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Bank capital and profitability: Evidence from a global sample

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Abstract

This study employs bank-level data for a global sample to examine the relationship between capital and profitability over 2000-2013. Our evidence suggests that bank capital is positively related to bank profitability, although the estimated impact is relatively marginal. However, more capitalised banks that are more profitable appear to have a higher traditional risk, a greater proportion of non-traditional activities in their balance sheets and they tend to be more effective at controlling their costs. The relationship depends on environmental conditions as well and bank size. It is typically stronger in crisis periods, in lower and middle income countries and for larger banks (but not for Global Systemically Important Banks, or GSIBs). Finally, for banks operating in less restricted, more unstable and corrupt environments, the same increase in capital is associated with more profitable institutions than banks operating in countries with lower corruption levels. Our findings are robust to different specifications and robustness tests, and carry important implications for policy reforms aimed at ensuring stability to the banking sector globally.

JEL classification: G21, G28, C33.

Keywords: Capital; Profitability; Risks; Crisis; Banking.

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1. Introduction

In recent years, the role of capital for modern banks and the implications of their capital structure for profitability and risk have largely dominated the debates about international banking sector reforms. Post crisis, the demand for a more stable and safe banking sector has increased dramatically. While revisiting Modigliani and Miller (1958)'s seminal capital structure theory as it applies to banks, several prominent authors (e.g. Admati et al., 2013; Miles et al. 2012) highlight the benefits from introducing substantially higher equity requirements (up to 40%). Banks, in turn, argue that capital is expensive for their business and that such requirements would ultimately affect their performance, operations and lending activity. Thus, banks may react by shifting to non-traditional activities and unregulated parts of the financial system.

For banking firms, debt is typically more attractive than equity for several reasons: the tax treatment that favours it over equity; its disciplinary role on bank managers; the presence of explicit guarantees (deposit insurance); its informational *insensitivity* that makes it less costly (Gorton, 2010); and the lower risk propensity of depositors compared with other investors. One of banks' typical arguments is that equity is more expensive than debt because it is riskier, therefore more equity will increase the overall cost of capital, thereby affecting performance via lower Return on Equity (ROE).[1] If this holds true, the introduction of significantly higher capital requirements should increase banks' private costs that eventually will result in money drained from the economy as banks will lend less and/or at a higher price.

On the relationship between capital and profitability in banking, theory does not offer an unambiguous prediction. Recent theoretical studies argue for a positive relationship (e.g. Holmstrom and Tirole, 1997; Allen et al., 2011; Mehran and Thakor, 2011) and base their predictions on the increased borrowers' monitoring activity that follow an increase in capital. This occurs because of the lower moral hazard and the greater exposure of shareholders to potential losses in case of failure. Similarly, Berger (1995), one of the most cited early empirical works on the topic, finds that the relationship between capital and profitability measured by ROE is positive and robust to up to three lags for the variables of interest for the US banking sector. In addition, the author finds that the relationship can also run in the opposite direction, i.e. from profitability to capital. The most recent empirical literature employs either ROA and/or ROE and highlights the need to test the validity of the relationship across bank-specific factors such as bank size, cost effectiveness, and liquidity (e.g. Berger and Bowman, 2013; Lee and Hsieh, 2013). It also stresses the importance of accounting for

[1] However, as pointed out by Thakor (2014) in a world without taxes, a reduction in ROE due to a reduction in leverage is of no consequence for the bank's shareholder value, if the change in leverage is not a distortion away from an optimal capital structure and the bank's operating profit.

the economic cycle as both bank profitability and capital holdings tend to be procyclical. A related aim of this paper is to identify the 'channels' through which the relationship between bank capital and profitability may operate.

The present study contributes to the extant literature in several ways. First, we employ a global sample of banks (asset size > constant US $100m on average over the sample period) operating in both the developed and emerging world for a period of 14 years. Hence our results should be robust to different economic cycles. Second, we adopt alternative measures of bank capital. Third, we control for micro (size, liquidity, lending characteristics, income diversification) and macro/environmental determinants (GDP growth, credit sector development), including a dummy for country-specific banking crises constructed following Laeven and Valencia (2012). Fourth, we identify possible channels (risk, business mix, and costs) that can help explain how the relationship between capital and profitability works. Finally, we evaluate how the relationships vary depending on country-specific banking crises, bank size, income levels (using the most updated World Bank income classifications), economic freedom, political stability, and corruption. As far as we are aware there are no similar studies carrying out such investigation for a global sample and a long time span that includes distress periods.

We design our methodological framework in the vein of Demirgüç-Kunt and Huizinga (2010) and carry out a pooled estimation where we include lagged bank capital variables and control for country and time fixed effects, to minimise endogeneity problems (which are however further investigated by means of additional robustness tests). Our findings clearly suggest a positive and significant relationship between capital and profits. This is true for all definitions of capital – both those that are linked to regulatory requirements and the crude leverage ratio. Our empirical evidence provides some support to the theoretical view that higher capital requirements translate in a stronger monitoring effect and greater safe investments that ultimately increase profitability (Berger, 1995; Berger and Bouwman, 2013). Nevertheless, we find that more capitalised banks that are more profitable have a higher traditional risk, a greater proportion of non-traditional activities in their balance sheets and they tend to be more effective at controlling their costs. In addition, the relationship depends on different environmental conditions as well as bank size. It appears to be stronger in crisis periods, for larger banks (but not for GSIBs), and in lower and middle income countries, although in this latter case the evidence is weaker. Finally, for banks operating in countries with lower economic freedom, less political stability and more corrupt environments, the same increase in capital is associated with a higher level of profits.

This paper is structured as follows. Section 2 reviews the extant empirical literature and identifies the main hypothesis. Section 3 explains the data and main methodological issues. Section 4 discusses the results. Section 5 concludes and draws the key implications of the study.

2. The relationship between capital and profitability in the empirical banking literature

Over the past fifteen years or so, there has been a spurt of theoretical and empirical research on bank capital. Equally, the interest on bank profitability and its determinants has resulted in a plethora of literature focusing specifically on the relationship between earnings and market conditions. As comprehensively reviewed in Berger et al. (2004), these studies either focus on the collusion hypothesis (the SCP paradigm) and/or in the persistence of profit (POP) (see e.g. Chronopoulous et al., 2015). The models employed in these works typically do not include capital as a main variable of interest but test it as a control variable measured by book value of equity over total assets.

There are however several empirical studies that investigate specifically the relationship between bank capital and profitability. For example, Berger (1995) is one of the most cited papers and employs a two-equation reduced form framework with three lags and control variables for a sample of US banks in the mid-to-late 1980s. His evidence shows Granger causality in both directions between earnings (measured as ROE) and capital (measured as book value of equity over assets). The positive causality from earnings to capital is explained by the hypothesis that banks retain some of their marginal earnings in the form of equity increases. The finding that higher capital is followed by higher earnings can be explained by two separate hypotheses: on one hand the *bankruptcy cost* hypothesis, and on the other the *signalling* hypothesis. Under the former, banks increase their earnings as the cost of uninsured debt decreases, since banks that were previously undercapitalised raise their capital levels closer to equilibrium levels. The latter hypothesis rather posits that bank management signals private information that prospects are *good* by increasing capital. That can be due to higher revenues, lower costs or reduced risk.

Empirical studies that followed Berger's work, such as those using banking data from the 1990s (e.g. Demirguc- Kunt and Huizinga, 2001; Goddard et al. 2004) and more recent ones that include the early 2000s, such as Demirgüç-Kunt and Huizinga (2010) and Gropp and Heider (2010), tend to find a positive relationship between bank capital and profitability. The former use a multi-country panel of 1,334 banks operating in 101 countries to investigate how bank activity and funding strategies affect bank risks and return for the 1995-2007 period. They show that there is a positive

relationship between bank capital to assets and bank profitability (measured as pre-tax ROA) and a negative one with risk. The latter consider the determinants of bank capital structure for a sample of large US and European banks over 1991-2004. Gropp and Heider (2010)'s evidence suggests that more profitable, dividend paying banks with high market-to-book ratios face lower costs of issuing equity. According to the authors, the fact that more profitable banks tend to hold significantly more capital is explained by the lower cost of raising equity at short notice that these banks can benefit from because they are better known to outsiders and have more financial slack, so they can obtain a better price.

In a US study, Berger and Bouwman (2013) examine the implications of greater capital for banks' performance (proxied by bank survival and market share) during financial crises over the past quarter century. Results show not only that capital always enhances small banks' probability of survival and market share, but also that it improves the performance of medium and large banks particularly during banking crises. Berger and Bouwman (2013) explore three channels through which capital may generate these effects. On the relationship between capital and profitability (ROE), the authors find that high-capital banks of all sizes improve their profitability during banking crises (although this result is not significant for medium banks) and market crises. In addition, they find that capital also enhances the profitability of small banks during normal times. These results generally support the hypothesis that capital improves bank profitability (although with ROA the results are confirmed for small banks, but are weaker for medium and large banks). One of the key results of this study is that the economic roles of capital vary in the cross section of banks depending on size and time period.

Lee and Hsieh (2013) use bank financial data for 42 Asian countries over 1994-2008 to investigate how and to what extent capital affects bank profits and riskiness. The authors employ four measures of bank profitability: ROA, ROE, net interest margins and net interest revenue over total assets, and their main methodology is GMM. They find a positive relationship between capital and profitability for the entire Asian banking sample and a negative one with risk. However, the ROA and ROE results often do not go in the same direction. Their evidence broadly suggests that the relationship significantly depends on bank types (namely, commercial versus investment and cooperative banks), countries' income levels and geographical regions.

In another cross-country study that includes twelve developed economies' banking sectors, Demirgüç-Kunt et al. (2013) investigate the relationship between different measures of capital (Tier 1 and 2 ratios, leverage and tangible equity) and stock market performance over a period that includes the financial crisis. They find that prior to the crisis higher capital (measured by the leverage ratio) resulted in higher stock returns in the full sample, but with a small coefficient and

marginal statistical significance. After the crisis, the Basel capital ratio is positive and (marginally) significant in the full sample during the crisis. Another important result is that the leverage ratio matters for equity prices especially in the sample of larger banks.

Our study is novel because it employs a global sample and a long time period, that includes both normal and crisis times. The reason for the expectation of a positive relationship can be explained by referring to the basic theory of financial intermediation: banks exist because of the advantages they have in the production of information about borrowers via loan screening and contracting as well as monitoring customers' behaviour in the long run. This causes an asymmetric information problem for banks vis-à-vis financial markets because, by having private information about their customers, bank managers will know more about the bank's earnings prospects and financial conditions. Therefore, they may signal private information that prospects are good through capital decisions (Acharya, 1988). Another interpretation of the positive relationship between capital and profits is given in the expected bankruptcy hypothesis. As noted in Berger (1995), if a bank is undercapitalised and the expected bankruptcy costs are high, higher capital should have a positive effect on the bank's earnings by decreasing interest costs on uninsured debt.

Several theoretical studies focus on banks' monitoring incentives as key channels in the relationship between capital and performance. Holmstrom and Tirole (1997) and Mehran and Thakor (2011) for example, find that greater bank capital increases performance by diminishing the moral hazard between shareholders and debtholders. This will increase the banks' incentives to monitor debtholders, as bank failure is costlier for shareholders of well capitalized banks. Another interpretation (Diamond and Rajan, 2001) acknowledges that the market discipline imposed by the highly leveraged capital structure encourages banks to commit to monitoring their borrowers. Consequently, more capital will relax managers from this discipline (i.e. it will decrease monitoring incentives) and ultimately adversely affect banks' performance.

Regarding possible differences in the relationship between capital and profits in financially healthy vs. tough periods, we conjecture that in times of financial distress lower revenues might follow increases in capital. This may happen because, under the expected bankruptcy costs hypothesis, banks with greater than optimal insolvency risk would likely try to reduce the probability of failure both by increasing capital and by reducing portfolio risk (these measures could even be imposed by regulators). Lower portfolio risk is generally associated with lower expected revenues. Therefore, it is important to test our main hypothesis separately for normal versus turbulent times.

Our interpretation of the signalling hypothesis results in a second stage analysis where we test possible channels through which the relationship between capital and profitability may operate, namely: (a) risk; (b) non-traditional activities; and (c) costs. The first channel is proxied by the risk

associated with traditional banking activities (i.e. the level of NPLs, or non-performing loans). Higher capital could induce banks to accept or take on more risk, which ensures higher interest and non-interest income. In other words, the relationship between capital and profits will be positive if more capitalised banks choose a riskier portfolio (higher NPLs) and higher profit volatility (higher standard deviation of ROA) and thus they will get more returns, but this could have adverse effects on their overall health.

