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BANK CAPITAL REQUIREMENTS, BUSINESS CYCLE FLUCTUATIONS AND THE BASEL ACCORDS: A SYNTHESIS

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1. Introduction

The Basel Committee on Banking Supervision (BCBS) released, in 2004, the new Basel Capital Accord (usually referred to as Basel II) to address some of the major shortcomings of the previous Basel Accord of 1988 (Basel I), thus fostering stability in the financial system. One of the central changes proposed by Basel II is the increased sensitivity of a bank's capital requirement to the risk of its assets: the amount of capital that a bank has to hold is to be directly connected to the riskiness of its underlying assets. This aspect of the new regulation has raised some concerns, at both academic and policy-making levels, because it may accentuate the procyclical tendencies of banking, in the presence of an imperfect market for bank capital: if, during a recession, bank borrowers are downgraded by the credit risk models in use, minimum bank capital requirements will increase. To the extent that it is difficult or costly for banks to raise external capital in bad times, this co-movement in bank capital requirements and the business cycle may induce banks to further reduce lending during recessions, thereby amplifying the initial downturn.

Banking regulation and, in particular, the procyclical effects of Basel II have gained special interest with the current financial crisis that began in 2007 in the US subprime market, then spreading to broader credit and funding markets. As pointed out by Rosengren (2008), banks play a critical role during periods of financial crisis because they are highly leveraged and regulated institutions, and to maintain their capital ratios after experiencing a large negative capital shock they must significantly shrink assets, which, in turn, tends to amplify the effects of economic shocks. Thus, the growing acceptance among investors that banks need to recapitalize led the crisis to deepen further and rendered it more difficult for policy makers to maintain macroeconomic stability.

The recent events and continuing instability in financial markets all over the world have led the procyclicality issue to enter the agendas of several political

international fora, such as the G7, the G20 and the European Union. In particular, according to the Action Plan agreed in the G20 Washington Meeting, in November 2008, the International Monetary Fund, the Financial Stability Board and other regulators and bodies should develop recommendations to mitigate procyclicality, including the review of how bank capital may exacerbate cyclical trends. The BCBS is now developing supervisory and regulatory approaches to mitigate procyclicality in the financial system and the Economic and Financial Affairs Council (ECOFIN) on July 2009 invited the European Commission to come forward with proposals, in coordination with the developments ongoing at international level, with a view to reducing potential procyclical effects and developing countercyclical measures. As mentioned by Wellink (2009), we cannot change procyclical behaviour, as it is the result of animal spirits, but we can seek to dampen the channels through which it manifests itself.

The present work surveys the literature in order to explore how the Basel II regulation on bank capital is likely to accentuate the procyclical tendencies of banking. We address this hypothesis – the Basel II procyclicality hypothesis – by bringing together the theoretical literature on the bank capital channel of propagation of exogenous shocks and the literature on the regulatory framework of capital requirements under the Basel Accords.

According to the literature on the bank capital channel, the introduction of bank capital requirements, for market or regulatory reasons, amplifies the effects of monetary and other exogenous shocks. This amplification effect usually rests on the argument that raising new capital can be difficult and costly for many banks, especially during economic downturns, thereby increasing the financing cost faced by firms that borrow from those banks. Firms with no effective alternative sources of credit tend to react to this increase in their financing cost by decreasing investment and output, thus amplifying the downturn. This thesis has been, to some extent, motivated by empirical evidence that bank capital affects banks' supply of loans and, consequently, real activity. Kishan and Opiela (2000, 2006), Van den Heuvel (2002b) and Gambacorta and Mistrulli (2004), for instance, show that the real effects of monetary policy are generally stronger when banks are small and low-capitalized. Hubbard *et al*. (2002), in turn, find that, even after controlling for information costs and borrower risk, the capital position of individual banks affects the interest rate at which their clients borrow. Additionally, there is a quite extensive empirical literature on the hypothesis that a 'credit crunch' – a significant leftward shift in the supply curve for bank loans – may have occurred in the USA during the early 1990s, simultaneously with the implementation of Basel I.[1]

After synthesizing the theoretical literature on the bank capital channel, we focus on whether the introduction of Basel II capital requirements may add to this amplification effect. We first briefly review the key reasons for regulating banks, as well as the role of bank capital requirements in banking regulation, and then we concentrate on how the increased sensitivity of a bank's capital requirements to the risk of its assets, as envisaged by Basel II, may accentuate the amplification effect underlying the bank capital channel. We conclude that, although the theoretical models which revisit the bank capital channel under Basel II generally support the

procyclicality hypothesis, the magnitude of the procyclical effects is still subject to some debate and further attention should be drawn to the main drivers of Basel II procyclicality, namely (i) the composition of banks' asset portfolios, (ii) the approach adopted by banks to compute their minimum capital requirements, (iii) the nature of the rating system used by banks, (iv) the view adopted concerning how credit risk evolves through time, (v) the capital buffers over the regulatory minimum held by the banking institutions, (vi) the improvements in credit risk management and (vii) the supervisor and market intervention under Basel II. Furthermore, we also address how some of these issues have been highlighted by the current financial crisis and some of the measures that are being proposed to dampen procyclicality in banking regulation, as well as how these measures may be integrated in the bank capital channel literature to test their effectiveness.

The chapter is organized as follows. After this introduction, Section 2 synthesizes the bank capital channel theoretical literature. Section 3 takes a closer look at regulatory capital requirements. After briefly reviewing the key reasons for regulating the banking system and the role of regulatory capital requirements in this context, we focus on the Basel Accords and, in particular, on capital requirements for credit risk under Basel II. Section 4 discusses the Basel II procyclicality hypothesis, both at the empirical and theoretical level, also pointing out some corrective measures that may counteract the potential procyclical effects and some key areas for further research. Section 5 concludes with some final remarks.

2. The Bank Capital Channel: Related Theoretical Literature

At present, the theoretical literature distinguishes three channels of monetary policy propagation through financial imperfections: (i) the bank lending channel, arising from the fact that banks finance loans in part with liabilities that carry reserve requirements, (ii) the borrowers' balance sheet channel, focusing on borrowers' financial position and its effect on the external finance premium that borrowers face and, more recently, (iii) the bank capital channel, emphasizing that monetary policy affects bank lending through its impact on bank capital.[2]

The bank lending channel and the borrowers' balance sheet channel have been more extensively studied – see Bernanke and Gertler (1995) for a review. Instead, we focus on the bank capital channel models, summarized in Table 1 and classified according to (i) the motivation for bank capital holdings (market versus regulatory capital requirements), (ii) the nature of bank capital (issued capital and/or retained earnings) and (iii) the effects of exogenous shocks on lending and on the business cycle.

The rationale for bank capital holdings builds on the premise that banks hold capital for market and/or regulatory reasons. Market capital requirements, as defined by Berger *et al.* (1995), are associated with the capital ratio (i.e. the ratio of bank capital to assets) that maximizes the value of the bank in the absence of regulatory capital requirements, but in the presence of the remaining regulatory structure that protects the safety and soundness of the banking system. According to these authors, market requirements can be justified (i) by the costs of banks' financial distress,

Table 1. The Bank Capital Channel – Related Theoretical Models.

	Capital requirements (CR)		Bank capital	Effect of exogenous shocks on lending and/or on the business cycle
Chen (2001)	Market	–	–	Amplified and more persistent[a]
Sunirand (2003)	Market	–	Retained earnings	Amplified with the introduction of a double CSV approach
Aikman and Paustian (2006)	Market	–	Retained earnings + endowment	Amplified and more persistent with the introduction of an asym. inform. problem between depositors and banks and between banks and firms
Meh and Moran (2007)	Market	–	Retained earnings	More persistent[a]
Blum and Hellwig (1995)	Regulatory	Binding	Fixed (no new equity issue)	Amplified with the introduction of binding CR
Thakor (1996)	Regulatory	Binding	–	↑ Risk-based CR ⇒ decrease in aggregate lending; expansionary MP when CR are binding may not increase lending
Repullo and Suarez (2000)	Regulatory	Binding	Retained earnings	Contractionary MP ⇒ ↓ bank lending relative to market lending
Furfine (2001)	Regulatory	Not binding	Retained earnings + issued equity	↑ Risk-based CR or a negative shock to bank capital ⇒ decrease in loan growth
Chami and Cosimano (2001)	Regulatory	Binding/not binding	Issued equity (but predetermined)	*Bank capital accelerator effect*: amplifies the impact of MP on the economy
Van den Heuvel (2002a)	Regulatory	Binding/buffer	Retained earnings	*Bank capital channel* (BCC): with CR, lending overreacts to a MP shock; the BCC amplifies the standard interest rate channel of MP
von Peter (2004)	Resembles a regulatory CR	Binding/not binding	Retained earnings	Negative shock ⇒ ↓asset prices ⇒ ↑firms default ⇒ ↑loan losses ⇒ ↓bank capital ⇒ ↓credit supply (if CR are binding) ⇒ ↓asset prices

