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Banks' Capital, Regulation and the Financial Crisis

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RESUMO/ABSTRACT

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Keywords: Bank Capital, Financing Policy, Capital Structure, Financial Crisis

JEL: G21, G32

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Abstract

This paper investigates whether regulatory capital requirements play an important role in determining banks' equity capital. We estimate equity capital regressions using panel data of a sample of 560 banks for 2004-2010. Our results suggest that regulatory capital requirements are not first order determinants of banks' capital structure. We document differences on the effect of most factors on banks' share of equity according to the type of bank and to the region of the bank. Finally, we show that the determinants of this share are sensitive to the recent international financial crisis and to a set of regulatory country factors.

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1. Introduction

The recent international financial crisis started in the financial sector and quickly turned into a global recession with an unprecedented effect on the investment and capital structure decisions made by executives of non-financial firms. The effect in the banking sector is even more problematic as, unlike most non-financial firms, regulation plays an important role in the way banks organize their activity. As far as the capital structure decision is concerned, banks have to comply with capital requirements resulting from Basel I, II and more recently from Basel III. Therefore, it is important to study the determinants of banks' capital structure. In particular, is important to investigate whether banks' capital structure is fully determined by regulation. If not, which bank-specific factors are really important in determining banks' capital structure? Is the proportion of banks' equity capital determined by the same set of factors that determine the capital structure of non-financial firms? This paper addresses these questions and also examines the effect of the recent international financial crisis on banks' share of equity capital.

Using panel data of a sample of 560 banks, 379 from the U.S.A. and 181 from Europe, spanning 23 countries, for the period 2004-2010, we find that the factors affecting the capital structure of non-financial firms play an important role in explaining banks' capital structure. This suggests that regulation may not be a first order determinant of banks' share of equity capital. In fact, we document a strong similarity in the factors affecting the capital structure of banks and those of non-financial firms. This result is in line with those documented in the related studies of Barber and Lyon (1997) and Gropp and Heider (2010), who find that the relationship between leverage and profitability, size, market-to-book ratios and stock returns extends to banks.

A further investigation on the determinants of banks' equity capital in our sample reveals that the buffer view of banks' capital structure, as discussed by Gropp and Heider (2010), is not validated. According to the buffer view, banks hold capital buffers in excess of the regulatory minimum because raising equity on short notice in order to avoid violating the capital requirement is costly. Moreover, our results do not support Mishkin (2000) argument that banks' managers often hold less capital than is required by regulation in order to avoid the high costs of holding capital.

Our paper departs from the empirical corporate finance literature that has examined the determinants of capital structure of non-financial firms. Starting with the seminal paper of Modigliani and Miller (1958), the most relevant papers in this field include Titman and Wessels (1988), Harris and Raviv (1991), Rajan and Zingales (1995) and Frank and Goyal (2009). These authors have analyzed a set of firm-specific and market factors that are consistently related to the capital structure of non-financial firms. While these authors typically estimate corporate finance regressions where the dependent variable is the leverage ratio, either measured in market or book terms, we are especially concerned with the determinants of the equity capital that banks hold in excess of the regulatory minimum.

We examine the determinants of banks' equity capital as follows. First, we estimate standard corporate finance regression models of equity capital where the dependent variable is the share of equity capital in excess of the regulatory minimum of 4%, either measured in book or market terms, and the explanatory variables are a set of bank-specific and market factors. We use the same set of firm-specific factors commonly used in the corporate finance literature to explain banks' capital structure, namely the market-to-book ratio, profitability, size, collateral, whether the bank is a dividend payer and asset risk. As market variables we consider the GDP growth,

inflation, the volatility of the national stock index and the term structure spread. We also estimate a regression for the Tier 1 capital ratio in excess of the regulatory minimum of 4%. We hypothesize that if bank-specific factors have an effect on banks' share of equity in excess of the regulatory minimum, then regulation is not a first order determinant of banks' capital structure. Next, if this hypothesis is confirmed, we examine the sign of the effect of each bank-specific factor on the excess equity capital in order to verify whether this sign is in accordance with the predictions of the empirical corporate finance literature or the predictions of the buffer view of capital.

Second, we investigate potential differences in the results of the excess capital model according to the region to where the bank has its headquarters (United States versus Europe) and to the type of bank considered, by comparing categories of banks based on size, growth opportunities and leverage. This analysis is conducted by adding to the original excess capital model a set of variables that are the multiplication of each explanatory variables and a dummy variable intended to capture the region of the bank, its size, growth opportunities or level of leverage.

Third, we analyze the effect of the recent international financial crisis in the results of the excess capital model by adding to the model a dummy variable intended to capture the time period of the crisis. We develop an analysis that allows us to discuss whether each explanatory variable has the same effect on the excess capital for the period before the international financial crisis (2004 to 2007) and during the international financial crisis (2008 to 2010).

Finally, we conduct a more detailed analysis of the effect of regulation on banks' proportion of equity in excess of the regulatory minimum by adding to the original excess capital model several variables intended to capture the regulatory framework of the country to where the bank belongs. Through the use of dummy year variables, we

compare the effect of the regulatory variables on the excess equity capital over the years of our sample period in order to investigate a potential temporal effect of regulation on capital structure.

We contribute to the literature on the determinants of banks' capital structure as follows. We extend the time period of the study developed by Gropp and Heider (2010) by considering four years before the international financial crisis (2004 to 2007) and three years during the same crisis (2008 to 2010). This allows us to discuss the effect of the international financial crisis on banks' capital structure. Furthermore, unlike other studies, we discuss potential differences in the results according to the region to where the bank belongs and to the type of bank considered.

We also contribute to the literature that examines the effect of regulation on banks' capital structure. As in Brewer *et al.* (2008), we provide a direct test for the effect of regulation on capital structure and, following Kalemli-Ozcan *et al.* (2012), we examine the existence of a temporal pattern of this effect. In addition, as in Bart *et al.* (2005), Berger *et al.* (2008) and Brewer *et al.* (2008), we find empirical evidence that banks hold capital in excess of the regulatory minimum.

Our results suggest that capital regulation and buffers are not a first order determinant of banks' capital structure. An alternative view of banks' capital structure is proposed by Flannery (1994), Myers and Rajan (1998), Diamond and Rajan (2000) and Allen *et al.* (2009). They argue that banks, like non-financial firms, may be optimizing their capital structure, relegating for a second order importance regulatory capital requirements. The market discipline theories also relegate for a second order importance capital requirements. For instance, Flannery and Sorescu (1996), Morgan and Stiroh (2001), Martinez and Schmuckler (2001), Calomiris and Wilson (2004), Ashcraft

(2008) and Flannery and Rangan (2008) suggest that banks' capital structures are the outcome of pressures arising from shareholders, debtholders and depositors, and that regulatory capital requirements may be non-binding and of second order importance.

The remainder of this paper is organized as follows. Section 2 investigates whether capital regulation fully determines banks' share of equity capital and presents the model of the determinants of banks' capital in excess of the regulatory minimum, followed by the predictions of the empirical corporate finance literature and the buffer view of capital. Section 3 examines the data and the descriptive statistics of the main variables. Section 4 debates our findings for the main model and further examines potential differences in the results based on the region to where the bank belongs and to the type of bank considered. It also analyzes the effect of the recent international financial crisis on the results and provides a direct test for the effect of regulation on capital structure. Section 5 concludes.

2. The determinants of banks' capital structure

In this section we investigate whether the standard determinants of capital structure for non-financial firms also apply to banks. This analysis provides a first glance on the potential effect of capital regulation on banks' proportion of equity owned. If capital regulation is the primary determinant of banks' capital structure, there should be little or no explanatory power of the common firms' or banks' specific factors that determine capital structure (Gropp and Heider (2010)). We first present the model of banks' excess capital in excess of the regulatory minimum by describing its econometric specification and subsequently discuss the expected relation between each explanatory variable and this excess capital, according to the corporate finance literature and the buffer view of capital.

The corporate finance literature has identified a set of firm specific factors that play an important role in determining the capital structure of non-financial firms. From Titman and Wessels (1988), to Rajan and Zingales (1995) and Frank and Goyal (2009), the literature seems to agree on the relevance of firms' growth opportunities, profitability, size, tangibility and risk for the firms' capital structure decision. As in Gropp and Heider (2010), we use this set of factors and incorporate another one that accounts for whether the bank is a dividend payer.

If our analysis shows that these banks' specific factors are indeed important determinants of banks' capital structure, we conclude that regulatory capital requirements are of second order importance and we then compare the predictions of the corporate finance literature with those of the buffer view of capital regarding how these factors affect banks' proportion of equity capital.

According to the buffer view of capital, in order to avoid the costs associated with issuing new equity capital at short notice, banks tend to hold capital buffers or discretionary capital above the regulatory minimum. As Wall and Peterson (1987), Barrios and Blanco (2003), Ayuso *et al.* (2004) and Peura and Keppo (2006) point out, we should therefore expect more equity capital or less leverage for banks facing higher costs of issuing equity. These costs of issuing equity are caused by asymmetric information, as in Myers and Majluf (1984).²

We define the regression equation for the share of capital in excess of the regulatory minimum as follows:

$$Excess\ capital_{i\ t} = \beta_0 + \beta_1 X_{i\ t-1} + \gamma_1 M_{t-1} + u_{i\ t} \quad (1)$$

where *Excess capital* is the equity capital ratio in excess of the regulatory minimum capital of 4%, measured either in market or book terms, or the regulatory Tier 1 capital ratio, also in excess of 4%. $X_{i\ t-1}$ is a set of one year lagged bank-specific factors, including the market-to-book ratio (measure of growth opportunities), profitability, the natural logarithm of total assets (measure of size), collateral (measure of tangibility), a dummy for dividend payers and the natural logarithm of asset volatility (measure of asset risk) for bank i in year t , whereas M_{t-1} is a vector of one year lagged macroeconomic variables, including the GDP growth, inflation, the natural logarithm of the stock market volatility and the term structure of interest rates. The term u is the stochastic error.³

² Wall and Peterson (1987) conjecture the existence of a buffer in their empirical analysis of the impact of regulatory factors on bank capital determination. Barrios and Blanco (2003), Ayuso *et al.* (2004), and Peura and Keppo (2006) provide formal models of the determination of such a buffer.

