

Balázs Zsámboki: Impacts of financial regulation on the cyclicalities of banks' capital requirements and on financial stability¹

One of the main functions of the central bank is to strengthen the stability of the financial system, an important aspect of which is to take an active part in the legislation process to improve the regulatory environment and to assess the potential impacts of new regulatory measures. In the summer of 2007 substantial changes took place in the governance of financial institutions with the introduction of regulations based on the new Basel capital standards (Basel II). The objective of this study is to investigate the likely consequences of such new bank regulations and their potential impact on financial stability. To this end, the study analyses the foreseeable developments in the cyclicalities of capital requirements of banks based on the corporate credit portfolio of internationally active large banks, and points out that bank regulations are not always capable of fulfilling their intended function of enhancing financial stability in times of economic distress. Notably, the prospective increase in the cyclicalities of capital requirements could well lead to a deepening of economic problems and to instability in the banking system, if the banking system appears undercapitalised relative to the risks assumed. All of this highlights the need for the development of a forward-looking risk assessment system and a supportive regulatory regime providing proper incentives.

INTRODUCTION

With a view to the rapid transition of financial markets and institutions and the emergence of new risks, it is necessary to improve financial regulations continuously on an international level. As far as banking regulations are concerned, the international capital standards published by the Basel Committee on Banking Supervision are set as benchmarks and currently provide a basis for several EU directives as well. The purpose of the Basel capital standards is to set forth regulatory principles at the international level, with the aim of creating a level playing field, enhancing the stability of banks and protecting the interests of customers. The new Basel rules adopted in 2004 (Basel II) fundamentally rearrange the principles and practical application of bank regulations, and are expected to have a significant impact on the banks' behaviour, and thereby on the real economy. According to plans, the new Basel rules will be implemented in more than 100 countries and made part of their national laws, which also means that their impact will be felt in many countries in the near future. The transposition of EU directives which are based on Basel II into Hungarian law took place in the summer of 2007.²

Nowadays, the key element of bank regulations lies in the definition of capital requirements consistent with the risks

assumed, as capital is the primary source to absorb losses, and thereby to protect depositors and other clients. To this end, it is of particular importance to have risks assessed accurately, and to define the capital requirement to cover potential losses. However, one major characteristic of risks is that they are not constant over time: when economic cycles are on the rise, expectations become more optimistic while the income of economic agents is also on the upswing, thereby improving their credit repayment capability, the value of collaterals is increasing and the number of bankruptcies is declining. In these cases, the level of measured risks is decreasing, and hence, the capital requirements prescribed for banks under the new Basel rules are also more lenient.

However, risks tend to build up during times characterised by strong economic activity, and they materialise in banks' books as losses in times of economic depression. What this means is that if a bank fails to build up its reserves in 'good times', it may become capital-constrained at times when the economy turns sour and when losses begin to accumulate; in other words, it will not be able to comply with the statutory provisions relating to capital requirements. One possible reaction banks might take to the above-specified phenomena is to cut back on lending operations and refuse loans to customers whom they deem risky in order to reduce the capital requirement. However, this could lead to the deprivation

¹ This analysis is based on Zsámboki, Balázs (2007): Basel II and financial stability. An investigation of sensitivity and cyclicalities of capital requirements based on QIS 5, published under MNB Occasional Papers.

² The transposition of Directive 2006/48/EC adopted on the basis of Basel II into Hungarian law was implemented by Act LI of 2007 on the Amendment of Act CXII of 1996 on Credit Institutions and Financial Enterprises and Other Regulations Concerning Specialised Credit Institutions, and by Government Decree 196/2007 (VII. 30.) on Credit Risk Management and Capital Requirement for Credit Risk.

of resources from economic agents who needed them the most. Typically, small and medium-sized companies are considered as such, as their access to alternative financial resources, apart from banks, is limited.

The correlation between lending cycles and economic cycles, i.e. procyclical banking behaviour is clearly apparent in most countries, however, the role of capital regulations for banks is not yet clear in this process. The objective of this study is to analyse the ties between real economic cycles and the cyclicity of capital requirements for banks, and thereby to provide a better understanding of the foreseeable consequences of the new bank regulations and their potential impact on financial stability. In this analysis, it is important to point out that the fluctuation in capital requirements fails to convey a complete picture on the impact of changes in risk factors that may occur over time, as banks are required to cover their losses not only with capital, but also by making provisions or value adjustments (hereinafter referred to collectively as 'provisions'). While capital covers unexpected losses, provisions are set aside to cover expected losses.³ It is important to point out that banks are required to cover any shortage of provisions with capital, consequently, in this analysis we will address both capital and provisioning requirements in terms of their movements over time.