Another channel runs through the non-traditional bank activities and it is tested by including in the model the proportion of loans over assets. Since capital is costly, banks' preference will be to increase revenues by accessing the non-traditional markets e.g. reducing on balance sheet loans and/or increasing activities in the non-traditional and shadow markets (e.g. via securitisation). This may reduce credit availability if there is no balance sheet expansion but only balance sheet adjustments.

The relationship between capital and earnings could work also through bank costs, and this is verified using the ratio of banks' total costs over total revenues. Essentially, the cost channel assumes that profits will increase if costs decrease, therefore we expect that better capitalised banks will be able to earn more profits via lower costs. This could be due to greater bank efficiency levels and/or better technology (Hughes and Mester, 2014).

3. Data and Methodology

3.1 Data

We use a multi-country panel of banks operating in 77 countries. Bank financial data are drawn from the international database BankScope over the period 2000-2013 while macroeconomic data are obtained from the World Bank Development Indicators. We focus on banks with at least an average of US $100m of total assets during the whole period. Among them, we select only those institutions that have at least 10% of total deposits to total assets and 25% of total loans to total assets, to ensure that the banks included in our sample are engaged in the credit intermediation activity. Our final sample consists of 24,848 observations on 4,414 banks.

We employ three alternative measures of bank capital: Tier 1 capital over risk weighted assets (*TIER1RWA*); book value of equity over total assets (*EQAST*); capital surplus over the regulatory requirement[2] (*CAPSURPLUS*). In line with Demirgüç-Kunt and Huizinga (2010), we use

[2] The values of the minimum capital-asset ratio requirement are drawn from the 'Bank Regulation and Supervision Survey', carried out by the World Bank and providing information on bank regulation and supervision for 143

one period lag of bank capital in the regressions (i.e. the beginning of period values) to mitigate the endogeneity problem that could arise while dealing with the capital-profits relationship. We also perform some robustness checks – Granger-causality, instrumental variable and dynamic generalised method of moments regressions – to address the endogeneity issue more directly. Bank profitability is measured as Return on Assets (*ROA*), calculated as net income over total assets. We choose to focus on ROA, rather than on the Return on Equity (ROE), because, as Admati et al. (2013) note, the use of ROE becomes problematic when comparisons are made across different capital structures.[3]

A set of bank-specific variables are included in all regressions as controls: the lagged value of ROA, to assess the importance of profits persistence; the natural logarithm of total assets (*TOTAST*), to take account of bank size; the liquidity ratio (*LIQUIDITY*), measured as non-customer deposits plus cash over total deposits (not far from the spirit of Gambacorta, 2011), to capture the role that holding more liquid liabilities has on banks' profits (which could be either positive, if liquidity allows a better perception in funding markets and hence a reduction of financing costs, or negative, if liquidity levies an opportunity cost due to the need of keeping liquid liabilities and liquid assets in balance, which translates into lower returns relative to other assets); the ratio of non-performing loans to net loans (*NPLs*), to gauge the impact of credit risk on overall profitability; the loans to assets ratio (*LOANAST*), as a proxy for lending specialisation; the cost to revenue ratio (*COSTREV*), representing a measure of bank efficiency; the share of non-interest revenue over total revenue (*NIRTR*), as an index of banks' income diversification.

Concerning macroeconomic factors, we employ the GDP yearly rate of growth (*GDPGROWTH*), to control for countries' economic conditions, and the domestic credit to GDP ratio (*CREDITGDP*), which accounts for the level of development of the banking sector and its relevance in financing the economic activity. The dummy for individual countries' systemic banking crises (*CRISIS*) is constructed following Laeven and Valencia (2013). This is defined (p. 228) as an event that meets the two following conditions: i) significant signs of financial distress in the banking system (e.g. significant bank runs, losses in the banking system and/or bank liquidations); and ii) significant banking policy intervention measures in response to significant losses in the banking system.[4]

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jurisdictions. Four surveys have been conducted in 2001, 2003, 2007, and 2012. For the years prior to 2001 we assume that the minimum levels are the same of 2001, while for the remaining years not covered by any survey we use the values reported in the previous available survey.

[3] As an example, Admati et al. (2013:14) observe that a manager who generates a 7% ROA with 20% capital will have an ROE of 15%, while a less productive manager who generates a 6.5% ROA but has 10% capital will have a ROE of 20%. Clearly, they operate with different capital structures, so a higher ROE does not necessarily imply that the second bank has deployed its assets more productively than the first.

[4] As the Laeven and Valencia database coverage ends in 2011, for sake of simplicity in our remaining years (2012 and 2013) we have confirmed the presence of a banking crisis for the countries marked as suffering such turmoil in 2011.

Table 1 reports the descriptive statistics of the variables used in this study as well as the description and the specific data sources. Large variations can be observed in the banks' profits and capital ratios (see also Gropp and Heider, 2010). The total banking observations by groups of country are reported in Table 2.

[Insert Table 1 around here]

[Insert Table 2 around here]

Table 3 shows the correlation matrix for selected bank variables with significance levels. The correlation between capital variables and *ROA* is always positive and significant (ranging between +0.06 and +0.23). As expected, there is a remarkable correlation between *TIER1RWA* and *CAPSURPLUS* (+0.92). Focusing on the remaining variables, of relatively high magnitude is also the correlation coefficients between *ROA* and *COSTREV* (-0.61).

[Insert Table 3 around here]

3.2 Methodological approach

In our investigation regarding the impact of capital on bank profitability in an international setting, we have to consider the possibility of reverse causality between the two variables, which may bias our estimation. To correct for this potential problem, as mentioned in the introduction, our reference regressions resemble those by Demirgüç-Kunt and Huizinga (2010), thus taking the lagged values of *TIER1RWA*, *EQAST* and *CAPSURPLUS* (as stated, we will later perform additional tests to deal with endogeneity issues).

Our baseline model is the following:

$$\pi_{i,c,t} = \alpha_1 \kappa_{i,c,t-1} + \alpha_2 \pi_{i,c,t-1} + \sum_{j=3}^{8} \alpha_j X_{i,c,t} + \sum_{k=9}^{10} \alpha_k \Psi_{c,t} + \alpha_{11} CRISIS_{c,t} + \delta_c + \gamma_t + \varepsilon_{i,c,t} \qquad (1)$$

where the dependent variable $\pi_{i,c,t}$ is the profitability (*ROA*) of bank *i* in country *c* in the year *t*. The main explanatory variable is the lagged capital measure $\kappa_{i,c,t-1}$; $\pi_{i,c,t-1}$ is the lagged profitability; $X_{i,c,t}$ and $\psi_{c,t}$ are, respectively, the six bank-specific variables and the two environmental variables; finally, *CRISIS* is the dummy for country-specific banking crises. We also control for country fixed effects

(δ_c) and time fixed effects (γ_t). Again, in line with Demirgüç-Kunt and Huizinga (2010), the estimation is by ordinary least squares (OLS) with clustering of standard errors at the bank level, which ensures that they are consistent to potential heteroskedasticity and correlation within banks. For robustness, Appendix 1 reports some tests based on the full specification of Equation (1).

4. Empirical results

4.1 Baseline regression

Results derived from our baseline model described in Equation (1) for the full sample are reported in Table 4. In particular, columns (1)-(3) report the regression results when considering the three specifications of bank capital as the only explanatory variables (together with country and time dummies), columns (4)-(6) encompass also bank-specific characteristics, and columns (7)-(9) further comprise macroeconomic and crisis variables. All coefficient signs and significances appear to be robust to the inclusion of additional control variables; hence, we will focus our discussion of results on the full specification in columns (7)-(9).

[Insert Table 4 about here]

We find a clear and strong indication that the relationship between capital, however measured, and ROA is positive and significantly different from zero at the 1% level. Our evidence gives therefore support to our hypothesis: a better capitalized bank is more profitable.[5]

Consistent to the signalling hypothesis, this occurs because, by increasing capital, bank managers convey private information on good prospects, in terms of expectations of revenues, costs or risk, that are more favourable than is publicly thought. Particularly, as noted in Berger (1995), to the extent that management has a stake in the value of the bank (e.g. through personal ownership, stock options, etc.), it is less costly for a "good" bank to signal high quality through the increase in the level of capital than for a "bad" bank; thus, banks that expect to have better future performance have an incentive to have higher capital. With the expected bankruptcy hypothesis, a bank holding a higher level of capital tends to have lower expected bankruptcy costs (because the probability of a failure reduces, and the deadweight liquidation costs that must be absorbed by creditors in the event

[5] We have also estimated a model with only lagged ROA as explanatory variables. Results show that the R-square is 0.4703, which is relatively high but significantly below the R-square of models (4)-(9).

of failure become more remote), and this in turn lowers interest expenses on uninsured debt, i.e. the cost of funding, thus raising bank's profitability.

Notwithstanding, the increase in profits predicted from our model for an increase in capital is relatively marginal. The estimated coefficient of *TIER1RWA* in column (7) indicates that an increase of one basis point in the ratio between Tier 1 capital and risk weighted assets generates, all else equal, a 0.0062 basis points growth of ROA. As an example, for a representative bank in our sample, a rise of Tier 1 over risk weighted assets by 5 basis points from the median value of 11.8% (a growth of about 42 percentage points) would move the bank from the 50th centile to the 82th centile of the Tier 1 distribution. In contrast, the estimated ROA for the same bank would rise from 0.82% to 0.85% (an increase of 3.8 percentage points), corresponding to a shift from the 51th to the 53th centile. We get similar qualitative results when using *EQAST* – column (8) – and *CAPSURPLUS* – column (9) – as the capital variable.

Under a policy perspective, this outcome would allow to deduce that, on one hand, increases in bank capital have a positive impact on profitability, but they are rather narrow; and on the other hand, that since they do not certainly produce negative effects on bank profits, the possibility that credit institutions finance a higher fraction of their lending with equity may appear reasonably acceptable. Miles et al. (2012) argues that *substantially high* capital requirements could create considerable benefits by reducing the probability of systemic banking crises. Nonetheless, excessive capital could result in greater idiosyncratic risk, such as traditional risk associated with lending and/or a shift towards less traditional assets away from lending activity.

The evidence that a higher capital increases ROA fits with a model of banks' asset expansion (Admati et al., 2013), where, because of e.g. increased capital requirements, banks expand their balance sheet by raising additional equity capital and using the proceeds to acquire new assets (see Figure 1).

[Insert Figure 1 around here]

Due to the increase in equity and the consequential growth in assets, with the same level of profits ROA would tend to fall. However, banks will be able to increase income and profits owing to the related expansion in assets, which would positively impact ROA. The positive coefficients of the capital variables in Table 4 suggest that the increase in profits should be larger (in relative terms) than the assets growth. As Figure 1 portrays, the most effective way to obtain this result is to drive the additional assets mainly to non-traditional banking activities, which usually are riskier but they allow higher revenues (we will investigate this possibility later in this study).

Concerning the control variables, the coefficient of the lagged ROA is highly significant and amounts to about 0.33. This means that in the sample period banks' profits appear to persist to a modest extent, and that in a global perspective banks are not much far from a competitive market structure, being able to retain only one third of their profit from year to year. Our evidence is broadly in line with that of Goddard et al. (2011), who focus on 65 countries and estimate an average persistence of profits (measured through ROE) of 0.43.

The relation between size (*lnTOTAST*) and profitability is negative: the evidence that smaller banks are characterized by a higher ROA, while the opposite is true for their larger counterparts, is in line with the studies that found economies of scale for smaller banks and/or diseconomies for larger credit institutions (Pasiouras and Kosmidou, 2007; Chronopoulos et al., 2015). The negative and significant sign of the *LIQUIDITY* coefficient makes clear that holding more liquid liabilities exerts a negative impact on banks' profits, thus emphasizing that the 'opportunity cost' effect exceeds the 'signalling benefit' effect. As expected, a higher portion of non-performing loans (*NPLs*), hence credit risk, negatively affects banks' ROA, and the same occurs for the loans to assets ratio (*LOANAST*). In the latter case, we deduce that more profitable banks are those with a smaller loan portfolio, and consequently that try to take advantage of the access to non-traditional markets. This is confirmed by the positive and significant coefficient of the *NIRTR* variable, which proves that more diversified banks, i.e. those relying more on non-interest income, have a higher ROA, essentially because they are less exposed to loan impairments. Higher profits also characterize more efficient banks, i.e. those with a lower cost to revenue ratio (*COSTREV*).

