Débats économiques et financiers N°12

Does the capital structure affect banks' profitability? Pre- and post financial crisis evidence from significant banks in France

Olivier de Bandt, Boubacar Camara, Pierre Pessarossi, Martin Rose*

* Autorité de Contrôle Prudentiel et de Résolution. Corresponding author: boubacar.camara@acpr.banque-france.fr . Comments by H. Rey, C. Pérignon and D. Thesmar, are gratefully acknowledged.

SECRETARIAT GENERAL DE L'AUTORITE DE CONTROLE PRUDENTIEL ET DE RESOLUTION
DIRECTION DES ÉTUDES

Does the capital structure affect banks' profitability? Pre and post financial crisis evidence from significant banks in France

Olivier de Bandt, Boubacar Camara, Pierre Pessarossi, Martin Rose

March 2014

Does the capital structure affect banks' profitability? Pre and Post-Financial crisis evidence from significant banks in France

Olivier de Bandt, Boubacar Camara, Pierre Pessarossi, Martin Rose

Abstract

This paper studies the effect of banks' capitalization on banks' Return on Equity (ROE). A debate has emerged on the costs for banks of the increase in capital requirements under Basel III. We bring empirical evidence on this issue by analyzing the effect of different capitalization measures on banks' ROE on a sample of large French banks over the period 1993-2012, controlling for risk-taking as well as a range of variables including the business model. We find that an increase in capital leads to a significant increase in ROE, albeit the economic effect is modest. Furthermore, the method chosen by a bank to increase capitalization (i.e. raising equity) does not alter the result. Over the period, we find some evidence of a negative relationship between the share of credit activities and ROE, which is driven by the 2002-2007 sub-period, characterized by a significant increase in other business line activities. Looking at revenue and cost components, the positive effect of capital on the ROE appears to be driven by an increase in efficiency.

JEL : *G21; G28*

Key Words : ROE, solvency ratios, capital, banking regulation, Basel III

Est-ce que la structure du capital affecte la profitabilité bancaire ? quelques résultats avant et après la crise financière sur les banques significatives en France

Résumé

Cet article étudie l'effet de la capitalisation des banques sur le rendement de leurs fonds propres (« ROE »). Un débat a émergé sur les coûts imposés aux banques à la suite du renforcement des exigences en capital sous Bâle III. Nous apportons des résultats empiriques sur cette question en analysant l'effet de plusieurs mesures de capitalisation sur le ROE des grandes banques françaises sur la période 1993 à 2012. Nous tenons compte d'un certain nombre de variables de contrôle, comme la prise de risque et le modèle économique de la

banque. Nous montrons qu'une augmentation du capital conduit à une augmentation significative du ROE, bien que l'effet économique soit modeste. Nous mettons également en évidence que la méthode choisie par une banque pour augmenter son capital (i.e. la levée de nouvelles actions) ne modifie pas ce résultat. Sur la période, nous trouvons une relation négative entre la part des activités de crédit et la profitabilité mais cet effet est dû à la sous-période 2003-2007, qui est caractérisée par une augmentation d'autres activités bancaires. En décomposant par types de produits et charges, l'effet positif du capital sur le ROE provient d'une amélioration de l'efficacité bancaire.

JEL : *G21; G28*

Mots Clés : Taux de rentabilité du capital, ratios de solvabilité, capital, réglementation bancaire, Bâle III

1. Introduction

The financial crisis has renewed attention to the role of bank capital because many highly levered financial institutions failed or had to be bailed-out by governments. The social cost of bank failures justifies the existence of regulatory capital requirements for financial institutions (Berger et al., 1995). Higher capital levels allow banks to absorb larger shocks and alleviate the incentives of banks' shareholders to take-on excessive risk. The Basel III accords notably propose an enhanced framework in terms of capital requirements for banks. This reform imposes an increase in capital quality by requiring higher levels of common equity. It also requires a minimum leverage ratio taking into account banks' total assets and off balance sheet items. The rationale of such capital requirements is that they are socially efficient by preventing financial instability in the economic system. According to the Bank of England Governor, M. Carney, "only well-capitalised banks can serve the needs of the real economy to promote strong, sustainable growth. […]. Where capital has been rebuilt and balance sheets repaired, banking systems and economies have prospered." (Carney 2013a and b).

Such capital requirements could however create trade-offs for the economy. Banks often argue that higher capital requirements will jeopardize their performance. This could occur for example if banks' cost of financing were to increase significantly due to more capital holding. These higher funding costs could result in lower ROE for banks and have a disruptive effect on lending. The economic theory does not help to solve this debate because no consensus emerges on the effect of capital on bank performance. In addition, as evidenced by the recent financial crisis, higher risk – may be associated with higher leverage- is usually associated with higher expected return (see among others Admati et al, 2011), so that the analysis of the ROE should control for risk-taking.

Different views are held in the literature. Relying on the hypothesis of perfect markets, the Modigliani-Miller (1958) framework makes irrelevant, in terms of bank value, capital structure decisions.[2] Another strand of the literature emphasizes the disciplinary role of debt on managers (see e.g. Hart and Moore, 1995; Diamond and Rajan, 2000). Thus, increasing capital might relax managers from this discipline and be detrimental for performance. Finally, a third view argues that capital diminishes the moral hazard between shareholders and debtholders. Banks act as delegated monitors (Diamond, 1984). However, monitoring is costly and banks need incentives to monitor on behalf of their debtholders. In this view,

[2] Some empirical papers have indeed found that an increase in capital leads to a decrease in equity risk premium, thereby showing that Modigliani and Miller (1958) partially apply to banks (see e.g. Miles et al., 2012).

higher levels of capital increase the banks' incentives to monitor their borrowers because shareholders will collect a larger share of assets payoffs and lose more in case of failure. This in turn explains why capital ratios might have a positive effect on banks' performance. Such an increase in ROE may be achieved, through higher margins, coming either from higher efficiency or higher market power. Our empirical strategy is to investigate the various determinants of the ROE and consider whether capital ratios have an additional role. However it is beyond the scope of the paper to address fully the channels through which the ROE may vary.

To contribute to this debate, we analyze how several bank capitalization measures affect their Return on Equity (ROE) on the basis of a structural equation controlling for banks' risk taking behavior and business model.

From an accounting point of view, the expected ROE will decrease when capital increases because the same profit is divided by a larger amount of equity[3]. In our approach, we are interested in disentangling this accounting effect from the economic effect of bank capital on ROE.

This study contributes to the literature in several ways. First, we bring evidence to an unsolved question from France, a major developed country with one of the largest banking system in Europe. Second, we use a novel database assembled by the *Autorité de Contrôle Prudentiel et de Résolution*, the French Prudential Supervisory Authority, on the basis of confidential accounting and prudential data on French banking groups. In comparison to other publicly available data, the database exhibits a higher degree of harmonization of indicators because all banks report under the same regulatory format in a given year. Our capitalization measure reflects different types of bank capital either employed in the economic literature or by supervisory authorities. These measures take into account un-weighted and risk-weighted assets, as well as on and off balance sheet exposures of banks. Thus, they reflect the rationale of the new Basel III framework which combines all these features. Using on and off-balance sheet items and prudential information over a long period, the database allows us to construct measures of capitalization taking into account weighted exposures of off-balance sheet items, as well as (Basel I) risk-weighted exposures that are consistent over the whole period. Third, our sample comprises large French banks over the period 1993-2012. This large sample period allows us to draw results that are robust to different economic cycles. Moreover, by focusing on large banks we concentrate on significant institutions for which the prudential

[3] This does not mean however a loss in value. This change compensates for the lower risk-borne by equity holders. For a discussion, see Admati et al. (2011).

regulation is the most relevant, as it represents more than 90% of the total assets of French banks in 2012. Earlier studies on the US banking system, but including many small banks in their analysis, also uncovered a positive effect of the level of capital ratios on the ROE (Berger, 1995).

We perform fixed effect regressions with lagged values of capital measures to avoid endogeneity between contemporaneous measures of capital and the ROE. We find that an increase in lagged value of capital has a positive effect on ROE for all our capital measures. This effect is stronger when we take two-year lags indicating that it takes some time to affect performance. This result is in accordance with theories pointing out the effect of stronger monitoring when capital increases. We also discuss the potential implications of the method chosen by banks to increase capital as raising equity might be more costly than retaining earnings. We test whether the effect of capital is weaker when banks choose to increase it through raising equity. We do not find statistical evidence supporting this view. We provide evidence of a small but economically significant positive effect on ROE. The rest of the paper is organized as follows. Section 2 presents a literature review and formulates our hypotheses. Section 3 describes the data and methodology. Section 4 presents the results. Section 5 performs some robustness checks. Section 6 concludes.

2. Literature review and hypotheses

There is an extensive theoretical literature studying the effect of capital on banks' value. Three views exist leading to different conclusions. The first is based on the Modigliani and Miller (1958) framework (hereafter denoted M&M), for which the level of capital relative to assets has no effect on banks' value. The second assumes that too much capital will decrease banks' value. A third one argues on the contrary that more capital has a positive effect on banks' performance, leading to value enhancement. Due to these divergent theories, testing the relation between capital and bank performance remains an empirical question (Berger and Bouwman, 2013). We present each theory in turn and discuss their implications for our hypotheses.

2.1.The Modigliani and Miller (1958) view

In the M&M framework, funding sources have no effect on asset cash flows. Thus changing the mix of equity and debt does not have any effect on the firm value. The cost of equity is a function of asset risk and leverage and decreases when equity financing increases. This effect explains why the funding mix is neutral for firm value, despite the cost of equity being superior to the cost of debt. Miller (1995) discusses whether this framework applies to banks. He argues that nothing prevents the cost of capital to decrease when capital increases. He also notes that departures from the M&M propositions (e.g. based on taxes and agency costs) do not explain in a systematic manner the different capital levels of firms across industries. The two other views depart from M&M propositions precisely because they develop theories where capital levels will have an effect on asset cash flows received by the bank.

2.2.The "negative view" of holding more capital

The second view states that higher equity levels are negatively related with banks' value. According to Berger and Bouwman (2013), "Banks often argue that imposing tighter capital requirements will lead to a decrease in banking performance". The literature has given some credit to this view. Following the seminal work of Jensen and Meckling (1976), agency conflicts between managers and shareholders can be exacerbated with more bank capital. There is an extensive literature in the corporate finance on the disciplinary role of debt (e.g. Hart and Moore, 1995). The manager can seek to remove herself from the market discipline by building an equity cushion. On the contrary, financing project by debt oblige managers to make efficient decisions to regularly repay creditors. Debt may also present advantages compared to capital due to the existence of information asymmetries. Managers might have private information on the evolution of firm yields or on investment opportunities. The firm, by issuing debt, reveals to external investors its ability to repay the principal and interest on debt and signals its soundness (Ross, 1977; Leland and Pyle, 1977).

However, bank debt is different from corporate debt. In fact, a large part is held by small insured depositors who have neither incentive nor expertise to monitor banks (Dewatripont and Tirole, 1994). This might limit the disciplinary role of debt suggested by the corporate finance literature.

Diamond and Rajan (2001) develop a theory of banking in which a 'fragile financial structure' (i.e. a financing through a large fraction of deposits) is necessary for the bank to credibly commit to extract all the value from its relationship loans. The bank could opportunistically choose not to monitor after lending. However, the model assumes that depositors can run on the bank in that case, which forces it to monitor the borrower. In this framework, increasing capital could lead to less loan value and a reduction in liquidity creation.

Capital requirements are also seen as a potential source of costs for banks in the literature.[4] A goal of regulatory capital is to control bank risk-taking. The literature finds mixed results on this question[5]. Hellman et al. (2000) show that higher capital requirements have an indeterminate effect on bank behavior: on the one hand, they give incentives to invest in less risky portfolios, but on the other hand they may also reduce banks' charter value. This increases in turn the incentives to take gambling behaviors. Rochet and Freixas (2008) show that, facing risk adjusted solvency regulation, banks have the right incentive regarding risk taking. In the empirical literature, capital requirements have been found to induce banks to switch from loans to low-yielding securities (Berger and Udell, 1994; Thakor, 1996). This shift in asset type can in turn decrease bank profits. In these papers, higher capital requirements induce banks to choose a lower risk-return locus.

