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INTRODUCTORY CHAPTER

Due to the vital role they play in the economy and the systemic risk their failure poses, it is no surprise that banking institutions are subject to so many constraints and regulations compared to non-financial firms. Banks are considered as the heart maintaining the blood supply of modern economies. Indeed, they centralize savers' money and manage the means of payments and inject the savings back into the economy by providing funds to investors. Hence, in order to maintain the stability of banking institutions, they have been subject to a wide range of regulations among which, at the international level, the minimum capital requirements since the 1988 Basel accord, the so-called Basel I. The performance as well as the deficiencies of these Basel minimum capital requirements, and how these shortcomings could be addressed are at the core of our thesis. This introductory chapter gives an overview of the main objectives of the subsequent Basel accords and the key shortcomings that were behind the transitions from Basel I to the current Basel III. It also highlights where our thesis makes a contribution and finally, it gives the summary of each one of the three chapters which constitute the core of our thesis.

Bank capital regulation from Basel I to Basel III: an overview

Our aim here is to briefly outline the major objectives that were (and still are) at the core of the subsequent Basel capital accords and the main failures that motivated the move from one accord to the next.

Basel I: the first international minimum capital requirement

Two main aims were assigned to the 1988 Basel capital accord, broadly known as Basel I, which was the first regulatory framework for banks at the international level (BCBS[1], 1988). The two stated main objectives of the initiative were: to strengthen the soundness and stability of the international banking system and, to create a level playing field among international banks by diminishing existing sources of competitive inequality. To achieve

[1] BCBS stands for Basel Committee on Banking Supervision.

these goals, international banks were required to hold Tier 1 and Total capital risk weighted ratios at least equal to 4% and 8% respectively[2].

Although the Accord is acclaimed for having been the first to create a worldwide benchmark for banking regulation[3], its design was far from being perfect due to its several deficiencies. First, the Accord focused only on credit risk and other kinds of risks were left to the purview of national regulators[4]. Second and more importantly, the idea of assigning risk and the corresponding regulatory capital following the identity of the borrower quickly revealed its failures. In fact, Basel I was based on four risk "buckets" associated with 0, 20, 50, and 100% risk weights; the last risk "bucket" being the largest as it concerns all claims on the private sector. It turned out that banks could reap higher profits by seeking the riskiest borrower in the same risk-weight band as they could charge a higher borrowing cost without incurring a higher capital burden. This problem became known as the "regulatory arbitrage" [5].

Hence, this lack of granularity and the regulatory arbitrage that followed sparked off the need to revise the 1988 Basel I accord. In this perspective, the first consultative paper (CP) was issued in June 1999 and two others followed before the final proposal was published five years later, in June 2004. The final regulatory framework, the so-called Basel II, was published in June 2006 after three quantitative impact studies (QIS) were performed to ensure that the global level of regulatory capital in the banking system remained sufficient (BCBS, 2006).

Basel II: two additional pillars alongside the minimum capital requirement

Basel II introduces two main innovations compared to Basel I that can be highlighted here. First, it is founded on the idea of looking, not at the identity of the borrower, but at its

[2] Tier 1 capital comprises equity capital and published reserves from post-tax retained earnings. Total capital is the sum of the Tier 1 and the supplementary capital also called Tier 2 that must not exceed 100% of Tier 1. Tier 2 comprises undisclosed reserves, revaluation reserves, general provisions, hybrid debt capital instruments and subordinated debt with a minimum original term maturity of over 5 years and only a maximum of 50% of Tier 1 can be included in Tier 2.

[3] Designed originally for internationally active banks of the G10 countries, it became the basis of the inspiration for banking regulations in more than 100 countries and was often imposed on national banks as well.

[4] Later on, market risk was included in the accord with the 1996 Amendment but other main risks such as operational risk, reputation risk, strategic risk, liquidity risk remained uncovered.

[5] See the seminal paper on this issue by Jones (2000).

rating and therefore, beyond being much more granular, Basel II is concerned with the borrower inherent risk instead of its identity[6]. Hence, on top of the two stated objectives of Basel I, Basel II aims to promote the adoption of more stringent practices in risk management. This is embedded in the so-called Pillar 1. Second, by adding two additional pillars (Supervisory review -Pillar 2- and Market discipline -Pillar 3) alongside the traditional focus on minimum capital requirement, Basel II acknowledges explicitly the importance of their complementary use in bank capital regulation[7]. This addition highlights that any rules-based approach will inevitably lag behind the rapid changing of banking activities and will fail to take into account the new risks involved.

The first and much documented Pillar 1 (Minimum Capital Requirements) of Basel II lays down how risk should be measured in order to compute the corresponding regulatory capital. In a nutshell, there are two fundamental methodologies, the first being the Standardised Approach (SA) where external agencies (such as Moody's, Standard & Poor's or Fitch) rate the borrower and the bank uses those inputs to compute the regulatory capital[8]. The second and very important approach is the Internal Ratings-based Approach that allows banks to use their internal rating systems for credit risk. It is divided into two broad approaches: Foundation Internal Ratings-based Approach (F-IRB) and the Advanced Internal Ratings-based Approach (A-IRB). In the F-IRB, the bank calculates the main input, the borrower's probability of default (PD) and relies on the supervisor's other three inputs, which are the loss given default (LGD), the exposure at default (EAD) and the maturity (M). By contrast, all four parameters are the bank's inputs in the A-IRB[9].

The second Pillar deals with the appropriate actions the supervisor should take if he is not satisfied with the bank's own risk assessment. For instance, he may call for the bank that does not meet the requirements to raise additional capital immediately or prepare and implement a satisfactory capital-adequacy restoration plan.

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[6] The passage of Basel I to Basel II left the numerator (capital measure) unchanged. The denominator however was completely modified with the inclusion, among other things, of the operational risk and extensive reliance on complex formulas to determine the risk weighted assets. The level of sophistication of Basel II can be seen just by looking at the document's size (333 pages) by comparison with the 1988 text (25 pages) and the number of years of discussions before the final document was adopted by the Basel Committee (7 years vs. 5 months).

[7] Although for the first time in international capital regulation, supervision and market discipline are placed at the same point of the hierarchy as the regulatory minimum, the focus of the Basel committee's attention seems to remain on the latter. Indeed, 191, 21 and 15 pages are respectively devoted to Pillars 1, 2 and 3 in the Basel II document (BCBS, 2006). On this imbalanced treatment, see Rochet (2004).

[8] All non rated claims under the Standardized Approach of Basel II receive 100% risk-weight as under Basel I.

[9] Throughout this thesis, by Basel II we will refer to this Internal Ratings-based Approach which allows banks to entirely control the inputs used to compute the regulatory capital requirement.

The third Pillar explains how and what information banks should disclose to the market. The idea is to impose more transparency on banks as it is a necessary condition for the market to be effective in its monitoring. Hence, banks are required to give information on, among other things, the composition of their regulatory capital and risk exposures.

However, as far as Pillar 1 is concerned, the valuable goal of using more sophisticated, highly risk sensitive, internal models of banks, to compute the regulatory capital requirement is not without cost. It entails new risks, the obvious one being the so-called model risk[10] especially due to imperfect information and incentives incompatibility. Moreover the issue of the procyclicality of regulatory capital[11] and the systemic risk dimension - the macroprudential overlay - were lacking in the Basel II accord which was solely designed at the bank level.

The eruption of the subprime crisis mid-2007 and its aftermath turned the spotlight on the shortcomings of Basel II. For instance, it was striking to see amidst the crisis that banks which experienced difficulties because they were excessively leveraged had risk-adjusted capital ratios well beyond the regulatory minimum capital requirements. As a result, discussions in response to these deficiencies in the Basel II framework were engaged. The outcome of these discussions was materialized by the release, in December 2010[12], of the Basel III document (BCBS, 2010).

Basel III and the introduction of the leverage ratio constraint

The stated objective of this new regulatory framework is to strengthen global capital and liquidity rules with the goal of promoting a more resilient banking sector. It is important to highlight that Basel III builds on the three pillars of the Basel II framework[13] to which it

[10] Hildebrand (2008) terms this model risk: risk about risk assessments or unknowanable unknows.

[11] Procyclicality, i.e capital requirements increase (decrease) during a downturn (upturn), is considered as an issue because it is likely to exacerbate the economic downturn. In fact, if banks' capital requirements increase in a recession when building reserves from decreasing profits or raising fresh capital is difficult, banks would have to reduce their lending activities and this credit squeeze would add to the downturn. This would exacerbate the recession, thus setting in motion an undesirable vicious circle that might ultimately have an adverse macroeconomic effect on the economy.

[12] The Basel III document was revised in June 2011.

[13] The passage of Basel II to Basel III leaves the denominator of the risk-weighted capital ratio globally unchanged but it completely modifies the numerator by raising the quality and the quantity of regulatory capital.

adds several new aspects. Among these, Basel III introduces the leverage ratio constraint, in which we are interested. Two objectives are pursued by its introduction. First, at microeconomic level, it is expected to supplement the more complex risk-based capital ratio of Basel II and should act as a safeguard against model risk and measurement error. Second, at macroeconomic level, it seeks to limit the leverage in the banking sector during boom times which will mitigate the risk of deleveraging during the bust and the spillover effect it entails. Several other new elements can be highlighted. For instance, the introduction of two new minimum capital ratios: conservation and countercyclical buffers in the macroprudential overlay to mitigate procyclicality and systemic risk. Basel III also introduces for the first time two minimum regulatory liquidity ratios: the short term liquidity coverage ratio (LCR) and the long-term net stable funding ratio (NSFR). Other new elements are still on the agenda (Wellink, 2011); notably concerning how to address the systemic risk and interconnectedness issues arising from the shadow banking system and Global Systemically Important Financial Institutions (G-SIFIs)[14].

After this overview of how the international Basel capital accord evolved from the first 1988 regulatory framework up to the current Basel III which is still to be finalised, we lay down the contribution of our thesis.

[14] The inclusion of off-balance sheet elements in the new leverage ratio constraint is considered as an indirect way to dampen the leverage resulting from the mutual exposure between classic banks and shadow banks (Walter, 2011). However, direct measures are still to be decided. Ongoing discussions are currently around, among other things, imposing capital surcharges, contingent capital and bail-in debt on the G-SIFIs (See BCBS, 2010, p.7).

Contribution and structure of our thesis

Following the overview above, our thesis asks and tries to answer the following related questions. First, how effective are the Basel minimum capital requirements? A recent study by Gropp and Heider (2010) casts doubt on the importance of the minimum capital requirements by showing that banks build their capital similarly to unregulated non-financial firms. Second, can market discipline complement the minimum capital requirements? And thirdly, why does the complex risk-adjusted capital ratio à la Basel II need the simple leverage ratio constraint?

This dissertation consists of three self-contained[15] papers presented in three chapters outlined hereafter. Chapter 1 analyzes empirically the impact of formal minimum capital requirements on bank capital structure by systematically comparing the persistence and convergence of the unregulated and regulated bank capital ratios. Chapter 2 investigates empirically the role market discipline plays in banks' capital buffer build up and its contributions in conjunction with the minimum capital requirements constraints. In this perspective, it formally distinguishes both debt holders according to their status in case of bank liquidation and banks by their degree of involvement in complex activities badly taken into account in the capital regulation. Chapter 3 offers a theoretical rationale of the recent introduction of the leverage ratio constraint alongside the more complex risk-adjusted capital ratio in the Basel III package.

Chapter 1: How effective are the minimum capital requirements constraints? Evidence from the comparative persistence and convergence of bank leverage and risk-adjusted capital ratios

In their investigation of the determinants of bank capital structure, Gropp and Heider (2010) dismiss the role of minimum capital requirements and suggest that banks may behave in a similar way to non-financial firms. This chapter aims at assessing this claim. It asks whether banks manage differently their regulated risk-adjusted capital ratios and unregulated leverage ratio. If they do, it also tries to identify factors that may be responsible for that different treatment.

[15] At the exception of the presentation of the sample common to our empirical studies which will be given once in this dissertation.

Unlike the risk-based capital ratios that are formally under capital regulation at international level with specified minimum thresholds to be respected, there is no formal minimum required for the leverage ratio in Europe. Building on this difference, we use a sample of European commercial banks over the period of 1992-2006 and we study bank capital structure focusing on the comparative persistence and convergence of these capital ratios. We infer the role of bank minimum capital requirements from any difference that may result from this comparison exercise. Moreover, this approach allows us to uncover factors that impact differently the formally regulated and unregulated capital ratios. We mainly find that, by specifying minimum regulatory capital requirements, the Basel accords foster market discipline which acts as a watchdog of the rules and ultimately explains the relatively rapid convergence of the risk-adjusted capital ratios towards the target ratios compared to that of the simple leverage ratio. Our results are thus broadly supportive of the specification of the minimum leverage ratio constraint in the Basel III package.

Chapter 2: The role of market discipline on bank capital buffer: Evidence from a sample of European banks

Chapter 2 deals with the determinants of bank capital buffer focusing on the role of market discipline. In this chapter, we depart from the fact that banks usually hold capital ratios higher than the minimum capital requirements constraints. We ask three interlinked questions. First, do uninsured debt holders taken globally pressure banks to hold capital buffers? If they do, can we determine if among those market participants, junior debt holders that are highly exposed to losses in the event of bank failure, exert a higher pressure than senior debt holders? Finally, do uninsured debt holders taken globally on the one hand and /or, junior and senior debt holders on the other hand, differentiate banks according to the degree of their involvement in non-traditional and hence more complex activities badly taken into account in the capital regulation? More precisely, do they require a higher capital buffer for these activities compared to traditional ones?

To answer these questions, we use a sample of European commercial banks over the period 1992-2006. We show that market discipline significantly and positively affects banks' capital buffer. By distinguishing junior from senior debt holders, we find that both types of investors exert a pressure on banks to hold more capital but that the pressure exerted by junior debt holders is higher. Besides, we show that, on the whole, the market exerts a pressure to hold capital buffer only on banks heavily involved in non-traditional activities but that senior and junior debt holders do not behave similarly. Junior debt holders do not distinguish banks according to their activities and exert a pressure whatever the importance of non-traditional activities. These results might help us to better understand the role of market discipline in complement to capital regulation.

Chapter 3: The supplement of the Leverage Ratio to Basel II as a Bank Discipline Device

In this chapter, we analyze bank portfolio composition under both non risk-based and risk-based capital regulation considered alternately first and then in combination. The objective underlying this investigation is, in the first place, to know whether the power with which Basel II, via its so-called IRB-approach, endows banks by allowing them to use their own internal models to compute the capital requirement is justified. In this perspective, we build a one period portfolio-based theoretical model. We mainly show that risk sensitivity à la Basel II considered alone is flawed if we take into account the fact that banks operate in an environment with imperfect information. Secondly, we analyze the joint effect of the leverage ratio constraint and Basel II. We find that supplementing Basel II with a simple, transparent leverage ratio constraint offers a better outcome in terms of ensuring that banks hold enough capital in line with the risks they take. Hence, we provide a justification for the necessity of a simple leverage ratio along with Basel II.

***

The remainder of the thesis is organized as follows. We start with the consecutive chapters outlined above. Then, the policy implications of our results are discussed in a concluding chapter. Finally, we provide all the references cited in the three chapters in a separate part and give a detailed table of contents at the end of the thesis.

HOW EFFECTIVE ARE THE MINIMUM CAPITAL REQUIREMENTS CONSTRAINTS?

EVIDENCE FROM THE COMPARATIVE PERSISTENCE AND CONVERGENCE OF BANK LEVERAGE AND RISK-ADJUSTED CAPITAL RATIOS

1.1. Introduction

The issue of how firms choose their capital structure has been (and continues to be) extensively studied in the corporate finance literature (Myers, 1984; Welch, 2011 for instance). However, as highlighted by Gropp and Heider (2010), banks are generally excluded from this empirical inquiry because bank capital regulation is often thought to be the most important determinant of bank capital structure. Indeed, since the 1988 Basel accords (known as Basel I), banks are required to hold at least 4% and 8% of their risk-weighted assets respectively in terms of Tier 1 and Total capital. Consistent with the classical assumption that equity is more costly than debt[16], banks are expected to hold capital ratios close to these minimum capital requirements. And yet, it has been widely shown that banks hold not only buffers well beyond the minimum capital requirements, but also that these buffers vary substantially across banks despite the fact that the minimum capital requirements apply uniformly to all banks (see Gropp and Heider, 2010; Angora et al., 2011 for instance). The natural question is therefore whether the minimum capital requirements are important determinants of a bank's capital structure. This is the objective of Gropp and Heider's (2010) paper. To our knowledge, it is the first paper to directly address this question. They investigate whether capital regulation is a first-order determinant of a bank's capital structure. In this perspective, they examine to what extent corporate capital structure determinants explain bank capital structure[17] using the large publicly traded banks in the US and Europe. They establish substantial similarities between banks' and non-financial firms' capital

[16] The assumption that equity is a more expensive form of funding for banks than debts is quite standard in the banking literature. Reasons for the extra premium on banks' equity are for instance due to tax rules, agency costs of equity, and the relative facility in deposit collection (Berger et al., 1995; Repullo and Suarez, 2004; Pelizzon and Schaefer, 2006). However, Hellwig (2010) and Admati et al. (2010) challenge this long held view and argue why this extra cost should not be exaggerated and why it is critical to make a clear distinction between the private and social costs (or benefits) of bank capital.

[17] An earlier paper by Barber and Lyon (1997) is close in spirit to Gropp and Heider (2010)'s paper by investigating if the significant relationship between firm size, book-to-market ratios, and security returns documented by Fama and French (1992) for non-financial firms exists for financial firms. More generally, this approach of taking insights from corporate literature or comparing financial with non-financial firms is not new. We can trace back this approach to Miller (1995) when he investigated if the Modigliani-Miller propositions apply to banks. Morgan (2002), Flannery et al. (2004) and Haggard and Howe (2007) meanwhile study the relative opacity of banks compared to non-financial firms.

structure and hence conclude on the second-order importance that capital regulation plays in determining the bank capital structure[18].

Our paper extends Gropp and Heider’s (2010) study on several aspects and makes the following contributions.

First, we consider a different approach to investigate the role of minimum capital requirements constraints imposed on banks. We proceed by systematically comparing the behaviour of unregulated (leverage ratio) and formally regulated bank capital ratios (risk-adjusted capital ratios). Any difference that may result from this comparison enables us to infer the role of bank capital regulation. Indeed, although Gropp and Heider (2010) refer to the Tier 1 capital ratio, they mainly focus on the banking leverage ratio whereas in Europe there is no formal capital regulation applied to this ratio as opposed to the case of the US where the Prompt Corrective Action (PCA) sets formal minimum requirements on the leverage ratio. For this reason (lack of international minimum requirement constraint on leverage ratio compared to the risk-adjusted capital ratios), the mix of European and US banks may also be questionable. Moreover, given that bank capital regulation treats banks equally, we use a broader sample of European commercial banks instead of considering only large and listed banks. We believe that the exclusion of small and unlisted banks may bias the results or limit the scope of their interpretations.

Second, we take into account the fact that banks play a specific role in the economy which appears in their balance sheet. They have easy access to funds through collecting savers' deposits, issuing debt securities, or borrowing on the inter-bank markets. The collected funds are granted as credits or invested in short-term and long-term risky assets. Moreover, compared to non-financial firms, it is an established fact that banking institutions are highly leveraged. These specificities may affect the way they manage their capital ratios. Thus, we consider bank specific variables in our analysis reflecting the types of their activities and risk taking from the asset side and market pressure emanating from the liability side. Gropp and Heider (2010) recognise that banks’ capital structure may result from the market discipline

[18] Memmel and Raupach (2010) empirically study the dynamics of large German banks' regulatory capital ratios and get results that contradict Gropp and Heider's (2010) denial of the role of capital regulatory thresholds. They show that large German banks have higher speeds of adjustment compared to non-financial firms. They also show that regulatory pressure plays an important role in German banks' control of capital ratios.

pressure which has been emphasized in many studies (Flannery and Sorescu, 1996; Morgan and Stiroh, 2001; Martinez Peria and Schmuckler, 2001; Calomiris and Wilson, 2004; Ashcraft, 2008; Flannery and Rangan, 2008) and yet, the test of this hypothesis is lacking in their investigation. In this paper, we explicitly take into account this element.

More precisely, our paper attempts to answer the following related questions: do banks manage differently their leverage and risk-adjusted capital ratios? Are these capital ratios stable over time? What are their comparative speeds of convergence toward their respective target ratios? If we uncover differences, what factors may explain them? Answers to these questions are of great importance because, beyond establishing the role played by the formal minimum regulatory capital constraints on bank capital structure decisions, our results might help us conjecture[19] the potential trend of the leverage ratio once it is introduced formally in the bank capital regulation. Moreover, as in our analysis of the unregulated leverage ratio and the regulated risk-adjusted capital ratios we explicitly consider both bank specificities and common determinants of capital structure, we are able to judge if being under formal capital regulation strengthens or not their respective impact.

To answer these questions, we investigate the comparative persistence and convergence of the leverage and risk-adjusted capital ratios. To do so, we adapt the graphical analysis of Lemmon et al. (2008) which gives us first hand evidence by portraying the comparative transitory and permanent nature of the considered capital ratios that we test econometrically in the next step.

The rest of the paper is organized as follows: section 1.2 deals with the data and the graphical analysis. Section 1.3 outlines the econometric approach adopted to conduct our empirical analysis. Section 1.4 presents the results. Section 1.5 details the different robustness checks that we undertake and section 1.6 concludes the paper.

[19] We only talk about conjecture because, consistent with the Lucas critique, it is impossible to know with certainty in advance the potential impact of a forthcoming change using current data.

1.2. Data and graphical analysis

This section firstly describes our sample of banks and then outlines the graphical approach carried out to investigate the persistence and convergence of the bank capital structure.

1.2.1 Presentation of the sample

Our sample consists of commercial banks[20] established in 16 European countries[21]. The sample period is from 1992 to 2006[22]. Accounting data (annual financial statements) for individual banks are obtained from Bankscope Fitch IBCA. Bankscope reports balance sheets and income statements for 1985 commercial banks for the countries we consider in this study. From these 1985 banks we end up with a sample of 742 banks. Indeed, the information about the Total capital ratio[23] is available only for 766 banks of which 24 banks present outliers in the distribution of this ratio and were deleted. We verify that, on average, our sample of banks constitutes over 56% of the banking assets of commercial banks of the respective sample countries in 2006[24]. We can notice that, except for four countries (Austria, Denmark, Germany and Switzerland), the final set of banks used in this study represents more than half of the banking system in terms of total assets of each country. Table 1 gives some descriptive statistics on the starting sample and on our final sample. It allows us to verify that our final sample does not considerably differ from the starting sample. Indeed, we consider 10 key variables and disclose their mean and their standard deviation for the full sample available in Bankscope and the final sample that we use. Overall, we can see that the two samples are very close even though the banks in our sample seem to be, on average, larger in terms of total assets.

[20] To identify commercial banks, we consider the Bankscope Fitch IBCA's classification. However, we notice that a bank classified as "commercial bank" can have a ratio (net loans/ total assets) equal to 0% or a ratio (market funding/ total liabilities) equal to 100%. Thus, to ensure that all the banks in our sample are commercial banks, i.e. they have loans and deposits activities, we clean our sample by deleting the observations of the ratios (net loans/ total assets) and (market funding/ total liabilities) that are in the first or in the last percentile of their distribution. However, running our regressions with these observations does not affect our conclusions.
[21] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom (see Table A1 in Appendix for details).
[22] Notice that during the whole sample period banks are under the Basel I framework. The year 2006 is chosen as the end of our time period to avoid any impact that anticipations of Basel II implementation might have on our results. Our time period is also in line with that of Gropp and Heider (2010) who consider 1991 - 2004.
[23] Total capital ratio is (Tier 1 + Tier 2)/ Risk weighted assets and is one of our three dependant variables (see section 1.3 for details).
[24] See Table A1 in Appendix.

Table 1. Descriptive statistics on average over the period 1992-2006

	Full sample of commercial banks available in Bankscope (1985 banks)		*Our sample (742 banks)*	
	Mean	Std. Dev.	Mean	Std. Dev.
Total assets	13 185.34	66 569.40	36 558.00	114 000.00
Total deposits/ Total assets	70.16	21.64	65.47	23.63
Net loans/ Total assets	48.25	28.39	54.78	21.45
Loan loss provisions/ Total assets	0.62	1.00	0.54	0.67
Return on assets = Net income/ Total assets	0.76	3.05	0.72	1.29
Net trading revenue/ Net operating income	9.41	24.81	7.27	17.51
Equity/ Total assets	10.55	8.99	8.05	4.98
Tier 1/ Risk weighted assets	11.29	6.96	9.85	4.76
(Tier 1 + Tier 2)/ Risk weighted assets	14.24	6.41	14.70	7.35
Off-balance sheet activities/ Total assets	28.59	75.87	23.75	28.70

All variables are expressed in percentages, except Total assets which is in millions of Euros.

1.2.2 Graphical analysis

In this section, we adapt the method by Lemmon et al. (2008) and investigate graphically how the initial capital ratios influence the future capital ratios by looking at the evolution of bank leverage, Tier 1 and Total risk-based capital ratios for our sample of banks. This graphical approach is suitable for visualizing the comparative persistence and convergence of the different bank capital ratios considered in this study. It allows us to basically understand how both the regulated and the non-regulated capital ratios evolve through time and the impact of initial capital ratio on the future capital ratio.

The graphical analysis is carried out in the following manner. First, for each calendar year, we sort banks into quartiles that give us four bank groupings according to the level of the considered capital ratio (leverage, Tier 1 or Total capital ratios alternatively), which we denote: Very High, High, Medium, and Low. Second, we compute the average capital ratio for each grouping at its formation year and in each of the subsequent seven years, holding its composition constant. To illustrate, consider for example 1992 which is our first grouping formation year. We sort banks and form the grouping representing banks in the first quartile and compute the average ratio (only for this group of banks) from 1992 to 1999. Notice that from 1999 onward, we lose a year in the length of the time we can follow the bank grouping. For instance, in 2000, it can only be followed during six years whereas in 2006, the last year of our sample, it is impossible to follow the bank grouping. Table 2 exhibited below gives an idea about this structure. We repeat these two steps of sorting and averaging for every year in the sample period (15 years from 1992 to 2006). This process generates 15 sets of averages, one for each calendar year in our sample. Finally, we compute the average of the averages of the ratio within each event time to obtain the points in Figure 1A[25].

However, we notice that some banks exit the sample either because of bankruptcy or mergers and acquisitions operations as we progress away from the grouping formation year as illustrated in Table 2 below.

[25] On the whole, we have eight event times and the number of averages used to compute the final points within each event time decreases as we progress further (from 15 for event time 1 to 8 for event time 8).

Table 2. Number of banks used to compute the leverage ratio evolution for the bank grouping "Low"

Event time (years) / Bank gr. form. year	1	2	3	4	5	6	7	8	% of exit
1992	39	39	38	38	37	36	27	*24*	38,5
1993	57	53	52	51	48	36	31	*28*	50,9
1994	66	60	58	53	42	34	32	*26*	60,6
1995	75	72	67	53	40	39	34	*31*	58,7
1996	79	70	58	41	36	31	27	*25*	68,4
1997	81	60	42	36	33	28	26	*26*	67,9
1998	80	53	46	39	36	33	32	*33*	58,8
1999	87	71	65	58	54	49	46	*46*	47,1
2000	81	73	64	59	55	50	*50*		38,3
2001	85	72	65	61	55	*57*			32,9
2002	81	74	67	61	*60*				25,9
2003	81	73	60	*62*					23,5
2004	80	65	*67*						16,3
2005	86	*79*							8,1
2006	*84*								0,0

Each line of Table 2 shows how the number of banks evolves from the bank grouping formation year and the consecutive seven years during which we follow this grouping. For instance in 1992, 39 banks have a leverage ratio belonging to the first quartile called "Low" and seven years after, in 1999, more than 38 % of the banks have exited the sample. We construct similar tables, not included here to ease the presentation[26], for the three remaining categories (Medium, High, Very High) and for the two other capital ratios (Tier 1 and Total capital ratios).

This exiting problem may be particularly troublesome if we consider that banks that exit the sample are mainly those with very low capital ratios (through bankruptcy) or very high capital ratios (through M&A operations[27]) and therefore the exit may mechanically impact the way the capital ratios evolve in the figure.

[26] See Tables A2-A6 in appendix for categories Low and Very High for the three capital ratios.
[27] Valkanov and Kleimeier (2007) show that bank targets are better capitalized than bank acquirers.

Hence, to control for this potential problem, we repeat the whole process of construction of the figures by constraining the grouping to contain the same number of banks from the year of formation up to the end of the period during which we maintain the bank grouping constant[28]. The number of banks used to compute the averages corresponds to that of the last event time and is given in italics in Table 2. The results are depicted in Figure 1B for survivor banks where we notice that the evolution of the capital ratios does not change significantly.

We perform these exercises for all three ratios (leverage, Tier 1 and Total risk-based capital ratios), the results of which are presented in Figure 1 for the category “all banks” and “survivor banks".

The charts in Figure 1 highlight several features that are worth noting. *First*, we notice an important cross-sectional dispersion at event time 1. For all three ratios, the gap between the Very High and the Low groups is substantial: 11.08, 12.29 and 14.28% for the leverage, Tier 1 and Total risk-based capital ratios respectively. *Second*, there is a substantial convergence among the four bank groupings' averages over time, particularly for the risk-based capital ratios. For instance, we can see from the chart for the Tier 1 risk-based capital ratio for the sample of all banks that after eight years, the Very High Tier 1 capital ratio grouping declined from 18.24% to 12.96%, whereas the Low grouping increased from 5.95% to 7.65%. The Total capital ratio groupings display a similar pattern, but the first chart which represents the leverage ratio seems to show a slower speed of convergence. Understanding this difference in convergence speed is one of the aims of this paper. *Finally*, despite the convergence, the average capital ratio across the bank groupings eight years later remains significantly different for all capital ratios. The banks with a low level of capital ratios at the beginning (event time 1) disclose a low level of capital ratios eight years later (event time 8). Overall, we obtain results on bank leverage ratio consistent with those of Lemmon et al. (2008), as they solely studied leverage of non-financial firms.

[28] Our robustness check is more restrictive compared to that of Lemmon et al. (2008) who only require firms to have nonmissing data on book leverage at least on 20 out of 39 years.