Banks that operate in countries with a high level of GDP growth (*GDPGROWTH*) appear to earn more profits; this is somewhat expected, as bank profitability should be procyclical if more lending increases interest income and if this in turn encourages economic activity via increased loan demand and lower provisions. In addition, more sizeable and developed credit markets (*CREDITGDP*) cause a reduction in profitability for banks, largely because they are also more crowded and hence competitive, so that banks' margins are negatively affected (Demirguc-Kunt and Huizinga, 1999). Finally, the (expected) negative coefficient of the dummy variable *CRISIS* confirms that ROA is significantly lower during periods of banking crises.

4.2 Dealing with endogeneity and reverse causality issues

The results described so far hint that the relationship between bank capital and profitability is positive and significant. However, one should be cautious in interpreting the above findings, as the evidence of a causal relationship could be a mere (strong) correlation instead. In addition, there

might be a reverse causality between variables: for example, banks earning higher profits could decide to retain a significant portion of them, which would increase their capital.

As already seen, we have tried to mitigate such potential endogeneity by means of the use of lagged capital variables in our empirical implementation, which is common in the economic literature of the field. We now address this endogeneity problem more directly.

For the purpose, we employ three different strategies. We first perform a series of Granger-causality tests to investigate the possibility that capital is causing profitability but at the same time there is reverse causation. In line with Berger (1995), we regress each variable y_t on three annual lags of both itself (y_{t-1}, y_{t-2}, y_{t-3}) and the other variable (x_{t-1}, x_{t-2}, x_{t-3}): there will be Granger-causality going from *x* to *y* if the coefficients of the three lagged *x*'s variables are statistically significantly different from zero.

Table 5 reports the results of these simple causality regressions – involving out three definitions of capital – in a compact way (all control variables are included in the regressions). The first column refers to the regression with *ROA* as the dependent variable and lagged values of both *ROA* and *TIER1RWA* as regressors. The sum of the coefficients of the three *TIER1RWA* lags amounts to 0.0052 and is statistically significantly different from zero at the 1% level: hence, higher levels of *TIER1RWA* seem to predict a higher future level of *ROA* (in line with our empirical evidence). In the same regression, the sum of the coefficients of the three *ROA* lags is equal to 0.4076 and is again significant at the 1% level, which indicates positive conditional serial correlation. On the other side, when we employ the same regressors but use *TIER1RWA* as the dependent variable (second column), we verify that the sum of the *ROA* gives -0.0429, a value that is not significantly different from zero, and conclude that *ROA* does not Granger-causes *TIER1RWA* (while the latter has significantly positive conditional serial correlation). Columns from third to sixth report the results of similar regressions with the other definitions of capital, from which we again deduce that increases in capital normally predict higher future values of profits, but not vice versa (the exception is *EQAST*, which exhibits a negative coefficient, meaning that increases in the level of the equity to assets ratio in the three preceding years predict lower current profits: however, the coefficient is not significant at the 5% level). Similar to Berger (1995), we also find a higher R^2 value in the regressions with the capital as the dependent variable, which indicates that capital is more stable and predictable than profits.

[Insert Table 5 around here]

Summing up, there is no evidence of reverse causality going from profits to capital. Nonetheless, even if this test makes us confident that we would not need to control for possible

backward effects from ROA to capital, to account for the possibility that influences on a bank's profits could cause it to adjust its level of capital, we have opted for using lagged values of the level of capital in our regressions, thus following the same approach of Demirguc-Kunt and Huizinga (2010).

The second strategy for identifying possible presence of endogeneity is an instrumental variable regression implemented using the Generalized Method of Moments (IV-GMM). Particularly, we apply IV-GMM with robust standard errors (whose estimates are generally considered as more efficient than the robust 2SLS estimates) and, to deal with potential endogeneity of the (lagged) bank capital variables, we use their third, fourth and fifth lags as instruments. We believe that these instruments are valid, as they should be correlated with the (lagged) capital but should not directly affect the level of bank profitability, and should also exhibit appropriate variation within a bank's observations over time. This would be true only if banks' capital varies sufficiently over time, and this is the reason why we consider lags of capital from third to fifth.

The IV-GMM estimation results for the full specification of our model are shown in Table 6. In terms of sign and significance of coefficients, they are virtually the same as those we obtained in Table 4: a higher bank capital allows greater ROA (even if the coefficient magnitudes are slightly higher). The same holds for the set of control variables. In addition, the first-stage regressions (not reported here) show that the lagged capital variables are generally significant, which is supported by the Sargan-Hansen test of overidentifying restrictions, as its null hypothesis cannot be rejected at the 5% level in all regression. Hence, we get confirmation of both the correct specification of the model and the validity of our choice of instruments, and hence of the overall estimates.

[Insert Table 6 about here]

As a third approach to control for possible reverse causality between capital and profits, we employ a dynamic panel data approach, where the equation to be estimated has at least one lagged dependent variable on the right-hand side. Particularly, we use a two-step system GMM estimator (Arellano and Bover, 1995; Blundell and Bond, 1998), where the first differenced values as well as lagged values are used as instruments for the lagged dependent variables. This estimator can be suitably employed when the left-hand-side variable is dynamic and depends on the past realizations, and some regressors may be endogenous. In addition, with respect to the first-difference GMM estimator, the system GMM can noticeably improve efficiency and avoid the weak instruments problem. It consists in the estimation of a system of two simultaneous equations, one in levels (with

lagged first differences as instruments) and the other in first differences (with lagged levels as instruments). Hence, the system GMM estimation only requires 'internal' instruments.

Table 7 reports the results of the system-GMM estimations (still including all control variables). They again confirm the positive and significant relationship between our bank capital variables, on the one side, and ROA, on the other side. Also, the evidence regarding the control variables is generally coherent with the previous sets of results. We just note that the coefficients of both macroeconomic variables (*GDPGROWTH* and *CREDITGDP*), as well as *LOANAST* in two regressions over three, lose their significance. The rows with ROA_{t-1} confirm that there is persistence of profitability with no exceptions, as all lagged coefficients are positive and significantly different from zero. The persistence implies that higher than normal profits continued in banking markets over the years under study (as seen, this may be due to a certain degree of market power that banks enjoy in their own markets), even if the coefficient magnitude is lower than that characterizing both the OLS and the IV-GMM regressions.

[Insert Table 7 about here]

Regarding first-order and second-order serial correlation in the residuals of the estimated equations, as expected the AR(1) test is rejected (high first-order autocorrelation), while the AR(2) test cannot be rejected at the 5% significance level (no evidence of second-order autocorrelation). Under this respect, our GMM specification is consistent. In contrast, the Hansen tests of overidentifying restrictions (which verifies validity of the full instrument set) are rejected at the 5% level, thus casting doubts on the validity of instruments.[6]

4.3 Channels in the relationship between bank capital and profitability

The acceptance of the main hypothesis of a positive relationship between capital and profits, prompted us to carry out a second stage analysis where we verify possible channels through which the relationship may operate. Our conjectured channels are: i) banks accept greater risk; ii) banks access more the non-traditional markets; iii) banks improve their efficiency by reducing costs relative to revenues.

[6] The failure of this test, however, could be justified by a couple of reasons. First, the Hansen test should not be relied upon too faithfully, as it is prone to weaknesses (Roodman, 2009: 98). Furthermore, while performing some Monte Carlo experiments to assess potential biases of the Sargan/Hansen test statistic, Blundell and Bond (2000) observe some tendency for these test statistics to reject a valid null hypothesis too often in these experiments, and that this tendency is greater at higher values of the autoregressive parameter.

To this aim, we perform a first test by sorting our sample banks according to each of the capital variables and then classifying them into three groups. This procedure provides a straightforward way to identify more- and less- capitalized banks. Credit institutions with "low level of capital" and "high level of capital" are defined as those below the 33th percentile (bottom third) and above the 66th percentile (top third) of the distribution of the capital variable, respectively. Next, for each capital definition we record the mean values of *NPLs*, *LOANAST* and *COSTREV* variables – i.e. those proxying our channels – for each third, also adding the corresponding means of the profitability variable (*ROA*). Such mean values are presented in Table 8. The differences in mean *NPLs*, *LOANAST*, *COSTREV* and *ROA* between the first and third groups, which deliver an index of the spread in the corresponding distributions, are presented in the fourth column of each capital sub-table. Since now, we notice that ROA always increases as we move upward from the bottom third, a further confirmation of the positive relationship between bank capital and profits. Moreover, the *t*-statistics (last columns) show that the difference in mean *ROA* between the bottom third and the top third is always significant at the 1% level, with the top third capitalized banks enjoying profits from 15% to 66% higher, depending on capital definition.

[Insert Table 8 about here]

Turning to the first channel, if more capitalized banks try to earn more profits by accepting more credit risk, we would expect a growth in non-performing loans of banks in the top third, at least relative to banks in the bottom third. The *NPLs* averages show strong evidence of this effect, as the mean difference between the above groups is always positive and statistically significant at the 1% level. We also verify that banks in the top thirds suffer 30% to 45% more non-performing loans than banks in the bottom third. In the view of Delis et al. (2014), banks with higher levels of capital might take on higher risk in the next period because of a standard moral hazard problem, in which better capitalized banks feel quite safe and tend to undertake more risk. This in theory should have a negative effect on profits (e.g. Diamon and Rajan, 2001) as the disciplinary role of debt on managers would be weakened.[7] The fact that we find a positive effect on NPLs and ROA confirms one hand the evidence of an evident risk/return trade-off and on the other that we could be in presence of risk shifting and/or that banks have to cut costs and operate in a more efficient way.

[7] Conversely, a conduit from capital to profits is the greater incentive to monitor borrowers as shareholders will lose more in case of failure (Holstrom and Tirole, 1997 and Mehran and Thakor, 2011). This would imply finding that more capitalised banks have lower NPLs.

Regarding the second channel, i.e. the possibility that more capitalized banks decide to operate more on the more profitable non-traditional markets (and correspondingly reduce the amount of loans they supply), we find that *LOANAST* significantly drops from the bottom to the top third when considering *TIER1RWA* and *CAPSURPLUS* (although differences are insignificant for *EQAST*). This could occur because of greater incentives of bank managers to shift to high risk/high return investments.

Finally, the analysis of the difference in mean *COSTREV* helps to discover whether our third channel, i.e. an improvement in cost efficiency, is a way more capitalized banks follow to increase profits. We discover that this conjecture is valid, as banks in the top third of capital always significantly reduce the cost to income ratio relative to those in the bottom third of capital (the drop lies between 1% and 5%, showing that there is not ample room for reducing overall expenses and making better use of bank resources).

Overall, the analysis above seems to provide robust evidence of the existence of our supposed channels through which banks with higher capital ratios can enjoy a higher profitability.

A second way for testing the above channels is to perform a regression where the relevant variables – *NPLs*, *LOANAST* and *COSTREV* – are interacted with the measures of capital. Regarding the *NPLs* variable, if the estimated coefficient of the interaction terms turns out to be positive, this means that those banks which at the beginning of the period are characterized by a higher level of capital are also affected by increases in their non-performing loans, thus corroborating our conjecture. Similarly, if the interaction terms between either *LOANAST* or *COSTREV* and the capital variables show a negative sign, this would imply that more capitalized banks exhibit also lower levels of loans to assets ratio and cost to revenue ratio, again supporting our assumptions.

The results of this extended model comprising the above interaction terms are shown in Table 9. It emerges that the first channel (higher credit risk) generally works, since the interaction variable exhibits a significantly positive coefficient (at the 10% level when considering the capital variable *EQAST*). Regarding the other two channels (reduction of loans and cost efficiency), the evidence is not so conclusive as in the analysis involving the difference in means, since the coefficients of interaction terms involving *LOANAST* and *COSTREV* are negative and significant only for the leverage variable *EQAST*.

[Insert Table 9 about here]

Summing up, there is clear evidence that more capitalised banks are more profitable because they are willing to bear more traditional risk. An ad-hoc test on difference in mean (not reported

here) for an additional variable, namely the standard deviation of ROA makes clear that more capitalised banks suffer from a higher standard deviation of ROA, i.e. a higher profit volatility. The latter result is in line with the empirical evidence of both Delis et al. (2014) and Mergaerts and Vander Vennet (2016), who find that higher capital ratios increase ROA volatility. Hence, more capital seems to induce to take on more risk, and the concurrent positive relationship between bank capital and profitability confirms the presence of a trade-off between risk and return, thus upholding the reinforcement of the capital requirements by Basel III as well as the need for an effective banking supervision.