Kopecky and VanHoose (2004)	Regulatory	Binding	Issued equity	↑ Risk-based CR reduce the effects of MP
Honda (2004)	Regulatory	Binding/not binding	Fixed	The more the banks are constrained by CR, the less effective MP is
Berka and Zimmermann (2005)	Regulatory	Binding	Issued equity	Negative aggregate shock ⇒ credit crunch; but negative ag. shock and procyclical CR (tighter during recession) soften the loan decrease
Cecchetti and Li (2008)	Regulatory	Binding/not binding	Moves with aggregate output (by assumption)	Confirms Blum and Hellwig (1995)'s results + optimal MP neutralizes the procyclical impact of binding CR
Bolton and Freixas (2006)	Regulatory	Binding	Issued equity	Potential amplifying effect of MP: tightening in MP ⇒↓ incentives to raise bank capital ⇒ further decline of lending
Markovic (2006)	Regulatory	–	Issued equity	Amplification of output response to a contractionary MP
Aguiar and Drumond (2007)	Regulatory	Binding	Issued equity	Introduction of CR amplifies monetary shocks through a liquidity premium effect on the external finance premium faced by firms
Jorge (2007)	Regulatory	Binding	Retained earnings	Due to CR, loans react with a delay to shifts in monetary policy
Van den Heuvel (2008)	Regulatory	Binding/not binding	Issued equity	↑ CR reduce welfare

[a]When compared to a situation where information frictions between banks and depositors are absent.
CSV, costly state verification; MP, monetary policy; CR, capital requirements.

which tend to increase if the bank capital ratio decreases, (ii) by the transaction costs of issuing equity, coupled with substantial financial distress costs from low capital, and (iii) by the existence of agency problems between shareholders and creditors.

As reported in Table 1, Chen (2001), Meh and Moran (2007), Aikman and Paustian (2006) and Sunirand (2003) focus on this type of bank capital requirements. The first three of these models have been built upon Holmstrom and Tirole's (1997) formulation, featuring two sources of moral hazard. The first source affects the relationship between banks and borrowers: entrepreneurs (borrowers) can choose between different projects and have an incentive to undertake the riskier projects in order to enjoy private benefits. To deter entrepreneurs from going after those private benefits, banks require them to invest their own funds in the project. The second source of moral hazard influences the relationship between banks and households (depositors) and is the reason for the existence of market capital requirements: because banks may not dutifully monitor entrepreneurs, households only lend to banks that invest their own net worth (bank capital) in financing the entrepreneurs' projects. As delegated monitors for depositors, banks must then be well capitalized to convince depositors that they have enough stake in the entrepreneurs' projects.

In this context, Chen's model predicts that, because both bank capital and firms' net worth are used as collateral, a change in their level has a direct effect on bank lending and, thus, on aggregate investment: when bank capital decreases, banks find it difficult to seek alternative sources of finance and are forced to cut back lending to firms, which, in turn, affects negatively firms' investment. This effect tends to persist over time: less investment in the previous period causes entrepreneurs and banks to earn less revenue, which affects negatively their level of net worth. This further weakens the lending capability of banks and the borrowing capacity of entrepreneurs.

Meh and Moran (2007) go a step further and embed Holmstrom and Tirole's (1997) framework within a dynamic general equilibrium model, in which a contractionary monetary policy not only raises the opportunity cost of the external funds that banks use to finance investment projects but also leads the market to require banks and firms to finance a larger share of investment projects with their own net worth. Because banks and firms' net worth are largely predetermined, bank lending must decrease to satisfy the market requirements, thereby leading to a decrease in investment. This, in turn, affects negatively banks and firms' earnings and, consequently, banks and firms' net worth in the future, leading to the propagation of the initial shock over time. This model thus seems to capture the tightening in market capital requirements that occurred during the current financial crisis and which led banks to hold tier one capital ratios well above the regulatory minimum and to government intervention in many countries, through the adoption of recapitalization plans, to avoid a stronger credit crunch.

Aikman and Paustian's (2006) model, building on the earlier work by Chen (2001), predicts that financial frictions lead to a persistent (as in Meh and Moran, 2007) and amplified response of the macroeconomic variables to technology, monetary and bank capital shocks. The amplification effect rests on the existence of

external capital adjustment costs in the model: a contractionary monetary policy, for instance, reduces the net worth of both entrepreneurs and banks, and, as in Kiyotaki and Moore (1997) and Bernanke *et al.* (1999), induces a negative feedback effect from net worth to asset prices and then back from asset prices to net worth, which greatly magnifies the impact of the initial shock.

Following a different approach, Sunirand (2003) also supports the bank capital amplification hypothesis: by extending the financial accelerator model of Bernanke *et al.* (1999) to consider a two-sided costly state verification (CSV) framework, Sunirand is able to dissociate the amplification effect caused by the moral hazard problem between depositors and banks from the amplification effect caused by the asymmetric information problem between banks and firms. In the well known CSV framework, first introduced by Townsend (1979), the lender must pay a cost in order to observe each borrower's realized return. In Sunirand's model, banks act as delegated monitors on firms' investment projects, as in Bernanke *et al.*, and depositors perform the role of 'monitoring the monitor', as in Krasa and Villamil (1992).[3] The two-sided CSV framework leads to a wedge between the internal and external cost of funds that motivates an endogenous role for firms' and banks' capital in the model. Sunirand then shows that embedding the informational asymmetry between households and banks into the financial accelerator model further amplifies and propagates the effects of a negative monetary shock on aggregate output and investment.

Notwithstanding the importance of market capital requirements on banks' behaviour, as the current crisis has shown, the majority of the theoretical bank capital channel literature focuses exclusively on bank capital requirements imposed by banking regulation. See, for instance, Blum and Hellwig (1995), Thakor (1996), Repullo and Suarez (2000), Chami and Cosimano (2001), Van den Heuvel (2002a, 2008), Berka and Zimmermann (2005), Bolton and Freixas (2006), Markovic (2006) and Aguiar and Drumond (2007). Blum and Hellwig (1995), who have pioneered this approach, argue that a rigid link between bank capital and bank lending imposed by regulation may amplify macroeconomic fluctuations, by leading banks to lend more when times are good and to lend less when times are bad. Assuming that banks cannot issue new capital and that firms do not fully replace bank loans by other sources of finance, the amplification mechanism works as follows. If many banks face low return realizations at the same time, they may all become simultaneously undercapitalized and then all may have to decrease lending (or to recapitalize) at the same time, in the presence of a regulatory capital adequacy requirement. This is likely to reduce firms' investment and, therefore, aggregate demand and firms' cash flows, which negatively affects the ability of firms to pay their debts and hence the return that banks receive on their loans. A given initial shock to asset returns may thus be amplified by a rigid application of a capital adequacy requirement (Blum and Hellwig, 1995, pp. 741–742).

An alternative explanation for the decrease in bank loan supply during bad times, under regulatory capital requirements, rests on banks' exposure to the interest rate risk. Take, for instance, the work by Repullo and Suarez (2000) according to which some long-term bank assets involve fixed interest rates whereas the returns of many

short-term bank liabilities are closely linked to market interest rates. A monetary tightening thus generates losses to the banks, thereby reducing bank capital, which, in turn, produces a credit crunch under regulatory capital requirements: bank lending and investment decrease, and the higher quality bank borrowers tend to shift to market finance. Van den Heuvel (2002a) also assumes that banks are exposed to interest rate risk, while not able to issue new capital. An increase in the interest rate after a contractionary monetary policy and, consequently, an increase in the bank's cost of funding leads to a decrease in the bank's profits, given the maturity mismatch on the bank's balance sheet, weakening the bank's future capital position and thus increasing the likelihood that its lending will be constrained by an inadequate level of capital. Therefore, new lending overreacts to the monetary policy shock, compared to a situation of unconstrained banks. Van den Heuvel refers to this channel operating via the supply of bank loans through its impact on bank capital as the bank capital channel. Its strength depends on the capital adequacy of the banking sector and on the distribution of capital across banks (because, as mentioned by Benink *et al.* (2008), there is no interbank market for bank equity): lending by banks with low capital is delayed and then amplified in reaction to interest rate shocks, relative to well capitalized banks.

Chami and Cosimano (2001), Berka and Zimmermann (2005), Bolton and Freixas (2006), Markovic (2006) and Aguiar and Drumond (2007) also consider regulatory capital requirements, but, in contrast with Van den Heuvel, assume that banks may issue equity. However, equity issuance may involve costs, as in Bolton and Freixas (2006), who introduce a cost of outside capital for banks by assuming information dilution costs in the issuance of bank equity: outside equity investors, having less information about the profitability of bank loans, tend to misprice the equity issues of the most profitable banks. In such a context, binding regulatory capital requirements may magnify the effects of a contractionary monetary policy, because this policy may cause a decrease (or prevent an increase) in bank capital, as bank loans become insufficiently lucrative when information dilution costs in bank equity issuance are taken into account.

