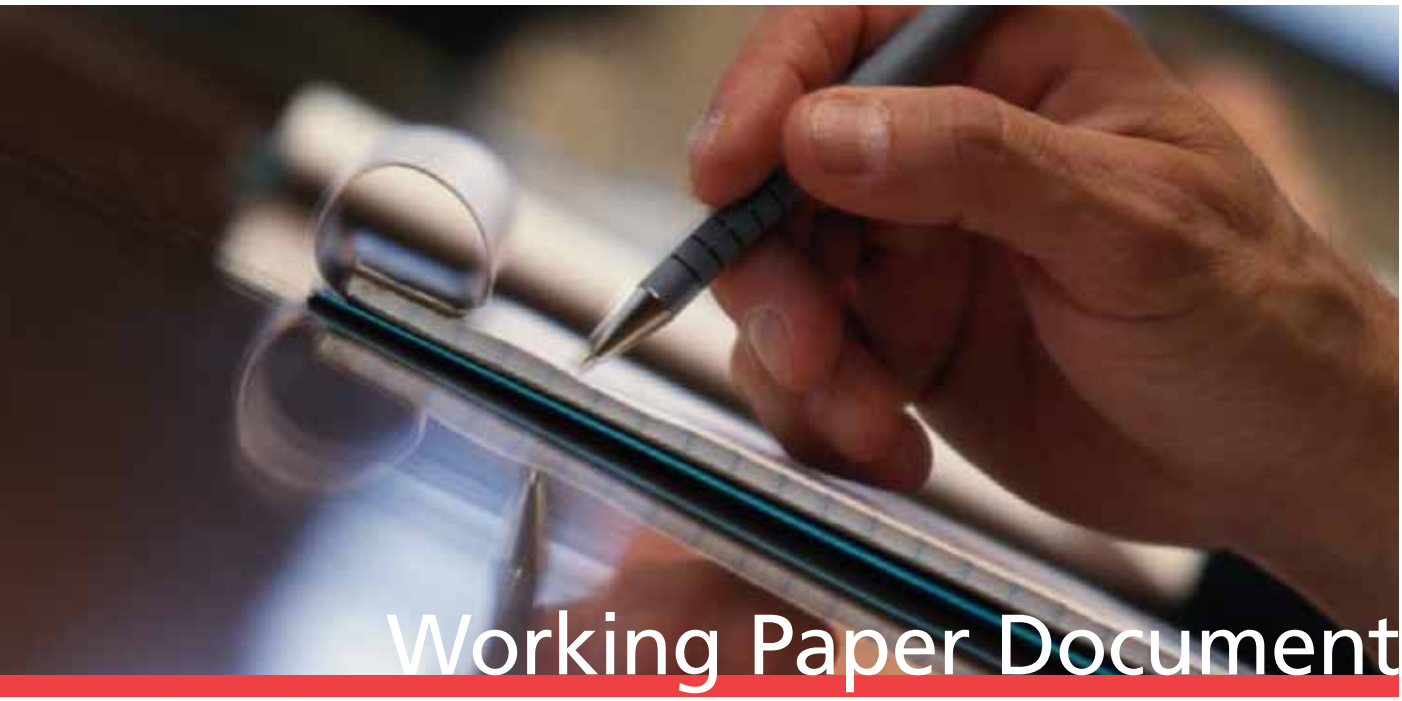
Monitoring pro-cyclicality under the capital requirements directive : *preliminary concepts for developing a framework*



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Abstract

This paper provides an overview of the questions that will need to be addressed in order to determine whether increased cyclicality in capital requirements will exacerbate the pro-cyclicality in the financial system. Many central banks have raised concerns about the potential cost of pro-cyclicality that could come with the Basel II framework, which will be implemented in the EU via the Capital Requirements Directive (CRD). Previous capital adequacy rules required banks to hold a minimum amount of capital for each loan, regardless of the different risks involved. The main objective of the Basel II framework/CRD is to make capital requirements more risk-sensitive. Therefore, by construction, the capital requirements under the CRD will be more cyclical than under the previous rules. This raises two questions. First, does it matter whether regulatory capital requirements fluctuate more than before if banks' (lending) behaviour is driven by other capital considerations (for example economic capital) ? Second, if it does matter, what impact will this have on the economic cycle?

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Introduction

Pro-cyclicality in bank lending has traditionally been a concern for policy-makers who try to maintain macro-economic and financial stability. By exacerbating the business cycle, pro-cyclicality increases systemic risk. Pro-cyclicality could result in a significant misallocation of resources if a significant number of negative net present value loans are extended during an economic expansion and positive net present value loans are denied during an economic downturn.

Recently, central banks[1] raised concerns regarding the potential costs of the additional pro-cyclicality in lending that may come with the Basel II Framework, as implemented in the EU via the Capital Requirements Directive (CRD). Previous capital rules require banks to hold a minimum amount of capital for each loan largely independent of the risk of this loan. The CRD has the objective of making capital requirements more risk-sensitive. Therefore, by construction, the capital requirements under the CRD will be more cyclical, i.e. co-moving with the cycle, than under the previous rules. Banks in a bad economic environment that see their capital fall below the minimum required may decide to cut back on their lending activity. Vice versa, an economic upturn may lead to some excess in capital within banks which may induce banks to increase lending. Consequently, the use of risk sensitive capital requirements may be reflected into more pro-cyclical lending behaviour, which may exacerbate the economic cycle. To closely monitor this, article 156 of the CRD has mandated the European Commission and the ECB to analyse the impact of the CRD on the economic cycle.

This paper provides an overview of the questions that will need to be addressed in order to monitor the possible pro-cyclicality that may result from the Basel II Framework / the CRD.