Our results are likely also to show that banks with higher capital earn more profits because they modify their business mix. They tend to reduce the proportion of loans over total assets and increase access to non-traditional markets. It follows that their higher income mostly derives from the extra assets (which in turn come from the higher level of capital) dispatched to non-traditional business, and this better explains our Figure 1, where in the right box we depict a situation where the additional equity is especially guided to purchasing new trading assets (bigger rectangle) rather than funding new loans (smaller rectangle). The cost channel also seems to work, as more capitalised banks appear to be more cost efficient (i.e. they display significantly lower costs relative to revenues).

The above discussion allows us to get important insights, on one hand into the relationship between capital and accounting banking risks, on the other hand on the banks' balance sheet strategic responses to capital requirements increases.

4.4 The impact of economic, social and cultural factors

Given our multi-country multi-year coverage, in this section we aim at providing some evidence on whether economic, social and cultural factors can shed further light on the (positive) relationship between bank capital and profitability, besides those that have been already incorporated in our previous empirical analyses.

We first investigate possible and significant differences in the link between capital and profits in crisis and non-crisis periods. Particularly, we consider the role of both individual countries' banking crises and the global financial crisis. In the first case, we build a group of interaction terms by multiplying the capital variables with two binary variables, *NOCRISIS* and *CRISIS*, derived from Laeven and Valencia (2013): for each country, they take value 1 in the years characterized by the absence or presence, respectively, of a local banking crisis (of course, in this case we drop the *CRISIS* variable from the regression). In the second case, we behave in a similar fashion, and interact

the capital variables with two binary variables (again, *NOCRISIS* and *CRISIS*) that assume value 1 in the periods 2000-2007 and 2008-2013, respectively.

Our evidence is provided in Table 10 and it suggests some differences depending on whether we consider the notion of capital that is linked to regulatory requirements or the one representing the leverage ratio. In the estimations with *TIER1RWA* and *CAPSURPLUS* – columns (1) and (3) – we discover that, all else equal, during (either banking or global financial) crisis periods the same increase in capital translates in a higher level of profits: just as an example, an increase of one basis point in *TIER1RWA* was able to generate a 0.0042 basis points growth of ROA before the global crisis, and a 0.0084 basis points growth of profits in the crisis years. In other words, far from being a problem, in bad times having more capital allows banks to increase their profitability. Berger and Bowman (2013) find that capital enhances the performance of medium and large banks primarily during banking crises. Our result is also a confirmation that crises emphasize the fragility of banks financed with short-term funds raised in the money markets rather than with capital (Beltratti and Stulz, 2012).

From the bottom lines of Table 10 we deduce that the difference between non-crisis and crisis periods is also statistically significant (only at the 10% level for banking crises), thus finding clear support to the importance of capitalization in turmoil periods. When using a wider notion of capital, i.e. *EQAST*, the empirical findings are reversed: moving from non-crisis to crisis years, the relationship between capital and profitability drops to become indistinguishable from zero (and the difference in the coefficients of the interaction terms is significant between the 5% and the 10% level). Hence, we find that in crisis years, when it is reasonable to expect that banks' income drops, holding more equity per dollar of assets does not affect profitability.

[Insert Table 10 about here]

A similar approach characterizes the second set of regressions, where we try to assess whether the strength of the relationship between capital and profitability differs significantly across alternative bank sizes. We therefore interact the capital variables with four size dummies based on banks' average total assets over the sample period: *SMALL* (i.e. banks whose average total assets are below US$5bn), *MEDIUM* (i.e. banks with average total assets between US$5bn and US$50bn), *LARGE* (i.e. institutions whose average total assets exceed US$50bn, excluding GSIBs), and *GSIBs* (i.e. systemically important banks, based on the lists provided by the Financial Stability Board for the sample years). Table 11 reports that the strength of the relationship between capital and profitability differs across alternative bank sizes. First, while non-GSIBs banks in our sample display positive and

significant coefficients, for GSIBs the relationships of interest are never significant, meaning that changing capital requirements does not affect their profits. Among non-GSIBs, our findings suggest that the estimated marginal effect of bank capital on profitability is generally lower for smaller banks, while it progressively increases with size, even if only to some extent (the bottom rows of Table 11 clearly show that there is no significant difference among them). We are therefore in line with Mergaerts and Vander Vennet (2016), whose analysis shows that a high capital ratio appears to have the greatest impact on larger banks (i.e. those that are furthest away from the retail business model).

[Insert Table 11 about here]

For smaller banks, the lower impact of capital growth on profits can be attributable to reduced possibility of diversifying income sources. In fact, it might happen that an increase in capital that is followed by assets expansion is better exploited by larger banks because of their greater flexibility and business diversification. Finally, there could also be a 'too-big-to-fail' effect that tolerates larger banks to operate at lower capital levels.

Another interesting inquiry involves the income level of countries, especially in a large heterogeneous sample of countries like ours. To check whether the relationship capital-profits varies across different buckets of countries, we split the sample using the World Bank income levels of the countries to whom banks belong. Particularly, we again interact the capital variables with two different dummy variables: *LOWMIDDLE* takes value 1 when the country is classified by the World Bank as a low or middle income country, while *HIGH* equals 1 for nations regarded as high income. The results of this empirical analysis are presented in Table 12. We find that the marginal effect of bank capital on profitability is slightly greater in lower and middle income countries than in their richer counterparts. It is possible that such results are driven by the fact that in high income countries the regulatory/monitoring activity is more stringent, effective and transparent than in less developed frameworks, which depresses profitability. However, the differences are quite small and the test of equality of coefficients (bottom rows of the table) fails to reject the null hypothesis.

[Insert Table 12 about here]

The last group of regressions focus on the role of three country characteristics: economic freedom, political stability, and corruption control. Since these factors are positively correlated, we

test them separately in the models. Unsurprisingly, all of them appear to exert major influence on banking markets and, in general, on firms' behaviour.

A good degree of economic freedom (with governments protecting and safeguarding the rights of economic agents) allows a more efficient functioning of markets, promotes a competitive background, and ultimately boosts economic growth. In this sense, it can increase the ability of banks in obtaining and managing more resources. On the other side, in such environment the fostered competition inevitably hits banks as well, so that revenues and profits may be negatively affected. Therefore, it is not clear whether economic freedom should affect banks' performance in a positive or negative way (e.g.: Sufian and Habiboullah, 2010; Djalikov and Piesse, 2016).

To assess the influence of economic freedom on the link between bank capital and profitability, we use the Index of Economic Freedom that the Heritage Foundation calculates every year for over 180 countries. It is built as an average of ten specific components of economic freedom, each being graded on a scale from 0 to 100. We then create two dummy variables, *LOW* and *HIGH*, marking each country for which the index is below or above the sample median value (equal to 71), respectively, and interact the capital variables. The regression results are exhibited in Table 13, columns (1)-(3).

In all estimations, we find that more economic freedom translates into a reduced impact of bank capital on profitability. Such differences are statistically significant for *EQAST* and *CAPSURPLUS*, but not for *TIER1RWA*, also if in the latter case the estimated coefficients differ by more than 25%. Hence, in countries with higher freedom on the business that firms can undertake, more capitalized banks earn less profits compared to banks with a similar degree of capitalization operating in countries with lower economic freedom. This is likely to be the consequence of the higher level of competition that generally characterizes freer economies, a result that we have checked empirically by adding a competition variable drawn by the World Bank dataset.[8]

[Insert Table 13 about here]

Another factor that could affect the capital-profits relationship in the banking industry is political stability. More stable governments and stronger institutions are likely to guarantee more stability in the economy. As Roe and Siegel (2011) note, a country's capacity and willingness to build and maintain investor and property protection institutions depend largely on its relative

[8] The competition variable is the Lerner index by country. We find that for countries characterised by competition below the median value (i.e. by Lerner indices *above* the median value), the impact of greater capitalisation on profits is higher (and vice versa). Results are not reported but are available with the authors.

democratic political stability, while unstable policies cannot, or will not, reliably protect investors. Moreover, in a politically stable nation financial development can generate much more economic opportunities. However, Kleinhow and Nell (2009) surprisingly find that political stability may contribute to increase the systemic risk of European banks, possibly since in a stable system actors establish, operate, and interconnect financial institutions beyond the level that the institutional framework reliably provides, while in more unstable contexts links between financial units may disappear, in this way reducing the systemic risk and the possibility of contagion.

To measure political stability, we employ the 'Political Stability and Absence of Violence' index from the Worldwide Governance Indicators database of the World Bank. For each country, it captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically- motivated violence and terrorism. Its value ranges from -2.5 to +2.5, with higher values indicating greater political stability. Next, we again generate the binary variables *LOW* and *HIGH*, which identify countries with values of the index below or above the median value of the sample (amounting to 0.5), respectively. Lastly, we build interaction terms between the three capital variables and the above dummy variables, and use it in our regression model. Empirical results are reported in Table 13, columns (4)-(6).

There is a robust and statistically significant evidence that in more stable countries more bank capital generates, all else equal, lower ROA than in more unstable nations. For example, doubling the regulatory capital surplus of a bank over the minimum requirement (i.e. $\Delta CAPSURPLUS = +1$) would cause a growth of ROA equal to 0.030% in the first group of countries and 0.054% in the second group. This is a somewhat unexpected result, as banks are supposed to be more profitable when there is political stability. One explanation could be that in difficult environments banks tend to build and maintain credit relationships with reliable borrowers who, in turn, need resources for their survival; it is clear that, if accessing to finance and lending is risky because of the instability of political institutions, loan rates will be higher (actually, in our sample their average values – calculated as the ratio between interest income and the volume of loans – amount to 9.7% and 7.8%, respectively, in countries with lower and higher political stability) and either screening and monitoring of borrowers will be tougher than it would be in normal conditions, both of which would positively affect banks' profits.

Regarding the role of corruption, it is widely recognized that it represents a severe obstacle to an optimal allocation of resources. If corruption is sometimes accepted as a 'cost of doing business' in many countries, it is increasingly seen as a barrier to development and economic growth (Wilhelm, 2002), especially through channels such as private investment and public expenditure

(Murphy et al., 1993; Shleifer and Vishny, 1993; Mauro, 1995; Wei, 2000; Beck et al., 2005). In an empirical analysis of cross-country differences in the rate of saving, Swaleheen (2008) demonstrates that corruption is positively correlated with real interest rates.

As to the banking sector, Demirguc-Kunt and Huizinga (1999) find that in countries with an environment relatively free of corruption banks are characterized by lower interest margins (hence, profitability), because they may require a lower risk premium on their investments. This result is in line with the study by Ben Naceur and Omran (2011), who consider a selection of Middle East and North Africa countries and notice that corruption increases the net interest margins. Park (2012) shows that corruption significantly aggravates the bad loans problems, since it distorts the allocation of bank funds from normal projects to bad projects, which decreases the quality of private investments and hence economic growth. Zheng et al. (2013) obtain robust evidence that firms operating in collectivist countries perceive a higher level of lending corruption than firms in other countries, attributed to the influence that norms in collectivist societies have both on the interactions between bank officers and bank customers and on the dynamics among bank colleagues. In the same vein, working on a survey database concerning over 4,000 firms in 54 countries, Beck et al. (2005) also find that corruption of bank officials represents a significant constraint on firm growth.

Following the same approach as before, our examination of the impact of corruption on the relationship between the levels of capital and profits in banking starts from splitting our sample into two groups. For the purpose, we make use of the 'Control of Corruption' index, again drawn from the Worldwide Governance Indicators database managed by the World Bank. It captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests, and its value spans from -2.5 (the poorest level of corruption control, i.e. likely high corruption) to +2.5 (strong corruption control, i.e. low expected corruption). The above index helps again to split our sample into two parts by means of two dummy variables: *LOW* refers to countries with values below its median value (amounting to 1.27), while *HIGH* denotes countries above it. As before, they are interacted with the capital variables and become regressors for new estimations, whose results are exposed in Table 13, columns (7)-(9).

The coefficients of the interaction variables show that banks operating in countries with more perceived corruption are generally characterized by higher marginal effects of bank capital on ROA, also if the gaps are statistically significant only for *EQAST* and (to a lesser extent) *CAPSURPLUS*. We interpret this result as evidence that, in line with Demirguc-Kunt and Huizinga (1999) and Ben Naceur and Omran (2011), banks operating in a more corrupt environment have the possibility to charge higher interest on loans and lower interest for deposits, with positive impact on margins and

profits and irrespective of (or even notwithstanding) factors like management quality or efficiency. Therefore, the same increase of capital allows the above credit institutions to enjoy more profits than banks operating in countries with low corruption.