Markovic (2006) also explores the asymmetric information relationship between banks and their shareholders, developing a model that extends Bernanke *et al.*'s (1999) work to account for three bank capital channels: (i) the adjustment cost channel, which builds on the allocation cost necessary to reduce the aforementioned asymmetric information problem; (ii) the default risk channel, which arises from the possibility of banks defaulting on their capital; and (iii) the capital loss channel, based on the assumption that, during a recession, banks' shareholders anticipate a future fall in the value of bank capital. All channels trigger an increase in the required return on bank capital by shareholders, and thus an increase in the cost of bank capital, during a recession. This higher cost is then transferred to firms, leading to lower firms' investment and output. All the three channels thus amplify the output response to a contractionary monetary policy.

In a slightly different perspective, Van den Heuvel (2008) quantifies the potential welfare costs of bank capital requirements by embedding the role for liquidity

creation by banks in a general equilibrium growth model, with no aggregate uncertainty. The households' preferences for liquidity play here a major role: equilibrium asset returns reveal the strength of these preferences and allow the quantification of a fairly large (according to the author's simulations for the US economy) welfare cost of bank capital requirements. Regulators, thus, face a trade-off between keeping the effective capital requirement ratio as low as possible while keeping the probability of bank failure acceptably low.

In fact, Diamond and Rajan (2000) and Gorton and Winton (2000) suggest that bank capital may be costly by reducing banks' ability to create liquidity through deposits: an increase in bank capital may reduce the probability of financial distress but also reduces liquidity creation by banks by decreasing the aggregate amount of deposits (the 'financial fragility-crowding out effect', as Berger and Bouwman (2006) put it, which may be especially significant for small banks). In this context, Aguiar and Drumond (2007) build a bank capital channel, working through a liquidity premium effect, into a dynamic general equilibrium model. The liquidity premium effect rests on the fact that bank capital is more expensive to raise than deposits, due to households' preferences for liquidity, and the amplification effect arises as this difference tends to widen (narrow) during a recession (expansion). In bad times, the increase in the liquidity premium required by households to hold bank capital in their portfolios is passed on to firms by the bank through an increase in the external finance premium. Hence, the external finance premium faced by firms increases, not only because firms' leverage increases (as in Bernanke *et al.*'s (1999) model), but also because the liquidity premium required by the households increases, thus further amplifying the real effects of both nominal and real exogenous shocks.

To summarize, the bank capital channel thesis overall predicts that the introduction of bank capital requirements, for market or regulatory reasons, tends to amplify the effects of monetary and other exogenous shocks. The amplification effect typically arises from imperfections in the markets for bank capital: in some models banks are not able to raise capital in the open market, implying that bank capital becomes determined by banks' retained earnings and changes in their asset values, whereas in other models banks may issue capital but face an issuance cost that tends to increase during economic downturns. In this context, if the value of bank capital decreases or its issuance costs increase, the banks' cost of funds tends to increase, particularly when the amount of bank capital is not much higher than the level demanded by regulators or the market. This higher cost is then transferred to firms, when borrowing from banks, thereby leading to lower investment and output.

As to the reviewed models, further research could go in several directions. First, all of them are based on a representative agent framework. A positive way forward would be to take into account the considerable banks' heterogeneity, in terms of size, leverage, capital ratio and balance sheet composition. This would allow, for instance, (i) the introduction of an interbank market which may impact the magnitude of the bank capital channel, (ii) a thorough analysis of Van den Heuvel's (2002a) conclusion that the strength of the bank capital channel depends on the

distribution of capital across banks, and (iii) the identification of potential systemic risk problems when large banks do not meet the capital requirements, although the 'representative bank' may show a favourable picture about the banking sector.

Second, the reviewed models analyse market or regulatory capital requirements, but do not consider both requirements simultaneously. However, the current crisis has shown that in bad times the market may require not only a higher return on bank capital, as predicted by several of the reviewed models, but also capital ratios well above the regulatory minimum. As we will argue later on, this raises some issues on the effectiveness of promoting the build-up of capital buffers in good times, which can be drawn down in periods of stress to attenuate the procyclical effects of banking regulation. It would thus be very interesting to study the bank capital channel when both types of requirement are in place and then distinguish the importance of each of the two channels – one that works through the regulatory requirements and another that works through the market requirements – in both good and bad times.

It is also worthwhile to note that economic policy conclusions should be drawn carefully from this review, because some of the models abstract from many important features of the economy, namely the benefits of banking regulation in preventing bank failures. In fact, the bank capital channel theoretical models focus, as expected, on business cycle fluctuations and not on crisis events. Nevertheless, it would also be interesting to introduce in those models the risk and incentives that support capital adequacy regulation, as the social cost of bank failure, and how the introduction of capital regulation can generate banks' risk averse or risk loving preferences.

Finally, the current discussion on the Basel II capital framework should also be assessed by the bank capital channel theoretical literature. We will address this issue later on. Before that, we proceed in the next section to a more detailed analysis of the institutional regulatory bank capital requirements, in order to further investigate their potential role in the propagation of business cycle fluctuations.

3. Capital Requirements within Banking Regulation

In the preceding section we have reviewed the bank capital channel literature and have seen how it hinges on the requirement of capital holdings by banks, for either market and/or regulatory reasons. We now take a closer look at regulatory capital requirements, with the purpose of discussing, in the next section, whether Basel II rules strengthen or weaken the amplification effect underlying the bank capital channel.

3.1 *Banking Prudential Regulation*

Regulatory bank capital requirements are part of a broader set of instruments used in banking prudential regulation. As mentioned by Freixas and Rochet (1997), other instruments include (i) entry, branching, network and merger restrictions, (ii) portfolio restrictions, (iii) deposit insurance, (iv) regulatory monitoring (including closure policy) and (v) deposit interest rate ceilings.

The rationale for any regulation is usually associated with market failures, such as externalities, market power or asymmetric information. For the particular case of the banking industry, Lind (2005) points out three motives for regulation: (i) certain banking activities are intrinsically vulnerable;[4] (ii) even minor disturbances can threaten overall financial stability through contagion; (iii) banks are the dominant providers of some services crucial for the society, such as the payment system and lending to small and medium-sized enterprises (SMEs). The recent events have shown the importance of all these factors.

Other authors focus on explanations related to asymmetric information. Santos (2001) argues that the inability of depositors to monitor banks is a major reason for banking regulation.[5] Small depositors' protection is indeed one of the primary concerns behind current prudential regulation of banks, as pointed out by Dewatripont and Tirole (1994). Asymmetric information leads to substantial moral hazard and adverse selection in banking, which requires that investors must perform several monitoring activities, such as screening and auditing. However, these activities are complex, expensive and time-consuming, and their duplication by several parties is technically wasteful. Because bank debt is primarily held by a very large number of small depositors, who are most often unable to understand the specificities of banking activities, a free riding problem emerges: each small depositor has little individual incentive to perform the various monitoring functions. This free riding gives rise to a need for private or public representatives of depositors (Dewatripont and Tirole, 1994, pp. 31–32).[6] It is true that large corporations are also financed by the public and that stocks and bonds issued by large companies are also widely diffused. However, these securities are not used as a means of payment, and the ratio of debt to assets is substantially higher for financial intermediaries than for non-financial firms. Therefore, the free rider problem involved in the monitoring of widely held firms seems to be quantitatively much more important in the case of banks (Freixas and Rochet, 1997, p. 264).

The prudential regulation of banks is further motivated by systemic risk prevention. As pointed out by Santos (2001), depositors' panic or the release of information when depositors have asymmetric information about bank returns may lead to the premature liquidation of assets and trigger a bank run, culminating in a banking system failure through contagion. In this context, Allen and Herring (2001) argue that reserve, capital and liquidity requirements designed to ensure that banks will be able to honour their liabilities to depositors have a consumer protection and microprudential rationale as well as a macroprudential rationale to protect the system against systemic risk.[7]

To avoid bank panics and their social costs, the authorities of many countries have established deposit insurance schemes, under which bank depositors have their deposits insured up to a fixed limit in case the bank fails. However, the creation of a government safety net for depositors may generate excessive risk taking by banks' managers, which itself calls for additional regulation. As Mishkin (2006) argues, with a safety net, depositors know they will not suffer huge losses if a bank fails and therefore tend not to withdraw deposits even when

they suspect that the bank is taking on too much risk. Additionally, as pointed out by Gorton and Winton (2003), once deposit insurance has been adopted, there is a further need for government intervention via bank regulation because of the incentive of banks to take additional risks once they have (underpriced) government deposit insurance.[8] Regulatory capital requirements should thus be introduced as part of the prudential regulation, providing a cushion against losses, as well as disciplining banks' managers: when a bank is forced to hold a large amount of capital, it faces larger losses in case of failure (Mishkin, 2006, p. 265). In this context, Kashyap and Stein (2004) describe capital regulation as an instrument the regulator uses in order to have each bank internalizing the systemic costs, such as losses backed by government deposit insurance and disruptions suffered by other financial system agents, which are not fully borne by the bank in question.