The first section of this paper discusses how the CRD can be a possible source of pro-cyclicality. Inherent to the design of the CRD, minimum regulatory capital requirements will fluctuate more than the present capital requirements ("Basel I"). This observation raises 2 questions. First, does it matter whether the required capital fluctuates more than before given that banks' lending behaviour is often driven by other capital considerations? In other words, is capital regulation binding? This question is addressed in section 2. Second, if it does matter, what will be the consequences on the economic cycle? In other words, will this capital constraint lead to an amplification of the macroeconomic cycle? This issue is addressed in section 3. On the basis of this conceptual framework, section 4 launches some questions one needs to address in order to monitor CRD pro-cyclicality.

[1] See for example the following non-complete list of published papers by several central banks: by the *Bank of England*: Nier and Zicchino, FSR, December 2005; by the *Deutsche Bundesbank*: Stolz and Wedow, Deutsche Bundesbank WP 2005, by *Banco de Espana*: Nota in Estabilidad Financiera, 05/2005 no.8; by the *Sveriges Riksbank*: FSR 2004 no.1, by the Bank of Finland: Peura and Jokivuolle 2004; by the *Oesterreichische Nationalbank*: Redak and Tscherteu FSR 2003 no. 5; by the *ECB*: Monthly Bulletin May 2001, by *De Nederlandsche Bank*: Bikker and Hu, Research Series Supervision 2001 no.39; …

1. CRD capital requirements as an (additional) possible source of pro-cyclicality.

1.1 Different sources of pro-cyclicality

Pro-cyclicality in lending and borrowing behaviour may have several sources, which are very often endogenous to financial systems. In practice, and in particular in stress circumstances, it may be hard to identify the source of the observed pro-cyclicality. Very often, these sources jointly contribute to the pro-cyclicality in lending.

First, fluctuations in the business cycle may be linked to *fluctuations in the quality of banks' and borrowers' balance sheets*. An increase in bank profits during upturns may support the extension of credit while a decrease in bank profits during downturns may dampen the extension of credit. An economic downturn may confront firms with declining profits and may decrease the demand for new credit.

A second related explanation for pro-cyclicality in the financial system has its roots in *information asymmetries between borrowers and lenders*. When economic conditions are depressed and collateral values are low, information asymmetries can mean that even borrowers with profitable projects find it difficult to obtain funding. When economic conditions improve and collateral values rise, the opposite situation may occur. This reasoning suggests that cyclical effects may be more pertinent for borrowers which are more prone to asymmetric information effects (such as SMEs).

Third, others (see e.g. Borio et al.) have argued that pro-cyclicality in lending may stem from inappropriate responses by financial system participants and that bank lending behaviour can be explained using *theories of behavioural finance.* Bank lending behaviour may be based either on euphoric expectations associated with an investment boom driven by the business cycle (Minsky, 1977) or on disaster myopia where the subjective probability of a major shock decreases as time elapses since the last shock (Guttentag and Herring, 1984). Consistent with the latter is the institutional memory hypothesis developed by Berger and Udell (2003) where the capacity of loan officers to evaluate risk and identify potential future problems deteriorates as time passes since the last period during which they experienced large credit losses. Therefore, lending standards soften as time passes since the last period when a bank experienced problem loans. Lending standards are then tightened again when large losses are experienced.

Fourth, it is unclear whether new *financial innovative instruments* are a possible additional source of pro-cyclicality. The use of these instruments facilitated the spreading and the diversification of credit risks and increased the possibilities of hedging. In favourable circumstances, banks can easily transfer credit risk using innovative credit risk transfer (CRT) products[2]. This may induce banks to increase lending as credit risk[3] can be transferred.

The pro-cyclical effects of these instruments in an economic downturn will depend very much on how well these new CRT markets function in distressed circumstances.

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[2] For example, single name (for example credit default swaps - CDS) or multi name (un)structured products (for example collateralised debt obligations – CDO).

[3] In what follows, the terms credit risk and default risk are used interchangeable. Some instruments, for example a CDS, only transfer the default risk.

Pro-cyclical effects may be dampened if these markets continue to function well. Credit to borrowers whose risk has increased in the downturn of the credit cycle may be sold. However, pro-cyclical effects may be reinforced when these markets function less effectively in stressed circumstances. Existing asymmetric problems between lenders and protection sellers/investors[4] may become more pertinent. Therefore, risks on the balance sheet of banks[5] may become harder to sell in the CRT markets. Moreover, risks that were sold may materialise when counterparties are unable to provide protection when an event occurs (for example due to the default of the counterparty). This may lead banks to refrain from granting credit, which may further amplify the stress situation.

To our knowledge, there is no literature on this topic[6]. However, the reasoning above suggests that new financial instruments may have an impact on the credit cycle. It is rather unclear whether they make them more or less pronounced in bad economic conditions.

Fifth, *regulation* may also come at the potential cost of greater pro-cyclicality. *Capital requirements*[7], for example, may further force banks to reduce lending in an economic downturn and stimulate increased lending in an economic upswing. Banks in a bad economic environment that see their actual capital fall below the minimum required may decide to tighten lending standards and to cut back on their lending activity, thus contributing to a worsening of the initial downturn. Vice versa, an economic upturn may lead to some excess in economic capital within banks. This may induce banks to soften lending standards and to increase lending, thereby providing a further stimulus to the increase in the macroeconomic cycle. The next section discusses how some of the specific features of the CRD (compared to present capital regulation) may increase pro-cyclicality concerns.

1.2 CRD cyclicality

Present capital rules require banks to hold a minimum amount of capital for each loan largely independent of the risk of this loan. The CRD has the objective of making capital requirements more risk-sensitive. Banks should therefore hold more capital for more risky credit exposures and less capital for less risky credit exposures. The CRD contains two different approaches to determine capital risk-weights: the external ratings-based approach (or standardised approach, SA) and the internal rating-based approach (IRB). These risk-weights need to be multiplied by the "exposure at default" (EAD) to obtain the risk-weighted exposures[8]. Capital requirements can be derived by dividing the risk-weights by 12.5.

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4 See Kiff et al. (2003), Mitchell (2005), CGFS (2005) and Masschelein and Praet (2001) for an overview of existing asymmetric information problems between lenders and protection sellers/investors in CRT markets.

