The Determinants of European Banks' Capital Structure: Is There a Difference between Public and Private Banks?*

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In this paper we examine whether the determinants of European banks' capital structure depend on the type of the institution (private or public). Using an international sample of 586 banks from 21 European countries for the period of 2000 to 2016, we find that when compared with private banks, the determinants of public banks' capital structure are more closely aligned with those that affect nonfinancial firms. Furthermore, this paper provides evidence that these differences can result in certain consequences with regards to the access to the market, which implies that public banks are more subject to market discipline. This is a very topical question, particularly when studied in the context of the introduction of more demanding capital requirements through Basel III and, in particular, in the context of the new resolution regime which imposes additional capital requirements, where banks' access to equity and debt markets plays a pivotal role.

JEL Codes: G21; G32.

*The authors acknowledge helpful comments and suggestions from António Antunes, Diana Bonfim, Hugo Reis, Miguel Ferreira, Olivier De Jonghe, Raquel Gaspar, Sudipto Karmakar, Teodora Paligorova, and the two anonymous referees. Clara Raposo gratefully acknowledges financial support from FCT - Fundação para a Ciência e Tecnologia (Portugal), national funding through research grant (UID/SOC/04521/2013). Clara Raposo also acknowledges the support of FCT grant PTDC/EGE-OGE/28603/2017. The views expressed in this article are those of the authors and do not necessarily reflect the views of the Banco de Portugal or the Eurosystem. Author e-mails: vmboliveira@gmail.com and clararaposo@iseg.ulisboa.pt.

1. Introduction

According to modern financial literature, the study of capital structure began with Modigliani and Miller (1958), who stated that in a frictionless world with full information and complete markets, the value of firms is independent of their capital structure (Santos 2001), leaving room for further research regarding the impact of disregarding the "frictionless assumption," i.e., by adding taxes, costs of financial distress, imperfections in the product market, transactions costs, asymmetry of information, and agency costs.

The study of the above-mentioned frictions has originated several theories, such as the trade-off theory, the pecking order theory, and the market timing theory (Flannery and Rangan 2006).

The great majority of the published empirical evidence over the last decades which is dedicated to the topic of capital structure was developed for nonfinancial firms. For instance, Rajan and Zingales (1995) justify the exclusion of financial firms from their sample, because their leverage would be strongly influenced by explicit (or implicit) investor insurance schemes, such as deposit insurance. Furthermore, regulation such as minimum capital requirements can directly affect the capital structure of financial firms.

Nevertheless, more recent empirical research regarding bank capital structure has contributed evidence which supports that the attributes that affect bank capital structure are not very different from those that influence the capital structure of nonfinancial firms. Studies by Flannery (1994), Flannery and Rangan (2008), and Allen, Carletti, and Marquez (2011) have shown that market discipline (carried out by subordinated creditors, or even by depositors) has played an important role in banks' capital structure. By the same token, other empirical papers published on this matter, such as Barber and Lyon (1997), Brewer Iii, Kaufman, and Wall (2008), Gropp and Heider (2010), and De Jonghe and Öztekin (2015), have found that bank-specific indicators also explain, to a large extent, bank capital structure, i.e., most banks seem to optimize their capital structure in much the same way as firms, except when their capital ratios are close to the regulatory minimum.

Nevertheless, most of the empirical studies developed so far regarding banks' capital structure are focused on large, public banks (Gropp and Heider 2010) and also on the main determinants of

the speed of adjustment toward the banks' target capital ratio (De Jonghe and Öztekin 2015), tending to omit an analysis of the relationship between the type of banks and their behavior regarding capital structure decisions. It is exactly this gap that we aim to fill with this paper.

Accordingly, we attempt to empirically answer the following question: Are the determinants of banks' capital structure different in public versus private banks? For the purpose of this paper, public banks are considered to be those that are quoted/listed in capital markets, whereas private banks are those that are not quoted/listed in capital markets.

The answer to this question is relevant from an empirical as well as a policy point of view. From an empirical point of view, it is important to challenge the conclusions drawn from the above-mentioned studies, which use samples that comprise only large and public banks—which are subject to a different intensity of market discipline and/or use a pooled data set of banks, extrapolating the results for the whole sample, which in turn could hide some non-negligible differences regarding the determinants of the capital structure of public and private banks.

From a policy point of view, when examined in the context of the requirements for additional capital, which has led to banks increasingly having to resort to own funds through the issue of, among others, equity or debt instruments with certain specific characteristics (e.g., subordinated debt) where the access to the market plays a pivotal role, it is important to investigate how the determinants of banks' capital structure have influenced banks' access to the market (which is represented by the share of subordinated debt for total assets).[1]

Using an international sample of 586 banks from 21 European countries for the period of 2000 to 2016, our results for the

[1]Beyond the new capital requirements encompassing the new capital buffers—namely the conservation capital buffer, countercyclical capital buffer, and systemically important institutions buffer (introduced with the Basel III framework)—the Directive on Banking Recovery and Resolution that entered into force in 2016 implies banks' compliance with the additional capital requirements so-called minimum requirement for own funds and eligible liabilities (MREL) which should equal 2 × (pillar 1 requirements + pillar 2 requirements and the combined buffer requirement) – 125 basis points.

whole sample confirm, to some extent, those of Gropp and Heider (2010), where size is positively related with leverage, whereas profits, market-to-book value, and risk all have a negative impact on leverage, which is broadly consistent with the pecking order and market timing theories.

Furthermore, considering the argument that banks manage their capital or leverage ratios based on achieving a target, we show that the speed of adjustment is material in banks, which enables these institutions to converge toward their long-run target.

Interestingly, our results have identified important differences between public and private banks. Whereas the determinants of the capital structure of public banks present a set of similarities with nonfinancial firms (which is in line with the results presented by Gropp and Heider 2010), for private banks we find that those determinants which are typical of the market timing and pecking order theories fail to evidence the same relevance as in the case of public banks.

Besides the higher asymmetry of information which characterizes private firms, including financial ones, this paper provides empirical evidence that those banks whose capital structure has been driven by the determinants envisaged in the literature (public banks) have been subjected to more market discipline (which is represented by the share of funding through subordinated debt).

The consequences of the above-mentioned differences observed between public and private banks for both the empirical literature and financial stability are twofold. From an empirical point of view, this is the first study which shows that "one size does not fit all," i.e., that the determinants of banks' capital structure vary between private and public banks. From a financial stability point of view, during an initial phase, the differences observed in this paper could negatively affect the access of private banks to capital and debt markets and thus compound the difficulties in complying with the more demanding capital requirements envisaged in Basel III, as well as in the new resolution regime—which implies the issuance of bail-in-able instruments. However, in the long term, it is expected that the implications of the new resolution regime (such as the issuance of MREL, composed of bail-in-able instruments, such as subordinated debt) will contribute to broadening market discipline to all types of banks and to the alignment of the determinants of their

capital structure. Additionally, the supervisors and regulators may well be able to reap the benefits of a wider market discipline—which is detailed below in this paper.

The remainder of the paper is organized as follows: Section 2 presents a literature review, which is focused on capital structure determinants (in general for nonfinancial firms, and specifically for banks). Section 3 develops hypotheses about how the determinants of capital structure in nonfinancial firms play a role in the case of banks. Section 4 introduces the data set, including descriptive statistics for bank-specific indicators and a cross-country analysis. The methodological approach is discussed in section 5. Section 6 reports the results and robustness tests, and the main conclusions are presented in section 7.

2. Literature Review

2.1 The Determinants of Capital Structure

Modern capital structure theory began with Modigliani and Miller (1958), advocating that the value of firms is independent of its capital structure in a frictionless world with full information and complete markets (Santos 2001), leaving room to exploit certain frictions.

To this end, Berger, Herring, and Szegö (1995) summarize that the main frictions that cause capital decisions to depart from Modigliani and Miller (1958) are (i) taxes—as interest payments are tax deductible, whereas dividends are not, and that by substituting debt for equity, firms are able to pass on larger returns to investors by reducing payments to the government, and, therefore, all else being equal, shareholders prefer to fund firms almost entirely with debt; (ii) financial distress—where more leverage can lead to an increase in the likelihood of incurring the costs of financial distress; (iii) asymmetric information—which stems from the fact that managers generally have access to more information about their own earnings prospects and financial condition than the market; (iv) transactions costs of new issues—which when combined with asymmetric information can also influence the relative costs of internal versus external finance, and the relative costs of debt versus

equity, and; (v) agency costs between shareholders and creditors or between the former and managers (Jensen and Meckling 1976).

A sizable amount of research has been carried out since then, which can be summarized into three main theories (Flannery and Rangan 2006): the trade-off theory, the pecking order theory, and the market timing theory. According to the trade-off theory, firms select target debt-equity ratios to trade off the costs and benefits of leverage, contradicting the unrealistic assumption that firms are always at their equilibrium leverage (Öztekin and Flannery 2012). The benefits of leverage include the tax deductibility of the debt service (the well-known "interest tax shield") and the agency benefits of debt associated with conflicts of interest between managers and stockholders. The costs of debt can be identified as costs of bankruptcy or financial distress, agency costs due to misalignment of interests between stockholders and creditors, and trading costs (according to Öztekin 2015, if a country's characteristics make the issuance of debt and equity expensive, firms tend to exhibit slower adjustment speeds). The pecking order theory, which was first suggested by Myers and Majluf (1984), is based on the assumption that information asymmetries between insiders and outsiders can lead managers to perceive that the uninformed market would generally underprice their firm's equity—and for this reason, managers have a preference for investments to be financed first with internal funds, second with secured debt, and lastly with equity—which is only used as a last resort. This order of preference between internal versus external funds, and between debt versus equity, is a justification for firms to maintain a certain financial slack, particularly those firms that operate in industries which are particularly opaque and are subject to asymmetry of information between insiders and outsiders. The market timing theory argues that a firm's leverage reflects its cumulative ability to sell overpriced equity shares, i.e., share prices fluctuate around their "true" value, and managers tend to issue shares when the firm's market-to-book value is high. Therefore, by exploiting asymmetric information, firms increase the wealth of their current shareholders.