Capital standards are also seen as an important instrument for promoting optimal governance of banks, as those standards can be used to define the threshold for the transfer of control from banks' shareholders to the regulator (Santos, 2001, p. 59). Additionally, Morrison and White (2005) argue that capital regulation should also discourage unsound and unreliable institutions from setting up operations: capital requirements can be used to select out bad banks from the system, thus solving adverse selection problems.

In sum, as argued by Santos (2001), rules on bank capital are one of the most prominent aspects of banking regulation, with this prominence resulting mainly from the role of bank capital in banks' soundness, risk-taking incentives and corporate governance, as the literature reviewed in this section shows.

3.2 *Bank Capital Regulation: The Basel Accords*

The bank capital regulation framework of the Basel Accord of 1988 (Basel I, hereafter), and adopted not only by the countries belonging to the BCBS but by more than 100 countries around the world, establishes banks' obligation to continually meet a risk-based capital requirement.[9] In short, under Basel I each bank must maintain a total risk-weighted capital ratio – defined as the ratio of bank capital to the bank's risk-weighted assets – of at least 8%, with the weights depending on the institutional nature of the borrower. For example, a zero weight is assigned to a government security issued in the OECD, meaning that the bank can finance such asset through deposits without adding any capital. Basel I allows for other three weights, in ascending order of risk: 0.2 (e.g. for interbank loans in OECD countries), 0.5 (e.g. for loans fully secured by mortgages on residential property) and 1 (e.g. for industrial and commercial loans).[10]

Under Basel I, the same risk weight thus applies to all loans of a particular category ('one-size-fits-all' approach). Consequently, this categorization does not reflect the risk that a particular borrower actually poses for the bank. The failure to distinguish between loans of very different degrees of credit risk created the incentive for arbitrage activities. As Jones (2000, p. 36) puts it,

> in recent years, securitization and other financial innovations have provided unprecedented opportunities for banks to reduce substantially their regulatory measures of risk, with little or no corresponding reduction in their overall economic risks - a process termed regulatory capital arbitrage (RCA).

As argued by Jones, RCA typically exploits differences between a portfolio's true risks and the risk measurements defined by the bank regulation, and usually involves the unbundling and repackaging of a bank's portfolio risks – so that a disproportionate amount of the portfolio's true underlying credit risk is treated as lower risk-weighted assets or as having been sold to third-party investors. According to Jones, capital arbitrage has thus undermined the effectiveness of Basel I: at least for large banks, capital ratios under this framework became no longer reliable measures of capital adequacy.[11] Furthermore, financial innovation has been making RCA increasingly accessible to a wider set of banks.[12]

In this context, a new framework for capital requirements, also established by the BCBS, has been put forth in order to address some of the major shortcomings of Basel I and thus foster stability in the financial system: the new Basel Accord – Basel II, hereafter. One of the central changes proposed by Basel II is an increased sensitivity of a bank's capital requirement to the risk of its assets: the amount of capital that a bank has to hold against a given exposure becomes a function of the estimated credit risk of that exposure. Consequently, the constant risk weight of 100% for commercial and industrial (C&I) loans, for instance, is replaced by a variable weight, so that C&I loans with a low credit rating and a high probability of default (PD) are assigned a high risk weight. Hence, under Basel II the risk weights used to compute bank capital requirements are determined both by the category of borrower and by the riskiness of each particular borrower.

Basel II is built on three complementary pillars:[13]

(i) pillar 1 (minimum capital requirements) establishes the capital requirements for credit risk, market risk and operational risk;[14]
(ii) pillar 2 (supervisory review process) outlines the requirements on banks' management of risks and capital and defines the roles and powers of the supervisors (Basel II thus involves supervisors more directly in the review of banks' risk profiles, risk management practices and risk-bearing capacity than Basel I);
(iii) pillar 3 (market discipline) sets out requirements on banks for public disclosures, namely the obligation to publish information on their business profile, risk exposure and risk management (market participants thus have better information on banks, improving the functioning of market discipline).

Given the main objective of this chapter, i.e. to discuss the relationship between regulatory capital requirements and business cycle fluctuations, our attention is focused now on pillar 1 of Basel II.

According to Basel II rules, banks may adopt one of the two following approaches to compute their minimum capital requirements for credit risk.

- The Standardized Approach. Under this approach, the risk weight associated with each loan is based on an external rating institution's assessment of the counterparty risk. This could markedly change risk weights compared to Basel I: for instance, the less risky C&I loans may be assigned a risk weight of 20% whereas loans granted to the riskiest C&I firms may be assigned a weight of 150%. However, capital charges for loans to unrated companies remain essentially unchanged compared to Basel I. Some authors (e.g. Hakenes and Schnabel, 2006) thus argue that, in practice, the standardized approach is quite similar to the regulation imposed by Basel I, because in many countries no external ratings exist for a large fraction of corporate loans.
- The Internal Ratings Based (IRB) Approach. Here, the estimated credit risk and the consequent risk weights are assumed to be a function of four parameters associated with each loan: the PD, the loss given default (LGD), the exposure at default (EAD) and the loan's maturity. Banks adopting the 'Advanced' variant of the IRB approach are responsible for providing all four of these parameters themselves from their own internal rating models. Banks adopting the 'Foundation' variant of the IRB approach will be responsible for providing only the PD parameter, with the other three parameters set externally by the regulatory authorities. By aligning required capital more closely to banks' own risk estimates, Basel II is supposed to decrease the gap between regulatory and market capital requirements, thus encouraging banks to improve their risk assessment methods.

Basel II contains a long list of minimum requirements that a bank has to fulfil to be eligible for the IRB approach. Consequently, as argued by Hakenes and Schnabel (2006), this approach requires high fixed costs which may deter smaller and less sophisticated banks from adopting it. Nonetheless, Lind (2005) points out that banks still have an incentive to move to the IRB approach because the required capital will then be more closely aligned with each bank's actual risk.[15] In addition, the adoption of the IRB approach may imply a lower capital requirement. In fact, the Quantitative Impact Study 5 (QIS 5) released by the Committee of European Banking Supervisors (2006) concludes that, for a sample of European banks, the minimum required capital under pillar 1 would decrease in comparison to Basel I and that this decline would be amplified if banks move to more advanced approaches to compute their minimum capital requirements. Note, however, that, as mentioned in QIS 5, these results might be influenced by the fact that the study was carried out in a period of favourable macroeconomic conditions in most countries. Moreover, Zsámboki (2007) points out that the market segments identified by QIS 5 as responsible for the decrease in capital requirements (e.g. mortgage lending) are the most sensitive to changes in risk parameters. Zsámboki thus argues that, from the financial stability point of view, these 'low-capital-need' portfolios should be examined carefully, as banks concentrating their activities on these markets may become capital constrained during periods of major shifts in risk parameters.[16]

Concerns have also been raised by Benink *et al*. (2008), who argue that the potential for risk arbitrage remains, to a certain extent, under the IRB approach,

because the risk weights are based on banks' private information rather than on external, verifiable variables – with private information possibly used to place relatively high-risk and high-return credits in a lower risk bucket. In their view, although pillars 2 and 3 should limit the scope for underestimation of risk, banks will always be somewhat able to shape their capital requirements based on private information, under Basel II.

In addition, Altman and Sabato (2005) point out that Basel II may increase the financing costs of SMEs, due to banks' potential perception that these firms are riskier and, hence, carry higher capital requirements than under Basel I. However, the 2004 version of the new framework recognizes a special treatment for these firms:[17] subject to certain conditions, aggregate exposures to an SME may be treated as 'retail exposures', which have an advantageous treatment compared to other corporate lending. Even SMEs considered as corporate can benefit, under certain conditions, from a preferential treatment based on an adjustment relative to the firm's size.[18]

Nonetheless, the current crisis has shown that some of the aforementioned concerns related to the implementation of Basel II rules are, in fact, quite important and that some of the shortcomings underlying Basel I still apply to Basel II. As mentioned by the de Larosière report,[19] although we cannot blame the Basel II agreement for being one of the major causes of the crisis – as these rules entered into force only on January 2008 in the EU and are still not in place in the USA – the Basel II framework nevertheless needs fundamental review as to the treatment for certain bank exposures, to better reflect the risk inherent in these products, the treatment of liquidity risk, the reliance on ratings provided by credit rating agencies and the quality of capital. As mentioned in the introduction, the BCBS is now working on these issues and has already approved pillar 2 guidance addressing several weaknesses that have been revealed in banks' risk management processes during the financial crisis.

Another area that deserves further consideration, and which was also highlighted by the crisis, relates to the general concern that the new regulation may accentuate the procyclical tendencies of banking. We now analyse this issue in detail.

