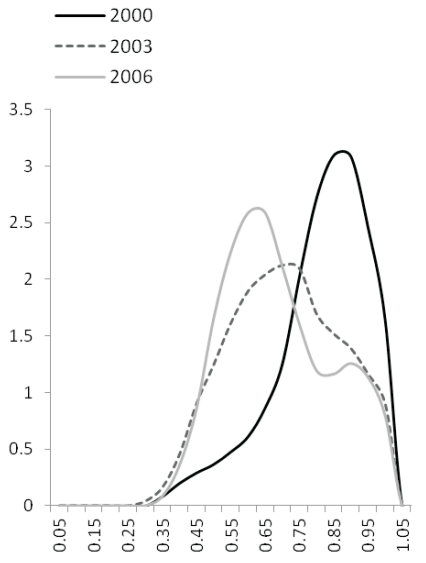


FIGURE 1D: EQUITY / (EQUITY+PREF. SHARES+SUBORD.DEBT)



Finally, Figures 1C and 1D provide evidence of the deterioration of Spanish banks' capital over time. Although we observe a slight increase in the weight of total capital instruments with respect to total assets (Figure 1C, the distribution shifts slightly towards the right), the composition of this capital has been evolving towards a structure in which debt-like instruments have become more important (Figure 1D). This evidences that the deterioration of capital in Acharya et al. (2011) and Mehran et al. (2012) has also been a characteristic of Spanish banks prior the crisis.

In the next sections, we will explore the determinants of these empirical facts. First, we will focus on the differences in leverage across banks and its determinants and we will test if there is an optimal leverage for every individual bank to which it converges. Next, we will study whether the observed increasing weight of hybrid capital can be read as a leveraging process within regulatory capital, since there is an increment of the debt-like instruments (subordinated debt and preferred shares) with respect to common equity. Finally, we will explore how banks issue debt and capital, taking into account their financial situations and other important matters, in order to achieve their optimal leverage and Basel ratios.

2.2. Static approach to bank leverage: The leverage equation

Corporate Finance

There is an extensive literature that has aimed at determining which factors are correlated with leverage, including papers by Titman and Wessels (1988), Crutchley and Hansen (1989), Smith and Watts(1992), Rajan and Zingales (1995) and Frank and Goyal (2007) and they have converged to a limited list of variables that are related to leverage. The consensus establishes that leverage is positively related with size and tangibility of assets and it is negatively related with profits, growth and dividends. The reasons why are explained by different corporate finance theories of leverage (See Harris and Raviv, 1991 and Frank and Goyal, 2008 for a survey). The main bulk of this literature estimates the leverage equation, which is based on explaining the leverage ratio in terms of the observable finance variables in order to test an effect or prediction. They aim at finding the cross-sectional determinants that explain the dispersion in leverage ratios across non-financial firms. More specifically, the leverage ratio is expressed in terms of the variables mentioned before:

$$L_{it} = b_o + b_1 Div_{it\text{-}1} + b_2 Growth_{it\text{-}1} + b_3 Tang_{it\text{-}1} + b_4 Profits_{it\text{-}1} + b_5 Size_{it\text{-}1} + u_{it}$$

where the expected signs of the coefficients are $b_1<0$; $b_2<0$; $b_3>0$; $b_4<0$; $b_5>0$, according to the predicted effects and sub-index i and t respond to bank i and time t, respectively.

In this paper, we will adapt the leverage equation to the bank firm. Our aim will be to determine whether the decisions of leverage in the bank firm are driven by the same forces that determine leverage in non-financial firms or, on the contrary, the corporate finance theories are not applicable to banks. The main reason why there can be a deviation in the behavior of banks is due to the existence of a regulation in capital that obliges banks to hold a minimum level of capital that is a function of the risk of the assets. We analyze this theory below.

We also will explore whether the levels of leverage for each bank remain constant over time and whether they are independent of the variables that explain the differences in book capital ratios across banks, as Lemmon et al. (2008) found for non-financial firms. Indeed, Lemmon et al. (2008) found that the optimal levels of leverage for each bank were mainly explained by idiosyncratic, unobservable, time-invariant components and they estimated the speed of adjustment towards these optimal levels. This paper adapts this setup and will compare the results obtained for banks with those obtained in previous papers, to assess if the leverage ratios of banks are also idiosyncratic and time invariant over time. If this was the case, the next question we will raise is how they manage to target the optimal levels of leverage.

Regulatory capital

The alternative explanation is that the book capital ratio of banks will be determined by capital regulation. The strict interpretation of this theory would suggest that there will not be much dispersion across banks leverage ratios (Mishkin, 2000), but this does not seem to be the case, as we have seen in Figure 1. A less strict interpretation of this theory would expect some effect of capital regulation on Basel ratios and, possibly, on book leverage ratios of banks, though this effect is expected to be lower the higher is the extra amount of capital that banks hold above the regulatory minimum, the so-called buffer of capital. In this line, we will explore if the predicted effects of the variables in the leverage equation are different for banks that are close to the regulatory minimum of capital, so as to learn whether capital regulation does have some effect in the decisions of leverage that make banks close to the minimum capital requirements behave differently from banks with a larger buffer.

Finally, we will apply the leverage equation to the relation between core capital to total regulatory capital. The aim is to analyze whether the increasing weight of hybrid capital observed in data can be read as a leveraging process within regulatory capital, since there is an increment of the debt-like instruments (subordinated debt and preferred shares) with respect to core capital. If this was the case, we could conclude that the components of regulatory capital are not homogeneous for banks and the choice of the weights of debt-like instruments responds to a leveraging process that follows the same patterns as the choice of the whole bank capital structure.

2.3. Dynamic approach to bank leverage: Issuance of debt and capital instruments

In the static framework, we have presented applied standard corporate finance theories to explain the leverage of the bank firm. Now we are interested in exploring the factors that affect the probability to issue financial instruments so as to study the dynamics of the components of the leverage ratio and of the leveraging process in capital. The reason why we posit a dynamic approach is to analyze factors and decisions that can be overlooked in the analysis of the ratios. That is, we can study how banks aim to reach or maintain a certain level of leverage in a framework of growth: whether they issue debt/capital, whether there is a timing in the issuances of debt and capital, whether capital issuances are substitutes of internally generated funds, whether past issuances reaching maturity are refinanced using debt or capital, and so on. More concretely, we will explore whether the probability to issue debt, capital or not to issue is affected by the following groups of factors:

Optimal leverage. We consider whether the variables included in the leverage equation (size, tangibility of assets, profits, growth and dividends) are also affecting the issuance of debt/capital. If banks want to modify their leverage ratio towards their optimal value, they can issue debt and/or capital instruments. We could expect that the probability to issue debt (capital) will have the same (opposite) relation with these variables than in the leverage equation, provided that banks want to increase (decrease) their leverage ratio.

Capital regulation. Banks have to fulfill Basel capital regulation and, thus, the issuances of debt and capital instruments will not be independent of its Basel ratio target. That is, banks will consider how new issuances of instruments impact on their regulatory capital levels. If this was the case, we could expect a positive correlation between the probability to issue debt and the probability to issue capital in the recent past or in the

near future. This correlation could be non significative if internally generated funds (that account as regulatory capital) were substitutes of new capital issuances and they increased (at least) at the same pace as risk weighted assets. On the other hand, we expect that banks close to the regulatory minimum will limit the issuances of debt and will be more likely to issue capital instruments.