5. Conclusions

Bankers often argue that a higher bank capital will reduce their performance, yet the existing literature fails to offer an unambiguous prediction. Our study provides an in-depth empirical analysis on the relationship between alternative measures of bank capital and profitability in a large cross-country setting. Our evidence suggests that, in line with most recent literature, the relationship between capital and Return on Assets (ROA) is consistently positive, although the impact appears relatively marginal. This is true for all definitions of capital – both those that are linked to regulatory requirements and the crude leverage ratio.

The finding that increases in bank capital do not appear to produce negative effects on bank profits lends support to the possibility that bank managers signal private information that bank prospects are good by increasing capital. From a policy perspective, a key question is: what would be the effects of *substantially* high capital requirements for banks who intend to maintain their profitability on their strategies, operations and activities? Our results on the possible channels offer some useful insights as we show that more capitalised banks typically have a greater idiosyncratic risk, mainly derived from higher credit risk, but also associated with a shift towards opaque non-traditional assets. This is a crucial finding that challenges traditional views relying on the borrowers' monitoring channel (e.g. Holmstrom and Tirole, 1997) that ignore the effect on profits from non-traditional banking activities. On the positive side, our results show that more capitalised banks that are also more profitable are more effective at controlling their costs, although this might derive from closing branches and staff redundancies.

Since we employ a global sample of banks operating in 77 developed and developing countries we also test the impact of economic factors (i.e. the financial crisis) as well as political and cultural ones. Our results suggest that the relationship between capital and profitability is stronger in crisis periods, for larger banks – although not for the largest i.e. the global systemically important ones –, and in lower and middle income countries. In addition, we find that in countries with lower economic freedom, less political stability and more corrupt environments, the same increase in capital allows banks to earn more profits than counterparts operating in countries with more economic freedom and political stability as well as lower corruption levels.

Our findings are robust to different specifications, endogeneity and robustness tests, and carry important implications for policy reforms aimed at ensuring both prosperity and soundness to the banking sector globally. Specifically, they clearly indicate that, although higher capital does not seem to hinder the profit opportunities of banks, there is clearly an expensive trade-off when it comes to greater risk taking and risk shifting that could ultimately affect global stability.

References

Acharya, S. (1988), A generalized econometric model and tests of a signalling hypothesis with two discrete signals. *Journal of Finance* 43 (June), 413-429.

Admati A. R., De Marzo P. M., Hellwig M. F. and P. Pfleiderer (2013), *Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is not socially expensive*, Rock Centre for Corporate Governance Working Paper Series No. 161, Stanford University.

Allen F., Carletti E. and A. Leonello (2011), Deposit insurance and risk taking. *Oxford Review of Economic Policy*, 27, 464-478.

Arellano M. and O. Bover (1995), Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68, 29-51.

Beck T., Demirguc-Kunt A. and V. Maksimovic (2005), Financial and legal constraints to growth: Does firm size matter?, *Journal of Finance*, 60, 137-177.

Beltratti A. and R.M. Stulz (2012), The credit crisis around the globe: Why did some banks perform better?, *Journal of Financial Economics*, 105, 1-17.

Ben Naceur S. and M. Omran (2011), The effects of bank regulations, competition, and financial reforms on banks' performance, *Emerging Markets Review*, 12, 1-20.

Berger A.N. (1995), The relationship between capital and earnings in banking. *Journal of Money, Credit, and Banking*, 27, 432-456.

Berger A.N., Demirgüç-Kunt A., Levine R. and J.G. Haubrich (2004), Bank concentration and competition: An evolution in the making. *Journal of Money, Credit and Banking*, 36(3), 433-451.

Berger, A.N. and C.H.S. Bouwman (2013), How does capital affect bank performance during financial crises?. *Journal of Financial Economics*, 109, 146-176.

Blundell R. and S. Bond (1998), Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.

Blundell R. and S. Bond (2000), GMM estimation with persistent panel data: An application to production functions. *Econometric Reviews*, 19(3), 321-340.

Chronopoulos D.K., Liu H., McMillan F.J. and J.O.S. Wilson (2015), The dynamics of US bank profitability. *The European Journal of Finance*, 21(5), 426-443.

Delis M.D., Hasan I. and E.G. Tsionas (2014), The risk of financial intermediaries. *Journal of Banking and Finance*, 44, 1-12.

Demirguc-Kunt A. and H. Huizinga (1999), Determinants of commercial bank interest margins and profitability: Some international evidence, *World Bank Economic Review*, 13, 379-408.

Demirguc-Kunt A. and H. Huizinga (2001), Financial structure and bank profitability, in Demirguc-Kunt A. and R. Levine (Eds.), *Financial Structure and Economic Growth. A Cross-Country Comparison of Banks, Markets, and Development*, MIT Press, Cambridge, 243-261.

Demirgüç-Kunt A. and H. Huizinga (2010), Bank activity and funding strategies: The impact on risk and return. *Journal of Financial Economics*, 98, 626-650.

Demirgüç-Kunt A., Detragiache E. and O. Merrouche (2013), Bank capital: Lessons from the financial crisis. *Journal of Money, Credit and Banking*, 45(6), 1147-1164.

Djalilov K. and J. Piesse (2016), Determinants of bank profitability in transition countries: What matters most?, *Research in International Business and Finance*, 38, 69-82.

Gambacorta L. (2011), Do bank capital and liquidity affect real economic activity in the long run? A VECM analysis for the US. *Economic Notes*, 40(3), 75-91.

Goddard J., Molyneux P. and J.O.S. Wilson (2004), The profitability of European banks: A cross-sectional and dynamic panel analysis, *The Manchester School*, 72(3), 363-381.

Goddard J., Liu H., Molyneux P. and J.O.S. Wilson (2011), The persistence of bank profit, *Journal of Banking and Finance*, 35, 2881-2890.

Gorton G. (2010), *Slapped By the Invisible Hand: The Panic of 2007*, Oxford University Press. Oxford, England.

Gropp R. and F. Heider (2010), The determinants of bank capital structure. *Review of Finance*, 14, 587-622.

Holmstrom B. and J. Tirole (1997), Financial intermediation, loanable funds, and the real sector. *Quarterly Journal of Economics*, 112, 663-691.

Hughes J. and L.J. Mester (2014), Measuring the Performance of Banks: Theory, Practice, Evidence, and Some Policy Implications, Chapter 10 in Berger A., Molyneux P. and J.O.S. Wilson (Eds.), *The Oxford Handbook of Banking*, 2nd edition, Oxford University Press.

Kleinhow J. and T. Nell (2009), Determinants of systemically important banks: The case of Europe, *Journal of Financial Economic Policy*, 7, 446-476.

Laeven L. and F. Valencia (2013), Systemic banking crises database, *IMF Economic Review*, 61, 225-270.

Lee C.C. and M.F. Hsieh (2013), The impact of bank capital on profitability and risk in Asian banking. *Journal of International Money and Finance*, 32, 251-281.

Mauro P. (1995), Corruption and growth, *Quarterly Journal of Economics*, 110, 681-712.

Mehran H. and A.V. Thakor (2011), Bank capital and value in the cross-section. *Review of Financial Studies*, 24, 1019-1067.

Mergaerts F. and R. Vander Vennet (2016), Business models and bank performance: A long-term perspective. *Journal of Financial Stability*, 22, 57-75.

Miles D., Yang J. and G. Marcheggiano (2012), Optimal bank capital. *Economic Journal*, 123, 1-37.

Modigliani F. and Miller M.H. (1958), The cost of capital, corporate finance and the theory of investment. *American Economic Review*, 48, 261-297.

Murphy K.M., Shleifer A. and R.W. Vishny (1993), Why is rent-seeking so costly to growth? *American Economic Review*, 83, P&P, 409-414.

Park J. (2012), Corruption, soundness of the banking sector, and economic growth: A cross-country study, *Journal of International Money and Finance*, 31, 907-929.

Pasiouras F. and K. Kosmidou (2007), Factors influencing the profitability of domestic and foreign commercial banks in the European Union, *Research in International Business and Finance*, 21, 222-237.

Roe M.J. and J.I. Siegel (2011), Political instability: Effects on financial development, roots in the severity of economic inequality, *Journal of Comparative Economics*, 39, 279-309.

Roodman D. (2009), How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1), 86-136.

Ross, S.A. (1977), The determination of financial structure: The incentive signalling approach. *Bell Journal of Economics and Management Science*, 8 (Spring), 177-183.

Shleifer A. and R.W. Vishny (1993), Corruption, *Quarterly Journal of Economics*, 108, 599-617.

Sufian F. and M.S. Habibullah (2010), Has economic freedom fostered bank performance? Panel evidence from China, *China Economic Journal*, 3, 255-279.

Swaleheen M. (2008), Corruption and saving in a panel of countries, *Journal of Macroeconomics*, 30, 1285-1301.

Thakor A. (2014), Bank capital and financial stability: An economic tradeoff or a Faustian bargain?. *Annual Review of Financial Economics*, 6, 185-223.

Wei S. (2000), How taxing is corruption on international investors?, *Review of Economics and Statistics*, 82, 1-11.

Wilhelm P.G. (2002), International validation of the Corruption Perceptions Index: Implications for business ethics and entrepreneurship education, *Journal of Business Ethics*, 35, 177-189.

Zheng X, El Ghoul S., Guedhami O. and C.C.Y. Kwok (2013), Collectivism and corruption in bank lending, *Journal of International Business Studies*, 44, 363-390.

Appendix A

A1. Additional Robustness checks

To ensure the robustness of our findings, we lastly conduct some additional tests, still based on the full specification of Equation (1).

First, we assess whether our results change when considering only banks for which at least 75% of observations (i.e. at least 11 over 14) are available during the time span, in order to focus on a more balanced dataset, even though smaller. As columns (1)-(3) of Table A1 show, the positive relationship between bank capital and profitability is confirmed, also if the coefficient of *EQAST* loses its significance. We also note a drop in the significance levels of *GDPGROWTH* (now only at the 10% level), *CREDITGDP* and *CRISIS*.

Second, we exclude US banks from the analysis, since they represent an important fraction of our sample. From columns (4)-(6) of Table A1 we again get proof that our results are robust, since the coefficients of the capital variables are all positive and highly significant (this holds also for the control variables, except *CREDITGDP* and *CRISIS*).

Finally, we focus only on banks for which we observe only moderate changes in the values of *TIER1RWA*, *EQAST* and *CAPSURPLUS* from one year to another, as large yearly variations of capital variables might be due to mergers or acquisitions (as well as to financial difficulties) that could alter both the sign and the significance of the estimated coefficients. Particularly, in three different estimations we consider only banks for which the annual changes of *TIER1RWA* and *EQAST* range between -10% and +10%, and the annual change of *CAPSURPLUS* vary between -20% and +20%. Results reported in columns (7)-(9) of Table A1 indicate that our main inferences hold even under this alternative sample composition.

