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The Determinants of Capital Structure: Some Evidence from Banks

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Discussion Paper No. 08-015

The Determinants of Capital Structure: Some Evidence from Banks

Reint Gropp and Florian Heider

ZEW

Zentrum für Europäische Wirtschaftsforschung GmbH

Centre for European Economic Research

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Non-technical summary:

Motivated by substantial cross-sectional variation in banks' leverage, which stands in contrast to the conventional wisdom that capital regulation is the main driver of banks' capital structures, this paper examines the capital structure of banks from the perspective of the empirical capital structure literature for non-financial firms. Moreover, banks are generally excluded from studies of capital structure and therefore constitute a natural hold-out sample that may be of particular interest given its relatively homogenous composition and particular institutional context. Our sample includes banks from 16 different countries (US and 15 EU members) from 1991 to 2004. We focus on the 200 largest listed banks (100 from the US and 100 from the EU – sampled anew each year based on their size) and have taken great care to reduce the survivorship bias in the Bankscope database.

The paper finds that the standard cross-sectional determinants of firms' capital structures also apply to large, publicly traded banks in the US and Europe. The sign and significance are identical and the economic magnitude of the effect of most variables on bank leverage tends to be *larger* compared to the results found in the literature for non-financial firms. We are unable to detect a first order effect of capital regulation on the capital structure of banks in our sample. This true for both book and market leverage, when controlling for risk and macro factors, when considering the effect of capital buffers, for US and EU banks examined separately, as well as when examining a series of cross-sectional regressions over time. Our results are unchanged when using regulatory Tier 1 capital ratios instead of book leverage as the dependent variable. The strength of the standard corporate finance determinants of leverage, however, weakens for those banks that are close to the minimum capital requirement.

Further, we document that beyond the standard corporate finance variables, unobserved time-invariant bank fixed-effects are important in explaining the variation of banks' capital structures. Banks with high (low) levels of leverage at the beginning of our sample also tend to have high (low) levels of leverage at the end. Hence, we confirm the recent evidence on the determinants of capital structure for non-financial firms in a sample of banks that operate in a different legal and institutional environment. Like non-financial firms, financial firms appear to have stable capital structures at levels that are specific to each individual bank. Such stability at the bank level stands in contrast to the uniform requirements imposed on banks by regulators based on Basel I and its subsequent modifications.

Furthermore, our paper is complementary to the market discipline view of banking regulation that examines why the level of capital of banks in the US and around the world is much higher than regulation would suggest. The paper is also related to recent theories of optimal bank capital structure, in which capital requirements are not necessarily binding.

Nicht-technische Zusammenfassung

Dieses Papier untersucht ob die Faktoren, die die Kapitalstruktur von Industrieunternehmen bestimmen, auch einen Einfluss auf die Kapitalstruktur von Banken haben. Die Kapitalstruktur von Banken variiert stark in der cross section, was der allgemeinen Ansicht widerspricht, dass die Kapitalstruktur von Banken allein von Regulierung bestimmt ist. Banken werden fast immer von Stichproben ausgeschlossen, die sich mit Kapitalstruktur beschäftigen und stellen deshalb eine natürliche „hold-out“ Stichprobe dar, die sich zudem noch durch eine große Homogenität und ungewöhnliche institutionelle Rahmenbedingungen auszeichnet. Die Stichprobe in diesem Papier besteht aus den 200 größten, am Aktienmarkt gehandelten, Banken in der EU und den USA. Die Daten erstrecken sich von 1991 bis 2004 und die Stichprobe wurde mit großer Sorgfalt für survivorship bias korrigiert.

Das Papier zeigt, dass die gleichen Faktoren, die die Kapitalstruktur von Industrieunternehmen bestimmen, auch die Kapitalstruktur von großen, an der Börse gehandelten Banken in der EU und den USA erklären können. Das Zeichen und die ökonometrische Signifikanz der Koeffizienten der meisten Variablen sind identisch und ökonomisch sind die Effekte eher stärker als für Industrieunternehmen. Wir sind nicht in der Lage einen Einfluss der Regulierung auf die Kapitalstruktur von Banken empirisch festzustellen. Diese Schlussfolgerung ergibt sich aus Regressionen mit Markt- und Bilanz-Verschuldung, wenn wir für Risiko und Makrofaktoren kontrollieren und auch wenn wir den Effekt von Kapitalreserven in Betracht ziehen. Sie gilt auch denn, wenn wir die Regressionen separat für Banken in den USA und Europa schätzen, und ist stabil im Zeitablauf. Wir erhalten weiterhin konsistente Ergebnisse, wenn wir die Tier1 Kapitalrelation als abhängige Variable verwenden. Nur für Banken, die sehr nahe an dem regulatorischen Minimum sind, schwächt sich der Effekt der Variablen ab.

Weiterhin dokumentieren wir, dass neben den üblichen Finanzstrukturvariablen, unbeobachtbare fixed effects, die sich im Zeitablauf nicht ändern, sehr wichtig sind in der Bestimmung der Kapitalstruktur von Banken. Banken mit viel (wenig) Eigenkapital am Anfang der Stichprobe haben auch viel (wenig) Eigenkapital am Ende der Stichprobe. Das bestätigt ein ähnliches Ergebnis für Industrieunternehmen in einer Stichprobe mit völlig anderen rechtlichen und institutionellen Rahmenbedingungen. Diese Stabilität in der Kapitalstruktur im Zeitablauf und die Stabilität der Unterschiede in der cross-section kontrastiert stark mit den gleichförmigen Kapitalregelungen unter Basel I.

Die Ergebnisse dieses Papier sind konsistent mit dem market discipline Ansatz zur Bankenregulierung, die sich mit der Frage auseinandergesetzt hat, warum Bankenkapital in den USA und anderen Ländern so viel höher ist, als es Regulierung vorschreibt. Das Papier hat außerdem einen Bezug zu neueren Papieren, die theoretisch zeigen, warum Banken optimale Kapitalstrukturen haben, in denen Kapitalvorschriften nicht bindend sind.

The determinants of capital structure: Some evidence from banks *

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The determinants of capital structure: Some evidence from banks

Abstract

This paper documents that standard cross-sectional determinants of firm leverage also apply to the capital structure of large banks in the United States and Europe. We find a remarkable consistency in sign, significance and economic magnitude. Like non-financial firms, banks appear to have stable capital structures at levels that are specific to each individual bank. The results suggest that capital requirements may only be of second-order importance for banks' capital structures and confirm the robustness of current corporate finance findings in a hold-out sample of banks.

Key words: capital structure, corporate finance, leverage, bank capital, banking regulation

JEL-codes: G32, G21

Introduction

Subsequent to the departures from Modigliani and Miller (1958)'s irrelevance proposition, there is a long tradition in corporate finance to investigate the capital structure decisions of firms. But what determines banks' capital structures? The standard textbook answer is that there is no need to investigate banks' financing decisions since capital regulation constitutes the overriding departure from the Modigliani and Miller propositions:

> *"Banks also hold capital because they are required to do so by regulatory authorities. Because of the high costs of holding capital [...], bank managers often want to hold less bank capital than is required by the regulatory authorities. In this case, the amount of bank capital is determined by the bank capital requirements (Mishkin, 2000, p.227)."*

Taken literally, this suggests that banks' leverage ratio is a constant. In the cross-section we should observe little variation of banks' capital structures. Figure 1 shows the distribution of the ratio of book equity to assets for a sample of the 200 largest publicly traded banks in the United States and 15 EU countries from 1991 to 2004 (we describe our data in more detail below). There is a large variation in banks' capital ratios.[1] Figure 1 indicates that bank capital structure deserves further investigation.