Recent research on capital structure has been developed around these three competing, but not necessarily mutually exclusive, theories. Many empirical studies have tried to identify the correct measures for characterizing the attributes present in these theories.

Amongst the main studies of interest in this context, we highlight Titman and Wessels (1988), Rajan and Zingales (1995), Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), and Frank and Goyal (2009). The measures used in these papers comprise (i) collateral, which is defined as being the sum of liquid assets and fixed assets; (ii) firm size, which is represented by total assets; (iii) market-to-book ratio, which is defined as being the ratio between the market value of assets and the book value of total assets; (iv) firm risk, which is usually computed as the standard deviation of a firm's market stock returns; and (v) profits. Collateral and firm asset risk can be included in the trade-off theory, whereas profits and market-to-book value are more easily aligned with the pecking order theory and market timing, respectively. To this end, Harris and Raviv (1991) showed that leverage increases with fixed assets (collateral), as well as with nondebt tax shields, growth opportunities, and firm size, and that it decreases with volatility, advertising expenditures, bankruptcy probability, and the uniqueness of the products.

With regards to the relationship between the above-mentioned variables and firms' capital structure, Rajan and Zingales (1995) concluded that (i) the relationship between the ratio of fixed assets to total assets and leverage is positive—the rationale underlying this factor being that tangible assets are easy to collateralize and they thus reduce the agency costs of debt; (ii) leverage is negatively correlated with market-to-book value for two reasons: first, in theory, firms with high market-to-book ratios have higher costs of financial distress and, second, this negative correlation stems from firms' tendency to issue stock when their stock price is high in relation to earnings or book value (which thus supports the assumptions underlying the market timing theory); (iii) size is positively correlated with leverage, as, in theory, larger firms are better diversified and have a lower probability of being in financial distress; and (iv) profitability is negatively correlated with leverage (which supports the pecking order theory). To a large extent, these results are consistent with those obtained by Frank and Goyal (2009), who used a different sample of firms as well as a different time span.

Flannery and Rangan (2006), Lemmon, Roberts, and Zender (2008), Öztekin and Flannery (2012), and Öztekin (2015) all focused on testing firms' willingness to move toward their target leverage ratio, and found that firms converge toward their long-run targets

at a rate of more than 30 percent per year, which depends, to a larger extent, on the institutional environment. An example is those countries which ease the issuance of debt and/or equity contribute to accelerate the speed of adjustment toward the optimal leverage ratio (Öztekin and Flannery 2012 and Öztekin 2015).

2.2 The Special Case of Banks

In many ways, banks are different from nonfinancial firms, which are able to induce differences in their capital structure decisions. Cocris and Ungureanu (2007) surmise that the main differences are that a high proportion of bank failures lead to negative externalities; agency problems are enhanced by the inefficient monitoring of banks by depositors and other stakeholders; information flow is complex, due to the opaque environment in which banks operate; banks are heavily regulated; sometimes the regulator itself is a bank stakeholder; the diversification of activities within a bank conglomerate intensifies agency problems between corporate insiders and small shareholders; in general, banks have a more concentrated equity ownership than nonfinancial firms, which makes it more difficult for small equity holders to exert influence over the management of banks; there is less competition regarding financial products and takeover activity; and banks have a safety net available, which affects the stakeholders' incentives to monitor banks. In addition, Harding, Liang, and Ross (2013) highlight the high levels of leverage which characterizes banks' capital structure, which was arguably responsible for the failure of the majority of investment banks during the recent global financial crisis.

To some extent, the identification of these special features of the banking sector are shared by Berger, Herring, and Szegö (1995) and Santos (2001), who both mention that the main frictions in the banking sector which can justify the departure from Modigliani and Miller (1958) are the following: the existence of a safety net—which is defined as all government actions which are devised to improve the safety and soundness of the banking system and thus shield banks' creditors (mainly depositors) from the full consequences of bank risk-taking; and the capital requirements stated by the regulators to protect themselves against the costs of financial distress,

agency problems, the reduction in market discipline (caused by the safety net), and the systemic risk posed by the banking sector.

These characteristics explain why the majority of the empirical research on firm capital structure was carried out with nonfinancial firms (see, for example, Rajan and Zingales 1995).

Nevertheless, the empirical research regarding banks' capital structure has evidenced that those attributes that affect bank capital structure are not so far removed from the attributes which influence nonfinancial firms' capital structure. Thus, Modigliani and Miller's theory holds, within limits, for banks as well (Miles, Yang, and Marcheggiano 2013). Research carried out by Flannery (1994), Flannery and Sorescu (1996), Morgan and Stiroh (2001), Flannery and Rangan (2008), and Allen, Carletti, and Marquez (2011) has shown that market discipline demonstrated by subordinated creditors, and even by depositors (as in Martinez Peria and Schmukler 2001), has played an important role in explaining banks' capital structure.

Regarding the existence of similarity, or not, between the determinants of banks' capital structure and nonfinancial firms and whether the traditional capital determinants also hold for financial institutions, an empirical work carried out by Barber and Lyon (1997) and Brewer Iii, Kaufman, and Wall (2008) established that bank-specific indicators also contribute to explain banks' capital structure. Barber and Lyon (1997) concluded that the relationships between size, market-to-book value, and security returns are positive and similar for both financial and nonfinancial firms. Brewer Iii, Kaufman, and Wall (2008) found that leverage is positively and significantly correlated with banks' risk; however, the remaining variables, such as return on assets and size, are not significantly related to leverage. Nevertheless, bank-specific variables collectively explain banks' leverage, taking into account the result from the Wald test. With regards to speed of adjustment, the value attained was 12 percent.

The more recent studies on banks' capital structure were developed by Gropp and Heider (2010)—who expound on the influence of bank-specific indicators on banks' capital structure, comparing these with those evidenced by nonfinancial firms—and also De Jonghe and Öztekin (2015), whose focus was to investigate the adjustment process for targeting capital. Using a sample of large public banks from the United States and Europe (from 1991 to 2004), the first

study evidences that regulation is not the main feature that causes the divergence of banks' capital structure from that which was argued by Modigliani and Miller (1958). For these authors, most banks seem to optimize their capital structure in much the same way as firms do, except when their capital ratios approach the levels of the regulatory minimum. Additionally, as demonstrated by Lemmon, Roberts, and Zander (2008), banks move toward their target leverage ratios at a speed of adjustment of 45 percent. This evidence contradicts the "regulatory view" of banks, whereby they should converge toward a common target, namely the minimum requirement set under Basel I, which gives support to the results obtained by Berger et al. (2008), who argue that banks actively manage their capital ratios.

The second study, that of De Jonghe and Öztekin (2015), using a sample of banks from 64 countries during the 1994–2010 period, based on the studies developed for nonfinancial firms by Öztekin and Flannery (2012) and Öztekin (2015), found that in the case of banks, the speed of adjustment is heterogeneous, depending on the institutional environment—which is consistent with the results obtained with nonfinancial firms. That is to say that the speed of adjustment toward the target capital ratio increases in those countries that have more stringent capital requirements, better supervisory monitoring, and more-developed capital markets—which in turn decreases the costs of debt and/or equity issuance. In addition, and consistent with those studies developed so far, this study found that smaller, more profitable, and cost-efficient banks have higher capital ratios.

3. Research Question and Hypothesis Development

This paper aims to empirically answer the following question: Are the determinants of banks' capital structure different in public versus private banks? Public banks are those that are quoted/listed in capital markets, whereas private banks are those that are not quoted/listed in capital markets.

On the one hand, we expect that the determinants of public banks' capital structure and their respective decisions regarding the optimal capital are different from those of private banks, due to the fact that the former has easier access to capital and debt markets, as

a result of having less of the information asymmetry which characterizes public firms, whether they be financial or nonfinancial firms. On the other hand, considering that the banking sector is one of the most regulated in the world (Santos 2001), supplemented by the fact that all banks (public or private) are obliged to disclose information through pillar 3 of the regulatory framework, the determinants of public banks' capital structure, as identified by Gropp and Heider (2010), may well be not so different from those of private banks.

Accordingly, we test the hypothesis that the determinants of public banks' capital structure are different from the determinants of private banks against the hypothesis that the determinants of banks' capital structure are the same for both types of banks.

A detailed overview of the explanatory variables and their sources is provided in table 1. Table 2 presents the expected signs of the effects of bank-specific indicators on banks' capital structure, as well as a summary of the arguments that support such expectations.

4. Data

The data for this paper include banks which have their headquarters in 21 European countries, as well as subsidiaries of foreign banks (mainly from the United States), which add up to 586 banks, for the period of 2000–16. The data give rise to a panel of 6,065 bank-year observations. As mentioned in table 1, all data were collected from the Bankscope and SNL databases.

As shown in figure 1, the sample covers a high percentage of the European banking system's assets, which represents a share of 90 percent in 2012, decreasing slightly to 85 percent from 2012 onward—which is due to the change of the database from Bankscope to SNL.