Figure 1. The Evolution of risk-based and non risk-based capital ratios

Figure 1A. All banks

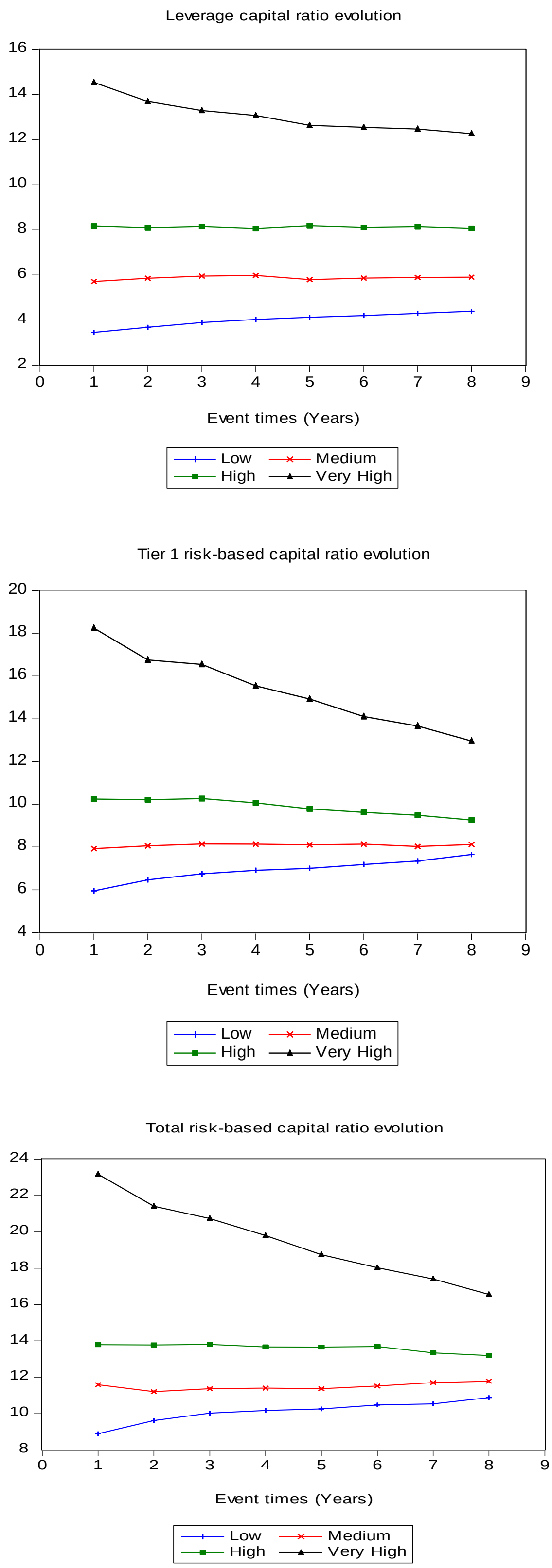
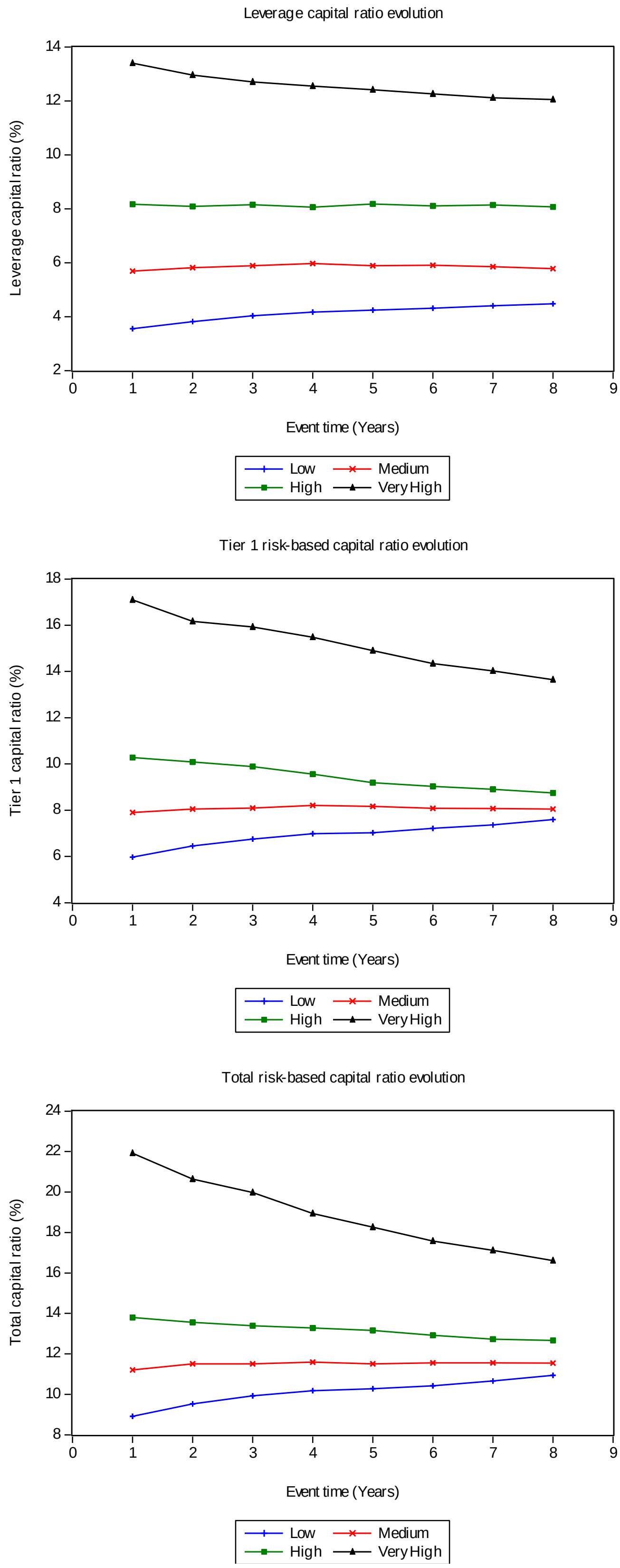


Figure 1B. Survivor banks



The main implication from Figure 1 is that banks' future leverage and risk-based capital ratios are closely related to their initial leverage and risk-based capital ratios consistent with the persistence of bank capital structure. However, despite this persistent phenomenon, we notice that bank capital ratios tend to converge towards their targets at different paces. The risk-adjusted capital ratios disclose high speed of convergence compared to the leverage ratio. However, the charts provide limited quantitative evidence of the initial ratios' economic importance. To measure the impact of initial bank capital ratios on future bank capital ratios and thoroughly investigate the question of convergence, we therefore proceed econometrically.

1.3. Empirical investigation

This section discusses how we empirically test the first hand evidence shown in Figure 1. We firstly examine the question of the persistence of the bank capital structure and then we go through the investigation related to the different speeds of convergence between the leverage and the risk-adjusted capital ratios. In this way, we might draw inferences on the role of capital regulation on bank capital structure and complement the recent results by Gropp and Heider (2010).

1.3.1 The persistence of bank capital structure

To examine the persistence issue of bank capital structure, we follow Lemmon et al. (2008) who test whether the initial leverage ratio explains much of the future firms' leverage ratio. We estimate an econometric model of the following form:

$$Cap_{i,t} = \alpha + \beta Cap_{i,o} + \sum_{c=1}^{5} \gamma_c T_{i,t} + \sum_{d=1}^{6} \delta_d BS_{i,t} + \nu_t + \varepsilon_{i,t} \qquad (1)$$

$Cap_{i,o}$, *T*, and *BS* stand for initial capital ratio, traditional and bank specific variables as detailed below in Table 3. By traditional variables, we mean variables from the previous literature that influence both financial and non-financial firms.

Table 3. Presentation of the dependent and independent variables with their descriptive statistics on our sample period (1992-2006)

Variables (all variables are expressed in %, except Size for which total assets is in million of €)	**Definition**	**Mean**	**Median**	**Std. Dev.**	**Max**	**Min**	**No. of obs.**	**Expected Sign of the coeff.**
Dependent variables								
Leverage ratio	Total Equity/Total assets	8.05	6.79	4.98	46.55	0.26	4561	
Tier 1 risk-based capital ratio	Tier 1 capital / Risk weighted assets	9.85	8.90	4.76	41.22	0.10	3130	
Total risk-based capital ratio	Total capital (Tier 1+Tier 2) / Risk weighted assets	14.70	12.20	7.35	41.70	0.10	4568	
Initial capital variables								
Initial Leverage ratio	The first nonmissing value for leverage ratio	8.14	6.68	5.36	46.55	0.66	4561	+
Initial Tier 1 capital ratio	The first nonmissing value for Tier 1 capital ratio	11.21	9.20	6.83	41.22	0.10	3130	+
Initial Total capital ratio	The first nonmissing value for Total capital ratio	14.82	12.30	7.39	41.70	0.10	4568	+
Traditional variables								
Size	Logarithm of total assets	15.01	14.79	2.27	21.18	9.16	4568	-
Profit	Post tax profit/ Total assets	0.67	0.59	1.10	10.60	-12.38	4542	+
Equity cost[29]	Return on equity(ROE) = Net income/ Equity	9.39	9.51	12.55	98.46	-99.81	4525	-
Economic cycle	Annual growth rate of the real gross domestic product (deseasonalized)	2.30	2.19	1.68	15.43	-3.98	4413	-
Competition	The average leverage ratio of the bank's competitors in the same country and per year	8.06	7.86	2.01	15.06	2.62	4566	+
	The average Tier 1 risk-based capital ratio of the bank's competitors in the same country and per year	10.55	10.75	2.08	20.94	4.70	4564	+
	The average Total risk-based capital ratio of the bank's competitors in the same country and per year	14.25	13.73	2.11	22.15	8.10	4566	+
Bank specific variables								
Credit risk	Loan loss provisions/ Total assets	0.54	0.34	0.68	6.58	0.00	3864	+
Credit growth	Annual net loan[30] growth	13.56	10.05	28.94	272.87	-100.00	3887	-
Credit activity	Net loans/ Total assets	54.78	56.23	21.45	95.72	1.44	4561	-
Market fundings	Total market fundings[31]/ Total liabilities	23.90	20.28	18.33	90.65	1.14	4568	+
Bank deposits	Bank deposits/Total liabilities	23.13	16.89	22.06	99.29	0.00	4514	+
Liability cost	Interest expense/Total liabilities							+

[29] ROE and profit are highly correlated. Therefore, we proceed by orthogonalization and use the residuals obtained by regressing ROE on *profit* as the *equity cost* variable.
[30] Net loans are gross loans minus loan loss reserves.
[31] Total market fundings corresponds to Total Liabilities minus Total Deposits.

The parameter β associated with the first component is the one of great importance as it determines the importance of a bank's initial capital ratios in determining its future capital ratios. Subscripts i and t denote bank and period respectively. We include in the regression time fixed effects[32] ν_t to account for unobserved heterogeneity over time that may be correlated with the explanatory variables.

In this model, the dependent variable *Cap* represents the bank capital structure. We consider three alternative dependent variables. In addition to the *leverage ratio*, defined as Total equity divided by Total assets, traditionally used in the corporate finance literature; we also consider the *Tier 1* and *the Total capital ratios*[33] respectively defined as Tier 1 capital/ Risk weighted assets and Total capital/ Risk weighted assets. These two variables allow us to take into account bank specificity that appears in bank capital regulation. Indeed, the international Basel accords require banks to hold at least 4% and 8% respectively of Tier 1 and Total capital ratios. Our aim is to compare how the determinants of bank capital structure, particularly the first (initial capital ratio) and the third (bank specific variables) components influence the unregulated and regulated capital ratios. In this way, we are able to extend the study by Gropp and Heider (2010) by tracking how within banking firms regulated and unregulated capital ratios respond to the impact exercised by the determinants described below. In the same way, we are able to compare our results related to the leverage ratio with those obtained by Lemmon et al. (2008) for non-financial firms.

Concerning the independent variables, beyond the initial capital ratio inspired by Lemmon et al. (2008), the paper draws heavily on previous works that have looked into how banks choose their capital structure. We identify several factors and classify them into traditional and bank specific variables.

Our first independent variable is therefore *initial capital ratio* ($Cap_{i,o}$). It means the initial leverage or the initial Tier 1 or Total capital ratios which are the first nonmissing values of these ratios. It should have a significant positive impact on future bank capital ratio in accordance with the persistence phenomenon found in Figure 1.

[32] Robustness checks regarding the inclusion of country fixed effects were undertaken (see Section 1.5).
[33] Definitions of all variables in italics can also be found in Table 3 along with their descriptive statistics and the expected signs of their coefficients.

The second component (T) is a set of independent variables that control for shared factors generally found to influence both financial firms and non financial firms' capital structure. These variables correspond to the profitability (*profit*), the cost of equity (*equity cost*), the size of the bank (*size*), the economic cycle (*economic cycle*), and the competition indicator (*competition*). Raising fresh equity is known to be costly and therefore capital accumulation can more easily result from funds generated internally (through higher retained earnings, weaker dividend payments and stock repurchase) in line with the "pecking order theory " (Flannery and Ragan, 2008). Thus, we expect a positive relationship between *profit,* defined as post-tax profit/ total assets and capital ratios. Equity is supposed to be more costly than other bank liabilities due to information asymmetries and because interest payments on debt are deducted from earnings before tax. Thus, we expect a negative relationship between *equity cost* and the capital ratios. We use the return on equity, i.e. the ratio of net income to total equity (*ROE*), as a proxy of the cost of equity[34]. Large banks benefit from economies of scale in screening and monitoring borrowers and from greater diversification. In addition, due to their too-big-to-fail position, large banks might be less prudent in their building of capital. Hence, we expect a negative relationship between bank size (*size*) and capital ratios. We also control for the business cycle. Indeed, bank capital and economic activity tend to be negatively related. Banks tend to decrease their capital during economic booms and increase it during economic downturns. Thus, we expect a negative relationship between economic cycle (*economic cycle*) and capital ratios. Concerning competition, we consider an indicator close to that used in corporate literature. Indeed, we consider the annual average capital ratio of a bank's competitors in the same country which is comparable to the annual industry median leverage ratio used in Lemmon et al. (2008) for instance. We expect a positive relationship between this variable and the bank's capital ratio.

The last component, and hence the last set of independent variables, consists of the bank specific features embedded in the bank balance sheet. We try to capture the effect of the credit risk and the bank activity type from the asset side and the impact of market discipline by looking at the type of bank creditors from the liability side in order to assess their impact on capital ratios. For this purpose, we consider the ratio of Loan loss provisions over Total assets as the *credit risk* variable and a prudent behavior should be associated with a positive

[34] Indeed, direct measurement of equity cost is difficult. Thus, we follow the previous literature (Jokippi and Milne, 2008) and consider ROE as a proxy variable. Note also that we orthogonalize this variable with the profit variable due to colinearity issue.

relationship between this variable and the bank capital ratios. We also consider the variables *credit growth*- measured as the annual net loan growth rate and *credit activity*- corresponding to the proportion of net loans in total assets that should be negatively related to the bank capital ratios. Indeed, an increase in assets through the expansion of credit should decrease the capital ratio as the denominator increases all else being equal (Ayuso et al., 2004). We also know that the Basel I accords were mainly designed to deal with bank credit activities. Despite the 1996 modifications to include market risks, it is generally agreed that they remain ill-suited for market activities (BCBS, 2009a; BCBS, 2009b) as they fail to take into account all the complexities that market activities involve[35]. Hence we may expect that banks highly involved in credit activities could operate with low capital ratios compared to those highly involved in market activities.

To assess the market discipline effect, we construct two quantitative indicators (Nier and Baumann, 2006) and a price indicator (Demirgüç-Kunt and Huizinga, 2004). Therefore, we consider the proportion of all *market fundings* in total liabilities and the proportion of *bank deposits*[36] in total liabilities. From the market discipline point of view, we expect a positive relationship between these two variables and bank capital ratios reflecting the pressure emanating from uninsured debt holders. Indeed, market fundings and bank deposits are uninsured liabilities. Thus, their holders have strong incentives to exert a discipline which makes it more costly for the bank to increase its risk of default when it has a larger proportion of these liabilities (Nier and Baumann, 2006).

We add a third market discipline variable as a price indicator termed *Liability cost* equal to the ratio of interest expense to interest-bearing debt. We assume that if the debt is not completely insured, market discipline makes banks substitute capital to debt when the debt cost increases. Thus, we expect a positive link between *Liability cost* and our dependent variables.

One major difficulty for our analysis is that we may have a two way causal relationship for some of the independent variables which are likely to be endogenous, i.e. themselves dependent on bank capital ratios. While the initial capital ratio variable ($Cap_{i,o}$) is

[35] The recent increase of risk weights associated with the trading activities illustrates this case (see Hannoun, 2010).
[36] Bank deposits are deposits received from other banks and they are not explicitly insured.

strictly exogenous, endogeneity is likely to be a problem for some of the traditional and the bank specific variables. In particular, banks that hold little capital may have to rely on attracting bank deposits or other uninsured funding in order to fund their assets. This would result in a negative relationship between capital and the bank deposit ratios and between capital ratio and the ratio of uninsured liabilities. On the other hand, banks that hold little equity capital could be perceived as risky by investors. This could increase their cost of uninsured funding and reduce their reliance on such funds, resulting in a positive relationship between capital and bank deposits and between capital and uninsured liabilities. Potential endogeneity biases therefore need to be addressed by a suitable choice of estimation method. The two closest papers to ours (Lemmon et al., 2008 and, Gropp and Heider, 2010) have dealt with this issue by using lagged variables in the Panel pooled OLS. We prefer to opt for a more advanced technique, the GMM method, and the pooled OLS is used as a robustness check. All our variables were instrumented except those representing the initial capital, or variables at the country level (economic cycle) or those variables for the credit growth and the bank size as they are exogenous[37]. As regards to the set of instruments, we follow the literature and consider lagged values of the concerned endogenous variable consistent with the satisfaction of the Sargan J-statistic for over-identification restrictions.

1.3.2 Comparative speeds of convergence

We take a step further to closely examine the question of convergence. Our aim is to empirically assess the findings shown in Figure 1 where risk-adjusted bank capital ratios seem to converge toward bank capital targets faster than the simple leverage ratio. Uncovering the factors responsible for this different behaviour might shed light on the role played by bank capital regulation. In this perspective, we consider a partial adjustment model as it is traditionally the case both in corporate finance literature (Flannery and Rangan, 2006) and banking literature (Flannery and Rangan, 2008; Berger et al., 2008; Brewer et al. 2008). The partial adjustment model is derived from:

$$\Delta Cap_{i,t} = \Delta^{d} Cap_{i,t} + \omega_{i,t} \quad (2)$$

[37] This was confirmed using the Granger causality test.

where the observed change in a banking institution's capital ratio at any time ($\Delta Cap_{i,t}$) is decomposed into a discretionary adjustment to its targeted equilibrium ratio ($\Delta^d Cap_{i,t}$) and an adjustment caused by exogenous current events ($\omega_{i,t}$).

Given that the bank may not be able to adjust its target equilibrium capital ratio instantaneously, expression (2) can be modified and modelled in a partial adjustment framework. It becomes:

$$\Delta Cap_{i,t} = \lambda\left(Cap^*_{i,t} - Cap_{i,t-1}\right) + \omega_{i,t} \quad (3)$$

where $Cap^*_{i,t}$ is the desired capital ratio and it is assumed to be given by expression (1). $\lambda \in [0,1]$ stands for the speed of adjustment (SOA)[38] in which we are interested. It measures the proportion of the gap between last year's capital ratio and this year's target that a typical bank closes each year.

The rest of the paper discusses the results and different robustness checks performed to probe their strength.

1.4.Results

For clarity of the presentation, the results are discussed in two separate parts. First, we discuss our results related to the issue of persistence (model (1)) and then we move to those obtained using our partial adjustment (model (3)) related to the issue of the speeds of convergence.

[38] Notice that equation (3) can be re-written as: $Cap_{i,t} = (1-\lambda)\, Cap_{i,t-1} + \lambda Cap^*_{i,t} + \omega_{i,t}$ and hence, the SOA can be easily derived by taking 1 minus the coefficient associated with the dependent lagged variable.

1.4.1 Comparative persistence of bank capital ratios

Table 4 presented below exhibits the results obtained with our model (1) related to the issue of the comparative persistence of the three capital ratios. In each column (1) of Table 4, we present the results of a model specification consisting solely of the initial capital ratio variable, that is initial leverage or initial risk-based capital ratios, which is one of our main focuses because it enables us to compare the persistence of unregulated and regulated capital ratios[39]. The coefficient is statistically and economically highly significant for all three dependent variables in columns (I), (II), and (III) indicating that the future bank capital ratio highly depends on its initial capital ratio. We can see that a one percentage change in initial leverage, Tier 1 and Total capital ratios results respectively in 0,73%; 0,57% and 0,53% change in future bank leverage, Tier 1 and Total capital ratios. This result is consistent with the permanent feature of leverage ratio found by Lemmon et al. (2008) for corporate firms. More importantly, it is consistent with our Figure 1 which discloses a more persistent phenomenon for the leverage than for the risk-adjusted capital ratios as the coefficient is on average a quarter higher for the former. Hence, this quantitative result confirms the graphical one found in Figure 1 which shows that despite convergence, banks with low or high capital ratios remain as such on average seven years after, and that this persistence is higher for the unregulated leverage ratio.

[39] The results with the leverage ratio allow us to make comparison with those of Lemmon et al. (2008) for non-financial firms.

Table 4. The effect of initial capital ratio, traditional and bank specific variables on future bank capital ratios

Variables	Leverage ratio (I)				Tier 1 risk-based capital ratio (II)				Total risk-based capital ratio (III)			
Model	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Initial capital												
Initial capital ratio	0.7343	0.4643	0.4658	0.4697	0.5759	0.5035	0.4673	0.4700	0.5350	0.4637	0.4148	0.4096
	(69.55)***	(33.69)***	(33.28)***	(33.68)***	(47.09)***	(35.77)***	(33.52)***	(33.65)***	(45.83)***	(35.24)***	(31.02)***	(30.68)***
Traditional variables												
Size		-0.3179	-0.3167	-0.3143		-0.1994	-0.3207	-0.4228		-0.1703	-0.2890	-0.3804
		(-12.61)***	(-12.23)***	(-11.25)***		(-4.76)***	(-7.86)***	(-9.81)***		(-4.44)***	(-7.39)***	(-8.77)***
Profit		1.4325	1.4796	1.4723		0.9115	1.1812	1.3217		0.5972	0.7957	0.9206
		(17.16)***	(17.72)***	(17.34)***		(6.19)***	(8.56)***	(9.37)***		(4.81)***	(6.77)***	(7.60)***
Equity cost		-0.1151	-0.1076	-0.1051		-0.0542	-0.0667	-0.0628		-0.0684	-0.0552	-0.0521
		(-9.55)***	(-8.79)***	(-8.58)***		(-2.60)***	(-3.34)***	(-3.16)***		(-3.71)***	(-3.11)***	(-2.93)***
Economic cycle		0.0687	0.0731	0.0776		0.1131	0.1423	0.2082		0.1710	0.1799	0.2217
		(2.10)**	(2.23)**	(2.33)**		(2.00)**	(2.69)***	(3.90)***		(3.17)***	(3.53)***	(4.30)***
Competition		0.1452	0.1435	0.1258		0.0135	0.0512	0.1086		0.2076	0.2164	0.2395
		(5.21)***	(5.12)***	(4.30)***		(0.24)	(0.99)	(2.08)**		(4.59)***	(5.03)***	(5.53)***
Bank specific variables												
Credit risk			0.2138	0.2696			-0.2531	-0.1061			0.0134	0.0669
			(1.55)	(1.95)*			(-0.90)	(-0.37)			(0.06)	(0.30)
Credit growth			-0.0056	-0.0048			-0.0206	-0.0198			-0.0188	-0.0189
			(-2.82)***	(-2.41)**			(-6.89)***	(-6.59)***			(-6.14)***	(-6.16)***
Credit activity			-0.0079	-0.0103			-0.0557	-0.0681			-0.0561	-0.0620
			(-3.09)***	(-3.79)***			(-13.43)***	(-15.15)***			(-13.83)***	(-14.31)***
Market fundings				0.0026				0.0296				0.0178
				(0.86)				(6.46)***				(3.78)***
Bank deposits				-0.0132				0.0024				0.0116
				(-5.21)***				(0.58)				(2.99)***
Liability cost				0.0245				0.1338				0.1328
				(0.93)				(3.23)***				(3.22)***
Intercept	2.0743	6.6667	7.0203	7.3203	3.8693	6.7944	12.0917	12.1272	5.8022	5.5987	11.2317	11.3107
	(21.60)***	(12.19)***	(12.19)***	(12.46)***	(26.52)***	(6.36)***	(11.37)***	(11.27)***	(33.02)***	(6.04)***	(11.67)***	(11.69)***
N° of obs.	2733	2733	2733	2733	2019	2019	2019	2019	2741	2741	2741	2741
R^2	0.6454	0.7412	0.7420	0.7456	0.5300	0.5582	0.6178	0.6222	0.4435	0.4718	0.5285	0.5343
% increase in R^2		14.84%	0.11%	0.49%		5.32%	10.68%	0.71%		6.38%	12.02%	1.10%

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and the Total risk-based capital ratio (III) presents the results with only one regressor called the initial capital ratio. Column (2) gives the results with five more variables called traditional variables. The subsequent columns (3) and (4) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Next, we add two sets of variables to the model[40]. The first set (column (2)) corresponds to the traditional variables which may influence bank capital ratios. The coefficient estimates are all consistent with the previous literature, in terms of sign and significance for the three dependent variables, except for the *competition* variable which is not significant for the Tier 1 ratio dependent variable (II). The final set consists of bank specific variables. Our aim is to compare the impact that these variables might have on formally regulated capital ratios (risk-adjusted capital ratios) and unregulated leverage ratio. The hypothesis here is that any different impact might be the result of bank capital regulation and in this way our paper might complement the results by Gropp and Heider (2010). The bank specific variables are added in two separate waves in order to disentangle if the different impact they might have on the leverage or the risk-adjusted capital ratios stems from the asset or the liability side. The impact from the liability side might ultimately enables us to capture the role of market discipline.

Column (3) contains the results with the addition of variables reflecting bank specificities at the asset side. Coefficients have the expected negative sign significant at the 1%, except for the *credit risk* variable, for the three dependent variables. The main difference lies in the coefficients' magnitude where those associated with the risk-adjusted capital ratios are 3 to 7 times higher than those associated with the leverage ratio. Column (4) gives the results where we incorporate the last subset of bank capital structure determinants related to market discipline reflected in the bank liability side. As expected from the market discipline perspective, the three added variables *Market fundings*, *Bank deposits* and *Liability cost* have positive and significant coefficients at the 1% for the Total risk-based capital ratio. By contrast, none of the three variables comes out as expected for the leverage ratio. The only significant variable *Bank deposits* has a negative coefficient which is not consistent with the role of market discipline. Instead, this result is in line with the substitution effect theorized by Gorton and Winton (2000) who argue that when the bank increases its financing with the bank deposits, then it will lower its recourse to capital. Concerning the Tier 1 capital ratio, *Market fundings* and *Liability cost* have positive and significant coefficients at the 1%. Hence, even though the same *Bank deposits* variable is not significant for the Tier 1 capital ratio, the results in column (4) establish a stark difference between the risk-adjusted dependent variable

[40] Although the magnitude of the coefficient of the initial capital ratio variable decreases once we add other explanatory variables, it remains economically significant across all the specifications.

and the leverage ratio. Thus, it clearly appears that, in Europe, uninsured creditors seem to exert a discipline only on the risk-based capital ratios, which are formally regulated. Another notable feature to highlight is the stability of our coefficients in terms of magnitude, signs and significance across all the model specifications.

To better grasp the effect of each added set of variables from model specification (1) to (4) used to explain the future leverage and the risk-based capital ratios, we compare the R-squared[41] (together with their variations) exhibited in the last two rows of Table 4.

First, we find that the initial capital ratio variable captures, in absolute terms, much of the future capital ratio. This result is consistent with the findings of Lemmon et al. (2008) who get similar results concerning corporate leverage ratio. In relative terms however, we notice that the initial capital ratio variable is more important for the leverage ratio regression (64.54% in column (I.1)) than for the risk-based capital ratios regression (53% and 44.35% in column (1) in regressions II and III respectively). This is consistent with the charts from Figure 1 which shows a greater persistent pattern for the leverage ratio than for risk-based capital ratios. In other words, while the regulated capital ratios are influenced by the initial capital ratio, this influence is more pronounced for the unregulated (or the leverage) capital ratio.

Second, the traditional variables contribute to the explanation of the future leverage ratio more than to the explanation of the future risk-based capital ratios as the increase in the R-squared is more than 14% in the first case whereas it is less than 6% on average in the second case. The opposite occurs when we consider the contribution of bank specific variables as they do not add that much to the explanation of the future leverage capital ratio (less than 0.5% increase[42]) whereas they contribute more than 12% on average to the explanation of the future risk-based capital ratios.

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[41] To make sure that the R-squared are not biased, it is important to check whether our panel series are stationary. In this perspective we performed three unit root tests: Levin, Lin and Chu (LLC); Im, Pesaran and Shin (IPS) and Fisher-ADF (Baltagi, 2008, p.275). Notwithstanding the fact that for small time series, panel unit root tests have low power and thus there is a potential risk of concluding that the whole panel is nonstationary even when there is a large proportion of stationary series in the panel (Karlsson and Löthgren, 2000), our series passed the three tests successfully. The stationarity test of Hadri (2000) was not performed because it is not appropriate for small time series (less than 16 years) (Hlouskova and Wagner, 2006).

[42] Although this increase is small, the added variables jointly contribute significantly to the explanatory power of the model as indicated by the Wald test.

All these results are consistent with the hypothesis that bank capital regulation, *via* the imposition of specific minimum thresholds to be respected, plays an important role in the explanation of the behaviour of the risk-adjusted capital ratio compared to that of the leverage ratio. Indeed, we find that initial capital conditions are comparatively more relevant to explain future unregulated leverage ratio whereas bank specific variables, and particularly market discipline variables, are more important explanatory variables for the risk-adjusted capital ratios which are formally under minimum capital requirements.

1.4.2 Comparative speeds of convergence

Now we discuss the results obtained using the partial adjustment model (3) related to the issue of convergence. These results are exhibited below in Table 5.

We progressively add different sets of determinants of the bank capital target in order to identify factors responsible for the variation of the speeds of adjustment (SOA). We maintain the same procedure as previously (Table 4) except the addition of the first column which gives the SOA when the target specification is solely made of the intercept term of equation (1). The coefficient in the first row (SOA) is our main focus for understanding the different speeds of convergence between the leverage and the risk-adjusted capital ratios highlighted in Figure 1.

Consistent with the graphical analysis, we can see that the SOA is 2 times higher at least in every column of Table 5 for the risk-adjusted capital ratios than for the leverage ratio. Every column (2) of the three dependent variables shows that the initial capital variable remains highly significant despite the presence of the one year lagged dependent variable and that the SOA increases (in relative terms[43]) by 52.88%, 19.21% and 29.84% respectively for the leverage, Tier 1 and the Total capital ratios. This empirical result corroborates the persistent phenomenon found in Figure 1. Moreover, consistent with the first empirical evidence in Table 4, the addition of bank specific variables (Columns (4) and (5)) has a very different impact on the SOA of the leverage and the risk-adjusted capital ratios. Whereas the risk-adjusted capital SOA increases by more than 5%, that of the leverage ratio does not increase. We can also notice that 2 out of 3 market discipline indicators are significant with positive coefficients whereas none of them is significant for the leverage ratio.

[43] The relative variation is computed as: $\left(SOA(2)-SOA(1)\right)/SOA(1)$.