2.3.The "positive view" of holding more capital

The third view, on the contrary, predicts that more capital will have an enhancing effect on banks' value. Two main channels based on the moral hazard between shareholders and debt holders explain this effect. The first channel is based on the risk premium required by debt holders.

Potential losses of equity holders are floored because of the limited liability of shares. However, gains increase with risk taking. This creates an incentive to take excessive risks at the expense of other stakeholders in the bank. Debt holders anticipate this behavior and require a premium to finance banks. Consequently, market discipline from debtors forces banks to detain positive amounts of capital (Calomiris and Kahn, 1991). An increase in capital reduces the willingness of shareholders to take excessive risks. In turn, debt holders require a

[4] The literature, however, points out that capital requirements are generally not binding in practice (see e.g Flannery and Ragan (2008), Ashcraft (2001) or Gropp and Heider (2010).

[5] However, the model of Kim and Santomero (1988) shows particular cases where the probability of bank failure might increase after the introduction of capital requirements.

lower premium when the bank is better capitalized. In the end, higher capital requirements imply lower debt costs, hence higher ROE.

The existence of a deposit insurance scheme, which renders deposits riskless, reduces the effectiveness of this mechanism[6]: protected depositors do not require a premium when the riskiness of the bank increases. This channel could nevertheless apply through unprotected debtors to the extent that they do not expect that the bank is 'too big to fail'.

The second channel is based on monitoring efforts exerted by the bank. The (costly) monitoring effort depends on bank capital: higher capital internalizes the potential losses coming from a lack of monitoring. The bank has thus stronger incentives to monitor when its capital ratio increases. In this channel, capital structures have an effect on asset cash-flows because monitoring affects the loan portfolio pay-offs.[7] Holmstrom and Tirole (1997) develop a model in which the monitoring effort of the bank depends on its capital ratio. Mehran and Thakor (2011) propose a dynamic model that takes into account the cost and benefits of higher capital ratios. In their model, detaining capital is costly but the marginal cost differs across banks. Monitoring is a function of capital ratio: more capital increases the incentive of banks to monitor. The gains from higher capital ratios come from a direct and an indirect effect. The direct effect is the higher payment extracted from borrowers due to the stronger monitoring effort.[8] This implies higher margins for the bank. An indirect effect comes from a supplementary incentive to increase monitoring s due to the bank's higher probability of survival when its capital ratio increases, which enhances its ability to collect the return of its investments in the future. Allen, Carletti and Marquez (2011) develop a model where capital ratio also induces more monitoring from the bank. They find that higher capital ratios creates more surplus in the banking relationship. The authors find there an explanation for the existence of capital buffers, on top of what is required by the regulator. Increasing capital ratios is therefore, in our view consistent with profit maximization. It is however reasonable

[6] Strictly speaking, this channel is not weakened by the deposit insurance, but by the inability to set an insurance premium for the guarantee that properly reflects the risk of the bank.

[7] Banks can improve borrowers' result in several ways. By acquiring private information, banks can improve the continuation/liquidation decision of a project, thus increasing firm value (Chemmanur and Fulghieri, 1994). Loan commitments allow the bank to provide more liquidity after obtaining private information to liquidity constrained borrowers. A bank that has a large portfolio in a certain industry can address valuable advices about pricing, inventory planning and capital budgeting without violating confidentiality of other borrowers (Boot and Thakor, 2000).

[8] Admati et al. (2011) also note that *"because of frictions associated with governance and information, highly leveraged banks are generally subject to distortions in their lending decisions. These distortions may lead them to make worse lending decisions than they would have made if they were better capitalized"*

to think that there are decreasing marginal returns from higher capital, so that the positive effect of higher capital ratios on ROA and ROE may not hold beyond a certain threshold.[9]

2.4.Empirical evidence of the effect of the capital ratio on banks' performance

Mehran and Thakor (2011) empirically examine how capital ratio influences the target's price in banking acquisitions in the United States over the 1989-2007 period. They find that acquirers pay more for targets with a higher capital ratio in terms of assets fair-value and goodwill. Empirical findings also suggest that banks with higher capital ratio attract more loans and deposits (e.g. Calomiris and Mason, 2003; Kim, Kristiansen and Vale, 2005). In a recent study, Berger and Bouwman (2013) test how capital ratio influences bank performance during financial crises from 1984 to 2010 in the United States. They analyze whether highly capitalized banks gain market share and have a higher probability of survival. Small banks with higher capital ratios have a higher probability of survival and higher market share both in 'normal' times and during financial crises. These results hold for large banks but only during financial crises episodes.

2.5.The link between market value and accounting data

In this study, we assess the effect of capital ratios on banks' ROE. Thus, we need to draw a link between the literature on bank value and our accounting approach.

The bedrock of the M&M framework is the neutrality of the debt-equity mix on asset cash flows. If the capital structure does not influence asset cash flows, a change in capital should not affect the average net profit of a bank.

By studying the effect of capital ratios on ROE, we study whether there is a significant impact on the average net profit of the bank. In the M&M framework, no impact on the net profit should be expected. We only expect in that case a negative *accounting* effect on the ROE due to the dilution of the capital base when the capital ratio increases (the same result is divided by a larger capital base).

The reasoning for the two other views naturally follows: in the "negative view", we expect the net profit of the bank to decrease. This leads to a stronger negative effect of a

[9] Another strand in the literature argues that the relationship between risk taking and cpital ratios has an inverted U-shape. (risk taking is higher for low or high level of capital). See notably Calem and Rob (1999). However, even if ROE and risk are correlated, this is not an argument in favor of a positive relationship between capital and ROE, conditional on risk.

capital increase on the ROE. Meanwhile we expect the net profit of the bank to increase according to the "positive view".

The lag between capital ratio decisions and its effect on banks' performance need to be taken into account when using accounting data. After a capital structure change, market value reacts immediately as investors anticipate the effects of capital ratios. When considering accounting data, we can only measure the *real* performance improvement which takes time to materialize. In this study we consider how lagged values of capital ratios affect the expected ROE.

Finally, accounting data present an advantage compared to market data in terms of potential reverse causality from profitability to capital ratios. Banks with over-valued shares might be tempted to raise equity. In that case, higher market value would be related to higher capital ratios but without causality stemming from capital (e.g. Baker and Wurgler, 2002). By using accounting data, we avoid this potential over-valuation bias.

2.6.Hypotheses on the effects of capital ratios on banks' ROE

To test which theory empirically holds, we derive three mutually exclusive hypotheses:

Hypothesis 1: If the M&M framework holds, a change in the capital ratio has no effect on the bank's profit. Consequently, the ROE decreases due to the accounting effect of an increase in capital. After controlling for this accounting effect, there is no remaining effect of the capital ratio on the expected ROE.

Hypothesis 2: If the "negative view" holds, a change in capital ratio has a negative effect on the bank's profit. Consequently, the ROE (even after controlling for the accounting effect) decreases.

Hypothesis 3: If the "positive view" holds, a change in capital ratio has a positive effect on the bank's profit. The effect on the ROE is indeterminate as the increase in profit may be offset by the negative accounting effect of an increase in capital. After controlling for the accounting effect, the expected ROE increases.

3. Data and methodology

3.1.Data

Our sample covers the period 1993-2012 for 17 French banks[10] on a consolidated basis. We use a novel database assembled by the *Autorité de Contrôle Prudentiel et de Résolution*, on the basis of confidential accounting and prudential data on French banking groups. In comparison to other publicly available data, the database exhibits a higher degree of harmonization of indicators as banks report their information under the same regulatory prescription. The data allows us to access to on- and off-balance sheet items, as well as prudential information over this long period. The selection criterion includes banks that are significant in the definition retained by the European Single Supervisory Mechanism (SSM). Financial institutions with total assets over EUR 30 billion are included. In addition, banks in the 'grey zone' with total assets smaller but close to EUR 30 billion are also included in our sample. LCH.Clearnet, Caisse de Refinancement Habitat, OSEO and Agence Française de Développement are in the list but do not properly qualify as 'banks' and are therefore excluded from our sample. Barclays France is a branch from Barclays UK. We also exclude it from the sample. All balance sheet and regulatory data are collected by the French Supervisory Authority (ACPR). After 2007, regulatory data are no longer available for Dexia Credit Local. Moreover, ROE figures of Dexia Credit Local are highly volatile since 2008 due to the large decrease in its equity base and heavy losses (e.g. losses were superior to equity in 2011). Thus, these observations after 2007 are not taken into account in the sample. Large cooperative banks have missing data in the early years of our sample because their central organism did not report on a consolidated basis at that time. Our final sample size has 135 bank-year observations. Data availability constraints (on top of mergers and acquisitions over the sample period) also explain the unbalanced structure of the database.

We compute three different un-weighted measures of bank capitalization: *Capital ratio*, *Tier1/Tangible assets* and *Tier1/TA with off-balance sheet (OBS)*. *Capital ratio* is simply the balance sheet value of equity over total assets. *Tier1/Tangible assets* is based on the leverage ratio enforced by the United States banking supervisory authority in parallel with the Basel regulatory framework. Its computation is as follows: (Tier1 capital – intangible

[10] Namely BNP (until 1999), Paribas (until 1999), BNP Paribas, Groupe Banques Populaires (until 2008), Groupe Caisse d'Epargne (until 2008), Groupe BPCE, Société Générale, Groupe Crédit Mutuel, Groupe Crédit Agricole, Crédit Lyonnais (until 2002), Groupe HSBC France, Dexia Crédit Local (until 2007), Crédit Immobilier France Développement (until 2006), General Electric Capital (until 2007), Compagnie financière Renault (until 2002), RCI Banque, PSA Finance.

assets) / (total assets – intangible assets). *Tier1/TA with OBS* approaches the Basel III leverage ratio definition. It is computed as Tier1 / (total assets + weighted off-balance sheet credit risk exposures). The weights of the off-balance sheet credit risk exposures follow the Basel 3 framework: a 10% weight is applied to all commitments that a bank can withdraw at any time without any condition. All other commitments are 100% weighted. We only include off-balance sheet credit risk elements as we are not able to obtain a consistent measure of off-balance market risk exposures over the whole period due to regulatory changes. Moreover, data is not detailed enough to apply Basel II netting rules to on balance sheet derivatives and securities financing transactions as well as to calculate off-balance sheet potential future exposures to derivatives over the whole period. We thus consider the gross exposures for all elements. Since, all the banks considered follow the same accounting standards, the leverage measure is consistent across all banks and years. This limits the importance of applying common netting rules like in the Basel framework.

In addition, we use the two solvency ratios defined in the Basel I framework. *Tier1 regulatory ratio* is computed as Tier 1 over Basel I risk-weighted assets. *Total regulatory ratio* is computed as Tier1+Tier2+Tier3 over Basel I risk-weighted assets. We prefer to rely on the Basel I framework for the whole period in order to remain consistent and avoid the Basel II change in regulatory definition of risk-weighted assets in 2008[11]. Bank report minimum required capital under Basel I definition even after 2007, which allow us to compute the Basel I risk-weighted assets for the period 2008-2012. However, this data is missing for two banks: Credit Immobilier France Dévelopement, and General Electric Capital.