Figure 1 (Distribution of book capital ratios)

The strategy in this paper is to look for guidance in the empirical corporate finance literature that has at length examined the capital structures of non-financial firms (for a survey of the

[1] The ratio of book equity to book assets is an understatement of the regulatory Tier-1 capital ratio (see for example MorganStanley, 2003). Using the latter shifts the distribution to the right (see Appendix Figure A.1). Figure A.1 shows that regulatory capital is not uniformly close to the minimum of 4% specified in the Basel Capital Accord (Basel I).

literature see Harris and Raviv, 1991, and Frank and Goyal, 2007). Specifically, this paper estimates banks' leverage as a function of variables that exhibit a consistent and stable cross-sectional relationship with the leverage of non-financial firms in the US and other G-7 economies (see for example Titman and Wessels, 1988, Rajan and Zingales, 1995, and Frank and Goyal, 2005). Can we uncover the same patterns for banks that have been identified for firms? Can we detect evidence of binding capital regulation or do financial firms look much like non-financial firms, at least from this perspective?

A further important motivation for this paper is that banks are generally excluded from the investigation of capital structure. However, large publicly listed banks are a homogenous group of firms operating internationally with a comparable production technology. Hence, they constitute a natural hold-out sample, in part precisely because they are regulated and are frequently viewed as "special".[2] The literature on firm leverage has converged on a number of standard variables that are reliably related to the capital structure of non-financial firms. We check the robustness of these factors outside the environment in which they were originally uncovered.

Lemmon et al. (2007) show that while the relationship of the standard variables to capital structure may be stable, their power to explain the overall variation of firms' capital structures is low. Instead, firms' capital structures are driven by an unobserved time-invariant firm fixed effect. Is the capital structure of financial firms also driven by such fixed effects? If so then this would suggest that we should be looking for factors explaining capital structure that are not limited to firms but extend to the financial sector.

[2] The approach taken in this paper is similar to the one by Barber and Lyon (1997), who confirm that the relationship between size, market-to-book ratios and stock returns uncovered by Fama and French (1992) extends to banks. An early investigation of banks' capital structures using a corporate finance approach is Marcus (1983). He examines the decline in capital to asset ratios of US banks in the 1970s.

This paper finds that the standard cross-sectional determinants of firms' capital structures also apply to large, publicly traded banks in the US and Europe. The sign and significance are identical and the economic magnitude of the effect of most variables on bank leverage tends to be *larger* compared to the results found in Frank and Goyal (2005) for US firms and Rajan and Zingales (1995) for firms in G-7 countries. We are unable to detect a first order effect of capital regulation on the capital structure of banks in our sample. This true for both book and market leverage, when controlling for risk and macro factors, when considering the effect of capital buffers, for US and EU banks examined separately, as well as when examining a series of cross-sectional regressions over time. Our results are unchanged when using regulatory Tier 1 capital ratios instead of book leverage as the dependent variable. The strength of the standard corporate finance determinants of leverage, however, weakens for those banks that are close to the minimum capital requirement.

Further, we document that beyond the standard corporate finance variables, unobserved time-invariant bank fixed-effects are important in explaining the variation of banks' capital structures. Banks with high (low) levels of leverage at the beginning of our sample also tend to have high (low) levels of leverage at the end. Hence, we confirm the recent evidence on the determinants of capital structure for firms in Lemmon et al. (2007) for a different set of firms and in a different legal and institutional environment. Like non-financial firms, financial firms appear to have stable capital structures at levels that are specific to each individual bank. Such stability at the bank level stands in contrast to the uniform requirements imposed on banks by regulators based on Basel I and its subsequent modifications.

We are not the first to call into question whether capital requirements constrain banks. Barth et al. (2005), Flannery and Rangan (2007) and Berger et al. (2007) show that the level of capital of banks in the US and around the world is much higher than regulation would

suggest.[3] Flannery and Rangan (2007) argue that bank leverage ratios are the outcome of market discipline (see also Flannery and Sorescu, 1996, Morgan and Stiroh, 2001, and Gropp et al., 2006). Our paper supports the market discipline view from a complementary perspective.

Our paper is related to Flannery (1994), Myers and Rajan (1998), Diamond and Rajan (2000) and Allen et al. (2006), who develop theories of optimal bank capital structure, in which capital requirements are not necessarily binding. In Flannery (1994) debt counters the risk-shifting incentives of the management of financial firms. Myers and Rajan (1998) show that a financial firm will have an optimal interior level of leverage that depends on the liquidity of its assets. Diamond and Rajan (2000) argue that optimal bank capital structure is the result of a trade-off between liquidity creation, costs of bank distress, and the ability to force borrower repayment. Banks may also hold equity in order to commit to monitoring their loans in a competitive environment (Allen et al., 2007).

The paper is organised as follows. Section 2 describes our sample and explains how we address the survivorship bias in the Bankscope database. Section 3 presents the background for the list of firms' capital structure determinants. Section 4 shows descriptive evidence. Section 5 carries out the econometric analysis. Section 6 discusses and extends our results and examines their robustness. Section 7 concludes.

II. Data

Our data comes from three sources. We obtain information about banks' consolidated balance sheets and income statements form the Bankscope database of the Bureau van Dijk,

[3] In our sample, the average Tier 1 capital ratio is 9.8%, more than twice the regulatory minimum of 4%.

information about banks' stock prices and dividends from Thompson Financial's Datastream database and information about country level economic data from the World Economic Outlook database of the IMF. Our sample starts in 1991 and ends in 2004. We focus only on the 100 largest publicly traded commercial banks and bank-holding companies in the United States (as in Flannery and Rangan, 2007) and the 100 largest publicly traded commercial banks and bank-holding companies in 15 countries of the European Union. Our sample consists of 2415 bank-year observations.[4] Table 1 shows the number of unique banks and bank-years across countries in our sample.

Table 1 (Unique banks and bank-years across countries)

Special care has been taken to eliminate the survivorship bias inherent in the Bankscope database. Bureau van Dijk deletes historical information on banks that no longer exist in the latest release of this database. For example, the 2004 release of Bankscope does not contain information on banks that no longer exist in 2004 but did exist in previous years.[5] We address the survivorship bias in Bankscope by reassembling the panel data set by hand from individual cross-sections using historical, archived releases of the database. Bureau Van Dijk provides monthly releases of the Bankscope database. We used the last release of every year from 1991 to 2004 to provide information about banks in that year only. For example, information about banks in 1999 in our sample comes from the December 1999 release of Bankscope. This procedure allows us to quantify the magnitude of the survivorship bias: 12% of the banks present in 1994 no longer appear in the 2004 release of the Bankscope dataset.

[4] We select the 200 banks anew each year according to their book value of assets. There are less than 100 publicly traded banks in the EU at the beginning of our time period. There are no data for the US in 1991 and 1992. We also replaced the profits of Providian Financial in 2001 with those of 2002, as Providian faced lawsuits that year due to fraudulent mis-reporting of profits.

[5] For example, Banque National de Paris (BNP) acquired Paribas in 2000 to form the current BNP Paribas bank. The 2004 release of Bankscope no longer contains information about Paribas prior to 2000. There is, however, information about BNP prior to 2000 since it was the acquirer.