³ In section 4.3 we further incorporate in this model a set of regulatory country control variables in order to examine the direct effect of regulation on the excess capital hold by banks.

We now provide the specification of each variable and the expected relation between the explanatory variables and the excess equity capital, in line with the predictions of the corporate finance literature and the buffer view of capital. Table 1 provides a summary of the variables definition.

(Insert Table 1 here)

We measure the market equity capital ratio as the ratio of the market value of equity to market value of assets and the book equity capital ratio as the ratio of the book value of equity to book value of assets. The market value of equity is given by the number of shares times the end of the year stock price, while the market value of assets is the sum of the market value of equity and book value of liabilities. As regards the Tier 1 capital ratio, it consists of the book value of equity over assets weighted by risk, as defined in Basel I. Risk-weighted assets are the total of all assets held by the bank weighted by credit risk according to a formula determined by the regulator, usually the country's central bank. Most of these banks follow the Basel Committee on Banking Supervision guidelines for the formulae of asset risk weights. The Basel I agreement established a minimum Tier 1 capital ratio of 4%, and this value was later maintained in the Basel II agreement. We should note that the book equity capital ratio understates the Tier 1 capital ratio given that the latter considers assets weighted by risk in the denominator.

The empirical corporate finance literature, from Rajan and Zingales (1995), Aggarwal and Jamdee (2003) and Frank and Goyal (2009), has found a positive relation between growth opportunities and equity capital, a result that agrees with the predictions of the tradeoff theory that more growth opportunities enhances costs of financial distress, highlights agency costs of debt and reduces free cash flow problems.

Alternatively, the buffer view of capital argues that banks with more growth opportunities tend to have less equity, as higher growth opportunities are associated with less costs of issuing equity capital at short notice and, therefore, for these banks it is not necessary to hold so much capital above the regulatory minimum. Based on Myers and Majluf (1984) asymmetric information argument, Gropp and Heider (2010) suggests that this happens because banks with higher growth opportunities are either better known to outsiders, can obtain a better price or have a stronger financial position. In line with most empirical studies, we use the market-to-book ratio as a proxy for growth opportunities. This ratio is defined as the market value of assets over the book value of assets.

As regards profitability, according to the agency theory of capital structure more profitable firms tend to use more debt due to the disciplining role that debt has on managers, as more debt is associated with a reduction in free cash flow (Jensen (1986)). On the contrary, the pecking order theory predicts that more profitable firms tend to be less levered because these firms are willing to use internal financing rather than debt financing (Myers (1993)). Frank and Goyal (2009) reports that most empirical studies in corporate finance have found a positive relation between profitability and equity capital, a result that suggests a rejection of the tradeoff theory of capital structure, in particular the agency hypothesis, and a validation of the pecking order theory. As for the buffer view of capital, we should expect more profitable banks to have less equity in excess of the regulatory minimum since these banks face lower costs of issuing capital at short notice. The argument, as discussed in Gropp and Heider (2010), is that banks with higher profits are either better known to outsiders or have greater financial robustness. We measure profitability as the ratio of pre-tax profits and interest expenses over the book value of assets.

The effect of firm's size on the equity capital ratio is expected to be negative according to most empirical papers, a finding that supports the predictions of the tradeoff theory. Rajan and Zingales (1995), Titman and Wessels (1998), Booth *et al.* (2001), Aggarwal and Jamdee (2003) and Frank and Goyal (2009) consider that larger firms tend to be more levered as they are likely to face lower default risk. Yet, as discussed by Gropp and Heider (2010), according to the buffer view there is not a clear relation between size and the share of capital owned by banks. On one hand, larger banks may have larger buffers if they are more complex, due to the effect of asymmetric information and, on the other hand, larger banks may have smaller buffers in case they are better known to the market and can issue equity capital more easily on the short run. We define banks' size as the value of total assets.

The empirical corporate finance literature has found a negative relation between asset tangibility and the equity capital ratio, a result that is usually explained by the important effect of tangibility on the reduction of costs of financial distress and on the mitigation of debt-related agency problems. Titman and Wessels (1988), Rajan and Zingales (1995), Aggarwal and Jamdee (2003) and Frank and Goyal (2009) argue that tangible assets are easier for outsiders to value, which causes a reduction in expected financial distress costs. Moreover, in line with Jensen and Meckling (1986), tangibility contributes to reduce the asset substitution effect as it makes more difficult to substitute high-risk for low-risk assets and, as a consequence, increases leverage and reduces equity capital. For financial firms tangibility is commonly defined as collateral and, as regards the banking literature and the buffer view, there is no clear prediction on how collateral affects the proportion of equity capital. Following Kalemli-Ozcan *et al.* (2012) we measure collateral as the sum of total securities, treasury bills, other bills,

bonds, CDs, cash and due from banks and lands and buildings over the book value of assets.

As far as the dividend variable is concerned, while the corporate finance literature reports a positive relation between dividend payments and the equity ratio, the buffer view predicts a negative effect of dividends on capital buffers. The documented effect of the corporate finance literature relies on the pecking order theory argument that firms with higher profits and potentially with higher dividends prefer to use internal financing rather than external financing through debt. Nevertheless, the buffer view predicts that more profitable banks or banks that pay dividends more often are potentially exposed to less costs of issuing capital at short notice and, as a result, tend to hold less equity capital. We define the dividend variable as a dummy variable that takes the value of 1 if the bank pays a dividend in a given year.

The expected effect of asset risk on the equity ratio is positive according to both the corporate finance literature and the buffer view of capital. Frank and Goyal (2009) finds a negative effect of asset risk on firms' leverage under the tradeoff theory assumption that firms with more volatile cash flows face higher expected costs of financial distress and have a lower probability of fully utilizing tax shields. In addition, they argue that risk is detrimental for stockholder co-investment. On the other hand, according to the buffer view the argument used for the positive effect of asset risk on banks' equity capital is that we should expect the size of buffers to depend on the probability of falling below the regulatory minimum capital and, therefore, more risky banks tend to have more capital in excess of this minimum. Asset risk is measured as the annualized standard deviation of daily stock price returns times the market value of equity over the market value of the bank.

Finally, we provide an explanation on how we measure the macroeconomic variables included in the regression. It is important to control for a set of macroeconomic variables in our model given the expected high exposure of banks activity to the economy of each country. The GDP growth is measured as the annual percentage change of gross domestic product, inflation is the annual percentage change in the average consumer price index, stock market volatility is the annualized standard deviation of the daily national stock market index return and the term structure spread is the difference between the 10 year and the 3 month interest rate on government bonds.

3. Data and descriptive statistics

We obtain information about banks' consolidated balance sheets and income statements from the Bankscope database of the Bureau van Dijk, 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 2004 and ends in 2010. This period selection allows us to examine four years before the international financial crisis (2004-2007) and three years where the markets have been affected by this crisis (2008-2010). We select only publicly traded commercial banks and bank-holding companies in a total of 560 banks, where 379 are from the US and 181 from 22 European countries. Observations of banks with negative capital in any given year were excluded in that year. Because some institutions did not have complete data for the sample period our panel is unbalanced.

The Bankscope database has been used in a series of studies in the banking literature. For example, Gropp and Heider (2010) use the database in the context of leverage, while Shehzad and De Haan (2013) use the database in the context of the financial crisis literature. The financial information at the bank level is presented in standardized formats, after adjusting for differences in accounting and reporting standards. Initially each country in Bankscope has its own data template, therefore allowing for differences in the accounting and reporting conventions. Then, the data is converted to a universal format using a globally standardized template derived from the country-specific templates. This universal format also provides standard financial ratios, which can be used for comparisons across banks from different countries. As pointed out by Pasiouras *et al.* (2006), Bankscope is a very comprehensive database that allows cross country comparisons and is commonly used by Fitch and other major rating agencies. The final sample consists of 3,496 bank-year observations, which includes

2,393 observations from the US and 1,103 from Europe. Table 2 depicts the number of banks and bank-years across countries in our sample.

(Insert Table 2 here)

Table 3 shows the descriptive statistics for the variables we use in our estimations. Like in Gropp and Heider (2010) and Kalemli-Ozcan *et al.* (2012), our sample reveals that banks' share of equity capital is substantially different from that of non-financial firms. Banks' mean equity ratio in market terms is 16.5% and mean equity ratio in book terms is 11.4%, whereas Frank and Goyal (2009) document that the mean market and book equity ratio of non-financial firms is 72% and 71%, respectively.

(Insert Table 3 here)

The results also illustrate a relatively high dispersion of banks' equity ratios. Figure 1 depicts the distribution of the book capital ratio (book value of equity over total assets) and it shows an important dispersion of the capital ratio, varying from almost 0 to 100%. This pattern is further confirmed by Figure 2 with the distribution of the Tier 1 capital ratio. Moreover, we find that, on average, banks hold capital well above the regulatory minimum as the mean Tier 1 capital ratio is 14.9%, whereas the minimum regulatory ratio is 4%.