We use lagged value for all our capitalization measures because the contemporaneous measures of capital are endogenous to bank profit. Non-distributed benefits increase banks' capital reserves. We consider one-year and two-year lags in our models. To check whether endogeneity might still be considered an issue with lagged values, we perform Granger-causality test with two year lags including bank and time fixed effects. We find that lagged values of ROE never Granger-cause any of our measures of bank capitalization.[12]

Our model should control for several aspects influencing the ROE. The variable labelled as *Equity accounting effect* is a dummy variable equal to 1 when equity increased between two periods, and 0 otherwise. As stated in the hypotheses, a capital ratio increase has a negative accounting effect when the increase origins in capital change.[13] This dummy is thus

[11] Results are robust when we consider use the Basel 2 definition of RWAs after 2008. See the robustness check section.

[12] Results are not reported for the sake of brevity but available upon request. We also run the tests with clustered standard errors at the bank level to account for potential autocorrelation of the residuals.

[13] Capitalization might also change due to a variation in the denominator. This does not lead to any accounting effect.

included to disentangle the accounting effect from the economic effect of capital measures. We rely on the dummy variable to pool the subgroup that experiments an absolute increase in capital (different from the change in capital ratios) because this subgroup will experiment the same economic effect of capital ratio change but will have a lower ROE on average due to the negative accounting effect. The dummy captures this decrease in the slope of the model. However, including the equity growth and not its dummy counterpart does not change the results. We expect this variable to be negatively related to the ROE. We consider a one-year lag of this variable because the contemporaneous variable is endogenous: benefits increase capital reserves and thus contemporaneously cause equity growth.

The other variables are introduced in order to take into account of banks' business model, as well as condition on risk-levels, given the usual risk-return tradeoff. *Asset diversification* is the Herfindhal-Hirschman index (HHI) computed on four different asset classes: cash, interbank loans, non-financial institutions bank loans and other earning assets. Higher indexes indicate a high concentration in asset classes and, hence, lower diversification. Diversification is often computed using the HHI (see e.g. Thomas, 2002; Stiroh and Rumble, 2006). Berger and Bouwman (2013) use a similar HHI indicator that takes into account different loan categories. Literature finds mixed evidence on the effects of diversification on bank performance. On the one hand, Baele et al. (2007) find that diversification increases franchise value and decreases bank idiosyncratic risks. On the other hand, Stiroh and Rumble find that benefits from diversification are offset by the high volatility on non-interest income activities. In a cross-country study, Leaven and Levine (2007) show that financial conglomerates suffer from a diversification discount. Diversification should thus affect banks' accounting return but the lack of conclusive evidence from the literature prevents us to predict a sign for this relationship.

Loan share represents the proportion of loans divided by all earning assets. Symmetrically, Berger and Bouwman (2013) rely on the trading assets share. *Loan share* captures to what extent banking institutions pursue 'traditional' credit activities. Investment banks tended to have higher ROE compared to traditional banks on average before the financial crisis. This pattern has, however, been reversed during the financial crisis (ECB, 2010). It suggests that market activities are more profitable than 'traditional' banking activities during 'normal times' but result in higher losses during financial crises. Thus, the average effect over the period remains uncertain. Note that two banks with the same *Asset diversification* can have very different *Loan share*.

Safety net is computed as deposits over total assets. Deposits are insured in France since 1980,[14] thus banks with a higher proportion of deposits benefit more from the public guarantee. Similarly, Berger and Bouwman (2013) include the ratio of core deposits to total assets to account. *Safety net* is expected to influence risk-taking. Merton (1977) initially shows that deposit insurance reinforces the moral hazard coming from banks' shareholders. Keeley (1990) provides a theoretical framework on how banks' incentive to take risk increase with a deposit insurance scheme. This variable will thus capture how moral hazard coming from a lack of control of the depositors affects bank return. In a portfolio approach, the average return has to be explained by risk-taking. In addition to *Asset diversification*, *Loan share*, which captures the constraints/opportunities associated with the business model of the bank and *Safety net* which measures the risk due to the increased moral hazard, we add the variable *Portfolio risk*. Following Berger (1995) and Berger and Bouwman (2013), *Portfolio risk* is computed as the Basel I definition of risk-weighted assets over total assets. It reflects the allocation of assets among the four weighting categories (0, 20, 50 and 100%) defined in the Basel framework. Using such a measure allows us to control banks' portfolio reallocation effects on the ROE. Again, we prefer to rely on the Basel I definition of risk-weighted assets in order to remain consistent over the whole period. Banks are required to keep report Basel I RWA indicators even under the Basel II regime. However these indicators are not available for Crédit Immobilier France Développement and General Electric Capital, hence these banks are not included after 2007 in the sample.

Finally, we also include a *Liquidity ratio*. It corresponds to the French regulatory liquidity ratio, which is computed as available liquid assets over liquid liability requirements. Berger and Bouwman (2013) also take into account liquidity, albeit in a cruder way by including cash holdings and other liquid assets divided by total assets in their model. Banks with more liquidity have a lower probability to suffer financial distress. Liquid assets also tend to be less risky, and thus have a lower expected return.

Banks might gain from economies of scale and scope when monitoring their borrowers (Diamond, 1984). However, as will be shown below, *Bank size* (computed as the logarithm of total assets) severely contributes to multicolinearity in the sample. This variable is therefore not included in the main model of the study. Our sample, however, only include large banks (a common threshold in the literature for a bank to be considered large is USD 1

[14] In practice deposits are insured only up to EUR 100 000 for each account in a given bank. We cannot distinguish between deposits above or below EUR 100 000 and take all deposits as a proxy.

billion (e.g. Cornet et al., 2011, p.303). It is thus uncertain whether size should be considered to affect ROE.

Table 1 presents descriptive statistics for our sample. With an average ROE of 10.71%, French banks have been highly profitable over the period. Our capital measures reveal relatively different situations across banks. The first decile *Capital ratio* is 2.68%, meanwhile the last decile is at 10.10%. Banks also appear to have different business models: the first decile of *Asset diversification* is at 0.39 (high level of diversification) and the last decile at 0.79 (very high level of concentration). The same observation can be made for *Loan share* (first decile at 28.50% to the last decile at 88.37%) and *Risk portfolio* (first decile at 21.01% to 90.29%), which reveal that banks choose different business models in our sample.

Figures A, B, C and D show preliminary evidence of a positive association between capital ratios and banks' return. There seems to be a positive correlation between capital ratios and banks' return on assets: the higher the capital ratio, the higher the ROA a year after. The relationship between these ratios and the return on equity tends to be flatter, which may be explained by a negative accounting effect.

Table 2 presents the correlation matrix between variables in the study. Despite their different definitions, our capital measures are highly correlated. They should thus consistently measure banks' capitalization. Interestingly, risk-weighted asset capital ratios (*Tier1 regulatory ratio* and *Total regulatory ratio)* are less correlated to the other capital measures. The measures of capitalization are positively correlated with ROE. However these correlations are weaker than those observed when we consider ROA. The lower correlation coefficients with the ROE may be due to the negative accounting effect.

Bank size, *Asset diversification*, *Loan share* and *Portfolio risk* are highly correlated with our measures of capitalization. The inclusion of highly correlated independent variables does not bias the estimates but leads to imprecise estimations (e.g. Gujarati, 2002, p. 350). Including all these variables will likely cause the model to suffer from multicollinearity. However, dropping all highly correlated variables is not advisable because it might result in an omitted variable bias. To identify which variable causes the more concern in term of multicollinearity, we rely on the Variance Inflation Factor (VIF) criterion. The more the variance of a regressor is explained by other regressors, the higher will be the VIF. When the variance of a regressor is almost entirely explained by other regressors, then it is highly collinear to other independent variables. In this case, multicollinearity will prevent a precise estimation of the model parameters. A rule of thumb suggests that a VIF value above 10

indicates that a variable is highly collinear with the other regressors (Kleinbaum et al., p.210, 1988)[15]. In our sample, the variable *Bank size* has the highest VIF value at 206. This variable contributes the most to multicollinearity in the sample. Moreover, as noted above, we only included very large banks in the sample. Thus, we do not expect *Bank size* to be an important determinant of ROE in our sample. Consequently, we exclude *Bank size* from our main specification to mitigate the problem of multicollinearity.

3.2.Methodology

To assess the effect of bank capitalization on ROE, we perform fixed effects regressions at the bank level. Standard-errors are corrected for heteroscedasticity using Hubert/White standard errors. We include in turn our lagged values of capitalization measures. Our baseline model is as follows:

$$ROE_{i,t} = \alpha_i + \theta_t + \beta_1 . Capitalization_{i,t-j} + \beta_2 . Equity\ accounting\ effect_{i,t-1} + X_{c,i,t} . \beta_c + \varepsilon_{i,t}$$

Where i is a subscript for the i[th] bank, t for the t[th] time period and $j \in \{1,2\}$. α_i and θ_t are, respectively, bank and time fixed effects. $Capitalization_{i,t-j}$ is one of the five measures of bank capitalization described above in the data section. $Equity\ accounting\ effect_{i,t-1}$ is a dummy variable equal to 1 when the bank i increased its equity in year *t-1* and 0 otherwise. $X_{c,i,t}$ is a vector of the following independent variables: *Asset diversification*, *Loan share*, *Safety net*, *Portfolio risk* and *Liquidity ratio*. β_1, β_2 and β_c are parameters to be estimated. $\varepsilon_{i,t}$ is the disturbance term.

4. Main results

4.1.Considering a one-year lag in capital measures

[15] The VIF is computed as $1/(1 - R_k^2)$ where R_k^2 is the R^2 from the regression of regressor *k* on all other independent variables of the model. A VIF of 10 indicates that R_k^2 equals 90%.

Table 3 reports the results of the fixed effects regressions of ROE on our capitalization measures. All our coefficients of capitalization are positive and, except *Capital ratio*, four of them are statistically significant. ROE tends to *increase* on average after an increase in capitalization. This result also holds for risk-weighted measures. Thus, our analysis supports the "positive view" where more capital increases the monitoring effort of the bank and thus the pay-offs it collects. Moreover, *Total regulatory ratio* exhibits the lowest significant effect on ROE. This is consistent with the fact that this ratio includes other forms of capital such as long term subordinated debt and some hybrid instruments. These forms of capital should influence less the monitoring effort of the bank because only pure form of equity will entirely capture the gains from increased monitoring. These results are in line with Berger and Bouwman (2013). They find that banks with higher capital ratios have a higher market share and probability of survival during financial crises. They also analyze the effect of capitalization on the change of banks ROE between 'normal times' and financial crises. They find that banks with higher capital ratio in pre-crisis times experiment an increase in profitability compared to less capitalized banks.

As expected, our variable *Equity accounting effect* is significantly negative, capturing the accounting effect of an increase in equity. We also find a significant impact of *Asset diversification* and *Loan share* on ROE. The positive coefficient on *Asset diversification* indicates that banks with more concentrated activities tend to have a higher ROE on average. This might reflect the high risk profile of banks choosing to focus their activities on one business which leads to higher profits on average. The negative sign on *Loan share* indicates that increasing banks' loan activity led to a decrease of the ROE on average. The latter result deserves, however, particular attention.

In fact, we suspect that the negative relationship *Loan share* and ROE is driven by sample sub periods. Figure E shows the evolution of the demeaned *ROE* and demeaned *Loan share* for the period. To compute the demeaned variables, we subtract from each observation the corresponding mean at the bank level and compute the variable average for each year of the sample. This allows to measure a within effect like in the fixed effects model. We observe that the demeaned *ROE* and demeaned *Loan share* have been strongly correlated on certain sub periods and strongly anti-correlated on others. More specifically, after an initial difference, the demeaned *ROE* and *Loan share* move in the same direction from 1997 to 2001

and from 2008 to 2012 but there is a strong anti-correlation of the two variables from 2002 to 2007.

Thus, it seems that the negative relation is driven from this sub period. Because this sub period led to the financial crisis, it is very plausible that market activities have been highly profitable at that time leading banks that increased their market activities (thus decreasing *Loan share*) to have abnormally high ROE.