III. Standard determinants of leverage

The different corporate finance theories produce a long list of factors that drive firms' capital structures (see Harris and Raviv, 1991, and Frank and Goyal, 2007, for surveys). Beginning with Titman and Wessels (1988), then Rajan and Zingales (1995) and recently Frank and Goyal (2005), the empirical corporate finance literature has converged on the following set of variables that reliably predict leverage of non-financial firms in the cross-section. First, leverage is positively related to size. It is usually argued that larger firms are either safer, better known in the market, more exposed to agency problems (Jensen and Meckling, 1976) or enjoy market power vis-à-vis investors, all of which may explain why larger firms have more debt in their capital structures. Second, more profitable firms tend to have less leverage. This is consistent with the pecking-order theory (Myers and Majluf, 1984, Myers, 1984) and dynamic versions of the trade-off theory (Hennessy and Whited, 2005), while static versions of the trade-off theory predict that more profitable firms should lever up to shield their profits from corporate income tax (Bradley et al., 1984). Third, leverage is negatively related to a firm's market-to-book ratio. Firms with high market-to-book ratios have little free-cash flow as they appear to have numerous profitable investment opportunities available to them (Jensen, 1986). Such firms need less debt in their capital structure to prevent managers from investing the free cash-flow in negative NPV projects. Flannery (1994) has argued that this problem may be particularly severe for banks due to the illiquidity and opacity of their assets. High growth firms also have more to lose in the case of bankruptcy and may suffer more from a debt-overhang problem so that they should be relatively less leveraged (Myers, 1977; see also Barclay et al., 2006). Market timing can also explain the negative relationship between leverage and the market-to-book ratio as firms issue equity when managers perceive it to be overvalued (Baker and Wurgler, 2002). Dittmar and Thakor (2007) argue that firms issue equity when their valuation is high as this indicates agreement between managers and

investors about investment opportunities. Fourth, firms with more collateral have higher leverage. When more assets can be used as collateral, less is lost in distress reducing the bankruptcy costs of debt. Moreover, collateral reduces the agency cost of debt since it makes the monitoring of the use of assets easier. Finally, Frank and Goyal (2005) also find that a dummy variable indicating whether or not the firm pays dividends is negatively related to leverage. One reason could be that paying dividends exposes firms to the scrutiny of capital markets and reduces the agency cost of equity (Easterbrook, 1984).[6]

All these arguments extend naturally to banks unless one follows the textbook view that banks' capital structures are predominately determined by capital regulation (Berger et al., 1995). The textbook view is that i) bank deposits are insured to protect depositors and ensure financial stability and ii) banks must be required to hold a minimum amount of capital in order to mitigate the moral-hazard of this insurance (Dewatripont and Tirole, 1993). Therefore, the standard corporate finance determinants of the capital structure should have little or no explanatory power for banks.

IV. Descriptive evidence

Table 2 provides descriptive statistics for the variables we use. In the appendix we describe in detail how we construct these variables.[7]

Table 2 (Descriptive statistics)

[6] A further reliable determinant of firms' leverage is the average leverage of their industry (see for example MacKay and Phillips, 2005).
[7] We follow Frank and Goyal (2005) in our definition of variables. All data have been winsorized at 0.05% on both the left and right tail as in Lemmon et al. (2007).

Given the sample selection process, the banks in our sample are large. Mean total book assets are $65 billion and the median is $14 billion. Even though we selected only the largest banks, the sample exhibits considerable heterogeneity in the cross-section. The largest bank in the sample is almost 3000 times the size of the smallest. In light of the objective of this paper, it is useful to compare the descriptive statistics of leverage and its main determinants to a typical sample of listed non-financial firms used in the literature. Hence, we compare our data to those used in Frank and Goyal (2005, Table 3).[8] For both banks and firms the median market-to-book ratio is close to one. The assets of firms are typically three times as volatile as the assets of banks (12% versus 3.6%). The median profitability of banks is 5.1% of assets, which is a little less than a half of firms' profitability (12% of assets). Banks hold much less collateral than non-financial firms: 27% versus 56% of book assets, respectively. Our definition of collateral for banks includes liquid securities that can be used as collateral with central banks (ECB, 2001). Nearly 95% of publicly traded banks pay dividends, while only 43% of firms do so.

Based on these simple descriptive statistics, banking appears to be a relatively safe and, correspondingly, low return industry. This matches the recent finding by Flannery et al. (2004) that banks may simply be "boring". Their level of leverage is, however, substantially different from that of firms. Banks' median book leverage is 92.6% and median market leverage is 87.3% while median book and market leverage of non-financial companies in Frank and Goyal (2005) is 24% and 23%, respectively. Banking is an industry with on average very high leverage.

[8] See also Table 1 in Lemmon et al. (2007) for similar information.

But is it the case that there are no non-financial firms with levels of leverage similar to the ones observed for banks? To answer this question, we replicate Table 4 in Welch (2006) here as Appendix Table A.1. The table contains the 30 most levered firms in the S&P 500 stock market index. As expected, banks figure prominently on this list. Of the 30 most leveraged S&P 500 companies in the US one third are financial firms. However, the S&P 500 contains 93 financial firms, which implies that 83 do not make this list. Instead, the 20 remaining non-financial firms in the top 30 come from essentially all sectors including consumer goods, IT, industrials and utilities. Most of them have investment grade credit ratings, i.e. they are not considered close to bankruptcy. Seen from this perspective, it is clear that while banks are more likely to be highly levered, there is also a substantial number of non-financial firms no less levered than banks. This further supports our approach to examine bank capital structures using determinants related to the capital structure of non-financial firms.

Table 3 presents the correlations among the main variables. Larger banks tend to have lower profits and more leverage. A bank's market-to-book ratio correlates positively with asset risk, profits and negatively with leverage. Banks with more asset risk, more profits and less collateral have less leverage.

Table 3 (Correlations among main variables)

The positive relationship between risk and the market-to-book ratio is surprising in light of the banking literature that examines the link between risk taking and charter values (see Keeley, 1990; and Hellmann et al., 2000). This literature usually argues that charter values reduce the moral-hazard arising from deposit insurance and safety nets because banks with high charter values have more to lose when they go out of business. These charter values are

usually measured using market-to-book ratios. Hence, there should be a negative relationship with risk. The positive relationship we find could simply reflect a standard risk-return trade-off: higher market values, i.e. higher expected future returns, are associated with higher risks.

V. Econometric analysis

Our baseline specification is the following standard capital structure regression:

$$L_{it} = \beta_0 + \beta_1 MTB_{it-1} + \beta_2 Prof_{it-1} + \beta_3 Ln(Size_{it-1}) + \beta_4 Coll_{it-1} + \beta_5 Div_{it} + c_c + c_t + u_{ict} \qquad (1)$$

The explanatory variables are the market-to-book ratio (*MTB*), profitability (*Prof*), the natural logarithm of size (*Size*), collateral (*Coll*) (all lagged by one year) and a dummy for dividend payers (*Div*) for bank *i* in year *t*. The dependent variable is one minus the ratio of equity over assets in market values (see the appendix for the definition of variables). It therefore includes both debt and non-debt liabilities such as deposits (see Welch, 2006). The regression includes time and country fixed effects (c_t and c_c) to account for unobserved heterogeneity at the country level and across time that may be correlated with the explanatory variables. Standard errors are clustered at the bank level to account for heteroscedasticity and serial correlation of errors (Petersen, 2007).

Table 4 shows the results of estimating equation (1). We also report the coefficient elasticities and confront them with the results of comparable regressions for non-financial firms in Rajan and Zingales (1995) and Frank and Goyal (2005).

Table 4 (Standard cross-sectional determinants of market leverage)

All coefficients are statistically significant at the one percent level, except for collateral, which is marginally significant at the 10 percent level. All coefficients have the same sign as in the corporate finance literature. Banks' leverage depends positively on size and collateral, and negatively on the market-to-book ratio, profits and dividends.