4. Basel II Capital Requirements and Procyclicality

As argued by Lowe (2002), Allen and Saunders (2003) and Amato and Furfine (2004), the banking industry is inherently procyclical, in the sense of reinforcing the business cycle, regardless of the design of capital requirements. This is mainly due to the existence of asymmetric information and market imperfections: banks tend to decrease lending during recessions, because of their concern about loan quality and repayment probability – exacerbating the economic downturn as credit constrained firms decrease their real investment activity – and to increase it during expansions, thereby contributing to a potential overheating of the economy.

As predicted by the theoretical models reviewed in Section 2, the introduction of regulatory capital requirements may accentuate the procyclical tendencies of banking, in the presence of an imperfect market for bank capital. These procyclical

effects may even be more prominent under the bank capital requirements rules proposed by Basel II. In fact, as pointed out in the previous section, under both the standardized and the IRB approaches the higher the credit risk of a given asset, the higher the capital that a bank will have to hold against it. If the credit risk of banks' assets is countercyclical, the risk weights used to compute capital requirements and, consequently, the minimum bank capital requirement will increase during recessions.[20] Hence the concerns with the possible macroeconomic effects of Basel II: a co-movement in capital requirements and the business cycle may induce banks to further reduce lending during recessions due to high capital requirements. This contention found support in some literature, well before the beginning of the crisis. See, for instance, Daníelsson *et al*. (2001, p.15):

> [T]he riskiness of assets varies over the business cycle. Risk assessments, whether based on credit rating agencies' assessments or internal ratings, reflect this procyclicality – possibly more so in the case of internal ratings, which typically do not attempt to assess risk 'through the cycle'. This procyclicality in ratings will create a similar procyclicality in capital charges, with the implication that banks hold less capital or overlend at the cusp of a cycle – exactly when the danger of a systemic crisis is largest - while they will hold too much capital or underlend during the downturn when macroeconomic stabilisation requires an expansion of lending. As a result, regulation not only renders bank crises more likely but could also destabilise the economy as a whole by exaggerating fluctuations.

In order to further clarify the Basel II procyclicality hypothesis, let us consider the potential effects of an economic downturn under Basel I and Basel II. Under Basel I, minimum capital requirements are fixed through time for a given portfolio, and may become binding when banks' capital declines following the identification of credit losses. Under Basel II, capital requirements may become binding not only because of the same effect (capital decline) but also because non-defaulted loans are likely to become significantly riskier, and as loans move to higher risk classes, the minimum capital requirement increases. To the extent that it is difficult or costly to raise external capital in bad times, as foreseen by several models analysed in Section 2 and shown by the current crisis, banks will be forced to reduce their lending activity, accentuating the initial downturn. Consequently, Basel II may lead to a greater financial amplification of the business cycle than Basel I, which counteracts the capital regulation's goal of fostering financial stability.

Moreover, as pointed out by Benink *et al*. (2008), Basel II may harmonize banks' behaviour – by requiring financial institutions to use similar risk models and directly control the type of models used, which by itself may be sufficient to bring on a crisis episode: in times of uncertainty, all the risk models in the industry indicate higher risk, create a decrease in capital ratios and, consequently, motivate the whole industry of banks to sell risky assets and buy safe assets, enhancing the so-called 'endogenous risk'.[21]

4.1 *Empirical Evidence on the Procyclicality Hypothesis*

The Basel II procyclicality hypothesis has been subject to some empirical research, which, given the lack of data, typically simulates the capital charge cyclicality during a given period of time had Basel II rules been in use. Segoviano and Lowe (2002), using data on internal ratings from banks operating in Mexico over the second half of the 1990s, conclude that measured risk is likely to increase in economic downturns and decrease in economic booms, so that the banks' required amount of capital under Basel II would have risen significantly after the crisis in 1994 and then declined as the economy recovered. Carling *et al.*'s (2002) results, using data from a major Swedish bank for the period from 1994 to 2000, also suggest that the application of the IRB approach would increase the credit risk sensitivity of minimum capital charges and accentuate the procyclical tendencies of banking.

Kashyap and Stein (2004) simulate the degree of capital charge cyclicality that would have taken place over the 1998–2002 interval – a period characterized by economic slowdowns in both the USA and Europe – had the Basel II Foundation IRB approach been in use. Their simulations, using data on the USA, some European countries and the 'Rest of the World', suggest that Basel II capital requirements have the potential to create an additional cyclicality in capital charges that may be quite large – depending on the bank's customer mix and its credit risk models. Altman *et al.* (2005) point out that the procyclical effects of Basel II may be even larger if banks use their own estimates of LGD (the Advanced IRB approach): low recovery rates when defaults are high will amplify cyclical effects, which will tend to be especially strong under the Advanced IRB approach, according to which banks estimate their own recovery rates and may revise them downward when defaults increase and ratings worsen. The use of long-term recovery rates should attenuate this effect, but would also force banks to maintain a less updated picture of their risks, thereby substituting stability for precision (Altman *et al.*, 2005, p. 2225).

As to the standardized approach of Basel II, Carpenter *et al.*'s (2001) estimates on how risk-weighted C&I loans might have evolved in the USA over the last three decades had banks been using this approach suggest that the level of required capital against business loans would be noticeably lower under Basel II than under the previous accord, but with a very little additional cyclical impact: the variation in ratings over the business cycle would not have been enough to imply much additional cyclicality under the standardized approach of the new accord. As pointed out above, under the standardized approach of Basel II, unrated firms are treated as in Basel I and the risk weights assigned to rated firms are based on ratings of external agencies. Many of those rating agencies follow a through-the-cycle approach to compute the default probability over the life of the loan, rating borrowers according to their ability to withstand a recession. An advantage of this approach, according to Segoviano and Lowe (2002), is that it makes ratings less sensitive to the business cycle, thus justifying Carpenter *et al.*'s results. Amato and Furfine (2004), using data on all US firms rated by Standard & Poor's, support this idea showing that a firm's rating, conditional on its underlying financial and

business characteristics, does not generally exhibit excess sensitivity to the business cycle.

However, as argued by Carpenter *et al*. (2001), although the through-the-cycle approach may create a presumption against changes in ratings over the business cycle, the additional information available during actual downturns may nevertheless induce some cyclical effects. As noted by Pederzoli and Torricelli (2005), if actual conditions are worse than the scenario considered by the rating agencies, downgrades are likely to follow. In fact, Zsámboki (2007) shows that Moody's database on rating transitions reveals that downgrades tend to dominate during recessions, and that this downgrade tendency often continues for a while even when the recession is over. Tanaka (2003) also points out that credit ratings derived from the existing through-the-cycle models tend to follow the business cycle, instead of leading it, so that the capital requirements based on external credit ratings are likely to be somewhat loose during booms and stringent during recessions.

Amato and Furfine (2004) emphasize that it is difficult to assess whether ratings are excessively procyclical because it is difficult to determine what an appropriate degree of co-movement between ratings and the cycle would be like. They argue that because most of the studies perform an analysis unconditional with respect to the specific characteristics of firms, one cannot conclude that ratings are assigned in a procyclical manner, but only that ratings move procyclically. Amato and Furfine's results indicate that the co-movement between through-the-cycle credit ratings and the business cycle is generally driven by cyclical changes in business and financial risks, and not in rating standards.

An alternative to the through-the-cycle approach is the point-in-time approach, followed by several banking institutions. The point-in-time rating systems assign ratings according to the ability of borrowers to fulfil obligations over the credit horizon, typically 1 year, and are likely to be more sensitive to the business cycle than the through-the-cycle approach.

That the extent of additional procyclicality associated with the IRB approach of Basel II could depend on the nature of the rating system used by banks seems supported by some recent empirical literature, as, for instance, Catarineu-Rabell *et al*. (2005). According to this study, if banks use internal ratings similar to those of the main rating agencies (which are designed to be relatively stable over the cycle) the increase in capital requirements during a recession is around 15%, whereas if banks choose an approach based on point-in-time rating systems, the increase in capital requirements during a recession will be much more pronounced (between 40% and 50%).

As mentioned by Pederzoli and Torricelli (2005), the 2004 version of Basel II implicitly requires a through-the-cycle rating system, by recognizing that banks adopting the IRB approach are required to use a time horizon longer than 1 year in assigning ratings and to assess ratings according to the 'borrower's ability and willingness to contractually perform despite adverse economic conditions or the occurrence of unexpected events' (Basel Committee on Banking Supervision, 2004, par. 415). Yet, Repullo and Suarez (2008) argue that, although Basel II implicitly

requires a through-the-cycle rating system, 'industry practices based on point-in-time rating systems, the dynamics of rating migrations, and composition effects make the effective capital charges on a representative loan portfolio very likely to be higher in recessions than in expansions' (Repullo and Suarez, 2008, p. 1). Additionally, Zsámboki (2007), focusing on QIS 5, finds that minimum capital requirements can fluctuate substantially over the business cycle under Basel II, even if long-term average default rates are used for estimating the PD.