We obtain an unbalanced panel data set, on account of a data gap and entry/exit in the sample. It is worth noting that the occurrence of certain mergers and acquisitions, together with the emergence of new banks, caused changes in the constitution of the sample during the period under analysis (table 3). It should be mentioned that these mergers and acquisitions events are included in banks' fixed effects.

Table 1. Variables: Description and Sources

Variables	Description	Source
BOOK VALUE OF ASSETS	The sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment.	Bankscope/SNL
BOOK VALUE OF EQUITY	The sum of the following items: "capital," "reserves," and "net income."	Bankscope/SNL
BOOK LEVERAGE (BL)	Computed as 1 – (book value of equity/book value of assets).	Bankscope/SNL
MARKET LEVERAGE (ML)	Calculated as 1 – [market value of equity (computed as number of outstanding shares*end of year stock price)/market value of bank (computed as the market value of equity + book value of liabilities)].	Bankscope/SNL
SIZE	The log of book value of assets.	Bankscope/SNL
PROFITABILITY (PROF)	Computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets.	Bankscope/SNL
MARKET-TO-BOOK RATIO (MBR)	Calculated as the ratio between market value of assets and book value of assets.	Bankscope/SNL
COLLATERAL (COLL)	Computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets.	Bankscope/SNL
RISK	Computed as the annualized standard deviation of monthly stock price returns (market*value of equity/market value of bank) or the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year.	Bloomberg/Bankscope/SNL
SUBORDINATED DEBT	A specific type of debt that ranks below the other types of debt such as deposits and other debt securities issued by an institution.	Bankscope/SNL
SUBORDINATED DEBT/ASSETS	Calculated as the ratio between total subordinated debt liabilities and total assets.	Bankscope/SNL

(*continued*)

Table 1. (Continued)

Variables	Description	Source
NONDEPOSITS/ASSETS	Computed as the ratio between nondeposits liabilities and total assets.	Bankscope/SNL
SECURITIES/ASSETS	The ratio between securities and total assets.	Bankscope/SNL
LOANS/ASSETS	The ratio between net loans and total assets.	
TOTAL CAPITAL RATIO	The ratio between own funds (as defined in Directive 2000/12/EC until 2006, in Directive 2006/49/EC between 2007 and 2013, and in Regulation 575/2013 from 2014 onwards) and risk-weighted assets.	Bankscope/SNL
TIER 1 CAPITAL RATIO	The ratio between own funds of tier 1 quality (as defined in Directive 2000/12/EC until 2006 and in Directive 2006/49/EC, in Directive 2006/49EC between 2007 and 2013, and in Regulation 575/2013 from 2014 onwards—essentially equity and reserves) and risk-weighted assets.	Bankscope/SNL
TIER 2 CAPITAL RATIO	The ratio between own funds of tier 2 quality (as defined in Directive 2000/12/EC until 2006, in Directive 2006/49/EC between 2007 and 2013, and in Regulation 575/2013 from 2014 onwards—essentially subordinated debt) and risk-weighted assets.	Bankscope/SNL
PUBLIC DUMMY	Dummy variable that takes the value of 1 if the bank is listed in market, and 0 otherwise.	Bankscope/SNL
SPEED OF ADJUSTMENT	Computed as 1 – coefficient on book leverage or market leverage lagged by one period.	Bankscope/SNL
CAPR	Dummy variable drawn from the study carried out by Cerutti et al. (2017) which takes the value of 1 if any tight capital measure was taken by each regulatory authority, and 0 otherwise.	Cerutti et al. (2017)

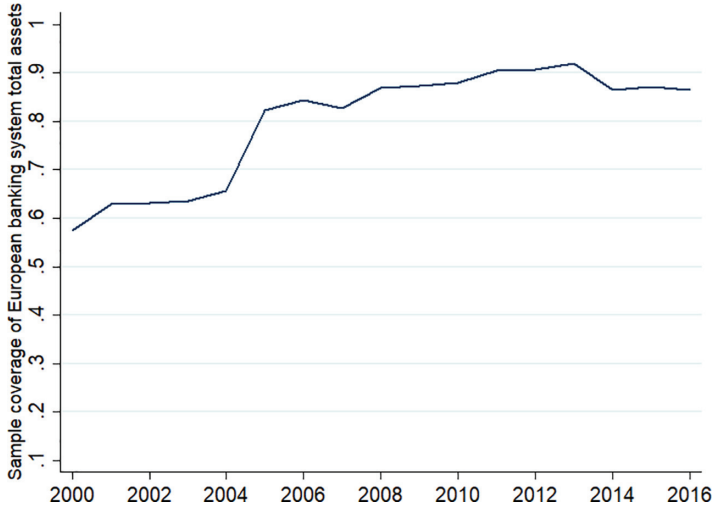
Note: This table presents the definitions and sources of the main variables used in this study.

Table 2. Expected Effects of Each Variable on Banks' Capital Structure

Variables		Expected Effects and Rationale
MARKET-TO-BOOK RATIO (MBR)	–	Based on Gropp and Heider (2010), leverage is negatively correlated with market-to-book ratio. In theory, firms with high market-to-book ratios have higher costs of financial distress.
PROFITABILITY (PROF)	–/+	Based on empirical literature (Gropp and Heider 2010 and De Jonghe and Öztekin 2015) leverage has a negative relationship with profits. These results underpin on the concept that firms that face a lower cost of raising equity in the short term (i.e., profitable firms) tend to hold significantly more capital. This is true mainly when debt financing is the dominant source of external financing (Rajan and Zingales 1995).
SIZE	+	In theory, larger firms are better diversified and have a lower probability of being in financial distress coupled with the fact that, being larger, they are better known by the market and find it easier to issue more debt than smaller firms. The empirical literature (Gropp and Heider 2010 and De Jonghe and Öztekin 2015) supports these arguments.
COLLATERAL (COLL)	+/–	Based on Gropp and Heider (2010), leverage has a positive relationship with collateral. The rationale underlying this factor is that tangible assets are easy to collateralize and thus they reduce the agency costs of data.
RISK	–	According to Gropp and Heider (2010), risk reduces leverage. Firms with more volatile cash flows face higher expected costs of financial distress and should use less debt.
SPEED OF ADJUSTMENT	+	According to Gropp and Heider (2010) and De Jonghe and Öztekin (2015), we expect that banks, like nonfinancial firms, converge toward bank-specific targets.

Note: This table presents the effects of each variable on bank capital structure, where MBR ratio is calculated as the ratio between market value of assets and book value of assets; PROF is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; RISK is calculated as the log of annualized standard deviation of monthly stock price returns (market*value of equity/market value of bank) or through the log of standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year (in the case of private banks); and SPEED OF ADJUSTMENT is computed as 1 – beta on book leverage or market leverage lagged by one period.

Figure 1. Sample Coverage of Countries' Banking Systems' Total Assets



4.1 Descriptive Statistics

Table 3 (panels A and B) presents descriptive statistics of the banks analyzed in our sample.

In our sample, the total assets of the average bank were 81 billion euros. We observed that the total assets of the bank in the 90's percentile was 211 billion euros, whereas the total assets of the banks in the 10's percentile was almost 800 million euros, which thus points to a large variability in the size of banks operating in Europe. For the average bank in the sample, the book value of equity and the book value of deposits was approximately 4 and 40 billion euros, respectively, which, when considered together with the book or market leverage ratios (92 percent and 91 percent on average, respectively), gives a clear picture of the higher leverage ratio that characterizes banks' capital structure when compared with most other industries.

As depicted in table 3 (panel A), banks' profitability (PROF) was affected by the 2008 crisis, as was the market-to-book ratio (MBR). The profitability of the average bank decreased from 5 percent in 2000 to 4 percent in 2008, and the market-to-book ratio

Table 3. Descriptive Statistics of Bank-Specific Indicators

Variables	2000	2008	2016	Total	Of Which Public	Of Which Private
Book Value of Assets (Millions)						
No. of Observations	273	477	177	6,065	1,517	4,548
Mean	50,183	78,406	163,124	80,911	186,959	45,539
Std. Dev.	114,513	255,208	335,003	229,117	391,000	118,461
Percentile 10%	888	686	8,114	797	1,579	698
Percentile 50%	7,983	8,279	28,810	9,697	24,196	7,815
Percentile 90%	176,844	184,572	527,859	211,103	636,133	126,621
Book Value of Equity (Millions)						
No. of Observations	273	477	177	6,065	1,517	4,548
Mean	2,367	2,847	9,667	3,962	8,931	2,304
Std. Dev.	5,560	7,774	18,127	11,091	17,230	7,353
Percentile 10%	88	61	647	69	162	62
Percentile 50%	512	533	2,411	694	1,794	534
Percentile 90%	6,099	6,248	29,587	19,988	29,030	4,691
Book Value of Deposits (Millions)						
No. of Observations	272	463	177	5,939	1,491	4,448
Mean	43,858	33,777	70,774	39,604	86,090	24,021
Std. Dev.	103,277	100,844	138,039	101,417	166,668	58,815
Percentile 10%	866	443	3,420	565	1,212	499
Percentile 50%	8,385	4,600	13,710	6,339	14,521	4,876
Percentile 90%	117,369	71,351	250,920	103,118	319,060	61,903
PROF						
No. of Observations	270	474	176	6,031	1,506	4,525
Mean	0.05	0.04	0.16	0.05	0.06	0.05
Std. Dev.	0.03	0.04	0.13	0.08	0.10	0.08
Percentile 10%	0.03	0.02	0.04	0.01	0.01	0.01
Percentile 50%	0.04	0.04	0.16	0.03	0.04	0.03
Percentile 90%	0.07	0.06	0.30	0.12	0.17	0.08