Table 4 reports the fixed effects regressions with the variable *Loan share* interacted with a dummy variable equal to 1 over the sub period 2002-2007 and 0 the rest of the time. We only include capital ratios measures and bank and time fixed effects in these models. The results confirm that an increase in *Loan share* is significantly negative only over the sub period 2002-2007. The model with all control variables included (not reported here) however leads to an insignificant interaction term and an insignificant coefficient for the variable *Loan share*. This also confirms the lack of strong significant relationship between *Loan share* and *ROE.*

As *Asset diversification*, *Loan share* and *Portfolio risk* also present high correlation coefficient with our measures of capitalization, we estimate a model without these variables. To check whether the inclusion of these variables influences the result, we include them in turn. Table 5 presents the same model including progressively the control variables. Our capital measures positively and significantly affect ROE in all regressions, except *Capital ratio* in the first specification. We do not report all possible combinations for the sake of brevity, but we also estimate other models, notably without *Asset diversification*, *Loan share*, *Portfolio risk* because of their high correlations with our capital measures. The conclusions of our results remain unchanged.

These results have considered that capital ratio can affect ROE over one period. Arguably, if the positive effect relies on increased monitoring, it might take longer for the bank to benefit entirely from an increase in capitalization. To check this, we estimate the effect of a two-year lag increase in capitalization.

4.2.Considering a two-year lag in capital measures

Table 6 reports the results of our baseline model with a two-year lag in our five capital measures. In this specification, all capitalization measures are positive and significant. Moreover, all coefficients are greater than in the previous specification with one-year lag, except for the slightly lower *Total regulatory ratio*. It appears that capitalization has a stronger effect on ROE two years after the initial increase.

In this specification, we still find that *Loan share* has a negative effect on the average ROE, but *Asset diversification* is only significant when we consider risk-weighted capital measures. The *Equity accounting effect* variable continues to capture well the negative accounting effect.

Finally, table 7 reports the results when both one-year and two-year lags are included at the same time in the model. We compute a joint significance test and the sum of lagged variables coefficients. The results indicate that the effect is more explained by the two-year lag as it is strongly significant in models (1) to (3). The one-year lag is never significant in all specifications. The joint test on the coefficients of one-year and two-year lagged capitalization measures being equal to 0 rejects the null hypothesis in all specifications. Moreover, the sum of coefficients of lagged capitalization measures is strongly significant and positive in all specifications.

Overall, our main findings can be summarized as follows: bank capitalization has a positive effect on its average ROE. The effect is particularly important two years after the initial increase in capital. We thus find strong empirical support for the "positive view" of the effect of capital on bank performance.

4.3.The economic effect of capital increase

The results indicate that capitalization has a statistically positive effect on ROE. The effect appears to be economically significant. From Table 3, which considers a one-year lag in capitalization measures, the *ceteris paribus* effect of a 1% (or 100 bp) increase in capitalization is an increase of ROE in the range of 0.54 % to 1.50% on ROE depending on the capital ratio measure.[16] When considering the inclusion of two years lag in the same specification as reported in Table 6, the average effect (i.e. the sum of lagged coefficients) is between 0.57% and 2.19%. Interestingly, non risk-weighted capitalization measures have the stronger effect on ROE, especially when off-balance sheet items are taken into account. Among regulatory ratios, increasing Tier1 regulatory capital is almost twice as effective as increasing total regulatory capital (0.97% against 0.57%).

The sum of net profit among banks for the five major banks was 9.6 billion of Euros in 2012. Taking this figure as a base scenario for the following years, the economic surplus for these banks in terms of net profit of a 1% increase in *T1/TA with OBS* can be roughly

[16] A 100 bp increase in the capital ratio corresponds approximately to a 1-standard deviation shock.

estimated between $9.6 \times 1.50\% = 144.2$ millions and $9.6 \times 2.19\% = 209.9$ millions of Euros depending of the number of lags included.

4.4. Discussion on the results and complementary investigations

As noted above, one view is that capital requirements impose a cost on banks because equity is a costly source of financing[17] that impedes banks' profits. However, our results suggest the reverse: higher capitalization leads to better accounting profits. How do our empirical results bear on that issue? An answer can be found in Miller (1995) discussion on the application of M&M propositions to banks. He stresses the fundamental distinction between the cost of *raising new equity* and the cost of *having equity*.

On the one hand, *raising equity* is generally supposed to be costly in the short-term: it creates dilution costs for existing shareholders and imposes issuance costs. Moreover, new shares might be sold at a discount if the issuance is interpreted as a bad signal of the bank's prospects. On the other hand, *capital structure* is irrelevant in the M&M framework; meanwhile we find that *having equity* has a positive effect on banks' returns. Thus, bankers might be right that *raising* new equity is costly and wrong on the effects of *having* equity[18].

To check whether the cost of raising equity has a negative effect on ROE, we compute a lagged variable[19] *Growth of paid-up capital* and a dummy variable *Growth of paid-up capital dummy* equal to 1 when the variable is strictly positive and 0 otherwise. Paid-up capital excludes all other forms of equity such as retained earnings. Change in paid-up capital should thus only account for increases in capital after raising equity (e.g. via Seasoned Equity Offering). Note that this variable is different from our previous variable *Equity accounting effect* which accounted for growth of all sources of equity (paid-up capital plus retained earnings and other form of equity). The correlation between *Equity accounting effect* and *Growth of paid-up capital dummy* is -0.06. We are interested in the interactions between *Growth of paid-up capital* (or *Growth of paid-up capital dummy*) and our capital measures. More precisely, we want to check if the effect of capitalization on ROE is different when

[17] This argument is all but new. In the discussion Miller wrote on that topic in the *Journal of Banking and Finance* in 1995 (Miller, 1995), he explains that he was already confronting this argument 15 years before the discussion in a banking conference about capital requirements.

[18] But one should note that capital requirements are not imposed overnight. For example, the Basel III framework is only progressively implemented and will not be fully binding before the 1st January 2019. This allows banks to pursue different strategies, such as retaining more earnings or reallocating assets, to attain the required levels of capitalization. Moreover, the costs of *raising* equity can thus be spread over the whole period of implementation. Consequently, this progressive implementation alleviates the bankers concerns on the costs of *raising equity*, especially after taking into account the beneficial effects of *having more equity*.

[19] Because the cost of raising equity can have an effect in the short run, we also tested with non lagged variables of growth of paid-up capital. The results remain unchanged.

equity is raised. As argued in the discussion, the costs of *raising* equity might reduce banks' profits in accordance with the bankers' view. If this view holds, we expect a negative sign for the interaction term between *Growth of paid-up capital* or *Growth of paid-up capital dummy* and each of our capitalization measure.

Table 8 reports the results of the fixed effects regressions with our capital measures interacted with the growth of paid-up capital. Models (1) to (5) report results for the interactions with *Growth of paid-up capital* and models (6) to (10) report results for the interactions with *Growth of paid-up capital dummy*. All the interaction terms are insignificant. We do not find statistical evidence that the way of increasing capital ratios (i.e. raising equity) reduces the positive effect of having high capital ratios.[20] We also tested the same fixed effects models only including capitalization measures, *Growth of paid-up capital* (or alternatively *Growth of paid-up capital dummy*) and the interaction terms. Results are unchanged. These results are similar to Berger (1995) who finds no difference between new issuances and retained earnings when testing for the effect of capital increase on banks' earnings.

The positive effect of capital on bank performance is theoretically a result of a stronger monitoring from the bank which increases the value added of its assets, all else being equal. To assess whether this hypothesis drives our results, we further analyze the impact of capital on the ratio of net operating income to administrative expenses (*Efficiency*) in order to explain the positive association between capital and ROE. This ratio should capture a more efficient behavior of banks if net operating incomeincreases more than administrative expenses. Table 9 shows a strong positive relationship between banks' capital ratios and the ratio of net operating income to administrative expenses. This indicates that an increase in capital ratios is associated with a more efficient behavior from the bank, income increases more than expenses.

To confirm the channel through which higher capital is associated with higher future earnings, we assess the impact of capital on the different components of earnings namely the ratios of revenue to equity, interest expenses to equity, commission expenses to equity and administrative expenses to equity. Since the coefficients associated with the capital measures may reflect the fact that equity is the denominator of the dependant variables and in the numerator of the capital measures, we also express these dependant variables as ratios to total assets. Overall, our results suggest that banks tend to become more efficient after an increase in capital by increasing revenues more than costs. Our results are similar to those of Berger (1995), who performs a similar analysis on the US banking system.[21]

5. Robustness checks

[20] Banks that need to raise external capital in order to balance losses do not seem to wipe out the positive effect of capital on ROA (and ROE).

[21] These results are available upon request from the authors.

We perform numerous robustness checks. All not reported results are available upon request.

5.1.*Taking into account Bank size*

In unreported results, we consider *Bank size* in the baseline model with one-year and two-year lag capital measures. With one year lag, estimates for capital measures are positive but no longer significant. This is unsurprising given the degree of multicollinearity introduced by the variable *Bank size*. With a two-year lag, *Capital ratio*, *Tier1/Tangible assets* and *Tier1/TA with OBS* remain positive and significant despite the multicollinearity issue, whereas the two regulatory ratios remain positive but insignificant. *Bank size* is insignificant in almost all specifications, except when we use one-year lag *Tier1/Tangible assets* $_{t-1}$, where it is significantly negative.

5.2.Lagging all independent variables and including growth of equity instead of the Equity accounting effect dummy variable

Next, we consider a model where all independent variables are one-year lag with respect to the ROE. This allows controlling for every other potential endogenous relation between ROE and other independent variables. Table 10 reports the results and find that all measures of capital are positive and significant. The results hold when we consider a two-year lag for capital measures and one-year lag for all other independent variables (not reported for the sake of brevity).

We also consider the one-year lag growth of equity instead of the dummy variable. The results, also not reported, remain qualitatively unchanged for all specifications tested in the paper for our capitalization measures. *Growth of equity* has the expected negative sign and is significant in almost all regressions.

5.3. *Considering average capital measures, potential nonlinear effects and market power.*

Capital measures have also been alternatively computed as the average of the one-year lag and two-year lag measures. All coefficients for capital measures remain positive and significant in the model (also not reported).

We also test for potential nonlinear effects for measures of capitalization, *Asset diversification* and *Loan share*. To do so, we include in separate specifications the square term of each variables. We do not find any evidence of a nonlinear effect on ROE.

To take into account the difference in market power between banks, we alternatively include the deposit share of the bank according to the total deposits in the banking system for a given year and the total assets share of the bank according to the total assets of the banking system in a given year. Banks with higher market power should be able to attract more deposits or increase their assets size (e.g. Berger, 1995). Our main results are robust but the measures of market power are not significant.

5.4.*Excluding the post financial crisis period and including Basel II risk-weighted assets after 2008*

To check whether our results are due to the financial crisis episode, we rerun the estimation on the pre-crisis period 1993-2007. *Tier1/Tangible assets*, *Tier1/TA with OBS* and *Tier1 regulatory ratio* remain significantly positive in all specifications.

Our risk-weighted assets are based on the Basel I framework for the whole period. To check the influence of this choice on the results, we take into account the change in regulation and apply the Basel II risk-weighted assets definition for the period 2008-2012. Hence, in these unreported specifications our variables *Risk portfolio*, *Tier1 regulatory ratio* and *Total regulatory ratio* are based on Basel I until 2007 and then Basel II afterwards. Our capital measures are still positive and significant, except for the *Tier1 regulatory ratio* which becomes insignificant. The variable *Risk portfolio* is significant but has an unexpected negative sign. This may be explained by important changes between Basel I and II regulatory framework. In fact, banks having enough expertise have been notably allowed to use their internal model to derive risk weights in the Basel II framework with a positive effect on the capital ratio, but has not been matched by gains in terms of ROE. Moreover, other independent variables are no longer significant, except *Safety net* which appears to have a positive effect on ROE. These results might come from the inconsistency of the risk-weighted assets definition over the period. In fact, important changes have been introduced in the Basel II framework. Banks now rely on external ratings or use their internal model – for those having enough expertise - to derive risk weights. Our main result on bank capitalization however remains robust.