Table 5. Speed of adjustment: comparative convergence between risk and non-risk adjusted bank capital ratios

Variables	**Leverage ratio (I)**					**Tier 1 risk-based capital ratio (II)**					**Total risk-based capital ratio (III)**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Speed of adjustment															
SOA	0.0607	0.0928	0.1328	0.1230	0.1249	0.1770	0.2110	0.2320	0.2597	0.2664	0.1746	0.2267	0.2447	0.2585	0.2622
	(9.28)***	(7.73)***	(9.56)***	(8.97)***	(9.08)***	(16.94)***	(12.41)***	(13.77)***	(15.54)***	(15.88)***	(17.96)***	(15.89)***	(16.89)***	(17.87)***	(18.11)***
% increase in **SOA**		52.88%	43.10%	-7.38%	1.54%		19.21%	9.95%	11.94%	2.58%		29.84%	7.94%	5.64%	1.43%
Initial capital															
Init. cap. rat.		0.3782	0.1506	0.1870	0.1970		0.1716	0.0448	0.1198	0.1378		0.2616	0.1725	0.1849	0.1846
		(3.18)***	(1.81)*	(2.12)**	(2.25)**		(2.53)**	(0.72)	(2.28)**	(2.68)***		(4.96)***	(3.44)***	(4.06)***	(4.13)***
Traditional variables															
Size			-0.7944	-0.8195	-0.8511			-0.2323	-0.3396	-0.4775			-0.1855	-0.2739	-0.3829
			(-6.38)***	(-6.05)***	(-5.92)***			(-1.85)*	(-3.06)***	(-4.14)***			(-1.67)*	(-2.51)**	(-3.20)***
Profit			0.9608	1.3537	1.3683			2.9353	3.1610	3.3074			0.9420	1.4495	1.6293
			(2.17)**	(2.89)***	(2.92)***			(6.85)***	(8.73)***	(9.14)***			(2.62)***	(4.47)***	(4.92)***
Equity cost			-0.0105	0.0894	0.0929			-0.2578	-0.1902	-0.1821			-0.1680	-0.0855	-0.0843
			(-0.18)	(1.33)	(1.40)			(-4.24)***	(-3.62)***	(-3.56)***			(-3.15)***	(-1.74)*	(-1.73)*
Econ. cycle			0.1732	0.2707	0.3106			0.1777	0.3292	0.4125			0.1929	0.2801	0.3082
			(1.08)	(1.60)	(1.82)*			(1.04)	(2.30)**	(2.91)***			(1.23)	(1.99)**	(2.19)**
Competition			0.3818	0.3911	0.3867			-0.2181	-0.1540	-0.0623			0.3085	0.2484	0.2826
			(2.81)***	(2.70)***	(2.59)***			(-1.31)	(-1.09)	(-0.45)			(2.35)**	(2.08)**	(2.37)**
Bank specific variables															
Cred. risk				0.1230	0.1249				0.2597	0.2664				0.2585	0.2622
				(2.03)**	(2.16)**				(1.59)	(1.82)*				(2.01)**	(2.00)**
Cred. growth				-0.1098	-0.1065				-0.1078	-0.1036				-0.1091	-0.1091
				(-10.52)***	(-10.32)***				(-12.52)***	(-12.33)***				(-12.87)***	(-13.03)***
Cred. activ.				-0.0602	-0.0673				-0.0797	-0.0961				-0.0797	-0.0824
				(-4.60)***	(-4.84)***				(-6.86)***	(-7.77)***				(-6.94)***	(-6.76)***
Mark. fund.					0.0176					0.0405					0.0137
					(1.13)					(3.32)***					(1.06)
Bank dep.					-0.0192					0.0090					0.0359
					(-1.50)					(0.81)					(3.40)***
Liab. cost					0.0472					0.2117					0.1972
					(0.3509)					(1.9641)**					(1.7627)*
Intercept	7.9094	4.9170	14.5587	18.1545	18.6029	9.2718	7.5981	12.8642	18.1028	17.6325	12.7285	9.2475	7.8161	14.6197	13.9260
	(8.25)***	(7.79)***	(5.36)***	(6.00)***	(6.09)***	(14.47)***	(14.03)***	(4.02)***	(6.22)***	(6.10)***	(16.09)***	(14.99)***	(2.91)***	(5.41)***	(5.18)***
N° of obs.	2733	2733	2733	2733	2733	1882	1882	1882	1882	1882	2741	2741	2741	2741	2741
R^2	0.0430	0.0466	0.0998	0.1359	0.1390	0.1490	0.1519	0.1986	0.2976	0.3034	0.1161	0.1241	0.1383	0.2193	0.2264

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (III) gives the speed of adjustment (SOA) when the target specification $cap^*_{i,t}$ is solely made of the intercept term. Columns (2) and (3) present the results when the initial capital and the traditional variables are respectively added. The subsequent columns (4) and (5) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables. The reported coefficients are obtained using the Delta method since they are non-linear transformations of the originally estimated coefficients (see Flannery and Rangan (2006) for a derivation of the model).

Overall, we get very sensible results consistent with the regulatory framework for banks in Europe that only focuses on the risk-based capital ratios. This is shown by the relatively great importance of initial leverage ratio on future leverage ratio on the one hand, and the weak impact of market discipline on future leverage ratio on the other hand. In other words, our results might suggest that the fact that risk-based capital ratios are formally under capital regulation with specified minimum thresholds to be respected makes market discipline cares about their evolution. We conjecture that the potential introduction of the leverage capital ratio into the bank capital regulation menu, as recently adopted in Basel III, could reduce the weight that an initial leverage ratio has on its future trend and could make it more sensitive to market discipline[44].

The rest of the paper discusses the different robustness checks performed to probe the strength of our results.

1.5.Robustness tests

In this section we report a number of robustness checks that were undertaken to verify the overall strength of our results. In particular, we introduce a number of changes to the benchmark specifications whose results are presented in Tables 4 and 5 and check whether the results change significantly. To ease the presentation, we report the results of all our robustness checks in Tables A7-A11 in the Appendix.

First, one can suspect that the magnitude of our R-squared is probably largely due to the inclusion of time fixed effects. To make sure that this is not the case, we re-run the models without the time fixed effects and compare the R-squared. The results are presented in Table A7 in the Appendix. Overall, we find our results and conclusions with regards to the variable signs and significance, and the R-squared magnitude and variation to be robust to the exclusion of time fixed effects. The highest decline in the R-squared is less than 3% for model specification III (2) (see Table A7.1). We also notice however that the coefficient of the

[44] To explore more deeply this conjecture, it could be interesting in future research to compare the behaviour of American or Canadian bank leverage ratio which are formally regulated to that of European bank leverage ratio.

liability cost variable becomes insignificant for the Tier 1 capital ratio regression (Tables A7.1and A7.2).

Second, one could also argue that our benchmark regression does not completely take into account all the banks' aspects that might differ across countries despite the inclusion of two variables specific to each country (*economic cycle* and *competition* variables). In order to make sure that this potential lack does not distort our findings, we add a set of country dummy variables. Table A8 shows the results of this robustness test. Overall, we find our results and conclusions to be robust to the inclusion of the country fixed effects. Unsurprisingly, *economic cycle* and *competition* variables were the mostly affected. Indeed, we notice the loss of significance for the *competition* variable in all specifications as the country fixed effects capture its contribution. The same is true for the *economic cycle* variable which is significant only for the Total risk-based capital ratio. Another notable effect is the loss of significance for the coefficient of the *liability cost* variable for both Tier 1 and Total capital ratios regressions for the issue of convergence (Table A8.2).

Third, the two previous studies Lemmon et al. (2008) and Gropp and Heider (2010) that are close to our paper and with which we mainly compare our results have used the Panel Pooled Least Square (OLS) method. Thus, we re-estimate our models using the Pooled OLS in which the instruments replace the independent variables in order to reduce the endogeneity issue. Table A9 contains the results. Note that this robustness check allows us to verify if our results are very sensitive to the estimation method. Once again, we find that the choice of the econometric method does not have a marked effect on the interpretation of our results and conclusions. Here also, the only notable effect is the loss of significance for the coefficient of the *Liability cost* variable for both Tier 1 and Total capital ratios regressions related to the convergence issue (Table A9.2).

We performed two other robustness checks concerning our sample. First, we notice that countries are not equally represented in our sample. For instance, France and Italy are comparatively highly represented. Hence, we exclude these two countries to make sure that our main results and conclusions are not significantly impacted by this imbalance in our sample (see Table A10). Second, bank capital regulation is somewhat different in the United Kingdom (UK) where the Financial Stability Authority (FSA) sets two different capital ratios for each bank: a 'trigger ratio', which is the minimum individual capital ratio; and a 'target ratio' set above the trigger. This 'target ratio' acts as a warning light and as a cushion of capital to help prevent an accidental breach of the individual capital requirement (Alfon et al., 2004). Hence, like in the preceding case, we exclude the UK from our sample and re-run all our regressions (see Table A11). Overall, we find that our main conclusions regarding the comparative persistence and convergence are unaffected. Compared to our main results, only one change appears concerning the results related to the issue of persistence obtained by excluding France and Italy. We notice that the coefficient of *bank deposits* variable becomes significant with an unexpected sign for the Tier 1 capital ratio regression and insignificant for the Total capital ratio (Table A10.1).

1.6. Conclusion

This paper examines the effectiveness of the minimum capital requirements constraints. In doing so, we complement the study by Gropp and Heider (2010) who investigate the role played by capital regulation on bank capital structure. They assess to what extent the determinants of non-financial firms apply to banks. They find substantial similarities and hence conclude on the second-order importance of capital regulation on bank capital structure.

Our paper takes a different approach. More precisely, we wonder whether European banks manage differently their unregulated leverage ratio and formally risk-adjusted capital ratios. We proceed by systematically comparing the persistence and convergence of these capital ratios. We then infer the role of the minimum capital requirements from any difference that may result from this comparison exercise. Moreover, this procedure enables us to investigate whether the results by Lemmon et al. (2008) which indicate that much of the future firm leverage ratio is explained by the initial leverage ratio also applies to bank capital ratios.

Overall, consistent with the findings from the corporate finance literature, we find that bank capital structure is quite stable over long periods of time: banks that have relatively high (low) capital ratios tend to remain as such for over eight years. More interestingly, as we analyze separately the risk-based capital ratios (Tier 1 and Total capital ratios) and the non risk-based capital ratio (leverage capital ratio), we find graphically a significant difference in the speed of convergence between them: convergence is faster for risk-based capital ratios than for leverage capital ratio. Moreover, the econometric approach confirms this result. It shows that the future bank leverage ratio depends on its initial leverage ratio more than the future bank risk-based capital ratios do confirming the comparative great persistence of the leverage ratio. We also find that, bank risk-based capital ratios are much more influenced by market discipline compared to the leverage ratio and, their speeds of adjustment are at least two times higher than that of the leverage ratio.

Hence, we deduce that the lack of a formal inclusion of the leverage ratio in the bank capital regulation package in Europe may explain these results. Our paper shows that, by specifying a minimum regulatory capital requirement, the Basel accords foster market discipline which acts as a watchdog of the rules and thus ultimately influence the behavior of the risk-adjusted capital ratios. Their comparative rapid convergence towards the target risk-adjusted capital ratios seems to be partly explained by market pressure.

On the whole, our results are therefore broadly supportive of recent policy initiatives that aim to strengthen bank capital regulation by introducing a regulatory minimum leverage ratio in the Basel III package.

APPENDIX:

Table A1. Distribution of banks by country and percentage of the total banking assets of each country present in our sample in 2006

Country	Number of banks	Percentage of the total banking assets present in our final sample
Austria	19	12.60
Belgium	18	74.53
Denmark	65	22.98
Finland	11	51.07
France	147	73.27
Germany	28	45.31
Greece	18	61.94
Ireland	14	68.83
Italy	198	67.94
Netherlands	50	67.84
Norway	21	66.50
Portugal	20	67.93
Spain	31	67.84
Sweden	31	69.39
Switzerland	20	22.64
United Kingdom	51	68.56
Total	742	56.82

Source: Bankscope Fitch IBCA

Table A2. Number of banks used to compute the leverage ratio evolution for the bank grouping "Very High".

Event time (years) / Bank gr. form. year	1	2	3	4	5	6	7	8	% of exit
1992	39	35	34	33	29	26	26	*24*	38,5
1993	57	49	46	41	38	38	31	*31*	45,6
1994	65	56	50	42	40	36	36	*33*	49,2
1995	75	62	53	53	52	49	43	*32*	57,3
1996	78	69	65	58	55	48	39	*40*	48,7
1997	81	73	57	55	48	41	40	*40*	50,6
1998	80	62	59	54	40	41	41	*40*	50,0
1999	87	72	66	56	51	52	51	*50*	42,5
2000	81	69	57	52	51	49	*49*		39,5
2001	84	59	55	55	49	*49*			41,7
2002	81	71	63	59	*60*				25,9
2003	81	70	62	*62*					23,5
2004	80	67	*62*						22,5
2005	85	*75*							11,8
2006	*84*								0,0

This table gives the number of banks used to compute the average leverage ratio for the grouping "Very High". More precisely, each line shows how the number of banks evolves from the bank grouping formation year and the consecutive seven years during which we follow this grouping. For instance in 1992, 39 banks have a leverage ratio belonging to the fourth quartile called "Very High" and seven years after, in 1999, more than 38 % of the banks have exited the sample. The figure of each line in italics corresponding to the last event time indicates the number of banks used to compute the leverage ratio for the survivor banks (see figure 1B).

Table A3. Number of banks used to compute the Tier 1 capital ratio evolution for the bank grouping "Low".

Event time (years) / Bank gr. form. year	1	2	3	4	5	6	7	8	% of exit
1992	21	21	21	21	21	21	16	*14*	33,3
1993	28	28	28	28	27	23	19	*18*	35,7
1994	32	32	32	31	25	19	18	*15*	53,1
1995	37	35	35	29	21	21	18	*16*	56,8
1996	44	40	32	25	23	20	18	*18*	59,1
1997	53	43	31	27	23	23	23	*24*	54,7
1998	56	41	39	37	35	35	34	*31*	44,6
1999	62	52	50	42	41	39	36	*36*	41,9
2000	59	56	46	45	44	39	*37*		37,3
2001	72	60	58	54	47	*45*			37,5
2002	66	60	56	48	*47*				28,8
2003	66	60	53	*55*					16,7
2004	69	57	*59*						14,5
2005	75	*68*							9,3
2006	*71*								0,0

This table gives the number of banks used to compute the average Tier 1 capital ratio for the grouping "Low". More precisely, each line shows how the number of banks evolves from the bank grouping formation year and the consecutive seven years during which we follow this grouping. For instance in 1992, 21 banks have a Tier 1 capital ratio belonging to the first quartile called "Low" and seven years after, in 1999, more than 33 % of the banks have exited the sample. The figure of each line in italics corresponding to the last event time indicates the number of banks used to compute the Tier 1 capital ratio for the survivor banks (see figure 1B).

Table A4. Number of banks used to compute the Tier 1 capital ratio evolution for the bank grouping "Very High".

Event time (years) / Bank gr. form. year	1	2	3	4	5	6	7	8	% of exit
1992	21	19	17	17	16	15	13	*12*	42,9
1993	26	23	22	19	16	14	11	*10*	61,5
1994	32	25	21	19	15	13	12	*12*	62,5
1995	36	29	25	21	20	17	15	*12*	66,7
1996	44	32	24	25	21	20	16	*15*	65,9
1997	51	38	30	27	27	24	19	*17*	66,7
1998	56	39	28	31	24	22	21	*27*	51,8
1999	59	42	44	32	30	29	35	*33*	44,1
2000	59	52	43	36	32	34	*34*		42,4
2001	64	44	39	36	36	*31*			51,6
2002	63	46	42	44	*38*				39,7
2003	63	55	50	*45*					28,6
2004	64	54	*45*						29,7
2005	70	*53*							24,3
2006	*68*								0,0

This table gives the number of banks used to compute the average Tier 1 capital ratio for the grouping "Very High". More precisely, each line shows how the number of banks evolves from the bank grouping formation year and the consecutive seven years during which we follow this grouping. For instance in 1992, 21 banks have a Tier 1 capital ratio belonging to the fourth quartile called "Very High" and seven years after, in 1999, more than 42 % of the banks have exited the sample. The figure of each line in italics corresponding to the last event time indicates the number of banks used to compute the Tier 1 capital ratio for the survivor banks (see figure 1B).

Table A5. Number of banks used to compute the Total capital ratio evolution for the bank grouping "Low".

Event time (years) / Bank gr. form. year	1	2	3	4	5	6	7	8	% of exit
1992	40	40	38	37	35	34	28	*26*	35,0
1993	57	48	45	42	38	33	26	*19*	66,7
1994	65	58	55	47	37	29	27	*24*	63,1
1995	77	68	60	49	36	35	31	*25*	67,5
1996	79	68	54	45	40	36	32	*32*	59,5
1997	81	62	46	44	39	38	33	*33*	59,3
1998	81	62	55	49	43	41	38	*39*	51,9
1999	93	76	74	65	61	56	54	*53*	43,0
2000	81	75	63	58	53	50	*47*		42,0
2001	86	68	61	56	51	*52*			39,5
2002	86	74	67	64	*64*				25,6
2003	84	75	70	*69*					17,9
2004	81	68	*68*						16,0
2005	86	*80*							7,0
2006	*85*								0,0

This table gives the number of banks used to compute the average Total capital ratio for the grouping "Low". More precisely, each line shows how the number of banks evolves from the bank grouping formation year and the consecutive seven years during which we follow this grouping. For instance in 1992, 40 banks have a Total capital ratio belonging to the first quartile called "Low" and seven years after, in 1999, 35 % of the banks have exited the sample. The figure of each line in italics corresponding to the last event time indicates the number of banks used to compute the total capital ratio for the survivor banks (see figure 1B).

Table A6. Number of banks used to compute the Total capital ratio evolution for the bank grouping "Very High".

Event time (years) / Bank gr. form. year	1	2	3	4	5	6	7	8	% of exit
1992	39	37	36	34	31	28	25	*20*	48,7
1993	57	50	46	43	38	33	27	*26*	54,4
1994	65	55	47	41	40	35	34	*31*	52,3
1995	75	60	51	46	44	39	34	*25*	66,7
1996	78	67	60	49	44	38	30	*31*	60,3
1997	81	66	49	42	34	27	27	*29*	64,2
1998	80	58	48	42	30	31	29	*33*	58,8
1999	84	66	55	42	37	37	39	*38*	54,8
2000	78	61	50	44	41	43	*42*		46,2
2001	84	60	55	51	47	*46*			45,2
2002	80	66	62	57	*58*				27,5
2003	80	69	58	*58*					27,5
2004	80	68	*62*						22,5
2005	82	*67*							18,3
2006	*83*								0,0

This table gives the number of banks used to compute the average Total capital ratio for the grouping "Very High". More precisely, each line shows how the number of banks evolves from the bank grouping formation year and the consecutive seven years during which we follow this grouping. For instance in 1992, 39 banks have a Total capital ratio belonging to the fourth quartile called "Very High" and seven years after, in 1999, more than 48 % of the banks have exited the sample. The figure of each line in italics corresponding to the last event time indicates the number of banks used to compute the Total capital ratio for the survivor banks (see figure 1B).

Table A7. Without both time and country fixed effects

Table A7.1. The effect of initial capital ratio, traditional and bank specific variables on future bank capital ratios

Variables	**Leverage ratio (I)**				**Tier 1 risk-based capital ratio (II)**				**Total risk-based capital ratio (III)**			
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Initial capital												
Initial capital ratio	0.7344	0.4688	0.4738	0.4759	0.5648	0.4891	0.4622	0.4672	0.5279	0.4520	0.4116	0.4106
	(69.55)***	(34.80)***	(34.59)***	(34.69)***	(46.4367)***	(34.9795)***	(33.2659)***	(33.4632)***	(44.59)***	(34.58)***	(31.13)***	(31.24)***
Traditional variables												
Size		-0.3098	-0.3055	-0.3087		-0.2020	-0.3193	-0.4165		-0.1812	-0.2806	-0.3638
		(-12.42)***	(-11.86)***	(-11.13)***		(-4.7860)***	(-7.8444)***	(-9.7427)***		(-4.71)***	(-7.25)***	(-8.53)***
Profit		1.4324	1.4685	1.4531		0.8432	1.1651	1.3177		0.5089	0.7809	0.9260
		(17.11)***	(17.46)***	(17.01)***		(5.7250)***	(8.4787)***	(9.3187)***		(4.10)***	(6.63)***	(7.56)***
Equity cost		-0.1118	-0.1042	-0.1019		-0.0690	-0.0696	-0.0633		-0.0831	-0.0584	-0.0531
		(-9.44)***	(-8.51)***	(-8.30)***		(-3.2940)***	(-3.4437)***	(-3.1402)***		(-4.52)***	(-3.27)***	(-2.96)***
Economic cycle		0.0514	0.0558	0.0625		0.1601	0.1594	0.1746		0.1780	0.1678	0.1732
		(1.99)**	(2.15)**	(2.37)**		(3.5766)***	(3.8243)***	(4.0878)***		(4.13)***	(4.11)***	(4.23)***
Competition		0.1604	0.1677	0.1446		-0.0043	0.0433	0.1082		0.2663	0.2300	0.2355
		(5.85)***	(6.11)***	(5.00)***		(-0.0789)	-0.8605	(2.1234)**		(6.24)***	(5.64)***	(5.64)***
Bank specific variables												
Credit risk			0.1187	0.1804			-0.0746	-0.0053			0.2153	0.1666
			(0.94)	(1.41)			(-0.2789)	(-0.0198)			(1.05)	(0.81)
Credit growth			-0.0057	-0.0049			-0.0214	-0.0208			-0.0195	-0.0193
			(-2.84)***	(-2.48)**			(-7.1907)***	(-6.9743)***			(-6.37)***	(-6.35)***
Credit activity			-0.0060	-0.0086			-0.0581	-0.0689			-0.0590	-0.0624
			(-2.47)**	(-3.27)***			(-14.6010)***	(-15.8761)***			(-15.14)***	(-14.97)***
Market fundings				0.0036				0.0282				0.0167
				(1.19)				(6.2784)***				(3.58)***
Bank deposits				-0.0122				0.0020				0.0108
				(-4.88)***				-0.4786				(2.80)***
Liability cost				-0.0070				-0.0070				0.1431
				(-0.30)				0.1433				(4.00)***
Intercept	2.0744	6.4210	6.5737	7.1003	3.9854	7.1311	12.2538	(3.9544)***	5.9012	5.1319	11.0606	11.1912
	(21.60)***	(11.96)***	(11.55)***	(12.05)***	(27.3661)***	(6.6328)***	(11.4520)***	(11.2668)***	(33.09)***	(5.59)***	(11.55)***	(11.68)***
N° of obs.	2733	2733	2733	2733	2019	2019	2019	2019	2741	2741	2741	2741
R^2	0.6454	0.7397	0.7402	0.7438	0.5167	0.5474	0.6144	0.6184	0.4206	0.4602	0.5243	0.5316
% increase in R^2		12.75%	0.07%	0.48%		6%	12%	1%		8.60%	12.23%	1.37%

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. The results were obtained by estimating: $Cap_{i,t} = \alpha + \beta Cap_{i,o} + \sum_{c=1}^{5} \gamma_c T_{i,t} + \sum_{d=1}^{6} \delta_d BS_{i,t} + \varepsilon_{i,t}$ $(1')$ where $cap_{i,0}$, *T*, and *BS* stand for initial capital ratio, traditional and bank specific. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (II) presents the results with only one regressor called the initial capital ratio. Column (2) gives the results with five more variables called traditional variables. The subsequent columns (3) and (4) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A7.2. Speed of adjustment: comparative convergence between risk and non-risk adjusted bank capital ratios

Variables	Leverage ratio (I)					Tier 1 risk-based capital ratio (II)					Total risk-based capital ratio (III)				
Model	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Speed of adjustment															
SOA	0.0622	0.0936	0.1342	0.1223	0.1250	0.1805	0.2098	0.2295	0.2595	0.2660	0.1730	0.2150	0.2387	0.2563	0.2610
	(9.56)***	(7.80)***	(9.66)***	(8.93)***	(9.09)***	(17.3772)***	(12.4701)***	(13.6826)***	(15.6038)***	(15.9239)***	(17.82)***	(15.22)***	(16.41)***	(17.73)***	(18.05)***
% increase in **SOA**		50,48%	43,38%	-8,87%	2,21%		16.23%	9.39%	13.07%	2.50%		24,28%	11,02%	7,37%	1,83%
Initial capital															
Init. cap. rat.		0.0344	0.0196	0.0258	0.0272		0.0311	0.0039	0.0321	0.0371		0.0483	0.0339	0.0470	0.0498
		(3.11)***	(1.78)*	(2.40)**	(2.50)**		(2.2166)**	(0.2745)	(2.3751)**	(2.7268)***		(4.08)***	(2.79)***	(4.04)***	(4.30)***
Traditional variables															
Size			-0.1069	-0.0942	-0.1004			-0.0528	-0.0854	-0.1232			-0.0470	-0.0635	-0.0901
			(-6.53)***	(-5.68)***	(-5.61)***			(-1.8212)*	(-2.9915)***	(-4.0690)***			(-1.73)*	(-2.28)**	(-2.92)***
Profit			0.1159	0.1539	0.1556			0.6528	0.8194	0.8716			0.1766	0.3690	0.4247
			(1.96)*	(2.65)***	(2.64)***			(6.5673)***	(8.7136)***	(9.0078)***			(2.01)**	(4.39)***	(4.84)***
Equity cost			-0.0036	0.0114	0.0119			-0.0644	-0.0493	-0.0480			-0.0479	-0.0225	-0.0217
			(-0.44)	(1.39)	(1.43)			(-4.5610)***	(-3.5782)***	(-3.4876)***			(-3.68)***	(-1.76)*	(-1.69)*
Econ. cycle			0.0111	0.0238	0.0281			0.0257	0.0661	0.0779			0.0336	0.0618	0.0596
			(0.66)	(1.44)	(1.67)*			-0.8232	(2.2542)**	(2.5786)***			(1.10)	(2.12)**	(2.03)**
Competition			0.0448	0.0532	0.0498			-0.0659	-0.0424	-0.0215			0.0921	0.0626	0.0657
			(2.50)**	(3.04)***	(2.69)***			(-1.7405)*	(-1.1928)	(-0.5960)			(3.03)***	(2.13)**	(2.18)**
Bank specific variables															
Cred. risk				0.1606	0.1792				0.3400	0.3744				0.3951	0.3541
				(2.00)**	(2.20)**				(1.7369)*	(1.8939)*				(2.72)***	(2.42)**
Cred. growth				-0.0135	-0.0133				-0.0280	-0.0278				-0.0285	-0.0288
				(-10.6)***	(-10.4)***				(-12.71)***	(-12.57)***				(-13.1)***	(-13.2)***
Cred. activ.				-0.0068	-0.0078				-0.0198	-0.0240				-0.0211	-0.0210
				(-4.40)***	(-4.63)***				(-6.7864)***	(-7.4740)***				(-7.38)***	(-6.84)***
Mark. fund.					0.0022					0.0109					0.0033
					(1.13)					(3.3998)***					(0.99)
Bank dep.					-0.0024					0.0026					0.0091
					(-1.52)					(0.8953)					(3.32)***
Liab. cost					-0.0056					0.0271					0.0468
					(-0.38)					(1.0727)					(1.83)*
Intercept	0.4917	0.4690	2.0542	2.0668	2.2528	1.6747	1.6441	3.2352	4.6593	4.7615	2.2017	2.0930	1.8052	3.6951	3.6132
	(8.48)***	(8.04)***	(5.81)***	(5.63)***	(5.88)***	(14.8322)***	(14.4688)***	(4.3820)***	(6.1691)***	(6.2147)***	(15.95)***	(14.93)***	(2.79)***	(5.33)***	(5.19)***
N° of obs.	2733	2733	2733	2733	2733	1882	1882	1882	1882	1882	2741	2741	2741	2741	2741
R^2	0.0324	0.0359	0.0881	0.1266	0.1280	0.1384	0.1406	0.1855	0.2912	0.2957	0.1040	0.1094	0.1240	0.2142	0.2224

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Results were obtained by estimating: $\Delta Cap_{i,t} = \lambda\left(Cap^*_{i,t} - Cap_{i,t-1}\right) + \omega_{i,t}$ $(3')$ where $Cap^*_{i,t}$ is given by expression $(1')$ and $\lambda = SOA$. Column (1) of any of the three dependent variables: Leverage capital ratio (III), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (IV) gives the speed of adjustment (SOA) when the target specification $Cap^*_{i,t}$ is solely made of the intercept term. Columns (2) and (3) present the results when the initial capital and the traditional variables are respectively added. The subsequent columns (4) and (5) correspond to the inclusion of bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A8. With both time and country fixed effects

Table A8.1. The effect of initial capital ratio, traditional and bank specific variables on future bank capital ratios

Variables	**Leverage ratio (I)**				**Tier 1 risk-based capital ratio (II)**				**Total risk-based capital ratio (III)**			
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Initial capital												
Initial capital ratio	0.6904	0.4724	0.4756	0.4785	0.568916	0.495320	0.457700	0.457935	0.5305	0.4594	0.4089	0.4042
	(62.51)***	(32.98)***	(32.85)***	(33.10)***	(41.6773)***	(32.2601)***	(30.7288)***	(30.4774)***	(43.51)***	(33.69)***	(29.97)***	(29.59)***
Traditional variables												
Size		-0.2866	-0.2826	-0.2842		-0.286236	-0.364493	-0.448249		-0.2811	-0.3676	-0.4316
		(-10.57)***	(-10.23)***	(-9.36)***		(-6.2486)***	(-8.4263)***	(-9.6593)***		(-6.54)***	(-8.64)***	(-9.16)***
Profit		1.4615	1.5346	1.5298		1.076650	1.391330	1.425570		0.6906	0.9817	1.0344
		(16.64)***	(17.22)***	(16.93)***		(6.9095)***	(9.6500)***	(9.8159)***		(5.12)***	(7.67)***	(7.98)***
Equity cost		-0.1170	-0.1093	-0.1080		-0.073194	-0.085558	-0.082887		-0.0718	-0.0588	-0.0543
		(-9.50)***	(-8.76)***	(-8.64)***		(-3.4907)***	(-4.3030)***	(-4.1663)***		(-3.80)***	(-3.25)***	(-2.99)***
Economic cycle		0.0552	0.0554	0.0646		0.104942	0.114004	0.136127		0.1870	0.1622	0.1778
		(1.29)	(1.29)	(1.51)		(1.3550)	(1.5718)	(1.8760)*		(2.67)***	(2.44)**	(2.68)***
Competition		0.0555	0.0847	0.1000		0.077170	0.005603	0.041780		0.1428	0.0861	0.0971
		(0.58)	(0.88)	(1.04)		(0.7424)	(0.0580)	(0.4290)		(1.31)	(0.820)	(0.93)
Bank specific variables												
Credit risk			0.2442	0.2960			0.139485	0.174169			0.4284	0.4227
			(1.69)*	(2.03)**			(0.4564)	(0.5693)			(1.89)*	(1.85)*
Credit growth			-0.0068	-0.0059			-0.020192	-0.019553			-0.0181	-0.0185
			(-3.38)***	(-2.93)***			(-6.3981)***	(-6.1697)***			(-5.93)***	(-6.04)***
Credit activity			-0.0110	-0.0130			-0.065265	-0.074708			-0.0649	-0.0694
			(-3.98)***	(-4.43)***			(-14.3628)***	(-15.5563)***			(-14.97)***	(-15.20)***
Market fundings				0.0027				0.027062				0.0148
				(0.80)				(5.2413)***				(2.85)***
Bank deposits				-0.01				0.004095				0.0110
				(-4.32)***				(0.9503)				(2.73)***
Liability cost				0.0257				0.107461				0.1206
				(0.94)				(2.5610)**				(2.88)***
Intercept	1.9393	6.6673	7.0455	6.9829	4.994003	8.569786	15.664155	15.805669	6.6387	8.8857	16.3176	16.3490
	(5.70)***	(6.44)***	(6.67)***	(6.54)***	(11.1561)***	(5.1925)***	(9.8129)***	(9.8044)***	(12.79)***	(4.25)***	(8.10)***	(8.11)***
N° of obs.	2733	2733	2733	2733	1882	1882	1882	1882	2741	2741	2741	2741
R^2	0.6777	0.7471	0.7482	0.7502	0.5284	0.5642	0.6303	0.6319	0.4590	0.4900	0.5457	0.5495
% increase in R^2		9.29%	0.15%	0.27%		6.78%	11.72%	0.25%		6.33%	10.21%	0.69%

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. The results were obtained by estimating: $Cap_{i,t} = \alpha + \beta Cap_{i,o} + \sum_{c=1}^{5} \gamma_c T_{i,t} + \sum_{d=1}^{6} \delta_d BS_{i,t} + \nu_t + c_c + \varepsilon_{i,t}$ $(1'')$ where $cap_{i,0}$, T, and BS stand for initial capital ratio, traditional and bank specific. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (II) presents the results with only one regressor called the initial capital ratio. Column (2) gives the results with five more variables called traditional variables. The subsequent columns (3) and (4) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A8.2. Speed of adjustment: comparative convergence between risk and non-risk adjusted bank capital ratios