Liquidity needs. The policy of growth and the availability of traditional sources of external funds (deposits) will determine whether a bank has the need to raise funds in the financial markets. We expect a positive correlation between the probability to issue financial instruments and variables that proxy the liquidity needs of banks. We expect higher correlations in the financing alternatives that are cheaper for the bank, considering cost of issuance, tax advantages or cost of capital.

Past issuances. The calendar of issuances will be affected by the history of past issuances of banks. First, the maturity of past issuances will possibly imply the need to refinance them. We will expect a positive correlation between the maturity of past issuances and the probability to issue new instruments. We also expect that, if possible, the refinancing will be carried out with the cheapest option available for banks. Second, the fact of having issued successfully in the past any kind of instruments in the financial markets could be positively correlated with the decision to issue capital and/or debt instruments in the future, since banks are already known by investors and the asymmetric information problem is reduced.

Market conditions. The conditions of financial markets and the thirst of investors to absorb new issuances is a key factor at the time to decide whether or not banks issue new instruments. We expect a positive correlation between the number and volume of recent, successful issuances in the market and the probability of a bank issuing debt or capital. Nonetheless, in the heat of the expansion period 2003-2006, one could have argued that new issuances were only responding to market conditions and they were independent of the internal factors of the bank (i.e., banks were issuing instruments because it was cheap and the rest of banks were issuing instruments). If this was the case, we would have some evidence that banks had been acting following a herd behavior.

Macro conditions. We include macroeconomic conditions as control variables in the model. Whether the national or global economy is growing, inflation rates, interest rates and other macro variables determine the decision to grow of banks, the cost of funds and, thus, the decision to issue debt or capital.

Summing up, we posit a theoretical framework in which the probability of issuing debt, equity or not issuing in the financial markets can be expressed as a function of groups of factors, that is:

$$Pr(k)=f\,(Optimal\ Leverage, Capital\ Reg, Liquidity\ Needs, Past\ Issuances, Market\ and\ Macro\ Cond)$$
$$k=\{Capital, Debt, No\ issuance\}$$

3. DATABASE AND DESCRIPTIVE STATISTICS

3.1. Database

Our main sources of data are Bankscope and Dealogic and we use consolidated data of Spanish commercial and savings banks during the period 1999-2007. This period covers the years of booming and expansion of the Spanish and global economy and expansion of banks' balance sheets, funded mainly with the issuance of new instruments (securitization) in the financial markets. We exclude subsequent years of the financial crisis, when financial markets did not operate normally.

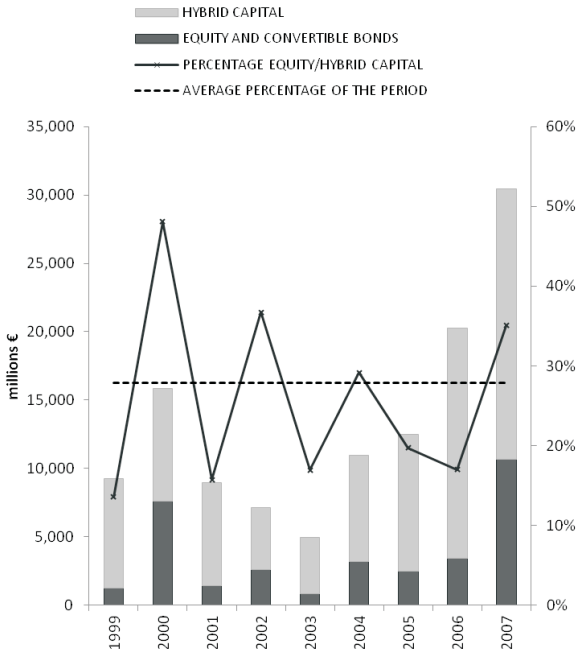
The data needed in the leverage equation is mainly drawn from the information that Bankscope has on balance sheet, P&L account and regulatory capital and completed from the annual reports of banks in the case of missing values.

On the other hand, the data of issuances of debt and equity in the markets has been drawn from Dealogic, from which we have monthly information since 1988. The issuances are classified into two groups, debt issuances and capital issuances, following the criteria of whether the corresponding instrument can absorb losses without risking the viability of the bank. Under this notion of capital, ordinary shares, convertible debt, preferred shares and subordinated debt have the capacity of absorbing losses because it is the ultimate stakeholder the one that assumes the loss of value. On the other hand, we group the issuances of senior debt, covered bonds and securitization as debt issuances because their value and proceeds do not absorb any kind of losses of the bank.[5] This is one of the two notions of capital in Acharya et al. (2011) that

[5] 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, Martín-Oliver and Saurina (2012) show that Spanish banks deployed securitization not ho transfer risks (they offered credit enhancements and kept the worst tranches), but exclusively to obtain liquidity,

coincides with the list of eligible capital of Basel I and II and it is consistent with Rauh and Sufi (2010) and Gropp and Heider (2010). We will not apply the alternative notion of capital (which only includes common shares) in the analysis of issuances because the bulk of issuances that computed as regulatory capital were in the form of hybrid capital. More concretely, only 27 out of 180 capital issuances corresponded to common shares or convertible debt, which is a low number of observations if we wanted to consider them separately. Figure 2 shows that the volumes of issuances of common capital and convertible debt represented the 27.86% of the total capital issued, what implies that the issuances of these instruments were of higher volume that those of hybrid capital.

FIGURE 2. COMPOSITION OF CAPITAL ISSUANCES: CORE CAPITAL AND HYBRID CAPITAL



Sas a complement instrument to debt. Indeed, Spanish banks accounted the liability counterpart of securitization as deposits because Spanish regulation did not let them to remove securitized assets from the balance sheet.

With these data, we can merge the issuances of capital and debt with the financial structure of the issuer bank and learn the determinants of the issuance of debt and equity. However, we have different frequencies, since Bankscope data is available at yearly basis and Dealogic data is available at monthly basis. To cope with this mismatch, 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. We are implicitly assuming that the decisions of issuance depend only on the financial structure and, thus, leverage ratios, at the beginning of the year and not to the variations that take place during the year.

3.2. Descriptive Statistics

Table 1 collects some relevant figures of the issuances of instruments of debt and capital drawn from Dealogic. Our sample is made out by Spanish commercial and savings banks for which we have data on the relevant variables defined in the paper. We exclude credit cooperatives because the data on NPL ratio and regulatory capital ratio was incomplete. The first column of Table 1 shows the number of banks for which we have data on all the relevant financial variables, showing that our sample starts with 92 banks in 1999, remains around 85 banks in most part of the sample and ends up with 70 banks. The second column of Table 1 collects the number of bank-month observations that did not issue capital or debt during that month. The rest of the table shows some descriptive statistics of the issuances of debt and capital for Spanish banks. We observe that the number of issuances of debt has multiplied sevenfold during the sample period, from 28 in 1999 to 195 in 2006, when the peak was reached prior the outburst of the crisis in mid-2007. Capital issuances have also increased but at a slower pace, peaking 40 issuances in 2006 that doubled the 16 of 1996. Nonetheless, the average balance of capital issuances is larger than the average issuance of debt, and the difference is increasing over time. At the beginning of the sample period, Spanish banks issued a higher volume of capital than debt instruments (34.6 and 27.1 billions of euros in 1999, respectively), but the situation reversed from 2001 because of the increase in the average volume and number of issuances of debt. Then, in 2007 with the beginning of the crisis, the number of issuances of capital almost halved but this was compensated by the jump in the average volume of issuances and the total volume issued became higher than the volume of debt (196.5 and 151.4 billions of euros, respectively). We also observe that, with the exception of capital in 2007, the distribution of the volume issued for both debt and capital remained fairly stable over time in spite of the increase in the number of issuances, what can be observed in the relatively constant values of the standard deviations and percentiles.