5.3.Considering alternative measures of performance: ROA and RAROC

Finally, we rerun all our models using alternative measures of performance as the dependent variable. First, we use *Return on Assets* (ROA). The ROE is simply the ROA multiplied by the accounting leverage ratio *Total assets over equity*. Thus, we should not expect a negative accounting effect with the ROA and drop the variable *Equity accounting effect* in these models. For the sake of brevity, we only report the baseline model in table 11. The same results hold as before and capital measures are positive and significant in all specifications that were tested using ROE.

We also employed a *Risk-ajusted Return on Capital* (RAROC) measure. The RAROC measures the return of a project over its economic capital (i.e. the capital that could be lost in a worst case scenario). Thus we measure economic capital of the bank as 8% of Basel I RWA. This follows from the fact that banks hold capital to absorb unexpected losses. Thus, our measure of return is $Net\ Profit/8\%\ of\ RWA$.

Table 12 reports the results of the regression with RAROC as a dependent variable and a one-year lag in capital ratios measures. Because RAROC is adjusted for the risk, we do not include anymore the variable *Risk portfolio*. We also exclude from the model the variable *Equity accounting effect* as RAROC does not suffer from an adverse accounting effect. All capital ratios measures are significantly positive. Results hold when the models include a two-year lag and both lags.

6. Conclusion

This paper brings new evidence of the effect of bank capitalization on performance. We contribute to the debate on the effect of capital requirements where no consensus emerges from previous literature. We find an unambiguous support of a positive effect of an increase in capital on banks' ROE. This effect does not depend on the way banks choose to increase their capital (specifically through raising equity). Our economic estimates of this effect highlight a modest but significant effect of capital increase on ROE. In conclusion, capital requirements do not appear to be detrimental to banks' performance in this study. This alleviates common critics on the potential trade-off imposed by prudential regulation on the banking system.

References

Admati, A.R., DeMarzo P.M., Hellwig M.F. and Pfeiderer, P.C., 2011. Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is Not Expensive, *Working paper Stanford University and Max Planck Institute*, Stanford, CA, and Bonn, Germany.

Allen, F., Carletti E. and Marquez R., 2011. Credit Market Competition and Capital Regulation, *Review of Financial Studies*, 24, 4, p. 983-1018.

Ashcraft, A. 2001. Do Tougher Bank Capital Requirements Matter? New Evidence from the Eighties, Working Paper, Federal Reserve Bank of New York.

Baele, L., Jonghe O.D. and Venner R.V., 2007. Does the Stock Market Value Bank Diversification, *Journal of Banking and Finance*, 31, p. 1999-2023.

Baker, M. and Wurgler J., 2002. Market Timing and Capital Structure, *Journal of Finance*, 57, 1, p. 1-32.

Berger, A.N., 1995. The Relationship between Capital and Earnings in Banking, *Journal of Money, Credit and Banking*, 27, p. 432-456.

Berger, A.N. and Bouwman C.H.S., 2013. How Does Capital Affect Bank Performance During Financial Crises?, *Journal of Financial Economics*, 109, p. 146-176.

Berger, A.N. and Udell G.F., 1994. Did Risk-Based Capital Allocate Bank Credit and Cause a "Credit Crunch" in the United States?, *Journal of Money, Credit and Banking*, 26, p. 586-627.

Boot, A.W.A. and Thakor A.V., 2000. Can Relationship Banking Survive Competition?, *Journal of Finance*, 55, 2, p. 679-713.

Calem, P. and R. Rob (1999) "The Impact of Capital-Based Regulation on Bank Risk-Taking", *Journal of Financial Intermediation*, 8, 37-352.

Calomiris, C.W. and Kahn C.M., 1991. The Role of Demandable Debt in Structuring Optimal Banking Arrangements, *American Economic Review*, 81, p.497-513.

Calomiris, C.W. and Mason J.R., 2003. Consequences of Bank Distress During the Great Depression, *American Economic Review*, 93, p. 937-947.

Carney M (2013a): "Progress of Financial Reforms", available at http://www.financialstabilityboard.org/publications/r_130905.pdf

Carney M (2013b): "Crossing the threshold to recovery", available at http://www.bankofengland.co.uk/publications/Documents/speeches/2013/speech675.pdf.

Chemmanur, T. and Fulghieri P., 1994. Reputation, Renegotiation and the Choice between Bank Loans and Publicly Traded Debt, *Review of Financial Studies*, 7, p. 476-506.

Cornett, M.M., McNutt J.J, Strahan P.E. and Tehranian H., 2011. Liquidity Risk Management and Credit Supply in the Financial Crisis, *Journal of Financial Economics*, 101, 297-312.

Dewatripont, M. and Tirole, J. (1994) *The Prudential Regulation of Banks*, MIT Press, Cambridge (MA).

Diamond, D. W., 1984. Financial Intermediation and Delegated Monitoring, *Review of Economic Studies*, 51, 3, p. 393-414.

Diamond, D. and Rajan R., 2001. Liquidity Risk, Liquidity Creation and Financial Fragility, *Journal of Political Economy*, 109, 2, p. 287-327.

ECB, 2010. Beyond ROE – How to Measure Bank Performance, Appendix to the Report on EU Banking Structures, September.

Flannery, M.J. and Ragan P., 2008. What Caused the Bank Capital Build-Up of the 1990s?, *Review of Finance*, 12, p. 391-429.

Freixas, J. and Rochet, J.-C. (2008) *Microeconomics of banking*, MIT Press.

Gropp, R. and Heider F., 2010. The Determinants of Bank Capital Structure, *Review of Finance*, 14, p. 587-622.

Gujarati, D.N., 2002. Basic Econometrics, 4th Edition, Palgrave-McMillan, Hampshire, UK.

Hart, O. and Moore J., 1995. Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management, *American Economic Review*, 85, p. 567-585.

Hellman, T.F., Murdoch K.C., Stiglitz J.E., 2000. Liberalization, Moral Hazard in Banking and Prudential Regulation: Are Capital Requirements Enough?, *American Economic Review*, 90, p. 147-165.

Holmstrom, B. and Tirole J., 1997. Financial Intermediation, Loanable Funds and the Real Sector, *Quarterly Journal of Economics*, 112, 3, p. 663-691.

Jensen, M. and Meckling W.H., 1976. The Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure, *Journal of Financial Economics*, 3, 4, p. 305-360.

Keeley, M.C., 1990. Deposit Insurance, Risk and Market Power in Banking, *American Economic Review*, 80, 5, p. 1183-1200.

Kim, M., Kristiansen E.G. and Vale B., 2005. Endogenous Product Differentiation in Credit Markets: What Do Borrowers Pay For?, *Journal of Banking and Finance*, 29, p. 681-699.

Kim, D. and Santomero A.M., 1988. Risk in Banking and Capital Regulation, Journal of Finance, 43, 5, p. 1219-1233.

Kleinbaum, D.G., Kupper, L.L. and Muller K.E., 1988. Applied Regression Analysis and other Multivariate Methods, 2d ed., PWS-Kent, Boston, Massachusetts.

Leaven, L. and Levine R., 2007. Is There a Diversification Discount in Financial Conglomerates?, *Journal of Financial Economics*, 85, p.331-367.

Leland, H.E. and D.H. Pyle, 1977. Informational Asymmetries, Financial Structure, and Financial Intermediation, *Journal of Finance*, 32, 2, p. 371-387.

Mehran, H. and Thakor A., 2011. Bank Capital and Value in the Cross-Section, *Review of Financial Studies*, 24, 4, p. 1019-1067.

Merton, R.C., 1977. An Analytic Derivation of the Cost of Deposit Insurance and Loan Guarantees: an Application of Modern Option Pricing Theory, *Journal of Banking and Finance*, 1, 1, p. 3-11.

Miller, M.H., 1995. Do the M&M Propositions Apply to Banks?, *Journal of Banking and Finance*, 19, p. 483-489.

Milles, D., Yang J. and Marcheggiano G., 2012. Optimal Bank Capital, *Economic Journal*, 123, p. 1-37.

Modigliani, F. and Miller M.H., 1958. The Cost of Capital, Corporate Finance and the Theory of Investment, *American Economic Review*, 48, p. 261-297.

Myers, S.C., 1984. The Capital Structure Puzzle, *Journal of Finance*, 39, 3, p. 575-592.

Ross, S.A., 1977. The Determination of Financial Structure: The Incentive-Signalling Approach, *The Bell Journal of Economics*, 8, 1, p.23-40.

Stiroh, K.J and Rumble A., 2006. The Dark Side of Diversification: The Case of US Financial Holding Companies, *Journal of Banking and Finance*, 30, p. 2131-2161.

Thakor, A.V., 1996. Capital Requirements, Monetary Policy and Aggregate Bank Lending: Theory and Empirical Evidence, *Journal of Finance*, 51, p. 279-324.

Thomas, S., 2002. Firm Diversification and Asymmetric Information: Evidence from Analysts' Forecasts and Earnings Announcements, *Journal of Financial Economics*, 64, p. 373-396.

Table 1: Summary statistics

Variables	Definition	N	Mean	SD	10%	Median	90%
ROE	Net profit over balance sheet equity.	135	10.71%	5.84%	4.23%	10.82%	17.77%
ROA	Net profit over balance sheet total assets.	135	0.61%	0.47%	0.14%	0.46%	1.33%
RAROC	Net profit over 8% of risk-weighted assets (Basel I).	135	14.45%	8.34%	3.82%	13.83%	24.95%
Efficiency	Net operating income over administrative expenses	132	1.95	0.74	1.4	1.63	3,3
Capital ratio $_{t-1}$	One year lagged value of balance sheet equity over total assets.	135	5.56%	2.93%	2.68%	4.58%	10.10%
Tier1/Tangible assets $_{t-1}$	One year lagged value of Tier 1 capital minus intangible assets over total assets minus intangible assets.	135	5.00%	2.60%	2.40%	4.01%	8.96%
Tier1/TA with OBS $_{t-1}$	One year lagged value of regulatory Tier 1 over the sum of balance sheet total assets and off-balance sheet weighted credit risk exposures.	135	4.28%	2.57%	1.88%	3.17%	8.81%
Tier1 regulatory ratio $_{t-1}$	One year lagged value of regulatory Tier 1 over risk-weighted assets (Basel I).	135	9.20%	2.28%	6.86%	8.87%	11.96%
Total regulatory ratio $_{t-1}$	One year lagged value of total regulatory capital over risk-weighted assets (Basel I).	135	11.39%	2.16%	9.15%	11.18%	14.22%
Equity accounting effect $_{t-1}$	Dummy variable equal to 1 when the one year lag growth rate of balance sheet equity is positive. 0 otherwise.	135	0.83	0.38	0	1	1
Bank size	Natural logarithm of balance sheet total assets.	135	18.98	1.5	16.96	19.19	21.01
Asset diversification	HH index of 4 different asset classes: cash, interbank assets, loans and other earning asset.	135	0.53	0.15	0.39	0.47	0.79
Loan share	Loans to non financial entities over total earning assets.	135	54.06%	22.31%	28.50%	49.65%	88.37%
Safety net	Deposits over total assets.	135	22.48%	16.16%	1.39%	25.02%	39.98%
Portfolio risk	Risk-weighted assets (Basel I) over total assets.	135	51.47%	23.91%	21.01%	46.63%	90.29%
Liquidity ratio	Available liquid assets over liquid liability requirements.	135	1.95	1.75	1.18	1.41	2.99