This article is intended to point out that, even though the ultimate goal of these regulations is to support banks' prudent operation, and through it to promote economic growth, these rules relating to individual institutions possibly fail to fulfil their role in supporting economic development and stability in times of economic distress. If the banking system on aggregate is undercapitalised relative to the risk assumed, the rules themselves could contribute to pushing the economy toward a deepening crisis, and therefore to destabilising the banking system.

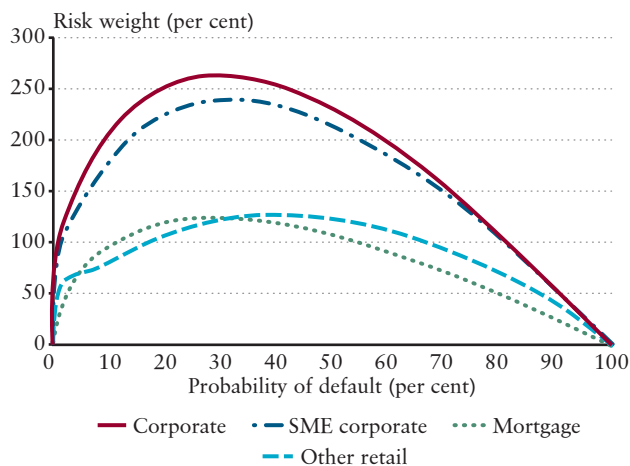
MAIN CHARACTERISTICS OF BASEL II

The original regulatory framework adopted in Basel in 1988 (Basel I) contained uniform rules for all corporate exposures in terms of risks. Irrespective of differences in default and recovery rates, a risk weight of 100% was assigned to all corporate exposures, and a capital requirement of 8% of the amount of such risk-weighted exposure was defined.⁴ One of the major innovations of the new Basel capital standards

(Basel II) is that risk weighting and the calculation of capital requirements have become more sensitive to changes in risks, with respect to the relative riskiness of exposures and the changes in riskiness of a specific exposure over time. The previous regime is replaced by a revised standardised method and by two internal rating based (IRB) methods, for banks to choose the most suitable one for their needs, consistent with the risk management practices they employ. Of the two IRB approaches, the more advanced one allows banks to determine – subject to supervisory recognition – the risk weight for each exposure using their own estimates of risk parameters, and consequently their capital requirements. These risk parameters include the probability of default (PD), loss given default (LGD), exposure at default (EAD) and maturity (M) estimated for each exposure.

Banks use a variety of statistical methods and internal risk models to estimate the aforementioned parameters, which then have to be substituted into the risk weight functions prescribed by the regulators to arrive at the capital requirement for the exposures in question. In this context, it is important to point out that while the risk weight functions define a cross-sectional relation, meaning that they measure the relative riskiness of various exposures, these very same

Chart 1
Risk weight functions



Note: In the above illustration for corporate and other retail loans an LGD of 45% and for mortgage loans an LGD of 20% is assumed, based on the average LGD data of QIS 5. Using higher LGDs would increase the steepness of the functions, while lower values would flatten out the functions. As regards corporate SME loans, where the regulations prescribe different risk weights according to the size of the firm, annual revenues of EUR 25 million are assumed for SMEs.

³ Expected losses are generally incurred in connection with the banks' usual business activities, and may be estimated with statistical methods. Banks usually recover their expected losses through pricing of loans. On the other hand, unexpected losses are treated as being generated by extraordinary events (e.g. external economic shocks), which have to be covered by capital.

⁴ Risk weights are designed to express the degree of riskiness of bank loans and other exposures in relative terms. Different weight risks are assigned to different exposures. In the Basel I regulatory framework the risk weight assigned to exposures to the central government and the central bank is 0%, to exposures to banks it is 20%, to exposures covered with mortgage it is 50%, and finally to other corporate and household exposures it is 100%. Banks are required to sum up their exposures under various risk weights, and to set aside capital covering 8 per cent of the value of this risk-weighted aggregate exposure to cover potential losses.

functions are to be applied to determine the capital requirement in connection with changes in riskiness of a specific exposure over time. Notably as time goes by, parameter estimations tend to change accordingly, just as the regulatory capital requirement for the individual exposures. The risk weights of different portfolio components are illustrated in Chart 1 as a function of PD. The chart clearly indicates that the risk weight of corporate exposures could be much lower or higher than the 100% specified uniformly under Basel I, depending on the probability of default.