TABLE 1. DESCRIPTIVE STATISTICS OF THE ISSUANCES OF DEBT AND CAPITAL OF SPANISH BANKS

The column *Number of banks* collects the number of banks for which we have information in Bankscope and *Not issuing that month* refer to the sum of observations of banks that do not issue in the considered year. For instance, in 1999 we have that, on average, there were 88 banks that did not issue during a month (1060 / 12 months). Data on volume of issuances is expressed in millions of Euros.

	number of banks	not issuing that month	DEBT INSTRUMENTS					CAPITAL INSTRUMENTS				
			Number of issuances	Volume of the issuances				Number of issuances	Volume of the issuances			
				Average	Std.Dev.	P25th	P75th		Average	Std.Dev.	P25th	P75th
1999	92	1060	28	775	1860	104	449	16	2163	2020	591	3160
2000	85	980	37	590	601	146	791	14	3701	4300	890	4540
2001	85	933	68	660	1620	100	435	19	1593	1990	462	2040
2002	84	940	67	778	2290	140	704	12	2581	3400	950	2480
2003	86	885	131	594	866	110	646	16	2369	4570	175	2160
2004	83	841	139	709	1120	100	690	16	3222	5450	275	3380
2005	85	824	170	766	1160	150	1000	26	3324	5500	290	4210
2006	81	737	195	1095	2930	100	950	40	2418	3730	450	3720
2007	70	621	184	823	1330	150	967	23	8547	13100	350	7560

4. EMPIRICAL MODEL AND RESULTS

This section presents the empirical models and results of the theoretical model of Section 2.

4.1. Static approach: Leverage equation

4.1.1. Empirical model

In our exercise, we will adapt this list to our sample in order to test whether the bank firm makes decisions on leverage with the same considerations as non-financial firms or whether, as suggested by other authors (Mishkin, 2000), the leverage ratio is determined by capital requirements set by regulation and does not respond to corporate finance issues. The variables considered in the analysis are:

Dividends. Dummy variable that identifies a bank that has issued dividends. The expected sign is negative because firms highly leveraged are more likely to retain profits to fund future growth or cancel debt.

Tobin's Q. It is defined as the ratio of market-to-book value of the capital of the bank[6] and it captures the effect of growth and expansion opportunities of the bank, which are positively related with the numerator of the ratio.

Collateral. It is a measure of the tangibility of the assets available for the bank equal to the proportion of liquid assets that are easier to convert to cash and suffer a smaller loss of their value in case of distress (see Appendix for an exact definition of this variable). The trade-off theory then predicts that firms with more collateral will suffer smaller distress costs and will have more leverage.

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[6] As we have *cajas* and some small commercial banks that are not listed in the stock market, we construct the market value actualizing the forecast of future profits at a discount rate that depends on the risk of the bank (see definition of variables in the Appendix). Our measure has a high correlation with the market value since, for the observations for which we have data (237 observations), the coefficient of correlation and Spearman's rho are 91.88% and 94.40%, both significant at 1%. We also obtain high correlation in the quartile regression at 50th percentile of the actual market value on our predicted value for the banks listed in the stock market, since the slope coefficient is 0.85 and intercept is 105.8, both significant at 1%. All the regressions in the paper have been estimated using the Tobin's *Q* replacing the market value by the predicted value for listed banks and the results do not change noticeably.

ROA: It is the proxy of banks profits; banks with higher profits would be less levered because they have more internal funds.

Size: Leverage is expected to be negatively related to size and we include the log of assets at the end of the period to capture this effect.

Risk: In spite of risk not being included in the list of reliable factors related to leverage, we include it in the regression because capital requirements are higher as the risk of assets increase, implying a negative relation between risk and leverage.[7] Our measures of risk will be the non-performing loan ratio (*NPL*) as a measure of the risk within the loan portfolio of the bank and the standard deviation of the ROA to capture the risk in the returns of the bank.

As an alternative explanation, Gropp and Heider (2010) posit that market-to-book ratio, profits and dividends could have a positive effect instead of the predicted for non-financial firms if banks were holding capital buffers so as to avoid costs of issuing equity at short notice (Ayuso, Pérez and Saurina, 2004). Under this view, these variables would act as signal for the markets that reduces the asymmetric information and enable banks to raise funds at lower cost.

The variables under the title *Optimal Leverage* of Table 2 provide some descriptive statistics of the main variables used in the leverage equation. Among other characteristics, we observe that only 23.7% of the observations correspond to banks that payed dividends during the year, Tobin's *Q* is centered at 1.7 in a symmetric distribution (similar value of the average and the median); 35% of the assets are, on average, liquid assets and the profitability of assets is around 0.7%.

Taking into account all the previous factors, we our basic regression will be:

$$L_{it} = b_t + b_1 Div_{it\text{-}1} + b_2 Q_{it\text{-}1} + b_3 Coll_{it\text{-}1} + b_4 ROA_{it\text{-}1} + b_5 ln\ Assets_{it\text{-}1} + b_6 NPL_{it\text{-}1} + b_7 Sd(ROA_{it\text{-}1}) + u_{it}$$

[7] Gropp and Heider (2010) did obtain a negative effect of risk for banks and Welch (2004) or Lemmon et al (2008) for non-bank firms.

TABLE 2. DESCRIPTIVE STATISTICS OF EXPLANATORY VARIABLES

Data of Spanish commercial and savings banks during the period 1999-2007. The Appendix contains the definition of the variables and how they have been constructed.

	Average	Median	Std.Deviation	25thPercentile	75thPercentile
Optimal leverage					
Dividends	0.237	0.000	0.425	0.000	0.000
Q Tobin	1.703	1.737	0.803	1.170	2.220
Collateral	0.355	0.314	0.231	0.198	0.472
ln Assets	8.226	8.464	1.863	7.204	9.304
ROA	0.007	0.008	0.013	0.006	0.011
Leverage and Capital Variables					
Leverage	0.910	0.931	0.062	0.906	0.944
Basel capital ratio	0.152	0.117	0.137	0.103	0.136
Leverage in Capital	0.138	0.136	0.166	0.000	0.271
Close	0.177	0.000	0.382	0.000	0.000
Capital Regulation					
Issuer Capital in t-1 to t-3	0.047	0.000	0.212	0.000	0.000
Issuer Capital in t-4 to t-12	0.094	0.000	0.292	0.000	0.000
Issuer Debt in t-1 to t-3	0.259	0.000	0.438	0.000	1.000
Issuer Debt in t-4 to t-12	0.399	0.000	0.490	0.000	1.000
Loan Loss Reserve/Loans	0.020	0.019	0.010	0.015	0.023
NPL ratio (x100)	1.362	0.998	1.363	0.600	1.523
Z score	1.790	1.897	0.863	1.306	2.445
Sd(ROA) (x100)	0.192	0.137	0.137	0.080	0.263
Liquidity Needs					
Loans / Deposits	0.816	0.839	0.324	0.676	0.969
Past Issuances					
Issuer in Past	0.502	1.000	0.500	0.000	1.000
Maturity Past Issuance	0.191	0.000	0.393	0.000	0.000
Market Conditions					
ln Herd Behavior	4.197	4.248	0.527	3.555	4.643
ln Volume Herd Behavior	24.95	25.10	0.94	24.41	25.59
Macro Variables					
Growth in House Prices	0.140	0.148	0.036	0.124	0.175
GDP	0.036	0.036	0.005	0.032	0.039
Real Interbank 12m	0.005	0.003	0.009	-0.002	0.012
CPI	0.030	0.031	0.006	0.030	0.034
Idiosyncratic variables					
Listed Stock market	0.135	0.000	0.342	0.000	0.000
Saving bank	0.568	1.000	0.495	0.000	1.000