Table 2 : Correlation matrix

	ROE	ROA	RAROC	Efficiency	Capital ratio $_{t-1}$	T1/Tang. Assets $_{t-1}$	T1/TA w. OBS $_{t-1}$	T1 reg. ratio $_{t-1}$	Total reg. ratio $_{t-1}$	Equity acc. effect $_{t-1}$	Bank size	Asset div.	Loan sh.	Safety net	Portf. risk
ROE	1														
ROA	0.64	1													
RAROC	0.93	0.62	1												
Efficiency	0.4	0.4	0.5	1											
Capital ratio $_{t-1}$	0.08	0.76	0.15	0.19	1										
T1/Tang. Assets $_{t-1}$	0.05	0.72	0.09	0.17	0.98	1									
T1/TA w. OBS $_{t-1}$	0.08	0.75	0.13	0.21	0.97	0.99	1								
T1 reg. Ratio $_{t-1}$	0.07	0.22	0.31	0.34	0.42	0.42	0.45	1							
Total reg. Ratio $_{t-1}$	0.10	-0.08	0.22	0.21	-0.03	0.002	0.02	0.70	1						
Equity acc. effect $_{t-1}$	0.03	0.13	0.05	0.12	0.17	0.17	0.17	0.17	0.25	1					
Bank size	-0.28	-0.68	-0.27	-0.38	-0.68	-0.72	-0.77	-0.41	-0.13	-0.16	1				
Asset div.	0.26	0.75	0.26	0.42	0.77	0.78	0.79	0.26	-0.11	0.11	-0.61	1			
Loan sh.	0.01	0.60	0.02	0.46	0.75	0.79	0.80	0.32	-0.04	0.16	-0.65	0.82	1		
Safety net	-0.34	-0.40	-0.39	-0.69	-0.23	-0.25	-0.33	-0.37	-0.19	-0.11	0.56	-0.39	-0.32	1	

Portfolio risk	0.06	0.72	-0.04	0.1	0.84	0.87	0.86	-0.004	-0.29	0.13	-0.68	0.75	0.80	-0.18	1
Liquidity ratio	-0.04	0.12	0.02	0.18	0.26	0.31	0.35	0.52	0.33	0.13	-0.40	0.24	0.36	-0.46	0.15

Table 3 : Bank capital and ROE

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	0.586				
	(0.464)				
T1/Tang. Assets $_{t-1}$		0.856*			
		(0.460)			
T1/TA with OBS $_{t-1}$			1.502**		
			(0.588)		
T1 reg. ratio $_{t-1}$				0.794**	
				(0.334)	
Total reg. ratio $_{t-1}$					0.540**
					(0.242)
Equity accounting effect $_{t-1}$	-0.021**	-0.021*	-0.023**	-0.024**	-0.022*
	(0.010)	(0.011)	(0.011)	(0.012)	(0.012)
Asset div.	0.260*	0.251*	0.245*	0.268**	0.262*
	(0.152)	(0.142)	(0.138)	(0.135)	(0.136)
Loan share	-0.244*	-0.257*	-0.277**	-0.309**	-0.273**
	(0.139)	(0.131)	(0.128)	(0.130)	(0.130)
Safety net	0.135	0.172	0.162	0.141	0.141
	(0.141)	(0.129)	(0.130)	(0.128)	(0.129)
Portfolio risk	-0.006	-0.026	-0.027	0.098	0.052
	(0.112)	(0.117)	(0.114)	(0.120)	(0.119)
Liquidity ratio	0.004	0.004	0.003	0.003	0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Constant	0.009	0.004	0.009	-0.050	-0.047
	(0.057)	(0.056)	(0.055)	(0.056)	(0.057)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	45.54	46.11	47.11	47.11	46.83

Table 4: Loan share during the sub period 2002-2007

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. 2002-2007 dummy is a dummy equal to 1 during the sub period 2002-2007 and 0 the rest of the period. Other variables definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	ROE				
	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	0.497				
	(0.388)				
T1/Tang. Assets $_{t-1}$		0.809*			
		(0.426)			
T1/TA with OBS $_{t-1}$			1.496***		
			(0.553)		
T1 reg. ratio $_{t-1}$				0.756**	
				(0.340)	
Total reg. ratio $_{t-1}$					0.563**
					(0.261)
Equity accounting effect $_{t-1}$	-0.024*	-0.025*	-0.027**	-0.026*	-0.025*
	(0.012)	(0.013)	(0.013)	(0.015)	(0.014)
Loan share	-0.103	-0.126	-0.152	-0.104	-0.100
	(0.083)	(0.090)	(0.092)	(0.087)	(0.086)
Loan share × 2002-2007 dummy	-0.078*	-0.078*	-0.077*	-0.082*	-0.079*
	(0.041)	(0.043)	(0.042)	(0.042)	(0.042)
Constant	0.095*	0.091*	0.091*	0.072*	0.055
	(0.049)	(0.047)	(0.046)	(0.041)	(0.040)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	45.16	45.71	46.95	46.81	46.68

Table 5: Bank capital and ROE (without including all control variables)

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Capital ratio $_{t-1}$	0.627	0.814**	0.835**												
	(0.398)	(0.368)	(0.385)												
T1/Tang. Assets $_{t-1}$				0.666*	1.079***	1.067***									
				(0.377)	(0.381)	(0.382)									
T1/TA with OBS $_{t-1}$							1.048**	1.782***	1.768***						
							(0.491)	(0.529)	(0.530)						
T1 reg. ratio $_{t-1}$										0.775***	0.867***	0.902***			
										(0.293)	(0.315)	(0.327)			
Total reg. ratio $_{t-1}$													0.614***	0.669***	0.675***
													(0.225)	(0.241)	(0.246)
Equity accounting effect. $_{t-1}$	-0.025**	-0.025**	-0.025**	-0.024*	-0.025*	-0.025*	-0.025*	-0.027**	-0.027**	-0.026*	-0.025*	-0.025*	-0.025*	-0.024*	-0.024*
	(0.012)	(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.015)	(0.015)	(0.015)	(0.015)	(0.014)	(0.014)
Asset div.															
Loan share		-0.132*	-0.128		-0.158*	-0.160*		-0.183**	-0.184**		-0.126	-0.135		-0.122	-0.126
		(0.079)	(0.082)		(0.083)	(0.085)		(0.085)	(0.087)		(0.082)	(0.084)		(0.081)	(0.082)
Safety net			-0.029			0.014			0.007			0.046			0.021
			(0.076)			(0.075)			(0.075)			(0.076)			(0.076)
Portfolio risk															
Liquidity ratio			-0.001			-0.001			-0.001			-0.002			-0.002
			(0.003)			(0.003)			(0.003)			(0.003)			(0.003)
Constant	0.047*	0.097**	0.105**	0.040	0.093**	0.091*	0.036	0.094**	0.094*	0.024	0.073*	0.063	0.006	0.052	0.049
	(0.025)	(0.048)	(0.050)	(0.026)	(0.046)	(0.050)	(0.025)	(0.045)	(0.050)	(0.021)	(0.041)	(0.047)	(0.026)	(0.041)	(0.048)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135
N. of banks	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
Adj. R^2 (%)	42.47	43.80	42.77	42.34	44.35	43.19	42.75	45.44	44.45	43.83	45.17	44.31	43.96	45.17	44.17

Table 6: Bank capital with two-year lag and ROE

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. *Capital ratio, T1/Tang. Assets, T1/TA with OBS, T1 reg. ratio* and *Total reg. ratio* are two years lags. Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-2}$	1.080**				
	(0.447)				
T1/Tang. Assets $_{t-2}$		1.354***			
		(0.477)			
T1/TA with OBS $_{t-2}$			2.202***		
			(0.611)		
T1 reg. ratio $_{t-2}$				0.892**	
				(0.360)	
Total reg. ratio $_{t-2}$					0.473*
					(0.242)
Equity accounting effect $_{t-1}$	-0.019*	-0.019*	-0.020*	-0.021*	-0.019*
	(0.010)	(0.011)	(0.011)	(0.012)	(0.011)
Asset div.	0.201	0.193	0.162	0.256*	0.264*
	(0.146)	(0.133)	(0.133)	(0.133)	(0.141)
Loan share	-0.212	-0.249*	-0.274**	-0.328**	-0.286**
	(0.134)	(0.127)	(0.125)	(0.135)	(0.132)
Safety net	0.102	0.119	0.085	0.098	0.124
	(0.135)	(0.127)	(0.128)	(0.130)	(0.136)
Portfolio risk	-0.050	-0.034	-0.029	0.119	0.058
	(0.116)	(0.116)	(0.112)	(0.123)	(0.123)
Liquidity ratio	0.003	0.002	0.001	0.002	0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.039	0.029	0.048	-0.037	-0.032
	(0.056)	(0.055)	(0.057)	(0.057)	(0.057)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	46.97	47.54	49.11	47.97	46.40

Table 7: Bank capital one-year and two-year lags included

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	-0.510				
	(0.896)				
Capital ratio $_{t-2}$	1.525*				
	(0.905)				
T1/Tang. Assets $_{t-1}$		-0.352			
		(0.888)			
T1/Tang. Assets $_{t-2}$		1.654*			
		(0.911)			
T1/TA with OBS $_{t-1}$			-0.076		
			(0.977)		
T1/TA with OBS $_{t-2}$			2.262**		
			(1.031)		
T1 reg. ratio $_{t-1}$				0.276	
				(0.502)	
T1 reg. ratio $_{t-2}$				0.694	
				(0.535)	
Total reg. ratio $_{t-1}$					0.388
					(0.407)
Total reg. ratio $_{t-2}$					0.184
					(0.408)
Sum of lag coefficients	1.015**	1.302***	2.186***	0.970**	0.572**
	(0.455)	(0.486)	(0.628)	(0.372)	(0.256)
Test for all lags=0	3.12**	4.12**	6.48***	3.42**	2.54*
p-value	0.049	0.019	0.002	0.037	0.085
Equity accounting effect $_{t-1}$	-0.016	-0.018	-0.020*	-0.023*	-0.021*
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Asset div.	0.193	0.188	0.161	0.255*	0.260*
	(0.139)	(0.130)	(0.132)	(0.134)	(0.140)
Loan share	-0.210	-0.250*	-0.274**	-0.329**	-0.279**
	(0.133)	(0.128)	(0.125)	(0.135)	(0.130)
Safety net	0.102	0.105	0.083	0.104	0.132
	(0.135)	(0.124)	(0.129)	(0.131)	(0.139)
Portfolio risk	-0.049	-0.025	-0.028	0.122	0.056
	(0.116)	(0.115)	(0.112)	(0.123)	(0.123)
Liquidity ratio	0.003	0.002	0.001	0.003	0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.041	0.031	0.049	-0.045	-0.045
	(0.056)	(0.055)	(0.058)	(0.058)	(0.058)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	46.54	46.98	48.56	47.55	46.26

Table 8: Bank capitalization interacted with growth of paid-up capital variables

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. *Growth of paid-up capital* is the lagged value of growth of paid-up capital and *Growth of paid-up capital dummy* is a dummy equal to 1 when *Growth of paid-up capital* is positive and 0 otherwise. Other variable definitions appear in table 1. Models (1) to (5) include the variable *Growth of paid-up capital*. Models (6) to (10) include the variable *Growth of paid-up capital dummy*. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Capital ratio $_{t-1}$	0.625					0.555				
	(0.467)					(0.459)				
Capital ratio $_{t-1}$×Growth of paid-up capital $_{t-1}$	0.706									
	(1.170)									
Capital ratio $_{t-1}$×Growth of paid-up capital dummy $_{t-1}$						-0.410				
						(0.293)				
T1/Tang. Assets $_{t-1}$		0.883*					0.818*			
		(0.467)					(0.449)			
T1/Tang. Assets $_{t-1}$×Growth of paid-up capital $_{t-1}$		1.330								
		(1.414)								
T1/Tang. Assets $_{t-1}$×Growth of paid-up capital dummy $_{t-1}$							-0.258			
							(0.294)			
T1/TA with OBS $_{t-1}$			1.529**					1.375**		
			(0.597)					(0.586)		
T1/TA with OBS $_{t-1}$×Growth of paid-up capital $_{t-1}$			0.922							
			(1.426)							
T1/TA with OBS $_{t-1}$×Growth of paid-up capital dummy $_{t-1}$								-0.172		
								(0.292)		
T1 reg. ratio $_{t-1}$				0.738**					0.490*	
				(0.341)					(0.297)	
T1 reg. ratio $_{t-1}$×Growth of paid-up capital $_{t-1}$				-0.043						
				(0.369)						
T1 reg. ratio $_{t-1}$×Growth of paid-up capital dummy $_{t-1}$									0.347	
									(0.253)	
Total reg. ratio $_{t-1}$					0.526**					0.464
					(0.240)					(0.327)