Variables	**Leverage ratio (I)**					**Tier 1 risk-based capital ratio (II)**					**Total risk-based capital ratio (III)**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Speed of adjustment															
SOA	0.0761	0.1148	0.1384	0.1302	0.1312	0.183195	0.223477	0.247879	0.281618	0.286755	0.1831	0.2343	0.2545	0.2713	0.2738
	(10.41)***	(9.22)***	(9.84)***	(9.43)***	(9.47)***	(16.7820)***	(13.0021)***	(14.4061)***	(16.3415)***	(16.5767)***	(18.14)***	(16.27)***	(17.33)***	(18.42)***	(18.65)***
% increase in **SOA**		50.85%	20.56%	-5.92%	0.77%		21.99%	10.92%	13.61%	1.82%		27.96%	8.62%	6.60%	0.92%
Initial capital															
Init. cap. rat.		0.0428	0.0257	0.0299	0.0306		0.041418	0.017761	0.039435	0.043100		0.0606	0.0421	0.0455	0.0460
		(3.82)***	(2.26)**	(2.68)***	(2.73)***		(2.7832)***	(1.1667)	(2.7422)***	(2.9851)***		(4.92)***	(3.32)***	(3.74)***	(3.79)***
Traditional variables															
Size			-0.0996	-0.0926	-0.1001			-0.100647	-0.122306	-0.159659			-0.0974	-0.1169	-0.1340
			(-5.59)***	(-5.22)***	(-5.14)***			(-3.1277)***	(-3.9195)***	(-4.7490)***			(-3.15)***	(-3.76)***	(-3.88)***
Profit			0.1410	0.2050	0.2041			0.702382	0.879825	0.899187			0.2416	0.4428	0.4713
			(2.30)**	(3.37)***	(3.32)***			(6.4422)***	(8.5195)***	(8.6524)***			(2.49)**	(4.75)***	(4.99)***
Equity cost			-0.0025	0.0089	0.0094			-0.064968	-0.055999	-0.054977			-0.0439	-0.0260	-0.0247
			(-0.29)	(1.05)	(1.11)			(-4.4260)***	(-3.9329)***	(-3.8635)***			(-3.24)***	(-1.97)**	(-1.87)*
Econ. cycle			0.0180	0.0203	0.0232			0.023734	0.062651	0.072353			0.0316	0.0425	0.0448
			(0.64)	(0.74)	(0.85)			(0.4379)	(1.2128)	(1.4015)			(0.63)	(0.88)	(0.93)
Competition			0.0232	0.0355	0.0417			-0.062347	-0.113653	-0.095561			0.0016	-0.0651	-0.0582
			(0.37)	(0.58)	(0.68)			(-0.8563)	(-1.6505)*	(-1.3775)			(0.02)	(-0.86)	(-0.77)
Bank specific variables															
Cred. risk				0.2028	0.2130				0.500612	0.512139				0.5173	0.4980
				(2.21)**	(2.29)**				(2.2960)**	(2.3485)**				(3.16)***	(3.01)***
Cred. growth				-0.0141	-0.0139				-0.027430	-0.027169				-0.0281	-0.0287
				(-10.9)***	(-10.7)***				(-12.16)***	(-12.01)***				(-12.7)***	(-12.9)***
Cred. activ.				-0.0092	-0.0100				-0.026255	-0.030602				-0.0256	-0.0263
				(-5.22)***	(-5.37)***				(-7.7897)***	(-8.5757)***				(-7.91)***	(-7.71)***
Mark. fund.					0.0024					0.011753					0.0029
					(1.15)					(3.1813)***					(0.77)
Bank dep.					-0.00					0.002870					0.0086
					(-1.07)					(0.9363)					(2.97)***
Liab. cost					0.0024					0.046921					0.0485
					(0.14)					(1.5763)					(1.60)
Intercept	0.4434	0.4221	1.9301	2.3191	2.3676	1.782847	1.883574	4.434823	7.415666	7.481556	2.5058	2.4341	4.3803	7.7732	7.5864
	(2.19)**	(2.09)**	(2.82)***	(3.40)***	(3.42)***	(5.5956)***	(5.9497)***	(3.8358)***	(6.4277)***	(6.4246)***	(6.70)***	(6.53)***	(2.92)***	(5.30)***	(5.17)***
N° of obs.	2733	2733	2733	2733	2733	1882	1882	1882	1882	1882	2741	2741	2741	2741	2741
R^2	0.0581	0.0632	0.1071	0.1501	0.1509	0.1559	0.1499	0.2086	0.3040	0.3085	0.1234	0.1312	0.1456	0.2237	0.2296

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Results were obtained by estimating: $\Delta Cap_{i,t} = \lambda\left(Cap^{*}_{i,t} - Cap_{i,t-1}\right) + \omega_{i,t}$ (3") where $Cap^{*}_{i,t}$ is given by expression ($1''$) and $\lambda = SOA$. Column (1) of any of the three dependent variables: Leverage capital ratio (III), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (IV) gives the speed of adjustment (SOA) when the target specification $Cap^{*}_{i,t}$ is solely made of the intercept term. Columns (2) and (3) present the results when the initial capital and the traditional variables are respectively added. The subsequent columns (4) and (5) correspond to the inclusion of bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A9. Alternative econometric method: Panel Least Square with time fixed effects

Table A9.1. The effect of initial capital ratio, traditional and bank specific variables on future bank capital ratios

Variables	Leverage ratio (I)				Tier 1 risk-based capital ratio (II)				Total risk-based capital ratio (III)			
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Initial capital												
Initial capital ratio	0.7343	0.5139	0.5186	0.5227	0.560875	0.495483	0.470554	0.474623	0.5350	0.4709	0.4285	0.4271
	(69.55)***	(39.59)***	(39.88)***	(40.33)***	(43.4939)***	(34.4232)***	(33.7851)***	(34.1231)***	(45.83)***	(36.39)***	(32.82)***	(32.89)***
Traditional variables												
Size		-0.3490	-0.3403	-0.3223		-0.231284	-0.334106	-0.401440		-0.2046	-0.2994	-0.3670
		(-13.81)***	(-13.32)***	(-11.97)***		(-6.0010)***	(-8.9485)***	(-10.2367)***		(-5.78)***	(-8.46)***	(-9.52)***
Profit		0.9334	0.9753	0.9572		0.673406	0.826536	0.895389		0.4188	0.5333	0.5919
		(17.10)***	(17.58)***	(17.30)***		(7.2147)***	(9.3910)***	(10.1718)***		(5.18)***	(6.80)***	(7.52)***
Equity cost		-0.0693	-0.0617	-0.0600		-0.040724	-0.041451	-0.039489		-0.0435	-0.0335	-0.0326
		(-9.70)***	(-8.46)***	(-8.26)***		(-3.5844)***	(-3.7192)***	(-3.5726)***		(-4.03)***	(-3.16)***	(-3.08)***
Economic cycle		0.0615	0.0624	0.0546		0.153791	0.189959	0.241345		0.1489	0.1602	0.1915
		(1.85)*	(1.87)*	(1.60)		(2.8234)***	(3.7328)***	(4.6712)***		(2.79)***	(3.15)***	(3.70)***
Competition		0.1523	0.1480	0.1191		0.005089	0.034360	0.068630		0.1696	0.1804	0.1991
		(6.04)***	(5.86)***	(4.57)***		(4.54)***	(5.07)***	(5.57)***		(4.54)***	(5.07)***	(5.57)***
Bank specific variables												
Credit risk			0.2419	0.2716			0.083609	0.153827			0.1420	0.1628
			(2.76)***	(3.11)***			(0.5221)	(0.9667)			(1.06)	(1.22)
Credit growth			-0.0090	-0.0085			-0.028636	-0.028515			-0.0253	-0.0258
			(-4.45)***	(-4.24)***			(-9.1188)***	(-9.1468)***			(-8.42)***	(-8.62)***
Credit activity			-0.0082	-0.0090			-0.052333	-0.060081			-0.0544	-0.0581
			(-3.38)***	(-3.58)***			(-13.7938)***	(-15.0702)***			(-14.51)***	(-14.86)***
Market fundings				-0.0014				0.021654				0.0135
				(-0.48)				(5.0367)***				(3.14)***
Bank deposits				-0.0143				0.003910				0.0120
				(-6.06)***				(1.0351)				(3.42)***
Liability cost				-0.0010				0.080290				0.0836
				(-0.04)				(2.7078)***				(2.77)***
Intercept	2.0743	7.0850	7.3640	7.6999	3.964529	7.512506	12.281368	12.226976	5.8022	6.7446	11.8371	11.7848
	(21.60)***	(13.21)***	(13.19)***	(13.65)***	(26.4107)***	(8.3599)***	(13.4810)***	(13.3081)***	(33.02)***	(8.21)***	(13.69)***	(13.60)***
N° of obs.	2733	2733	2733	2733	1882	1882	1882	1882	2741	2741	2741	2741
R^2	0.6454	0.7171	0.7208	0.7249	0.5083	0.5406	0.6027	0.6105	0.4435	0.4687	0.5204	0.5264
% increase in R^2		10.00%	0.51%	0.57%		6.35%	11.49%	1.29%		5.38%	9.93%	1.14%

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. The results of the first two columns (I) and (II) were obtained by estimating: $Cap_{i,t} = \alpha + \beta Cap_{i,o} + \left[\gamma_1 size_{i,t} + \gamma_2 economic\ cycle_{i,t} + \sum_{c=3}^{5}\gamma_c T_{i,t-1}\right] + \left[\delta_1 credit\ demand_{i,t} + \sum_{d=2}^{6}\delta_d BS_{i,t-1}\right] + \nu_t + \varepsilon_{i,t}$ (1‴) where $cap_{i,0}$, *T*, and *BS* stand for initial capital, traditional and bank specific. Column (1) of any of the two dependent variables: Leverage capital ratio (I) and the Total risk-based capital ratio (II) presents the results with only one regressor called the initial capital ratio. Column (2) gives the results with five more variables called traditional variables. The subsequent columns (3) and (4) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A9.2. Speed of adjustment: comparative convergence between risk and non-risk adjusted bank capital ratios

Variables	**Leverage ratio (I)**					**Tier 1 risk-based capital ratio (II)**					**Total risk-based capital ratio (III)**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
							Speed of adjustment								
SOA	0.0606	0.0927	0.1321	0.1244	0.1274	0.1770	0.2098	0.2322	0.2579	0.2643	0.1745	0.2266	0.2423	0.2564	0.2596
	(9.28)***	(7.73)***	(9.83)***	(9.49)***	(9.64)***	(16.94)***	(12.47)***	(13.74)***	(15.54)***	(15.85)***	(17.96)***	(15.89)***	(16.78)***	(17.91)***	(18.10)***
% increase in **SOA**		52.97%	42.50%	-5.83%	2.41%		18.52%	10.71%	11.04%	2.50%		29.86%	6.93%	5.82%	1.25%
							Initial capital								
Init. cap. rat.		0.0351	0.0229	0.0275	0.0299		0.0311	0.0180	0.0397	0.0457		0.0593	0.0443	0.0515	0.0531
		(3.18)***	(2.06)**	(2.53)**	(2.73)***		(2.21)**	(1.25)	(2.91)***	(3.32)***		(4.96)***	(3.62)***	(4.38)***	(4.53)***
							Traditional variables								
Size			-0.1066	-0.0974	-0.0986			-0.0854	-0.1114	-0.1389			-0.0642	-0.0819	-0.1037
			(-6.54)***	(-6.04)***	(-5.80)***			(-3.19)***	(-4.22)***	(-4.95)***			(-2.56)**	(-3.20)***	(-3.72)***
Profit			0.0789	0.1026	0.1038			0.4674	0.554543	0.5835			0.1702	0.2582	0.2826
			(2.15)**	(2.80)***	(2.83)***			(7.25)***	(9.0345)***	(9.42)***			(2.97)***	(4.62)***	(5.03)***
Equity cost			-0.0009	0.0070	0.0073			-0.0361	-0.0275	-0.0270			-0.0253	-0.0132	-0.0140
			(-0.19)	(1.52)	(1.59)			(-4.61)***	(-3.55)***	(-3.49)***			(-3.32)***	(-1.76)*	(-1.86)*
Econ. cycle			0.0231	0.0319	0.0340			0.0434	0.0875	0.1081			0.0347	0.0582	0.0628
			(1.11)	(1.56)	(1.61)			(1.15)	(2.47)**	(2.98)***			(0.92)	(1.61)	(1.70)*
Competition			0.0468	0.0443	0.0418			-0.0366	-0.0289	-0.0136			0.0602	0.0537	0.0611
			(2.94)***	(2.84)***	(2.59)***			(-1.30)	(-1.09)	(-0.50)			(2.28)**	(2.12)**	(2.39)**
							Bank specific variables								
Cred. risk				0.1391	0.1469				0.2858	0.3111				0.2420	0.2344
				(2.58)***	(2.71)***				(2.56)**	(2.79)***				(2.56)**	(2.48)**
Cred. growth				-0.0141	-0.0140				-0.0307	-0.0307				-0.0307	-0.0311
				(-11.3)***	(-11.2)***				(-14.12)***	(-14.12)***				(-14.40)***	(-14.62)***
Cred. activ.				-0.0068	-0.0072				-0.0183	-0.0217				-0.0190	-0.0192
				(-4.54)***	(-4.63)***				(-6.71)***	(-7.35)***				(-6.92)***	(-6.69)***
Mark. fund.					0.0009					0.0081					0.0020
					(0.53)					(2.70)***					(0.67)
Bank dep.					-0.0024					0.0033					0.0093
					(-1.64)					(1.26)					(3.76)***
Liab. cost					0.0011					0.0292					0.0307
					(0.08)					(1.40)					(1.43)
Intercept	0.4800	0.4562	1.9941	2.2247	2.3072	1.6411	1.6441	3.3832	4.9166	4.8898	2.2224	2.0964	2.4296	4.0967	3.9606
	(8.25)***	(7.79)***	(5.77)***	(6.32)***	(6.43)***	(14.47)***	(14.46)***	(5.40)***	(7.52)***	(7.37)***	(16.09)***	(14.99)***	(4.15)***	(6.50)***	(6.25)***
N° of obs.	2733	2733	2733	2733	2733	1882	1882	1882	1882	1882	2741	2741	2741	2741	2741
R^2	0.0430	0.0466	0.0701	0.1198	0.1210	0.1490	0.1406	0.1903	0.2894	0.2937	0.1161	0.1241	0.1361	0.2125	0.2185

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Results were obtained by estimating: $\Delta Cap_{i,t} = \lambda\left(Cap^*_{i,t} - Cap_{i,t-1}\right) + \omega_{i,t}$ $(3''')$ where $Cap^*_{i,t}$ is given by expression ($1'''$) and $\lambda = SOA$. Column (1) of any of the three dependent variables: Leverage capital ratio (III), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (IV) gives the speed of adjustment (SOA) when the target specification $Cap^*_{i,t}$ is solely made of the intercept term. Columns (2) and (3) present the results when the initial capital and the traditional variables are respectively added. The subsequent columns (4) and (5) correspond to the inclusion of bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A.10. Without both France and Italy

Table A10.1. The effect of initial capital ratio, traditional and bank specific variables on future bank capital ratios

Variables	**Leverage ratio (I)**				**Tier 1 risk-based capital ratio (II)**				**Total risk-based capital ratio (III)**			
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Initial capital												
Initial capital ratio	0.7288	0.3092	0.3086	0.3111	0.6119	0.5352	0.4782	0.4562	0.5199	0.4353	0.3854	0.3550
	(53.70)***	(17.20)***	(16.74)***	(16.87)***	(39.13)***	(28.12)***	(24.61)***	(23.21)***	(35.99)***	(25.92)***	(21.82)***	(19.87)***
Traditional variables												
Size		-0.4064	-0.3877	-0.3685		-0.0751	-0.2159	-0.3142		-0.0983	-0.2135	-0.3401
		(-12.35)***	(-11.38)***	(-9.79)***		(-1.38)	(-3.90)***	(-5.20)***		(-1.97)**	(-4.06)***	(-5.65)***
Profit		1.6899	1.7291	1.7138		0.6383	0.8909	1.0635		0.3712	0.4804	0.7324
		(17.87)***	(17.93)***	(16.91)***		(4.00)***	(5.83)***	(6.73)***		(2.65)***	(3.53)***	(5.04)***
Equity cost		-0.1840	-0.1846	-0.1847		-0.0889	-0.1142	-0.1331		-0.1114	-0.0946	-0.1074
		(-9.63)***	(-9.43)***	(-9.41)***		(-2.79)***	(-3.75)***	(-4.35)***		(-3.95)***	(-3.40)***	(-3.86)***
Economic cycle		0.1135	0.1187	0.1139		0.0616	0.0827	0.0925		0.1201	0.1281	0.1187
		(3.35)***	(3.50)***	(3.35)***		(1.03)	(1.44)	(1.61)		(2.13)**	(2.36)**	(2.20)**
Competition		0.1511	0.1416	0.1273		0.0535	0.0777	0.1116		0.2349	0.2520	0.2162
		(5.44)***	(5.05)***	(4.28)***		(0.98)	(1.48)	(2.12)**		(5.05)***	(5.59)***	(4.80)***
Bank specific variables												
Credit risk			0.1936	0.1793			-1.0822	-1.0597			-0.2712	-0.2269
			(1.14)	(1.06)			(-3.21)***	(-3.17)***			(-1.01)	(-0.85)
Credit growth			-0.0029	-0.0029			-0.0164	-0.0133			-0.0097	-0.0087
			(-1.08)	(-1.06)			(-3.69)***	(-3.01)***			(-2.23)**	(-2.02)**
Credit activity			0.0057	0.0069			-0.0381	-0.0548			-0.0423	-0.0561
			(1.78)*	(2.01)**			(-7.29)***	(-9.57)***			(-7.91)***	(-9.78)***
Market fundings				-0.0054				0.0282				0.0266
				(-1.40)				(4.85)***				(4.31)***
Bank deposits				-0.0029				-0.0139				-0.0064
				(-0.81)				(-2.46)**				(-1.15)
Liability cost				-0.0207				0.3739				0.4933
				(-0.42)				(5.23)***				(6.24)***
Intercept	2.3018	8.8826	8.2526	8.2647	3.7445	4.6005	9.8531	10.3875	6.2538	4.8642	9.6256	10.9573
	(17.95)***	(13.27)***	(11.54)***	(10.37)***	(20.65)***	(3.63)***	(7.40)***	(7.35)***	(27.48)***	(4.32)***	(7.83)***	(8.25)***
N° of obs.	1548	1548	1548	1548	1103	1103	1103	1103	1548	1548	1548	1548
R^2	0.6582	0.8074	0.8085	0.8101	0.5876	0.6095	0.6482	0.6542	0.4688	0.4952	0.5344	0.5445
% increase in R^2		22.67%	0.14%	0.20%		3.73%	6.35%	0.93%		5.63%	7.92%	1.89%

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and the Total risk-based capital ratio (III) presents the results with only one regressor called the initial capital ratio. Column (2) gives the results with five more variables called traditional variables. The subsequent columns (3) and (4) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A10.2. Speed of adjustment: comparative convergence between risk and non-risk adjusted bank capital ratios

Variables	**Leverage ratio (I)**					**Tier 1 risk-based capital ratio (II)**					**Total risk-based capital ratio (III)**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Speed of adjustment															
SOA	0.0471	0.0626	0.1184	0.1077	0.1107	0.1198	0.1686	0.1799	0.1872	0.1974	0.1610	0.2089	0.2275	0.2264	0.2323
	(6.32)***	(4.57)***	(6.16)***	(5.57)***	(5.71)***	(10.63)***	(8.90)***	(9.19)***	(9.47)***	(9.77)***	(14.29)***	(12.78)***	(13.27)***	(13.06)***	(13.14)***
% increase in **SOA**		32.91%	89.14%	-9.04%	2.79%		40.73%	6.70%	4.06%	5.45%		29.75%	8.90%	-0.48%	2.61%
Initial capital															
Init. cap. rat.		0.0168	0.0089	0.0058	0.0074		0.0507	0.0335	0.0374	0.0385		0.0534	0.0402	0.0435	0.0416
		(1.36)	(0.72)	(0.47)	(0.60)		(3.20)***	(2.03)**	(2.37)**	(2.44)**		(4.03)***	(2.90)***	(3.18)***	(3.05)***
Traditional variables															
Size			-0.1439	-0.1324	-0.1319			-0.0222	-0.0220	-0.0548			-0.0090	-0.0010	-0.0095
			(-6.81)***	(-6.17)***	(-5.54)***			(-0.66)	(-0.64)	(-1.45)			(-0.28)	(-0.03)	(-0.24)
Profit			0.1077	0.1941	0.1815			0.1139	0.3168	0.3477			-0.0640	0.0901	0.1808
			(1.50)	(2.72)***	(2.45)**			(1.15)	(3.32)***	(3.49)***			(-0.70)	(1.01)	(1.88)*
Equity cost			0.0129	0.0282	0.0286			-0.0420	-0.0322	-0.0355			-0.0534	-0.0306	-0.0339
			(0.93)	(1.99)**	(2.00)**			(-2.12)**	(-1.69)*	(-1.83)*			(-2.88)***	(-1.66)*	(-1.83)*
Econ. cycle			0.0312	0.0468	0.0463			0.0004	0.0399	0.0460			0.0053	0.0304	0.0249
			(1.44)	(2.18)**	(2.14)**			(0.01)	(1.12)	(1.29)			(0.14)	(0.85)	(0.69)
Competition			0.0407	0.0318	0.0244			-0.0462	-0.0563	-0.0468			0.0611	0.0503	0.0457
			(2.27)**	(1.78)*	(1.29)			(-1.36)	(-1.72)*	(-1.41)			(2.00)**	(1.67)*	(1.52)
Bank specific variables															
Cred. risk				0.2831	0.2793				0.3288	0.3269				0.3659	0.4075
				(2.66)***	(2.61)***				(1.55)	(1.54)				(2.05)**	(2.29)**
Cred. growth				-0.0127	-0.0126				-0.0220	-0.0214				-0.0208	-0.0212
				(-7.34)***	(-7.22)***				(-7.99)***	(-7.74)***				(-7.29)***	(-7.39)***
Cred. activ.				-0.0051	-0.0046				-0.0118	-0.0157				-0.0116	-0.0126
				(-2.52)**	(-2.11)**				(-3.58)***	(-4.25)***				(-3.23)***	(-3.21)***
Mark. fund.					-0.0011					0.0079					0.0003
					(-0.46)					(2.16)**					(0.06)
Bank dep.					-0.0000					-0.0010					0.0033
					(-0.02)					(-0.29)					(0.91)
Liab. cost					-0.0375					0.0498					0.1356
					(-1.19)					(1.12)					(2.58)**
Intercept	0.3906	0.3825	2.5583	2.5851	2.7903	1.1769	1.1466	2.2837	2.9572	3.3194	2.1435	2.0328	1.7770	2.2781	2.0048
	(5.64)***	(5.50)***	(5.82)***	(5.66)***	(5.45)***	(9.48)***	(9.25)***	(2.92)***	(3.54)***	(3.71)***	(12.90)***	(12.13)***	(2.42)**	(2.78)***	(2.23)**
N° of obs.	1548	1548	1548	1548	1548	1103	1103	1103	1103	1103	1548	1548	1548	1548	1548
R^2	0.0554	0.0565	0.1274	0.1534	0.1489	0.1535	0.1614	0.1612	0.2415	0.2485	0.1428	0.1518	0.1375	0.1905	0.1984

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (III) gives the speed of adjustment (SOA) when the target specification $cap^*_{i,t}$ is solely made of the intercept term. Columns (2) and (3) present the results when the initial capital and the traditional variables are respectively added. The subsequent columns (4) and (5) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A11. Without UK

Table A11.1. The effect of initial capital ratio, traditional and bank specific variables on future bank capital ratios

Variables	Leverage ratio (I)				Tier 1 risk-based capital ratio (II)				Total risk-based capital ratio (III)			
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Initial capital												
Initial capital ratio	0.7431	0.4787	0.4817	0.4864	0.5643	0.4899	0.4563	0.4590	0.5415	0.4714	0.4226	0.4164
	(71.13)***	(34.60)***	(34.25)***	(34.74)***	(43.54)***	(33.09)***	(31.22)***	(31.29)***	(46.08)***	(35.49)***	(31.22)***	(30.81)***
Traditional variables												
Size		-0.3071	-0.3058	-0.2972		-0.1857	-0.3066	-0.4014		-0.1622	-0.2792	-0.3710
		(-12.21)***	(-11.82)***	(-10.67)***		(-4.39)***	(-7.46)***	(-9.18)***		(-4.21)***	(-7.08)***	(-8.47)***
Profit		1.3846	1.4309	1.4260		1.0288	1.3063	1.4507		0.6045	0.8240	0.9641
		(16.50)***	(17.02)***	(16.63)***		(6.97)***	(9.48)***	(10.29)***		(4.81)***	(6.92)***	(7.81)***
Equity cost		-0.1110	-0.1026	-0.0995		-0.0669	-0.0745	-0.0712		-0.0687	-0.0510	-0.0477
		(-9.16)***	(-8.33)***	(-8.09)***		(-3.22)***	(-3.75)***	(-3.59)***		(-3.66)***	(-2.82)***	(-2.63)***
Economic cycle		0.0433	0.0481	0.0507		0.1357	0.1661	0.2255		0.2020	0.2079	0.2512
		(1.22)	(1.35)	(1.40)		(2.28)**	(2.98)***	(4.00)***		(3.44)***	(3.73)***	(4.47)***
Competition		0.1408	0.1402	0.1190		0.0021	0.0474	0.1011		0.1971	0.2050	0.2285
		(5.06)***	(5.03)***	(4.08)***		(0.04)	(0.91)	(1.92)*		(4.36)***	(4.76)***	(5.25)***
Bank specific variables												
Credit risk			0.1797	0.2455			-0.2061	-0.0770			0.0661	0.1271
			(1.31)	(1.79)*			(-0.69)	(-0.26)			(0.30)	(0.58)
Credit growth			-0.0072	-0.0062			-0.0227	-0.0217			-0.0192	-0.0192
			(-3.58)***	(-3.10)***			(-6.92)***	(-6.60)***			(-6.16)***	(-6.16)***
Credit activity			-0.0071	-0.0095			-0.0548	-0.0672			-0.0564	-0.0629
			(-2.77)***	(-3.49)***			(-12.89)***	(-14.48)***			(-13.78)***	(-14.28)***
Market fundings				0.0014				0.0277				0.0176
				(0.44)				(5.89)***				(3.71)***
Bank deposits				-0.0147				0.0017				0.0106
				(-5.78)***				(0.40)				(2.68)***
Liability cost				0.0301				0.1443				0.1489
				(1.14)				(3.41)***				(3.56)***
Intercept	1.9986	6.5147	6.8305	7.1054	3.9257	6.6869	11.8145	11.8176	5.7373	5.4694	11.0726	11.1373
	(21.03)***	(11.80)***	(11.76)***	(12.03)***	(26.00)***	(6.23)***	(11.06)***	(10.88)***	(32.46)***	(5.88)***	(11.41)***	(11.42)***
N° of obs.	2681	2681	2681	2681	1853	1853	1853	1853	2689	2689	2689	2689
R^2	0.6597	0.7475	0.7486	0.7529	0.5126	0.5455	0.6098	0.6131	0.4506	0.4781	0.5340	0.5398
% increase in R^2		13.31%	0.15%	0.57%		6.42%	11.79%	0.54%		6.10%	11.69%	1.09%

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and the Total risk-based capital ratio (III) presents the results with only one regressor called the initial capital ratio. Column (2) gives the results with five more variables called traditional variables. The subsequent columns (3) and (4) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

Table A11.2. Speed of adjustment: comparative convergence between risk and non-risk adjusted bank capital ratios

Variables	**Leverage ratio (I)**					**Tier 1 risk-based capital ratio (II)**					**Total risk-based capital ratio (III)**				
Model	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Speed of adjustment															
SOA	0.0605	0.1047	0.1422	0.1318	0.1340	0.1853	0.2248	0.2396	0.2678	0.2738	0.1823	0.2291	0.2464	0.2639	0.2668
	(9.33)***	(8.73)***	(10.32)***	(9.75)***	(9.86)***	(16.99)***	(12.68)***	(13.72)***	(15.53)***	(15.81)***	(17.74)***	(15.46)***	(16.44)***	(17.51)***	(17.67)***
% increase in **SOA**		73.06%	35.82%	-7.31%	1.67%		21.32%	6.58%	11.77%	2.24%		25.67%	7.55%	7.10%	1.10%
Initial capital															
Init. cap. rat.		0.0484	0.0329	0.0372	0.0389		0.0415	0.0129	0.0355	0.0410		0.0540	0.0361	0.0430	0.0447
		(4.38)***	(2.98)***	(3.43)***	(3.56)***		(2.82)***	(0.88)	(2.56)**	(2.94)***		(4.38)***	(2.86)***	(3.54)***	(3.69)***
Traditional variables															
Size			-0.0990	-0.0940	-0.0991			-0.0397	-0.0810	-0.1210			-0.0501	-0.0828	-0.1123
			(-6.03)***	(-5.71)***	(-5.59)***			(-1.30)	(-2.67)***	(-3.75)***			(-1.77)*	(-2.77)***	(-3.40)***
Profit			0.1117	0.1475	0.1539			0.8246	0.9176	0.9889			0.2737	0.3923	0.4452
			(1.91)*	(2.58)***	(2.65)***			(7.38)***	(8.69)***	(9.04)***			(2.89)***	(4.35)***	(4.77)***
Equity cost			-0.0022	0.0114	0.0122			-0.0630	-0.0496	-0.0495			-0.0425	-0.0221	-0.0232
			(-0.26)	(1.39)	(1.48)			(-4.18)***	(-3.40)***	(-3.39)***			(-3.11)***	(-1.67)*	(-1.74)*
Econ. cycle			0.0214	0.0300	0.0362			0.0136	0.0619	0.0872			0.0356	0.0621	0.0710
			(0.93)	(1.34)	(1.58)			(0.33)	(1.60)	(2.23)**			(0.91)	(1.67)*	(1.88)*
Competition			0.0542	0.0530	0.0534			-0.0573	-0.0469	-0.0287			0.0370	0.0154	0.0259
			(3.03)***	(3.01)***	(2.89)***			(-1.41)	(-1.23)	(-0.75)			(0.98)	(0.43)	(0.71)
Bank specific variables															
Cred. risk				0.1438	0.1601				0.3148	0.3839				0.3314	0.3294
				(1.67)*	(1.84)*				(1.26)	(1.53)				(1.82)*	(1.79)*
Cred. growth				-0.0148	-0.0145				-0.0291	-0.0285				-0.0279	-0.0282
				(-11.57)***	(-11.34)***				(-12.39)***	(-12.11)***				(-11.96)***	(-12.05)***
Cred. activ.				-0.0068	-0.0078				-0.0204	-0.0254				-0.0216	-0.0225
				(-4.21)***	(-4.51)***				(-6.47)***	(-7.34)***				(-6.95)***	(-6.71)***
Mark. fund.					0.0022					0.0109					0.0034
					(1.13)					(3.22)***					(0.98)
Bank dep.					-0.0027					0.0022					0.0090
					(-1.65)*					(0.70)					(3.06)***
Liab. cost					0.0071					0.0518					0.0493
					(0.42)					(1.71)*					(1.61)
Intercept	0.3906	0.3825	2.5583	2.5851	2.7903	1.6909	1.6483	2.8039	4.6446	4.7101	2.2729	2.1500	2.5856	4.7956	4.6477
	(5.64)***	(5.50)***	(5.82)***	(5.66)***	(5.45)***	(14.30)***	(13.86)***	(3.57)***	(5.80)***	(5.79)***	(15.81)***	(14.73)***	(3.41)***	(5.96)***	(5.73)***
N° of obs.	2681	2681	2681	2681	2681	1714	1714	1714	1714	1714	2531	2531	2531	2531	2531
R²	0.0437	0.0506	0.0998	0.1443	0.1481	0.1625	0.1664	0.2199	0.3210	0.3262	0.1225	0.1292	0.1447	0.2220	0.2280

All variables are described in Table 3. *, **, *** mean significant at the 10, 5 and 1% level respectively and t-statistics are between parentheses. Column (1) of any of the three dependent variables: Leverage capital ratio (I), Tier 1 risk-based capital ratio (II) and Total risk-based capital ratio (III) gives the speed of adjustment (SOA) when the target specification $cap^{*}_{i,t}$ is solely made of the intercept term. Columns (2) and (3) present the results when the initial capital and the traditional variables are respectively added. The subsequent columns (4) and (5) correspond to the inclusion of the bank specific variables added in two different waves starting by asset structure variables followed by market discipline variables.