The dependent variable of leverage is defined as one minus the ratio of capital and reserves over total assets which considers non-debt liabilities (i.e., deposits) as leverage (Gropp and Heider, 2010). We also use another measure of leverage that includes preferred shares and subordinated debt as capital. These two dependent variables account for the two notions of capital pointed in Acharya et al.(2011), one that only considers common equity and reserves and the extended version implicit in Basel I approach that includes hybrid instruments In a second step, our dependent variable will be the *leverage in capital*, that is, the weight of equity and reserves with respect to the total regulatory capital, so as to analyze the determinants of the composition of regulatory capital. This second step will enable us to study the reasons of the deterioration of capital in Spanish banks All the regressions include time dummy variables and also two dummy variables identifying whether the bank is a savings bank (as opposed to commercial bank) and whether the bank is listed in the stock market, to test whether these categories have any effect on leverage. All the variables are lagged one year so as to capture causal effects, in line with the estimation of the standard leverage equation of previous papers and standard errors are clustered at the bank level to account for heteroskedasticity and serial correlation.

Regulatory capital

To test the hypothesis of whether leverage is determined by capital regulation, we run an additional set of regressions that introduce some variation in the leverage equation. First, we define a dummy that identifies banks close to the regulatory minimum of 8%, *Close*, that takes the value of 1 if the bank has a Basel ratio smaller than 10% and include the interact this variable with those included in the leverage equation, in order to test whether there is a different behavior of banks that have a small or no capital buffer at all to fulfill capital regulation. Second, we estimate the leverage equation substituting the dependent variable for the Basel ratio. Finally, and as explained above, we explore whether the deterioration of regulatory capital can be explained by the same theories that explain the leverage in non-financial firms. Figure 2 shows that the proportion of hybrid capital with respect to total regulatory capital has doubled, from 16.3% in 1999 to 32% in 2007. The idea is that the increasing weight of hybrid capital can be read as a leveraging process within regulatory capital, since there is an increment of the debt-like instruments with respect to "pure" capital. Hence, banks could be increasing the proportion of hybrid instruments within regulatory capital in the same way that banks choose an optimal proportion of debt in their capital structure. If that was true, we could expect that the ratio of hybrid instruments to total capital was explained by the same determinants as the leverage ratio.

4.1.2. Results

Corporate Finance Regressions

The first half of Table 3 presents the results of the estimation of the leverage equation following the standard approach of corporate finance regressions. The first two columns report the basic specification where leverage is explained by the set of variables posited by corporate finance literature using pooled *OLS*, clustering the standard errors by bank. The results are similar for the two measures of leverage, the basic measure and the extended ratio that includes preferred shares and subordinated debt in the definition of capital. As predicted, ROA is negatively related to leverage and the size increases the leverage of banks, both effects significant at 1% and 10%, respectively. As in Welch (2004) and Lemmon et al. (2008), the risk captured by the standard deviation of profits negatively affects the leverage ratio, what in this case might be also a consequence of a higher requirement of capital set by regulation. Finally, savings banks tend to be more leveraged than commercial banks (p-value of coefficient around 9% and 11%, in the first and second regressions, respectively), what can be possibly due to their specialization in mortgages, with lower capital requirements in Basel I. The rest of variables are not statistically significant. These results suggest that, far from being exclusively determined by capital regulation, the leverage ratios of banks are optimized following the patters empirically observed in non-financial firms.

In the third regression of Table 3 we include fixed effects of bank to test whether leverage is mainly explained by time-invariant unobservables as in non-financial firms (Lemmon et al., 2008). The results show that the R^2 increases from 34.65% to 82.45%, what implies that most of the dispersion in leverage are due to unobservable idiosyncratic factors that remain constant over time. We also observe that the sign of the coefficients estimated with OLS has not changed but now only assets and ROA remain statistically significant, so the inclusion of fixed effects diminishes the predicted effect of risk that were surely capturing differences of dispersion of ROA across banks rather than over time. Finally, the fourth regression in Table 3 includes the lagged dependent variable to estimate the speed of adjustment. We obtain that banks adjust to their optimal level of leverage at a speed of 0.452 (1-0.548), a parameter similar to Gropp and Heider (2010) for banks, but now only profits remain statistically significant at 10%.[8]

[8] Bertrand and Schoar (2003) and Frank and Goyal (2007) attributes part of the differences in capital structures observed in non-financial firms to management preferences and differences in corporate governance across firms.

Therefore, the results that we obtain for are similar to those obtained in the empirical corporate finance literature: First, the leverage of banks has mainly cross sectional variation and the optimal decisions of leverage made by each bank are related to optimal leverage theories accepted for non-financial firms. Second, the differences across banks are mainly explained by unobservable, time-invariant factors and banks leverage ratios converge to long term levels that do not depend on corporate finance theories. This suggest that banks keep their leverage ratios relatively constant over time, in spite of being differences across banks explained by optimal leverage theories.

Regulatory Capital Regressions

The right half of Table 3 presents regressions to test whether the leverage of banks does depend on capital requirements set by regulation. The first regression of the bloc (fifth regression of Table 3) shows that banks close to the minimum requirement of capital do behave different than those with a buffer of at least two percentage points (10%-8%), whereas the non-interacted coefficients remain relatively unchanged. We observe that the positive and significant coefficient of *Close* denotes that banks close to the minimum are more leveraged than banks with a buffer, what suggest that higher leverage ratios are also associated with lower Basel capital ratios. Therefore, we have some empirical evidence that capital regulation does affect the decisions of bank leverage but only for those banks close to the regulatory minimum of capital.

The next regression in Table 3 presents the leverage equation substituting the dependent variable by one minus the Basel capital ratio. Now, all the variables but assets and risk are non-significant, what implies that the differences across banks in the Basel ratio could also be explained by corporate finance issues, though the evidence is weaker. Again, when we include fixed effects (not shown), R^2 increases from 27.29% to 87.15% and all the coefficients become non-signifiactive, what implies that the variance in the Basel ratio is explained by unobservable, constant factors that are idiosyncratic for each bank.

The result of the existence of an idiosyncratic, constant level for the leverage ratio and the Basel ratio is consistent with the constant distributions of the ratios presented in Figure 1A and 1B. Figure 3 shows that these constant leverage and regulatory capital ratios for every bank are translated to the aggregate: the evolution of the average of the leverage and one minus Basel ratio among banks for the period 1999-2007 has remained fairly constant over time, though the Basel ratio has slightly decreased (1-Basel ratio has increased).