It is true that the main conclusions of these studies should be interpreted with some caution, given the assumptions on which they rely. For instance, in Carpenter *et al*.'s (2001) study, the structure of bank C&I loan portfolios by risk category is not available over most of the data and the fraction of borrowers with external ratings represents a small portion of banks' C&I loan portfolios. In Zsámboki's (2007) analysis, PD and LGD estimations do not always meet the requirements of Basel II as some of the banks considered in the sample have not used long-term average default rates for estimating PD and downturn loss rates for estimating LGD. Furthermore, the internal models used for estimating risk parameters have not been validated by supervisory authorities. But notwithstanding these limitations, which are not easy to solve given the lack of available data, the reviewed studies clearly show that the rating process plays a key role in the implementation of Basel II and in its procyclical effects. The assessment in the literature and the current crisis – that, according to Benink *et al*. (2008), is a good example of how the over reliance on risk models has the potential to create a financial catastrophe – suggest some margin for concerns. According to Buiter (2007), the models used by rating agencies are typically the models of the designers and sellers of complex structures (created by pooling heterogeneous underlying asset classes), who work for the issuers of the instruments. The potential for conflict of interest is therefore obvious, and even honest models tend to be useless during periods of disorderly markets, because there are not enough observations on these types of episodes to construct reasonable estimates of the risks involved. Buiter, thus, concludes that the regulatory function of private credit risk ratings in Basel II should be de-emphasized and preferably ended altogether: the procyclical effect of the Basel capital requirements and the more recent doubts about the quality of the rating process should lead to an immediate re-opening and rethinking of Basel II (Buiter, 2007, p. 8).

Yet, besides the rating process, other factors may affect the procyclical effects of Basel II. One of them is the view adopted concerning how credit risk evolves through time. According to Lowe (2002) and Segoviano and Lowe (2002), one possible view is that the current performance of the economy can be taken as the best guess of its future performance (the random walk view). This view leads to risk being measured as low in good times and high in bad times, leading to higher regulatory capital requirements in a downturn than in a boom, under Basel II. An alternative view postulates that the forces driving economic booms often (although not always) contribute to future economic downturns by generating imbalances in both real and financial sectors – the predictability view. Segoviano and Lowe argue that these imbalances increase risk by increasing uncertainty about

the financial strength of individual borrowers, by making default probabilities more highly correlated, and by making the future value of collaterals more uncertain. In this context, the increase in defaults during a recession might be thought of as the materialization of risk built up during the boom, which would suggest relatively high measured credit risk when times are good, leading to higher regulatory capital requirements in a boom than in a downturn.

As argued by Pederzoli and Torricelli (2005), although there is no controversy on the relationship between real activity and default rates (as a measure of the materialized risk), the debate is still ongoing regarding the relationship between economic conditions and risk accumulation. This debate is crucial to assess the potential procyclicality of Basel II, as the adoption of one of the two views described above influences the path of the risk-based capital requirements during the business cycle: depending on the view adopted, ratings may decline when economic conditions are depressed or when financial imbalances emerge in good times.

Another factor that may influence the potential procyclical effects of Basel II is the building up of bank capital buffers, i.e. the excess of current capital over the minimum capital requirements held by the banks. Taking into account that bank capital is more costly for banks than other forms of funds, it is frequently considered that regulatory capital requirements are binding. However, banks trade off this cost with those associated with approaching or falling below the minimum requirement (e.g. the costs associated with an intensified supervisory review or a weakened reputation), and thus often hold capital above the regulatory minimum. In fact, Allen *et al*. (2008) argue that market forces lead banks to keep capital buffers, even when capital is relatively costly, as bank capital commits the bank to monitor and, without deposit insurance, allows the bank to raise deposits more cheaply. Ayuso *et al*. (2004), drawing on a large panel of Spanish banks over the period 1986–2000, find a robust significant negative relationship between the business cycle and the capital buffers held by Spanish banks.[22] This result comes from the Basel I period but, according to von Thadden (2004), if it carries over to the era of Basel II, the current concerns about the procyclicality of the new capital regulation may be exaggerated: 'if banks build up capital buffers in downturns without being forced to do so by regulation, then new regulation that makes part of this build-up mandatory may have little effect' (von Thadden, 2004, p. 93).

However, one of the things that this crisis has made evident is the lack of capital and capital buffers of most of the banking institutions. In fact, Ayuso *et al*. (2004) argue that their result offers some support to the view that some banks may behave in an excessively negligent manner during booms, because they do not take properly into account the cyclical nature of output and therefore tend to underestimate risks in economic upturns. Furthermore, the cyclical pattern of the buffers may get reversed in Basel II, relative to Basel I, for precautionary reasons, as argued by Repullo and Suarez (2008).[23] According to these authors, capital buffers contribute to dampen, but do not eliminate, the procyclicality of Basel II and it is unwise to predict the cyclical behaviour of capital buffers under Basel II from the empirical behaviour of capital buffers under Basel I: 'If buffers

are endogenously affected by the prevailing bank capital regulation (even if they appear not to "bind"), reduced-form extrapolations from the Basel I world to the Basel II world do not resist the Lucas critique' (Repullo and Suarez, 2008, p. 35). In this context, von Thadden's (2004) conclusion may be considered too optimistic.

We may thus conclude this section by synthesizing the main factors that should determine how Basel II bank capital requirements react over the business cycle and, consequently, the strength of the Basel II procyclicality hypothesis. Those factors are, according to the reviewed empirical studies, (i) the composition of banks' asset portfolios, (ii) the approach adopted by banks to compute their minimum capital requirements – the standardized or the IRB approach, (iii) the nature of the rating system used by banks – through-the-cycle or point-in-time rating systems, (iv) the view adopted concerning how credit risk evolves through time – the random walk or the predictability view, and (v) the capital buffers over the regulatory minimum held by the banking institutions. We now focus on how some of these factors have been incorporated in the theoretical literature that revisits the bank capital channel thesis, analysed in Section 2, under Basel II.

4.2 *The Bank Capital Channel under Basel II*

The potential procyclical effects of Basel II motivated the development of new theoretical models that revisit the relationship between business cycle fluctuations and bank capital requirements under the new rules. In particular, Tanaka (2002) extends a static IS-LM model, in the spirit of Bernanke and Blinder (1988), to introduce the Basel II rules: the risk weights used to compute capital requirements are a function of the mean probability of borrowers' default over the business cycle. Her model suggests that an increase in credit risk raises the probability of banks facing a regulatory penalty, thus restricting banks' ability to lend. Therefore, if the credit risk varies with the business cycle, the new regulation may exacerbate macroeconomic fluctuations. The model also predicts that an expansionary monetary policy under Basel II may be less (more) effective during recessions (booms), when credit risk tends to be higher (lower): if banks become undercapitalized during a recession, the bank loan supply becomes more insensitive to an expansionary monetary policy, because a lower capital-to-asset ratio restricts banks' ability to increase their risky asset holdings.

Also aiming at capturing the link between loan risk weights and borrowers' creditworthiness, Zicchino (2006) introduces capital requirements risk weights that vary with macroeconomic conditions in the partial equilibrium model of Chami and Cosimano (2001): capital requirements risk weights are a function of the macroeconomic activity, which, in turn, follows a first-order autoregressive stochastic process. Consequently, if banks face binding capital constraints, they will be able to increase their loan supply when times are good but they might be forced to reduce supply during a recession. Zicchino thus concludes that Basel II may lead to a greater reduction of credit following a negative macroeconomic shock: on the top of the loan demand fall, banks may be forced to reduce loan supply to satisfy tighter capital requirements. In order to avoid such an eventuality,

supervisors should, according to Zicchino, encourage banks to build a capital buffer during expansions above the one banks would choose voluntarily.

Indeed, the model developed by Heid (2007) predicts that capital buffers optimally set by banks under Basel II help to mitigate the impact of the volatility of capital requirements, but may not be sufficient to avoid a stronger procyclical effect than under Basel I. A similar conclusion is drawn by Repullo and Suarez (2008). They also consider the possibility that banks optimally choose to keep capital buffers (when the value of the on-going lending relationships is large enough and the cost of bank capital is not very large), but these buffers are insufficient to neutralize Basel II procyclicality: during a recession banks significantly decrease the supply of credit to some of their dependent borrowers causing a credit crunch that would not occur under Basel I.

Aguiar and Drumond (2007) extend their general equilibrium model, whose main conclusions were briefly reviewed in Section 2, in order to compare a simplified version of the two regulatory frameworks (Basel I and II), and find that the liquidity premium effect, which underlies the bank capital channel in the benchmark model, amplifies business cycle fluctuations more significantly the closer the regulatory rules are to Basel II. In face of a contractionary shock, for instance, banks must issue more capital under Basel II due to the increase in borrowers' credit risk. To absorb this additional capital, households require a stronger increase in the liquidity premium than under Basel I, which leads to a stronger increase in the external finance premium faced by firms (borrowers), and, consequently, to a more amplified decrease in investment and output.