(Insert Figure 1 here)

(Insert Figure 2 here)

There is a considerable heterogeneity in the cross section based on banks' size. The mean book value of assets is 592,627 thousand euros, whereas the median is only 1,724 thousand euros. Moreover, the largest bank in the sample has an asset value of 2,586,701 thousand euros, while the smallest bank has an asset value of 2 thousand

euros. A comparison of our descriptive statistics for banks with those for non-financial firms of Frank and Goyal (2009) reveals that while non-financial firms have a mean market-to-book ratio closer to one, banks have a mean ratio of 1,21. Banks are, on average, less profitable than firms: the mean profitability of banks is 3.3%, whereas of non-financial firms it is 12%. Furthermore, banks have higher collateral ratios than non-financial firms, 90% versus 56% of book value of assets, respectively. While an average of 87% of banks pay dividends, only 43% of non-financial firms do so. Finally, we find that banks are less risky than non-financial firms as the mean asset volatility of banks is 5,8% and the mean asset volatility of non-financial firms in Frank and Goyal (2009) is 12%.

Before we proceed with the discussion of the results of the econometric model, we briefly examine the correlation among the main bank-specific variables based on the correlations of Table 4. The sign of the correlations is in line with those typically found in the empirical corporate finance literature. Banks with higher growth opportunities, higher profitability and that typically pay dividends hold, on average, more equity capital. Also, larger banks and banks with more collateral are, on average, more debt financed. Finally, riskier banks tend to have more equity.

(Insert Table 4 here)

4. Results

We discuss the results of the capital structure model in four sections. First, we examine the determinants of banks' excess equity capital for the full sample and analyze whether the pure regulatory view of capital holds for banks' capital structure. If capital regulation is not the primary determinant of capital structure, we then compare the predictions of the corporate finance literature with those of the buffer view of capital. Second, we examine potential differences in the results of the capital structure model according to the region to where the bank belongs (Europe versus United States) and to the type of bank considered, namely comparing categories of banks based on size, growth opportunities and leverage. Next, we analyze the effect of the international financial crisis on the results of the regression model. Finally, we further investigate the effect of the regulatory environment on banks' capital by introducing into the original model of excess equity capital several regulatory variables that may vary across countries and time.

4.1 The determinants of banks' excess equity capital: the corporate finance view versus the buffer view

In this section we analyze the regression results of estimating Equation (1) based on the full sample of bank-years observations, i.e. considering the panel of banks from both Europe and the United States. As point out previously in Section 2, we consider three measures of excess equity capital, namely the market and the book equity ratios in excess of the regulatory minimum of 4%, and the Tier 1 capital ratio also in excess of

this minimum.⁴ In order to decide whether to apply a random or a fixed effects estimator we used Hausman (1978) test. The test suggested that the key random effect assumption (unobserved effect is uncorrelated with each explanatory variable) is true, and then the random effects were used. Table 5 depicts the results of the excess equity model, with report of the estimated coefficients and the corresponding standard error and elasticity.

(Insert Table 5 here)

In model 1A, where the dependent variable is the excess equity capital measured in market values, we find that, among the variables associated with banks' specific characteristics, all coefficients are statistically significant at the 1 percent level. This suggests that, at least at a first glance, the pure regulatory view does not apply to banks' capital structure. This leads us to examine then how the excess equity capital is affected by these banks' characteristics, in particular how the sign of the estimated coefficients is consistent with the predictions of the corporate finance literature or the buffer view of capital.

The excess market equity regression shows that all estimated coefficients regarding the banks' specific factors have the same sign as in the empirical corporate finance literature of Rajan and Zingales (1995) and Frank and Goyal (2009), which provides evidence that the standard determinants of the capital structure of non-financial firms are also the main determinants of banks' capital structure. Furthermore, we find that the sign of the estimated coefficients for the market-to-book ratio, profits and dividends is at odds with the predictions of the buffer view of capital, suggesting that the buffer view does not seem to apply to the banks' capital structure decision. The

⁴ Previous related papers have used frequently book and market measures of equity or leverage ratios, with consistent results. While Gropp and Heider (2010) uses both market and book measures, Welch (2004) focus on the market measure and Barclay *et al.* (2006) on the book measure.

buffer view predicts that banks with higher growth opportunities, higher profits and higher frequency of dividend payment should hold less equity capital in excess of the regulatory minimum, since these banks are expected to face lower costs of issuing equity capital in the short run, but we find that these banks tend to hold more capital buffers.

Although globally the results are inconsistent with the buffer view of capital, there are two estimated coefficients in the excess market equity regression that may support the buffer view. First, the negative coefficient for banks' size suggests that larger banks may have smaller buffers because they are better known to the market and can issue equity capital more easily on the short run. Second, the positive coefficient for the banks' asset risk can be an indication that riskier banks hold larger buffers since these banks have a higher probability of falling below the regulatory minimum capital.

The findings of the excess book equity regression, model 1B, concerning the banks' specific variables, are consistent with the results of the excess market equity regression, with the exception of the sign of the market-to-book ratio coefficient, which is now negative at a 5 percent level, and the estimated coefficient of the dividend variable that turns out to be insignificant. Overall, the book leverage regression confirms that for most bank-specific variables the sign of the estimated coefficients supports the standard corporate finance literature.

Then, the Tier 1 excess capital regression, model 1C, further confirms the results of model 1A, where the excess capital is measured in market values. The only difference in the results concerning the bank-specific variables relies on the sign of the dividend coefficient. In the Tier 1 excess capital regression we find that banks that pay dividends tend to hold less capital in excess of the regulatory minimum of 4%.

Finally, as far as the macroeconomic variables are concerned, we find that the excess equity capital tend to be associated with lower GDP growth, lower inflation, lower term structure of interest rates and higher stock market volatility.

In sum, the estimation results of the excess equity model agree with the results of Gropp and Heider (2010) that regulation is not the primary determinants of banks' equity share of equity. The factors affecting the level of equity of non-financial firms play an important role in explaining banks' equity capital. Also, our findings provide support for the empirical corporate finance literature and, for most bank-specific variables, are at odds with the buffer view of capital. At last, we confirm the importance of macroeconomic variables in the level of banks' excess equity capital.

4.2 The determinants of banks' excess equity capital for different banks' characteristics and the effect of the international financial crisis

In this section we investigate whether the model's results vary according to some banks' characteristics. In particular, we analyze if the effect of each explanatory variable on the excess equity capital is different for European and US Banks, large and small banks, high growth and low growth banks and high leverage and low leverage banks. The study of a "region effect" is important since regulatory requirements may apply to different regions and, although globalization made the European and US economies strongly related, the literature recognizes some differences in the way businesses are conducted in Europe and in the United States. For instance, Kalemli-Ozcan *et al.* (2012) identify some differences in the pattern of leverage for US and European banks. Then, the study of the sensitivity of the excess equity model to categories of banks based on size, growth opportunities and leverage constitutes a new contribution to the banking

literature. It extends the work of Frank and Goyal (2009) that has examined this issue for non-financial firms.

Next, we investigate whether the level of banks' excess equity has changed over time and whether the factors determining this excess equity have the same effect before and during the international financial crisis. In the last few years the financial news documented how the international financial crisis has put pressure on governments and regulatory entities to adjust the regulatory environment where banks operate. As profit maximizing entities, banks naturally adjust their strategy, in particular their capital structure decisions to the business cycle. As Shehzad and De Haan (2013) point out, the recent crisis mainly affected banks operating in industrial economies, therefore it is important to study a possible crisis effect in our model that relies on a sample of European and US banks.

We depart from model 1 and now incorporate into the model one dummy variable that captures the category of the bank and a vector of variables that consist of this dummy variable times each explanatory variable. In the first model of this section, model 2, the dummy variable *EUR* takes the value of 1 if the bank is European and zero otherwise. In model 3, banks are defined as being large if they are equal or above percentile 75 in terms of the variable size. Therefore, the dummy variable *Large* is 1 for large banks and zero otherwise. In model 4, we classify banks as a high growth banks if they have a market-to-book ratio equal or above percentile 75. Thus, the dummy variable *High growth* takes the value of 1 for high growth banks and zero otherwise.

Then, in model 5, the dummy variable *High leverage* is 1 for banks that have a market leverage ratio equal or above percentile 75 and zero otherwise.⁵

The study of the international financial crisis effect is conducted with the same framework. We use a dummy variable that takes the value of 1 for the years of the international financial crisis (2008 to 2010) and zero for the previous years (2004 to 2007) and further incorporate into the model the vector of variables consisting of this dummy variable times each explanatory variable.

4.2.1 Region effect: European versus US banks

The findings of the model that intends to capture a region effect, model 2, are depicted in Table 6.

(Insert Table 6 here)

The estimated coefficients of the dummy variable EUR reveal that European banks have, on average, more excess equity capital, either in market or book terms (models 2A and 2B, respectively), or considering the Tier 1 excess equity capital (model 2C). This result is consistent with the evolution of the market equity ratio over time, as depicted in Figure 3, which shows that European banks tend to have mean equity ratios above US banks over the period 2004-2010.

(Insert Figure 3 here)

⁵ We keep the same definition of the variables size and market-to-book ratio of Table 1. Market leverage is defined as the sum of total liabilities over the market value of total assets. To avoid multicollinearity, in the regression that incorporates the dummy variable of large banks we exclude the initial variable log of size since this dummy variable already captures the size. The same rationing explains the exclusion of the variable market-to-book ratio in the model that incorporates the dummy variable of banks with high growth opportunities.

Moreover, the results of model 2A, the one that considers as dependent variable the excess market equity capital, show that size is the only bank-specific variable for which there is no difference on its effect for European and US banks, as the estimated coefficient of the variable EUR times size is not statistically significant. The positive effect on the excess market equity capital of profitability and dividends is, on average, less pronounced for European banks, whereas the positive effect of the market-to-book ratio and asset risk is more pronounced for European banks. The estimated coefficients associated with collateral show that although this variable has a negative effect over the excess market equity capital of European banks, it has no effect on the excess market equity capital of US banks.

The findings of the excess book equity regression, model 2B, confirm that the positive effect of asset risk on the excess equity is more pronounced for European banks. Moreover, the results show that although the market-to-book ratio has a negative effect on the excess book equity capital of US banks, it has a positive effect over the excess book equity of European banks. In addition, we observe that the variables profitability, size and collateral have stronger effects on the excess book equity capital of European banks.