TABLE 3. DETERMINANTS OF BANK LEVERAGE RATIO

In this table, we present the results of the estimation of:

$$Lit = \beta t + \beta 1\ Divit\text{-}1 + \beta 2\ Qit\text{-}1 + \beta 3\ Collit\text{-}1 + \beta 4\ ROAit\text{-}1 + \beta 5\ ln\ Assetsit\text{-}1 + \beta 6\ NPLit\text{-}1 + \beta 5\ Sd(ROAit\text{-}1) + uit$$

The dependent variable of the first regression is the leverage ratio, defined as one minus the ratio of capital and reserves over total assets. From regression 2 to 5, the dependent variables is the extended leverage ratio, which includes preferred shares and subordinated debt as capital. The dependent variable of the sixth regression is one minus the Basel capital ratio and the dependent variable of the last regression is the ratio of Tier 1 capital to total regulatory capital. All the estimations include time dummy variables and all the variables are lagged one year. Standard errors are clustered at the bank level to account for heteroskedasticity and serial correlation. . See definition of variables in the Appendix. (***)= Significant at 1%, (**) = Significant at 5%, (*)= Significant at 10%.

	Corporate Finance Regressions								Regulatory Capital Regressions					
	Dep: Basic Leverage Ratio		Dep: Leverage Ratio		Dep: Leverage Ratio		Dep: Leverage Ratio		Dep: Leverage Ratio		Dep: 1-Basel ratio		Dep: Leverage in Capital	
	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error
Speed of Adjustment							0.548 ***	0.139						
Dividends	-0.005	0.007	-0.004	0.007	-0.002	0.006	-0.003	0.005	-0.002	0.007	-0.004	0.014	-0.051 *	0.028
Q Tobin	-0.004	0.005	-0.006	0.005	0.002	0.004	-0.007	0.004	-0.003	0.006	0.008	0.008	-0.011	0.017
Collateral	-0.013	0.025	-0.019	0.025	0.016	0.015	0.009	0.011	-0.009	0.027	-0.024	0.039	-0.082	0.050
ROA	-1.422 ***	0.392	-1.199 ***	0.392	-0.387 *	0.212	-0.346 *	0.195	-1.146 ***	0.377	-0.308	0.538	-1.809 **	0.716
ln Assets	0.013 ***	0.004	0.008 *	0.004	0.032 ***	0.011	-0.002	0.012	0.009 *	0.005	0.015 ***	0.005	0.021 ***	0.008
NPL ratio	-0.002	0.004	-0.001	0.004	-0.001	0.002	-0.001	0.001	-0.001	0.004	0.008	0.006	0.002	0.005
Sd (ROA)	-15.660 ***	3.224	-15.718 ***	3.224	0.667	1.468	-0.798	1.122	-14.041	3.247	-15.465 ***	4.721	-27.825 ***	10.757
Saving bank	0.021 *	0.011	0.018	0.011					0.023 **	0.011	0.020	0.018	0.047	0.037
Listed Stock market	0.014	0.018	0.016	0.018					0.017	0.017	0.008	0.023	0.087	0.054
Close									0.109 ***	0.041				
Close*Dividends									-0.001	0.010				
Close*Q tobin									-0.009	0.010				
Close*Collateral									-0.020	0.042				
Close*ROA									-1.444	1.268				
Close*ln Assets									-0.005	0.006				
Close*NPL ratio									-0.005	0.007				
Close*Sd (ROA)									0.192	6.855				
Observations	757		757		757		757		757		757		757	
R^2	45.94		34.65		82.45		87.32		39.92		30.62		22.25	
Time dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Fixed Effects	No		No		Yes		Yes		No		No		No	

Leverage in Capital

Now we raise the question on how the quality of bank capital has been affected during a period in which bank have been continuously issuing hybrid instruments (subordinated debt, preferred shares,…) and new financing tools (securitization). Figure 3 shows evidence of deterioration in the quality of capital, since the ratio of one minus common capital and reserves to total regulatory capital has doubled from 16% to 32%. Now we use this ratio as the dependent variable of the leverage equation to test whether the increasing proportion of hybrid capital is the result of a leveraging process within the regulatory capital that responds to the same determinants than the standard leverage ratio. The results (last regression of Table 3) show that the decisions of leveraging within capital requirements do respond to the same determinants as the standard leverage ratio, as well as to dividends, with a negative, significant effect (at 10%) in the line predicted by corporate finance theory. Finally, the coefficients of the time dummy variables (not shown) present an increasing trend, what implies that the leveraging in capital is increasing over time, even after controlling for the variables included in the regression. These results suggest that banks consider hybrid instruments within regulatory capital as having debt properties and they have increased the proportion of hybrid instruments in the same way that they choose the optimal proportion of debt in their capital structure. Therefore, the constant evolution of the Basel ratio hided the deterioration of regulatory capital, since banks were substituting part of their core capital by hybrid capital to fulfill the capital regulation.

Now we will turn into the dynamics of the leverage and Basel ratio. We want to decipher what is behind the decisions of issuances of capital and debt instruments.

4.2. Dynamic approach of bank leverage: Issuances of instruments

4.2.1. Empirical model

In the previous section, we have obtained that the leverage ratio responds to standard corporate finance theories applied to non-financial firms. However, we have also found that there is an active management to maintain the Basel ratio constant whereas the composition of the regulatory capital has varied during the sample period, since hybrid capital has been increasing its importance with respect to pure capital and reserves. More concretely, the issuances of subordinated debt and preferred shares in our database represent the 86.96% (180 out of 207) of the total issuances of capital instruments

and the 72.14% in terms of volume. In Figure 2 we observe that, with the exception of the year 2000, the volume of common equity and convertible debt issued in the financial markets was below the 40% of the total amount of regulatory capital.

Since leverage ratios are relatively constant over time, an analysis focused only on the levels of these ratios can disregard important decisions made by banks that affect the amount and composition of capital and that can help us to understand the leveraging process in capital. For instance, how balance sheet growth is financed, how banks refinance past issuances that reach maturity, how banks close to the regulatory minimum finance their growth, and so on. To complete the analysis, we now focus on the determinants to issue debt and capital components, defining both categories according to the capital regulation. Given the low number of common equity and convertible debt issuances (27 out of 180), there is little variability to consider this "core capital" as an independent option in our analysis, so we will include both common equity and hybrid capital in the choice of issuing capital instruments. We will look for different patterns in the decision to issue debt and/or capital and we will control for all the potential factors presented in the model of Section 2 that might affect the decision.

The empirical model is a multinomial logit whose dependent variable is the decision to issue capital instruments, debt instruments and, as control group, the decision of not issuing any instrument.

We will proxy the determinants that affect the decision to issue debt and capital with the following variables:

Optimal Leverage. We consider the same variables as in the leverage equation, that is, Dividends, Tobin's Q, Collateral, Assets, and ROA. We also include the leverage ratio at the beginning of the year to account for the potential effect on decisions of different levels of departure. The results of the leverage equation showed that the leverage was correlated with profits and size, which explained the differences across banks. If banks issue new debt (capital) to increase (decrease) their leverage, then we can expect the same (opposite) correlation of these variables with leverage. However, we have obtained in the previous section that the level of leverage is relatively constant over time and respond to unobservable, time-invariant factors, so the decisions to issue debt and capital might not always have leverage implications, but can be related to manage the current leverage ratio to keep it around target values. If this is the case, some of the explanatory variables might be capturing other effects explained below.

Liquidity needs: We will capture the needs of funds with the ratio loans to deposits, *Loans/Deposits*. The higher is the proportion of loans with respect to amount of deposits collected by the bank, the higher the probability of recurring financial markets to obtain additional resources to fund future growth. A large value of this variable might identify banks that are growing, since traditional banks that cannot recur to financial markets have to limit loan growth to the growth of deposits (Almazán et al. 2015). Parallelly, Tobin's *Q* is also a proxy of growth opportunities and, thus, liquidity needs.