(*continued*)

Table 3. (Continued)

Variables	2000	2008	2016	Total	Of Which Public	Of Which Private
MBR						
No. of Observations	100	128	71	1,826	1,826	—
Mean	2	1	1	1	1	—
Std. Dev.	2	1	1	7	7	—
Percentile 10%	0.0	0.0	0.23	0.01	0.01	—
Percentile 50%	1.5	0.6	0.57	0.93	0.93	—
Percentile 90%	3.2	1.6	1.49	2.41	2.41	—
RISK						
No. of Observations	273	477	177	6,064	1,517	4,547
Mean	0.00	0.01	0.00	0.00	0.00	0.00
Std. Dev.	0.01	0.01	0.00	0.01	0.01	0.01
Percentile 10%	0.00	0.00	0.00	0.00	0.00	0.00
Percentile 50%	0.01	0.00	0.00	0.00	0.00	0.00
Percentile 90%	0.01	0.01	0.00	0.01	0.01	0.01
BL						
No. of Observations	273	477	177	6,065	1,517	4,548
Mean	0.92	0.92	0.91	0.92	0.91	0.92
Std. Dev.	0.06	0.07	0.04	0.07	0.07	0.07
Percentile 10%	0.88	0.86	0.86	0.87	0.86	0.86
Percentile 50%	0.94	0.93	0.92	0.93	0.93	0.93
Percentile 90%	0.97	0.97	0.96	0.97	0.96	0.97
ML						
No. of Observations	100	128	71	1,826	1,826	—
Mean	0.92	0.92	0.91	0.92	0.92	—
Std. Dev.	0.07	0.04	0.07	0.07	—	—
Percentile 10%	0.88	0.86	0.86	0.87	0.87	—
Percentile 50%	0.94	0.93	0.92	0.93	0.93	—
Percentile 90%	0.97	0.97	0.96	0.97	0.97	—

(*continued*)

Table 3. (Continued)

Variables	2000	2008	2016	Total	Of Which Public	Of Which Private
COLL						
No. of Observations	264	458	175	5,876	1,473	4,403
Mean	0.22	0.28	0.26	0.28	0.26	0.28
Std. Dev	0.13	1.12	0.14	0.95	0.14	1.09
Percentile 10%	0.09	0.08	0.13	0.08	0.11	0.07
Percentile 50%	0.21	0.20	0.23	0.21	0.23	0.20
Percentile 90%	0.45	0.44	0.47	0.45	0.46	0.45

Notes: This table presents descriptive statistics of banks' specific indicators during the period 2000–16. The table presents the number of observations (N), the mean, standard deviation (Std. Dev.), and some percentiles of the following variables: BOOK VALUE of ASSETS, which is the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; BOOK VALUE of EQUITY, which is the sum of the following items: "capital," "reserves," and "net income"; BOOK VALUE of DEPOSITS, which is total deposits from clients; PROF, when computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; MBR ratio, which is calculated as the ratio between market value of assets and book value of assets; RISK, which is computed as the log standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year; BL, which is computed as 1 – (book value of equity/book value of assets); ML, which is calculated as 1 – [market value of equity (computed as number of outstanding shares*end of year stock price)/market value of bank (computed as the market value of equity + book value of liabilities)]; and COLL, which is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets. Public banks are the ones that have their equity quoted/listed in the capital market whereas private banks are banks that do not have their equity quoted/listed in the capital market.

dropped from 2 to 1 during the same period. While banks' profitability has recovered to a level of around 16 percent up until 2016, market-to-book ratio has never recovered to its pre-crisis level.

Table 3 also shows that there are significantly more private banks than public banks, which appears to indicate that the European Banking System is mainly composed of small and medium-sized private banks, with the sample of public banks being more heterogeneous than that of private banks—as the standard deviation in several bank-specific indicators is higher in the case of public banks. Furthermore, public banks are larger, on average (with average assets of 187 billion euros, when compared with 46 billion euros for private banks), although they are more profitable (1 percentage point above the average profitability of private banks) but less leveraged (1 percentage point below the average leverage shown by private banks) than private banks. These differences are statistically significant when the Wilcoxon signed-rank test is carried out, as shown in table 4. In addition, public banks seem to rely more on nondeposits debt and subordinated debt than private banks. According to Flannery (1994), Flannery and Sorescu (1996), Morgan and Stiroh (2001), Flannery and Rangan (2008), and Allen, Carletti, and Marquez (2011), this kind of debt is more subject to market discipline than deposits.[2]

4.2 Cross-Country Comparison Throughout the Period 2009–16

This subsection explores the main differences between countries, in particular the distribution of public and private banks and their capital composition.

In table 5 we can observe that the percentage of public banks across European countries for the period of 2000 to 2016, in both number and percentage of total assets of each country's banking systems, varies significantly, ranging from 0 percent to 75 percent, and 0 percent to 92 percent, respectively. It should be added that the majority of banks are private at the European level.

[2]Some of the differences between the data presented in table 3 and those shown in table 4 are due to the fact that the variables presented in table 4 were windsorized, whereas those presented in table 3 were not.

Table 4. Descriptive Statistics of Bank-Specific Indicators: Public vs. Private

Variables	Observations	Mean
BL		
Private	4,548	0.922
Public	1,517	0.919
Difference		0.5
BOOK VALUE OF ASSETS (Million Euros)		
Private	4,548	41,110
Public	1,517	107,438
Difference		0.00
PROF		
Private	4,525	0.05
Public	1,506	0.06
Difference		0.00
COLL		
Private	4,403	0.23
Public	1,473	0.25
Difference		0.00
RISK		
Private	4,547	0.0029
Public	1,517	0.0031
Difference		0.00
SECURITIES/ASSETS		
Private	4,517	0.239
Public	1,514	0.230
Difference		0.00
LOANS/ASSETS		
Private	4,548	0.565
Public	1,516	0.585
Difference		0.36
NONDEPOSITS/ASSETS		
Private	4,448	0.304
Public	1,491	0.357
Difference		0.00

(*continued*)

Table 4. (Continued)

Variables	Observations	Mean
SUBORDINATED DEBT/ASSETS		
Private	3,547	0.017
Public	1,337	0.018
Difference		0.02

Notes: This table presents the main differences between public and private banks regarding the following variables: BL, which is computed as 1 – (book value of equity/book value of assets); BOOK VALUE of ASSETS, which is the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; PROF, which is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; COLL, which is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; RISK, which is computed as the log standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year; SECURITIES/ASSETS, which is the ratio between securities and total assets; LOANS/ASSETS, which is the ratio between set loans and total assets; NONDEPOSITS/ASSETS, which is computed as the ratio between nondeposits liabilities and total assets; and SUBORDINATED DEBT/ASSETS, which is calculated as the ratio between total subordinated debt liabilities and total assets. Each variable was windsorized at 0.05 on both the left and right tail. We test for the differences between the two types of banks using a nonparametric test of significance knows as Wilcoxon rank-sum test. Public banks are the ones that have their equity quoted/listed in the capital market, whereas private banks are banks that do not have their equity quoted/listed in the capital market.

Table 5 also shows that a high percentage of public banks (both in terms of number and with regards to the share of the total assets of countries' banking systems) are located in northern and central European countries. With a few exceptions, these countries represent those which have the most capitalized banks and also those which have shown more access to tier 2 capital instruments—mostly composed of subordinated debt. This feature is in alignment with the recent analysis published by the European Central Bank (Gaiduchevici and Zochowski 2017), which stresses that Germany and France have the largest bank debt markets. In another research

Table 5. List of Public Banks and Their Representativeness per Country

Countries	% of Public Banks in the Sample (in number)	% of Public Banks in the Sample (in total assets)	TCR	Tier 1 CR	Tier 2 CR
Austria (AT)	16	11	14	11	3
Belgium (BE)	7	41	16	13	3
Czech Republic (CZ)	17	73	14	13	1
Denmark (DK)	27	83	15	13	2
Estonia (EE)	0	0	22	15	7
Finland (FI)	43	57	16	11	5
France (FR)	19	52	14	11	3
Germany (DE)	9	34	15	11	4
Greece (GR)	75	90	12	11	1
Hungary (HU)	11	51	16	12	4
Ireland (IE)	13	32	13	11	2
Italy (IT)	25	63	13	11	2
Luxembourg (LU)	11	2	17	13	4
Netherlands (NL)	14	56	17	15	2
Poland (PL)	58	84	14	13	1
Portugal (PT)	20	41	13	10	3
Slovakia (SK)	0	0	14	13	1
Slovenia (SI)	25	90	12	10	2
Spain (ES)	10	54	13	10	3
Sweden (SE)	33	92	15	13	2
United Kingdom (UK)	9	49	16	12	4
Average	21	46	15	12	3

Notes: This table presents the representativeness (on average) of public banks per country in number and total assets for the period 2000–16. Public banks are those that have their equity quoted/listed in the capital market, whereas private banks do not have their equity quoted/listed in the capital market. Total capital ratio (TCR), tier 1 capital ratio (Tier 1 CR), and tier 2 capital ratio (Tier 2 CR) are computed according to table 1.

note published by BBVA Research (Garcia and Rocamora 2018), the banks of Greece, Portugal, Ireland, and Spain all display the greatest shortfalls of MREL—which proves that countries with a small number of public banks are more likely to be able to overcome difficulties in complying with MREL requirements.