[Insert Table A1 about here]

Table 1 – Descriptive statistics

Variable **(#of *obs* 24,848)**	**Mean**	**St.dev.**	**Min**	**Median**	**Max**
ROA	0.8288	0.8359	-4.5832	0.8100	5.4715
TIER1RWA	13.3677	6.1094	4.1000	11.8000	59.9000
EQAST	9.7708	4.1294	1.9050	9.0348	38.7846
CAPSURPLUS	0.8370	0.7012	-0.1200	0.6388	6.0963
TOTAST	43,672.93	197,399.70	42.39	2,517.45	4,163,404.50
LIQUIDITY	15.4986	16.1598	0.2029	9.4141	94.9643
NPLs	4.2014	5.1714	0.0301	2.3551	39.9017
LOANAST	63.6121	13.8217	25.0108	65.0978	94.8749
COSTREV	75.1400	12.0051	8.0112	75.1976	214.4578
NIRTR	19.1834	10.8968	0.0108	17.7303	91.6406
GDPGROWTH	2.2226	3.0427	-14.8000	1.8765	26.1704
CREDITGDP	70.1388	33.8139	7.1154	56.9859	311.7775
CRISIS	0.3488	0.4766	0	0	1

Variable	**Description**	**Source**
ROA	Net income/Total assets (%)	Bankscope
TIER1RWA	Tier 1 capital/Risk weighted total assets (%, beginning of period)	Bankscope
EQAST	Total equity/Total assets (%, beginning of period)	Bankscope
CAPSURPLUS	(Total regulatory capital ratio-Minimum capital requirement ratio)/Minimum capital requirement ratio (beginning of period)	Bankscope & World Bank
TOTAST	Total assets (millions 2005 USD)	Bankscope
LIQUIDITY	(Non-customer deposits+Cash)/Total deposit (%)	Bankscope
NPLs	Non-performing loans/Net loans (%)	Bankscope
LOANAST	Net loans/Total assets (%)	Bankscope
COSTREV	Total costs/Total revenue (%)	Bankscope
NIRTR	Revenue from non-traditional activities/Total revenue (%)	Bankscope
GDPGROWTH	GDP yearly rate of growth (%)	World Bank
CREDITGDP	Domestic credit to private sector by banks/GDP (%)	World Bank
CRISIS	Dummy for years with a banking crisis	Laeven and Valencia (2012)

Table 2 – Sample countries, number of banks, and number of observations by World Bank region

Region	**Countries**	**Banks**	**Obs.**
East Asia & Pacific	Australia, China, Hong Kong, Indonesia, Japan, Malaysia, Philippines, Rep. of Korea, Singapore, Thailand	496	2,161
Europe & Central Asia	Armenia, Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Moldova, Romania, Russian Federation, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom	2,032	9,376
Latin America & Caribbean	Brazil, Chile, Colombia, Ecuador, Mexico, Panama	151	652
Middle East & North Africa	Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, United Arab Emirates	126	827
North America	Canada, United States of America	1,350	10,442
South Asia	Bangladesh, India, Nepal, Pakistan, Sri Lanka	156	962
Sub-Saharan Africa	Kenya, Mauritius, Namibia, Nigeria, South Africa, Tanzania, Uganda	103	428
Total	*77*	*4,414*	*24,848*

Table 3 – Correlation matrix

	ROA	*TIER1RWA*	*EQAST*	*CAPSURPLUS*	*TOTAST*	*LIQUIDITY*	*NPLs*	*LOANAST*	*COSTREV*	*NIRTR*	*GDPGROWTH*	*CREDITGDP*	*CRISIS*
ROA	1												
TIER1RWA	0.1293*	1											
EQAST	0.2306*	0.7151*	1										
CAPSURPLUS	0.0588*	0.9242*	0.6161*	1									
TOTAST	-0.0511*	-0.1216*	-0.1823*	-0.0719*	1								
LIQUIDITY	-0.0553*	-0.0274*	-0.0283*	-0.0585*	0.1644*	1							
NPLs	-0.2982*	0.1503*	0.1008*	0.1188*	-0.0354*	0.1584*	1						
LOANAST	-0.0632*	-0.2522*	-0.0300*	-0.2618*	-0.1895*	-0.1590*	-0.1221*	1					
COSTREV	-0.6069*	-0.0353*	-0.1436*	-0.0041	-0.0250*	0.0155*	0.0866*	-0.0091	1				
NIRTR	0.1418*	-0.0454*	0.0578*	-0.0295*	0.1354*	0.1124*	0.0469*	-0.1850*	-0.1336*	1			
GDPGROWTH	0.3342*	-0.0097	0.0004	-0.0487*	0.0006	0.0137*	-0.2229*	-0.1534*	-0.1916*	-0.0334*	1		
CREDITGDP	-0.2294*	-0.0901*	-0.1838*	-0.0119	0.2121*	0.2084*	0.1071*	0.0217*	0.0099	0.0104	-0.1950*	1	
CRISIS	-0.3326*	0.0432*	0.0376*	0.0927*	0.0342*	0.1205*	0.2266*	0.0955*	0.1835*	0.0357*	-0.4740*	0.1655*	1

* = the level of the correlation coefficient is significant at the 5% level or better.

Table 4 – The relationship between capital and profitability (ROA): baseline regressions

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TIER1RWA(t-1)	0.0138***	-	-	0.0064***	-	-	0.0062***	-	-
	(7.99)			(6.53)			(6.35)		
EQAST(t-1)	-	0.0363***	-	-	0.0053***	-	-	0.0049***	-
		(11.37)			(3.19)			(2.93)	
CAPSURPLUS(t-1)	-	-	0.1004***	-	-	0.0449***	-	-	0.0434***
			(6.64)			(5.43)			(5.29)
ROA(t-1)	-	-	-	0.3296***	0.3314***	0.3313***	0.3298***	0.3318***	0.3315***
				(25.98)	(26.15)	(26.18)	(25.88)	(26.06)	(26.08)
lnTOTAST(t)	-	-	-	-0.0335***	-0.0379***	-0.0360***	-0.0332***	-0.0375***	-0.0356***
				(-12.42)	(-13.9)	(-13.43)	(-12.25)	(-13.74)	(-13.21)
LIQUIDITY(t)	-	-	-	-0.0021***	-0.0021***	-0.0021***	-0.0020***	-0.0020***	-0.0020***
				(-6.01)	(-6.07)	(-5.98)	(-5.69)	(-5.75)	(-5.66)
NPLs(t)	-	-	-	-0.0301***	-0.0301***	-0.0302***	-0.0289***	-0.0288***	-0.0289***
				(-18.69)	(-18.28)	(-18.67)	(-17.76)	(-17.36)	(-17.73)
LOANAST(t)	-	-	-	-0.0021***	-0.0030***	-0.0023***	-0.0021***	-0.0029***	-0.0022***
				(-5.51)	(-8.55)	(-5.82)	(-5.43)	(-8.42)	(-5.72)
COSTREV(t)	-	-	-	-0.0303***	-0.0303***	-0.0304***	-0.0303***	-0.0303***	-0.0303***
				(-37.91)	(-37.74)	(-37.92)	(-37.86)	(-37.7)	(-37.88)
NIRTR(t)	-	-	-	0.0072***	0.0068***	0.0071***	0.0070***	0.0066***	0.0070***
				(10.51)	(10.2)	(10.38)	(10.16)	(9.86)	(10.03)
GDPGROWTH(t)	-	-	-	-	-	-	0.0131***	0.0135***	0.0132***
							(4.05)	(4.17)	(4.07)
CREDITGDP(t)	-	-	-	-	-	-	-0.0010**	-0.0010**	-0.0010**
							(-2.25)	(-2.27)	(-2.31)
CRISIS(t)	-	-	-	-	-	-	-0.0475***	-0.0463***	-0.0486***
							(-2.75)	(-2.67)	(-2.81)
N	24,848	24,848	24,848	24,848	24,848	24,848	24,848	24,848	24,848
R^2	0.2645	0.2803	0.2620	0.6671	0.6661	0.6667	0.6680	0.6670	0.6676

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Table 5 – Granger-causality tests between capital and profitability

		Dependent variables					
		ROA	*TIER1RWA*	*ROA*	*EQAST*	*ROA*	*CAPSURPLUS*
Lagged regressors	*ROA*	0.4076***	-0.0429	0.4571***	-0.0470	0.4103***	-0.0014
		(305.08)	(0.27)	(318.94)	(0.52)	(314.52)	(0.02)
	TIER1RWA	0.0052***	0.8727***	-	-	-	-
		(20.41)	(8493.40)				
	EQAST	-	-	-0.0039*	0.8859***	-	-
				(3.12)	(14852.02)		
	CAPSURPLUS	-	-	-	-	0.0390***	0.8627***
						(16.44)	(7687.24)
	N	20,113	20,098	20,305	20,284	20,058	20,012
	R^2	0.6707	0.8672	0.6690	0.8593	0.6698	0.8467

Reported values are the sum of the estimated coefficients of the three lags of the row variables in regressions where the dependent variables are the column variables. Significance for the coefficient sums: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
All regressions also include control variables, country and time fixed effects (coefficients are not reported). Standard errors are clustered at bank level.

Table 6 – The relationship between capital and profitability (ROA): IV-GMM estimates

Variable	(1)	(2)	(3)
TIER1RWA(t-1)	0.0105***	-	-
	(6.00)		
EQAST(t-1)	-	0.0073**	-
		(2.55)	
CAPSURPLUS(t-1)	-	-	0.0839***
			(5.98)
ROA(t-1)	0.3313***	0.3425***	0.3335***
	(19.28)	(20.17)	(19.46)
lnTOTAST(t)	-0.0369***	-0.0446***	-0.0403***
	(-10.14)	(-12.65)	(-11.30)
LIQUIDITY(t)	-0.0016***	-0.0019***	-0.0017***
	(-3.40)	(-4.17)	(-3.58)
NPLs(t)	-0.0344***	-0.0323***	-0.0345***
	(-14.62)	(-13.63)	(-14.67)
LOANAST(t)	-0.0019***	-0.0033***	-0.0020***
	(-3.56)	(-7.33)	(-3.71)
COSTREV(t)	-0.0287***	-0.0287***	-0.0287***
	(-28.83)	(-28.74)	(-28.57)
NIRTR(t)	0.0078***	0.0072***	0.0078***
	(9.13)	(8.85)	(9.17)
GDPGROWTH(t)	0.0147***	0.0157***	0.0149***
	(2.72)	(3.03)	(2.77)
CREDITGDP(t)	-0.0015**	-0.0012*	-0.0014**
	(-2.49)	(-1.93)	(-2.05)
CRISIS(t)	-0.0627***	-0.0547**	-0.0522**
	(-2.88)	(-2.43)	(-2.30)
N	14,239	14,641	14,233
R^2	0.6025	0.6014	0.6015
J statistic	2.1503	3.0292	2.6422
	(0.34)	(0.22)	(0.27)

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *z*-values in parentheses.
All regressions include country and time fixed effects (coefficients are not reported). Standard errors are clustered at bank level.
Capital variables enter the estimations with a one year lag and have been instrumented by their third, fourth and fifth order lags. The null hypothesis of the Sargan-Hansen *J* test of overidentifying restrictions is that the instruments are valid instruments (i.e., uncorrelated with the error term) and that the excluded instruments are correctly excluded from the estimated equation (*p*-value in parentheses).

Table 7 – The relationship between capital and profitability (ROA): system GMM estimates

Variable	(1)	(2)	(3)
TIER1RWA(t-1)	0.0228***	-	-
	(5.54)		
EQAST(t-1)	-	0.0236***	-
		(3.86)	
CAPSURPLUS(t-1)	-	-	0.1823***
			(4.95)
ROA(t-1)	0.2152***	0.2220***	0.2135***
	(13.24)	(13.59)	(13.23)
lnTOTAST(t)	-0.0426***	-0.0626***	-0.0519***
	(-3.17)	(-4.76)	(-3.96)
LIQUIDITY(t)	-0.0027***	-0.0029***	-0.0027***
	(-3.36)	(-3.72)	(-3.36)
NPLs(t)	-0.0508***	-0.0489***	-0.0525***
	(-14.64)	(-14.16)	(-14.70)
LOANAST(t)	-0.0016	-0.0042***	-0.0021
	(-1.25)	(-3.38)	(-1.61)
COSTREV(t)	-0.0362***	-0.0362***	-0.0365***
	(-27.29)	(-27.09)	(-27.63)
NIRTR(t)	0.0090***	0.0082***	0.0085***
	(6.28)	(5.70)	(5.92)
GDPGROWTH(t)	-0.0000	0.0007	0.0001
	(-0.01)	(0.23)	(0.04)
CREDITGDP(t)	-0.0003	0.0002	-0.0002
	(-0.52)	(0.36)	(-0.41)
CRISIS(t)	-0.0636***	-0.0607***	-0.0637***
	(-3.22)	(-2.98)	(-3.22)
N	24,830	24,817	24,774
AR(1)	-13.38	-13.36	-13.35
AR(1) (p-value)	0.00	0.00	0.00
AR(2)	-1.08	-0.90	-1.16
AR(2) (p-value)	0.28	0.37	0.25
Hansen J test	881.46	892.83	881.23
Hansen J test (p-value)	0.00	0.00	0.00

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses) are based on two-step standard errors clustered by bank and incorporating theWindmeijer correction. All regressions include country and time fixed effects (coefficients are not reported).

Capital variables are treated as endogenous; bank variables are treated as predetermined; country-level variables, time dummies and country dummies are treated as exogenous. Regressors have been instrumented by their second and third order lags. The Hansen *J* statistic tests the instruments' joint validity.