5 Linnel and Merritt (2004) have shown some anecdotal evidence that even for liquid names, market volumes can dry up very quickly in stress events.

6 Only some very general discussion has been provided in Rajan (2005).

7 In what follows, we ignore possible pro-cyclicality effects at work through asset revaluation reserves that under certain conditions can be included in Tier 2 capital.

8 For loans, this EAD is the book value. For credit lines, the EAD under the IRB approach reflects the bank's estimate of likely drawdown prior to default.

The SA differs from Basel I essentially in making the capital requirements dependent on external ratings. Banks continue, however, to be allowed to take account of several credit risk mitigating techniques, such as collateral, guarantees, credit derivatives and netting agreements. The SA does not allow banks to use their own data and estimates for calculating capital requirements for lending secured by mortgages on residential property and on commercial real estate. The "broad-brush" treatment provided for by the SA implies that lending that is fully secured by mortgages on residential property will (under certain circumstances) be risk weighted at 35%. Lending fully secured by commercial real estate will be risk weighted at 100%[9].

In the IRB, banks are allowed to use their own ratings in determining the risk weights to exposures. The weights exhibit a much higher risk-sensitivity than the ones under the SA. An IRB supervisory formula transforms risk components (probability of default or PD, loss given default or LGD, and effective maturity or M) into risk-weights, which then need to be multiplied by the EAD.

For corporate exposures, there is a distinction between a foundation and an advanced approach. In the IRB foundation approach (FIRB) banks need to internally calculate PD. LGDs for unsecured exposures are set by the CRD. This supervisory LGD can be adjusted when exposures are collateralised. The calculation of the EAD and M are also determined by the CRD. Under the advanced approach (AIRB), banks must provide their own estimates of PD, LGD, M and EAD. In both the FIRB and the AIRB and under certain conditions, residential and commercial real estate is accepted as collateral in order to calculate the LGD[10]. For retail exposures, only the AIRB approach is available; hence, banks must provide their own estimates of PD, LGD and EAD.

It is expected that the risk-weights in the different approaches are correlated with the macro-economic conditions. We make the following 3 conjectures.

1. The risk-weights in all three approaches (SA, FIRB and AIRB) are expected to be responsive to macro-economic conditions. Borrowers may be downgraded in a recession, which may require banks to meet additional capital requirements and induce them to tighten lending standards. Borrowers may be upgraded in a boom, which may result in some freeing of capital and stimulate banks to increase lending. We therefore expect the minimum capital requirements to fall as the economy enters into an expansion and to increase as it enters into a recession.

2. The IRB risk-weights are expected to be more responsive than the SA risk-weights. The degree of the cyclicality will very much depend on the characteristics of the PD rating system (point-in-time (PIT) or through-the-cycle (TTC)). External ratings are typically viewed as more through-the-cycle than internal ratings and therefore likely to be less cyclical than IRB risk-weights. Furthermore, the IRB approach also allows banks to use residential and commercial real estate collateral to adjust the supervisory LGDs, which are more responsive to economic conditions than other types of collateral.

[9] Exposures secured by mortgages on commercial real estate are allowed to be weighted at 50%, subject to the discretion of the competent authorities and at certain conditions.

[10] This collateral will need to be valued at or less than the fair value.

3. The AIRB risk-weighted exposures for corporates are expected to be more responsive to the business cycle than the FIRB risk-weighted exposures for corporates. In the AIRB approach, banks must provide their own estimates of LGD and EAD. Internally estimated LGD and EAD are seen as more responsive to the business cycles than the supervisory LGD and EAD.

It is not clear whether the capital requirements that banks need to hold for exposures which are hedged using new CRT instruments, contribute to cyclicality. Minimum capital requirements differ for single name products and multi name products products (see also Basel (2004, 2005) and Joint Forum, 2005)). In the box below, a simple example is presented, to illustrate how pro-cyclicality can occur in the case where a bank uses single name products, but examples can also be given for multi-name products.

Box 1: Possible effects of capital requirements for CDS products on cyclicality

By using a simple example this box *illustrates* how both the CRD capital requirements and the use of CRT products may affect the cycle.

Suppose that time t represents a period in which macro-economic conditions are normal. Time t+1 represents an expected period of distress. We assume that all loans are homogenous at time t and that they all require a risk-weight of 100%. All loans are equally affected by the worsened macro-economic conditions at time t+1. Therefore, at time t+1 they all require a risk-weight of 150%.

If the bank decides to buy credit protection for this loan via a CDS, the bank can replace the risk-weight of the underlying loan (reference entity) by that of the protection seller (at least if the necessary supervisory criteria are fulfilled). Suppose that the bank buys protection of an AA-rated bank. Hence, the bank will be able to substitute its corporate risk-weight charge for the one applied to the bank. Let us assume this is 20%, which is the risk-weight for an AA-rated bank in the standardised approach.[11].

We consider 3 cases (see also table below). In the **first case**, the bank grants a loan at time t and sells the related credit risk immediately via the CDS market. This allows the bank to replace the 100% risk-weight by the 20%. This risk-weight remains independent of the functioning of the CDS market at time t+1 (i.e. whether the credit risk can be sold or not in the CDS market). The lower capital requirements that banks need to hold, may induce banks to increase their lending in good times. These decisions, when taken simultaneously by many banks for many exposures, may have an impact on the credit cycle.

In the **second case**, the bank grants a loan at time t and decides to sell it at time t+1 (possibly due to the increase in the risk-weight). Again the bank can replace the 150%

[11] We assume here that this risk-weight already takes into account the double-default adjustment, which recognises the additional benefits obtained from the presence of credit protection, i.e. both the underlying exposure and the protection provider must default for a loss to be incurred. See BCBS (2005) for more information on this adjustment.

risk-weight by the 20%. If credit risk is accurately priced then the bank will need to pay a higher CDS premium to the protection seller. If the loan has been granted at a fixed rate at time t, it may not be possible for the bank to pass the premium on to the borrower. The additional cost of the CDS premium may affect banks' profitability and may thus induce banks to reduce loan exposure. In a badly functioning CDS market, the bank is not able to sell the credit risk because there is no counterparty in the CDS market willing to take on this risk. The bank will then need to bear the additional capital cost for this corporate loan and may decided to lower its loan exposure. It is only in a situation where the increase in the required capital in a badly functioning CDS market is different from the decrease in required capital and increase in CDS premium in a good functioning CDS market that one expects a different effect on banks' loan exposure.