(Continued)

Table 8 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Total reg. ratio $_{t-1}$ × Growth of paid-up capital $_{t-1}$					0.038					
					(0.247)					
Total reg. ratio $_{t-1}$ × Growth of paid-up capital dummy $_{t-1}$										0.031
										(0.366)
Growth of paid-up capital $_{t-1}$	-0.023	-0.046	-0.024	0.005	-0.003					
	(0.037)	(0.048)	(0.037)	(0.018)	(0.023)					
Growth of paid-up capital dummy $_{t-1}$						0.035	0.025	0.020	-0.018	0.010
						(0.021)	(0.019)	(0.017)	(0.023)	(0.045)
Equity accounting effect $_{t-1}$	-0.023**	-0.022*	-0.024**	-0.023*	-0.021*	-0.021**	-0.021*	-0.022**	-0.023*	-0.020*
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)	(0.009)	(0.011)	(0.011)	(0.011)	(0.011)
Asset div.	0.270*	0.266*	0.257*	0.269*	0.265*	0.254*	0.244*	0.241*	0.261**	0.258*
	(0.159)	(0.148)	(0.144)	(0.139)	(0.138)	(0.144)	(0.136)	(0.134)	(0.130)	(0.131)
Loan share	-0.249*	-0.263*	-0.283**	-0.304**	-0.276**	-0.247*	-0.259**	-0.276**	-0.325**	-0.277**
	(0.142)	(0.133)	(0.130)	(0.132)	(0.134)	(0.138)	(0.130)	(0.127)	(0.138)	(0.136)
Safety net	0.131	0.178	0.169	0.144	0.142	0.135	0.164	0.160	0.153	0.146
	(0.142)	(0.133)	(0.134)	(0.133)	(0.132)	(0.140)	(0.127)	(0.128)	(0.131)	(0.127)
Portfolio risk	0.004	-0.010	-0.017	0.091	0.049	0.008	-0.020	-0.023	0.099	0.045
	(0.114)	(0.118)	(0.116)	(0.123)	(0.122)	(0.111)	(0.115)	(0.112)	(0.120)	(0.126)
Liquidity ratio	0.004	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.004	0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	0.004	-0.008	0.000	-0.049	-0.046	-0.010	-0.004	0.002	-0.032	-0.046
	(0.060)	(0.059)	(0.058)	(0.058)	(0.059)	(0.060)	(0.056)	(0.056)	(0.052)	(0.062)
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135	135	135	135	135	135
N. of banks	17	17	17	17	17	17	17	17	17	17
Adj. R^2 (%)	44.65	45.53	46.25	45.82	45.53	46.25	46.25	46.98	47.27	46.69

Table 9: Efficiency and bank capital

This table reports estimates of the fixed effect regressions at the bank level of the ratio of net operating income over administrative expenses on bank capital and a set of independent variables over the period 1993-2012. Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. *** denotes statistical significance respectively at 1%

	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	11.854***				
	(2.523)				
T1/Tang. Assets $_{t-1}$		12.607***			
		(2.854)			
T1/TA with OBS $_{t-1}$			19.575***		
			(3.330)		
T1 reg. ratio $_{t-1}$				8.819***	
				(1.664)	
Total reg. ratio $_{t-1}$					5.192***
					(1.267)
Asset div.	0.186	0.233	0.224	0.605	0.577
	(0.820)	(0.763)	(0.742)	(0.751)	(0.767)
Loan share	1.292	0.971	0.706	0.358	0.752
	(0.891)	(0.904)	(0.856)	(0.861)	(0.950)
Safety net	-1.096	-0.421	-0.516	-0.786	-0.802
	(0.751)	(0.737)	(0.715)	(0.744)	(0.826)
Portfolio risk	-0.592	-0.620	-0.555	0.957	0.482
	(0.760)	(0.826)	(0.808)	(0.795)	(0.861)
Liquidity ratio	-0.008	-0.009	-0.011	-0.015	-0.013
	(0.028)	(0.028)	(0.026)	(0.031)	(0.032)
Constant	1.128***	0.952**	0.972***	0.274	0.377
	(0.381)	(0.384)	(0.368)	(0.403)	(0.436)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	132	132	132	132	132
N. of banks	17	17	17	17	17
Adj. R^2 (%)	90.26	89.86	90.64	90.07	89.23

Table 10: Bank capital and ROE with all independent variables lagged

This table reports estimates of the fixed effect regressions at the bank level of ROE on a set of independent variables over the period 1993-2012. *Asset div.*, *Loan share*, *Safety net*, *Portfolio risk* and *Liquidity ratio* are one year lagged variables**.** Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%.

	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	0.750**				
	(0.341)				
T1/Tang. Assets $_{t-1}$		0.925**			
		(0.436)			
T1/TA with OBS $_{t-1}$			1.528**		
			(0.582)		
T1 reg. ratio $_{t-1}$				0.990***	
				(0.312)	
Total reg. ratio $_{t-1}$					0.687***
					(0.245)
Equity accounting effect $_{t-1}$	-0.028**	-0.028**	-0.030**	-0.033**	-0.030**
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
Asset div. $_{t-1}$	0.075	0.075	0.077	0.079	0.064
	(0.110)	(0.115)	(0.112)	(0.112)	(0.113)
Loan share $_{t-1}$	-0.157	-0.176	-0.200	-0.236	-0.197
	(0.146)	(0.148)	(0.148)	(0.146)	(0.145)
Safety net $_{t-1}$	-0.019	0.016	0.002	-0.024	-0.028
	(0.090)	(0.097)	(0.097)	(0.093)	(0.091)
Portfolio risk $_{t-1}$	0.058	0.049	0.058	0.217	0.171
	(0.148)	(0.163)	(0.156)	(0.154)	(0.154)
Liquidity ratio $_{t-1}$	0.004	0.004	0.003	0.003	0.003
	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	0.057	0.047	0.050	-0.032	-0.031
	(0.072)	(0.076)	(0.075)	(0.073)	(0.072)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	40.98	41.13	42.12	43.41	42.84

Table 11: Bank capital and ROA

This table reports estimates of the fixed effect regressions at the bank level of ROA on a set of independent variables over the period 1993-2012. Variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	0.096***				
	(0.023)				
T1/Tang. Assets $_{t-1}$		0.095***			
		(0.029)			
T1/TA with OBS $_{t-1}$			0.152***		
			(0.035)		
T1 reg. ratio $_{t-1}$				0.068***	
				(0.016)	
Total reg. ratio $_{t-1}$					0.041***
					(0.012)
Asset div.	0.007	0.008	0.008	0.010**	0.010*
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Loan share	-0.007	-0.009*	-0.012**	-0.014**	-0.011*
	(0.005)	(0.006)	(0.005)	(0.005)	(0.006)
Safety net	0.001	0.006	0.005	0.003	0.003
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Portfolio risk	0.002	0.002	0.002	0.014**	0.010*
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Liquidity ratio	0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.003	-0.004	-0.004	-0.010***	-0.009**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	78.14	77.01	78.28	77.43	76.30

Table 12: Bank capital and RAROC

This table reports estimates of the fixed effect regressions at the bank level of *Risk-adjusted Return on Capital* (RAROC) on a set of independent variables over the period 1993-2012. RAROC is computed as Net profit over 8% of RWA. Other variable definitions appear in table 1. Hubert/White heteroscedasticity robust standard-errors are reported into brackets. ***, ** and * denote statistical significance respectively at 1%, 5% and 10%

	RAROC				
	(1)	(2)	(3)	(4)	(5)
Capital ratio $_{t-1}$	1.647**				
	(0.683)				
T1/Tang. Assets $_{t-1}$		1.802***			
		(0.624)			
T1/TA with OBS $_{t-1}$			2.831***		
			(0.784)		
T1 reg. ratio $_{t-1}$				1.462***	
				(0.391)	
Total reg. ratio $_{t-1}$					0.765**
					(0.330)
Asset div.	0.363*	0.371*	0.367*	0.353*	0.376**
	(0.215)	(0.200)	(0.196)	(0.185)	(0.188)
Loan share	-0.398**	-0.448**	-0.482***	-0.397**	-0.381**
	(0.178)	(0.171)	(0.170)	(0.167)	(0.174)
Safety net	0.151	0.240	0.228	0.282*	0.250
	(0.187)	(0.162)	(0.159)	(0.147)	(0.160)
Liquidity ratio	0.004	0.004	0.003	0.001	0.002
	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
Constant	-0.059	-0.084	-0.079	-0.122*	-0.122*
	(0.071)	(0.067)	(0.068)	(0.070)	(0.072)
Year effects	Yes	Yes	Yes	Yes	Yes
Observations	135	135	135	135	135
N. of banks	17	17	17	17	17
Adj. R^2 (%)	52.82	52.40	53.66	53.52	51.00

Figure A: Linear adjustment between ROE and one year lagged Capital ratio

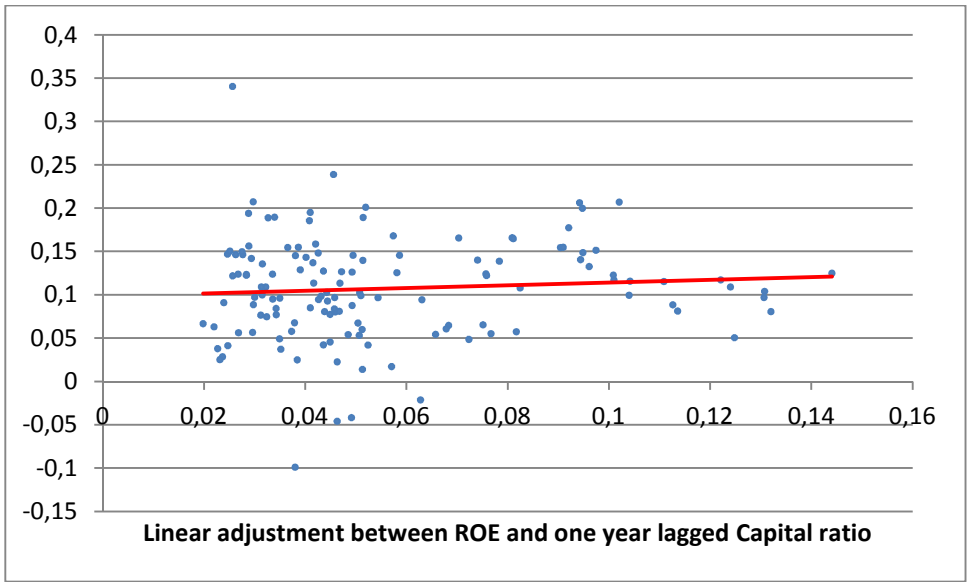


Figure B: Linear adjustment between ROA and one year lagged Capital ratio

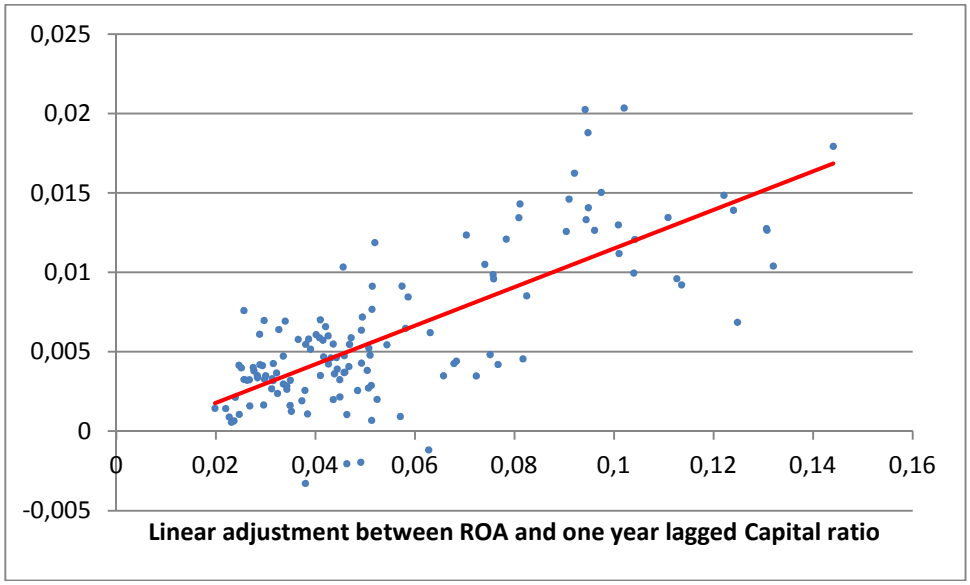


Figure C: Linear adjustment between ROE and one year lagged Tier1 regulatory ratio