Finally, the results of the Tier 1 excess capital regression, model 2C, confirm, once again, that the effect of the asset risk over the excess capital is of higher magnitude for European banks. In addition, the effect of the market-to-book ratio, profitability and collateral is more pronounced for European banks, whereas the effect of banks' size is negative but only for US banks.

4.2.2 Size effect: Large versus small banks

Table 7 presents the estimation results of model 3, the one that investigates the size effect on the excess equity capital.

(Insert Table 7 here)

The results of model 3A, where the dependent variable is the excess market equity capital, show that the sign and statistic significance of the estimated coefficient of the dummy variable for large banks agrees with our previous discussion that larger banks have, on average, less capital in excess of the regulatory minimum. This is in line with the findings of Figure 4 that documents lower mean market equity ratios for larger banks over our sample period.

(Insert Figure 4 here)

Furthermore, model 3A shows that for most bank-specific variables the effect of each variable on the excess market equity is, on average, stronger for smaller banks as compared with larger banks. This holds for profitability, dividend payments and asset risk. Interestingly, the estimated coefficient for collateral reveals that this variable has no effect on the excess market equity of larger banks but has the predicted corporate finance positive effect on the excess market equity of smaller banks. Only the effect of the market-to-book ratio is more pronounced for larger banks.

In line with model 3A, the results of model 3B show that the effect of profitability over the excess book equity is less pronounced for larger banks. In addition, they show that while the variables collateral and asset risk have an effect over the excess book equity of smaller banks, they have no effect on the excess book equity of larger banks. We also find that the effect of the variable market-to-book ratio is stronger for larger banks.

At last, the results of the Tier 1 excess capital regression, model 3C, reveal that while the variables collateral and dividends have an effect on the excess Tier 1 capital of smaller banks, they have no effect on the excess capital of larger banks. Furthermore, the growth opportunities effect is more pronounced for larger banks and the profitability variable has opposite effects for smaller and larger banks.

4.2.3 Growth opportunities effect: high growth versus low growth banks

The results of the model that incorporates a dummy variable for the market-to-book ratio, model 4, are depicted in Table 8.

(Insert Table 8 here)

Both the regressions of the excess market equity ratio and excess Tier 1 capital ratio confirm our debate that banks with higher growth opportunities tend to have more capital in excess of the regulatory minimum of 4%, as the estimated coefficient associated with this dummy variable is positive and statistically significant in both regressions. This is consistent with Figure 5, as from 2004 to 2010 the mean market equity ratio is always higher for banks with higher market-to-book ratios.

(Insert Figure 5 here)

Furthermore, based on the estimation of the excess market equity regression, model 4A, we find that while profitability tend to have a lower effect on high growth banks, asset risk has a stronger effect on this category of banks. Then, although size, collateral and dividends have an effect on the excess market equity for low growth banks, they have no effect on the excess market equity of high growth banks.

The results of model 4B provide evidence that the effect of profitability, size and asset risk on the excess book equity is more pronounced in high growth banks, while the effect of collateral is weaker on these banks as compared with the effect on low growth banks.

Then, based on the estimations results of model 4C we conclude that all bank-specific variables have a stronger effect on the excess Tier 1 capital of high growth banks, with the exception of the dividend variable that has no effect on this dependent variable for both categories of banks.

4.2.4 Leverage effect: high leverage versus low leverage banks

In model 5 we discuss whether the explanatory variables affect differently banks measure of excess equity according to their level of leverage, i.e. based on banks being considered high levered or low levered. The results are depicted in Table 9.

(Insert Table 9 here)

We observe that, on average, the effects of the bank-specific variables on the excess equity measure are of smaller scale for high leverage banks. This holds for profitability, size, dividends and asset risk considering the three measures of the dependent variable, i.e. models 5A, 5B and 5C. As far as the market-to-book ratio is concerned, while it has no effect on the excess market equity ratio of high leverage banks, it has a stronger effect on the excess book equity ratio of these banks. Then, we find that the effect of the market-to-book ratio in the excess Tier 1 capital is positive for low leverage banks but is negative for high leverage banks. At last, it is interesting to observe that the effect of collateral is contrary for low and high leverage banks according to models 5B and 5C. For low leverage banks greater levels of collateral tend

to have a negative effect on the share of equity capital above the regulatory minimum, whereas for high leverage banks this effect tends to be positive.

4.2.5 International financial crisis effect

The findings of model 6, the one that incorporates the dummy variable for the years of the recent international financial crisis, are presented in Table 10. Only in model 6B, where the dependent variable is the excess book equity capital, we find evidence that banks tend to have more excess equity capital during the years of the recent international financial crisis. This agrees with Quijano (2013), who points out that the recent financial crisis created a natural experiment where huge amounts of equity were injected into banks' balance sheets in order to reduce their capital fragility.

(Insert Table 10 here)

Moreover, as far as the excess market equity regression is concerned, model 6A, we find that the variables market-to-book, size and collateral exhibit a greater effect on the excess market equity during the years of the financial crisis. Conversely, the effect of dividends and asset risk is less pronounced during these years and there is no effect for profitability.

The existence of no profitability effect over the excess equity during the years of the international financial crisis is further confirmed in models 6B and 6C. In addition, these models show, as in model 6A, that the effect of collateral on excess capital is stronger during the crisis, whereas the effect of asset risk is weaker during the crisis. As regards size, the results of models 6B and 6C show an opposite behavior as in model 6A, since this variable has a less pronounced effect on the excess capital during the

crisis. The same applies to the market-to-book ratio, but now only in model 6C, given that in model 6B this variable has no effect on the excess book value of equity during the crisis.

4.3 Regulation measures and the excess equity capital

In this section we exploit the cross country nature of our dataset to explicitly identify a potential effect of regulation on the equity capital above the regulatory minimum. In section 3 we provided an indirect test for the effect of regulation on the excess equity capital by analyzing whether banks' excess equity is affected by a set of bank-specific factors. We have concluded that since banks' excess capital is affected by these factors, regulation does not constitute a first order determinant of capital structure. Now, following Brewer *et al.* (2008), we provide a direct test for the effect of regulation on capital structure by adding to the original excess equity model two sets of country specific regulatory factors that may help to explain cross country differences in excess equity capital among commercial banks and bank holding companies.

The first set of variables is from the 2012 World Bank's Doing Business Data Set, with available data for the period 2007-2010. It provides two indices: one for the protection of shareholders rights and the other for the protection of investor rights in the country. It is based on bank country level data from Caprio *et al.* (2007) and these variables measure the extent to which a country's ownership structure and investor rights protection influences its bank capital ratio. The indices take values between 1 and 10, where a higher value means more protection. Caprio *et al.* (2007) argues that a large value for the shareholders rights protection index may reflect a stronger owners' ability to expropriate bank resources. Therefore, higher values of this variable are likely to be

associated with greater risk taking by banks and lower capital ratios. Similarly, we should expect higher values for the investors' rights protection index to be associated with less excess equity capital by banks.

The second set of variables is from the Bank Regulation Data Set of Barth *et al.* (2012). This data set is derived from a survey conducted by the World Bank on bank regulation and supervision practices across countries, with data available also for the period 2007-2010. We use two of the most representative variables in the dataset. The first, called monitoring index, measures the level of efficiency of monitoring banks' activity. Following Kalemli-Ozcan *et al.* (2012), we define this variable as a dummy variable that takes the value of 1 if the top ten banks in the country are all rated by international rating agencies, if off-balance sheet items are disclosed to the public, if banks must disclose risk management procedures to the public and if subordinated debt is part of regulatory capital. The index is zero otherwise. Therefore, when this value takes the value of 1 there is a greater level of efficiency of monitoring banks' activity, which can be understood as a stricter regulation. The second variable is the overall restrictiveness index. It measures the extent to which banks may engage in three sorts of activities: real estate, insurance and securities activities. Each of these activities leads to a separate index that takes a value between 1 and 4, where a value of 1 indicates no restriction and a value of 4 means these activities cannot be conducted. The overall restrictiveness index is the sum of the three separate indices and therefore it takes a value between 3 and 12, where a higher number means more restrictiveness or stricter regulation. Kalemli-Ozcan *et al.* (2012) predicts that stricter regulation should lead to lower banks' level of equity capital as banks operating in a stricter regulatory environment typically hold less risky assets or higher quality assets, which lowers the requirements to hold equity capital.

We decided to present only the results of the excess Tier 1 capital model since the Tier 1 capital in excess of the regulatory minimum of 4% is the variable that really captures the excess capital as defined by the regulatory banking entities. These results are depicted in Table 11.⁶ The findings show that three out of the four estimated coefficients of the regulatory variables have a negative sign and are statistically significant. On one hand, this agrees with Caprio *et al.* (2007) prediction that higher shareholder's and investor's protection in the country is likely to imply greater risk taking by banks and lower proportion of equity capital. On the other hand, we confirm Kalemli-Ozcan *et al.* (2012) result that in a stricter regulatory environment, with greater efficiency of monitoring banks' activity and greater business restrictiveness, banks tend to have less equity capital in excess of the regulatory minimum.

(Insert Table 11 here)

Next, we investigate whether the effect of regulation on banks' excess Tier 1 capital ratio varies through the years in our sample, i.e. we try to identify a potential temporal pattern of the regulation effect. Thus, we now incorporate into the previous excess Tier 1 regressions of Table 11 a set of year-dummy interactions with the regulatory variables. Since we only have available data for the regulatory variables for the period 2007 to 2010, the year of 2007 is left out in the interaction. The findings are presented in Table 12. First, the results show that, with the exception of the monitoring index measure, in model 8C, the estimated coefficients of the year-dummy interaction terms are statistically significant. This suggests the existence of a temporal effect of regulation on leverage. Second, if we consider only the regressions where the year-dummy interaction coefficients are statistically significant, model 8A, 8B and 8D, we

⁶ Note, however, that the estimations of the excess market and book equity capital regressions reveal similar results as regards the effect of the regulatory variables on these measures of excess capital and therefore, they may be omitted from the main results.

observe that for all the years a higher investor and shareholder rights' protection and a stricter regulation leads, on average, to higher Tier 1 capital ratios in excess of 4%.