In the **third case**, the bank wants to grant a loan at t+1 to a firm whose credit risk has increased between time t and time t+1 due to the macroeconomic developments. If the credit risk can be sold in the CDS market, it is likely that part of the higher CDS premium will be passed on to the borrower, which in turn may have a negative effect on the loan volume the firm wants to borrow. If the credit risk cannot be sold in the CDS market and the bank anticipates this, then the higher capital cost can be (at least partially) passed on to the borrower, which may have an impact on the size of loan. Again it is only in a situation where the increase in the required capital in a badly functioning CDS market is different from the decrease in required capital and increase in CDS premium in a good functioning CDS market that one expects a different effect on banks' loan exposure.

Considerations related interactions CRD capital requirements and CRT products

		Well-functioning CDS market		**Badly-functioning CDS market**	
	Impact	**t**	**t+1**	**t**	**t+1**
CASE 1	**RW**	RW=100→20	RW=20	RW=100→20	RW=20
	Loan (*)	↑ loans		↑ loans	
CASE 2	**RW**	RW=100	RW=20 (gain ↓ RW and cost ↑ CDS premium)	RW=100	RW=150 (↑ capital cost)
	Loan (*)	= loans	? loans	= loans	↓ loans
CASE 3	**RW**		RW=150→20 (gain ↓ RW ,↑ CDS premium passed on to borrower)		RW=150 (↑ capital cost passed on to borrower)
	Loan (*)		? loans		↓ loans

Case 1: Loan granted at time t, credit risk sold via CDS market at time t
Case 2: Loan granted at time t, credit risk sold via CDS market at time t+1
Case 3: Loan granted at time t+1, credit risk sold via CDS market at time t+1
(*) Under the condition that regulatory capital is binding

This simple example has illustrated that the combined effect of applying capital requirements and using CDS for hedging purposes on cyclicality is not unambiguous. This example could be extended to take account of the following considerations.
1/ Typically, banks do not only use these CRT products to hedge risks but also to take on risks. This may have an effect on banks' total riskiness.

2/ No assumptions are made about the quality of the new loans when banks increase their lending or about the quality of loans that banks dispose of / or the loans that they reject when they want to decrease their lending. This may affect the overall quality of the loan portfolio and thus banks' total riskiness.
3/ It is implicitly assumed that market participants do not anticipate the stress event.
4/ Furthermore, worsening macro-economic conditions may affect the rating (and thus the risk-weight) of the counterparty.

1.3 Mitigators to cyclicality in the CRD

Some of the pro-cyclicality concerns have been partially met in the design of the capital framework. In the IRB approach, banks are encouraged to base their Pillar 1 calculation of required capital on a so-called *"through-the-cycle (TTC)"* estimate of PD, a so-called *"down-turn"* LGD and a *"down-turn"* EAD. PDs need to be derived from a two-stage process. In the first stage, a bank must assign to each of its obligors a rating grade. Basel II suggests a preference for a TTC rating grade (in contrast to a more point-in-time rating grade). In the second stage, banks need to calculate a PD for each grade, and this PD is assigned to each obligor in a given grade. These PDs need to be a long-run average of the one-year default rates (see box 2 for an illustration). LGDs and EADs need to be calculated at the facility-level and need to reflect economic downturn conditions. The LGDs cannot be less than the long-run default-weighted average loss rate given default. EADs must be an estimate of the long-run default-weighted average EADs.

Secondly, at the purely *mechanical level*, the concavity of the *IRB supervisory curve* with respect to PD reduces the sensitivity of requirements capital to downgrades compared to the SA. The concavity of the IRB curves implies that capital requirements for higher quality portfolios are more sensitive to volatility in borrower PDs than is capital on lower quality portfolios. For some asset classes this effect has been strengthened by the way the asset correlation formula has been specified, namely as a decreasing function of PD. The effect of the concavity of the curve is to dampen the cyclicality of the IRB capital requirements. Also at the mechanical level, the maturity adjustment in the AIRB, which has been specified as a decreasing function of PD, reduces the sensitivity of capital downgrades compared to the FIRB approach (see box 2 for a concrete example).

Box 2: Illustrations of mitigators to cyclicality in the CRD.

This box illustrates some of the mechanisms that have been introduced in the CRD to mitigate cyclicality. First, the impact of using TTC PD rating grades versus PIT PD rating grades on capital requirements. Second, the maturity adjustment in the AIRB, which has been specified as a decreasing function PD.

First, the degree to which capital requirements fluctuate depends on whether a PIT or a TTC rating system is used. Point-in-time rating systems use all available obligor-specific and aggregate information to measure the PD of the rating buckets. A TTC rating system uses all available obligor characteristics, but tends not to adjust ratings

in response to changes in macroeconomic conditions. In practice, however, rating systems tend to exhibit characteristics of both TTC and PIT rating philosophies.