Table 8 – Means of NPLs, LOANAST, COSTREV, and ROA by thirds of capital variables

Capital variable: *TIER1RWA(t-1)*

Variable	*Bottom third*	*Middle third*	*Top third*	*Mean difference (top-bottom)*	*t-value*	
NPLs(t)	3.65	3.68	5.30	+1.65	-19.59	***
LOANAST(t)	66.45	64.66	59.71	-6.74	31.52	***
COSTREV(t)	75.91	75.16	74.36	-1.55	8.08	***
ROA(t)	0.70	0.82	0.97	+0.27	-20.53	***

t-tests test the hypothesis that each variable has the same mean within the group of *TIER1RWA* below the 33th percentile (bottom third) and the group of *TIER1RWA* above the 66th centile (top third). Significance levels: *** = 1% level; ** = 5% level; * = 10% level.

Capital variable: *EQAST(t-1)*

Variable	*Bottom third*	*Middle third*	*Top third*	*Mean difference (top-bottom)*	*t-value*	
NPLs(t)	3.88	3.58	5.16	+1.28	-15.46	***
LOANAST(t)	62.52	66.02	62.21	-0.31	1.42	
COSTREV(t)	77.30	74.90	73.22	-4.08	21.38	***
ROA(t)	0.62	0.84	1.03	+0.41	-30.29	***

t-tests test the hypothesis that each variable has the same mean within the group of *EQAST* below the 33th percentile (bottom third) and the group of *EQAST* above the 66th centile (top third). Significance levels: *** = 1% level; ** = 5% level; * = 10% level.

Capital variable: *CAPSURPLUS(t-1)*

Variable	*Bottom third*	*Middle third*	*Top third*	*Mean difference (top-bottom)*	*t-value*	
NPLs(t)	3.85	3.78	5.00	+1.15	-13.73	***
LOANAST(t)	66.74	64.57	59.47	-7.27	34.24	***
COSTREV(t)	75.50	75.04	74.89	-0.61	3.18	***
ROA(t)	0.78	0.82	0.89	+0.11	-8.00	***

t-tests test the hypothesis that each variable has the same mean within the group of *CAPSURPLUS* below the 33th percentile (bottom third) and the group of *CAPSURPLUS* above the 66th centile (top third). Significance levels: *** = 1% level; ** = 5% level; * = 10% level.

Table 9 – The relationship between capital and profitability (ROA): testing channels

Variable	(1)	(2)	(3)
TIER1RWA(t-1)	0.0028	-	-
	(0.35)		
EQAST(t-1)	-	0.0808***	-
		(6.56)	
CAPSURPLUS(t-1)	-	-	-0.0703
			(-0.96)
ROA(t-1)	0.3269***	0.3213***	0.3286***
	(25.59)	(25.43)	(25.76)
lnTOTAST(t)	-0.0337***	-0.0363***	-0.0360***
	(-12.45)	(-13.51)	(-13.38)
LIQUIDITY(t)	-0.0019***	-0.0021***	-0.0019***
	(-5.47)	(-6.05)	(-5.40)
NPLs(t)	-0.0394***	-0.0361***	-0.0361***
	(-15.08)	(-10.05)	(-17.58)
LOANAST(t)	-0.0025***	-0.0010	-0.0027***
	(-3.21)	(-1.11)	(-5.14)
COSTREV(t)	-0.0298***	-0.0209***	-0.0309***
	(-20.79)	(-14.65)	(-29.28)
NPLs(t)×TIER1RWA(t-1)	0.0006***	-	-
	(5.25)		
LOANAST(t)×TIER1RWA(t-1)	0.0000	-	-
	(0.59)		
COSTREV(t)×TIER1RWA(t-1)	-0.0000	-	-
	(-0.31)		
NPLs(t)×EQAST(t-1)	-	0.0006*	-
		(1.89)	
LOANAST(t)×EQAST(t-1)	-	-0.0002**	-
		(-1.96)	
COSTREV(t)×EQAST(t-1)	-	-0.0009***	-
		(-6.78)	
NPLs(t)×CAPSURPLUS(t-1)	-	-	0.0062***
			(6.16)
LOANAST(t)×CAPSURPLUS(t-1)	-	-	0.0006
			(1.20)
COSTREV(t)×CAPSURPLUS(t-1)	-	-	0.0006
			(0.78)
NIRTR(t)	0.0070***	0.0068***	0.0070***
	(10.05)	(10.38)	(9.89)
GDPGROWTH(t)	0.0125***	0.0128***	0.0123***
	(3.86)	(3.99)	(3.83)
CREDITGDP(t)	-0.0010**	-0.0009**	-0.0010**
	(-2.25)	(-1.98)	(-2.33)
CRISIS(t)	-0.0373**	-0.0334*	-0.0396**
	(-2.14)	(-1.90)	(-2.27)
N	24,848	24,848	24,848
R^2	0.6690	0.6711	0.6691

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Table 10 – The relation between capital and profitability (ROA): non-crisis vs. crisis years

	COUNTRY- SPECIFIC BANKING CRISES (years vary by country)			*GLOBAL FINANCIAL CRISIS* (pre-2008 vs. post-2007)		
Variable	(1)	(2)	(3)	(1)	(2)	(3)
TIER1RWA(t-1)×NOCRISIS(t)	0.0056***	-	-	0.0042***	-	-
	(5.55)			(3.98)		
TIER1RWA(t-1)×CRISIS(t)	0.0073***	-	-	0.0084***	-	-
	(5.96)			(6.28)		
EQAST(t-1)×NOCRISIS(t)	-	0.0062***	-	-	0.0072***	-
		(3.61)			(3.65)	
EQAST(t-1)×CRISIS(t)	-	0.0025	-	-	0.0028	-
		(1.18)			(1.22)	
CAPSURPLUS(t-1)×NOCRISIS(t)	-	-	0.0357***	-	-	0.0258***
			(4.04)			(2.84)
CAPSURPLUS(t-1)×CRISIS(t)	-	-	0.0571***	-	-	0.0655***
			(4.97)			(5.59)
ROA(t-1)	0.3302***	0.3318***	0.3320***	0.3296***	0.3317***	0.3314***
	(25.92)	(26.07)	(26.12)	(25.88)	(26.06)	(26.08)
lnTOTAST(t)	-0.0329***	-0.0372***	-0.0353***	-0.0333***	-0.0373***	-0.0356***
	(-12.15)	(-13.69)	(-13.13)	(-12.34)	(-13.70)	(-13.24)
LIQUIDITY(t)	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***
	(-5.75)	(-5.79)	(-5.69)	(-5.82)	(-5.72)	(-5.75)
NPLs(t)	-0.0296***	-0.0289***	-0.0295***	-0.0289***	-0.0288***	-0.0288***
	(-18.28)	(-17.55)	(-18.31)	(-17.79)	(-17.34)	(-17.75)
LOANAST(t)	-0.0021***	-0.0030***	-0.0022***	-0.0021***	-0.0029***	-0.0022***
	(-5.36)	(-8.46)	(-5.65)	(-5.54)	(-8.36)	(-5.81)
COSTREV(t)	-0.0303***	-0.0303***	-0.0303***	-0.0303***	-0.0303***	-0.0303***
	(-37.93)	(-37.72)	(-37.95)	(-37.92)	(-37.72)	(-37.94)
NIRTR(t)	0.0070***	0.0066***	0.0069***	0.0070***	0.0066***	0.0069***
	(10.08)	(9.85)	(9.94)	(10.05)	(9.89)	(9.89)
GDPGROWTH(t)	0.0149***	0.0136***	0.0149***	0.0133***	0.0133***	0.0131***
	(4.69)	(4.25)	(4.68)	(4.08)	(4.14)	(4.04)
CREDITGDP(t)	-0.0009*	-0.0010**	-0.0009**	-0.0010**	-0.0010**	-0.0011**
	(-1.92)	(-2.22)	(-2.00)	(-2.31)	(-2.22)	(-2.38)
CRISIS(t)	-	-	-	-0.0493***	-0.0449***	-0.0542***
				(-2.82)	(-2.59)	(-3.09)
N	24,848	24,848	24,848	24,848	24,848	24,848
R^2	0.6679	0.6671	0.6675	0.6682	0.6671	0.6679
CAP×NOCRISIS=CAP×CRISIS (F-test)	2.81*	4.74**	3.53*	8.54***	2.88*	9.61***
CAP×NOCRISIS=CAP×CRISIS (p-value)	0.09	0.03	0.06	0.00	0.09	0.00

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Table 11 – The relation between capital and profitability (ROA): estimations for bank size subgroups

Variable	(1)	(2)	(3)
TIER1RWA(t-1)×SMALL(t)	0.0057***	-	-
	(5.65)		
TIER1RWA(t-1)×MEDIUM(t)	0.0078***	-	-
	(6.04)		
TIER1RWA(t-1)×LARGE(t)	0.0090***	-	-
	(4.30)		
TIER1RWA(t-1)×GSIBs(t)	-0.0032	-	-
	(-1.03)		
EQAST(t-1)×SMALL(t)	-	0.0048***	-
		(2.74)	
EQAST(t-1)×MEDIUM(t)	-	0.0050**	-
		(2.45)	
EQAST(t-1)×LARGE(t)	-	0.0054*	-
		(1.73)	
EQAST(t-1)×GSIBs(t)	-	-0.0046	-
		(-0.95)	
CAPSURPLUS(t-1)×SMALL(t)	-	-	0.0394***
			(4.41)
CAPSURPLUS(t-1)×MEDIUM(t)	-	-	0.0613***
			(4.39)
CAPSURPLUS(t-1)×LARGE(t)	-	-	0.0659***
			(2.63)
CAPSURPLUS(t-1)×GSIBs(t)	-	-	-0.0516
			(-1.13)
ROA(t-1)	0.3296***	0.3318***	0.3313***
	(25.87)	(26.08)	(26.08)
lnTOTAST(t)	-0.0386***	-0.0378***	-0.0383***
	(-9.20)	(-8.51)	(-11.02)
LIQUIDITY(t)	-0.0020***	-0.0020***	-0.0020***
	(-5.61)	(-5.75)	(-5.62)
NPLs(t)	-0.0289***	-0.0288***	-0.0289***
	(-17.74)	(-17.32)	(-17.70)
LOANAST(t)	-0.0021***	-0.0029***	-0.0022***
	(-5.42)	(-8.44)	(-5.78)
COSTREV(t)	-0.0303***	-0.0303***	-0.0303***
	(-37.84)	(-37.68)	(-37.87)
NIRTR(t)	0.0070***	0.0066***	0.0069***
	(10.18)	(9.93)	(10.03)
GDPGROWTH(t)	0.0131***	0.0135***	0.0132***
	(4.05)	(4.17)	(4.07)
CREDITGDP(t)	-0.0010**	-0.0010**	-0.0010**
	(-2.16)	(-2.26)	(-2.27)
CRISIS(t)	-0.0494***	-0.0464***	-0.0502***
	(-2.86)	(-2.66)	(-2.90)
N	24,848	24,848	24,848
R^2	0.6681	0.6670	0.6677
CAP×SMALL=CAP×LARGE (F-test)	2.42	0.03	1.00
CAP×SMALL=CAP×LARGE (p-value)	0.12	0.86	0.32

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Table 12 – The relation between capital and profitability (ROA): estimations for country income level subgroups

Variable	(1)	(2)	(3)
TIER1RWA(t-1)×LOWMIDDLE(t)	0.0064***	-	-
	(2.70)		
TIER1RWA(t-1)×HIGH(t)	0.0061***	-	-
	(5.94)		
EQAST(t-1)×LOWMIDDLE(t)	-	0.0082**	-
		(2.40)	
EQAST(t-1)×HIGH(t)	-	0.0035*	-
		(1.85)	
CAPSURPLUS(t-1)×LOWMIDDLE(t)	-	-	0.0455**
			(2.04)
CAPSURPLUS(t-1)×HIGH(t)	-	-	0.0430***
			(4.97)
ROA(t-1)	0.3297***	0.3316***	0.3314***
	(25.87)	(26.03)	(26.07)
lnTOTAST(t)	-0.0332***	-0.0375***	-0.0356***
	(-12.25)	(-13.78)	(-13.21)
LIQUIDITY(t)	-0.0020***	-0.0021***	-0.0020***
	(-5.70)	(-5.89)	(-5.67)
NPLs(t)	-0.0289***	-0.0288***	-0.0289***
	(-17.75)	(-17.31)	(-17.71)
LOANAST(t)	-0.0021***	-0.0030***	-0.0022***
	(-5.43)	(-8.54)	(-5.75)
COSTREV(t)	-0.0303***	-0.0303***	-0.0303***
	(-37.83)	(-37.63)	(-37.85)
NIRTR(t)	0.0070***	0.0066***	0.0070***
	(10.06)	(9.74)	(9.95)
GDPGROWTH(t)	0.0131***	0.0135***	0.0132***
	(4.05)	(4.17)	(4.08)
CREDITGDP(t)	-0.0010**	-0.0010**	-0.0010**
	(-2.25)	(-2.28)	(-2.31)
CRISIS(t)	-0.0474***	-0.0438**	-0.0486***
	(-2.74)	(-2.50)	(-2.81)
N	24,848	24,848	24,848
R^2	0.6680	0.6671	0.6676
CAP×LOWMIDDLE=CAP×HIGH (F-test)	0.01	1.44	0.01
CAP×LOWMIDDLE=CAP×HIGH (p-value)	0.92	0.23	0.91