THE ROLE OF MARKET DISCIPLINE ON BANK CAPITAL BUFFER: *EVIDENCE FROM A SAMPLE OF EUROPEAN BANKS*

1.7. Introduction

Since 1985, nearly all the Basel Committee countries have placed substantial reliance on specific capital ratios that were increasingly based on a risk weighting of assets. However, it was not until 1988 that a formal minimum capital requirement was firstly introduced at the international level through what became known as Basel I[45]. The main motivation of Basel I was to deal with the risk associated with the phenomenon known as "the race to the bottom" that is "one country's lower regulatory standards make it more difficult for other countries to maintain rigorous but necessarily more costly standards"[46]. Hence, under Basel I, to meet the prudential regulation guidelines, banks must hold a minimum regulatory capital ratio dependent on its asset risk. More precisely, they have to fulfil two requirements: Tier 1 capital at least equal to 4% of risk weighted assets (RWA) and Total regulatory capital (Tier 1 + Tier 2) at least equal to 8% of RWA. Consequently, internationally active banks have raised their capital ratios in accordance with the regulation.

However, after the implementation of Basel I, there has been a noticeable upward trend in bank capital ratios throughout G-10 countries with banks holding capital ratios well beyond the regulatory constraint. This has raised the issue of why banks hold such high capital ratios, or put differently, why they hold capital in excess[47] of what is required by the regulator. Indeed, bankers often argue that capital is more expensive than debt. Therefore, it appears important to determine what underlines this unexpected behavior.

The very few empirical studies that we are aware of, which deal with the determinants of capital buffer, have mainly focused on the relationship between a given factor and the buffer by controlling for its other potential determinants. In this vein, Lindquist (2004) considers Norwegian banks and investigates if risk is an important determinant of the buffer[48]. He does not find any significant link. Ayuso et al. (2004), Stolz and Wedow (2011) consider

[45] The final agreement was signed on July 11, 1988. The capital standard became effective in March 1989 and internationally active banks were required to achieve the benchmark by December 1992.
[46] Tarullo (2008, p.53).
[47] Throughout this paper, this excess capital is called capital buffer and defined as the difference between the actual capital ratio ((Tier 1+Tier2)/Risk weighted assets) and the Basel minimum required capital ratio (8%), except for special cases (see section 2.2.2).
[48] A study by Jokippi and Milne (2011) focuses on the relationship between risk and the buffer adjustments and finds a positive two-way link.

Spanish and German banks respectively and Jokipii and Milne (2008) consider banks from 25 European countries to investigate how the business cycle influences the capital buffer. Their results globally indicate that banks tend to decrease the capital buffer during the upturn and increase it in the downturn.

In our analysis of the determinants of capital buffer, we mainly focus on the role played by market discipline. Other papers have considered market discipline. For example, Flannery and Rangan (2008) considering large US banks, investigate the causes of the bank capital build-up of the 1990s. They find that even though several factors explain the capital build-up, market discipline[49] contributed for the largest part of it. Fonseca and Gonzalez (2010), using cross country data based on 70 countries, aim to determine if the influence of market discipline[50] (among other factors) on capital buffer varies between countries that have different frameworks of regulation, supervision and institutions. They show that, although the market discipline indicator has a positive impact on the bank capital buffer, the relationship depends on some structural factors. Restrictions on bank activities, official supervision and bad institutional environment reduce the incentives to hold capital buffers by weakening market discipline. The closest paper to ours is Nier and Baumann (2006). They test empirically the hypothesis that market discipline provides incentives for banks to constitute capital buffer in order to limit their default risk. They find, using a large cross-country panel data set from 32 countries, that market discipline, measured as the share of interbank deposits and subordinated debt in total liabilities, induces banks to choose higher capital ratios.

Following Nier and Baumann (2006) and using a sample of European commercial banks over 1992-2006, we study the influence[51] of market discipline on the build-up of capital buffer. According to Evanoff and Wall (2000), banks can be exposed to ex-ante or ex-post market discipline. Ex-post market discipline implies that banks change their behaviour following a change in debt spread whereas ex-ante market discipline refers to the fact that

[49] Flannery and Rangan (2008) consider bank's quasi-market value of assets volatility as the risk variable and assume that bank counterparties require higher capital buffers accordingly. Thus, if BHCs are subject to market forces the coefficient associated with the risk variable should be significant and the more market discipline there is the higher should be the coefficient.

[50] Fonseca and Gonzalez (2010) consider countries with very different banking systems and therefore, they are able to use the cost of deposits as a market discipline proxy.

[51] Bliss and Flannery (2001) distinguish two components of market discipline : *monitoring* that corresponds to the fact that investors accurately assess changes in banks financial condition and promptly incorporate it into their stock and bond prices, and *influence* that is the ability of market participants to affect banks' financial decisions. In this paper, we focus on influence.

banks exposed to market discipline may change their behaviour ex-ante in order to avoid the costs imposed by market participants through higher spreads. In this paper, we consider ex-ante discipline assuming that this discipline encourages banks to behave more prudently and, we explicitly focus on the link between market discipline and bank capital buffer. Besides, we enrich the previous literature on two main aspects.

First, we distinguish junior from senior debt holders. Indeed, both types of debt holders are not expected to similarly consider bankruptcy risk because their status in case of liquidation is different. Junior debt holders have a lower priority than senior debt holders and thus are more at risk. Thus, we test whether these two kinds of debt holders exert a significant pressure on banks to hold capital buffer and whether junior debt holders exert a higher pressure. It is important to determine whether the discipline exerted by these different debt holders might be considered as a complement to capital regulation and which one is the most effective.

Second, we suspect that market participants may require capital buffer because the regulatory capital constraint does not appropriately take into account all the risks borne by banks specifically those related to non traditional activities (in opposition to traditional activities such as loan supply). Indeed, it is widely known that the substantial growth of the off-balance sheet activities experienced during the last years was mainly motivated by the low capital regulatory requirements associated with them (Jagtiani et al., 1995). Moreover, it is also recognized that the trading book was a key source of the build-up of the leverage witnessed during the last financial crisis. As argued in a recent BIS document (BCBS, 2009b), "an important contributing factor was that the current capital framework for market risk, based on the 1996 Amendment to the Capital Accord to incorporate market risks, does not capture some key risks". Accordingly, the activities of banks have rapidly and deeply changed these last decades: market activities have expanded with the creation of more and more complex financial instruments and banks have broadly used securitization. These changes have been reflected in the structure of banks' income with an increasing proportion of non-interest income[52]. By contrast, capital regulation seems quite rigid; it is difficult, even impossible to adapt it timely and adequately to this new evolving environment. We assume that market participants may adapt more rapidly and may consider these changes to determine the adequate level of capital of the bank[53]. Thus, it appears interesting to determine whether

[52] Non interest income includes trading income beyond commission and fee income.

[53] A recent theoretical support of the complementary use of capital regulation and market discipline is Chen and Hasan (2011). Their results show in particular that their combination may be needed if bank capital ratios cannot

the impact of market discipline on bank capital buffer is different depending on whether the bank is highly involved in non-traditional activities or not. If market discipline is effective for banks highly involved in nontraditional activities, it might be used as a complement to capital regulation.

The rest of the paper is structured as follows. In section 2.2, we set our hypotheses and the method used to test them, define our variables and present the sample of banks. The results and the robustness checks are presented in section 2.3. Section 2.4 concludes the paper.

1.8. Hypotheses, model, variables and sample

1.8.1 Hypotheses

Firstly, we consider that banks whose debt holders are more sensitive to default risk are expected to hold more capital than prescribed by the regulator. Indeed, we assume that these debt holders may lack confidence in the ability of a bank to survive if it operates with a capital ratio very close to or below the regulatory minimum[54]. In that case, they may pressure the bank to hold more capital than required by regulation. Hence, we consider that the type of funding could impact bank capital buffer. Accordingly, we investigate the impact of market discipline on capital buffer by focusing on the extent to which banks rely on market funding. Capital buffer should be positively related to the proportion of market funding because their holders are the creditors who have the highest incentives to exert a discipline and therefore, it is more costly for the bank to increase its risk of default when it has a larger proportion of market liabilities (Nier and Baumann, 2006). Besides, it has been shown both theoretically and empirically by Gropp and Vesala (2004) that banks with a larger share of uninsured funding have incentives to take less risk. They suggest that the larger is the proportion of

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timely reflect the true financial health of banks. They also derive necessary conditions for having an effective market discipline regulation.

[54] In this paper, we focus on the pressure to hold a capital buffer emanating from uninsured debt holders. However regulatory or supervisory pressure may also induce banks to ensure themselves against the risk to fall below the regulatory minimum capital ratio (see Lindquist, 2004 and Flannery and Rangan, 2008). In our robustness tests, we follow Flannery and Rangan (2008) and control for the regulatory pressure (see section 2.3.2 for details).

uninsured funding, the stronger is the effect of market discipline. Indeed, the larger is the proportion of uninsured liabilities, the stronger is the cost impact related to market discipline for a given increase in bank risk. Thus, following these studies, we consider that the structure of bank liabilities is a crucial factor and assume that banks heavily relying on market funding may exhibit higher capital buffer as they are potentially more subject to market discipline.

H1: Market debt holders exert a pressure on banks to hold capital buffer: the more the bank relies on market funding the higher is its capital buffer.

Secondly, there is a variety of uninsured debt holders of banks and they may behave differently. A large part of the literature on market discipline is dedicated to subordinated debt (Bliss, 2001; Evanoff and Wall, 2000; Morgan and Stiroh, 2001; Sironi, 2003). The reason is that for market discipline to be effective, market participants must have the incentives to exert it, that is they must feel at risk, and subordinated debt holders are particularly at risk due to their *junior* status. Indeed, junior debt also called subordinated debt corresponds to a debt that has a lower priority than other debt in case of failure of the issuer. It comes after government tax authorities and senior debt holders in the hierarchy of creditors and just before equity. Thus, subordinated debt holders are particularly at risk and have higher incentives to monitor banks and to exert a discipline. Therefore, we distinguish junior from senior debt holders and study whether both of them exert a pressure on banks to hold capital buffer. We expect that the pressure of the market on banks to hold capital buffer may be different depending on the status of the creditors: senior or junior debt holders. Junior debt holders should have more incentives to exert a pressure on banks.

H2: The market pressure exerted by junior debt holders on banks to hold capital buffer is higher than the one exerted by senior debt holders.

Lastly, we depart from the fact that trading activities and securitizations have gained an increasing importance in recent years but that they are more imperfectly taken into account in the Basel accords than bank traditional activities (BCBS, 2009a; BCBS, 2009b). We therefore conjecture that, the more the bank is involved in trading activities, the more capital buffer market participants require. Indeed, we assume that the market, contrary to regulators, can adapt quickly (De Young et al., 2001) and consider the risk of these activities which are not well taken into account in the regulatory constraint. We hypothesize that the type of activity of banks affects capital buffer. The market pressure on banks heavily involved in non-traditional activities (market activities as opposed to loan activity)[55] to hold capital buffer may be higher than on those more turned towards traditional activities as it reflects the lack of the capital regulation.

H3: The market pressure on banks to hold capital buffer is higher for those more involved in trading activities.

1.8.2 Model and main variables

To test our three hypotheses, we estimate the two following models. Subscripts i and t denote bank and period respectively.

$$buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t} \quad (1)$$

$$buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t} \quad (2)$$

Buffer is the capital buffer variable, *mktdisc*, *mktdisc_senior*, and *mktdisc_junior* the market discipline variables, C_j the jth control variable and η_i and τ_t the individual and time fixed effects[56].

The dependent variable *buffer* corresponds to the amount of capital banks hold in excess of what is required by national regulators. More precisely, we construct the variable *buffer* as the bank's actual total risk-weighted capital ratio less its regulatory minimum requirements. This regulatory minimum requirement is set to 8% in most countries of our

[55] Non-traditional activities not only consist of market activities. For example, there are also insurance activities and other financial services. However, in this paper, we focus on activities generating market risks as they are considered to be imperfectly taken into account into the Basel accords.
[56] The regressions include individual and time fixed effects as the Fisher test rejects the null hypothesis of homogeneity in both individual and time dimensions.

sample except in Germany where it is set to 12.5% for newly established banks in the first two years of business and in the United Kingdom where we consider 9%. Indeed, the Financial Stability Authority (FSA) sets two separate capital requirements for each UK bank: a 'trigger ratio', which is the minimum individual capital ratio; and a 'target ratio' set above the trigger. We therefore follow Jokipii and Milne (2008) and consider 9% minimum capital requirement ratio for all UK banks.

Hypothesis H1 is tested by estimating Model 1 and testing the significance of the coefficient associated with our market discipline indicator *mktdisc*. We expect to find a positive and significant relationship with capital buffer. The market discipline indicator reflects the importance of market funded liabilities in total liabilities. This ratio is constructed as (total liabilities minus total deposits)/ total liabilities.

In order to test our second hypothesis H2, we estimate Model 2 in which we replace the previous market discipline indicator by two separate indicators: one for senior debt (*mktdisc_senior*) and one for junior debt (*mktdisc_junior)*. Our variable *mktdisc_junior* corresponds to the ratio of subordinated debt to total liabilities. The ratio of senior market debt *mktdisc_senior* is constructed as (total liabilities minus total deposits minus subordinated debt)/ total liabilities. This ratio considers only senior market debt that is market debt that takes priority over junior debt. In case of bank default, senior debt holders are reimbursed before junior debt holders. We expect to find higher significance level and/or higher coefficient magnitude for the variable *mktdisc_junior* than for the variable *mktdisc_senior*.

To test the third hypothesis H3 that is whether the pressure exerted by market participants on banks to hold capital buffer is different depending on bank activities, we estimate Models 1 and 2 on different sub-samples defined on the basis of two alternative ratios. First, we consider the revenue generated by trading activities and construct the ratio of net trading revenue to net operating income where net operating income is defined as net interest income plus net non interest income[57]. We also consider the rough ratio of off-balance sheet activities to total assets as another proxy for the involvement of banks in non traditional activities which generate market risk. The higher are these ratios, the higher is the involvement of banks in non-traditional activities. These ratios are used alternatively to

[57] Net non interest income is defined as the sum of net commission and fee income and net trading revenue.

separate our sample in two parts. For each ratio, we separate banks with a value of the considered ratio higher than the median from those with a ratio lower than the median[58]. Our hypothesis is that our market discipline variables may be more significant or only significant for banks more involved in non-traditional activities.

In all our regressions, in line with the existing literature, we consider several control variables C_j likely to explain banks' capital buffer.

Following Flannery and Rangan (2008), we consider the fact that capital buffer could simply reflect an unusual period of bank profitability. When raising new capital is costly, capital accumulation could rely on internally generated funds, in line with the “Pecking order theory” of capital structure. Bankers may increase capitalization through higher retained earnings and weaker dividend payments and stock repurchase. We therefore expect a positive relationship between *profit*, which is defined as post tax profit/ total assets, and capital buffer.

In a world different from that of Modigliani and Miller (1958), equity is more costly compared to other bank liabilities because of information asymmetries. Equity may also be disadvantaged because interest payments on debt are deducted from earnings before tax. Capital buffer is hence expected to be negatively associated with the cost of equity. However, direct measurement of this cost is difficult. Therefore, previous studies have considered the return on equity (ROE) as a proxy variable for the direct cost of capital buffer[59].

We consider the ratio of loan loss provisions to total assets (*llpa)* as the risk variable and the expected sign between this variable and capital buffer is not clear cut. Indeed, on the one hand a strand of literature outlines a significant positive impact of risk on capital (Flannery and Rangan, 2008; Gropp and Heider, 2010 and; Berger et al., 2008). The rationale for this finding is that good bank management implies that the more the risk the bank plans to take, the more the capital it keeps aside. On the other hand, there is another strand of literature that supports the idea that the increase of ex post measure of risk should lower capital buffer given that capital is kept to face unexpected losses (Ayuso et al., 2004; Nier and Baumann, 2006 and; Fonseca and Gonzalez, 2010).

[58] Note that 63% of the observations are classified similarly on the basis of these two different criteria.

[59] As stressed by Jokipii and Milne (2008), ROE reflects both cost and revenue and is strongly correlated with the profit variable (in our sample, the coefficient of correlation between ROE and *profit* is of 77.4%). As the cost of equity may be an important determinant of capital buffer, we deal with the issue of correlation by orthogonalizing the variable ROE with our profit variable. The variable *roe* used in our regressions corresponds to the orthogonalized variable. Thus, we make sure that we do not omit an important determinant.

We also consider that banks which operate in a highly competitive environment are expected to hold more capital than prescribed by the regulator. The rationale for this behaviour might stem from the fact that capital buffer may serve as an instrument, which the bank is willing to pay for, in the competition with its peers for unsecured deposits and money market funding (Lindquist, 2004; Dietrich and Vollmer, 2005; Bernauer and Koubi, 2006 and; Schaeck and Cihak, 2010). Thus, we consider the annual mean of capital buffer of the bank's competitors in the same country, *comp*, which should positively affect capital buffer.

All else equal, an increase in assets through loans should increase the capital requirements and therefore decrease capital buffer (Ayuso et al., 2004). Thus, we expect a negative relationship between *loang*, the annual net loans growth rate, and the dependent variable. The importance of loans activity may also affect capital buffer. Indeed, we assume that loans activities are relatively better taken into account into the capital regulatory constraint than other non-traditional activities. Hence, we consider the variable *nla*, corresponding to the proportion of net loans in total assets, and expect a negative relationship between capital buffer and this variable.

A consensus among the previous literature also emerges: it indicates that larger banks hold less average capital in excess of regulatory requirements due to scale economies in screening and monitoring and larger diversification. The dependent variable should be negatively related to *size* that is the natural logarithm of total assets. Another reason for large banks to hold a smaller buffer may be their Too Big To Fail (TBTF) nature. Indeed, if a bank is perceived as TBTF, this implies that it benefits from government implicit guarantee. Consequently, it could be less prudent in the building of its capital buffer.

The level of capital banks hold may also depend on macroeconomic conditions. We therefore introduce the business cycle to determine whether it has any effect on the capital held by institutions. Previous studies have mostly shown that capital buffer and economic cycle tend to be negatively linked (Ayuso et al., 2004; Lindquist, 2004 and; Jokipii and Milne, 2008). This is to say that banks tend to decrease their capital buffer during the upturn and increase it in the downturn. The rationale for this finding may be found in Berger et al. (1995) who argue that banks may hold capital buffer to be able to exploit unexpected investment opportunities. Thus, we expect a negative link between the annual growth rate of the real Gross Domestic Product[60], *gdpg,* and capital buffer.

Table 1 exhibited below summarizes our set of variables with some descriptive statistics on our sample of banks that we present in the following section. We notice that our dependent variable *buffer* is on average equal to 6.10 which stands for the extra capital ratio that European commercial banks hold in excess of the regulatory minimum capital requirement. Nevertheless, our sample discloses a minimum of -7.9% which means that some banks do not comply with the regulatory constraint. We verify that only few observations correspond to a negative buffer (less than 3% of total observations) and that this does not affect our results. Therefore we keep them in our sample in order to avoid a selection bias. However, given that our investigation relates to capital buffer, we perform two robustness checks in which we exclude banks with negative capital buffer or banks whose capital ratio is close to the regulatory minimum (see section 2.3.2 for details).

[60] We also consider the output gap obtained by applying the Hodrick-Prescott filter to the real GDP series as an alternative indicator and get similar results.

Table 1. Presentation of the dependent and independent variables with their descriptive statistics on our sample period (1992-2006)

Variable (in %, except Size for which total assets is in million of €)	**Mnemonic**	**Definition**	**Mean**	**Median**	**Standard deviation**	**Min**	**Max**	**Expected Sign of the coefficient**
Capital buffer	buffer	((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements	6.10	4.10	6.29	-7.90	33.70	
Profitability	profit	Post tax profit/ Total assets	0.66	0.59	1.09	-12.37	10.60	+
Equity cost	roe	Return on equity = Net income/ Equity[61]	9.39	9.51	12.54	-99.81	98.45	-
risk	llpa	Loan loss provisions/ Total assets	0.54	0.34	0.67	0.00	6.58	-/+
Peer discipline	comp	Annual mean of the buffer of banks in the same country	6.10	5.69	1.97	0.10	14.15	+
Asset structure	nla	Net loans[62]/ Total assets	54.78	56.23	21.45	1.44	95.72	-
Market discipline	mktdisc	Total market funding[63]/ total liabilities	23.90	20.28	18.33	1.14	90.65	+
	mktdisc_junior	Subordinated debt/ total liabilities	1.79	1.61	1.69	0.00	16.73	+
	mktdisc_senior	Other market funding[64]/ total liabilities	22.08	18.73	18.24	1.07	89.20	+
Credit growth	loang	Annual net loan growth rate	13.56	10.04	28.94	-100.00	272.87	-
Economic cycle	gdpg	Annual growth rate of the real gross domestic product (deseasonalized)	2.29	2.18	1.67	-3.97	15.43	-
Size	size	Natural logarithm of total assets	15.01	14.79	2.26	9.16	21.17	-

[61] Notice that in our regressions, the variable *roe* corresponds to the residuals of the regression of the Return on Equity on our profit variable (see footnote 59).
[62] Net loans are: gross loans – loan loss reserves.
[63] Total market funding corresponds to Total Liabilities minus deposits.
[64] Other market funding corresponds to Total Liabilities minus deposits minus subordinated debt.

1.8.3 Our sample of banks

We consider the same sample as the one used in chapter 1 (see p.14). We remind that this sample consists of commercial banks established in 16 European countries[65]. The sample period is from 1992 to 2006[66]. Accounting data (annual financial statements) for individual banks are obtained from Bankscope Fitch IBCA.

1.9. Results and robustness checks

1.9.1 Results

In line with the previous literature (Ayuso et al., 2004; Jokipii and Milne, 2008), we suspect bank level variables to be endogenous, i.e. themselves dependent on capital buffer[67]. Following Nier and Baumann (2006), we therefore consider the Two Stage Least Squares (TSLS) procedure with estimators of variance-covariance matrix that are robust to heteroskedasticity. Our set of instruments consists of the one year lagged values of these variables.

First, we estimate a model with our control variables and the market discipline variable *mktdisc* (Model 1) on the full sample of banks. The results are presented below in Table 2 column (1). The coefficient associated with the variable *mktdisc* is significant at the one percent level with the positive expected sign. Market participants seem to exert a pressure on banks to hold capital buffer. This result is in line with previous studies (Nier and Baumann, 2006; Flannery and Rangan, 2008 and; Fonseca and Gonzalez, 2010) which find, with different proxy variables, that market discipline is an important factor to explain banks' capital ratios.

[65] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom (see table A1 in Appendix for details).

[66] Notice that during the whole sample period banks are under the Basel I framework.

[67] Indeed, a reverse relationship with capital buffer can exist for almost all our explanatory variables. For example, another recent literature deals with the role of capital buffer as a strategic variable to attract and monitor borrowers (Allen et al., 2011) or to charge higher borrowing interest rates (Kim et al., 2005 and Fischer et al., 2009) or how the capital buffer dampens the impact on bank lending activities resulting from monetary policy change and GDP shocks (Gambacorta and Mistrulli, 2004). In our models, following the previous literature on the determinants of capital buffer, the only bank level variable which is considered as exogenous is the size of the bank.

Table 2. Capital buffer, market discipline and bank activity differentiation

Model 1: $buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Model 2: $buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Eq Name:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.062		0.092	0.041			0.074	0.064		
	(4.172)***		(2.901)***	(1.406)			(2.568)**	(1.345)		
Mktdisc _Senior		0.055			0.090	0.008			0.067	0.037
		(3.670)***			(3.107)***	(0.232)			(2.422)**	(0.798)
Mktdisc_Junior		0.727			0.656	0.953			0.837	1.080
		(5.715)***			(3.606)***	(2.760)***			(3.446)***	(2.967)***
Nla	-0.098	-0.114	-0.083	-0.111	-0.099	-0.142	-0.066	-0.162	-0.086	-0.177
	(-5.872)***	(-6.566)***	(-3.520)***	(-2.251)**	(-3.884)***	(-2.500)**	(-2.408)**	(-3.522)***	(-2.805)***	(-4.102)***
Size	-2.700	-2.695	-2.542	-2.396	-2.662	-2.526	-1.842	-2.999	-1.754	-2.799
	(-7.667)***	(-7.873)***	(-5.173)***	(-2.472)**	(-5.689)***	(-2.187)**	(-1.975)**	(-3.704)***	(-1.864)*	(-3.706)***
Comp	0.266	0.342	0.375	0.349	0.414	0.466	0.264	0.241	0.346	0.235
	(2.569)**	(3.329)***	(2.698)***	(1.494)	(3.122)***	(2.056)**	(1.722)*	(0.794)	(2.250)**	(0.801)
Gdpg	0.069	0.052	0.044	0.085	0.028	0.079	0.050	-0.104	0.037	-0.041
	(1.464)	(1.154)	(0.898)	(0.452)	(0.663)	(0.345)	(0.825)	(-0.612)	(0.611)	(-0.270)
Roe	-0.016	0.002	-0.140	0.014	-0.076	-0.018	-0.003	-0.093	0.035	-0.142
	(-0.355)	(0.043)	(-1.212)	(0.124)	(-0.689)	(-0.136)	(-0.025)	(-0.770)	(0.329)	(-1.007)
Llpa	-0.451	-0.765	-1.095	1.513	-1.375	2.782	-0.524	-0.638	-0.382	0.310
	(-0.524)	(-0.919)	(-0.922)	(0.403)	(-1.315)	(0.577)	(-0.374)	(-0.154)	(-0.275)	(0.088)
Loang	-0.010	-0.012	-0.010	-0.003	-0.012	-0.002	-0.017	-0.007	-0.020	-0.006
	(-2.282)**	(-2.627)***	(-1.861)*	(-0.424)	(-2.336)**	(-0.259)	(-2.870)***	(-0.549)	(-3.097)***	(-0.522)
Profit	0.917	0.864	1.174	2.148	0.794	2.191	2.133	2.174	2.399	1.857
	(1.692)*	(1.518)	(1.981)**	(0.915)	(1.218)	(0.824)	(0.863)	(1.323)	(0.956)	(1.116)
Constant	48.814	48.302	44.723	42.327	46.622	43.787	32.179	57.110	29.796	53.486
	(8.053)***	(8.170)***	(5.481)***	(2.644)***	(5.936)***	(2.312)**	(1.796)*	(4.122)***	(1.650)*	(4.308)***
Nb of Obs.:	2238	2238	1095	991	1095	991	1210	881	1210	881
R-squared:	0.8149	0.8206	0.8564	0.8440	0.8650	0.8348	0.7807	0.8486	0.7635	0.8681

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the whole sample (4.58%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the whole sample (14.90%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Second, we split our market discipline indicator by separating junior from senior debt holders. We can see (column (2)) that both exert a significant pressure on banks to hold a capital buffer. This result is shown through the high level of significance (at the 1% level) of the both positive coefficients associated with the variables *mktdisc_senior* and *mktdisc_junior*. However, consistent with the second hypothesis, the *mktdisc_junior* coefficient is 13 times higher than the one of *mktdisc_senior*[68].

The remaining columns of Table 2 present the results obtained by estimating models (1) and (2) on different sub-samples defined on the basis of the degree of involvement of the bank in non-traditional activities. Hence, we study whether the pressure of the market taken globally or the pressure of junior and senior debt holders taken separately on banks to hold capital buffer is different depending on their activity. We consider two different ratios to split banks into two different categories. When we consider the importance of trading activities through the ratio net trading revenue/ net operating income, we find that the ratio of market funded liabilities to total liabilities (*mktdisc*) is significant only for banks heavily involved in these activities (column (3)). Consistent with hypothesis H3, this result imply that market participants exert a pressure only on banks that are highly involved in trading activities which are imperfectly taken into account in the capital regulation. When we distinguish senior debt holders from junior debt holders, we notice that this result holds only for senior debt holders, junior debt holders always exert a pressure, whatever the importance of trading activities (columns (5) and (6)). The significance and the comparative high coefficient of the *mktdisc_junior* variable irrespective of the bank's activity denotes the high pressure exerted by these junior debt holders on banks to hold capital buffer. Using the ratio off-balance sheet activities/ total assets as an alternative criterion to separate banks gives similar results (columns (7)-(10)). Indeed, the market funding variable (*mktdisc*) is significant at the five percent level only for banks that have a high proportion of off-balance sheet activities, that is for banks highly involved in non-traditional activities whereas it is not significant for banks with a low ratio. Besides, we also find that this result holds for senior debt but is different for junior debt as the variable *mktdisc_junior* is significant whatever the importance of off-balance sheet activities.

[68] Besides, these two coefficients are statistically different at the one percent level of significance.

To summarize, our results validate our three hypotheses H1, H2 and H3. Consistent with H1, we find that, after controlling for other determinants, market discipline is a significant determinant of banks' capital buffer. Both senior debt holders and junior debt holders seem to exert a pressure on banks to hold capital buffer. However, as assumed in hypothesis H2, this pressure is higher for junior debt holders. In accordance with hypothesis H3, we find a higher pressure of market discipline on banks highly involved in non-traditional activities. Indeed, for banks highly involved in non-traditional activities, our market discipline indicators are always significant to explain bank capital buffer. By contrast, for those less involved in such activities, the importance of market funded liabilities as a whole is always insignificant to explain capital buffer. However, the behavior of senior and junior debt holders appears different: senior debt holders do not exert a pressure on such banks whereas junior debt holders do. Thus, junior debt holders exert a pressure on banks to hold capital buffer whatever the importance of non-traditional activities.

These results might suggest that senior debt holders exert a pressure to hold capital buffer on banks heavily involved in non-traditional activities because these activities are not well taken into account by the capital regulation. The buffer required by senior debt holders would reflect the capital needed for the risks not correctly embedded into the capital constraint. This would explain why they do not exert a pressure on banks mainly involved in traditional activities: the risks generated by these activities are already taken into account in the capital constraint. By contrast, junior debt holders always require capital buffer whatever banks' activities. This result might be due to the junior status of these debt holders: they are particularly at risk in case of bank default which might explain that they require higher capital buffer. Independently of banks' activities, they require capital buffer because they find the capital required by regulation insufficient even for traditional activities.