(Insert Table 12 here)

Finally, if we consider only the models for shareholders and investor rights protection, we conclude from the magnitude of the estimated coefficients that the negative effect of these regulatory measures on the excess Tier 1 capital ratio is stronger for the year of 2008, followed by the year of 2007. This agrees with the results of Kalemli-Ozcan *et al.* (2012) and further confirms the existence of a temporal effect of regulation on banks' excess equity capital. In the years of 2007 and 2008 the US and European economies were more vulnerable to the international financial crisis and the effect of these regulatory measures were more evident on the restriction of banks' equity capital and, as a consequence, on the increase of market leverage. The model that incorporates the overall restrictiveness variable, model 8D, further reveals that in the years of 2007 and 2008 the effect of this variable on the excess Tier 1 capital is more evident. The difference is that, in this model, the effect is stronger in 2007 than in 2008.

Overall, we conclude that although regulation is not a first order determinant of banks' capital structure, there is a negative effect of some regulatory measures on the excess Tier 1 capital and this effect is more pronounced in 2007 and 2008, which provides evidence of a temporal effect of regulation on banks' capital structure.

5. Conclusion

This paper investigates the relevance of regulatory capital requirements in determining banks' capital structure. It examines whether banks' capital structure is fully determined by capital requirements. If capital requirements are of second order importance, it investigates which bank-specific and market factors play an important role in determining banks' excess equity capital. Motivated by a considerable dispersion in banks' equity ratios, it compares the predictions of banks' equity ratios proposed by the buffer view of capital with the predictions proposed by the empirical corporate finance literature for non-financial firms. Moreover, it investigates whether the results of the determinants of banks' excess equity capital may vary with the region to where the bank belongs and to the type of bank considered, in particular if they are variations for large versus small banks, high grow versus low growth banks and high leverage versus low leverage banks. It then studies the effect of the recent international financial crisis on the results and provides a direct test for the effect of regulation on the excess equity capital.

The study is conducted in a panel of 560 banks, 379 from the US. and 181 from Europe, for the years of 2004 to 2010. A typical corporate finance equity model is estimated for the full sample and then the model is further developed to incorporate the other dimensions of the analysis.

The main contribution of the study relies on the dataset used, as it comprises data for a recent time period, covering the years before the recent international crisis (2004 to 2007) and during the crisis (2008 to 2010), and on the methodology employed, since we investigate the determinants of excess equity not only for the full sample of banks but also for categories of banks based on the region where the banks has its

headquarters and on the type of bank. Moreover, we provide an important contribution to the literature on the effect of regulatory country factors on banks' capital structure.

We find that banks' capital structure is not fully determined by capital regulation. In fact, the results show a strong similarity in the factors commonly determining the capital structure of non-financial firms and the factors affecting the capital structure of banks. Our results provide support for the empirical corporate finance predictions on the determinants of firms' capital structure and do not seem to validate the buffer view of capital requirements. Indeed, we find that banks' excess equity capital is positively related with banks' growth opportunities, profitability, dividends and risk and negatively related with size and collateral. Macroeconomic factors as the GDP growth, inflation, the national stock market volatility and the term structure of interest rates also play a role in explaining banks' capital structure.

We confirm the existence of a region effect since the results show that European banks have, on average, more equity capital, and for most bank-specific variables their effect on banks' excess equity depends on whether the bank is European or from the US. We also document differences on the effect of most variables on banks' excess equity according to the type of bank. For instance, we observe that, on average, the effects of the bank-specific variables on excess equity are of greater scale for smaller banks and for low leverage banks.

Our paper provides evidence that the recent international financial crisis has an important effect in banks' excess equity capital. We find that during the crisis banks' have, on average, less equity capital and that not all variables affect banks' excess equity with the same magnitude for the periods before and during the financial crisis. Finally, a direct test for the effect of regulation on the excess Tier 1 capital ratio reveals that although regulation is not a first order determinant of banks' capital structure, there

is a negative effect of some regulatory measures on excess capital. Moreover, we provide evidence of a temporal effect of regulation on banks' excess equity as this effect is more pronounced in 2007 and 2008.

The findings documented in this paper can be an important tool for regulatory authorities and bank managers. It provides empirical evidence of the factors that determine banks' capital structure and highlights that although regulatory capital requirements are not first order determinants of this capital structure, there are cross country factors that have to be taken into account in the capital structure of banks. We believe this paper can be further improved in future research with the addition of banks from less developed economies. This would provide a more detailed analysis of the effect of regulatory country factors on capital structure. Moreover, it would be important to investigate the determinants of the several components of banks' leverage, as banks' liabilities can consist of not only of the typical long term debt but also of deposits.

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Table 1. Definition of bank-specific and macroeconomic variables

Variables	Definition
Excess equity capital (market)	Ratio of the market value of equity to market value of assets minus the regulatory minimum capital of 4%.
Excess equity capital (book)	Ratio of the book value of equity to market value of assets minus the regulatory minimum capital of 4%.
Excess Tier 1 capital	Ratio of the book value of equity over assets weighted by risk, as defined in Basel I, minus the regulatory minimum capital of 4%.
Market-to-book ratio	Market value of assets over the book value of assets.
Profitability	Ratio of pre-tax profits and interest expenses over the book value of assets.
Size	Value of total assets.
Collateral	Sum of total securities, treasury bills, other bills, bonds, CDs, cash and due from banks and lands and buildings over the book value of assets.
Dividend	Dummy variable that takes the value of 1 if the bank pays a dividend in a given year.
Asset risk	Annualized standard deviation of daily stock price returns times the market value of equity over the market value of the bank.
GDP growth	Annual percentage change of gross domestic product.
Inflation	Annual percentage change in the average consumer price index.
Stock market risk	Annualized standard deviation of the daily national stock market index return.
Term structure spread	Difference between the 10 year interest rate and the 3 month interest rate on government bonds.

Table 2. Number of banks and bank-years across countries

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010.

Country	Number of banks	Bank-years
AT - Austria	6	41
BE - Belgium	4	24
CH - Switzerland	16	103
CY - Cyprus	3	21
DE - Germany	19	113
DK - Denmark	33	214
ES - Spain	8	55
FI - Finland	3	18
FR - France	11	61
GB - Great Britain	10	58
GR - Greece	11	73
IE - Ireland	2	11
IT - Italy	17	95
LI - Liechtenstein	1	7
LU - Luxembourg	2	10
MC - Monaco	1	6
MT - Malta	4	23
NL - Netherlands	6	36
NO - Norway	1	6
PT - Portugal	4	25
SE - Sweden	4	24
TR - Turkey	15	79
US - United States	379	2,393
Total Europe	181	1,103
Total United States	379	2,393
Total	560	3,496

Table 3. Descriptive statistics

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010.

	N	Mean	St. Dev.	Min.	Max.	Distribution		
						10 th	50 th	90 th
Excess equity capital (market)	3,496	0.125	0.140	-0.040	0.960	0.044	0.101	0.163
Excess equity capital (book)	3,496	0.074	0.117	-0.040	0.960	0.032	0.050	0.073
Excess Tier 1 capital	3,496	0.109	0.128	0.000	0.960	0.056	0.076	0.111
Book value of assets (thousand €)	3,496	592,627	232,238	2	2,586,701	594	1,724	9,129
Market value of bank (thousand €)	3,496	608,876	235,100	2	2,555,413	620	1,927	10,113
Market-to-book ratio	3,496	1.210	2.893	0.000	78.000	1.000	1.050	1.120
Profitability	3,453	0.033	0.056	-0.140	2.060	0.020	0.030	0.040
Collateral	3,496	0.900	0.099	0.000	1.000	0.890	0.920	0.940
Dividend	3,447	0.870	0.340	0	1	1	1	1
Asset risk	3,254	5.789	5.924	0.000	116.420	2.570	4.305	7.010
GDP growth	3,496	1.467	2.591	-8.230	9.360	-0.020	2.540	3.060
Inflation	3,496	2.470	1.640	-4.480	10.580	1.640	2.680	3.390
Stock market risk	3,496	19.819	10.667	8.240	56.030	10.900	15.680	26.810
Term structure spread	3,417	1.744	1.214	-5.383	5.759	0.407	1.937	2.856

Table 4. Correlations

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. Numbers between brackets indicate p-values.