We find that the elasticity of bank leverage to all explanatory variables except collateral and dividends is larger than the elasticities of firm leverage to the corresponding variables.[9] A one percentage change of the market-to-book ratio decreases bank leverage by 0.683 percent. Frank and Goyal (2005) find an elasticity of market leverage to the market-to-book ratio of -0.170. The elasticity of leverage to profits is -0.018 for banks (and -0.008 for firms). A one percent increase in median profits, $7.3m, decreases median liabilities by $250m. This is an economically significant effect. We conclude that the standard corporate finance determinants of capital structure also speak to banks' market leverage. The model fits the data very well: The R^2 is 0.72.

The similarity of the results for banks and firms may even be more surprising as we are comparing a cross-country data set of very large entities with a US dataset composed of much smaller entities. The book value of assets in the bank dataset is about $64 billion, while the book value of assets in Frank and Goyal's (2005) firm dataset is less than $100 million. Our dataset spans 16 countries. On the other hand, large listed banks as those in our sample may be viewed as a relatively homogenous set of firms operating with a similar technology across many markets. This further highlights the usefulness of examining standard firm capital structure in a hold-out sample of banks.

[9] We examined whether the difference in the elasticity of collateral is due to differences in measurement across banks and firms. However, we found the results robust to defining collateral including or excluding liquid assets. We attribute the relatively weak result for dividends to the fact that almost all of the banks in the sample (more than 94 percent) pay dividends, suggesting only limited variation in this explanatory variable.

Leverage can be measured in both book and market values. Both definitions have been used in the literature and yield similar results.[10] The difference between book and market values offers an interesting angle for banks since capital regulation is imposed on book but not on market capital. Hence, we estimate equation (1) with book leverage as the dependent variable and check whether in the case of banks, standard corporate finance determinants continue to drive both measures of leverage similarly.[11]

Table 5 (Standard cross-sectional determinants of book leverage)

Table 5 shows that the results for book leverage are stronger than those for market leverage. Regressing book leverage on the standard corporate finance determinants of capital structure produces estimated coefficients that are all significant at the 1% level and all have the same sign as in studies of non-financial firms. Moreover, elasticities for the market-to-book ratio and size are much larger than for firms. The elasticity of bank leverage to profits is almost identical to the elasticity of firm leverage to profits. As in the case of market leverage, collateral and dividends are less important determinants of bank book leverage than of firm book leverage. Similar to the corporate finance literature for firms we are unable to detect large differences between the results for book and for market leverage of banks. This does not support the hypothesis that regulatory concerns create a wedge between the determinants of banks' book and market capital structures.

Despite its prominent role in corporate finance theory, risk sometimes fails to show up as a reliable factor in the empirical literature on firms' leverage (Titman and Wessels, 1988; Frank and Goyal, 2005). Regulators, however, can be expected to care about minimising the

[10] Exceptions are Barclay et al. (2006) who focus on book leverage and Welch (2004) who argues for market leverage. Most studies, however, use both.
[11] We report results for regressions on Tier 1 regulatory capital ratios in section VI below.

downside risk of banks. Hence, we examine whether risk is an important factor for banks and whether it drives out the standard corporate finance determinants of leverage.

Table 6 (columns 2 and 4) reports the results of estimating

$$L_{it} = \beta_0 + \beta_1 MTB_{it-1} + \beta_2 Prof_{it-1} + \beta_3 Ln(Size_{it-1}) + \beta_4 Coll_{it-1} + \beta_5 Div_{it} + \beta_6 Ln(Risk_{it-1}) + c_c + c_t + u_{ict} \quad (2)$$

The equation includes asset volatility (*Risk*) as an explanatory variable. The dependent variable is either book or market leverage.

Table 6 (Adding risk to the standard cross-sectional determinants of leverage)

Banks with more volatile assets have significantly less leverage, both in book and market values. Adding risk also substantially improves the fit of the book leverage regression: the R^2 increases from 0.32 to 0.48. The increase is smaller for market leverage. One possible interpretation could be that this reflects regulatory intervention. We tend to find this interpretation unconvincing. Capital requirements under Basel I are generally risk insensitive, which indeed was the motivation for revising the accord (Basel II). It seems therefore unlikely that the strong relationship between risk and leverage is explained by regulatory intervention based on Basel I alone. Regulators may, however, discretionally ask banks to hold more capital when they are riskier. In the US for example, regulators have modified Basel I to increase its risk sensitivity and the results could reflect these modifications (FDICIA). But Jones and King (1995) show that mandatory actions under FIDICIA are applied only very infrequently. Flannery and Rangan (2007) conclude that regulatory pressures cannot explain the relationship between risk and book leverage. Moreover, the marginal impact of risk on market leverage is twice as large as on book leverage. Finally, as we show below, we find a

significant negative relationship between risk and both market and book leverage for both the US and Europe. If FDICIA were the primary reason for the risk sensitivity of leverage, we should find this effect mainly for banks' book leverage in the US. The negative coefficient of risk on leverage is in line with standard corporate finance arguments. More risk increases the likelihood of going bankrupt. This in turn may raise the cost of debt. In Welch (2004) and Lemmon et al. (2007) risk significantly reduces leverage. Halov and Heider (2004) argue that high risk firms issue equity to avoid the adverse selection cost of risky debt.

Risk does not drive out the other variables. An F-test on the joint insignificance of all non-risk coefficients is rejected. All coefficients from Tables 4 and 5 remain significant at the 1% level, except i) the coefficient of the market-to-book ratio on book leverage, which is no longer significant, and ii) the coefficient of collateral on market leverage, which becomes significant at the 5% level (from being marginally significant at the 10% level before). Risk lowers the coefficient on the market-to-book ratio by two thirds. The reason is that risk strongly commoves positively with the market-to-book ratio (see Table 3: the correlation coefficient is 0.85) and we are unable to fully disentangle the effect of risk versus the effect of the market-to-book ratio on book leverage.

Finally, we examine the finding of Lemmon et al. (2007) that most of the variation of firms' capital structures is driven by an unobserved time-invariant firm specific factor. To check whether this finding extends to our hold-out sample of banks, we alter equation (2) and include firm instead of country fixed effects.

$$\begin{aligned} L_{it} &= \beta_0 + \beta_1 MTB_{it-1} + \beta_2 Prof_{it-1} + \beta_3 Ln(Size_{it-1}) + \beta_4 Coll_{it-1} + \beta_5 Div_{it} \\ &\quad + \beta_6 Ln(Risk_{it-1}) + c_i + c_t + u_{it} \end{aligned} \tag{3}$$

The results in Table 7 show that most of the variation of banks' capital structures is also driven by bank fixed effects. The fixed effect accounts for 92% of book leverage and for 76% of market leverage.

Table 7 (Adding bank fixed effects)

Banks' capital structures tend to remain stable over long periods of time at bank specific levels even after controlling for the standard determinants of leverage identified in the literature. The estimates keep the same sign as in Table 6 (columns 2 and 4) (except for the effect of the market-to-book ratio on book leverage) but their magnitude and significance reduces since they are identified from the time-series variation within banks only.[12]

The Basel 1 capital requirements and their implementation apply to all relevant banks in the same way and are of course irrelevant for non-financial firms. Yet, banks' leverages are stable around levels specific to each individual bank and this stability is similar to the one documented for non-financial firms.