Attention should be paid to Greece—which recorded a high percentage of public banks and yet a lower number of tier 2 capital instruments—which is an exceptional case, originating from the dramatic reduction of the number of total banks after the onset of the banking and sovereign crisis in that country, which led to a consolidation of Greece's banking system. However, as they are public, these public banks overcame many difficulties by issuing bail-in-able instruments, as a result of concerns regarding the sustainability of both Greek banks and the Greek economy as a whole. Estonia is at the other end of the spectrum, as it has no record of listed banks, although its banking system has the highest percentage of tier 2 capital instruments in the sample. This feature could be explained by the fact that this country is inundated by subsidiaries of foreign banks, whose listed holding companies have much easier access to capital markets to fund their activities, and they thus gain from the benefit of belonging to reputable and well-known banking groups.

5. Methodology

To address the research question presented in section 3, we carry out the following empirical analysis for year, country, and bank's fixed effects:

$$L_{ict} = \beta_0 + \beta_1 PROF_{ict-1} + \beta_2 SIZE_{ict-1} + \beta_3 COLL_{ict-1} + \beta_4 RISK_{ict-1} + C_i + C_t + C_c + e_{it},$$

where L_{ict} is book leverage (BL), and the remaining variables are those described in table 1. i, c, and t represent bank, country, and time, respectively, and C_i, C_t, and C_c represent bank, time, and country fixed effects. Banks' specific variables are lagged by one year (as used by Gropp and Heider 2010), in order to mitigate possible

endogeneity problems.[3] We ran the model above for all the banks in the sample, and subsequently distinguished between public and private banks in the subsamples. As a first step, we apply exactly the same model to private and public banks, adopting the same dependent and explanatory variables for both types of banks (table 6, regressions 2 and 3). Apart from the variables considered above, we next add the MBR in the case of public banks, and also the market leverage, rather than use book leverage, as expressed below:

$$L_{ict} = \beta_0 + \beta_1 MBR_{ict-1} + \beta_2 PROF_{ict-1} + \beta_3 SIZE_{ict-1} + \beta_4 COLL_{ict-1} + \beta_5 RISK_{ict-1} + C_i + C_t + C_c + e_{it}.$$

At a first glance, this second step could undermine the comparison between public and private banks, as we can observe regressions with one different dependent variable and one additional explanatory variable. In order to properly assess the determinants of public banks' capital structure, we opt to consider market values instead of book values in terms of leverage ratio, as the former are the most frequently used to make decisions in all types of public firms (including banks). Additionally, it is essential to control for market-to-book ratio (MBR) in order to assess the capital structure of listed firms/banks, as well as to evaluate the behavior of the other determinants. Furthermore, by not considering MBR, which is a special feature of public firms or banks, we choose to neglect the empirical work which has been carried out to date. In particular, the results obtained by Gropp and Heider (2010), whose sample was only composed of public and large banks, showed that the regressions with a higher R^2 (and thus with the greatest explanatory power) were those which use market leverage as a dependent variable and MBR as one of the explanatory variables. In this paper, the particularities of public banks gain even more importance and need to be taken into consideration, as the sample is more heterogeneous than that considered by Gropp and Heider (2010), which only includes large, public banks.

As in Gropp and Heider (2010), we consider the regulation and supervision frameworks in year and country's fixed effects. It should

[3]We do not include dividends as used by Gropp and Heider (2010) due to availability issues.

Table 6. Regression Results: The Determinants of Banks' Capital Structure

	Regression 1 (All Banks) BL	**Regression 2 (Public Banks) BL**	**Regression 3 (Private Banks) BL**	**Regression 4 (Public Banks) ML**	**Regression 5 (Gropp and Heider 2010) ML**
MBR	—	—	—	−0.0289***	−0.118***
	—	—	—	(0.0039)	(0.039)
PROF	−0.0231	−0.0143**	−0.0451*	−0.1087**	−0.392***
	(0.0252)	(0.0383)	(0.0249)	(0.0508)	(0.079)
SIZE	0.0167***	0.0106**	0.0187***	0.0224**	0.013**
	(0.0022)	(0.0043)	(0.0024)	(0.0094)	(0.006)
COLL	0.0096	0.0179*	0.0068	−0.0113	0.006
	(0.0071)	(0.0098)	(0.0091)	(0.0204)	(0.013)
RISK	−0.0015***	−0.0072***	−0.0018***	−0.0100**	−0.016***
	(0.0004)	(0.0023)	(0.0014)	(0.0023)	(0.003)
Year Fixed Effects	Yes	Yes	Yes	Yes	No
Bank's Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	No
R-square	0.86	0.88	0.86	0.87	0.88
Observations	4,876	1,217	3,559	1,210	2,415

(*continued*)

Table 6. (Continued)

Notes: This table reports coefficients of the following regression models:

$$L_{ict} = \beta_0 + \beta_1 PROF_{ict-1} + \beta_2 SIZE_{ict-1} + \beta_3 COLL_{ict-1} + \beta_4 RISK_{ict-1} + C_i + C_t + C_c + e_{it}$$

$$L_{ict} = \beta_0 + \beta_1 MBR_{ict-1} + \beta_2 PROF_{ict-1} + \beta_3 SIZE_{ict-1} + \beta_4 COLL_{ict-1} + \beta_5 RISK_{ict-1} + C_i + C_t + C_c + e_{it},$$

where L_{ict} is the ML (regressions 4 and 5) or BL as presented in the table, BL is computed as 1 – (book value of equity/book value of assets); ML is calculated as 1 – [market value of equity (computed as number of outstanding shares*end of year stock price)/market value of bank (computed as the market value of equity + book value of liabilities)]; MBR is calculated as the ratio between market value of assets and book value of assets; PROF is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; and RISK is computed as the annualized standard deviation of monthly stock price returns (market* value of equity/market value of bank) – regressions 2 and 4 or the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year – regressions 1 and 3. Regressions 2 and 4 only consider public banks, whereas regression 3 only considers private banks. We use the explanatory variables lagged by one period to mitigate possible endogeneity problems. Regression 5 presents the results obtained by Gropp and Heider (2010) using a sample consisting of the 200 largest traded banks in the United States and EU from the Bankscope database from 1991 to 2004. Public banks are those that have their equity quoted/listed in capital markets, whereas private banks are those that do not have their equity quoted/listed in capital markets. The sample is from 2000 to 2016. Robust standard errors clustered at the bank and country-year levels are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

be mentioned that we relax this assumption as a robustness check, by including a variable in the model which attempts to proxy the regulation framework of each country. The variable in question is a dummy variable, which assumes a value of 1 if a country's banking regulatory authority has implemented a measure which influences banks' capital requirements, and consequently banks' capital structure, and 0 otherwise. The data for this variable were sourced from the study of Cerutti et al. (2017).

Considering that the standard deviation of stock returns does not apply to private banks, we also adjust this variable, using the standard deviation of return on assets, which is computed as being the standard deviation during the last three years of the ratio between net income and average assets (as described in table 1). This measure has already been adopted by other researchers, such as Beaver, Kettler, and Scholes (1970), Miller and Bromiley (1990), and Bromiley (1991), and also Titman and Wessels (1988), albeit for a context of capital structure.

As a final step, we follow a common practice in the empirical literature on capital structure and opt to use a partial adjustment framework (Flannery and Rangan 2006, Lemmon, Roberts, and Zender 2008, Gropp and Heider 2010, and De Jonghe and Öztekin 2015), which states that in a frictionless world, both banks and firms always maintain their target capital ratio. The speed of this adjustment depends on the tradeoff between adjustment costs and the costs of operating with suboptimal leverage.

Accordingly, in a partial adjustment model, a bank's current capital ratio, $K_{ij,t}$, is a weighted average of its target capital ratio (with weight $\lambda \in [0, 1]$), $K^*_{ij,t}$, and the previous period's capital ratio, $K_{ij,t}$, as well as a random shock, ξ_{ijt}:

$$K_{ij,t} = \lambda K^*_{ij,t} + (1 - \lambda) K_{ij,t-1} + \xi_{ijt}.$$

Every year, banks try to close a proportion λ of the gap between their actual and target capital levels. The smaller the λ, the more rigid bank capital is; that is to say, banks take more time to reach their target. Therefore, λ is interpreted as being the speed of adjustment. As banks' target capital ratio is not manifested, we have to model each bank's target capital level as a function of observed bank characteristics $X_{ij,t-1}$, banks', year, and countries' fixed effects:

$$K^*_{ij,t} = \beta X_{ij,t-1}.$$

Substituting the equation of target leverage in equation of partial adjustment yields the following specification:

$$K_{ij,t} = \lambda\beta X_{ij,t-1} + (1-\lambda)K_{ij,t-1} + \xi_{ijt},$$

which, when translated to our model, produces the following regression:

$$L_{ict} = \beta_0 + \lambda\beta_1 X_{ict-1} + (1-\lambda)L_{ict-1} + C_i + C_t + C_c + e_{ict},$$

where $X_{ij,t-1}$ represents banks' determinants such as profitability, market-to-book ratio, size, collateral, and risk.

Despite acknowledging that the generalized method of moments (GMM) panel analysis proposed by Blundell and Bond (1998) is the most suitable estimator for handling dynamic panel data (with lagged dependent variables), we choose to use a fixed-effects estimator—as our sample has a relatively long time-series dimension, and after taking into consideration the bias caused by the presence of both lagged dependent variables and fixed effects (Nickell 1981) and also bearing in mind that our objective is not to estimate the true speed of adjustment, but rather to test whether these variables and fixed effects are similar for both public and private banks, together with the fact that the above-mentioned bias reduces proportionally as the number of time-series observations increases (Blundell and Bond 1998).