Past issuances. Here we include two dummy variables, *Issuer in the past*, which takes the value of 1 if a bank has issued any kind of instrument in the financial markets at some point in time in the past and *Maturity Past Issuance*, which takes the value of 1 if the there is a past issuance of the bank that matures in the previous, current or next month. Both variables have been constructed using available monthly data of Dealogic from January of 1988.

Capital Regulation. Basel ratios are relatively constant over time for individual banks. However, the leverage within the eligible capital has increased over time and the determinants are similar to the determinants of book leverage ratios. This suggests an active management on regulatory capital by banks to target their optimal Basel ratio, though worsening the quality of capital requirements. We will include a list of variables to learn how banks make their decisions to issue debt and capital to manage capital regulation.

– Issuances of debt/capital in recent past. We include four dummy variables that take the value of 1 if the bank has issued debt / capital during the last four months or between five and twelve months ago. If banks actively manage the Basel capital ratio, a new issuance of debt might shortly be followed by a new issuance of capital instruments and vice-versa, so we expect some positive coefficient of the variables *Issue Capital (Debt) in t-1 to t-4* and/or *Issue Capital (Debt) in t*-4 *to t*-12 in the decision to issue Debt (Capital). Here we can also learn the timing in the decision, that is, whether banks usually issue debt first and capital follows or if it is the other way around. The complementary variables, that is, *Issue Capital (Debt) in t-1 to t-4* and/or *Issue Capital (Debt) in t*-4 *to t*-12 in the decision to issue Capital (Debt) will inform us whether an issuance of debt/capital is followed in the next future by issuances of the same instrument (positive coefficient) or whether it decreases the probability of issuing the same instrument (negative coefficient).
– Loan Loss Reserves to Loans, *LLR/Loans*. Basel I recognizes generic provisions as eligible capital up to an established limit. If banks use capital loan reserves as substitutes of other capital instruments to fulfill capital requirements or if banks consider

them as part of capital, we can expect a negative (positive) coefficient in the probability to issue capital (debt). Using the same argument, we could expect the same relation for the variable ROA (included in optimal leverage) if high, retained profits were to substitute externally risen capital.

– Risk. We include two variables, the NPL ratio that captures the risk embedded in the loan portfolio and the Z-score (in logs), which measures the risk of losses being higher than capital, normalized by the standard deviation of profits. Riskier banks should be more likely to issue capital instruments if they were obliged to hold higher capital requirements. But if regulation was not binding, we could expect the opposite effect, since riskier banks could be less averse to leverage and, thus, issue larger amounts of debt.
– Finally, and as in the leverage equation, we will interact the whole list of explanatory variables considered in the empirical model with the dummy *Close*, to determine if banks that are close to the regulatory minimum behave differently from the rest.

Market conditions. The number and volume of issuances absorbed by the market is an indicator of the development of financial markets. However, if they were the only reason why banks issue debt or equity (rather than the factors listed above), it could be possible that banks were merely replicating the conduct observed in rivals that, added up, ends up in a bubble. Here we include two variables to capture this potential effect, *Herd Behavior*, which is the total number of issuances of debt and capital instruments issued by Spanish banks during the last 12 months and *Vol Herd Behavior*, that accounts for the total amount of Euros that were effectively issued during the last 12 months.

Macro conditions. We control for the growth in house prices, GDP growth, the real interbank 12 month interest rate and the Consumer Price Index (CPI).

Let X be a vector that includes all the explanatory variables, then our empirical model consists on the multinomial logit estimation of the equation:

$$\Pr(y_{it}=k)=\frac{\exp(X_{it}\beta_k)}{1+\sum_{j=1}^{2}\exp(X_{it}\beta_j)};\quad k=\{0,1,2\}$$

where the dependent variable takes the value of 1 if the bank issues debt, 2 if it issues capital and 0 if it does not issue during that month, being the latter the reference group. We lag one year the financial variables drawn from annual reports because we consider that the decision to issue debt or capital is determined by the situation at the beginning of the year. Standard errors are cluster at bank level.

Table 2 provides descriptive statistics for all the variables used in the regressions. A definition of the variables can be found in the Appendix.

4.2.2. Results

Table 4 shows the results of the multinomial estimation. The coefficients have to be interpreted as differences in the probability to issue capital or debt instruments with respect to the reference group, that is, not to issue.

The first estimation shows that the bulk of variables in *Optimal Leverage* that were determinant in the level leverage ratio now are non-significant, as expected if leverage ratios are relatively constant at bank level. The only mild evidence is found in the negative and significant (at 10%) coefficient of *ROA* in the debt issuance equation. Assets are positive and significant for both types of issuances, what suggest a size (positive) effect in the probability to issue rather than a leverage effect. The leverage ratio is also non-significant, possibly due to the commented low variation within bank.

Liquidity needs to fund loan growth above deposit growth is fulfilled with the issuance of debt instruments, that is, the gap between loans and deposits is covered with debt. This result suggests that the expansion of credit during the pre-crisis period was mainly funded via the issuance of debt. The issuance of capital is not directly correlated with liquidity needs and it seems to respond to other factors rather than bank growth, in spite of providing the bank with additional funds.

The fact of having a previous experience as issuer of instruments in financial markets has a positive effect on both the probability to issue debt and capital instruments, as implied by the positive and significant at 1% coefficient of *Issuer in the Past*, and the maturity of previous issuances seems to be refunded with new issuances of debt (*Maturity Past Issuance* positive and statistically significant at 10%). *Market conditions* do not have a direct effect on the probability of issuing debt, but they do on capital issuances. It seems that the probability that banks issue capital instruments is higher as the number of recent issuances increases (ln *Herd Behavior* positive and significant at 5%), though there could be a competition effect that limits the amount of funds that can be raised in periods of large volume of recent issuances. (negative ln Vol *Herd Behavior*). Then, we cannot conclude that banks growth funded through issuances of debt and capital obeyed exclusively to herd behavior, since debt issuances are not related to the recent activity of the market and capital issuances also depend on other internal factors of the bank. As for the *Macro conditions,* again

debt is not related to macro factors, but capital issuances are enhanced by favorable macroeconomic conditions (increasing house prices, GDP growth and low real interest rates). From the results on Market conditions and Macro conditions, we learn that banks issue capital when the external conditions are optimal, possibly because these instruments are more affected by the asymmetric information problem (as studied in the pecking order theory) and the costs are reduced under a good environment, whereas debt, less sensitive to information asymmetry problems, is less dependent of external conditions.

Capital regulation

The results from the leverage equation showed that leverage ratios and Basel capital ratios showed little variation within banks. Gropp and Heider (2010) attributed this finding to a reduced role of capital regulation in the determinants of leverage. However, the results of Table 4 show that capital regulation plays an important role on the decisions to issue capital and debt, though its determining effect can be overlooked because of the relatively constant path of leverage ratios. The importance of capital regulation can be inferred by the following results:

– The issuance of debt instruments is preceded by the issuance of eligible capital during the previous 12 months (positive and statistically significant coefficients at 5% of *Issue Capital in months t*-1 *to t*-4 and *Issue Capital in months t*-4 *to t*-12). This suggest that the banks that have funded their growth with debt (we saw that probability of debt issuances increased with *Loans/Deposits*) first they will have issued some form of eligible capital to maintain the Basel ratio at desired levels. On the other hand, the issuance of debt have an immediate negative (substitution) effect during the following fourth months to new debt issuances. However, it turns out to be positive and highly significant during the months *t*+4 to *t*+12, what might be due to the continuous resource to debt by banks that are growing. For capital, the success of an issuance has also a positive effect on immediate issuances, reflected in the positive coefficient *Issue Capital in months t*-1 *to t*-4, statistically significant at 10%.