In order to illustrate the impact of the rating system on capital, a PIT and a TTC rating system is developed by using the same dataset and the same methodology as in Marcelo and Scheicher (2005). The PIT rating system is developed using the Moody's KMV EDF database on European firms. These "expected default frequencies" or EDFs are measured in a Merton-type model using information on the equity price of the firm and information on the firm's liabilities. These firms are then grouped into 10 risk categories; the average EDF of the firms in each group is then used to estimate the PD. The TTC rating system has been created by using the same dataset. In order to (partially) eliminate macroeconomic influences, the firms were first ordered in terms of their relative difference in EDF from the average sector EDFs. These firms were then allocated to a rating grade using a symmetric distribution. The average EDF of the group was then used to estimate the PD. [12]

Figure 1: Capital requirements *k* (under FIRB) using PIT versus TTC rating system

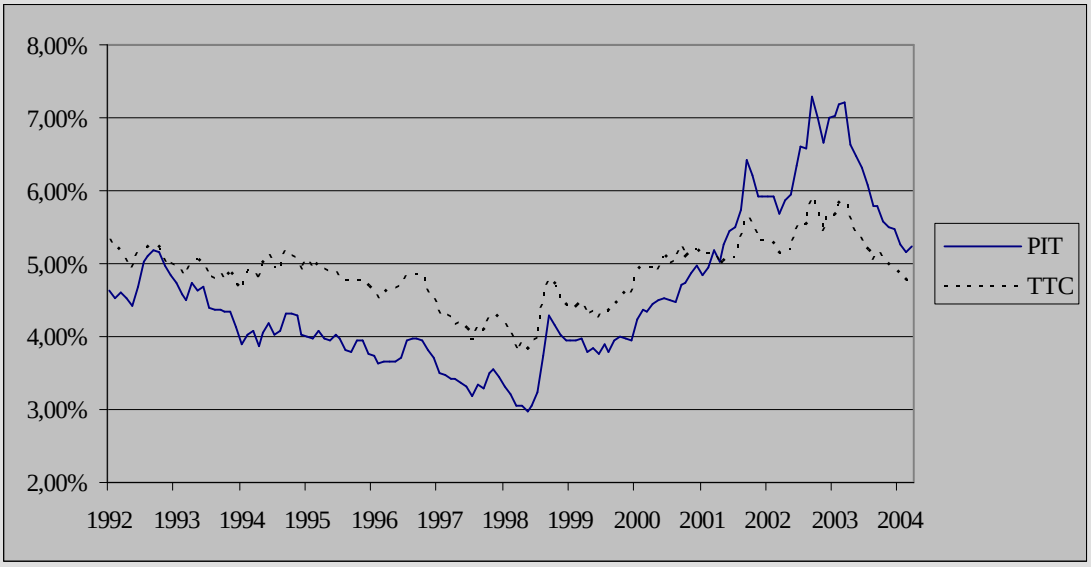

Figure 1 clearly shows the dampening effect on capital requirements of using a TTC rating system compared to a PIT rating system. The volatility in the capital requirements, measured as the standard deviation relative to the mean, is 0.09 when a TTC rating system is used and 0.22 for a PIT rating system.

Second, at the purely mechanical level, the IRB supervisory risk-weight curve includes some technicalities that dampen the cyclicality (see also Gordy and Howells (2006)). One example is the maturity adjustment in the AIRB, which has been specified as a decreasing function in PD, and which reduces the sensitivity of capital to a downgrade.

For example, a three-year loan to a borrower which has been classified in grade 3 in the PIT rating system discussed above has a PD of 0.27%. If this borrower is

[12] The general idea of this technique is in line with the one used in Gordy and Howells (2006). More detailed information can be found in Scheicher and Marcelo. Other papers often use data provided by rating agencies to create a TTC rating system.

downgraded after one year to a grade in which the PD is 0.54% (which is an increase in PD of 100%) then the capital requirements under the AIRB approach increases by 17% (k(PD=0.54%, M=2)/k(PD=0.27%, M=3)) while the increase under the FIRB approach is 14% (k(PD=0.54%, M= 2.5)/k(PD=0.27%, M=2.5)). The corresponding increases for a three-year loan of grade 7 with a PD of 3.7%, which sees its PD increase by 100% are 17% under the AIRB approach and 26% under the FIRB approach. This example clearly shows that there is a larger relative effect of maturity at lower PD levels. This implies that pro-cyclicality under the AIRB will be dampened by the maturity adjustment.

Further, in assessing capital adequacy under *Pillar 2*, the supervisor is required to be mindful of the particular stage of the business cycle in which the bank is operating. In addition, banks need to conduct rigorous, forward-looking *stress tests* that identify possible events or changes in market conditions that could have an advert impact.

The CRD may also stimulate more *forward-looking behaviour by banks*. As they will now dispose of a better metric for measuring credit risk, this may result in a more structured decision-making process. It could prevent banks from exhibiting irrational exuberance during an expansion and being suddenly confronted with a drop in capital adequacy triggering a credit crunch.[13] The CRD may encourage banks, especially those under the IRB, to recognise capital insufficiencies earlier in a credit cycle.

1.4 Empirical literature on the cyclicality of CRD

Several studies have analysed the potential cyclical effects of the new capital requirements. A large stream of studies (see e.g. Kashyap and Stein (2003) and Marcelo and Scheicher (2005) for a detailed overview of this literature) uses the IRB foundation formulas in order to analyse the relationship between the credit quality of corporate borrowers (PD) and the capital charges. Other input factors (such as LGD and EAD) are typically assumed to be constant.

The analysis is done by mechanically plotting different PDs in the IRB risk-weight curves. The PDs are calculated in good and bad macroeconomic periods, and using point-in-time and through-the-cycle approaches. Some authors have stressed the many methodological differences between different studies (sample differences, survivorship bias, handling of default borrowers, portfolio management assumptions, etc.).[14]

Despite these differences, the main findings of these studies can be summarised as follows:

- Ratings typically worsen in an economic downturn and improve in an economic expansion, which translates into a significant cyclical behaviour of the regulatory requirements. For example, Gordy and Howells (2006) find that

[13] For example, Basel I gave banks incentives to reduce regulatory capital requirements by shedding high-quality assets from their books. One popular way of doing this is to securitize them, with the originating banks often holding on to the riskiest first loss positions to help support the deal.

[14] See Kashyap and Stein (2003); Gordy and Howells (2006) and Marcelo and Scheicher (2005) for an overview.

the new approach could lead to volatility in the capital charge[15] (relative to the mean) of 0.1 to 0.26 (depending on the simulation technology).