Regarding the control variables, we can notice that the coefficient of the loan activity variable *nla* is always negative and highly significant. This expected finding shows that banks highly involved in credit activities hold less capital buffer. We also confirm the well known result which stipulates that large banks operate with less capital buffer than small banks (Ayuso et al., 2004 for instance). In fact, our variable *size* has a negative and significant coefficient across all our specifications. The peer pressure variable *comp* is significant in 7 out of 10 of our specifications and its coefficient is positive as expected. Therefore, consistent with the findings from Lindquist (2004) and Alfon et al. (2004), the higher the peer pressure is, the higher capital buffer banks hold. In addition, we can notice that it is more significant for banks highly involved in non-traditional activities and hence the bank peer discipline seems consistent with the market discipline. Profit and loan growth variables (*profit* and *loang*) are significant in some specifications and their coefficients have expected signs, positive and negative respectively. The risk variable *llpa* is not significant; a result backed by Lindquist (2004) who shows with Norwegian data that risk is not a significant determinant of bank buffer under Basel I. Contrary to the results of Jokipii and Milne (2008), we find no significant relationship between the business cycle (*gdpg*) and bank capital buffer.

1.9.2 Robustness checks

We perform several robustness checks reported in Tables A2 to A8 in Appendix.

First, in our regressions, we consider capital buffer of banks without any restriction. To check the robustness of our results, we perform in the first place estimations restricting our sample to solely banks with a positive capital buffer. Then, we eliminate banks that may be considered to be regulatory constrained. Hence, we restrict our sample to banks with a capital buffer higher than 1.5% following Flannery and Rangan (2008) to control for the pressure to hold a capital buffer that might emanate from supervisors or regulators. In this way, the capital buffer of 1.5% is assumed to stand for the protective capital buffer that banks might wish to hold in order to avoid the potential supervisory interventions that might result from the violation of the minimum regulatory capital requirements. We re-run all the regressions and we obtain the same conclusions (see Tables A2 and A3).

Second, we perform a robustness check regarding a potential sample bias. French and Italian banks are comparatively more represented in our sample. To make sure that our results do not depend on this unbalanced sample representation, we run again all our regressions by excluding the banks from these two countries. We also find that the conclusions remain globally unchanged (Table A4). The only noticeable difference is that the coefficient associated with *mktdisc_junior* is no longer significant for banks with a low proportion of off-balance sheet activities.

Third, British banks are somewhat differently regulated compared to other European banks in our sample (cf 2.2.2 and FSA (2001)[69] for details). Therefore, in our main regressions, we consider 9% (instead of 8%) as the minimum regulatory capital requirement. Thus, to ensure that this particular aspect of British banks regulation does not distort our results, we repeat all the regressions by excluding them. All our conclusions remain similar (Table A5).

Fourth, we can suspect that some banks in our sample have experienced mergers and acquisitions during the considered period. Unfortunately, we have no direct way to identify those banks. An indirect way to do so is to look at the bank's total assets growth. Hence, we computed the total assets growth rate and we excluded banks that have experienced a growth rate exceeding 30 %[70]. Our conclusions remain unchanged (Table A6).

Fifth, concerning the separation of our sample in two sub-samples on the basis of the values of the ratios net trading revenue to net operating income and off-balance sheet activities to total assets, we consider another criterion than the median. In order to have sub-samples of banks with very different characteristics in terms of activity, we consider the median value of the considered ratio and delete the 10% of our sample observations with a value of the ratio around the median. Then, we separate banks with low values from banks with high values. This criterion ensures that banks in the high category one year are not in the low category the year after. Using this criterion leads to similar conclusions except that the variable *mktdisc_junior* is no longer significant for banks with a low ratio of Trading revenue/Net operating income (Table A7).

Finally, some papers have considered how banks adjust towards their desired optimal capital buffers (Ayuso et al. (2004) and Jokipii and Milne (2008, 2011)). In doing so, the dynamic GMM method that considers the lagged dependent variable as a regressor representing the adjustment cost is used. In our paper, we have considered observed capital buffer as desired capital buffer. As a robustness check, we relax this assumption and implement the dynamic GMM method using Arellano and Bond's (1991) GMM estimator. All our conclusions remain unchanged (Table A8).

[69] http://www.fsa.gov.uk/Pages/Library/Policy/Policy/2001/pscapitalratios.shtml

[70] As there is no objective cut-off, we have considered other percentages less restrictive (40%) and more restrictive (20%) and we have found the same conclusions.

1.10. Conclusion

The aim of this paper was to investigate firstly whether market participants taken globally lead banks to hold a capital ratio higher than the minimum regulatory capital requirement. Secondly, we went a step further and studied whether market participants who are highly exposed to losses in case of bank failure (junior debt holders) exert a higher pressure than those (senior debt holders) less exposed to it. Finally, we investigated if market participants, taken globally or not, differentiate banks according to their involvement in non-traditional activities inappropriately taken into account in the Basel capital regulation framework.

Using an unbalanced panel data of European commercial banks from 16 countries on 1992-2006, our results show that, after controlling for other determinants of capital buffer, the higher the reliance on market funding is, the higher capital buffer banks hold. We also show that when we distinguish junior from senior debt holders, although they both have a positive impact on capital buffer, the former exert a higher pressure on banks to hold capital buffer due to their junior status. When we differentiate traditional from non-traditional bank activities, our results indicate that market players taken as a whole require capital buffer only for non-traditional activities reflecting the idea that they take into account the slow reaction of regulators concerning the rapid changes of bank activities. Besides, contrary to senior debt holders, junior debt holders do not distinguish banks according to their activities and exert a pressure whatever the importance of non-traditional activities.

These results highlight the benefits of the use of market discipline in complement to capital regulation: banks subject to market discipline behave more prudently as the pressure exerted by debt holders lead them to hold higher capital buffer. Besides, consistent with the proposals for mandatory subordinated debt, we show that this debt is the most disciplining one: junior debt holders exert a pressure on banks to hold capital buffer whatever their activities and this pressure is always higher than the one exerted by senior debt holders. However, one of the limits of mandatory subordinated debt is that due to its cost, it cannot be implemented for all banks. Interestingly, our results indicate that senior debt can also be an effective tool for market discipline. Indeed, we find that senior debt holders require capital buffers for banks involved in non-traditional activities that is when capital regulation is supposed to be the less efficient.

APPENDIX:

Table A1: Distribution of banks by country and percentage of the total banking assets of each country present in our sample in 2006

Country	**Number of banks**	**Percentage of the total banking assets present in our final sample**
Austria	19	12.60
Belgium	18	74.53
Denmark	65	22.98
Finland	11	51.07
France	147	73.27
Germany	28	45.31
Greece	18	61.94
Ireland	14	68.83
Italy	198	67.94
Netherlands	50	67.84
Norway	21	66.50
Portugal	20	67.93
Spain	31	67.84
Sweden	31	69.39
Switzerland	20	22.64
United Kingdom	51	68.56
Total	742	56.82

Source: Bankscope Fitch IBCA

Table A2. Capital buffer, market discipline and bank activity differentiation: the case of banks with positive buffer.

Model 1: $$buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$$

Model 2: $$buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$$

Eq Name:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.065		0.115	0.061			0.078	0.051		
	(3.998)***		(3.631)***	(1.119)			(2.719)***	(1.030)		
Mktdisc_Senior		0.057			0.107	0.029			0.071	0.035
		(3.509)***			(3.669)***	(0.673)			(2.578)**	(0.649)
Mktdisc_Junior		0.708			0.612	0.920			0.842	1.001
		(5.579)***			(3.297)***	(2.340)**			(3.541)***	(2.365)**
Nla	-0.105	-0.122	-0.084	-0.106	-0.097	-0.128	-0.068	-0.152	-0.087	-0.162
	(-6.029)***	(-6.871)***	(-3.240)***	(-1.919)*	(-3.599)***	(-2.630)***	(-2.610)***	(-3.343)***	(-2.901)***	(-3.908)***
Size	-2.557	-2.589	-2.270	-2.449	-2.424	-2.163	-1.766	-2.743	-1.735	-2.480
	(-6.937)***	(-7.407)***	(-4.435)***	(-1.851)*	(-5.019)***	(-1.637)	(-2.012)**	(-3.015)***	(-1.948)*	(-2.760)***
Comp	0.194	0.265	0.340	0.169	0.388	0.286	0.225	0.171	0.300	0.098
	(1.819)*	(2.549)**	(2.273)**	(0.558)	(2.783)***	(1.066)	(1.548)	(0.541)	(2.109)**	(0.293)
Gdpg	0.061	0.046	0.050	0.088	0.034	0.103	0.042	-0.102	0.032	-0.072
	(1.252)	(0.996)	(0.942)	(0.287)	(0.753)	(0.360)	(0.732)	(-0.638)	(0.558)	(-0.462)
Roe	-0.113	-0.090	-0.190	-0.067	-0.117	-0.161	-0.067	-0.116	-0.004	-0.211
	(-1.411)	(-1.166)	(-1.406)	(-0.446)	(-0.913)	(-0.980)	(-0.438)	(-0.666)	(-0.023)	(-1.043)
Llpa	-0.699	-0.914	-1.091	-1.680	-1.384	-1.538	-0.850	-0.860	-0.574	-1.474
	(-0.789)	(-1.136)	(-0.791)	(-0.301)	(-1.155)	(-0.294)	(-0.748)	(-0.227)	(-0.523)	(-0.398)
Loang	-0.009	-0.010	-0.009	-0.006	-0.011	-0.007	-0.017	-0.001	-0.019	-0.002
	(-1.970)**	(-2.284)**	(-1.728)*	(-0.605)	(-2.189)**	(-0.679)	(-2.833)***	(-0.120)	(-3.045)***	(-0.266)
Profit	0.716	0.678	1.356	1.330	0.967	1.774	1.902	1.658	2.283	1.232
	(1.296)	(1.263)	(2.259)**	(0.371)	(1.432)	(0.564)	(0.882)	(0.900)	(1.033)	(0.622)
Constant	47.797	47.901	40.167	45.885	42.611	40.896	31.720	53.864	29.981	50.057
	(7.697)***	(8.173)***	(4.804)***	(2.038)**	(5.329)***	(1.888)*	(1.923)*	(3.582)***	(1.789)*	(3.533)***
Nb of Obs.:	2165	2165	1063	953	1063	953	1178	843	1178	843
R-squared:	0.8151	0.8246	0.8526	0.8359	0.8640	0.8462	0.7924	0.8657	0.7790	0.8750

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the whole sample (4.58%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the whole sample (14.90%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Table A3. Capital buffer, market discipline and bank activity differentiation: the case of banks with a buffer of more than 1.5%.

Model 1: $buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Model 2: $buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Eq Name:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.075		0.146	0.120			0.086	0.089		
	(3.648)***		(3.007)***	(0.817)			(2.453)**	(1.054)		
Mktdisc_Senior		0.067			0.125	0.063			0.080	0.066
		(3.404)***			(3.171)***	(1.117)			(2.388)**	(0.814)
Mktdisc_Junior		0.799			0.737	1.112			0.879	1.475
		(5.705)***			(3.532)***	(2.166)**			(3.692)***	(3.287)***
Nla	-0.101	-0.119	-0.086	-0.100	-0.099	-0.115	-0.059	-0.160	-0.083	-0.160
	(-5.249)***	(-6.289)***	(-2.118)**	(-1.749)*	(-2.768)***	(-2.560)**	(-2.120)**	(-2.793)***	(-2.642)***	(-3.254)***
Size	-2.486	-2.562	-1.749	-2.929	-2.239	-2.830	-1.885	-2.908	-1.897	-2.514
	(-5.470)***	(-6.115)***	(-1.878)*	(-1.433)	(-2.799)***	(-2.242)**	(-1.379)	(-2.200)**	(-1.429)	(-2.110)**
Comp	0.100	0.200	0.203	0.128	0.310	0.300	0.107	0.066	0.196	-0.043
	(0.837)	(1.735)*	(0.837)	(0.314)	(1.614)	(1.116)	(0.648)	(0.202)	(1.270)	(-0.128)
Gdpg	0.050	0.031	0.022	0.259	0.006	0.213	0.005	-0.039	0.007	0.022
	(0.943)	(0.644)	(0.329)	(0.451)	(0.126)	(0.827)	(0.081)	(-0.195)	(0.114)	(0.119)
Roe	-0.159	-0.113	-0.343	-0.108	-0.175	-0.130	-0.065	-0.171	0.005	-0.312
	(-1.700)*	(-1.258)	(-1.186)	(-0.435)	(-0.747)	(-0.897)	(-0.278)	(-0.919)	(0.020)	(-1.580)
Llpa	-0.941	-1.097	-1.276	-3.056	-1.385	-1.688	-1.533	-2.006	-0.901	-2.927
	(-0.926)	(-1.253)	(-0.656)	(-0.292)	(-0.940)	(-0.312)	(-1.199)	(-0.480)	(-0.797)	(-0.917)
Loang	-0.011	-0.012	-0.009	-0.011	-0.012	-0.011	-0.020	-0.004	-0.023	-0.006
	(-2.091)**	(-2.482)**	(-1.230)	(-0.558)	(-1.780)*	(-1.002)	(-2.762)***	(-0.398)	(-2.987)***	(-0.693)
Profit	0.420	0.399	1.311	2.272	0.877	1.061	0.811	1.239	1.560	0.363
	(0.711)	(0.765)	(1.989)**	(0.209)	(1.295)	(0.270)	(0.304)	(0.656)	(0.603)	(0.183)
Constant	47.506	47.984	32.873	51.469	40.179	49.322	35.222	57.732	33.676	51.377
	(6.508)***	(7.202)***	(2.367)**	(1.433)	(3.313)***	(2.428)**	(1.454)	(2.678)***	(1.434)	(2.738)***
Nb of Obs.:	1844	1844	921	801	921	801	1021	702	1021	702
R-squared:	0.8015	0.8176	0.8108	0.7659	0.8589	0.8522	0.7901	0.8528	0.7907	0.8615

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the whole sample (4.58%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the whole sample (14.90%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Table A4. Capital buffer, market discipline and bank activity differentiation excluding French and Italian banks.

Model 1: $$buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$$

Model 2: $$buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$$

Eq Name:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.069		0.140	0.072			0.083	0.101		
	(3.158)***		(2.727)***	(1.343)			(1.853)*	(1.225)		
Mktdisc_Senior		0.056			0.115	0.029			0.071	0.099
		(2.720)***			(2.578)**	(0.503)			(1.731)*	(1.271)
Mktdisc_Junior		0.810			0.660	1.223			0.907	0.799
		(5.352)***			(2.944)***	(2.223)**			(3.805)***	(0.942)
Nla	-0.075	-0.098	-0.065	-0.132	-0.083	-0.165	-0.061	-0.158	-0.085	-0.177
	(-3.294)***	(-4.343)***	(-1.836)*	(-1.859)*	(-2.269)**	(-2.245)**	(-2.297)**	(-2.045)**	(-2.992)***	(-2.403)**
Size	-1.888	-2.003	-1.354	-2.501	-1.929	-2.090	-1.345	-2.891	-1.397	-2.962
	(-3.732)***	(-4.361)***	(-1.385)	(-1.664)*	(-2.079)**	(-1.342)	(-0.917)	(-2.231)**	(-1.033)	(-2.454)**
Comp	0.275	0.356	0.340	0.394	0.420	0.430	0.135	0.438	0.304	0.393
	(2.140)**	(2.967)***	(1.776)*	(1.592)	(2.433)**	(1.863)*	(0.653)	(1.883)*	(1.565)	(1.757)*
Gdpg	0.059	0.052	0.012	0.157	0.010	0.183	-0.016	-0.106	0.019	-0.112
	(1.117)	(1.038)	(0.201)	(0.656)	(0.194)	(0.758)	(-0.224)	(-0.551)	(0.292)	(-0.653)
Roe	-0.159	-0.110	-0.319	-0.082	-0.199	-0.126	-0.088	0.050	-0.021	-0.009
	(-1.849)*	(-1.354)	(-1.710)*	(-0.500)	(-1.126)	(-0.716)	(-0.400)	(0.310)	(-0.101)	(-0.046)
Llpa	-0.677	-0.583	-2.000	2.079	-1.858	2.322	-2.179	1.335	-1.411	1.165
	(-0.572)	(-0.570)	(-1.337)	(0.864)	(-1.527)	(0.939)	(-1.904)*	(0.324)	(-1.502)	(0.356)
Loang	-0.011	-0.012	-0.010	-0.004	-0.012	-0.006	-0.019	-0.004	-0.023	-0.003
	(-1.635)	(-1.970)**	(-1.289)	(-0.287)	(-1.668)*	(-0.429)	(-2.588)***	(-0.274)	(-2.879)***	(-0.190)
Profit	0.935	0.930	1.005	3.792	0.689	4.493	0.178	3.909	0.892	3.560
	(1.752)*	(1.676)*	(1.694)*	(1.358)	(1.124)	(1.580)	(0.092)	(2.433)**	(0.505)	(2.110)**
Constant	35.248	36.485	25.538	42.594	34.399	35.964	28.005	52.270	26.210	53.985
	(4.348)***	(4.934)***	(1.692)*	(1.799)*	(2.368)**	(1.486)	(1.128)	(2.319)**	(1.149)	(2.559)**
Nb of Obs.:	1426	1426	709	580	709	580	812	525	812	525
R-squared:	0.8076	0.8207	0.7949	0.8210	0.8302	0.8157	0.7603	0.8694	0.7772	0.8870

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of one the year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the sample (5.37%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the sample (16.32%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Table A5. Capital buffer, market discipline and bank activity differentiation excluding British banks.

Model 1: $buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Model 2: $buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Eq Name:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.066		0.091	0.050			0.078	0.056		
	(4.148)***		(2.882)***	(1.722)*			(2.671)***	(1.229)		
Mktdisc_Senior		0.058			0.088	0.015			0.074	0.006
		(3.617)***			(3.063)***	(0.504)			(2.527)**	(0.136)
Mktdisc_Junior		0.788			0.642	1.122			0.963	1.348
		(5.498)***			(3.536)***	(3.304)***			(3.983)***	(3.298)***
Nla	-0.100	-0.114	-0.079	-0.128	-0.093	-0.158	-0.068	-0.181	-0.092	-0.203
	(-5.432)***	(-5.717)***	(-3.108)***	(-2.404)**	(-3.450)***	(-2.921)***	(-2.363)**	(-3.847)***	(-2.796)***	(-4.330)***
Size	-3.010	-3.130	-2.531	-2.895	-2.697	-3.073	-2.175	-4.061	-2.168	-3.416
	(-7.985)***	(-8.006)***	(-4.826)***	(-3.315)***	(-5.404)***	(-3.502)***	(-2.446)**	(-3.915)***	(-2.365)**	(-3.138)***
Comp	0.265	0.356	0.390	0.216	0.426	0.312	0.310	0.140	0.421	0.219
	(2.539)**	(3.371)***	(2.835)***	(1.017)	(3.283)***	(1.528)	(2.036)**	(0.452)	(2.677)***	(0.682)
Gdpg	0.073	0.051	0.054	0.132	0.036	0.095	0.057	-0.105	0.039	-0.052
	(1.514)	(1.104)	(1.091)	(0.773)	(0.849)	(0.545)	(0.905)	(-0.660)	(0.604)	(-0.337)
Roe	-0.020	0.019	-0.137	-0.007	-0.057	-0.029	0.019	-0.106	0.072	-0.148
	(-0.405)	(0.386)	(-1.053)	(-0.064)	(-0.464)	(-0.225)	(0.169)	(-0.718)	(0.627)	(-0.866)
Llpa	-0.596	-1.165	-1.265	0.416	-1.507	0.927	-0.778	-0.536	-0.705	1.008
	(-0.624)	(-1.164)	(-1.076)	(0.120)	(-1.476)	(0.259)	(-0.511)	(-0.139)	(-0.454)	(0.240)
Loang	-0.009	-0.012	-0.011	-0.002	-0.014	-0.002	-0.018	-0.004	-0.020	-0.002
	(-1.916)*	(-2.367)**	(-2.000)**	(-0.211)	(-2.487)**	(-0.224)	(-2.851)***	(-0.305)	(-3.041)***	(-0.147)
Profit	1.165	0.841	1.207	1.638	0.840	1.143	1.960	2.204	2.161	2.128
	(1.978)**	(1.268)	(2.040)**	(0.729)	(1.277)	(0.520)	(0.766)	(1.340)	(0.812)	(1.304)
Constant	53.187	54.739	44.027	52.021	46.568	54.978	37.179	74.845	35.984	64.059
	(8.286)***	(8.190)***	(5.212)***	(3.640)***	(5.713)***	(3.965)***	(2.163)**	(4.777)***	(2.025)**	(4.031)***
Nb of Obs.:	2054	2054	1025	911	1025	911	1141	777	1141	777
R-squared:	0.8045	0.8054	0.8533	0.8476	0.8619	0.8531	0.7721	0.8470	0.7426	0.8631

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the sample (4.55%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the sample (15.40%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Table A6. Capital buffer, market discipline and bank activity differentiation excluding banks that might have experienced M&A.

Model 1: $buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Model 2: $buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Eq Name:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.054		0.070	0.023			0.070	0.066		
	(3.416)***		(2.296)**	(0.422)			(2.003)**	(1.321)		
Mktdisc_Senior		0.049			0.070	-0.001			0.066	0.048
		(3.128)***			(2.433)**	(-0.013)			(1.861)*	(0.983)
Mktdisc_Junior		0.660			0.497	0.947			0.836	1.056
		(4.639)***			(2.389)**	(1.949)*			(2.621)***	(3.268)***
Nla	-0.099	-0.111	-0.094	-0.127	-0.103	-0.152	-0.073	-0.149	-0.092	-0.164
	(-5.512)***	(-5.959)***	(-3.393)***	(-2.083)**	(-3.491)***	(-2.220)**	(-2.288)**	(-3.445)***	(-2.463)**	(-4.168)***
Size	-2.308	-2.372	-2.238	-1.904	-2.332	-2.204	-1.392	-3.328	-1.350	-3.140
	(-5.951)***	(-6.031)***	(-4.132)***	(-1.571)	(-4.340)***	(-1.727)*	(-1.230)	(-3.871)***	(-1.105)	(-3.943)***
Comp	0.382	0.429	0.565	0.449	0.591	0.491	0.416	0.230	0.471	0.184
	(3.490)***	(3.919)***	(3.576)***	(1.763)*	(3.910)***	(1.929)*	(2.362)**	(0.739)	(2.516)**	(0.617)
Gdpg	0.057	0.045	0.038	0.078	0.028	0.080	0.040	-0.074	0.024	-0.014
	(1.186)	(0.961)	(0.795)	(0.291)	(0.646)	(0.260)	(0.600)	(-0.417)	(0.334)	(-0.091)
Roe	-0.022	0.002	-0.151	0.042	-0.106	0.015	-0.028	-0.061	0.003	-0.099
	(-0.472)	(0.053)	(-1.157)	(0.276)	(-0.869)	(0.087)	(-0.202)	(-0.478)	(0.023)	(-0.710)
Llpa	-0.541	-0.877	-1.427	5.071	-1.659	6.056	0.051	-0.547	0.298	0.392
	(-0.493)	(-0.800)	(-1.153)	(0.752)	(-1.453)	(0.777)	(0.020)	(-0.131)	(0.111)	(0.112)
Loang	-0.020	-0.021	-0.027	-0.009	-0.027	-0.007	-0.035	-0.017	-0.036	-0.015
	(-2.489)**	(-2.640)***	(-2.703)***	(-0.628)	(-2.769)***	(-0.452)	(-2.985)***	(-1.113)	(-2.849)***	(-1.148)
Profit	1.464	1.246	1.425	4.374	1.111	4.810	3.849	1.908	4.386	1.710
	(2.251)**	(1.727)*	(2.312)**	(0.999)	(1.621)	(1.008)	(0.840)	(1.021)	(0.902)	(0.915)
Constant	41.900	42.597	39.743	32.052	41.055	35.888	23.215	61.550	21.349	58.177
	(6.133)***	(6.144)***	(4.415)***	(1.554)	(4.575)***	(1.664)*	(1.001)	(4.099)***	(0.856)	(4.270)***
Nb of Obs.:	2020	2020	996	888	996	888	1108	795	1108	795
R-squared:	0.8075	0.8120	0.8561	0.7471	0.8629	0.7138	0.7191	0.8469	0.6684	0.8713

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the whole sample (4.58%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the whole sample (14.90%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Table A7. Capital buffer, market discipline and bank activity differentiation considering another criterion to define sub-samples.

Model 1: $buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Model 2: $buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Eq Name:	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.104	0.028			0.071	0.087		
	(3.403)***	(0.584)			(2.081)**	(1.736)*		
Mktdisc_Senior			(3.348)***	(0.058)			(2.045)**	(1.096)
			0.734	0.818			0.687	1.184
Mktdisc_Junior			(3.818)***	(1.239)			(2.362)**	(2.684)***
Nla	-0.087	-0.123	-0.102	-0.143	-0.054	-0.181	-0.071	-0.169
	(-3.548)***	(-1.410)	(-3.936)***	(-1.246)	(-1.595)	(-3.091)***	(-1.915)*	(-3.015)***
Size	-2.529	-2.620	-2.699	-3.114	-0.881	-3.582	-0.830	-2.938
	(-4.824)***	(-0.836)	(-5.564)***	(-0.675)	(-0.770)	(-3.441)***	(-0.702)	(-2.728)***
Comp	0.336	0.389	0.392	0.519	0.249	0.159	0.304	0.122
	(2.208)**	(1.168)	(2.807)***	(1.408)	(1.319)	(0.390)	(1.549)	(0.281)
Gdpg	0.051	0.005	0.025	-0.081	0.047	-0.123	0.042	-0.046
	(0.905)	(0.011)	(0.562)	(-0.114)	(0.661)	(-0.679)	(0.578)	(-0.259)
Roe	-0.184	0.047	-0.072	0.041	-0.051	-0.071	-0.015	-0.190
	(-1.128)	(0.273)	(-0.461)	(0.170)	(-0.366)	(-0.313)	(-0.107)	(-0.757)
Llpa	-0.526	3.787	-0.953	4.736	0.281	-0.470	0.486	-0.932
	(-0.365)	(0.471)	(-0.806)	(0.423)	(0.141)	(-0.098)	(0.244)	(-0.207)
Loang	-0.010	-0.000	-0.013	0.002	-0.018	-0.005	-0.020	-0.009
	(-1.715)*	(-0.012)	(-2.363)**	(0.074)	(-2.676)***	(-0.340)	(-2.759)***	(-0.610)
Profit	1.605	1.073	1.060	0.268	3.643	1.982	3.873	1.425
	(2.395)**	(0.190)	(1.297)	(0.032)	(1.098)	(1.065)	(1.146)	(0.699)
Constant	44.276	46.036	47.072	53.267	15.111	67.179	13.478	56.000
	(5.093)***	(0.876)	(5.697)***	(0.683)	(0.684)	(4.139)***	(0.594)	(3.379)***
Nb of Obs.:	997	876	997	876	1103	770	1103	770
R-squared:	0.8581	0.8132	0.8747	0.7616	0.7342	0.8481	0.7134	0.8589

This table shows estimation results obtained using the TSLS method. Our set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. To define our sub-samples of banks, we consider the median value of the considered ratio (trading revenue/ net operating income or off-balance sheet activities/ total assets) and delete the 10% of our sample observations with a value of the ratio around the median. Then, we distinguish banks with low values from banks with high values. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than 5.60% (3.75%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than 16.97% (13.18%).Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

Table A8. Capital buffer, market discipline and bank activity differentiation using the Dynamic GMM method.

Model 1: $buffer_{i,t} = \alpha_0 + \alpha_1 mktdisc_{i,t} + \alpha_2 buffer_{i,t-1} + \sum_{j=1}^{J} \gamma_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Model 2: $buffer_{i,t} = \beta_0 + \beta_1 mktdisc\_senior_{i,t} + \beta_2 mktdisc\_junior_{i,t} + \beta_3 buffer_{i,t-1} + \sum_{j=1}^{J} \delta_j C_{ji,t} + \eta_i + \tau_t + u_{i,t}$

Eq Name:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
Model:	Model 1	Model 2	Model 1	Model 1	Model 2	Model 2	Model 1	Model 1	Model 2	Model 2
Sample:	Whole sample		(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Trading revenue/ net operating income) high	(Trading revenue/ net operating income) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low	(Off-balance sheet activities/ total assets) high	(Off-balance sheet activities/ total assets) low
Mktdisc	0.09		0.07	0.06			0.12	-0.01		
	(2.4803)**		(3.8104)***	(2.2317)**			(4.4712)***	(-0.4066)		
Mktdisc_Senior		0.08			0.05	0.04			0.10	-0.03
		(2.3122)**			(3.3134)***	(2.1326)**			(3.8487)***	(-1.0475)
Mktdisc_Junior		0.64			0.46	1.10			0.47	1.01
		(3.7614)***			(4.3579)***	(6.9160)***			(4.3923)***	(5.4715)***
$Buffer_{i,t-1}$	-0.13	-0.07	-0.04	-0.11	-0.02	0.17	-0.13	-0.05	-0.11	-0.04
	(-4.2886)***	(-2.2630)**	(-0.9947)	(-3.0220)***	(-0.4965)	(4.0217)***	(-4.6025)***	(-1.6918)*	(-3.3491)***	(-1.2484)
Nla	-0.08	-0.09	-0.05	-0.13	-0.07	-0.08	-0.05	-0.15	-0.07	-0.17
	(-4.2969)***	(-5.5298)***	(-3.8706)***	(-6.9822)***	(-4.5446)***	(-5.3366)***	(-3.1786)***	(-7.1392)***	(-4.3104)***	(-8.2933)***
Size	-3.32	-3.51	-2.84	-2.86	-3.05	-3.01	-2.80	-4.15	-2.83	-3.25
	(-9.4102)***	(-9.3651)***	(-6.8648)***	(-3.9423)***	(-7.4395)***	(-4.0028)***	(-4.1967)***	(-5.0855)***	(-4.1018)***	(-3.4240)***
Comp	0.28	0.38	0.37	0.25	0.41	0.35	0.34	0.21	0.43	0.37
	(2.9154)***	(3.9299)***	(3.2842)***	(1.4622)	(3.8469)***	(2.0909)**	(2.5465)**	(0.7648)	(3.1422)***	(1.1902)
Gdpg	0.07	0.04	0.05	0.14	0.03	0.11	0.05	-0.15	0.04	-0.06
	(1.6054)	(1.0684)	(1.1586)	(0.9975)	(0.8712)	(0.7142)	(0.9993)	(-1.0341)	(0.6924)	(-0.3927)
Roe	-0.01	0.04	-0.11	0.00	-0.03	-0.01	0.06	-0.12	0.11	-0.16
	(-0.2047)	(0.7765)	(-1.0677)	(0.0110)	(-0.3123)	(-0.1198)	(0.6407)	(-1.0329)	(1.0790)	(-1.0627)
Llpa	0.03	0.02	-0.56	0.12	-0.65	-0.43	-0.58	0.71	-0.36	0.82
	(0.0898)	(0.0657)	(-1.9504)*	(0.3227)	(-2.5586)**	(-1.0024)	(-2.0020)**	(1.7656)*	(-1.2788)	(1.8594)*
Loang	-0.00	-0.00	-0.01	0.01	-0.00	-0.02	-0.01	0.02	-0.01	0.02
	(-0.5080)	(-0.1006)	(-1.9943)**	(1.6170)	(-0.6088)	(-3.7797)***	(-2.9135)***	(3.6832)***	(-2.5764)**	(3.0991)***
Profit	-0.13	-0.13	0.92	0.71	0.89	1.17	-0.03	1.19	-0.11	1.17
	(-0.4474)	(-0.4769)	(3.7629)***	(2.5484)**	(3.7817)***	(2.9743)***	(-0.1043)	(3.0021)***	(-0.4612)	(2.8494)***
Constant	0.31	0.26	0.63	1.13	0.57	-0.15	0.16	1.58	0.12	1.51
	(1.0122)	(0.8790)	(1.7839)*	(2.2530)**	(1.5658)	(-0.3136)	(0.6128)	(2.8653)***	(0.4678)	(2.6221)***
Nb of Obs.:	1802	1802	883	799	832	799	982	679	982	679
R-squared:	-	-	-	-	-	-	-	-	-	-

This table shows estimation results obtained using the Arellano and Bond's (1991) GMM estimator method. The set of instruments consists of the one year lagged value of the endogenous variables. The regression includes time and individual fixed effects. Trading revenue/ net operating income is considered as high (low) if it is greater (lower) than the median value on the whole sample (4.58%). Off-balance sheet activities/ total assets is considered as high (low) if it is greater (lower) than the median value on the whole sample (14.90%). Standard errors are adjusted robust to heteroskedasticity. ***, ** and * pertain to 1, 5 and 10% level of significance, respectively. T-stats are between parentheses. Variables definition: Buffer = ((Tier 1 + Tier 2 capital)/ risk-weighted assets) - regulatory minimum requirements ; Nla = Net loans/ Total assets ; Mktdisc_Junior = Subordinated debt/ total liabilities ; Mktdisc_Senior = Other market funding/ total liabilities ; Mktdisc = Total market funding/ total liabilities ; Logta = Natural logarithm of total assets ; Comp = Annual mean of the buffer of banks in the same country ; Gdpg = Annual growth rate of the gross domestic product (deseasonalized) ; Roe = the residuals obtained when we regress the ratio (Net Income/ Total Equity) on the *profit* variable ; Llpa = Loan loss provisions/ Total assets ; Loang = Annual net loan growth ; Profit = Post tax profit/ Total assets.