– *LLR/Loans* is negative and significant at 5% for capital and positive and significant at 10% for debt. This suggests that banks perceive *LLR/Loans* as a substitute of capital issuances, since they compute (up to a maximum) as eligible capital in the Basel ratio. Also, the positive and significant coefficient (at 5%) of the *z-score* (higher risk of bankruptcy, lower *z-score*) suggests that banks accumulate more capital to cover the higher risk, as obliged by Basel regulation, rather than the alternative hypothesis that riskier banks bet at larger issuances of debt.

– Finally, the second block of regressions of Table 4 show the results of the multinomial logit when we include the interaction of the explanatory variables with *Close*, that is, a dummy that takes the value of 1 if the Basel capital ratio is smaller than 10%. Roughly, the non-interacted variables maintain the sign and significance of the coefficients. However, the statistically significant coefficients of some interacted variables imply that banks close to the minimum requirements do behave differently than banks holding a capital buffer above 2pp. First, the positive and significant at 5% of *Close* in the capital regression imply that banks close to the minimum 8% are more likely to issue some kind of computable capital to increase their Basel ratio. They are also more likely to substitute past issues reaching maturity (usually, debt) by new capital issuances (*Close · Issuer in Past* in capital regression positive and significant at 10%), as well as increasing retained profits (that compute as core capital and are substitutes of capital issuances) at the expense of dividends (*Close · Dividends* negative and significant at 1%). We also observe that banks with higher liquidity needs (higher Loan to Deposit ratio) are more likely to issue new capital instruments, possibly to offset the decrease in the Basel ratio that the growth through debt (explained above) might have caused. Finally, the positive and significant coefficient of *Close · Collateral* might respond to the reduction of the costs associated to asymmetric information at the time of issuing capital, when the bank has a higher proportion of liquid assets.

The coefficients of the interacted variables in the debt equation suggest that issuances of debt are limited when banks are close to the regulatory minimum: the issuance of debt in the previous 12 months decreases the probability of a new issue, due to the difficulties to absorb new debt by the limited eligible capital held by the bank; and also riskier banks (lower *z-score*) are less likely to issue debt instruments, though the tenure of liquid assets might partly offset the previous effects.

TABLA 4. MULTINOMIAL LOGIT OF THE DECISION TO ISSUE DEBT AND CAPITAL (DEFAULT=NOT TO ISSUE)

IThis table presents the results of the multinomial logit estimation of the equation:

$$\Pr(y_{it}=k)=\frac{\exp(X_{it}\beta_k)}{1+\sum_{j=1}^{2}\exp(X_{it}\beta_j)};\quad k=\{0,1,2\}$$

where the dependent variable takes the value of 1 if the bank issues debt, 2 if it issues capital and 0 if it does not issue during that month, being the latter the reference group. We lag one year the financial variables drawn from annual reports because we consider that the decision to issue debt or capital is determined by the situation at the beginning of the year. Standard errors are clustered at bank level. See definition of variables in the Appendix. (***)= Significant at 1%, (**) = Significant at 5%, (*)= Significant at 10%

	SPECIFICATION I				SPECIFICATION II			
	Issue of Debt at *t*		Issue of Capital at *t*		Issue of Debt at *t*		Issue of Capital at *t*	
	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error	Coeff	Std.Error
Past issuances and markets								
Issuer in past	1.517 ***	0.273	3.396 ***	1.045	1.331 ***	0.274	15.838 ***	0.714
Maturity Past Issuance	0.237 *	0.142	-0.419	0.261	0.208	0.153	-0.426	0.290
Issue Capital in months t-1 to t-4	0.441 ***	0.136	0.328 *	0.181	0.434 ***	0.142	0.204	0.221
Issue Capital in months t-4 to t-12	0.264 **	0.128	0.482	0.377	0.264 *	0.146	0.458	0.295
Issue Debt in months t-1 to t-4	-0.235 **	0.101	0.400	0.271	-0.188 *	0.107	0.421	0.308
Issue Debt in months t-4 to t-12	0.657 ***	0.118	0.687	0.479	0.711 ***	0.127	0.685	0.549
ln Herd Behavior	-0.028	0.498	0.686 **	0.299	0.007	0.495	0.453	0.370
ln Vol.Herd Behavior	-0.091	0.274	-0.524 ***	0.178	-0.104	0.269	-0.544 ***	0.184
Corporate Finance variables								
Dividends	0.076	0.171	0.277	0.351	0.046	0.173	0.412	0.364
Loans / Deposits	0.732 ***	0.229	0.736	0.600	0.758 ***	0.253	0.360	0.722
Q tobin	0.001	0.092	-0.049	0.155	-0.048	0.096	-0.053	0.175
z-score	0.179 **	0.088	-0.098	0.235	0.137	0.092	-0.063	0.218
Collateral	-0.390	0.457	0.252	0.847	-0.596	0.505	-0.816	0.952
LLR / Loans	21.214 *	10.943	-54.416 **	21.684	20.753 *	11.308	-60.672 **	27.212
ROA	-18.216 *	9.648	-33.708	22.380	-11.688	9.755	-36.441	31.387
ln Assets	0.510 ***	0.087	0.965 ***	0.170	0.541 ***	0.095	1.044 ***	0.183
NPL ratio	-0.091	0.082	0.374	0.257	-0.050	0.081	0.311	0.294
Leverage	-1.706	2.594	1.948	4.748	-0.856	2.744	4.661	5.325
Idiosyncratic variables								
Listed Stock market	0.149	0.437	0.118	0.563	0.049	0.406	0.458	0.883
Saving bank	0.551	0.394	-0.329	0.544	0.441	0.355	-0.190	0.901

Close to capital minimum and interactions								
Close					0.969	6.454	22.092 **	9.401
Close*Issuer in past					1.452 **	0.568	-12.462 ***	1.474
Close*Maturity Past Issuance					0.228	0.303	1.250 *	0.740
Close*Issue Capital in months t-1 to t-4					0.171	0.363	0.565	0.896
Close*Issue Capital in months t-4 to t-12					0.110	0.233	-0.014	1.252
Close*Issue Debt in months t-1 to t-4					-0.585 ***	0.191	-0.258	0.707
Close*Issue Debt in months t-4 to t-12					-0.747 **	0.338	-0.272	0.625
Close*ln Herd Behavior					-0.746	0.823	-0.252	0.670
Close*ln Vol.Herd Behavior					0.336	0.355	-0.139	0.270
Close*Dividends					0.205	0.204	-2.140 ***	0.568
Close*Loans / Deposits					0.215	0.800	2.755 *	1.653
Close*Q tobin					0.286	0.194	-0.589	0.520
Close*z-score					0.426 *	0.246	-0.322	0.577
Close*Collateral					1.851 *	1.088	6.007 ***	2.177
Close*LLR / Loans					12.367	32.975	10.606	68.211
Close*ROA					-38.736	29.546	85.420	63.808
Close*ln Assets					-0.237	0.146	-0.401	0.472
Close*NPL ratio					-0.236	0.343	0.332	0.486
Close*Leverage					-7.195	5.037	-5.208	9.350
Macro Variables								
Growth in House Prices	-1.458	2.757	9.494 *	4.863	-1.848	2.904	6.615	6.026
GDP	-33.461	20.687	102.774 **	44.082	-39.801 *	22.046	79.913 *	47.717
Real Interbank 12m	-17.262	16.608	-44.323 *	23.877	-16.649	16.378	-52.266 **	21.829
CPI	14.254	14.061	8.081	34.229	16.268	14.855	15.188	36.766
Observations		9022				9022		
Pseudo-R^2		32.36				32.87		

5. CONCLUSIONS

This paper explores how banks financed their growth during the boom period prior the current financial crisis and the consequences on the quantity and quality of the bank capital. We adopt an approach that combines the traditional leverage equation used in the corporate finance theory to explain leverage of non-financial firms with a dynamic analysis of the determinants of the issuance of debt and capital instruments by banks in the financial markets.