	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital	Book value of assets (thousand €)	Market value of bank (thousand €)	Market- to- book ratio	Profitability	Collateral	Dividend	Asset risk
Excess equity capital (market)	1									
Excess equity capital (book)	0,812 (0,000)	1								
Excess Tier 1 capital	0,862 (0,000)	0,868 (0,000)	1							
Book value of assets (thousand €)	-0,164 (0,000)	-0,122 (0,000)	-0,104 (0,000)	1						
Market value of bank (thousand €)	-0,153 (0,000)	-0,123 (0,000)	-0,098 (0,000)	0,999 (0,000)	1					
Market- to- book ratio	0,301 (0,000)	0,011 (0,509)	0,257 (0,000)	-0,016 (0,346)	0,01 (0,557)	1				
Profitability	0,205 (0,000)	0,204 (0,000)	0,193 (0,000)	-0,024 (0,199)	-0,020 (0,230)	0,013 (0,439)	1			
Collateral	-0,296 (0,000)	-0,275 (0,000)	-0,295 (0,000)	0,007 (0,678)	0,005 (0,757)	-0,004 (0,830)	-0,123 (0,000)	1		
Dividend	0,146 (0,000)	0,010 (0,552)	0,021 (0,217)	0,010 (0,545)	0,014 (0,415)	0,023 (0,173)	-0,010 (0,556)	-0,003 (0,872)	1	
Asset risk	0,704 (0,000)	0,581 (0,000)	0,614 (0,000)	-0,134 (0,000)	-0,126 (0,000)	0,228 (0,000)	0,202 (0,000)	-0,342 (0,000)	0,044 (0,012)	1

Table 5. Excess equity capital (market and book) and excess Tier 1 capital ratio models

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. The dependent variable is pointed out in the top of each column. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

	Model 1A	Model 1B	Model 1C
Dependent variable	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital
Constant	0.333*** (0.028)	0.407*** (0.021)	0.462*** (0.029)
Market-to-book ratio	0.011*** (0.001)	-0.001** (0.001)	0.020*** (0.001)
Standard error			
Elasticity	1.036	-0.021	0.0217
Profitability	1.074*** (0.038)	0.468*** (0.020)	0.562*** (0.036)
Standard error			
Elasticity	0.284	0.211	0.171
Log size	-0.016*** (0.001)	-0.012*** (0.001)	-0.014*** (0.001)
Standard error			
Elasticity	-1.300	-0.170	0.129
Collateral	-0.134*** (0.020)	-0.185*** (0.012)	-0.217*** (0.020)
Standard error			
Elasticity	-0.958	-2.265	-1.788
Dividend	0.032*** (0.003)	-0.001 (0.002)	-0.007** (0.003)
Standard error			
Elasticity	0.218	-0.010	-0.059
Log asset risk	0.035*** (0.002)	0.008*** (0.001)	0.012*** (0.002)
Standard error			
Elasticity	0.281	0.103	0.109
GDP growth	-0.002*** (0.001)	-0.001** (0.000)	-0.012** (0.001)
Standard error			
Elasticity	0.022	-0.012	-0.017
Inflation	-0.003*** (0.001)	-0.000 (0.000)	-0.000 (0.001)
Standard error			
Elasticity	-0.065	-0.016	-0.003
Log stock market risk	0.012*** (0.003)	-0.003** (0.001)	-0.001 (0.003)
Standard error			
Elasticity	0.097	-0.046	-0.006
Term structure spread	-0.002* (0.001)	-0.000 (0.000)	-0.002* (0.001)
Standard error			
Elasticity	-0.023	-0.004	-0.014
R ²	0.550	0.302	0.332
Number of banks	515	515	515
Number of observations	3,093	3,093	3,093

Table 6. Excess equity capital models and the region effect

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. For each model, the dummy variable *EUR* takes the value of 1 if the bank is European and zero otherwise. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

Dependent variable	Model 2A	Model 2B	Model 2C
	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital
	Estimate	Estimate	Estimate
Constant	0.116*** (0.038)	0.158*** (0.028)	0.028*** (0.041)
Market-to-book ratio	0.010*** (0.001)	-0.001** (0.001)	0.018*** (0.001)
Profitability	1.832*** (0.059)	0.233*** (0.033)	0.251*** (0.061)
Log size	-0.010*** (0.002)	-0.003** (0.001)	-0.011*** (0.002)
Collateral	-0.003 (0.026)	-0.071*** (0.017)	-0.077*** (0.028)
Dividend	0.031*** (0.004)	-0.000 (0.002)	0.001 (0.005)
Log asset risk	0.031*** (0.018)	0.005*** (0.001)	0.006*** (0.002)
GDP growth	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)
Inflation	0.001 (0.001)	0.000 (0.001)	0.001 (0.001)
Log stock market risk	0.009** (0.004)	0.002 (0.002)	0.002 (0.004)
Term structure spread	-0.001 (0.001)	-0.001* (0.001)	-0.002 (0.001)
EUR	0.202*** (0.056)	0.465*** (0.043)	0.166*** (0.061)
EUR × Market-to-book ratio	0.210*** (0.014)	0.028*** (0.001)	0.139*** (0.014)
EUR × Profitability	-1.612*** (0.076)	0.264*** (0.042)	0.172** (0.079)
EUR × Log size	-0.004 (0.003)	-0.017*** (0.002)	-0.003 (0.003)
EUR × Collateral	-0.205*** (0.037)	-0.179*** (0.023)	-0.204*** (0.039)
EUR × Dividend	-0.021*** (0.006)	0.002 (0.004)	-0.010 (0.007)
EUR × Log asset risk	0.026*** (0.004)	0.013*** (0.002)	0.020*** (0.004)
EUR × GDP growth	0.002* (0.001)	-0.000 (0.001)	0.000 (0.001)
EUR × Inflation	-0.003 (0.002)	-0.004*** (0.001)	-0.005** (0.002)
EUR × Log stock market risk	-0.043*** (0.007)	-0.017*** (0.004)	-0.021*** (0.007)
EUR × Term structure spread	0.001 (0.002)	0.004*** (0.001)	0.006*** (0.002)
R ²	0.648	0.434	0.440
Number of banks	515	515	515
Number of observations	3,093	3,093	3,093

Table 7. Excess equity capital models and the size effect

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. For each model, the dummy variable *Large* takes the value of 1 if the bank is above percentile 75 for the variable size and zero otherwise. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

Dependent variable	Model 3A	Model 3B	Model 3C
	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital
	Estimate	Estimate	Estimate
Constant	0.063*** (0.021)	0.214*** (0.014)	0.228*** (0.022)
Market-to-book ratio	0.010*** (0.001)	-0.001* (0.001)	0.019*** (0.001)
Profitability	1.057*** (0.039)	0.538*** (0.021)	0.671*** (0.039)
Collateral	-0.119*** (0.021)	-0.178*** (0.013)	-0.192*** (0.022)
Dividend	0.036*** (0.004)	0.000 (0.002)	-0.010*** (0.004)
Log asset risk	0.043*** (0.002)	0.008*** (0.001)	0.015*** (0.002)
GDP growth	0.002** (0.001)	-0.000 (0.000)	-0.001 (0.001)
Inflation	-0.004*** (0.001)	-0.001 (0.001)	-0.001 (0.001)
Log stock market risk	0.018*** (0.003)	-0.002 (0.002)	0.002 (0.003)
Term structure spread	-0.005*** (0.001)	-0.001* (0.001)	-0.004*** (0.001)
Large	-0.499*** (0.054)	0.654** (0.031)	0.007 (0.054)
Large × Market-to-book ratio	0.543*** (0.288)	-0.049*** (0.016)	0.073** (0.029)
Large × Profitability	-0.646*** (0.440)	-0.433*** (0.075)	-0.907*** (0.136)
Large × Collateral	0.042 (0.044)	-0.002 (0.026)	-0.072 (0.045)
Large × Dividend	-0.036*** (0.008)	-0.003 (0.004)	0.007 (0.008)
Large × Log asset risk	-0.024*** (0.004)	0.000 (0.002)	-0.006* (0.004)
Large × GDP growth	-0.001 (0.001)	0.001 (0.001)	-0.000 (0.001)
Large × Inflation	0.003 (0.002)	-0.000 (0.001)	0.002 (0.002)
Large × Log stock market risk	-0.027*** (0.006)	-0.004 (0.003)	-0.006 (0.006)
Large × Term structure spread	0.007*** (0.002)	0.002 (0.001)	0.005*** (0.002)
R ²	0.646	0.324	0.308
Number of banks	515	515	515
Number of observations	3,093	3,093	3,093

Table 8. Excess equity capital models and the growth opportunities effect

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. For each model, the dummy variable *High growth* takes the value of 1 if the bank is above percentile 75 for the variable market-to-book ratio and zero otherwise. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

	Model 4A	Model 4B	Model 4C
Dependent variable	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital
	Estimate	Estimate	Estimate
Constant	0.343*** (0.028)	0.390*** (0.022)	0.388*** (0.032)
Profitability	1.036*** (0.051)	0.252*** (0.030)	0.274*** (0.060)
Log size	-0.014*** (0.012)	-0.012*** (0.001)	-0.010*** (0.001)
Collateral	-0.147*** (0.021)	-0.180*** (0.013)	-0.166*** (0.024)
Dividend	0.026*** (0.003)	0.003* (0.002)	-0.004 (0.004)
Log asset risk	0.028*** (0.001)	0.007*** (0.001)	0.010*** (0.002)
GDP growth	0.001** (0.001)	-0.000 (0.000)	-0.002*** (0.001)
Inflation	-0.002** (0.001)	-0.001 (0.001)	0.001 (0.001)
Log stock market risk	0.003 (0.003)	-0.003* (0.002)	-0.003 (0.003)
Term structure spread	-0.000 (0.001)	-0.000 (0.001)	-0.001 (0.001)
High growth	0.070** (0.033)	-0.014 (0.020)	0.185*** (0.039)
High growth × Profitability	-0.296*** (0.067)	0.432*** (0.040)	0.511*** (0.079)
High growth × Log size	-0.001 (0.001)	-0.004*** (0.001)	-0.014*** (0.001)
High growth × Collateral	-0.014 (0.021)	0.062*** (0.012)	-0.060** (0.025)
High growth × Dividend	-0.012 (0.009)	-0.015*** (0.006)	-0.005 (0.011)
High growth × Log asset risk	0.010*** (0.004)	0.004* (0.002)	0.011*** (0.004)
High growth × GDP growth	0.000 (0.001)	-0.000 (0.001)	0.006*** (0.002)
High growth × Inflation	-0.001 (0.002)	0.001 (0.001)	-0.009*** (0.002)
High growth × Log stock market risk	0.017*** (0.006)	0.002 (0.004)	0.025*** (0.007)
High growth × Term structure spread	-0.004** (0.002)	-0.002 (0.001)	-0.005** (0.002)
R ²	0.598	0.323	0.372
Number of banks	515	515	515
Number of observations	3,093	3,093	3,093