Confirming the finding of Lemmon et al. (2006) in our hold-out sample narrows down the list of candidate explanations for the unobserved determinants of the stability of capital structure. It not only holds in the original sample of publicly traded non-financial US firms (and a subsample of US and UK firms prior to going public) across many industries but also for large publicly traded banks in Europe and the US. Such banks form a fairly homogenous and global industry that operates under different institutional and technological circumstances than non-financial firms. One possible explanation that has been suggested for the original

[12] A recent literature examines the dynamic properties of firms' leverage (see for example Hovakimian et al., 2001; Fama and French, 2002; and Flannery and Rangan, 2006).

result of Lemmon et al. (2006), and that could also be applied to banks, is the importance of top managers and corporate culture on firms' financing decisions (see for example Bertrand and Schoar, 2003; Frank and Goyal, 2007; and Chemmanur et al., 2007).

VI. Discussion, extensions and robustness

Even though the concern of this paper is not the level of bank leverage, but rather its variation in the cross-section, our results shed new light on one explanation for the high levels of bank discretionary capital, i.e. capital in excess of the regulatory threshold, in many countries (Barth et al., 2005; Flannery and Rangan, 2007; Berger et al., 2007): The idea that banks hold capital buffers above the regulatory minimum in order to avoid the costs associated with having to issue fresh equity at short notice (see, for example, Peura and Keppo, 2006). It follows that banks facing higher cost of issuing equity should be less levered (see Section III). When we re-examine our results in this light, the evidence in favour of buffers appears weak: Banks with higher market–to-book ratios, higher profits and dividend paying banks can be expected to face lower costs of issuing equity. However, these banks hold less debt and, hence, more discretionary capital. Larger banks are more levered, which may be seen as evidence in favour of buffers, if one thinks that larger banks are better known to the market. But it may also be seen as evidence against buffers, if one believes that larger banks are more complex and, hence, potentially face larger asymmetric information costs of issuing equity compared to smaller banks. The only evidence unambiguously in favour of buffers is that riskier banks hold less debt.

Although standard corporate finance determinants of firm leverage explain banks' capital structures in the whole sample, and capital regulation therefore does not appear to be of first-

order importance for all banks, they could be less relevant for those banks close to the regulatory minimum. We therefore examine the leverage of banks that have little discretionary regulatory capital.

Equation (4) builds on equation (2) and interacts all explanatory variables with a dummy (*Close*) that is equal to one if a bank has less than 5% of regulatory Tier 1 capital in the previous year.[13] The dependent variable is the book leverage ratio.

$$\begin{aligned} L_{it} = {} & \beta_0 + \beta_1 MTB_{it-1} + \beta_2 MTB_{it-1} * Close_{it-1} + \beta_3 Prof_{it-1} + \beta_4 Prof_{it-1} * Close_{it-1} \\ & + \beta_5 Ln(Size_{it-1}) + \beta_6 Ln(Size_{it-1}) * Close_{it-1} + \beta_7 Coll_{it-1} + \beta_8 Coll_{it-1} * Close_{it-1} \\ & + \beta_9 Div_{it} + \beta_{10} Div_{it} * Close_{it-1} + \beta_{11} Ln(Risk_{it-1}) + \beta_{12} Ln(Risk_{it-1}) * Close_{it-1} + c_c + c_t + u_{ict} \end{aligned} \quad (4)$$

The first column of Table 8 shows that the marginal impact of size, collateral and dividends is not significantly different for banks close or far away from the regulatory minimum. However, the coefficients for the market-to-book ratio, profits and risk are significantly different. For these variables the interaction terms tend to have the opposite sign and are significant at least at the five percent level. For banks close to the regulatory minimum, profits and risk are not significantly different from zero. The market-to-book ratio is significantly positive for those banks while it has a negative (although insignificant) effect for banks with more discretionary capital.[14] We therefore conclude that the standard corporate finance drivers of leverage weaken for banks close to the regulatory minimum.

Table 8 (Extension and robustness)

We checked the robustness of the results along four additional dimensions: One, we add macro-economic control variables. Second, we run the regressions separately for US and EU

[13] The Tier 1 capital ratio is not available for all banks in the sample.
[14] Based on an F-test whether the sum of an explanatory variable and its interaction with the *Close* dummy equals zero.

banks. Third, we estimate the model year by year, in order to check whether the coefficients change over time and fourth, we estimate the model using the Tier 1 capital ratio as the dependent variable instead of market or book leverage.

First consider the model with macro variables, which is reported in columns 2 (book leverage) and 5 (market leverage) of Table 8. Frank and Goyal (2005) test whether the capital structure of publicly traded firms in the US reacts to macro-economic conditions. We therefore add GDP growth, stock market volatility and the term structure of interest rates to the determinants of capital structure. It is possible that, unlike for firms, these variables matter for banks given their particular role in the economy. Banks finance firms so that their business depends on firms' investment opportunities. It is therefore reasonable to expect that the business cycle, measured by the growth rate of domestic GDP, affects banks' capital structures more than firms' capital structures. Similarly, a key function of banks is maturity transformation. Banks receive short-term deposits that they lend as long-term loans to firms. The spread between the 3 month and the 10 year interest rate on domestic government bonds captures a possible impact of such intermediation on banks' leverage. The overall risk of the environment banks operate in, measured by the standard deviation of domestic stock market index returns, may also play a role. Finally, we want to check whether some of the bank specific variables simply pick up business cycle effects, rather than bank specific trade-offs.

Controlling for macro-economic factors does not change the coefficients or the significance of the standard determinants of leverage. The stock market volatility is a significant macro-economic determinant of both book and market leverage (at the 10% level). Similar to banks' individual risk, a riskier environment is associated with less leverage. A larger term structure spread is associated with higher market but not book leverage and this effect is significant at the 1% level. GDP growth is not significant. Once individual banks' asset risk is controlled

for, adding macroeconomic factors does not help much in explaining the cross-sectional variation of banks' capital structures.

The results for estimating the model separately for US and EU banks are reported in columns 3 and 4 (book leverage) and 6 and 7 (market leverage) of Table 8. We present the results for the two economic areas separately in order to examine whether the results are driven by US bank or EU banks alone. We find that this is not the case. All coefficients have the same sign as in previous specifications and tend to be significant. Exceptions include size and collateral for market leverage of US banks and dividends in case of book leverage for US banks.[15] We conclude that our results do indeed extend to banks on both sides of the Atlantic.

We next estimate the models year by year to examine Flannery and Rangan's (2007) contention that capital requirements have become less binding over time. Controlling for the standard determinants of leverage in each cross-section, we are unable to detect a clear trend in the estimated coefficients over time. While the significance of the coefficients is reduced in any given year (which is to be expected given the smaller sample size for each year), the signs and economic magnitudes are stable through time. The results are available from the authors upon request.

Finally, we examine whether the standard corporate finance variables not only explain book and market leverage, but also Tier 1 capital ratios. We define the Tier 1 capital ratio in line with Basel I as Tier 1 capital divided by risk weighted assets. Note that we would expect all coefficients to have the opposite sign of the leverage regressions. Column 8 of Table 8 confirms that more profitable and smaller banks have more Tier 1 capital (the coefficients are

[15] We examined the insignificance of size and collateral and found that estimating the model without the large US credit card issues (5 firms) results in positive and significant estimates for size on market leverage.

significant at the 1 percent level). Perhaps surprisingly, banks with more collateral hold more Tier 1 capital (significant at the 1 percent level). And finally, as one would expect, riskier banks also hold more Tier 1 capital (significant at the 1 percent level). Tier 1 capital ratios are not significantly related to market–to-book ratios and dividend paying status. Overall, the results for Tier 1 capital ratios are similar to those for book leverage.