- In some cases the capital requirement on the non-defaulting portfolio can decrease in an economic downturn By sweeping away the weakest borrowers, a stress event can paradoxically improve the average credit quality in a portfolio. (Catarineu-Rabell et al. 2003).
- The volatility of capital charges is higher for better quality credits as such credits have the potential of further migrating down the rating scale and face a steeper risk curve.
- The impact seems to be larger when a point-in-time rating system is used compared to a through-the-cycle rating system.

This literature has its merits in measuring the sensitivity of Pillar I regulatory capital requirements when using different types of rating systems in different time periods. However, these studies ignore some important issues.

First, all the studies focus on FIRB banks ignoring the possible cyclical effects that can come from time-varying LGDs and EADs. Literature on whether there is a relationship between the business cycles and the LGDs is not clear cut. Whereas Asarnow and Edwards (1995), Altman and Brady (2002) and Dermine and Neto de Carvalho (2006) observe only a weak or no dependence of LGDs on macroeconomic variables, the work by Gupton et al. (2000), Frye (2003) and Düllmann and Trapp (2004) suggests that LGDs are more closely linked to the business cycle. A recent study by Jiménez et al. (2006) has shown that EAD also exhibits cyclical characteristics. Using data on Spanish credit lines they found that during recessions, credit line usage increases, in particular among the more fragile borrowers. Also Asarnow and Marker (1995) have shown that the size of the drawn portion of loan commitments is closely related to the credit quality of the obligor.

Second, the studies do not address the possible (anti)cyclical effects that could come from the new CRT markets. To the best of our knowledge, no research has been conducted in this area. There is also very limited data available on CRT products. Therefore, there is no information on whether this is an important factor and if so, under which conditions.

Third, all studies that analyse the impact of Basel II on pro-cyclicality limit the discussion to Pillar I. Capital required under Pillar II is hard to quantify and is therefore always ignored. However, Pillar II may moderate or amplify capital cyclicality, thus it may be worthwhile to extend the pro-cyclicality discussion also to Pillar II.

Fourth, the analysis is typically performed on a (small) subset of (hypothetical) bank portfolios i.e. corporate portfolios. Cyclicality of the regulatory capital requirements for other asset classes (retail, mortgages, SMEs, banks, sovereign etc.) is typically not addressed.

[15] To estimate the volatility, the authors first calculated for each bank the standard deviation across time of the capital charges. Volatility is then the mean across banks of this standard deviation.

Finally, the empirical part of the *literature ignores the fact that capital requirements may not be binding*. Often the argument is made that it does not matter that new capital requirements fluctuate more than before given that banks' behaviour is driven by other capital considerations.

1.5 Summary

Pro-cyclicality may have different sources. An analysis aimed at determining the extent to which cyclical lending behaviour depends upon capital requirements requires a good understanding of the different other possible sources of pro-cyclicality and of the developments in the financial sector which may influence the importance of these sources over time. An empirical exercise intended to analyse the cyclicality that comes from regulatory capital requirements needs to control for these other potential sources.

The CRD has the objective of making capital requirements more risk-sensitive. By construction, the capital requirements under the new regime will be more cyclical than under Basel I. In order to dampen these effects several mitigators have been built in. This raises the question as to whether it matters that required capital fluctuates more than before, given that banks' behaviour is driven by other capital considerations.

2. Are banks constrained by the CRD capital requirements?[16]

A necessary condition for regulatory capital requirements to have a pro-cyclical effect is that they are binding, at least at the downturn of the business cycle. Capital requirements, however, may not be binding when banks' shareholders and other counterparties require a higher level of capital.

Banks distinguish between regulatory capital, economic capital, rating agencies' capital and actual capital. Regulatory capital is defined as the minimum capital required by regulators. Economic capital can be defined as the amount of capital that the banks' shareholders would target in the absence of any regulation or other constraint. Rating agency capital can be defined as the capital that is required by rating agencies in order for the bank to obtain a given rating. The actual capital the bank holds is defined as the capital chosen by banks' counterparties taking into account these market and regulatory constraints. In determining the level of capital, regulators, investors, counterparties take into account the trade-off between the cost of funding the bank with expensive capital against the benefit of decreasing the probability of reducing its franchise value (which is reducing the probability of bank failure).

Banks often statistically estimate their economic capital as the capital a bank needs to hold in order to cover the potential loss calculated over 1 year at a pre-specified

[16] I like to thank Janet Mitchell for discussions on this section.

confidence level. Banks typically use the latter for pricing purposes. Similar to the way banks estimate their economic capital, the CRD regulatory capital has been set so that it covers the loss over 1 year calculated at a certain confidence level (see box 3 for a general comparison between the CRD capital and economic capital models).

Box 3: Possible differences regulatory capital and economic capital model.

The objective of the IRB risk-weight functions is better alignment of the regulatory capital requirements with economic capital requirements. Similar to the definition of economic capital, regulatory capital in the CRD has been defined as the capital that is set by regulatory authorities so that it covers the loss over one year calculated at a certain confidence level.

In principle, the IRB risk-weight functions are based on the same risk measurement concepts as the economic capital models used by banks internally[17]. If economic and regulatory capital requirements are modelled in the same way and are driven by the same input factors, one should expect that events have the same impact on economic and regulatory capital requirements. In practice, however, there seem to be many differences between the input factors and the applied modelling techniques. Therefore, economic capital and regulatory capital requirements do not necessarily move together over time.

Input factors

Bank shareholders mostly require banks to hold a level of economic capital which differs from the level of regulatory capital in that they target a higher solvency standard. Large international banks employ a solvency standard which is higher than the 99.9% probability implicitly set forward in the CRD. Evidence for this can be found in academic literature (see e.g. Jackson et al (2001)) and in individual banks' annual reports. Deutsche bank (2004) and ING Groep NV (2004), for example, mention in their annual reports that economic capital is set at a solvency level of 99.98% and 99.95% respectively.