More recently, Drumond and Jorge (2008) address the Basel II procyclicality hypothesis in the context of a dynamic heterogeneous agent model, in which firms' access to bank credit depends on their estimated credit risk. The model thus takes into account the heterogeneity of banks' assets, predicting that, to the extent that it is more costly to raise bank capital in bad times, a negative aggregate technology shock under Basel II has a larger effect on the cost of funds for highly leveraged firms, whose bank loans require more bank capital. In this context, if the loan portfolio of the banking system is characterized by a significant fraction of high credit risk firms, the changeover from Basel I to Basel II capital requirements should reinforce the bank capital channel of propagation of aggregate shocks.

4.3 *Discussion*

The reviewed theoretical models are unanimous in predicting that the introduction of the new bank capital requirements rules accentuates the procyclical tendencies of banking, compared to Basel I, which may conflict with the main objective of Basel II – promoting the stability of the international banking system. However, some of these models have some specific limitations which might influence the final outcome. For instance, Tanaka's (2002) static IS-LM model abstracts from the dynamic impact of a monetary policy shock under the Basel II rules and Zicchino's (2006) partial equilibrium framework ignores the demand-side fluctuations and aggregate feedback effects that might influence the supply-side effects.

Additionally, some of the limitations underlying the models reviewed in Section 2 also apply here: the reviewed 'Basel II models' do not combine market and regulatory capital requirements and abstract from banks' heterogeneity, ignoring, for instance, the potential systemic risk problems when large banks do not meet the capital requirements. Furthermore, they overlook some of the aspects of Basel II that may attenuate the procyclical effects, such as, for instance, the adoption of through-the-cycle ratings systems by banks.[24]

In this context, some authors argued, at least before the current crisis, that Basel II procyclicality might not be a problem. In particular, Jordan *et al*. (2003) point out that the improved risk sensitivity encourages banks to recognize and correct capital inadequacies earlier in the cycle, and therefore prevent the sudden declines in capital adequacy that cause credit crunches. Jokivuolle and Vesala (2007), in turn, argue that Basel II may have a beneficial allocation effect, which may counteract the potential procyclical effects: the introduction of Basel II rules may reduce overinvestment in high-risk investment projects and increase the entrepreneurs' general participation in the credit market, so that the overall lending volume may be higher. Nonetheless, Jokivuolle and Vesala also recognize that a procyclical effect is still present – due to the increase in the PD of risky assets after a negative shock – and that the sign of the net effect remains an open issue.

Moreover, the models reviewed only focus on the first pillar of Basel II, ignoring that the magnitude of the procyclical effects also depends on what else changes under pillars 2 and 3. As argued by Lowe (2002), the supervisory review process specifies that supervisors (i) must assess whether a bank is adequately capitalized, taking into account external factors such as business cycle effects, (ii) should expect banks to operate above the minimum regulatory capital ratios and (iii) should have the ability to require banks to hold enough capital buffers, especially in good times, to enable them to meet the higher requirements when times are not so good. Pillar 2 also establishes that banks must develop an internal capital adequacy assessment process (ICAAP), which should ensure that they adequately identify and measure their risks, set adequate internal capital in relation to their risk profile, and use and develop further sound risk management systems. Supervisors are responsible for evaluating banks' ICAAP and for ensuring that the processes for developing those assessments are robust and satisfactory. Additionally, credit quality problems may become evident much earlier than under Basel I not only because of better credit risk management practices but also because of broader disclosure under pillar 3. In this context, supervisors cannot ignore deteriorations in the quality of banks' portfolios, and should help to overcome the problems that arise when banks in very poor condition are allowed to continue operating.

Therefore, one positive way forward in terms of further research on the Basel II procyclicality hypothesis would be to introduce some of these factors that were already envisaged by the 2004 version of Basel II, and test their effectiveness in dampening Basel II procyclicality.

Alternatively, and given the concerns about this issue brought up by the current crisis, it would also be interesting to test the adequacy of some additional measures that are now being proposed to attenuate the procyclical effects of banking

regulation. One of those proposals relies on the build up of mandatory pillar 1 capital buffers in good times, which will be allowed to be drawn down during downturns. For this approach to work, it is crucial that the capital buffers are not perceived as new regulatory minimum capital levels and that the market allows the buffers to decrease during bad times. Consequently, to test the effectiveness of this measure both market and regulatory capital requirements should be considered to assess if, in the presence of the incentives which underlie the market capital requirements, the capital buffers imposed by regulation can in fact be drawn down in periods of stress and, consequently, dampen procyclicality (or if other measures, such as dynamic provisioning, are more suitable).[25]

In addition, given the excessive increase in leverage of many large and internationally active banking institutions before the crisis, it appears that the capital requirements underlying Basel II are not proportionate to actual risk and that, in order to achieve the higher capital ratios currently considered appropriate by the market, many banks have had to deleverage abruptly, with negative consequences for the real economy. In this context, another proposal that is being considered, both at the EU and G20 level, and whose effects deserve further research, is to complement the risk-based requirement of Basel II with a simple measure, as a leverage ratio, which should avoid the excessive balance sheet growth of the banking institutions.

The existing literature also points out other forms of counteracting the Basel II procyclicality hypothesis, which could also be embedded into a dynamic general equilibrium model to evaluate their effectiveness. In particular, Gordy and Howells (2006) suggest that the output of the IRB capital function can be smoothed (instead of smoothing the inputs of the Basel II formula, as argued by other authors):

> Let C_{it} denote the unsmoothed output from the IRB capital formula for bank i at time t, expressed as a percentage of portfolio book value, and let $\hat{C}_{it}$ denote the corresponding regulatory minimum applied to the bank. At present, the new accord sets $\hat{C}_{it} = C_{it}$. One simple smoothing rule would specify $\hat{C}_{it}$ as an autoregressive process that adjusts towards C_{it}, i.e.
>
> $$\hat{C}_{i,t} = \hat{C}_{i,t-1} + \alpha(C_{i,t} - \hat{C}_{i,t-1})$$
>
> The current accord can be represented in stylized fashion as setting $\alpha = 0$, whereas the new accord sets $\alpha = 1$. An intermediate value of α would offer a compromise between the current accord and new accord in sensitivity to the business cycle. (Gordy and Howells, 2006, p. 397)

According to Repullo *et al.*'s (2009) results, the best approach to smooth the Basel II capital requirements is, in fact, to smooth the output of the Basel II formula, as suggested by Gordy and Howells, but through a business cycle multiplier, which depends on the deviation of the rate of growth of the GDP with respect to its long-run average. According to the results for the portfolio of Spanish C&I loans,

the multiplier should be increased in expansions (or decreased in recessions) by 7.2% for each standard deviation in GDP growth.

Kashyap and Stein (2003, 2004), in turn, recommend a family of point-in-time risk curves, with each curve corresponding to different macroeconomic conditions. But they also recognize that their corrective measure, by suggesting the reduction of capital requirements in bad times, may be naïve because it will 'give regulators an excuse to engage in after-the-fact forbearance, with all the accompanying potential for various forms of regulatory moral hazard' (Kashyap and Stein, 2004, p. 28).

Another alternative to attenuate the Basel II procyclical effects, put forward by Pennacchi (2005), would be to combine a risk-based capital requirement with a risk-based deposit insurance such that undercapitalized banks would be required to partially adjust their capital ratio toward a target standard and pay a higher insurance premium appropriate to the capital ratio they choose. Finally, Cecchetti and Li (2008) suggest that under Basel II the optimal monetary policy should move interest rates more aggressively when the banking system is capital constrained, thus counteracting and even completely neutralizing the procyclicality of capital regulation. However, as the empirical work of Kishan and Opiela (2006) indicates, if Basel II creates more constrained banks during recessions and better capitalized banks during expansions, countercyclical policy may become more difficult: high-capital banks tend not to decrease loans in response to a contractionary monetary policy and, conversely, an expansionary monetary policy may have no stimulating effects on the loan growth of low-capital banks. Therefore, it remains to be proved whether Cecchetti and Li's (2008) proposal would be effective. Nonetheless, as Kishan and Opiela (2006) also point out, changes introduced by Basel II will result in banks reallocating their capital and, consequently, adjusting the way they organize their balance sheets and the way they react to monetary policy shocks. In this context, it is not clear that Kishan and Opiela's results are valid under Basel II: once more, extrapolations from the Basel I world to the Basel II world may not resist the Lucas critique.

5. Concluding Remarks

In this chapter we have discussed the relationship between bank capital requirements and business cycle fluctuations, bringing together the theoretical literature on the bank capital channel of propagation of exogenous shocks and the literature on the regulatory framework of capital requirements under the Basel Accords. Our integrating review has shown how the new banking system regulatory framework may strengthen the propagation of exogenous shocks to the economy and, consequently, amplify business cycle fluctuations (the Basel II procyclicality hypothesis).