Table 9. Excess equity capital models and the leverage effect

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. For each model, the dummy variable *High leverage* takes the value of 1 if the bank is above percentile 75 for the variable market leverage and zero otherwise. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

Dependent variable	Model 5A	Model 5B	Model 5C
	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital
	Estimate	Estimate	Estimate
Constant	0.330*** (0.027)	0.430*** (0.021)	0.501*** (0.030)
Market-to-book ratio	0.010*** (0.001)	-0.001** (0.001)	0.019*** (0.001)
Profitability	0.942*** (0.038)	0.498*** (0.021)	0.586*** (0.038)
Log size	-0.014*** (0.001)	-0.014*** (0.001)	-0.017*** (0.001)
Collateral	-0.148*** (0.019)	-0.201*** (0.012)	-0.240*** (0.020)
Dividend	0.019*** (0.005)	-0.002 (0.002)	-0.008* (0.005)
Log asset risk	0.033*** (0.002)	0.010*** (0.001)	0.016*** (0.002)
GDP growth	0.003*** (0.001)	-0.000 (0.000)	0.000 (0.001)
Inflation	-0.006*** (0.001)	-0.001** (0.001)	-0.002** (0.001)
Log stock market risk	0.021*** (0.003)	-0.001 (0.001)	0.005* (0.003)
Term structure spread	-0.004*** (0.001)	-0.002*** (0.001)	-0.003*** (0.001)
High leverage × Market-to-book ratio	-0.036 (0.050)	-0.311*** (0.027)	-0.477*** (0.050)
High leverage × Profitability	-0.297** (0.117)	-0.231*** (0.063)	-0.430*** (0.112)
High leverage × Log size	0.005*** (0.001)	0.006*** (0.001)	0.012*** (0.001)
High leverage × Collateral	0.005 (0.046)	0.247*** (0.024)	0.352*** (0.045)
High leverage × Dividend	-0.011* (0.006)	0.005 (0.003)	-0.002 (0.006)
High leverage × Log asset risk	-0.021*** (0.004)	-0.001 (0.002)	-0.008** (0.004)
High leverage × GDP growth	-0.004*** (0.001)	0.000 (0.001)	-0.002* (0.001)
High leverage × Inflation	0.008 (0.002)	0.001 (0.001)	0.005*** (0.002)
High leverage × Log stock market risk	-0.032*** (0.006)	-0.003 (0.003)	-0.012* (0.006)
High leverage × Term structure spread	0.004* (0.002)	0.003*** (0.001)	0.002 (0.002)
R ²	0.601	0.331	0.367
Number of banks	515	515	515
Number of observations	3,093	3,093	3,093

Table 10. Excess equity capital models and the crisis effect

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. For each model, the dummy variable *Crisis* takes the value of 1 for the years of the recent international financial crisis (2008-2010) and zero otherwise (2004-2007). Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

Dependent variable	Model 6A	Model 6B	Model 6C
	Excess equity capital (market)	Excess equity capital (book)	Excess Tier 1 capital
	Estimate	Estimate	Estimate
Constant	0.284*** (0.027)	0.377*** (0.022)	0.458*** (0.031)
Market-to-book ratio	0.009*** (0.001)	-0.001* (0.001)	0.018*** (0.001)
Profitability	0.557*** (0.063)	0.493*** (0.041)	0.488*** (0.073)
Log size	-0.008*** (0.001)	-0.015*** (0.001)	-0.016*** (0.001)
Collateral	-0.129*** (0.019)	-0.123*** (0.013)	-0.196*** (0.022)
Dividend	0.019*** (0.004)	-0.000 (0.003)	-0.001 (0.005)
Log asset risk	0.061*** (0.002)	0.006*** (0.001)	0.019*** (0.002)
GDP growth	-0.003*** (0.001)	0.000 (0.000)	-0.000 (0.001)
Inflation	-0.000 (0.001)	-0.002*** (0.001)	-0.001 (0.001)
Log stock market risk	-0.008** (0.003)	0.001 (0.002)	-0.001 (0.003)
Term structure spread	0.000 (0.001)	-0.002*** (0.001)	-0.002* (0.001)
Crisis	-0.002 (0.023)	0.077*** (0.014)	0.008 (0.026)
Crisis × Market-to-book ratio	0.004*** (0.000)	0.000 (0.000)	-0.004*** (0.001)
Crisis × Profitability	0.069 (0.068)	0.026 (0.043)	0.060 (0.079)
Crisis × Log size	-0.001* (0.001)	0.003*** (0.001)	0.006*** (0.001)
Crisis × Collateral	-0.113*** (0.016)	-0.105*** (0.010)	-0.067*** (0.018)
Crisis × Dividend	-0.015*** (0.005)	0.001 (0.003)	-0.011* (0.006)
Crisis × Log asset risk	-0.016*** (0.002)	-0.002 (0.001)	-0.011*** (0.002)
Crisis × GDP growth	0.004*** (0.001)	-0.001* (0.001)	-0.001 (0.001)
Crisis × Inflation	0.001 (0.001)	0.002** (0.001)	0.001 (0.002)
Crisis × Log stock market risk	0.029*** (0.005)	-0.008*** (0.003)	-0.005 (0.006)
Crisis × Term structure spread	-0.000 (0.002)	0.003*** (0.001)	0.001 (0.002)
R ²	0.657	0.290	0.373
Number of banks	515	515	515
Number of observations	3,093	3,093	3,093

Table 11. Excess Tier 1 capital model and regulation measures

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

	Model 7A	Model 7B	Model 7C	Model 7D
Dependent variable	Excess Tier 1 capital	Excess Tier 1 capital	Excess Tier 1 capital	Excess Tier 1 capital
Regulation variable included in the model	Investors rights	Shareholders rights	Monitoring index	Overall restrictiveness
Constant	0.588*** (0.039)	0.610*** (0.039)	0.473*** (0.033)	0.505*** (0.035)
Market-to-book ratio	0.015*** (0.001)	0.015*** (0.001)	0.015*** (0.001)	0.014*** (0.001)
Profitability	0.604*** (0.041)	0.596*** (0.041)	0.671*** (0.043)	0.604*** (0.042)
Log size	-0.012*** (0.001)	-0.013*** (0.001)	-0.011*** (0.001)	-0.011*** (0.001)
Collateral	-0.312*** (0.025)	-0.311*** (0.024)	-0.305*** (0.025)	-0.298*** (0.024)
Dividend	-0.010** (0.004)	-0.010** (0.004)	-0.011** (0.004)	-0.010** (0.004)
Log asset risk	0.010*** (0.002)	0.011*** (0.002)	0.008*** (0.002)	0.010*** (0.002)
GDP growth	-0.001 (0.001)	-0.001 (0.001)	-0.000 (0.001)	-0.001 (0.001)
Inflation	-0.002 (0.001)	-0.002 (0.001)	-0.002* (0.001)	-0.001 (0.001)
Log stock market risk	0.005 (0.004)	0.005 (0.004)	0.009** (0.004)	0.005 (0.004)
Term structure spread	-0.001 (0.001)	-0.001 (0.001)	-0.002* (0.001)	-0.001 (0.001)
Regulation variable	-0.010*** (0.002)	-0.011*** (0.002)	0.007*** (0.003)	-0.003*** (0.001)
R ²	0.419	0.425	0.399	0.411
Number of banks	491	491	496	484
Number of observations	1,745	1,745	1,734	1,714

Table 12. Excess Tier 1 capital model and the temporal effect of regulation

The sample consists of 560 publicly traded commercial banks and bank-holding companies in Europe and the US from the Bankscope database from 2004 to 2010. Numbers between brackets indicate the standard error. ***, ** and * denote statistical significance at the 1%, the 5% and the 10% level, respectively.

	Model 8A	Model 8B	Model 8C	Model 8D
Dependent variable	Excess Tier 1 capital	Excess Tier 1 capital	Excess Tier 1 capital	Excess Tier 1 capital
Regulation variable included in the model	Investors rights	Shareholders rights	Monitoring index	Overall restrictiveness
Constant	0,541*** (0.040)	0,560*** (0.040)	0,433*** (0.033)	0,537*** (0.037)
Market-to-book ratio	0,015*** (0.001)	0,015*** (0.001)	0,016*** (0.001)	0,015*** (0.001)
Profitability	0,675*** (0.043)	0,665*** (0.043)	0,682*** (0.043)	0,693*** (0.042)
Log size	-0,013*** (0.001)	-0,013*** (0.001)	-0,011*** (0.001)	-0,013*** (0.001)
Collateral	-0,269*** (0.025)	-0,269*** (0.024)	-0,279*** (0.025)	-0,258*** (0.023)
Dividend	-0,003 (0.004)	-0,003 (0.004)	-0,007* (0.004)	-0,000 (0.004)
Log asset risk	0,023*** (0.003)	0,023*** (0.003)	0,017*** (0.002)	0,021*** (0.002)
GDP growth	-0,001* (0.001)	-0,001* (0.001)	-0,001 (0.001)	-0,001 (0.001)
Inflation	-0,001 (0.001)	-0,002 (0.001)	-0,002 (0.001)	-0,002 (0.001)
Log stock market risk	0,005 (0.004)	0,005 (0.004)	0,008** (0.004)	0,006 (0.004)
Term structure spread	-0,001 (0.001)	-0,001 (0.001)	-0,002 (0.001)	-0,001 (0.001)
Regulation variable	-0,013*** (0.002)	-0,013*** (0.002)	0,038 (0.048)	-0,010*** (0.001)
Regulation variable × 2008	-0,001* (0.000)	-0,001* (0.000)	-0,042 (0.048)	0,001*** (0.000)
Regulation variable × 2009	0,001* (0.000)	0,001* (0.000)	-0,034 (0.048)	0,002*** (0.000)
Regulation variable × 2010	0,004*** (0.000)	0,003*** (0.000)	-0,015 (0.048)	0,004*** (0.000)
R ²	0.450	0.457	0.415	0.448
Number of banks	491	491	496	484
Number of observations	1,745	1,745	1,734	1,714

Figure 1. Distribution of book capital ratio

The figure shows the distribution of banks' book capital ratio (book equity divided by book assets) for the 3,496 bank-year observations in our sample of 560 publicly traded commercial banks and bank-holding companies in Europe and in the US from the Bankscope database from 2004 to 2010.