Modelling techniques

The IRB risk-weight functions are based on a single-factor model which does not account for differences in diversification. Economic capital models, however, typically take into account diversification benefits, both within and across risk types. A credit portfolio, for example, can produce diversification gains by investing in a variety of sectors and countries. Furthermore, the aggregation of different risk types enables to capture the diversification benefits between the different risk types.

To give an example, the CRD does not allow for an integrated modelling of credit and market risk to calculate capital requirements. It requires banks to calculate capital requirements for market and credit risk separately, which then need to be summed arithmetically[18]. Economic capital models, however, may take into account time-

[17] See Gordy (2003) for credit risk

[18] This implicitly assumes perfect correlation between credit and market risk.

varying correlation between credit and market risk. The attendance of an external shock that greatly magnifies the correlation between credit and market risk (and keeping all other variables constant), may lead to an increase in economic capital but not to an increase in regulatory capital.

It is very often argued that regulatory capital requirements are not binding as long as banks hold positive capital buffers, which is defined as the difference between actual capital and regulatory capital. However, a bank may use its regulatory capital requirements as a starting point to determine its actual capital by adding for example a % mark-up. In this case one could not with certainty say that the regulatory capital requirements are not binding. It is thus not possible to see whether regulatory capital is binding by only comparing regulatory and actual capital without any knowledge about how banks choose their actual capital holdings.

Literature points out several reasons why banks may want to hold positive capital buffers. One argument is that it is not only costly to hold capital but it is also costly to raise capital in response to unexpected changes in market conditions. Apart from the pure transaction costs, other adjustment costs relate to the problem of asymmetric information in capital markets (as the issuer has an informational advantage over the potential buyer).

This reasoning would imply that firms may wish to increase capital when conditions are favourable for periods when conditions for raising extra capital are not ideal (e.g. in a downturn). In order to avoid breaches of the regulatory capital requirements, banks thus may want to build up capital buffers during upturns, which might be used to fulfil a likely increase in requirements in a downturn. This behaviour would reduce, but may not fully eliminate, possible pro-cyclical effects. Numerical analysis in Peura and Jokivuolle (2004) suggests that the introduction of the risk sensitive capital requirements may even necessitate higher bank capital buffers because of the increased volatility of the minimum capital requirements.

Empirical analysis on the Basel I regime, however, suggests that banks' capital buffers do not serve as a mitigator of cyclicality of the present capital requirements. Ayuso et al (2004) and Stolz and Wedow (2005) for example found a negative effect of the business cycle (GDP) on the regulatory capital buffers of Spanish and German banks respectively. Capital buffers decrease when economic conditions improve, while capital buffers increase when economic conditions worsen. One possible explanation of the latter result is the short-sightedness of banks. Banks expand their loan portfolios in an economic upturn without building up their capital buffers to the same extent. Another possible reason is that firms may be inclined to ask more credit in an economic upturn and less credit in an economic downturn.

As rightfully pointed out by Repullo and Suarez (2007) one has to be very careful in using results obtained in the Basel I regime to predict behaviour in the Basel II world. Buffers are likely to be endogenously affected by the characteristics of capital regulation. Therefore the analysis on capital buffers may not be immune to the Lucas critique.

It is unclear how the implementation of the CRD will affect the size of the capital buffers. The QIS5 results (see box 4 for a summary) suggest that the minimum regulatory requirements under the CRD will decrease relative to the current regulatory framework. Assuming that the CRD does not affect banks capital holding, this implies that under the favourable QIS5 macroeconomic conditions during which the QIS5 was undertaken, it is more likely that a larger number of banks have binding larger capital buffers (compared to the previous framework). A bank that sees its capital fall in good times relative to the capital of the previous regime may be induced to increase its lending; it may decrease its lending in bad times when it sees its capital rise relative to current previous capital requirements.

In order to analyse the question whether the CRD capital requirement constraints will be binding requires a good understanding of how actual capital is set and how the different categories of capital, rating agencies', the regulatory and the economic capital relate to each other.

Box 4: Likely impact of the CRD on capital requirements (QIS5)

The main objective of the Quantitative Impact Studies (QIS) is to allow the Basel Committee on Banking Supervision to evaluate the potential changes in minimum required capital levels under Basel II. This box summarises the main results of the QIS5 exercise for the CEBS countries (see BCBS (2006) for the full report). These countries are either EU member states, EU accession candidates or members of the European Economic Area.

1. The QIS5 results show a decrease in minimum required capital relative to current requirements. CEBS Group 1[19] banks see, on average, a decrease in their minimum required capital of 0.9%, 3.2% and 8.3% for the standardised, foundation and advanced IRB approaches respectively. CEBS Group 2 banks demonstrate decreases of 3.0%, 16.6% and 26.6%. Focussing on the most likely approach, the results show an average decrease of 7.7% for CEBS Group 1 banks and of 15.4% for CEBS Group 2 banks.

2. Macro-economic conditions prevailing in most countries at the time of the QIS5 were more benign than during e.g. QIS3. A comparison of the results from QIS5 and QIS3 is, however, difficult (e.g. due to differences in calculation rules, data quality, etc.). The Basel Committee reported that currently available information does not allow the impact of the macro-economic conditions to be quantified with precision.

Summary

One necessary condition for regulatory capital requirements to have a pro-cyclical effect is that they are binding. *If regulatory capital requirements, however, are not*

[19] Group 1 banks are banks which fulfil the following three criteria: the bank has a Tier 1 capital in excess on €3 billion; the bank is diversified; and the bank is internationally active. Group 2 consists of banks that do not meet these criteria.

the binding constraint, then any action to reduce the co-movements of the CRD requirements with the economic cycle will have no effect on banks' lending behaviour.