VII. Conclusion

Motivated by substantial cross-sectional variation in banks' leverage, this paper examines the capital structure of banks from the perspective of the empirical capital structure literature for non-financial firms. Banks are generally excluded from studies of capital structure and therefore constitute a natural hold-out sample that may be of particular interest given its relatively homogenous composition and particular institutional context. Our sample includes banks from 16 different countries (US and 15 EU members) for 14 years. We focus on the largest listed banks and have taken great care to reduce survivorship bias.

This paper documents that standard cross-sectional determinants of firm leverage also apply to the capital structure of large banks in the United States and Europe. This is true for both market and book leverage ratios, when we examine US and European banks separately, controlling for risk and macro variables. The relationships appear stable over time. Except for some banks close to the regulatory minimum, the results do not reveal a strong effect of capital regulation on banks' capital structures. Most banks seem to be optimising their capital structure in much the same way as firms. The results offer complementary evidence to studies showing that capital levels of banks in the US and around the world are much higher than regulation would suggest.

Moreover, the variation of banks' leverage appears to be driven by an unobserved time-invariant bank fixed effect. Like non-financial firms, banks have stable capital structures at levels that are specific to each individual bank. Our paper extends current capital structure findings, namely the robustness of a limited number of variables in explaining capital structure of non-financial firms and the importance of time-invariant firm fixed effects, to banks and across national borders. As these results hold outside the environment they were initially tested in, we think this has important implications for future work in capital structure for both banks and firms.

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Figure 1: Distribution of book capital ratios

The figure shows the distribution of banks' book capital ratio (book equity divided by book assets) for the 2415 bank-year observations in our sample (15 EU countries and the US) from 1991 to 2004.

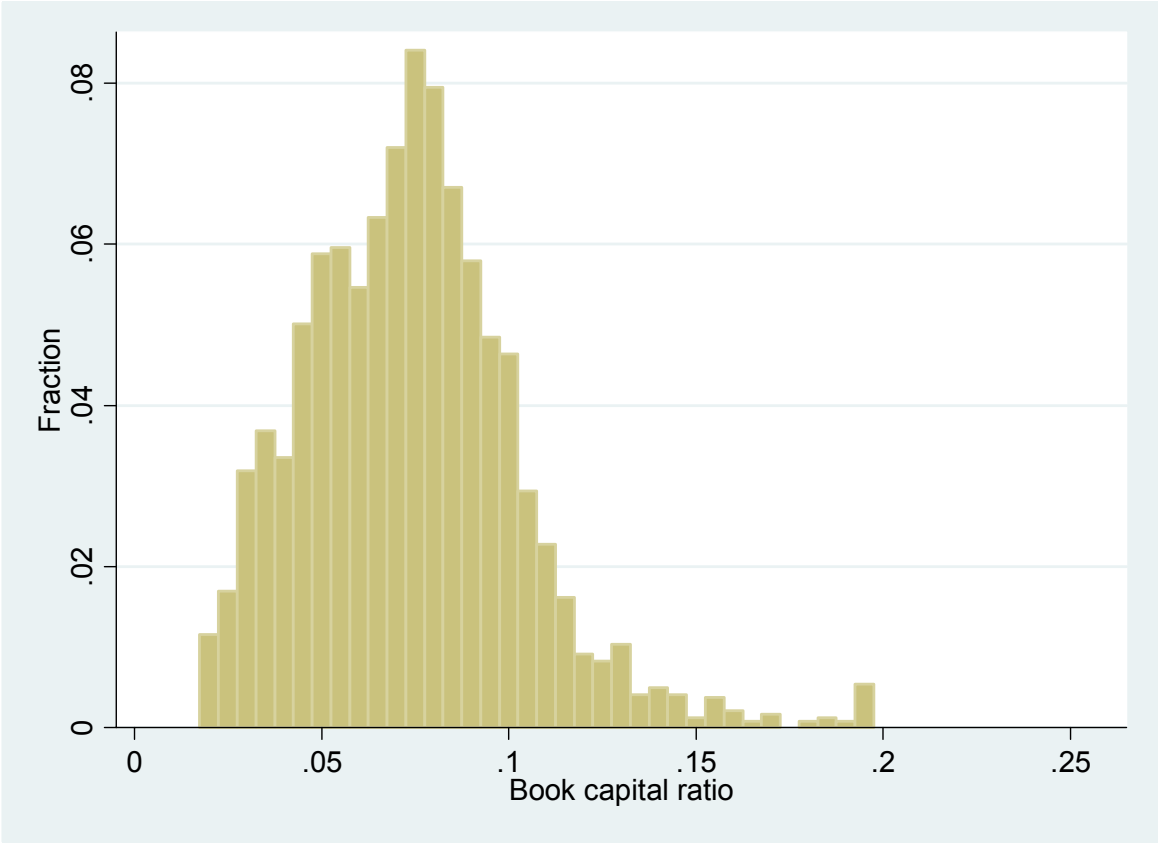

Table 1: Unique banks and bank-years across countries

Country	Unique banks	Bank-years
AT	8	44
BE	5	29
DE	12	123
DK	11	77
ES	13	133
FI	3	30
FR	29	168
GB	17	121
GR	8	53
IE	5	43
IT	30	223
LU	4	34
NL	4	35
PT	5	62
SE	4	40
US	169	1,200
Total	327	2,415

Table 2: Descriptive statistics
The sample is the 2415 bank-year observations in 15 EU countries and the US from 1991 to 2004. See the appendix for the definition of variables.

	Mean	Median	St.Dev.	Max	Min
Book assets (m$)	64,100	14,900	126,000	795,000	288
Market-to-book	1.065	1.039	0.105	1.809	0.942
Asset risk	0.036	0.028	0.034	0.245	0.002
Profits	0.051	0.049	0.019	0.145	0.011
Collateral	0.266	0.260	0.130	0.782	0.015
Dividend payer	0.944	1	0.231	1	0
Book leverage	0.926	0.927	0.029	0.983	0.806
Market leverage	0.873	0.888	0.083	0.988	0.412

Table 3: Correlations among main variables

The sample is the 2415 bank-year observations in 15 EU countries and the US from 1991 to 2004. See the appendix for the definition of variables. Numbers in italics indicate p- values.

	Book assets	Market-to-book	Asset risk	Profits	Collateral	Dividend payer	Book leverage	Market leverage
Book assets	1.000							
Market-to-book	-0.085	1.000						
	0.000							
Asset risk	-0.083	0.848	1.000					
	0.000	*0.000*						
Profits	-0.118	0.166	0.164	1.000				
	0.000	*0.000*	*0.000*					
Collateral	-0.019	0.081	0.128	-0.163	1.000			
	0.363	*0.000*	*0.000*	*0.000*				
Dividend payer	0.041	0.089	0.035	0.019	0.031	1.000		
	0.042	*0.000*	*0.083*	*0.354*	*0.128*			
Book leverage	0.298	-0.420	-0.527	-0.083	-0.070	-0.082	1.000	
	0.000	*0.000*	*0.000*	*0.000*	*0.001*	*0.000*		
Market leverage	0.183	-0.819	-0.744	-0.111	-0.144	-0.126	0.690	1.000
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	

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Table 4: Standard cross-sectional determinants of market leverage

The first column shows the result of estimating equation (1). It includes time and country fixed-effects. The dependent variable is market leverage. See the Appendix for the definition of variables. The second column reproduces estimates from Table 8, column 7 of Frank and Goyal (2005) and the third column reproduces estimates from Table 9, panel B, first column of Rajan and Zingales (1995) for comparison. The R^2 in the first column is the correlation between the fitted value of the dependent variable from the regression and its actual value in the data. Standard errors are adjusted for clustering at the bank level. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