In addition, the panel GMM methods are prone to flaws such as the weak instrument problem (Bun and Windmeijer 2010).[4]

The results are presented with and without the lag dependent variable. Acknowledging the fact that the leverage ratio is characterized by a high time persistence—which, to a certain degree, hampers the contributions of the other identified determinants of capital structure—we opt to present and analyze the contributions of the other determinants, with and without this variable, which is

[4]We also carry out the analysis using GMM, which proves not to impair the results presented in the paper.

in line with the research methodology of both Lemmon, Roberts, and Zender (2008) and Gropp and Heider (2010).

It is worth mentioning that the results obtained here are presented alongside those of Gropp and Heider (2010), in order to facilitate the comparison between them both.

6. Results

This section provides empirical evidence for the research question and the hypothesis presented in section 3.

6.1 Banks' Capital Determinants

Table 6 outlines that banks' capital structure definitively does not depend exclusively on regulation, in contrast to the argument of Gropp and Heider (2010) that the coefficients associated with each determinant of banks' capital structure are statistically nonsignificant. We find that leverage is indeed positively correlated with size and is negatively related with risk. These results are highly aligned with those obtained by Rajan and Zingales (1995), Frank and Goyal (2009), and Gropp and Heider (2010), except for collateral and profitability—whose relationships are not statistically significant, even though they manifest the same signs in the vast majority of the regressions.

Nevertheless, some differences exist between the coefficients originating from the research carried out by Gropp and Heider (2010) and also from those described in this paper (regressions 4 and 5 of table 6)—which are mostly related with the magnitude of the coefficients. These differences result from different samples and time span used by both studies, as well as the use of time fixed effects in this paper, as detailed in table 6.[5] For example, the economic importance (magnitude) of the market-to-book ratio (MBR) coefficient in Gropp and Heider (2010) when compared with that obtained in this paper is probably due to the stress experienced in capital markets between 2008 and 2012 in several European countries, which results

[5]Gropp and Heider (2010) use a sample comprising the 200 largest traded banks in the United States and EU from the Bankscope database, from 1991 to 2004.

in market timing being a capital determinant with less economic relevance. Additionally, the differences encountered with regards to regressions 1, 2, and 3 are hardly surprising, as they include private banks, whereas the sample used by Gropp and Heider (2010) only includes large public banks.

The split of the analysis between private and public banks yields some interesting results. When we use regressions 2 and 3, with the same dependent and explanatory variables, to assess the differences between public and private banks, we find that the determinants of both types of banks' capital structures are broadly similar. Nonetheless, we can observe that profitability and collateral count more in public banks' capital structure than in the case of private banks. Profitability and collateral coefficients have a higher statistical significance in public banks, when compared with private banks. In the case of public banks, profitability is statistically significant at 5 percent, and collateral is statistically significant at 10 percent, whereas in the case of private banks, profitability is significant at 10 percent, and collateral is not statistically significant at all.

Although the above-mentioned analysis has some drawbacks—such as assuming that market timing (measured by market-to-book ratio) does not apply to public banks and that the book values of assets, liabilities, and equity are taken into account in banks' capital decisions to the same degree as market value—it neglects to a large extent the empirical studies which have been carried out over the past years, in particular those carried out by Brav (2009) in the case of nonfinancial firms, and Gropp and Heider (2010) in the case of banks.

In fact, regression 4 reveals that the role carried out by the market timing theory is important for public banks, and that market values are important for capital structure, which highlights the differences between public and private banks.

Taking into account the arguments presented above, we base our analysis on regressions 3 and 4, in order to explain the main differences between public and private banks, and we opt to only subject these specifications to robustness checks.

That said, the comparison between the results from regressions 3 and 4 of table 6 all indicate that the determinants of public and private banks' capital structure are different. As such, the results of this paper evidence that, in the case of private banks, only size

and risk are statistically significant at 5 percent and these maintain the expected signs, whereas in the case of public banks, their leverage is negatively related with market-to-book ratio (thus supporting the market timing theory), as well as profitability (associated with the pecking order theory) and risk, and are positively correlated with size, with all the coefficients being statistically significant at a 5 percent level. These results are in line with those obtained by Flannery and Rangan (2008), Lemmon, Roberts, and Zender (2008), Frank and Goyal (2009), and Gropp and Heider (2010).

So far, we can state that in the case of private banks, there are two theories which do not apply in the same manner as in the case of public banks. First, the market timing theory by nature does not apply to private banks, as previously observed in the case of nonfinancial firms (Brav 2009), because the equity of private banks is not marked-to-market. Additionally, the pecking order theory does not apply to private banks with the same significance and magnitude as it is applicable to public banks. According to regression 3, the beta for banks' profitability reaches –0.045 and is only statistically significant at a 10 percent level, whereas in the case of public banks (regression 4), this measure amounts to –0.109, and it is statistically significant at a 5 percent level. It is logical that profitability counts more in the case of public banks, as the pecking order theory gains more relevance against the cost of issuing equity in the market—which is only available to public banks. Economically speaking, we can see that an increase of 1 percentage point of profitability for the average public bank (table 3, panel A) results in a decline of 1 basis point in banks' leverage, whereas for private banks, this increase results in a reduction of 0.2 basis point—in other words, profitability does not have an economic impact on banks' leverage in the case of private banks. Regarding other determinants, we also find differences in magnitude of size and risk; however, these do not result in a significant impact for the average bank in both types of banks.

Considering the argument that banks manage their capital or leverage ratios toward a target, table 7 shows that the speed of adjustment remains stable at around 40 percent whether we consider either the full sample or just private banks—which means that the banks of our sample converge toward their long-run target at a speed of adjustment which is approximately the same as that obtained by Gropp and Heider (2010) (46 percent) and greater

Table 7. Regression Results: The Determinants of Banks' Capital Structure

	Regression 1 (All Banks) BL	**Regression 2 (Public Banks) BL**	**Regression 3 (Private Banks) BL**	**Regression 4 (Public Banks) ML**	**Regression 5 (Gropp and Heider 2010) ML**
L_{t-1}	0.6128***	0.6077***	0.6028***	0.7263***	0.532***
	(0.0327)	(0.0694)	(0.0371)	(0.0536)	(0.045)
MBR	—	—	—	0.0089**	0.032**
	—	—	—	(0.0035)	(0.015)
PROF	0.0185	0.0286	0.0060	−0.0078	−0.096**
	(0.0154)	(0.0220)	(0.0179)	(0.0386)	(0.045)
SIZE	0.0038**	0.0046**	0.0041**	0.081	−0.005**
	(0.0015)	(0.0021)	(0.0019)	(0.0062)	(0.002)
COLL	0.0066	0.0114	0.0060	−0.0135	0.007
	(0.0047)	(0.0072)	(0.0061)	(0.0131)	(0.012)
RISK	−0.0012***	−0.0021**	−0.0013***	−0.0004	−0.003
	(0.0003)	(0.0009)	(0.0003)	(0.0019)	(0.002)
Year Fixed Effects	Yes	Yes	Yes	Yes	No
Bank's Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	No
R-square	0.91	0.92	0.91	0.90	0.92
Observations	4,876	1,217	3,559	1,210	2,059

(*continued*)

Table 7. (Continued)

Notes: This table reports coefficients of the following regression models:

$$L_{ict} = \beta_0 + \lambda\beta_1 X_{ict-1} + (1-\lambda)L_{ict-1} + C_i + C_t + C_c + e_{ict},$$

where L_{ict} is the ML (regressions 4 and 5) or BL as presented in the table, BL is computed as 1– (book value of equity/book value of assets); ML is calculated as 1–[market value of equity (computed as number of outstanding shares*end of year stock price)/market value of bank (computed as the market value of equity + book value of liabilities)]; $X_{ij,t-1}$ stands for banks' determinants such as MBR, PROF, SIZE, COLL, and RISK. MBR is calculated as the ratio between market value of assets and book value of assets; PROF is computed as the ratio between the sum of pre-tax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; and RISK is computed as the annualized standard deviation of monthly stock price returns (market*value of equity/market value of bank) – regressions 2 and 4 or the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year – regressions 1 and 3. We use the explanatory variables lagged by one period to mitigate possible endogeneity problems. Regression 5 presents the results obtained by Gropp and Heider (2010) using a sample consisting of the 200 largest traded banks in the United States and EU from the Bankscope database from 1991 to 2004. Public banks are those that have their equity quoted/listed in capital markets, whereas private banks are those that do not have their equity quoted/listed in capital markets. The sample is from 2000 to 2016. Robust standard errors clustered at the bank and country-year levels are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

than that obtained by De Jonghe and Öztekin (2015) (29 percent). Despite the similar significance of the lag coefficient for both types of banks, it is interesting to observe that private banks, which evidence a speed of adjustment of 40 percent, are slightly faster than public banks in reaching their capital target ratios, whose speed of adjustment is around 27 percent. This feature is probably due to the fact that public banks are more exposed to market volatility than private banks. It is not surprising that public banks show a lower speed of adjustment than private banks, bearing in mind that the time period considered in this study encompasses the global financial crisis, as well as the sovereign debt crisis experienced in Europe—both of which negatively affected capital markets, and especially those banks that detained sovereign debt and were under the spotlight of the markets.

It should be mentioned that the effect of the lag of the leverage ratio on the other determinants does not put into question the differences found between public and private banks. This result is due to the acknowledged high persistence of the leverage ratio, over time, which jeopardizes the effect of other variables. To this end, we commence our analysis by ignoring the lag of the leverage ratio and instead include the persistence of the leverage ratio in our analysis, as carried out by Lemmon, Roberts, and Zender (2008) and Gropp and Heider (2010), in order to better assess the slight differences between public and private banks.