3. Does the capital constraint lead to an amplification of the macro-economic cycle?

If a bank is constrained by its capital position, it can react in three ways: (1) by raising new capital, the numerator; (2) by decreasing its overall credit exposure; or (3) by shifting the composition of exposures toward those with a lower risk weight and away from those with a higher risk weight (possibly using credit risk transfer instruments). Banks will choose the option or the combination of options that entails the lowest cost. Banks may prefer e.g. to limit the amount of credit granted or may prefer to set interest rates at a level at which the higher capital cost is reflected into the interest rate. These actions may contribute to a worsening of the downturn. Alternatively, banks may opt for a safer lending policy. Reducing exposures to bad borrowers and increasing exposures to good borrowers may support a macroeconomic recovery.

Empirical literature provides some evidence that capital constraints may play a role in reducing the availability of loans and that weakly capitalised banks sometimes substitute away from high risk-weighted assets (see Jackson et al (1999) for an overview[20]). An analysis of the impact of the CRD on loan volumes, however, requires an understanding of the link between banks' capital management policy and loan granting process.

Literature also points out that some of the loans that were cut cannot be substituted by credit from other banking institutions or by external capital markets, at least not at the same cost (e.g. loans to households, SMEs). Further, literature shows that credit cycles may have an impact on business cycles (see Berg et al (2005) for a general discussion). Hence, an increase or a reduction in credit may have a good potential to exacerbate macroeconomic fluctuations. It is unlikely that the CRD will have an effect on firms' funding options and on the link between the credit cycle and the business cycle. Therefore, a framework to monitor CRD cyclicality could adopt these two empirical findings as stylised facts.

[20] Binding capital requirements seem to play in particular a role in the reduction of loans in 'strong' recessionary periods (see e.g. Hancock and Wilcox (1997), Hancock and Wilcox (1998) , Peek and Rosengren (1995) The size of the impact of binding capital requirements in 'moderate' recessionary periods is somewhat less clear cut (e.g. Aikman and Vlieghe (2004)) have found that the role of bank capital in propagating a recession may be rather small. A study by Zicchino and Nier (2005) has shown that poorly capitalised banks extend fewer loans than their stronger competitors.

4. A possible framework for monitoring pro-cyclicality

The framework to monitor pro-cyclicality should be a *dynamic* one. At this juncture, the CRD is still being implemented. The implementation date for the SA and the FIRB approach is 1 January 2007. The most sophisticated approaches to credit risk and operational risk will be available at the start of 2008. Banks adopting the CRD will be required to calculate their capital requirements using the CRD and the present framework in parallel for a period of 1 year. Furthermore, banks will be subject to a transition period during which limits[21] will be applied on the amount by which each institution's risk-based capital may decline in comparison with the requirements stemming from the CRD. It is likely, however, that the CRD will not only change the regulatory capital banks need to hold but also banks' entire capital management policy.

Possible follow-up work relating to a monitoring framework for pro-cyclicality should tackle the following questions:

1. How will the CRD affect the cyclicality of the capital requirements?

Given that the CRD is still in the process of being implemented, very few data are currently available. In the first years after implementation, the framework could be limited to a descriptive analysis of available data and to a qualitative analysis. As time passes and banks adapt to the CRD requirements, more data will become available. As a result, more thorough econometric analysis will become possible.

Analysing potential pro-cyclicality in capital requirements requires *data at the level of individual banks* (or alternatively *data for different bank types* which are more or less prone to pro-cyclicality). However, it is important that the *analysis* take account of the *aggregate impact*. Individual bank analysis related to pro-cyclicality may be reasonable when seen from the perspective of individual agents, regardless of what other banks do. The action of any individual bank, taken in isolation, would not be such as to lead to a sufficient deterioration in the economic environment to make the bank worse off. But if every bank does so, at some point there might be an effect on the business cycle.

2. Are banks constrained by the CRD capital requirements? How will CRD affect banks' capital management policy?

It has been argued that it may not matter that regulatory capital requirements fluctuate more than before when large banks' behaviour is driven by other capital considerations. Follow-up work could address the following questions:

[21] These limits will be implemented through capital floors, calculated as a function of the Basel I requirements. These floors will in principle be abolished from 2010 onwards. However, for banks that do not successfully complete the transition, supervisors have the possibility of continuing to apply the capital floors or of introducing another, more appropriate floor.

- What are the main characteristics of banks' determination of the actual capital they hold? What are the linkages and possible differences with the regulatory capital requirement models?
- Is it banks' regulatory capital (both Pillar I and Pillar II) which is the binding constraint for banks (and under which conditions)?
- How important are other capital constraints (e.g. as set by rating agencies)?
- Will the CRD affect the likelihood that banks are confronted with binding capital constraints and under which conditions? Will the CRD affect the role of capital buffers for mitigating pro-cyclicality?
- Will the CRD affect the link between banks' capital management policy and loan granting process?

As pointed out before, this analysis is important because if the binding constraint for banks is not regulatory capital, then any action to reduce the co-movement of the CRD requirements with the economic cycle may not serve its purpose. A report which analyses the cyclicality of regulatory capital requirements demands an analysis of whether the possibly observed cyclicality also has an impact on bank behaviour.

3 Interaction CRD and other sources of pro-cyclicality?

Example: What is the impact of CRT products and the capital requirements that banks need hold for these on pro-cyclicality ?

Most studies that analyse the cyclicality of Basel II assume that banks are unable to hedge their exposures and are unable to take on credit risk by selling credit protection. Thereby they ignore the possible cyclical implications that could come from the use of these CRT instruments. Some papers have analysed the relationship between collateral and the business cycle, however it seems that no paper has analysed the relationship between new CRT instruments and the business cycle. Therefore, an analysis of the following questions seems relevant:

- What is the possible impact of new CRT products on the cyclicality of lending?
- What is the impact of new CRT products on the cyclicality of capital requirements?
- Are these new CRT instruments more important than more "traditional" credit risk mitigation techniques (such as collateral and guarantees)?

Analysing the interaction between the CRD and other sources of pro-cyclicality is important as an analysis on the pro-cyclicality of capital requirements should not be performed in isolation. Different possible interacting sources of pro-cyclicality need to be analysed. In particular, additional work might be required on those sources of pro-cyclicality on which there is still insufficient knowledge such as the new CRT products.

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