Dependent variable Market leverage		Frank and Goyal (2005b) Table 8, Column 7 (1990-2000)	Rajan and Zingales (1995) Table 9, Panel B (United States)
Market-to-book ratio	-0.560***	-0.022***	-0.08***
se	*0.034*	*0.000*	*0.01*
elasticity	*-0.683*	*-0.170*	
Profits	-0.298***	-0.104***	-0.60***
se	*0.097*	*0.003*	*0.07*
elasticity	*-0.018*	*-0.008*	
Log(Size)	0.006***	0.021***	0.03***
se	*0.001*	*0.000*	*0.00*
elasticity	*0.115*	*0.082*	
Collateral	0.020*	0.175***	0.33***
se	*0.012*	*0.004*	*0.03*
elasticity	*0.006*	*0.314*	
Dividends	-0.019***	-0.092***	
se	*0.004*	*0.002*	
elasticity	*-0.020*	*-0.106*	
constant	1.360***		
se	*0.039*		
Number of observations	2415	63144	2207
R^2	0.72	0.29	0.19

Table 5: Standard cross-sectional determinants of book leverage

The first column shows the result of estimating equation (1). It includes time and country fixed-effects. The dependent variable is book leverage. See the Appendix for the definition of variables. The second column reproduces estimates from Table 9, column 7 from Frank and Goyal (2005) and the third column reproduces estimates from Table 9, panel A, first column from Rajan and Zingales (1995) for comparison. The R^2 in the first column is the correlation between the fitted value of the dependent variable from the regression and its actual value in the data. Standard errors are adjusted for clustering at the bank level. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

Dependent variable Book leverage		Frank and Goyal (2005b) Table 9, Column 7 (1990-2000)	Rajan and Zingales (1995) Table 9, Panel A (United States)
Market-to-book ratio	-0.066***	-0.002***	-0.17***
se	*0.016*	*0.001*	*0.01*
elasticity	*-0.076*	*-0.012*	
Profits	-0.210***	-0.214***	-0.41***
se	*0.063*	*0.004*	*0.10*
elasticity	*-0.012*	*-0.013*	
Log(Size)	0.006***	0.013***	0.06***
se	*0.001*	*0.001*	*0.01*
elasticity	*0.107*	*0.050*	
Collateral	0.032***	0.157***	0.50***
se	*0.009*	*0.005*	*0.04*
elasticity	*0.009*	*0.270*	
Dividends	-0.009***	-0.078***	
se	*0.003*	*0.003*	
elasticity	*-0.009*	*-0.086*	
constant	0.886***	0.038***	
se	*0.022*	*0.005*	
Number of observations	2415	64057	2079
R^2	0.32	0.16	0.21

Table 6: Adding risk to the standard cross-sectional determinants of leverage

The first and third columns reproduce the first column of Table 4 and 5 respectively. The second and fourth column show the result of estimating equation (2) where the dependent variable is book and market leverage respectively. All regressions include time and country fixed-effects. See the Appendix for the definition of variables. R^2 is the correlation between the fitted value of the dependent variable from the regression and its actual value in the data. Standard errors are adjusted for clustering at the bank level. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

Dependent variable		Market leverage		Book leverage	
		from Table 4		from Table 5	
Market-to-book ratio		-0.560***	-0.472***	-0.066***	-0.020
	se	*0.034*	*0.036*	*0.016*	*0.015*
	elasticity	*-0.683*	*-0.576*	*-0.076*	*-0.023*
Profits		-0.298***	-0.262***	-0.210***	-0.192***
	se	*0.097*	*0.087*	*0.063*	*0.058*
	elasticity	*-0.018*	*-0.015*	*-0.012*	*-0.011*
Log(Size)		0.006***	0.005***	0.006***	0.006***
	se	*0.001*	*0.001*	*0.001*	*0.001*
	elasticity	*0.115*	*0.105*	*0.107*	*0.102*
Collateral		0.020*	0.020**	0.032***	0.032***
	se	*0.012*	*0.010*	*0.009*	*0.008*
	elasticity	*0.006*	*0.006*	*0.009*	*0.009*
Dividends		-0.019***	-0.019***	-0.009***	-0.009***
	se	*0.004*	*0.004*	*0.003*	*0.003*
	elasticity	*-0.020*	*-0.021*	*-0.009*	*-0.009*
Log(Risk)			-0.024***		-0.013***
	se		*0.004*		*0.002*
	elasticity		*-0.028*		*-0.014*
constant		1.360***	1.195***	0.886***	0.799***
	se	*0.039*	*0.047*	*0.022*	*0.022*
Number of observations		2415	2415	2415	2415
	R^2	0.72	0.78	0.32	0.48

Table 7: Adding bank fixed effects

The Table shows the result of estimation equation (3). It includes time and bank fixed-effects. In the first column the dependent variable is book leverage, in the second column it is market leverage. See the Appendix for the definition of variables. The R^2 is the correlation between the fitted value of the dependent variable from the regression and its actual value in the data. Standard errors are adjusted for clustering at the bank level. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

Dependent variable		Book leverage	Market leverage
Market-to-book ratio		0.017***	-0.118***
	se	*0.006*	*0.039*
Profits		-0.244***	-0.392***
	se	*0.042*	*0.079*
Log(Size)		0.003	0.013**
	se	*0.002*	*0.006*
Collateral		0.001	0.006
	se	*0.007*	*0.013*
Dividends		0.000	-0.010
	se	*0.002*	*0.007*
Log(Risk)		-0.005***	-0.016***
	se	*0.001*	*0.003*
constant		0.845***	0.717***
	se	*0.035*	*0.146*
Number of observations		2415	2415
Frac. of variance due to bank FE		0.92	0.76
	R^2	0.26	0.57

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Table 8: Extension and robustness: close to regulatory threshold, macro-variables, US-EU separately and Tier 1 capital

The first column shows the result of estimating equation (4). It includes time and country fixed effects and all explanatory variables are lagged one year (except dividends). The dependent variable is either book leverage or market leverage. In the first column the dummy *Close* equals one if the Tier 1 regulatory capital ratio was less than five percent for a bank in in the previous year. See the Appendix for the definition of variables. The R^2 is obtained from a dummy variable regression to account for the fixed effects. Standard errors are adjusted for clustering at the bank level. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level respectively.