THE SUPPLEMENT OF THE LEVERAGE RATIO TO BASEL II AS A BANK DISCIPLINE DEVICE

1.11. Introduction

The new international regulatory framework for banks, the so-called Basel III, seeks to supplement the Basel II framework, with a simple capital ratio, the leverage ratio constraint, as a backstop. Hence, for the first time, banks will be subject to a combination of risk and non risk-sensitive capital requirements at international level. Knowing that historically, the leverage ratio constraint was the first form of regulatory capital that ever existed in many countries, its return and recognition at international level are more than surprising. Our paper offers a rationale about the necessity of this leverage ratio constraint alongside the more complex risk-based capital ratio à la Basel II.

However, before dealing with the benefits of coupling Basel II with the leverage ratio constraint, we use a simple theoretical model tractable enough to allow us go back to the old capital regulatory standards and assess the reasons behind the transitions towards more sophisticated capital regulatory frameworks. Hence, we start with the simple leverage ratio constraint and show how the regulatory arbitrage that it entailed was behind its failure. Then, we explain why the advent of the risk sensitive capital regulation was rightly seen as an improvement but, we also show how the benefits associated with the risk sensitive capital regulation à la Basel II fade away once we consider the existence of asymmetric information between the bank and the supervisor. Finally, and here lies our main contribution, we show how these shortcomings might be dampened by supplementing Basel II with the simple leverage ratio constraint as recently adopted by the Basel committee.

This paper is part of a huge literature that investigates the impact of capital regulation on bank behaviour[71]. For the purpose of our study, this literature is classified in three categories around the three types of capital regulatory standards we are interested in: leverage ratio constraint, Basel II, and the joint effect of Basel II and a simple leverage ratio constraint as in Basel III. Hence, the *first* is the strand of literature that deals with bank behaviour under risk insensitive capital regulation. This literature has yield conflicting results. While Kahane (1977), Koehn and Santomero (1980), and Kim and Santomero (1988) show that the imposition of higher leverage ratio constraint may induce banks to take more risk, Furlong

[71] See Santos (2001) and VanHoose (2007) for an extensive survey of the theoretical literature. Jackson et al (1999) provide the empirical literature review. As our paper is mainly interested in the issue of bank portfolio allocation, our (non exhaustive) literature review is organized mainly around the portfolio-based approach.

and Keeley (1989) challenge the mean-variance methodology used to derive these results, and Keeley and Furlong (1990) literally reach an opposite conclusion. They argue that an increase in leverage ratio constraint is unambiguously associated with a reduction of bank risk taking. The *second* category of studies that we consider investigates the notion of portfolio choice using the standard framework that only focuses on Pillar 1 of Basel II. The aim of these studies is to analyse the potential reshuffling of bank portfolio under Basel II. Two main findings emerge from this literature. The optimistic one shows that the passage from Basel I to Basel II could encourage banks to shift their loan portfolios toward safer credits (Furfine, 2001). The other result largely shared by this literature is the potential bank specialization that may result from the advent of Basel II. Repullo and Suarez (2004), Rime (2005), Ruthenberg and Landskroner (2008), Hakenes and Schnabel (2011) all of them conclude on the idea that large banks, potential candidates to Basel II would concentrate on low risk assets and offer competitive borrowing conditions to this type of borrowers whereas small banks would specialize in high risk assets. The *third* category is made of studies that relax the assumption of perfect supervision and hence consider a possibility of bank “cheating” or bank risk understating. Pelizzon and Schaeffer (2006) and Blum (2008) lie in this category. Pelizzon and Schaeffer (2006) study the interaction between Pillar 1 and Pillar 2 when banks are able to use risk management to “cheat”. They mainly show that Pillar 2 is irrelevant when banks act honestly, but it becomes necessary when there is limited Pillar 1 compliance[72]. Blum (2008) considers a supervisor who has a limited power to identify or sanction banks that misreport their true type. He explains why Basel II may require a simple leverage ratio to induce truthful reporting. To the best of our knowledge, he is the first to explicitly investigate the complementary use of risk-sensitive capital requirement and leverage ratio restrictions. On this particular point, his paper is the closest in spirit to ours but our framework differs from his on several aspects. For instance, in contrast to our paper, Blum's paper ignores the question of portfolio choice and considers a one risk-type loan (see section 3.3 for more details).

Our paper takes on all the three aspects (risk insensitiveness, risk sensitiveness with perfect supervision and risk sensitiveness with imperfect supervision) considered

[72] More precisely, they consider two scenarios of limited compliance and argue that with limited cheating, Pillar 2 has little effect on the level of capital that banks choose and the potential role that Pillar 2 may play is as a complement to Pillar 1 not as a substitute. When extensive cheating is possible, Pillar 2 does not complement Pillar 1 in the sense of making it more effective; rather, it acts as a separate, “substitute” form of regulatory control.

progressively. In preview, we show the existence of regulatory arbitrage that prevailed under Basel I and the justification for the advent of Basel II. Then, we show how the hypothesised superiority of Basel II fades away once we take into account either bank's risk measurement imperfection or the ability and the incentives of the banks to misreport their risk-taking (Pillar 1) coupled with the limited ability of supervisors to identify or sanction this failure or misbehaviour (Pillar 2). Finally, we provide an explanation for the necessity of a simple leverage ratio along with Basel II.

The remainder of the paper is structured as follows: the next section describes the main parameters and assumptions of the base framework of our model. Then, it deals with the bank portfolio choice respectively under non- and risk-based capital regulations in the base framework with perfect information. We enrich this base framework by introducing asymmetric information between the bank and the supervisor in section 3.3. Section 3.4 investigates the benefits of the complementary use of risk-based capital regulation and a simple leverage ratio. Section 3.5 relaxes the binding minimum capital requirement assumption made in the previous sections and discusses the potential extensions of the model. Section 3.6 concludes the paper.

1.12. Bank portfolio choice assuming perfect information

1.12.1 Model set up

The bank is assumed to have a representative balance sheet comprised of, on the asset side, commercial loans L with inherent and discernable differences in their credit risk, and idle reserves R. On the liability side it has deposits D and capital K. Thus, the balance sheet condition requires that: $R+L=D+K$. We consider that the loan market comprises both low and high risk borrowers. As it is usually assumed (see Furfine, 2001; Hakenes and Schnabel, 2011; Chen and Hasan, 2011 for instance), we consider two types of commercial loans: L_L for low risk loans and L_H for high risk loans $\left(L=L_L+L_H\right)$. Under Basel I where low and high risk commercial loans receive a unique 100% risk weight $\left(w=1\right)$, there is no differentiation between low and high risk loans to compute the capital requirement. Hence, $k_1 = \dfrac{K}{w\left(L_L + L_H\right)} \geq k$ where k_1 and k are respectively the actual capital ratio and the regulatory minimum capital requirement under Basel I. As discussed in the introductory chapter, the category with 100% risk weight concerns all claims on the private sector under Basel I and all non rated claims under the Standardized Approach of Basel II. As we only focus on commercial loans, the simple leverage ratio constraint, Basel I and the SA of Basel II are similar and are considered as non risk-based capital regulation. Therefore: $k_1 = k_{LR} = \dfrac{K}{L}$, k_{LR} being the simple leverage ratio.

The main objective of Basel II is to link appropriately the capital requirement to the risk taken. Hence, even for the same category of corporate loans, low risk loans receive a low risk weight w_L while high risk loans receive a high risk weight w_H. Thus, the regulatory capital ratio is computed as: $k_2 = \dfrac{K}{w_L L_L + w_H L_H} \geq k$ where k_2 is the actual capital ratio under Basel II such that: $0 \prec w_L \prec w = 1 \prec w_H$. The bank determines its loan allocation between the two borrower segments by choosing a proportion $\gamma \in [0,1]$ of low risk loans according to its risk aversion, market interest rates setting, and the risk weights set by the regulator. Therefore: $L_L = \gamma L$ and $L_H = \left(1-\gamma\right) L$.

Concerning market interest rates, we consider two gross rates of return on the asset side:

$\tilde{r}_H = \begin{cases} \overline{r}_H & \text{with a probability} \quad q \\ \underline{r}_H = 0 & \text{with a probability} \quad (1-q) \end{cases}$ and r_L respectively for high and low risk loans[73].

We also consider two gross rates of return on the liability side: the cost of equity (r_K) and the cost of insured debt[74] (r_D) with $1 \leq r_D \prec r_K \prec r_L$[75]. We assume a risk neutral bank with the high risk loan being efficient. Hence, $E\left(\tilde{r}_H\right) = q\overline{r}_H \succ r_L$.

[73] Here the low risk rate of return is assumed certain.
[74] The assumption of totally insured debt will be relaxed in the robustness checks, see section 3.5.1 for details.

With all these assumptions, the general expected profit function is written as:

$$E(\pi_G) = r_L \gamma L + E(\tilde{r}_H)(1-\gamma)L - r_D D - r_K K \tag{1}$$

Hereafter, we drop the expectation operator ($E(\;)$) at the left hand side of the equation for simplicity and substitute $q\bar{r}_H$ for $E(\tilde{r}_H)$ at the right hand side of the equation.

1.12.2 Bank portfolio choice under non risk-based capital regulation: the leverage ratio

In line with previous studies and in order to only focus on the main interest of this paper, which is loan portfolio allocation, we consider the minimum capital requirement as a binding constraint. This assumption allows us to rule out the question of determining the optimal capital ratio. However, as recent studies show, the minimum regulatory capital requirement is far from being binding in reality (see for instance, Flannery and Rangan, 2008; Berger et al., 2008; Jokipii and Milne, 2008; Gropp and Heider, 2010). Nevertheless, it has also been shown that this capital buffer may be used as a strategic tool to negotiate uninsured debt at a lower cost (Lindquist, 2004; Dietrich and Vollmer, 2005; Bernauer and Koubi, 2006). It could also serve to attract and monitor borrowers (Allen et al., 2011) or to charge higher borrowing cost (Kim et al., 2005; Fischer et al., 2009). Therefore, as far as the minimum regulatory capital ratio is used as a benchmark to determine the capital buffer for the above purposes, it remains a relevant constraint. We show in section 3.5 that our main results still hold when we relax the binding minimum capital ratio assumption and make the capital ratio a choice variable to be determined. That said, the program maximisation becomes unconstrained:

[75] For reasons why equity is more costly than debt, the literature cites tax rules, agency costs of equity, the relative facility in deposit collection (Berger et al., 1995; Pelizzon and Schaefer, 2006; Kashyap et al., 2008; Hellmann et al., 2000).

$$\max_{\gamma} \ \pi_1 = r_L \gamma L + q\bar{r}_H (1-\gamma) L - r_D D - r_K k L \qquad (2)$$

$$\frac{\partial \pi_1}{\partial \gamma} = \left(r_L - q\bar{r}_H \right) L \prec 0$$

The optimal choice for the bank is therefore a corner solution, $\gamma = 0$ because the expected return on high risk assets is assumed higher than that on low risk assets.

Hence, under risk insensitive capital regulation, the bank portfolio allocation is not capital regulation driven. Only the comparison between low risk and expected high risk assets rates of returns matters. The bank chooses high risk assets whenever the expected rate of return is higher than that of the low risk assets. This finding is in line with the regulatory arbitrage which is one of the main motivations that explain the passage from Basel I to Basel II.

1.12.3 Bank portfolio choice under risk-based capital regulation: Basel II

In this case, the capital requirement depends on the loan risk characteristics. As already explained, we have $K = k\left(w_L \gamma + w_H (1-\gamma) \right) L$. Hence, the bank programme maximization is:

$$\max_{\gamma} \ \pi_2 = r_L \gamma L + q\bar{r}_H (1-\gamma) L - r_D D - r_K k \left(w_L \gamma + w_H (1-\gamma) \right) L \qquad (3)$$

In the same way, we determine the portfolio allocation of the bank:

$$\frac{\partial \pi_2}{\partial \gamma} = \left(r_L - q\bar{r}_H \right) L + r_K k \left(w_H - w_L \right) L \underset{\prec}{\overset{\succ}{-}} 0 \qquad (4)$$

Here, besides interest rates differentiation, the bank decision depends also on the risk weights differentiation assigned by the regulator. Expression (4) is higher for high risk weight differentiation. Thus, when $(w_H - w_L) \succ \frac{q\overline{r}_H - r_L}{r_K k}$, the optimal choice for the bank will always be low risk assets $(\gamma = 1)$, which is a corner solution, in order to benefit from low capital cost.

Hence, under the standard framework of Basel II, bank portfolio reshuffling depends, not only on the interest rates charged on low risk and high risk assets, but also on risk weights differentiation. The higher the gap between risk weights for high risk and low risk assets $(w_H - w_S)$ is, the more probable the choice of low risk assets $\gamma = 1$ will be.

This finding is in line with the previous literature that conjectures a potential specialization under Basel II. The idea goes as follows: on the one hand, because equity is costly and given that Basel II recognizes risk sensibility and requires low capital for low risk, which is a new feature compared with Basel I and, on the other hand, as Basel II fails to incorporate capital charges for concentration risk, the risk diversification does not appeal beneficial in terms of capital cost saving. All in all, these studies conjecture a kind of “cherry-picking”, large and sophisticated banks adopting Basel II would focus on low risk borrowers and benefit from low capital charges and hence offer competitive borrowing conditions to this low risk segment (Repullo and Suarez, 2004; Hakenes and Schnabel, 2011). Small and unsophisticated banks which stick with Basel I, as they cannot overcome the high implementing cost of Basel II, would also have a competitive advantage in high risk segment. Whereas high risk borrowers require higher capital charges under Basel II, they still require the same amount of capital under Basel I. Therefore, it is argued that those banks that remain under Basel I could offer lower borrowing cost to this segment and therefore specialize in high risk loans. This specialization is worrisome in the sense that high risk borrowers end up in the portfolios of small banks with less risk management skills (Rime, 2005). However, as argued by Feess and Hege (2008), by confining high risk assets into Too Small To be Bailed Out banking institutions, Basel II has the merit of sheltering the banking system from systemic risk.

So far, we followed the previous literature and considered the standard framework built on the sole minimum capital requirements (Pillar 1) assuming perfect supervision (Pillar 2). In the remaining sections *which contain the main contribution of the paper*, we question this potential specialization by considering a more realistic view that relaxes the perfect supervision assumption.

1.13. Bank portfolio choice with asymmetric information between the bank and the supervisor

In the previous section, we ignored the possible asymmetric information that could exist between regulators and the bankers. Here we consider that, on the one hand, banks and regulator's incentives are not perfectly aligned and on the other hand, Basel II confers to the banks a certain superiority in terms of information as banks control entirely the information they communicate to the supervisor concerning their risk taking and the corresponding regulatory capital. To motivate our approach, suffice to read the excerpt below from Blundell-Wignall and Atkinson (2008, p.78-79) quoting a senior investment banker wishing to remain anonymous: "We started looking at the implications of Basel II from the day it was published back in 2004...What you have to understand about complex regulations that affect our business is that we work intensively to minimise the impact they have on our bottom line... The more complex the structure the more scope there is for finding ways around it! *It amazes me that regulators asked us to set our capital regulation weights, given the way the incentives are*…But good luck to any supervisors who want to find out what is going on inside businesses – *that is difficult for insiders to know fully and impossible for outsiders... The supervisors can never match this with the best will in the world*."[Emphasis added]

From this excerpt, we infer that asymmetric information could exist at two levels as regards to the computation of the regulatory capital. On the one hand, it is difficult for banks to perfectly gauge the risk they take and hence, there is limited information between the bank and the borrower in this case[76]. On the other hand, Basel II endows the bank with the

[76] This could particularly be true during the boom period where it is well known that "market-price based, risk-sensitive models tell banks in the up-cycle that risks have fallen and capital is sufficient for more risk-taking" Goodhart and Persaud (2008).

possibility to fully control what it communicates to the supervisor and hence there is limited information between the bank and the supervisor. Thus, we reasonably consider that the bank knows more than the supervisor does. In this model, we therefore focus on the imperfect information between the bank and the supervisor by assuming that what is impossible for the bank to know is also impossible for the supervisor.

Under risk insensitive capital regulation (the leverage ratio), banks benefit from the same risk weights and therefore, we only consider the risk-based capital regulation (Basel II).

We assume a proportion $i \in [0,1]$ reflecting the bank's incentives to report high risk assets as low risk assets. Of course, there is a cost associated with this misreport when it is discovered by the supervisor. We consider that the bank succeeds to understate its risk with an exogenous probability p and therefore the supervisor discovers the bank's game with probability $(1-p)$ and imposes a certain fine f, proportional to the magnitude of the bank's "cheating"[77].

Actually two regulatory penalties may exist (Freixas and Parigi, 2008): increasing required capital and restrictions on the portfolio of risky assets, i.e. the prohibition of investments in certain assets. In this paper, we only consider the former. This choice is backed by the third principle set in the BIS founding document of Basel II (BCBS[78], 2006, p.211-212). It stipulates that, "supervisors should take appropriate action if they are not satisfied with the results of the bank's own risk assessment and capital allocation. [They] should expect banks to operate above the minimum regulatory capital ratios and should have the ability to require banks to hold capital in excess of the minimum".

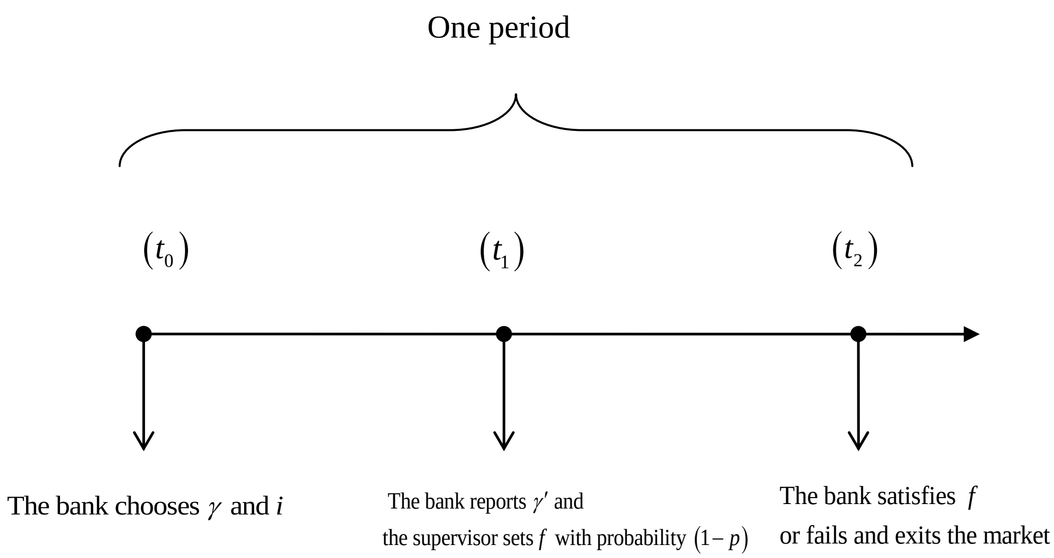
We consider that the actual share of low risk assets is still equal to γ and its share of high risk assets is $(1-\gamma)$. However, in order to reduce its required capital cost, the bank could decide to report a higher share of low risk asset to benefit from the low risk weight (w_L) associated with it. Therefore, with the probability *p*, the bank reports and the supervisor sees a higher share of low risk assets γ'. Where $\gamma' = \gamma + i(1-\gamma)$. As discussed above, with

[77] The same reasoning applies if we consider that the bank unwillingly understates its risk taking because of measurement error. For convenience, we will only refer to "cheating".
[78] BCBS stands for the Basel Committee on Banking Supervision.

probability $(1-p)$, the supervisor requires the dishonest bank to hold a higher regulatory capital ratio $k+fk$, where $f=si(1-\gamma)$ is the fine. The proportionality coefficient $s\geq 0$ represents the supervisor's severity. We assume that only banks that satisfy the sanctions remain in activity.

As this simple model lasts one period, the added capital (fk) therefore translates into higher reserves $(R\uparrow)$ waiting for the new asset allocation that, by assumption, would be decided similarly in a second period and the game would go on repeatedly as represented on Figure 1.

Figure 1. The bank and the supervisor decisions' timeline



The new bank profit function under asymmetric information is therefore written as:

$$\pi_2^{AI}=r_L\gamma L+q\bar{r}_H(1-\gamma)L-r_DD-r_KkL\left[p\left(w_L\gamma'+w_H(1-\gamma')\right)+(1-p)(1+f)\left(w_L\gamma+w_H(1-\gamma)\right)\right] \quad (5)$$

Where $\gamma'=\gamma+i(1-\gamma)$ and $f=si(1-\gamma)$

With this expression, we are able to assess whether the bank has incentives to understate its risk taking, and if so, under which conditions this bank behaviour is possible. To do so, we compare profit functions of a given bank under Basel II with perfect supervision (equation(3)) and Basel II with supervision under asymmetric information (equation (5)). For this purpose, we solve the following inequality for the same bank: $\pi_2^{AI} - \pi_2 \succ 0$ for sanctions magnitude s. That is:

$$\left(w_L\gamma + w_H(1-\gamma)\right) - p\left(w_L\gamma' + w_H(1-\gamma')\right) - (1-p)(1+f)\left(w_L\gamma + w_H(1-\gamma)\right) \succ 0$$

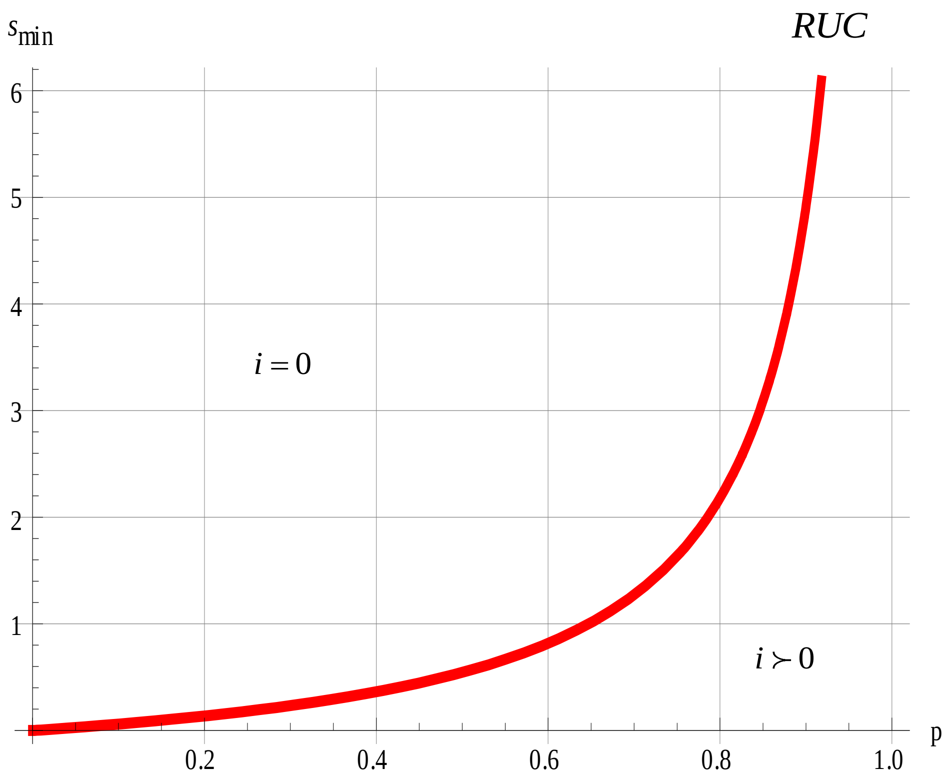
We get the following result that we call the *risk understating condition* (RUC):

$$\pi_2^{AI} - \pi_2 \succ 0 \text{ if } s \prec s_{\min} = \frac{p\left(w_H - w_L\right)}{(1-p)\left(w_H - \gamma\left(w_H - w_L\right)\right)} \quad (6)$$ [79]

Expression (6), depicted on Figure 2 below, means that, for a given value of bank's ability to understate its risk p, unless the supervisor's sanction is above a certain minimum $s_{\min}$, the bank will benefit from understating a portion $i \in]0,1]$ of high risk loans as low risk loans.

[79] One can show that, when $p = 1$, i.e., when the bank has the full ability to cheat, it could reap higher profit by misreporting its risk-taking for every possible sanction s.

Figure 2. Relationship between the bank's ability to misreport *p* and the required supervisor's minimum sanction $s_{\min}$ needed to have $i = 0$[80]



According to this chart, we can see that for a mere 20% $(p = 0.8)$ chance of the supervisor to detect bank's game, he needs to be tough enough by imposing harsh sanctions mounting to $s = 2{,}18$ at least. This implies, under our assumptions, an extra capital ratio to the regulatory minimum requirement $fk = 8.72\%$ and therefore, the bank should hold a risk weighted capital ratio of 16.72 % at least.

Now that we have determined the conditions under which the bank could misreport its risk taking to maximise its profit, we can determine the optimal choice of the bank as regards to its actual share of low risk assets and its misreporting incentives magnitude. Hence, the maximisation of π_2^{AI} with respect to γ and i gives the following system of two equations:

[80] We assume (for all figures) that $w_L = 0.8$, $w_H = 1.4$ and $\gamma = 0.5$. Other configurations do not modify the main conclusion. For instance, when the risk weight gap is less than the one assumed above, we find that for low probability p, the minimum sanction is rather low (the opposite is true), but for high values of p, $s_{\min}$ remains very high.

$$\begin{cases} \dfrac{\partial \pi_2^{AI}}{\gamma} = \left(r_L - q\overline{r}_H\right)L + r_K k\left(w_H - w_L\right)L\left[p\left(1-i\right) - \left(1-p\right)\left(2si\gamma - si - \dfrac{w_H}{w_H - w_L}si - 1\right)\right] = 0 & (7) \\ \dfrac{\partial \pi_2^{AI}}{i} = r_K k\left(1-\gamma\right)\left(w_H - w_L\right)L\left[p - \left(1-p\right)s\left(\dfrac{w_H}{w_H - w_L} - \gamma\right)\right] = 0 & (8) \end{cases}$$

The system of equations above shows that we have no more corner solutions. The second derivative of π_2^{AI} respect to γ shows that we have a concave function and therefore, the programme maximisation admits a maximum. We derive the optimal actual low risk asset share γ^* and bank's optimal incentives i^* which are given by the expressions:

$$\gamma^* = \frac{w_H}{w_H - w_L} - \frac{p}{\left(1-p\right)s} \text{ and } i^* = \frac{kr_K\left(w_H - w_L\right) - \left(q\overline{r}_H - r_L\right)}{kr_K\left(\left(1-p\right)sw_L - p\left(w_H - w_L\right)\right)} . \qquad (9)$$

We see that the bank maximises the profit by diversifying its portfolio. Above γ^*, its profit decreases and hence, the bank rationally chooses $\left(1-\gamma^*\right)$ of high risk assets. The expression $\left(9\right)$ shows that the higher the gap between low and high risk weight asset $\left(w_H - w_L\right)$, the higher the supervisor's severity s are and/or the lower the ability to "cheat" p, the higher the optimal low risk share γ^* should be.

RESULT 1. In presence of asymmetric information between banks and the supervisor, the bank has incentives to understate its risk taking and the optimal portfolio allocation is no more a corner solution. There is an optimal low risk asset share $\gamma *$ above and below which the bank is not willing to go.

We can infer from the expression (6) that $\lim_{p \to 1} s_{\min} = \infty$. It seems difficult, if not impossible, for the supervisor to devise appropriate sanctions to deter the bank from misreporting its risk assessment when he can only detect bank's wrongdoing with very limited ability (high values of p). To this supervisor's lack of "ability to act", there could be an additional lack of "will to act" reflected in the tendency of some supervisors to accommodate banking institutions which do not comply with requirements and refrain from intervening with corrective measures. This is what is called supervisor's forbearance.

Thus, in the following section, we study the benefits of coupling Basel II with a simple leverage ratio as recently adopted in the new regulatory framework, the so-called Basel III. To the best of our knowledge, only Blum (2008) has explicitly investigated theoretically the joint effect of Basel II and a simple leverage ratio on bank behaviour[81]. However our approach differs from his on several aspects. For instance, we define low and high risk banks subsequent to the bank portfolio choice while Blum's interpretation of the two types is that the safe banks are operated by competent, efficient managers and the risky banks are operated by less competent managers who do not have access to the safe, profitable projects. He ignores the question of portfolio choice which is at the core of our paper and therefore considers loans of one risk-type.

[81] Despite this scarcity of theoretical investigations on the joint effect of risk-adjusted capital and simple leverage ratios, a substantial number of empirical studies on US (Avery and Berger, 1991; Estrella et al., 2000 for instance) and Canadian (Bordeleau et al., 2009) experiences where both capital standards exist provide evidence that having both standards is superior to having one of them. The investigations on the case of the US experience mainly find that the two capital standards have independent and complementary information on future bank performance problems while that on the Canadian experience find that the leverage ratio complements the risk-adjusted capital ratio by dampening the procyclicality problem associated with the risk-weighting.

1.14. Complementary use of Basel II and a simple leverage ratio

Here, we consider a case in which the regulator requires the bank to hold simultaneously a minimum risk weighted capital ratio (Basel II) and a minimum simple capital leverage ratio. Hence, the bank has to satisfy[82]:

$$\begin{cases} k_{LR} = \dfrac{K}{L} \geq k \\ k_2 = \dfrac{K}{w_L \gamma L + w_H (1-\gamma) L} \geq k \end{cases} \qquad (10)$$

The bank profit functions are written as:

$$\pi_{2LR} = r_L \gamma L + q\bar{r}_H (1-\gamma) L - r_D D - r_K kL \max\left\{1, \left(w_L \gamma + w_H (1-\gamma)\right)\right\} \qquad (11)$$

under perfect supervision or,

$$\begin{aligned} \pi_{2LR}^{AI} = {} & r_L \gamma L + q\bar{r}_H (1-\gamma) L - r_D D - \\ & r_K kL \max\left\{1, \left[p\left(w_L \gamma' + w_H (1-\gamma')\right) + (1-p)(1+f)\left(w_L \gamma + w_H (1-\gamma)\right)\right]\right\} \end{aligned} \qquad (12)$$

under imperfect supervision.