Overall, the theoretical literature on the bank capital channel predicts that the introduction of bank capital requirements, for either market or regulatory reasons, amplifies the effects of monetary and other exogenous shocks. This amplification effect usually rests on the argument that raising new capital may be difficult and costly for many banks, especially during economic downturns,

thereby increasing the financing cost faced by firms that borrow from those banks. If firms are restricted to banks as sources of credit, this would affect negatively firms' investment and output.

The introduction of Basel II adds to these concerns, as it establishes that the amount of capital that a bank has to hold in its balance sheet depends on the riskiness of its portfolio. In fact, if the credit risk of banks' exposures increases during a recession, the risk weights used to compute capital requirements (and, consequently, the minimum bank capital requirements) will also increase, and, to the extent that it is difficult or costly to raise external capital in bad times, banks will be forced to reduce their lending, thereby contributing to a worsening of the downturn. Consequently, Basel II may lead to a greater financial amplification of the business cycle than Basel I, which would contradict the capital regulation's goal of fostering financial stability.

On the basis of our assessment, it seems fair to say that the theoretical studies revisiting the bank capital channel under the new accord generally support the Basel II procyclicality hypothesis. In particular, Basel II leads to a greater reduction of credit following a negative macroeconomic shock, because banks are forced to reduce loan supply in order to satisfy tighter capital requirements. Additionally, the literature available shows that the magnitude of the procyclical effects depends essentially on (i) the composition of banks' asset portfolios, (ii) the approach adopted by banks to compute their minimum capital requirements – the standardized or the IRB approach, (iii) the nature of the rating system used by banks – through-the-cycle or point-in-time rating systems, (iv) the view adopted concerning how credit risk evolves through time – the random walk or the predictability view, (v) the capital buffers over the regulatory minimum held by the banking institutions, (vi) the improvements in credit risk management and (vii) the supervisor and market intervention under pillars 2 and 3.

The recent events and continuing instability in financial markets all over the world have led the procyclicality issue to enter the agendas of several political international fora, and the BCBS is now developing supervisory and regulatory approaches to mitigate procyclicality in the financial system. The bank capital channel literature should now definitely play a role in evaluating the effectiveness of the measures that are being put forward.

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Notes

1. On this credit crunch literature, see, for instance, Bernanke and Lown (1991), Berger and Udell (1994), Peek and Rosengren (1995, 2000), Furfine (2001) and Sharpe (1995) for a review.

2. As both the bank lending channel and the bank capital channel build on the hypothesis that monetary policy works, in part, by affecting banks' supply of loans, they are sometimes treated as part of a broader bank lending channel, notwithstanding being based on different transmission mechanisms. Note, for instance, that in contrast to the traditional bank lending channel, the borrowers' balance sheet and the bank capital channels may operate in response to factors other than changes in monetary policy.
3. See also Zeng (2002) on this approach.
4. For instance, as loans usually have a longer duration than deposits, banks may lose a large proportion of their deposits rather quickly while their loans remain outstanding.
5. The other being the risk of a systemic crisis, which will be analysed below.
6. To ensure that there is better public information, regulators can also require banks to follow certain standard accounting principles and to disclose a wide range of information that helps to assess the quality of a bank's portfolio (Mishkin, 2006, p. 268).
7. Overall, among the proposals to avoid bank runs are the development of narrow banks (banks that invest the deposits of the public in traded securities), the development of banks that finance loans entirely with equity, the suspension of convertibility, the central bank's role as lender of last resort and the development of deposit insurance. See Santos (2001) for more details.
8. There is a large body of literature on the moral hazard issue of deposit insurance. See Santos (2006) for a review.
9. The BCBS consisted, at that time, of central banks and supervisory authorities representatives from Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Spain, Sweden, Switzerland, the UK and the USA.
10. See Basel Committee on Banking Supervision (1988) for a detailed description of the rules introduced by Basel I, and Dewatripont and Tirole (1994) for a short review.
11. Nevertheless, Jones also argues that RCA has been beneficial in minimizing allocative inefficiency in lending markets: RCA permits banks to compete effectively with non-banks in low-risk businesses they would otherwise be forced to exit owing to high regulatory capital requirements.
12. Gorton and Winton (2000) also suggest that national regulators have consistently weakened the 1988 Basel agreement both by applying capital guidelines selectively and by redefining what is meant by 'capital'. Even as international bank regulators have been revising the 1988 Basel Accord to strengthen it (e.g. the statement issued by the Basel Committee on 'Instruments Eligible for Inclusion in Tier 1 Capital'), 'the national regulators have successfully lobbied to weaken these standards by broadening the definition of capital' (Gorton and Winton, 2000, p. 2). This issue still applies to the new Basel Accord and further work by the BCBS on the quality of capital is under way. von Thadden (2004) adds that Basel I ignored modern credit risk management techniques, failed to take account of the dynamic distortions of capital regulation, and neglected complementary regulatory instruments such as supervisory monitoring or prompt corrective regulatory action.
13. See Basel Committee on Banking Supervision (2004) for details. On July 2006, the BCBS issued a comprehensive version of the Basel II framework. This document is a compilation of Basel Committee on Banking Supervision (2004), the elements of the Basel I that were not revised during the Basel II process, the 1996 Amendment

to the Capital Accord to Incorporate Market Risks, and the 2005 paper on the Application of Basel II to Trading Activities and the Treatment of Double Default Effects. For a concise chronology of the Basel II process see Dierick *et al*. (2005, p. 9, box 1).

14. Operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events (Basel Committee on Banking Supervision, 2004).
15. See Repullo and Suarez (2004) and Hakenes and Schnabel (2006) on the banks' optimal choice between the IRB and the standardized approaches.
16. At a theoretical level, Zhu's (2008) model predicts that the changeover from Basel I to Basel II capital requirements may differ substantially across banks depending on the risk profile of their loan portfolios: Basel II has a particularly significant disciplinary role in the case of small banks, forcing them to hold a higher ratio of bank capital to loans, and rewards those banks with high-quality assets.
17. Based on the fact that default probabilities for smaller firms are observed to be less correlated with the overall state of the economy (Dierick *et al*., 2005).
18. See, for instance, the illustrative risk weights calculated for four asset classes types, including SMEs, in Annex 3 of Basel Committee on Banking Supervision (2004).
19. The de Larosière report was released in February 2009 and suggests important reforms in the EU regulatory and supervisory framework. The European Commission endorsed most of the report's recommendations and is now working on their implementation. The report is available at http://ec.europa.eu/internal_market/finances/docs/de_larosiere_report_en.pdf.
20. See Lowe (2002) and Allen and Saunders (2003) for a review on the relationship between the measures of credit risk exposure (namely, PD, LGD and EAD) and macroeconomic conditions.
21. Benink *et al*. define endogenous risk as a situation whereby a substantial number of market participants act in concert and therefore in aggregate exert significant price impact (Benink *et al*., 2008, p. 91).
22. See also Peura and Jokivuolle (2004), who, using data on large banks in G10 countries, show that banks tend to hold considerable buffer capital, and Jokipii and Milne (2006), who, focusing on the cyclical behaviour of European bank capital buffers, find that bank capital buffers in the accession countries have a significant positive relationship with the cycle, while in the EU15 and in the combined EU25 the relationship is significantly negative. Stolz (2007) criticized the approach followed by Ayuso *et al*. – arguing that regressing banks' capital buffers on the business cycle does not distinguish banks' capital buffer decisions, which are supply-side effects, from demand-side effects working through loan demand – and tried to circumvent this shortcoming by testing the effect of capitalization on the reaction of capital buffers to business cycles. However, using micro data for German savings and cooperative banks for 1993–2003, she finds strong evidence that capital buffers behave countercyclically, in line with Ayuso *et al*.
23. See also Heid (2007).
24. According to Pederzoli and Torricelli (2005), if the business cycle effects are considered in a forward-looking perspective and a through-the-cycle rating system is used, both objectives – increased risk sensitivity of capital requirements and business cycle effects neutralization – can be reconciled. In particular, these authors develop a measure of time-varying capital requirements that, for quarterly US data over

the forecasting period 1971–2002, behaves quite well in anticipating the business cycle, increasing (decreasing) in anticipation of recessions (expansions), and with a possible smoothing effect on the business cycle turning points.

25. Another interesting issue that could be further analysed concerns the role of credit rating agencies in Basel II. It is now generally agreed that the credit rating agencies played a role in the current crisis by underestimating the credit default risks of several instruments, especially of structured products. This underestimation was due not only to the lack of historical data on those products, but also to the existence of conflict of interests associated with the issuer-pays model. Thus, even if those rating agencies follow a through-the-cycle approach, as argued by some of the studies reviewed in Section 4.1, the use of those ratings in Basel II regulation may raise a number of problems that deserve further attention.

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