Dependent variable		Book leverage				Market leverage			Regulatory tier 1 capital
		(1)	(2)	(3) EU only	(4) US only	(5)	(6) EU only	(7) US only	(8)
Market-to-book ratio		-0.007	-0.020	-0.033	0.024	-0.475***	-0.523***	-0.412***	-0.019
	se	*0.016*	*0.016*	*0.024*	*0.016*	*0.037*	*0.039*	*0.058*	*0.020*
Profits		-0.224***	-0.174***	-0.134*	-0.260*	-0.164	-0.156*	-0.427*	0.423***
	se	*0.065*	*0.066*	*0.083*	*0.140*	*0.101*	*0.091*	*0.236*	*0.090*
Log(Size)		0.004***	0.006***	0.009***	0.001**	0.005***	0.009***	0.001	-0.009***
	se	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*	*0.001*
Collateral		0.021***	0.033***	0.039***	0.020*	0.023**	0.022*	0.001	0.097***
	se	*0.007*	*0.008*	*0.011*	*0.010*	*0.010*	*0.013*	*0.014*	*0.012*
Dividends		-0.007***	-0.009***	-0.006*	-0.007	-0.020***	-0.009**	-0.033***	0.004
	se	*0.002*	*0.003*	*0.004*	*0.005*	*0.004*	*0.004*	*0.008*	*0.004*
Log(Risk)		-0.011***	-0.013***	-0.012***	-0.020***	-0.024***	-0.022***	-0.031***	0.010***
	se	*0.002*	*0.002*	*0.002*	*0.003*	*0.004*	*0.003*	*0.007*	*0.002*
Market-to-book ratio*Close		0.038							
	se	*0.027*							
Profits*Close		0.532*							
	se	*0.295*							
Log(Size)*Close		-0.001							
	se	*0.002*							
Collateral*Close		0.036							
	se	*0.038*							
Dividends*Close		-0.008							
	se	*0.007*							
Log(Risk)*Close		0.010*							
	se	*0.006*							
GDP growth			-0.010			-0.010			
	se		*0.025*			*0.049*			
Term structure spread			-0.000			0.004***			
	se		*0.001*			*0.001*			
Log(Stock market risk)			-0.006*			-0.011*			
	se		*0.003*			*0.006*			
constant		0.829***	0.786***	0.767***	0.803***	1.159***	1.214***	1.206***	0.265***
	se	*0.023*	*0.023*	*0.032*	*0.028*	*0.051*	*0.053*	*0.072*	*0.028*
Number of observations		2003	2415	1215	1200	2415	1215	1200	2007
	R^2	0.62	0.48	0.53	0.27	0.78	0.81	0.74	0.48

Appendix

Definition of variables

Book leverage = 1- (book value of equity / book value of assets)

Market leverage = 1- (market value of equity (=number of shares * end of year stock price) / market value of bank (=market value of equity + book value of liabilities))

Size = book value of assets

Profits = (pre-tax profit + interest expenses) / book value of assets

Market-to-book ratio = market value of assets / Book value of assets

Collateral = (total securities + treasury bills + other bills + bonds + CDs + cash and due from banks + land and buildings + other tangible assets) / book value of assets

Dividend dummy = one if the bank pays a dividend in a given year

Asset risk = annualised standard deviation of daily stock price returns * (market value of equity / market value of bank).

GDP growth = annual percentage change of gross domestic product

Stock market risk = annualised standard deviation of daily national stock market index return

Term structure spread = 10 year interest rate – 3 month interest rate on government bonds

Regulatory Tier 1 capital = Tier 1 capital divided by risk weighted assets

Close = one if the bank has a Tier 1 capital ratio of less than 5% in the previous year

Figure A.1: Distribution of banks' regulatory Tier 1 capital ratio
The figure shows the distribution of banks' book capital ratio (book equity divided by book assets) for the 2007 bank-year observations in our sample for which information about Tier 1 capital is available.

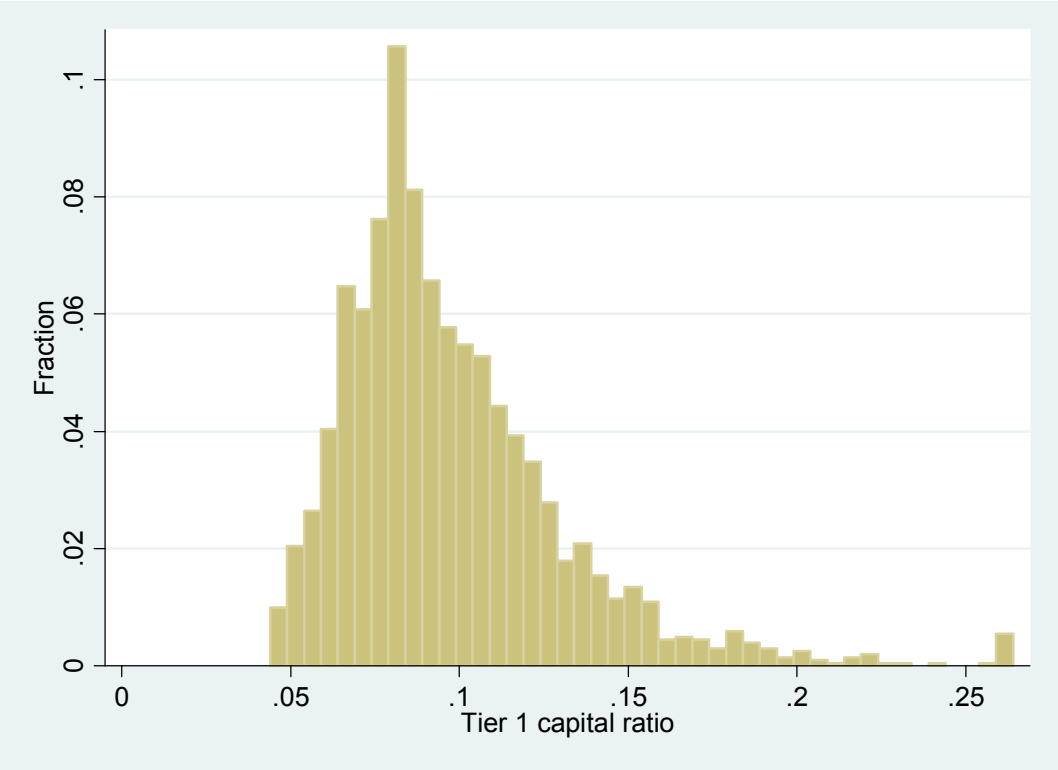

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Table A.1: Capital Structure: Highly Levered S&P500 Companies in February 2006
The table is a condensed version of Table 4 in Welch (2006). Empty cells denote data not available or not comparable. F=Financials, C=consumer goods, H= healthcare, I= industrial, IT= information technology, S= services. Ranking based on the debt/equity ratio. Ratings are from S&P.

Ticker	Name	Industry	Market leverage	Book leverage	Debt/equity ratio	Rating
FNM	Fannie Mae	F			3597%	
TXU	TXU	U		98%	2820%	BBB-
SLM	SLM	F	81%	96%	2425%	A
FRE	Freddie Mac	F			2240%	AA-
GT	Goodyear	C	83%	100%		B+
LU	Lucent	IT	57%	98%	1836%	B
MS	Morgan Stanley	F	93%	97%	1792%	A+
GM	General Motors	C	98%	97%	1708%	B
BSC	Bear Sterns	F		96%	1430%	A
LEH	Lehman Bros	F	91%	96%	1296%	A+
UST	UST	C		95%	1280%	A
AES	AES	U	73%	94%	1263%	B+
F	Ford	C	95%	95%	1191%	BB-
GS	Goldman Sachs	F	91%	96%	1170%	A+
CFC	Country Fin'l	F		93%	860%	A
CNP	Centerpoint	U		92%	700%	BBB
CIT	CIT Group	F	84%	89%	687%	A
AMZN	Amazon	IT	15%	93%	616%	BB-
NAC	Navistar	C	78%	94%	565%	BB-
EP	El Paso	I		89%	520%	B+
ET	E Trade	F			510%	B+
AXP	American Express	F	62%	91%	440%	A+
CZN	Citizens Comm	IT	58%	84%	406%	BB+
PBI	Pitney	C		88%	360%	A+
THC	Tenet	H		90%	350%	B
AZO	Autozone	S		91%	340%	BBB+
GE	General Electric	Mixed	96%	84%	339%	AAA
CAT	Caterpillar	I	50%	82%	305%	A
CMS	CMS Energy	U	81%	85%	299%	BB
DJ	Dow Jones	S	36%	91%	291%	BBB+