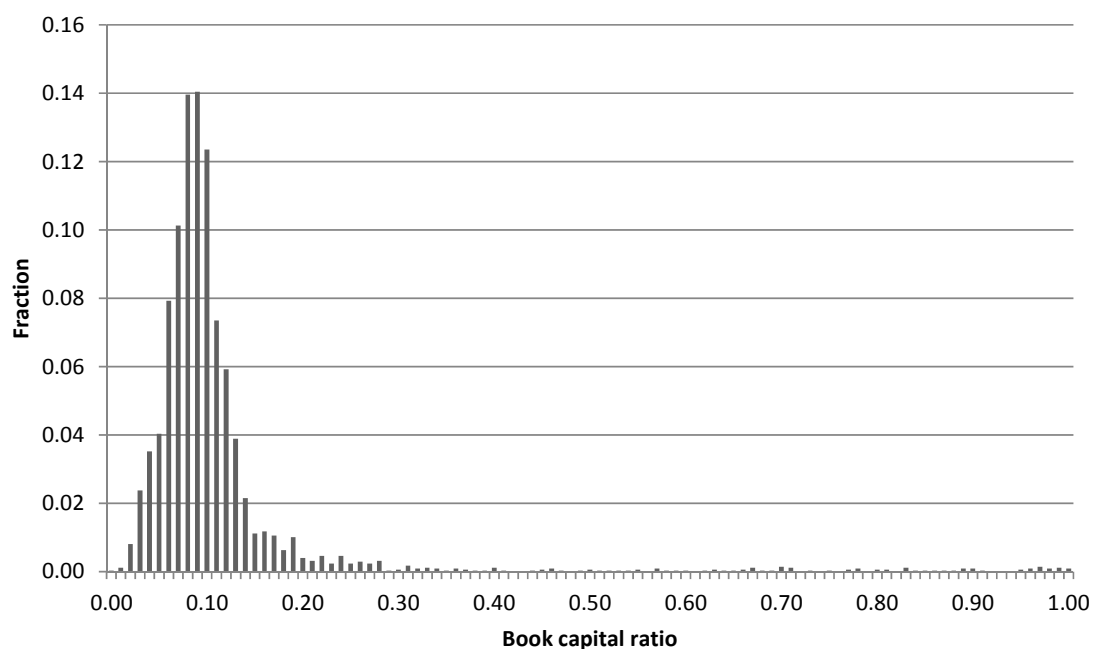


Figure 2. Distribution of Tier 1 capital ratio

The figure shows the distribution of banks' regulatory Tier 1 capital ratio (equity over risk weighted assets as defined in Basel I) for 3,496 bank-year observations in our sample of 560 publicly traded commercial banks and bank-holding companies in Europe and in the US from the Bankscope database from 2004 to 2010.

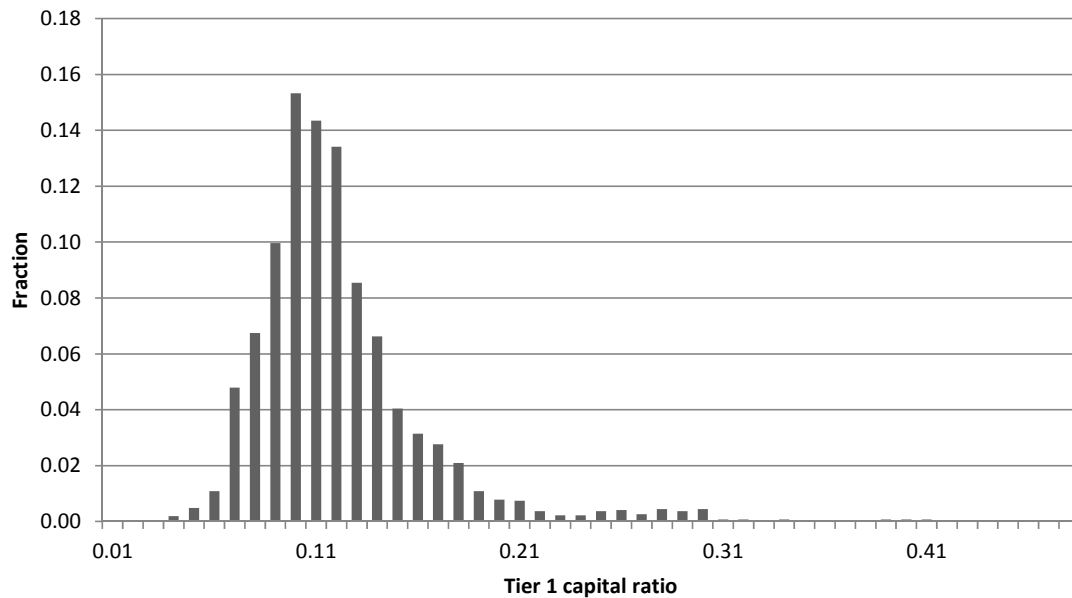


Figure 3. Evolution of mean market equity ratio for European versus US banks

The figure shows the evolution of banks' mean market equity ratio for European versus US banks of the 181 publicly traded commercial banks and bank-holding in Europe and in the US from the Bankscope database from 2004 to 2010.

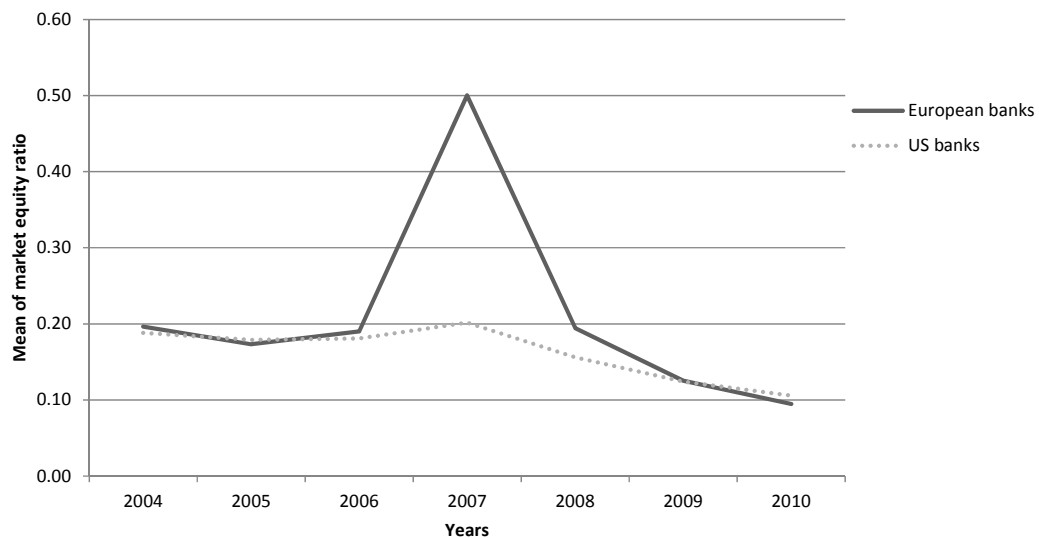


Figure 4. Evolution of mean market equity ratio for large versus small banks

The figure shows the evolution of banks' mean market equity ratio for large versus small banks of the 181 publicly traded commercial banks and bank-holding in Europe and in the US from the Bankscope database from 2004 to 2010.

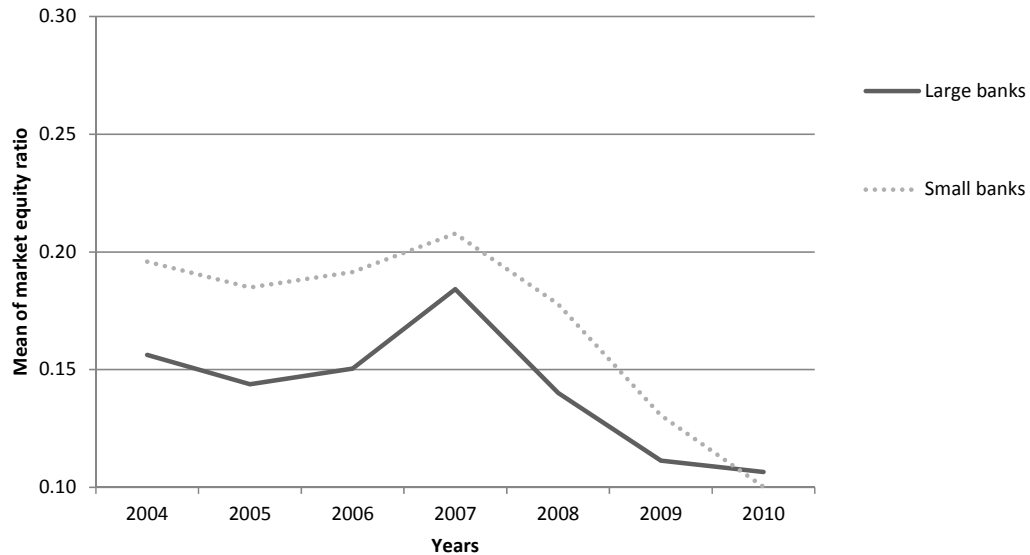


Figure 5. Evolution of mean market equity ratio for high growth versus low growth banks

The figure shows the evolution of banks' mean market equity ratio for high growth versus low growth banks of the 181 publicly traded commercial banks and bank-holding in Europe and in the US from the Bankscope database from 2004 to 2010.