6.2 Access to the Subordinated Debt and the Influence of Its Discipline

The results presented so far point out some differences between public and private banks, both in statistical significance and in magnitude, with regards to their decisions in relation to the optimization of their capital structure, with particular relevance for their main determinants. These results are hardly surprising, given that it is natural for public banks to have easier access to capital and debt markets, which in turn can highly influence their decisions regarding capital structure. It is therefore important to investigate the implications of these differences in terms of access by banks to capital and debt markets and consequently the space given to market discipline.

Market discipline can be defined as the "process by which informed market investors gather and monitors firm's activities and prospects as well as their risk" (Flannery and Sorescu 1996). The importance of market discipline has been recognized by supervisors and regulators since the implementation of Basel II (Basel Committee on Banking Supervision 2006). It is important to mention that Basel II introduced a third pillar called "Market Discipline"—whose aim is to encourage market discipline by introducing the disclosure of a broader range of information, in order to enable market participants to assess key pieces of information regarding capital, risk exposures, risk-assessment procedures, and the capital adequacy of the institution (BCBS 2006).

Even though one stream of the literature argues that banks' capital structure and risk-taking are heavily determined by regulators and supervisors, rather than by markets (Berger, Herring, and Szegö 1995, Rajan and Zingales 1995, Santos 2001, and Calomiris and Wilson 2004), another, more recent, strand of the literature advocates that the attributes that affect banks' capital structure and target ratios are not that different from those which influence nonfinancial firms' capital (Flannery 1994, Flannery and Rangan 2008, Gropp and Heider 2010, Allen, Carletti, and Marquez 2011, and De Jonghe and Öztekin 2015). This view stresses that banks are, to a certain extent, subject to market discipline, and that more space should be given to the market discipline of banks.

In this context, in order to shed some light on the differences between public and private banks with regards to access to capital and debt markets and ultimately the influence of market discipline on both types of banks' capital determinants, it is useful to test whether public banks rely more on nondeposits debt and subordinated debt than private banks. According to Flannery (1994), Flannery and Sorescu (1996), Morgan and Stiroh (2001), Flannery and Rangan (2008), and Allen, Carletti, and Marquez (2011), this kind of debt is more subject to market discipline than deposits.

Taking the share of assets funded by subordinated debt as a proxy for market access and market discipline, table 8 shows that public banks have been relying more on subordinated debt to fund their assets than private banks—which could imply that public banks have been capturing the preference of the market, as their capital determinants are more similar to those observed in the case

Table 8. Regression Results: The Differences between Public and Private Banks

	Regression 1 (All Banks)	**Regression 2 (All Banks)**
	Nondeposits	**Subordinated Debt**
PROF	0.4821**	0.0071
	(0.2374)	(0.0089)
SIZE	0.2699***	−0.0078***
	(0.0283)	(0.0014)
COLL	0.0044	0.0015
	(0.0728)	(0.0035)
RISK	−0.0057	0.0001
	(0.0052)	(0.0002)
PUBLIC	−0.1219	0.0102**
	(0.1190)	(0.0050)
Year Fixed Effects	Yes	Yes
Bank's Fixed Effects	Yes	Yes
Country Fixed Effects	Yes	Yes
R-square	0.52	0.59
Observations	4,815	4,028

Notes: This table reports coefficients of the following regression model:

$$L_{ict} = \beta_0 + \beta_1 PROF_{ict-1} + \beta_2 SIZE_{ict-1} + \beta_3 COLL_{ict-1} + \beta_4 RISK_{ict-1} + \beta_5 PUBLIC_{ict} + C_i + C_t + C_c + e_{it},$$

where L_{ict} is the nondeposits liabilities (regression 1) or subordinated debt (regression 2) as presented in the table, where "Nondeposit" is computed as the ratio between nondeposits liabilities and total assets; "Subordinated Debt" is calculated as the ratio between total subordinated debt liabilities and total assets; PROF is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; RISK is computed as the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year; and PUBLIC is a dummy variable that assumes 1 if the bank is quoted/listed and 0 otherwise. The sample period is from 2000 to 2016. Robust standard errors clustered at the bank and country-year levels are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

of nonfinancial firms—which is commonly stated in the extant literature.

Therefore it seems that the main differences found so far regarding the determinants of capital structure of public and private banks have been influencing the access to market financing, fostering market discipline in the case of public banks. This empirical evidence is also in line with the descriptive analysis carried out in subsection 4.2, as well as with the conclusions presented by the European Central Bank (Gaiduchevici and Zochowski 2017) and other research notes published by investment banks (Garcia and Rocamora 2018), which all highlight the fact that the southern European countries, which have a lower percentage of public banks, present material shortfalls regarding MREL requirements.

Regarding the fact that it is apparently easier for public banks to gain access to capital markets when compared with private banks (which is represented by the share of funding by subordinated debt), it is interesting to explore whether the market makes a distinction within the public bank sector between the levels of risk, size profitability, and collateral, by interacting each bank-specific variable with the dummy variable which identifies public banks. Additionally, it was decided to test whether the characteristics of the capital market of the country where the bank is headquartered influences access to the market for the case of public banks. This test was carried out by applying a measure of market efficiency which had previously been developed by Svirydzenka (2016), and then interacting this measure with a dummy variable which identifies public banks.

Taking into account the results outlined in table 9, it appears that public banks have equal access to market funding; however, this access is facilitated in more efficient markets, as the coefficient resulting from the interaction between public banks and market efficiency is both statistically significant and positively related with the share of subordinated debt.

6.3 Robustness Checks

We are tempted to be of the opinion that the differences observed are driven by other characteristics, rather than being private or public. Acknowledging this, we have split the original sample into two

Table 9. Regression Results: The Differences between Public and Private Banks

	Regression 1 Subdebt	Regression 2 Subdebt	Regression 3 Subdebt	Regression 4 Subdebt	Regression 5 Subdebt
PROF	0.0062	0.0070	0.0062	0.0073	0.0073
	(0.0094)	(0.0088)	(0.0090)	(0.0090)	(0.0089)
SIZE	−0.0078***	−0.0075***	−0.0079***	−0.0078***	−0.0078***
	(0.0014)	(0.0015)	(0.0014)	(0.0014)	(0.0014)
COLL	0.0015	0.0016	0.0064*	0.0014	0.0018
	(0.0035)	(0.0035)	(0.0036)	(0.0035)	(0.0035)
RISK	0.0001	0.0000	0.0000	0.0002	0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)
PUBLIC	0.0100*	0.0218	0.0143***	0.0073	0.0085*
	(0.0051)	(0.0162)	(0.0055)	(0.0052)	(0.0044)
FME	—	—	—	—	−0.0004
	—	—	—	—	(0.0021)
PUBLIC*PROF	0.0027	—	—	—	—
	(0.0094)	—	—	—	—
PUBLIC*SIZE	—	−0.1219	—	—	—
	—	(0.0017)	—	—	—
PUBLIC*COLL	—	—	−0.0160*	—	—
	—	—	(0.0084)	—	—
PUBLIC*RISK	—	—	—	−0.0005	—
	—	—	—	(0.0003)	—
PUBLIC*FME	—	—	—	—	0.0046*
	—	—	—	—	(0.0026)

(*continued*)

Table 9. (Continued)

	Regression 1 Subdebt	**Regression 2 Subdebt**	**Regression 3 Subdebt**	**Regression 4 Subdebt**	**Regression 5 Subdebt**
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Bank's Fixed Effects	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-square	0.59	0.59	0.59	0.59	0.59
Observations	4,028	4,028	4,028	4,028	4,028

Notes: This table reports the coefficients of several regressions which exploit interactions between public banks and bank-specific variables as well as a country-specific variable that characterizes each country financial market efficiency, inspired by the work carried out by Svirydzenka (2016). "SubDebt" stands for subordinated debt, calculated as the ratio between total subordinated debt liabilities and total assets; PROF is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets, which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; RISK is computed as the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year; PUBLIC is a dummy variable that assumes 1 if the bank is quoted/listed, and 0 otherwise; and FME stands for financial market efficiency index computed as stock market turnover ratio, i.e., stocks traded to capitalization (Svirydzenka 2016). The sample period is from 2000 to 2016. Robust standard errors clustered at the bank and country-year levels are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

subsamples which group the institutions into two clusters according to their size (as a proxy for similarity). Cluster 1 comprises small/medium banks (banks with average assets of less than 81 billion euros), and cluster 2 comprises large banks (banks with average assets equal to or greater than 81 billion euros). By using this division, we can isolate the differences between public and private, comparing similar banks by using size as the common characteristic for the two groups of banks.

Table 10 shows that, in the case of small/medium banks (cluster 1), the differences between the determinants of public and private banks' capital structure are maintained when compared with the results presented in table 6. That is to say that the determinants of public banks' capital structure are closer to those which affect nonfinancial firms. In the case of large banks (cluster 2), to a large extent these results do not confirm those initially reported. Accordingly, we can notice certain differences between public and private banks in relation to their capital structure, although these differences are not relevant for the group of large banks (cluster 2). This may be partly explained by the fact that in cluster 2 we obtained a substantially lower number of observations, which hampers the variability in the coefficients, compounded by the fact that large banks are subject to tighter market discipline than small/medium banks—which diminishes the effect of the type of banks on their capital structure determinants.