Using a sample of Spanish banks during the period 1999-2007 that combines data from Bankscope and Dealogic, we find that the dispersion of book capital ratios across banks can be explained by the theories of corporate finance accepted for non-financial firms and that banks have managed to hold leverage and Basel ratios at relatively constant levels over time. However, this stability in regulatory capital ratios was hiding a deterioration of the quality of capital, since the capital needs were mainly fulfilled with issuance of second-order category instruments. We provide evidence that the increasing weight of hybrid capital can be read as a leveraging process within the regulatory capital, since there is an increment of the debt-like instruments with respect to the common capital that responds to the same determinants than the standard leverage ratio. This *leverage in capital* presents an increasing trend during the period, even after controlling for these determinants of leverage.

Focusing on the issuance of debt and capital instruments, we find that the strategy used by banks to finance credit growth combined the issuance of debt instruments to cover their liquidity needs (i.e.,gap between loans and deposits) with the issuance of hybrid capital instruments to keep capital ratios at constant levels, if other sources of internal funds were not available. We also find that the probability to issue capital instruments increased if the macro and market conditions were optimal. Next, the total number of issuances carried out by total Spanish banks during the recent past positively affected the probability of issuing capital, what can suggest a potential herd behavior in individual banks'decisions. Nonetheless, there was a negative correlation between the probability to issue and the total volume issued, which might be due to a competition effect. Finally, we present evidence that capital regulation plays a key role in the decision to issue capital and debt instruments. First, debt issuances are preceded by the issuance of capital instruments to compensate the effect in the capital ratios. Second, capital issuances are substitutes of other forms of internally generated funds (i.e., loan loss reserves). Finally, banks closer to the regulatory minimum are more likely to issue capital and limit the use of debt. As well, they are more likely to refinance past issuances reaching

maturity with issuances of capital and also to save dividends in order not to dwindle their capital resources.

This paper provides evidence to capital regulators that, during the last period of credit growth, banks covered the higher capital requirements recurring to second-category capital, at the expense of core capital instruments, so it provides arguments to justify the stricter definition of regulatory capital of Basel III. Future research will focus on understanding the relationship among the components of debt and capital and how banks choose among the different alternatives to issue debt (senior debt, securitization, covered bonds,…) and capital (convertible debt, shares, subordinated debt,…)

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Appendix. Definition of variables.

Leverage equation

The list of variables used in the leverage equation have been constructed using Bankscope

Dividends. Dummy variable that takes the value of 1 if the bank issued dividend during the year.

$$Collateral = \frac{Total\ \ Securities + Gov't\ Securities + Other\ \ Earning\ \ Assets + Cash\ and\ \ due\ \ from\ \ Banks + Fixed\ \ Assets}{Total\ \ Assets}$$

ROA. Ratio of the after-tax profit and the assets of the bank.

Assets. Book value of the bank's assets at the end of the year.

NPL ratio. Ratio of the non-performing loans in the balance sheet to the total amount of loans.

Sd(ROA). Standard deviation of the ROA computed with the data of ROA of the five previous years. We have data on ROA from 1994 onwards and we obliged to have at least 3 years of ROA to compute the standard deviation.

Savings bank. Dummy variable that takes the value of 1 if the bank is a savings bank and 0 if it is a commercial bank.

Listed Stock Market. Dummy variable that takes the value of 1 if the bank is listed in the Stock Market and 0 otherwise.

Close. Dummy variable that takes the value of 1 if the bank has a Basel capital ratio below 10% and 0 otherwise.

Tobin's Q. It is the ratio of the market-to-book value of equity. Since there are savings banks and small banks that are not listed in the stock market, we estimate a proxy of the market value, *V*. The estimated market value of a bank i in year t is then calculated as follows,

$$\hat{V}_{it} = \hat{P}_{it}^{t} + \xi_{i,t}\hat{P}_{i,t+1}^{t} + \xi_{i,t}^{2}\hat{P}_{i,t+2}^{t} + \xi_{i,t}^{3}\overline{P}_{i}^{t}\frac{1+\overline{\rho}_{it}}{\overline{\xi}_{it}-\overline{\rho}_{it}}$$

where $\hat{P}^{t}_{i,t+s}$ are the predicted adjusted earnings of bank i at time $t+s$, given the information available at time t using an AR(2) model; is the discount factor of each bank, inversely related to the opportunity cost of capital of that bank at time t. The opportunity cost of capital of the bank is set equal to the risk-free interest rate plus a risk premium that takes into account the credit risk of loans plus the risk from debt leverage.

From $t+3$ onwards, the level of profit of banks is calculated applying a constant expected growth rate to the average of the predictions for t, $t+1$ and $t+2$, . It is assumed that this rate of growth of profit is equal to the profit retention rate times the long-run Return On Equity (ROE). The proxy value of the long-term growth rate $\overline{\rho}_{it}$ is obtained assuming that banks retain one half of their earnings, and further assuming that the long-term ROE is equal to the average of the ROE of the last three years (with equity valued at replacement cost). The long-term discount factor $\overline{\xi}_{it}$ has been approximated to the average of the opportunity cost of capital of the bank in the previous three-year period.

Basic Leverage. The ratio of the sum of book capital (capital and reserves) to assets.

Leverage. The ratio of the sum of book capital, preferred shares and subordinated debt to assets.

Leverage in capital. Ratio of common capital and reserves to Basel capital requirements.

Multinomial logit of debt and capital issuances

Issuer in the past. Dummy variable that takes the value of 1 if the bank has ever issued any instrument in the financial markets and 0 otherwise. We use monthly information since 1986.

Maturity Past Issuance. . Dummy variable that takes the value of 1 if there is a past issuance of the bank that is maturing in the current month, the previous month or the next month and 0 otherwise. We use monthly information of debt and capital issuances since 1986 to construct this variable.

Issue Capital (Debt) in months t-x to t-y. . Dummy variable that takes the value of 1 if the bank has issued capital (debt) during the months *t-x to t-y.*

Herd Behaviour. It contains the total number of issuances of any kind of instrument that Spanish banks have carried out during the last 12 months.

Vol Herd Behaviour. It is equal to the total volume in monetary units of the issuances that Spanish banks have carried out during the last 12 months.

Loans / Deposits. Ratio of the total balance of loans to the total balance of deposits of the bank.

Z-Score. The ratio of the sum of ROA and the book capital ratio to the standard deviation of ROA (see *Sd(ROA)*). In logs.

LLR/Loans. 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.

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