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Table 13 – The relation between capital and profitability (ROA): economic, political and social characteristics

	ECONOMIC FREEDOM			*POLITICAL STABILITY*			*CORRUPTION CONTROL*		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TIER1RWA(t-1)×LOW(t)	0.0070***	-	-	0.0072***	-	-	0.0069***	-	-
	(5.77)			(6.82)			(5.47)		
TIER1RWA(t-1)×HIGH(t)	0.0051***	-	-	0.0048***	-	-	0.0053***	-	-
	(4.28)			(4.64)			(4.45)		
EQAST(t-1)×LOW(t)	-	0.0082***	-	-	0.0070***	-	-	0.0081***	-
		(4.09)			(3.98)			(3.82)	
EQAST(t-1)×HIGH(t)	-	0.0006	-	-	0.0017	-	-	0.0013	-
		(0.25)			(0.93)			(0.57)	
CAPSURPLUS(t-1)×LOW(t)	-	-	0.0569***	-	-	0.0542***	-	-	0.0548***
			(5.21)			(5.77)			(4.98)
CAPSURPLUS(t-1)×HIGH(t)	-	-	0.0283***	-	-	0.0304***	-	-	0.0313***
			(2.75)			(3.14)			(3.07)
ROA(t-1)	0.3294***	0.3312***	0.3308***	0.3288***	0.3306***	0.3308***	0.3296***	0.3313***	0.3310***
	(25.81)	(25.98)	(25.97)	(25.76)	(25.97)	(26.01)	(25.82)	(25.97)	(25.98)
lnTOTAST(t)	-0.0331***	-0.0369***	-0.0354***	-0.0334***	-0.0380***	-0.0357***	-0.0332***	-0.0371***	-0.0355***
	(-12.23)	(-13.55)	(-13.08)	(-12.28)	(-13.82)	(-13.23)	(-12.25)	(-13.66)	(-13.14)
LIQUIDITY(t)	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***
	(-5.68)	(-5.79)	(-5.63)	(-5.59)	(-5.62)	(-5.62)	(-5.66)	(-5.73)	(-5.61)
NPLs(t)	-0.0290***	-0.0290***	-0.0292***	-0.0289***	-0.0288***	-0.0289***	-0.0290***	-0.0289***	-0.0291***
	(-17.89)	(-17.54)	(-18.00)	(-17.73)	(-17.33)	(-17.70)	(-17.84)	(-17.51)	(-17.94)
LOANAST(t)	-0.0021***	-0.0029***	-0.0022***	-0.0021***	-0.0030***	-0.0022***	-0.0021***	-0.0029***	-0.0022***
	(-5.49)	(-8.47)	(-5.79)	(-5.51)	(-8.53)	(-5.78)	(-5.48)	(-8.40)	(-5.78)
COSTREV(t)	-0.0303***	-0.0303***	-0.0303***	-0.0304***	-0.0304***	-0.0304***	-0.0303***	-0.0303***	-0.0303***
	(-37.84)	(-37.65)	(-37.85)	(-37.71)	(-37.58)	(-37.78)	(-37.84)	(-37.61)	(-37.85)
NIRTR(t)	0.0070***	0.0067***	0.0069***	0.0071***	0.0067***	0.0070***	0.0070***	0.0067***	0.0069***
	(10.07)	(9.91)	(9.93)	(10.20)	(9.94)	(10.06)	(10.08)	(9.92)	(9.95)
GDPGROWTH(t)	0.0131***	0.0132***	0.0133***	0.0141***	0.0149***	0.0139***	0.0132***	0.0135***	0.0133***
	(4.05)	(4.09)	(4.10)	(4.28)	(4.54)	(4.25)	(4.07)	(4.19)	(4.10)
CREDITGDP(t)	-0.0010**	-0.0010**	-0.0010**	-0.0011**	-0.0012***	-0.0011**	-0.0010**	-0.0011**	-0.0011**
	(-2.23)	(-2.22)	(-2.31)	(-2.46)	(-2.69)	(-2.47)	(-2.28)	(-2.41)	(-2.36)
CRISIS(t)	-0.0468***	-0.0424**	-0.0424***	-0.0407**	-0.0345**	-0.0439**	-0.0463***	-0.0410**	-0.0471***
	(-2.71)	(-2.43)	(-2.73)	(-2.33)	(-1.97)	(-2.52)	(-2.68)	(-2.34)	(-2.72)
N	24,848	24,848	24,848	24,848	24,848	24,848	24,848	24,848	24,848
R^2	0.6680	0.6674	0.6677	0.6682	0.6675	0.6677	0.6680	0.6673	0.6677
CAP×LOW=CAP×HIGH(F-test)	1.64	7.44***	4.40**	9.62***	19.06***	6.34**	1.05	5.75**	2.98*
CAP×LOW=CAP×HIGH(p-value)	0.20	0.01	0.04	0.00	0.00	0.01	0.31	0.02	0.08

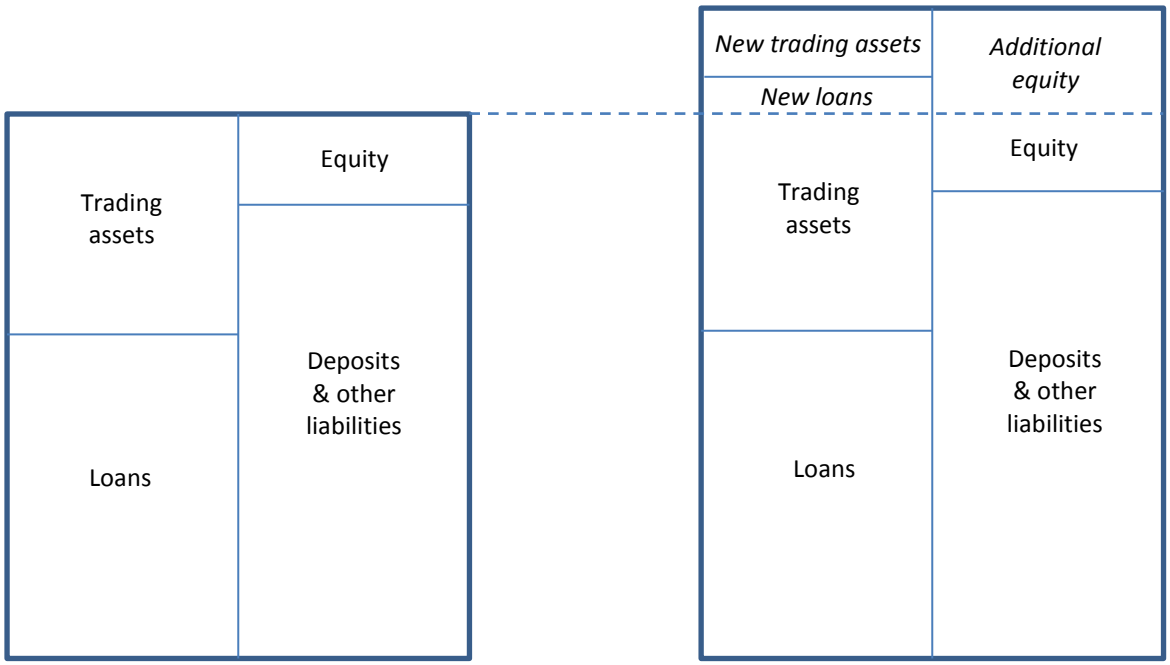
Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Table A1 – The relationship between capital and profitability (ROA): robustness estimates

	BANKS WITH AT LEAST 11 OBSERVATIONS OVER 14			*EXCLUDING US BANKS*			*BANKS WITH MODERATE ANNUAL CHANGES IN CAPITAL VARIABLES*		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TIER1RWA(t-1)	0.0060***	-	-	0.0058***	-	-	0.0076***	-	-
	(3.18)			(4.81)			(6.55)		
EQAST(t-1)	-	0.0011	-	-	0.0074***	-	-	0.0046**	-
		(0.26)			(3.61)			(2.35)	
CAPSURPLUS(t-1)	-	-	0.0469***	-	-	0.0409***	-	-	0.0558***
			(2.95)			(3.95)			(5.70)
ROA(t-1)	0.3213***	0.3286***	0.3225***	0.3521***	0.3504***	0.3539***	0.3633***	0.3982***	0.3587***
	(14.93)	(15.31)	(15.03)	(22.44)	(22.12)	(22.69)	(23.62)	(25.48)	(22.77)
lnTOTAST(t)	-0.0432***	-0.0493***	-0.0451***	-0.0269***	-0.0275***	-0.0294***	-0.0342***	-0.0407***	-0.0374***
	(-10.54)	(-11.84)	(-10.96)	(-7.85)	(-7.78)	(-8.61)	(-11.98)	(-14.08)	(-12.78)
LIQUIDITY(t)	-0.0030***	-0.0032***	-0.0030***	-0.0022***	-0.0023***	-0.0022***	-0.0017***	-0.0019***	-0.0018***
	(-4.87)	(-5.26)	(-4.85)	(-5.88)	(-6.02)	(-5.84)	(-4.51)	(-4.70)	(-4.37)
NPLs(t)	-0.0333***	-0.0328***	-0.0334***	-0.0248***	-0.0248***	-0.0248***	-0.0306***	-0.0290***	-0.0299***
	(-11.65)	(-11.10)	(-11.71)	(-14.58)	(-14.41)	(-14.57)	(-15.25)	(-14.71)	(-15.06)
LOANAST(t)	-0.0029***	-0.0038***	-0.0029***	-0.0023***	-0.0031***	-0.0024***	-0.0017***	-0.0030***	-0.0018***
	(-4.31)	(-6.23)	(-4.40)	(-4.58)	(-6.85)	(-4.74)	(-4.01)	(-8.26)	(-4.22)
COSTREV(t)	-0.0292***	-0.0293***	-0.0292***	-0.0315***	-0.0314***	-0.0316***	-0.0291***	-0.0280***	-0.0290***
	(-24.43)	(-24.28)	(-24.47)	(-32.97)	(-32.86)	(-33.02)	(-32.31)	(-30.88)	(-32.51)
NIRTR(t)	0.0086***	0.0083***	0.0085***	0.0024***	0.0019**	0.0023***	0.0079***	0.0069***	0.0080***
	(7.12)	(6.83)	(7.10)	(2.93)	(2.41)	(2.84)	(10.50)	(10.13)	(10.78)
GDPGROWTH(t)	0.0123*	0.0130*	0.0123*	0.0135***	0.0136***	0.0135***	0.0089***	0.0060*	0.0095***
	(1.71)	(1.81)	(1.70)	(3.75)	(3.82)	(3.77)	(2.74)	(1.80)	(2.81)
CREDITGDP(t)	-0.0007	-0.0008	-0.0007	-0.0008	-0.0007	-0.0008	-0.0013***	-0.0015***	-0.0013**
	(-0.78)	(-0.88)	(-0.81)	(-1.39)	(-1.31)	(-1.39)	(-2.67)	(-3.14)	(-2.56)
CRISIS(t)	-0.0367	-0.0379	-0.0373	-0.0237	-0.0205	-0.0255	-0.0556***	-0.0517***	-0.0514**
	(-1.26)	(-1.29)	(-1.28)	(-1.11)	(-0.95)	(-1.19)	(-2.86)	(-2.74)	(-2.51)
N	9,702	9,702	9,702	14,527	14,527	14,527	18,254	18,386	18,212
R^2	0.6676	0.6664	0.6675	0.6991	0.6988	0.6987	0.6837	0.6854	0.6826

Significance for the parameter estimates: *** = 1% level; ** = 5% level; * = 10% level. *t*-values (in parentheses).
Capital variables enter the estimations with a one year lag. All regressions include country and time fixed effects (coefficients are not reported).
Standard errors are clustered at bank level.

Figure 1 – Asset expansion as a response to increased capital requirement



Source: Adapted from Admati et al. (2013).