As mentioned in section 5, we relax the assumption that each country's regulatory framework is included in country and year fixed effects, in similarity to Gropp and Heider (2010), and we include a dummy variable which is adapted from the study carried out by Cerutti et al. (2017)—which assumes the value of 1 if any tight capital measure was implemented by each regulatory authority, and 0 otherwise. The inclusion of this variable does not change the results nor the conclusions presented in this paper (table 11).

7. Main Conclusions and Policy Implications

Over the last decade there has been a considerable increase in the number of empirical studies which have focused on testing how the determinants of capital structure applied to nonfinancial firms can also apply to banks. Two of the most important recent studies

Table 10. Regression Results: The Determinants of Banks' Capital Structure

	Regression 1 (Private Banks) (Cluster 1) BL	Regression 2 (Public Banks) (Cluster 1) BL	Regression 3 (Private Banks) (Cluster 2) BL	Regression 4 (Public Banks) (Cluster 2) ML
MBR	—	−0.0274***	—	−0.0324***
	—	(0.0045)	—	(0.0069)
PROF	−0.0565**	−0.1805***	0.0108	0.0201
	(0.0285)	(0.0614)	(0.0353)	(0.0835)
SIZE	0.0186***	0.0174	0.0226***	0.0224**
	(0.0027)	(0.0122)	(0.0043)	(0.0095)
COLL	0.0050	0.0031	0.0156	0.0101
	(0.0105)	(0.0263)	(0.0145)	(0.0368)
RISK	−0.0019***	−0.0082***	−0.0015**	−0.0129***
	(0.0006)	(0.0028)	(0.0007)	(0.0039)
Year Fixed Effects	Yes	Yes	Yes	Yes
Bank's Fixed Effects	Yes	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes	Yes
R-square	0.85	0.88	0.82	0.79
Observations	3,067	831	492	379

Notes: This table reports coefficients of the following regression model:

$$L_{ict} = \beta_0 + \beta_1 PROF_{ict-1} + \beta_2 SIZE_{ict-1} + \beta_3 COLL_{ict-1} + \beta_4 RISK_{ict-1} + C_i + C_t + C_c + e_{it},$$

where L_{ict} is the ML (regressions 2 and 4) or BL as presented in the table, BL is computed as 1 – (book value of equity/book value of assets); PROF is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets, which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; RISK is computed as the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year. Public banks are those that have their equity quoted/listed in capital markets, whereas private banks are those that do not have their equity quoted/listed in capital markets. The sample is from 2000 to 2016. Robust standard errors clustered at the bank and country-year levels are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

Table 11. Regression Results: The Determinants of Banks' Capital Structure

	Regression 1 (All Banks) BL	Regression 2 (Private Banks) BL	Regression 3 (Public Banks) ML
MBR	—	—	−0.0249***
	—	—	(0.0040)
PROF	−0.0456*	−0.0401	−0.1151*
	(0.0274)	(0.0325)	(0.0642)
SIZE	0.0164***	0.0179***	0.0225**
	(0.0024)	(0.0026)	(0.0110)
COLL	0.0111	0.0092	−0.0132
	(0.0072)	(0.0093)	(0.0201)
RISK	−0.0014***	−0.0019***	−0.0109***
	(0.0005)	(0.0006)	(0.0025)
CAPR	0.0009	0.0006	−0.0020
	(0.0017)	(0.0019)	(0.0040)
Year Fixed Effects	Yes	Yes	Yes
Bank's Fixed Effects	Yes	Yes	Yes
Country Fixed Effects	Yes	Yes	Yes
R-square	0.87	0.87	0.87
Observations	4,512	3,345	1,067

Notes: This table reports coefficients of the following regression model:

$$L_{ict} = \beta_0 + \beta_1 PROF_{ict-1} + \beta_2 SIZE_{ict-1} + \beta_3 COLL_{ict-1} + \beta_4 RISK_{ict-1} + \beta_5 CAPR_{ict-1} + C_i + C_t + C_c + e_{it},$$

where L_{ict} is the ML (regression 3) or BL as presented in the table, BL is computed as 1– (book value of equity/book value of assets); ML is calculated as 1 – [market value of equity (computed as number of outstanding shares*end of year stock price)/market value of bank (computed as the market value of equity + book value of liabilities)]; PROF is computed as the ratio between the sum of pretax profit and interest expenses and the book value of assets; SIZE is defined as the log of total assets which is computed as the sum of the following items: "cash and advances in other credit institutions," "claims on other credit institutions," "total loans and receivables," "financial assets classified at fair value through profit or loss," "financial assets classified as available for sale," "financial assets classified as held for trading," "financial assets classified as held to maturity," and "other assets" net of the respective impairment; COLL is computed as the ratio between the sum of the following items: "total securities," "fixed assets," and "cash and due from banks" and the book value of assets; RISK is computed as the log of the standard deviation of return on assets (which is computed as the ratio between net income and the average of book value of assets) calculated from the last three observations for the respective year; and CAPR is a dummy variable drawn from the study carried out by Cerutti et al. (2017) which takes the value of 1 if any tight capital measure was taken by each regulatory authority, and 0 otherwise. Public banks are those that have their equity quoted/listed in capital markets, whereas private banks are those that do not have their equity quoted/listed in capital markets. The sample is from 2000 to 2016. Robust standard errors clustered at the bank and country-year levels are in parentheses. *, **, and *** denote significance at the 10 percent, 5 percent, and 1 percent level, respectively.

are those of Gropp and Heider (2010) and De Jonghe and Öztekin (2015). Using a sample of large and public banks from Europe and the United States (from 1991 to 2004), the first study shows that regulation is not the main feature that distinguishes bank capital structure from what was argued by Modigliani and Miller (1958), as, for these authors, most banks appear to optimize their capital structure in much the same way as nonfinancial firms—except when their capital is close to the regulatory minimum.

Taking Gropp and Heider (2010) as a starting point, we assess whether the determinants of European banks' capital structure also depend on the type of the institution (i.e., whether it is private or public). We attempt to empirically answer the following question: Are the determinants of banks' capital structure different in public versus private banks? This topic has gained significant attention after the implementation of the new capital requirements of Basel III (conservation buffer, countercyclical buffer, and capital buffers for systemically important institutions, as well as leverage requirements—unweighted capital requirements) and also the MREL requirements envisaged in the new resolution framework—where access by banks to market financing plays a pivotal role in the success of compliance with these new requirements, which consequently strengthen the entire financial system and ultimately financial stability as a whole.

To a certain extent, our results for the sample as a whole confirm those of Gropp and Heider (2010), namely that leverage is positively correlated with size and is negatively correlated with profits, market-to-book value, and risk—which is broadly consistent with the pecking order and market timing theories.

Interestingly, our results have identified differences between public and private banks which influence the access to market. As such, public banks whose capital determinants are more similar to those observed in the case of nonfinancial firms have been those which have been more active in funding their assets with subordinated debt (proxy used for market financing), in accordance with the empirical literature which compares them with private banks.

In this context, this paper sheds some light on the potential success of the introduction of additional capital requirements under Basel III, and also how the entrance into force of the EU Directive on Banking Recovery and Resolution (BRRD), which regulates access

to equity and debt markets, plays a pivotal role in their success. The new resolution regime envisages a "bail-in process"—where shareholders, creditors, and a certain proportion of deposits are called upon to jointly share any losses with the first- and second-mentioned stakeholders—which implies that banks have to comply with the additional capital requirements (which are known as MREL), and that, in turn, they should comply with those equity and/or debt instruments that have bail-in-able characteristics.

The observed differences between public and private banks in accessing market financing can result in different levels of implementation of the new resolution regime and the MREL requirements across banks. Therefore, according to the results reported in this paper, public banks are expected to be quicker in complying with these kinds of requirements than private banks, which are more able to withstand difficulties in this regard.

In summary, the results presented in this paper represent serious implications from a policy point of view. On the one hand, the results highlight the potential challenges facing private banks as a consequence of the implementation of the new resolution regime when compared with public banks, due to the fact that the latter are already subject to diversified liabilities and capital ratios, where subordinated debt plays an important role. The unlevel playing field across banks in terms of accessing capital and debt markets might well undermine the success of this new regime, and in fact ultimately result in negative consequences for financial stability. Furthermore, private banks, which are characterized by a weaker investor base, due to a lack of, or limited experience in, issuing equity and debt instruments, are expected to withstand a higher spread—which in turn could undermine their profitability and also the internal generation of capital. On the other hand, the combination of this new resolution regime and the requirement to issue bail-in-able debt instruments could contribute to increasing the number of banks which are subject to market discipline and align the capital structure determinants of public and private banks and thus change the capital determinants of private banks to be more similar to those of public banks.

Despite the weakness demonstrated by market forces which came to light during the last financial crisis, market discipline is welcomed by regulators, and some strands of the literature recognize that market discipline can augment the role traditionally carried out by

regulatory and supervisory bodies. According to some authors, market discipline can be beneficial in several ways. First, the market can provide information to supervisors regarding the probability of default by banks (Flannery and Sorescu 1996, Gropp and Vesala 2004, Ashcraft 2008, Flannery and Rangan 2008, Distinguin, Kouassi, and Tarazi 2013, Hoang, Faff, and Haq 2014, and Oliveira and Raposo 2019)—which helps supervisors to efficiently allocate resources. Second, the market can discipline banks directly by adopting certain covenants regarding debt issues (Ashcraft 2008). Third, this type of discipline can reduce the moral hazard incentives which governmental guarantees create for banks. And finally, market discipline can improve efficiency and thus create pressure on less efficient banks to change their modus operandi (Martinez Peria and Schmukler 2001).

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