In order to investigate the bank behaviour concerning its incentives to misreport its own risk assessment, we proceed like previously by solving $(12)-(11)>0$. This inequality offers technically four potential cases where only two are consistent with our framework. In fact, if the risk adjusted capital is less than the leverage capital, therefore the bank has to satisfy the latter and there is no risk understating[83]. Thus, we only consider that the risk adjusted capital under Basel II with perfect information is equal or higher than the leverage capital. Hence, the two possible cases detailed below correspond to the situation where both

[82] We assume the same minimum regulatory capital ratio k for simplicity. In future research, it could be interesting to conduct calibrations on what should be the appropriate value of k for the leverage ratio.

[83] Formally, we have $(12) \Leftrightarrow (11)$.

the risk adjusted capital under perfect and imperfect information are above the simple leverage capital and the situation where the risk adjusted capital under imperfect information is less than the simple leverage capital. Note however that in the latter case, the bank will be obliged to hold the minimum capital required by the leverage capital constraint.

1.14.1 The leverage capital ratio constraint is not binding

In this case, the situation is such that the risk adjusted capital, both under perfect and imperfect supervision, is superior to the simple leverage ratio. To find out under which conditions the bank could benefit from understating its risk taking, we solve the following system compounded by three inequalities to be simultaneously satisfied. That is:

$$\begin{cases} \pi_{2LR}^{AI} - \pi_{2LR} > 0 \\ \left(w_L\gamma + w_H\left(1-\gamma\right)\right) - 1 \geq 0 \\ p\left(w_L\gamma' + w_H\left(1-\gamma'\right)\right) + \left(1-p\right)\left(1+f\right)\left(w_L\gamma + w_H\left(1-\gamma\right)\right) - 1 \geq 0 \end{cases}$$

The system is satisfied, i.e. the bank makes profit by understating its risk ($\pi_{2LR}^{AI} - \pi_{2LR} > 0$) given that the leverage ratio is not binding under the conditions reported in Table 1.

Table 1. Risk understating conditions in the case of non binding leverage capital constraint

$\pi_{2LR}^{AI} - \pi_{2LR} > 0$			
Low "cheating" ability	High "cheating" ability		
$0 \prec p \leq p_{\min}$	$p_{\min} \prec p \prec 1$		$p=1$
$0 \leq s \prec s_{\min}$	$0 \leq s \prec s'_{\min}$	$s'_{\min} \leq s \prec s_{\min}$	$\forall s \geq 0$
$\forall 0 \prec i \leq 1$	$0 \prec i \leq i_{\max}$	$\forall 0 \prec i \leq 1$	$0 \prec i \leq 1 - \frac{1-w_L}{(w_H - w_L)(1-\gamma)} \prec 1$

Where: $p_{\min} = \frac{(w_H - 1) - \gamma(w_H - w_L)}{(1-\gamma)(w_H - w_L)}$, $s_{\min} = \frac{p(w_H - w_L)}{(1-p)(w_H - \gamma(w_H - w_L))}$,

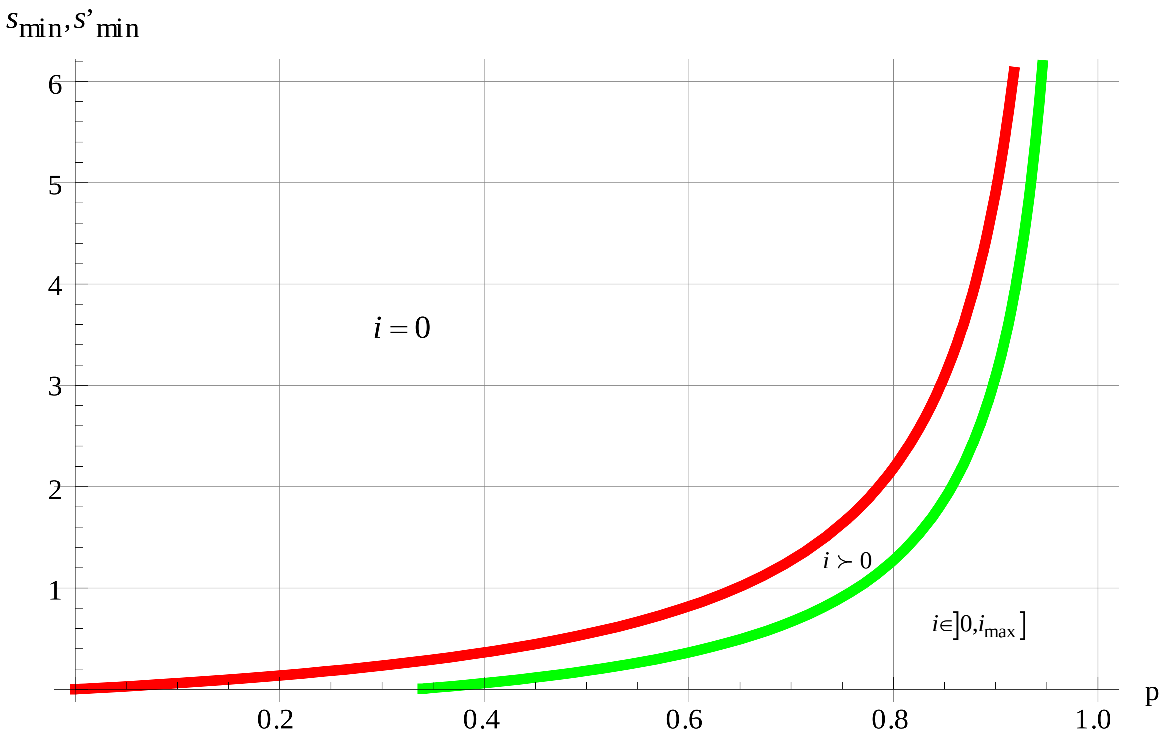
$$s'_{\min} = \frac{1 + (1-p)(1-\gamma)w_H - w_L\left(p + \gamma(1-p)\right)}{(1-p)\left(w_H - \gamma(w_H - w_L)\right)}$$

and

$$i_{\max} = \frac{1 - (1-\gamma)w_H - \gamma w_L}{(1-\gamma)\left(\left(w_H\left(s(1-p)(1-s\gamma) - p\right) - w_L\left(p + s(1-p)\right)\right)\gamma\right)\right)}$$

These results have to be compared with those obtained under sole Basel II in order to highlight the role, if any, of supplementing the simple leverage to Basel II. We notice that the results in the first column are equivalent to those under sole Basel II. Thus, we infer from this similarity that under low bank's ability to understate its risk taking (low p) (or equivalently high supervisor's power), the simple leverage ratio is superfluous and thus, unnecessary in curbing bank's incentives to misreport its risk taking. On contrary, when p is high (remaining columns), the fraction of high risk assets that the bank could potentially masquerade as low risk assets is bounded from above and depend on p and s. One can easily show that the upper bound limit of i decreases as p gets higher and higher. It reaches the minimum when $p=1$ (see Figure 3 below).

Figure 2. Relationship between the bank's ability to misreport p and the supervisor's minimum sanctions $s_{\min}$ and $s'_{\min}$



: Sole Basel II

: Basel II coupled with a simple leverage ratio

From Figure 2 we can see that, even though the minimum supervisor's sanction needed to deter completely the bank from misreporting its risk remains the same, that is $i=0$ for every $s \succ s_{\min}$, we notice that the simple leverage ratio introduces an upper bound limit $i_{\max}$ for lower supervisor's minimum sanction than $s'_{\min}$ as detailed on Figure 3.

Figure 3. Relationship between the actual supervisor's sanction s, the bank's ability p and incentives $i_{\max}$ to misreport its risk taking

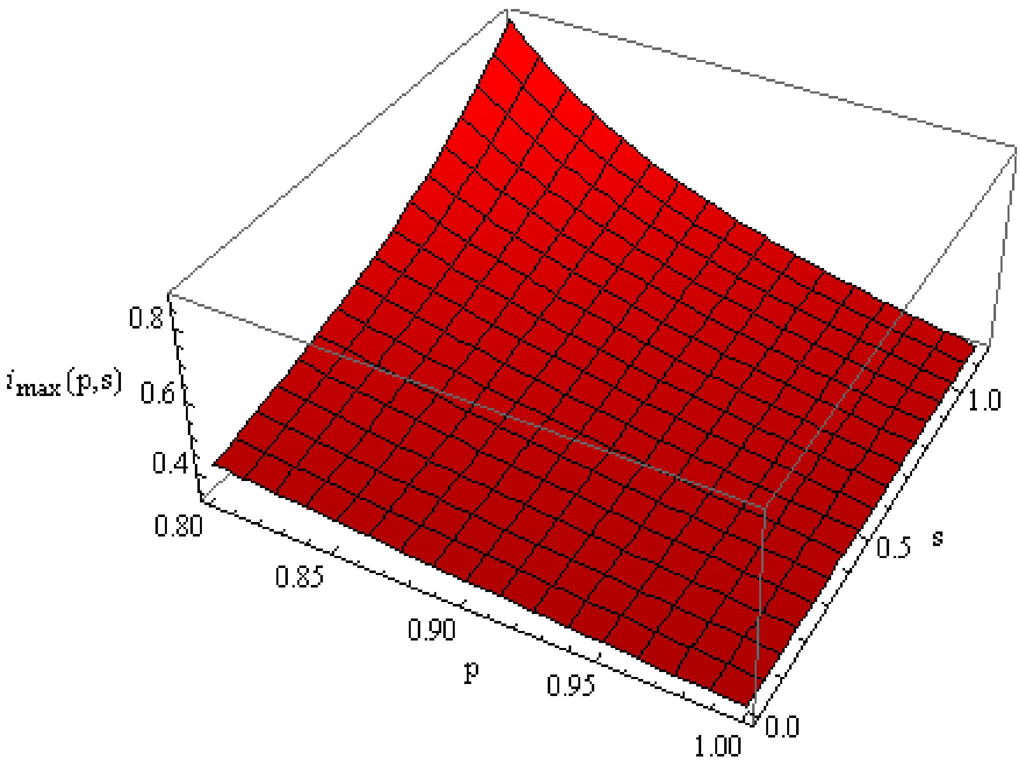


Figure 3 shows how supplementing Basel II with the simple risk insensitive leverage ratio affects the bank's incentives to understate their risk reporting. It depicts for a given value of bank's ability to misreport its risk $p \succ p_{\min}$, the range of supervisor's minimum sanction S and the corresponding upper bound limit of bank's incentives to misreport its risk i_{max}. The figure highlights the role of the simple leverage ratio in curbing bank's incentives to "cheat". This means that, for a given supervisor's sanction s lower than $s'_{\min}$, the bank would not misreport a fraction of high risk asset as low risk asset higher than i_{max} without breaching the simple leverage ratio requirement. For instance, for bank's ability to cheat $p = 0.8$, the supervisor can completely deter the bank from cheating by setting a sanction $s \geq s_{\min} = 2.18$. If not, the chart shows that for lower sanction than $s'_{\min} = 1.27$, the maximum fraction of high risk asset the bank could misreport is lower than the unity $(i = 1)$ found under sole Basel II. For example, for the same $p = 0.8$, if $s = 1$, the maximum fraction the bank could misreport is

$i_{\max} = 0.77$ and the upper bound limit decreases for lower sanction s or higher bank's ability p. We have $i_{\max} = 0.42$ for $s = 0$ for instance. This limiting role of the leverage ratio is of great importance notably if we consider the issue of supervisor's forbearance.

1.14.2 The leverage capital ratio constraint is binding

In this case, we consider the situation where the bank understates significantly its risk reporting and therefore the risk adjusted capital under Basel II with imperfect information is lower than the leverage capital. Hence, the former system of three inequalities is slightly modified and becomes:

$$\begin{cases} \pi_{2LR}^{AI} - \pi_{2LR} > 0 \\ \left(w_L\gamma + w_H\left(1-\gamma\right)\right) - 1 \geq 0 \\ p\left(w_L\gamma' + w_H\left(1-\gamma'\right)\right) + \left(1-p\right)\left(1+f\right)\left(w_L\gamma + w_H\left(1-\gamma\right)\right) - 1 \prec 0 \end{cases}$$

Thus, when the leverage ratio binds, the bank makes profit by understating its risk only under the conditions reported in Table 2.

Table 2. Risk understating conditions in the case of binding leverage capital constraint

$\pi_{2LR}^{AI} - \pi_{2LR} > 0$	
High "cheating" ability	
$p_{\min} = \frac{(w_H - 1) - \gamma(w_H - w_L)}{(1-\gamma)(w_H - w_L)} \prec p \prec 1$	$p=1$
$0 \leq s \prec s'_{\min} = \frac{1 + (1-p)(1-\gamma)w_H - w_L(p + \gamma(1-p))}{(1-p)(1-\gamma)(w_H - \gamma(w_H - w_L))}$	$\forall s \geq 0$
$i'_{\min} = \frac{1-(1-\gamma)w_H - \gamma w_L}{(1-\gamma)((w_H(s(1-p)(1-s\gamma)-p) - w_L(p+s(1-p))\gamma))} \prec i \leq 1$	$i_{\min} = 1 - \frac{1-w_L}{(w_H - w_L)(1-\gamma)} \prec i \leq 1$

Notice that, contrary to the previous non binding case, the situations where the bank can make profit by understating its risk are rather rare. For instance, the case where the bank has less capability ($p \leq p_{\min}$) no longer exists. The table above indicates that the bank only benefits from understating its risk if, at the same time, it is capable enough, the supervisor is less severe and it masquerades a considerable fraction of high risk as low risk assets. In this case too, we can see how the coexistence of the simple leverage ratio and Basel II is superior to the sole Basel II. Whereas the bank could gain by "cheating" for every value of p and i when $s \prec s_{\min}$ under sole Basel II, now, not only p has to be superior to $p_{\min}$ and $i \succ i'_{\min}$, but also the supervisor's minimum sanction necessary to deter the bank from "cheating" $s'_{\min}$ is lower $s'_{\min} \prec s_{\min}$.

All in all, coupling Basel II with a simple leverage ratio has several merits when the supervisor's ability to detect and sanction banks' wrongdoing is weak. We can see how the simple leverage ratio, on the one hand, substantially lowers the maximum the bank can misreport when the supervisor is completely unable to detect and/or sanction the bank (non binding case). In the other hand, it tightens the conditions under which the bank could "cheat" (binding case). For instance, $i_{\max} = 1 - \frac{1 - w_L}{\left(w_H - w_L\right)\left(1 - \gamma\right)} \prec 1 \; \forall p = 1$ and $s \geq 0$. The supplement of the simple leverage requirement prevents banks from holding a capital ratio lower than $k = K/L$ which could otherwise be possible under some circumstances of the sole Basel II. Indeed, even in a situation where the bank has full ability to "cheat" $\left(p = 1\right)$ and the sanction is absent $\left(s = 0\right)$, the leverage ratio guarantees that the bank holds at least a capital level: $kL \succ kw_L L$.

RESULT 2. When supervisor's ability to detect bank's risk misreporting and its sanction enforcement are relatively weak, the supplement of a simple leverage ratio to self risk reporting Basel II helps to curb bank's incentives to understate its risk.

1.15. Robustness checks and potential extensions

1.15.1 Relaxation of the binding minimum capital requirements assumption

As discussed in section 3.4, we ignored optimal capital ratio determination by assuming that the minimum regulatory capital requirement is binding. This assumption allowed us to only concentrate on the portfolio choice which is the main focus of this paper. This section argues that this assumption can be relaxed without distorting the interpretations of our main results. To this end, we also relax the assumption that the whole debt D is insured and follow Blum (2002) by considering that there exists a portion $\lambda \in [0,1]$ which is not. Hence, as we know that one of the main reasons why banks hold capital buffer (that is the difference between the actual capital ratio and the minimum capital requirement ratio) is to be used as a strategic negotiation tool to borrow at a cheaper cost, we assume a gross rate of debt r_{UD} applied to the portion of the uninsured debt (λD) and modeled as follows: $r_{UD} = r_D\left(1+\frac{k}{k_a}\right)$. Where we consider that $k_a \geq k$, such that k_a is the actual capital ratio reflecting the non-binding minimum capital requirement ratio. $\left(\frac{k}{k_a}\right)$ is the cost difference between non insured and insured debt costs. The higher the actual capital ratio k_a is, the lower the cost difference will be[84]. Thus, the total cost of the debt: $r_D(1-\lambda)D + r_{UD}\lambda D$ can be simply written as: $r_D\left(1+\lambda\frac{k}{k_a}\right)D$. In this way of modelling, we introduce the natural trade-off between bearing high equity cost and benefiting from low non insured debt cost. Hence, the bank maximisation programme under Basel II with asymmetric information is written as:

$$\max_{\gamma,i,k_a} \pi_2^{AI} = r_L\gamma L + q\overline{r}_H(1-\gamma)L - r_D\left(1+\lambda\frac{k}{k_a}\right)D$$
$$- r_K k_a L\left[p\left(w_L\gamma' + w_H(1-\gamma')\right) + (1-p)(1+f)\left(w_L\gamma + w_H(1-\gamma)\right)\right]$$

[84] The idea that the cost associated with uninsured debt decreases when the bank capital buffer increases is close to the way Furfine (2001) models the costs associated with bank's capital ratio being close to the regulatory minimum capital requirement.

Where $\gamma' = \gamma + i(1-\gamma)$ and $f = si(1-\gamma)$

We can easily show that with this new maximisation programme, there are only minor changes which do not modify the conclusions of the paper. The optimal value for the real share of safe assets γ^* remains unchanged while the optimal expression of the misreporting incentives i^* takes the optimal actual capital ratio k_a^* instead of the regulatory minimum capital requirement k. Thus:

$$\gamma^* = \frac{w_H}{w_H - w_L} - \frac{p}{(1-p)s} \text{ and } i^* = \frac{k_a^* r_K (w_H - w_L) - (q\bar{r}_H - r_L)}{k_a^* r_K ((1-p)sw_L - p(w_H - w_L))}, \text{ where:}$$

$k_a^* = \left(k \cdot s \cdot \frac{1-p}{p} \cdot \frac{r_D}{r_k} \cdot \frac{1}{w_H - w_L} \cdot \frac{\lambda D}{L} \right)^{\frac{1}{2}}$ which is the only new element, is the optimal value for the actual capital ratio. *Ceteris paribus*, we find that k_a^* varies in an intuitive fashion. For instance, we can see that the optimal capital ratio k_a^* increases when (1) the minimum regulatory capital k increases, (2) the supervisor's sanction s increases, (3) the bank's "cheating" capability p decreases, (4) the cost of equity r_k decreases or the cost of insured debt r_D increases as the bank has more incentives to rely on non insured debt and therefore holds higher excess capital for signalling effect, (5) the risk weight asset differentiation $(w_H - w_L)$ decreases because the bank's incentives to take on more high risk assets increases and hence it increases its capital ratio, and (6) when the amount of uninsured debt (λD) increases or the size of loans (L) decreases.

1.15.2 Extensions for future research

To keep our model as tractable as possible, several assumptions were made. Hereafter, we discuss how some of them might be relaxed in the future research. *First*, our model does not make an exception to the usual caveats that apply to any static model. For instance, allowing our setting to live one more period could have enabled us to assess whether considering that some banks go bankrupt could have yield additional results. In fact, we could have added an other layer where only a fraction of banks satisfy the supervisor's sanction to increase equity and another fraction that exit the market due to their inability to levy fresh equity on short notice. Nevertheless, such a setting would require the introduction of many other parameters such as the relative easiness to levy fresh equity, the supervisor’s sanction enforcement. Hence, it is the combination of all these parameters that would render the leverage ratio more or less important. Moreover, given that the leverage ratio constraint is considered as a micro- and macro-prudential tool in Basel III (Hannoun, 2010), it could be interesting to use a dynamic setting in order to take into account the issue of procyclicality. For instance, we could consider that risk understating is severe during boom times where it is well known that banks erroneously appreciate the risks they take, and hence investigate how the role of the leverage ratio may change depending on the economic cycle. *Second,* we only considered the profit maximisation of the bank. It could be interesting to extend the setting and include the supervisor's function and then derive the welfare analysis of the whole economy at equilibrium. *Third*, we considered a loan market with two types of loan and hence a two points distribution setting whereas a more granular approach is offered under Basel II. It could be interesting to consider a more risk sensitive modelling which may yield additional interesting results. *Fourth*, in order to keep the analysis as simple as possible, some parameters were considered exogenous or assumed linear. For instance, bank's ability to understate its risk taking p and its incentives' magnitude i were assumed independent. However, the incentives magnitude could be an increasing function of p, i.e., $i\left(\underset{+}{p}\right)$. By the same token, bank's ability to understate its risk taking p could be considered as a decreasing function of the degree of the asset riskiness. The assumption would be easily relaxed if we consider a more risk sensitive modelling instead of the two points distributions considered in this paper. Of course, relaxing the assumptions made in our setting and endogenizing variables might yield new insights but at the price of a high complexity. These extensions constitute avenues for future research.

1.16. Conclusion

In this paper, we present a simple model that recapitulates the failures of the simple leverage ratio constraint, the promises and the limits of Basel II and we show that the combination of a simple leverage with Basel II offers a higher outcome.

Basel II was built on the idea nicely put by Prescott (2004): "After all, who knows the risks of bank's assets better than the bank itself". Therefore, it seems reasonable to consider that the bank's supervisor has only limited ability to know the true risk faced by the bank. Moreover, given the high cost of capital and the bank tendency to save on regulatory capital, banks with high risk assets have less, if at all, incentives to reveal the true riskiness of their assets. That is the reason why it is important to go beyond the first Pillar and assess how supervisors can induce truthful bank reports on their risk taking. It is what this paper has tried to do. We show that sanctions or penalties imposed for non-compliance are critical for determining bank incentives. However, in some circumstances, that is when supervisors' ability to detect bank's misdeed is very low, sanctions needed under sole Basel II to affect the incentives of banks to send accurate reports are so huge that it seems impossible to implement. In this case, we show that coupling Basel II with a simple leverage ratio is necessary as it lowers the minimum sanction needed to induce truthful risk report and curbs bank's incentives to "cheat". This conclusion is consistent with the very few formal studies that analyse this issue (Jarrow, 2007; Blum, 2008) and the various propositions subsequent to the subprime mortgage crisis (Hildebrand, 2008; FSA, 2009; Brunnermeier et al., 2009 for instance) that were crowned with the adoption by the Basel committee in December 2010 of the leverage ratio alongside the more complex-risk adjusted capital ratio of Basel II.

Quoting *The Economist* (May 16, 2009, p.13): "The more a financial system depends on the wisdom of regulators, the more likely it is to fail catastrophically". Hence, it seems illusory to believe that supervisors could always perfectly detect bank's misdeed and enforce sanction when needed as envisaged in the Pillar 2 of Basel II. That is why the simple leverage ratio which is easily computable and verifiable reveals itself as a necessary tool to curb banks' incentives to understate the risks they take or their inability to correctly measure and report it. It also appears as a necessary palliative remedy to supervisor's imperfection and forbearance.

CONCLUDING CHAPTER

This final chapter provides general concluding remarks of our thesis. It summarizes in the first place the main findings and contributions contained in each one of the three preceding chapters. Then, it discusses how the results offered in this thesis directly address some of the regulatory and supervisory concerns about the shortcomings embedded in the capital regulatory framework for banks. Finally, it indicates where future research might yield additional insights. But first of all, we remind that all our three essays are mainly concentrated around the issue of bank capital regulation. More precisely, the guiding thread of all our research has been to assess how some of the missing points in the risk-based capital ratios could be filled in by market discipline and/or by a simple and transparent leverage ratio constraint.

The starting point of our thesis (chapter 1) was to assess whether having formal minimum capital requirements in place has an impact on bank capital structure. Our procedure is structured around Gropp and Heider's (2010) denial of the role of regulatory minimum capital requirements. We investigate this issue by asking whether banks manage differently their regulated and unregulated capital ratios. To this end, we consider a sample of European banks where only the international Basel minimum capital requirement exists and hence the leverage ratio is not under formal regulation. We study bank capital structure by comparing the persistence and convergence respectively for the leverage, Tier 1 and Total capital ratios. In this analysis, we take care to try to identify factors that may be responsible for differences that may result from this comparison exercise. Hence, we consider separately variables representing the impact of the initial conditions, those that are common to both non-financial and financial firms, and finally we include bank specific variables both from the asset and liability sides. We develop a graphical analysis à la Lemmon et al. (2008) that gives us first hand evidence of the relative transitory and permanent nature of the three capital ratios. These findings are econometrically confirmed in the next steps using the partial adjustment model approach. Overall, our comparative analysis shows that, bank leverage capital ratio is comparatively more persistent and converges less rapidly toward its target leverage capital ratio. When trying to identify the factors that may explain these findings, we show that bank leverage ratio is mainly determined by its initial leverage ratio whereas bank specific variables, particularly those representing market discipline, are more determinant for the behavior of the risk-adjusted capital ratios. We infer from these results that defining formal minimum capital ratios to be respected has a significant impact on bank capital structure. We also show that it strengthens the impact of market discipline on bank capital structure.

The second chapter builds upon the findings from the first chapter and directly analyzes the role market discipline can play in complement to bank minimum capital requirements. It departs from the fact that banks hold a significant capital buffer, which is the difference between the actual bank capital ratio and the minimum capital requirement. We consider a homogenous panel dataset of European commercial banks and empirically study the determinants of the bank capital buffer. As our main aim is to uncover the role of market discipline in complement to minimum capital requirement, we test the following three related hypotheses. Firstly, we ask a general question of whether market discipline makes a bank hold a capital buffer. Secondly, we separate junior from senior debt holders and investigate whether the pressure they exert on banks to hold a capital buffer differs according to their degree of exposure to losses in case of bank failure. Thirdly, we analyze if these debt holders fill in the gap created by capital regulation sluggish to adapt adequately and timely to the rapid evolution of banking activities and complexities. Concretely, we test whether they require a capital buffer for the complex trading activities badly taken into account in the minimum capital requirement. Overall, we find that, consistent with our three hypotheses, debt holders pressure banks to hold a capital buffer. Junior debt holders are the most demanding creditors given their higher exposure in case of a bankruptcy. And more importantly, our findings show that market discipline adapts more quickly than capital regulation because debt holders as a whole require a capital buffer only for banks highly involved in non-traditional activities. Taken separately, we find that this result holds only for senior debt holders as junior debt holders require a capital buffer irrespective of the bank's type of activities confirming the high pressure emanating from them.

In the third chapter we build a simple one period model that allows us to derive bank behavior with respect to its portfolio choice under different capital regulatory standards. We particularly show that combining the risk insensitive leverage ratio constraint and the highly complex risk sensitive Basel II is superior to having only one of them. Indeed, Basel II alone is only beneficial if banks operate in an environment free from information imperfections and risk measurement error problems. Once we consider that information asymmetries are a reality and that the bank has an informational advantage regarding the computation of the regulatory capital compared to the supervisor or that its internal risk model is far from being perfect, we show that the risk insensitive leverage ratio constraint helps to align the bank's and supervisor's incentives and therefore curbs the bank's possibilities to understate their risk taking. Our findings are in total support of the recent introduction of the leverage ratio constraint in the Basel III capital regulation.

On the whole, our thesis gives rise to the following compelling findings that should be taken into consideration. *Firstly*, we show that specifying minimum capital ratios strengthens market discipline and accelerates the convergence movement toward the target capital ratio. *Secondly*, uninsured debt holders considered globally require a capital buffer for banks highly involved in complex, non-traditional activities badly taken into account in the minimum capital requirement and *thirdly*, the complex risk-based capital regulation à la Basel II needs a simple leverage ratio to curb banks' incentives to understate their risk taking.

All these results give rise to several important policy implications.

First, our results claim that the risk-based capital regulation is not enough by itself to ensure that banks hold the necessary capital corresponding to their risk taking. Hence, they support the recent adoption by the Basel committee of the simple leverage ratio as a backstop to Basel II. However, we know that the requirements of the Basel committee are not directly binding at national levels. For this to occur, national authorities have to adopt the measures in their respective jurisdictions which can be a very long process. Indeed, a living example of this long process is offered by the endless discussions that took more than seven years (from June 1999 to June 2006) before the Basel committee adopted the final document of Basel II. More striking is how several countries are reluctant to implement it in their respective national jurisdictions. For instance, we know that the US had not implemented Basel II before the subprime crisis interrupted the process. Hence, several investigations to weigh up the pros and cons of the Basel committee’s recommendations are generally needed to help national regulators to act adequately and timely. We hope that our results will contribute to the efforts that plead for the inclusion of the leverage ratio constraint alongside the risk-adjusted capital ratio in Pillar 1 of Basel III.

Second, Gropp and Heider (2010) fail to find the role of minimum capital requirements and conclude their paper by arguing that their results support the market view on bank's capital structure, even though untested. Our investigation confirms this intuition but also reconciles the complementary role of minimum capital requirements and market discipline. Indeed, we show that having minimum capital requirements in place sparks and strengthens market discipline. This finding is even important when we consider our other result which shows that market discipline can complement the minimum capital requirements. Hence, our results support the direction taken by the Basel committee which specifies several new minimums on top of the current two minimum capital requirements on Tier 1 and Total capital. Indeed, Basel III includes two additional minimum capital requirements on leverage ratio and tangible equity. Two other minimums on capital conservation buffer and countercyclical buffer are also introduced to promote the conservation of the capital and the build-up of adequate buffers that can be drawn in periods of stress. In fact, capital distribution constraints will be imposed on the bank when it does not meet the conservation buffer requirement and/or national authorities judge that there is an excess credit growth that could lead to the build up of system-wide risk.

Third, our conclusions support all regulatory measures directed toward promoting market discipline. Currently, the Basel committee in conjunction with the Financial Stability Board (FSB) is studying the role that contingent capital and bail-in debt could play in the regulatory capital framework. These instruments are designed to reduce the likelihood of a government bailout of large, interconnected and complex institutions, the so-called Too Big To Fail (TBTF), or under the new acronyms SIFIs or G-SIFIs meaning Global-Systemically Important Financial Institutions. These regulatory tools (contingent capital and bail-in debt) are debt securities that convert to common equity under certain conditions. The arrangements governing their conversion would be set out in the contractual terms of the instruments. As a result, investors who hold them would accept the prospect of conversion under certain conditions, and consequently would require compensation for bearing this risk, depending on their expectations of conversion. As such, these regulatory tools should improve the incentives affecting both bank shareholders and holders of these instruments because they expose holders of common equity to a risk of significant dilution of ownership and they widen the pool of debt holders with incentives to discipline the bank. Accordingly, market discipline should be strengthened, moral hazard reduced and the financial system made more resilient.

The discussion above highlights several new measures that Basel III introduces which therefore require future thorough research. Indeed, the Basel III document gives details on the new requirements that deserve further investigations. For instance, as a cautious way, the Basel committee has decided a progressive implementation of the leverage ratio constraint ranging from January 2011 to January 2018 (see BCBS, 2010, p.63). This transition period will start by a supervisory monitoring process, then a period of parallel run on risk- and non risk-based capital ratios will follow before the leverage ratio finally migrates to Pillar 1. During these different stages of phasing-in, assessments of the appropriate level (set currently at 3 %) and the components of the ratio (the numerator comprises Tier 1 capital and the denominator includes off-balance sheet items on the top of Total assets) will be done. Hence, further research on these phasing-in arrangements as well as on the appropriateness of the chosen level and the components of the leverage ratio are needed. The same need for further research applies to the new capital buffers to determine whether the chosen thresholds of 2.5 % of conservation buffer and 0-2.5 % interval for the countercyclical buffer are adequate. These investigations will help design appropriate levels that both guarantee financial stability and avoid undesired economic costs related to a slowdown in bank lending activities. The interactions of all these new measures with the current ones constitute a substantial avenue for future research.

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