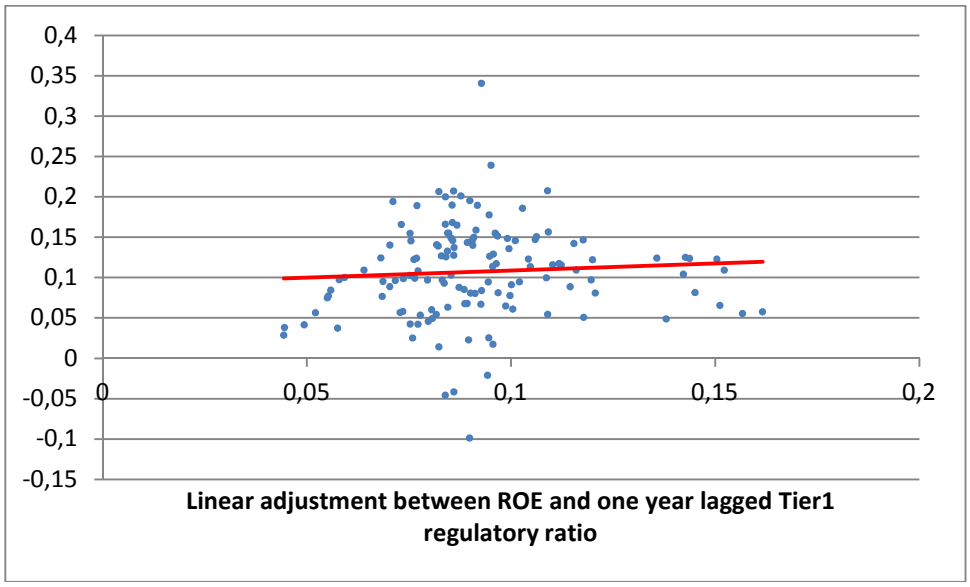


Figure D: Linear adjustment between ROE and one year lagged Tier1 regulatory ratio

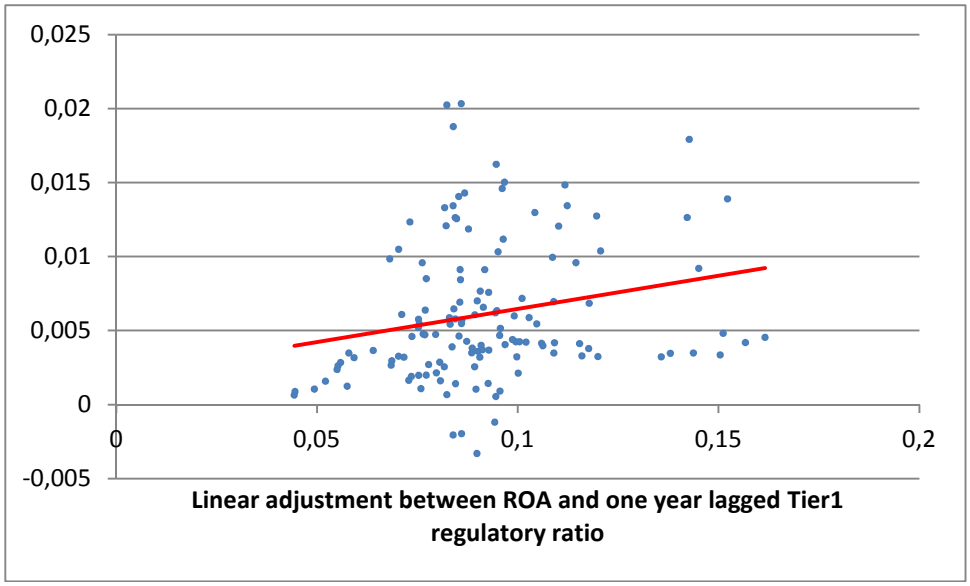
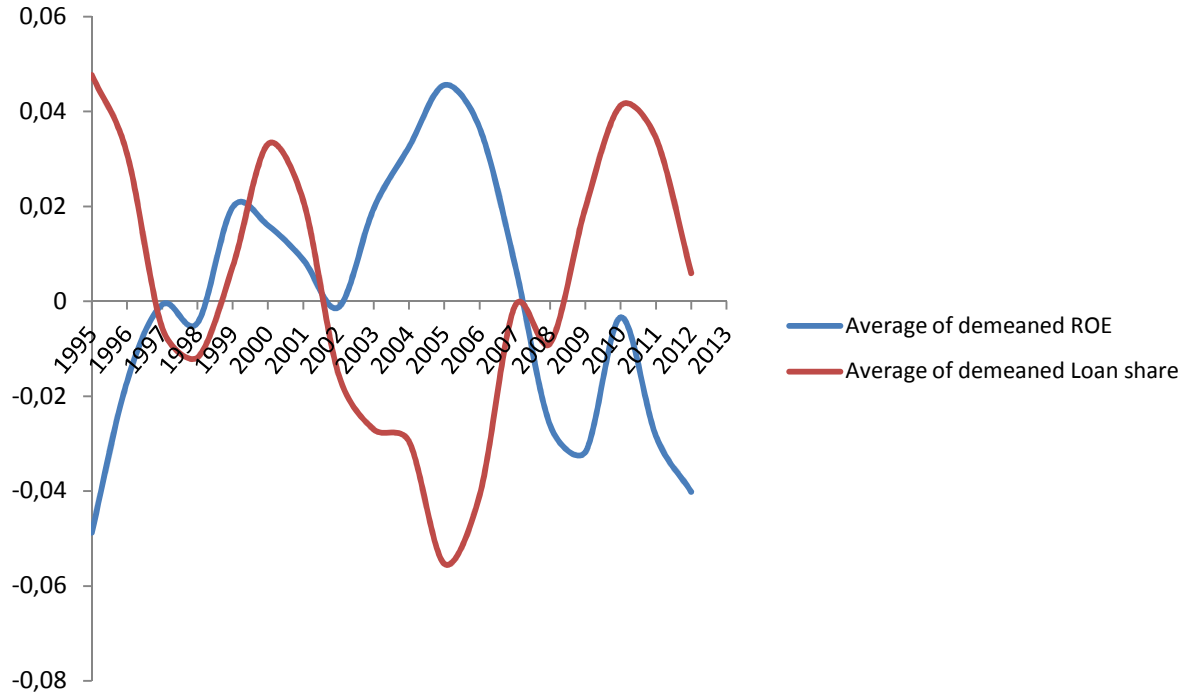


Figure E: Within bank evolution of ROE and Loan share over 1995-2012.



This figure graphs the evolution of the average demeaned *ROE* and average demeaned Loan *share* variables over the sample period. The demean *ROE* (*Loan share*) is computed as the *ROE* (*Loan share*) in a given year for a given bank minus the bank's *ROE* (*Loan share*) over the period.

Débats Économiques et Financiers

1. M. Dietsch and H. Fraisse, « De combien le capital réglementaire diffère-t-il du capital économique : le cas des prêts aux entreprises par les grands groupes en France », Février 2013.

2. O. de Bandt, N. Dumontaux, V. Martin et D. Médée, « Mise en œuvre de stress tests sur les crédits aux entreprises» Mars 2013

3. D. Nouy, « Les risques du Shadow banking en Europe : le point de vue du superviseur bancaire », Avril 2013.

4. L. Frey, S. Tavolaro, S. Viol, « Analyse du risque de contrepartie de la réassurance pour les assureurs français », Avril 2013

5. D. Nouy, « La réglementation et la supervision bancaire dans les 10 prochaines années et leurs effets inattendus », Mai 2013.

6. O. de Bandt, J-C. Héam, C. Labonne et S. Tavolaro, « Mesurer le risque systémique suite à la crise financière », Juin 2013

7. B. Camara, L. Lepetit, et A. Tarazi, « Capital Initial, Changements par Composantes du Capital Réglementaire et Risques Bancaires», Juin 2013

8. M. Brun, H. Fraisse, D. Thesmar, «Les effets réels des exigences en fonds propres», Aout 2013

9. M. Lé, «Mise en place d'un mécanisme de garantie des dépôts et risque bancaire : le rôle du levier financier », Décembre 2013

10. S. Tavolaro et F. Visnovsky, « Une analyse de la mesure SRISK comme outil de supervision », Janvier 2014

11. O. de Bandt, B. Camara, P. Pessarossi and M. Rose, « Changements réglementaires et coût des fonds propres : résultats sur les banques françaises », Mars 2014

12. O. de Bandt, B. Camara, P. Pessarossi et M. Rose, « Est-ce que la structure du capital affecte la profitabilité des banques ? Quelques résultats avant et après la crise financière pour les banques significatives en France », Mars 2014

Economic and Financial Discussion Notes

1. M. Dietsch and H. Fraisse, “How different is the regulatory capital from the economic capital: the case of business loans portfolios held by major banking groups in France”, February 2013

2. O. de Bandt, N. Dumontaux, V. Martin and D. Médée, “Stress-testing banks’ corporate credit portfolio”, March 2013

3. D. Nouy, « The risks of the Shadow banking system in Europe: the perspective of the banking supervisor », April 2013.

4. L. Frey, S. Tavolaro, S. Viol, « Counterparty risk from re-insurance for the French insurance companies», April 2013

5. D. Nouy, « Banking regulation and supervision in the next 10 years and their unintended consequences », May 2013.

6. O. de Bandt, J-C. Héam, C. Labonne and S. Tavolaro, « Measuring Systemic Risk in a Post-Crisis World », Juin 2013

7. B. Camara, L. Lepetit, and A. Tarazi, « Ex ante capital position, changes in the different components of regulatory capital and bank risk », Juin 2013

8. M. Brun, H. Fraisse, D. Thesmar, « The Real Effects of Bank Capital Requirements », August 2013

9. M. Lé, « Deposit Insurance Adoption and Bank Risk-Taking: the Role of Leverage », December 2013

10. S. Tavolaro and F. Visnovsky, « What is the information content of the SRISK measure as a supervisory tool ? », January 2014

11. O. de Bandt, B. Camara, P. Pessarossi et M. Rose, « Regulatory changes and the cost of equity: evidence from French banks », March 2014

12. O. de Bandt, B. Camara, P. Pessarossi et M. Rose, « Does the capital structure affect banks’ profitability? Pre- and post-financial crisis evidence from significant banks in France », March 2014

ACPR
BANQUE DE FRANCE

61, rue Taitbout
75009 Paris
Téléphone : 01 49 95 40 00
Télécopie : 01 49 95 40 48
Site internet : www.acpr.banque-france.fr