The probable effects of the new Basel rules are addressed in several impact studies, the most comprehensive of which is the so-called Fifth Quantitative Impact Study (QIS 5) conducted during the second half of 2005 by the Basel Committee on Banking Supervision, with the findings published in 2006.⁵ The impact study indicates the prospects concerning capital requirements for specific portfolios in a given time, but fails to offer any information relating to the dynamics of capital requirements. Consequently, the findings of the study largely depend on the macroeconomic and financial market conditions prevailing at the particular time, which was decidedly favourable during the period under review. From the perspective of financial stability, however, it is important to investigate how booms and depressions in the economy influence developments in the capital requirements of banks over time.

The only database that is available to the general public, and that would be required for the purposes of the analysis, is concerned with corporate exposures. This study relies on the database of Moody's, a credit rating agency, including data from the period between 1983 and 2006 to model changes in the capital requirements for corporate credit portfolios in the various phases of economic cycles. This database contains information on corporate exposures covering approximately 5,000 companies worldwide. The 1983-2006 period covered by the analysis contains two recession periods (1990-91 and 2001-2002). The database offers information on the default

rates within the various categories, the spread of such defaults and the minimum and maximum rates during the period under review.⁶ In the analysis numerous assumptions are made, which have to be taken into consideration for the evaluation of the results as well.

ANALYTICAL FRAMEWORK

For the analysis of the impacts of the new Basel capital regulations, first we have to create a model bank, whose corporate portfolio reflects the composition of the portfolios of major international banks. On the one hand, this is necessary because Basel II is also calibrated upon these types of institutions, and on the other hand because the rated companies in Moody's database are typically clients of large banks. As for portfolio composition, we relied on the findings of QIS 5. Then, based on this portfolio, the effects of changes in risk parameters are investigated, calculating the developments of expected and unexpected losses over time as well as the impacts of changes in quality composition of the portfolio.⁷

Estimation of probability of default (PD)

QIS 5 lists the various exposures under three categories with different PD bands. For the sake of simplicity, we will refer to these categories as good, average and poor portfolios.

From the perspective of this study, it is imperative to determine the average PD for these categories, and consequently to review developments in these average PDs over time. To this end, the following assumptions were employed:

1. For good and average categories, we consider the middle of the PD bands as defined in QIS 5 as the average PD. Therefore, in the 'good' category the PD is the middle of the 0-0.2% band, that is 0.1%, while in the 'average' category it is the middle of the 0.2-0.8% band, that is 0.5%.

Table 1

Percentages of corporate exposures of large international banks according to PD bands in accordance with QIS 5 (%)

	Good	Average	Poor
PD band	<0.2%	0.2–0.8%	0.8–99.99%
Share of corporate exposures	38.5	31.8	27.8

Source: BCBS (2006).

⁵ The impact study covers approximately 400 banks from around the globe. For more details, see BCBS (2006).

⁶ For a detailed description of the database, see Hamilton et al. (2007).

⁷ In this paper only the effects of changing PD and LGD are analysed, while both EAD and M are assumed to be constant.

2. In the ‘poor’ category, that covers the 0.8-99.99% PD band, the middle of the band would be unrealistic for any estimation of the average PD. Therefore, in this category we will make calculations with two alternative assumptions, namely 3% and 7% PDs. These PDs are close to the average default rate of exposures classified as speculative by the credit rating agencies, therefore, they can be interpreted empirically as well.

Naturally, breaking up the portfolio into three categories makes the analysis considerably simpler, as the new Basel rules require banks to set up at least 7 categories. This type of breakdown, however, is not possible with the publicly available databases, but the impact mechanisms of Basel II under such simplified conditions is still more understandable than if we were to use only one average corporate PD estimate.

In the next step, we examine which category a portfolio with a presumed 0.1%, 0.5%, or 3% and 7% average PD can be mapped with Moody’s database. This analysis makes a critical assumption, namely that a bank portfolio with a specific average PD behaves during an economic cycle the same way as a portfolio with similar average PD according to the Moody’s database. However, it is important to emphasise that the new Basel rules require banks to make their own PD estimates under the internal rating categories based on the long-term average default rate observed in the given category. Therefore, in this analysis we assumed that our model bank uses the five-year average default rate to estimate the PDs for the exposures listed under the category in question (in other words, the PD estimated for 1987 is the same as the average default rate of the previous five-year period). This assumption smoothes out short-term fluctuations of PDs, and as such it can be viewed as a step toward a through-the-cycle rating method.

Estimation of loss given default (LGD)

In connection with LGDs, initially a fixed 45% is assumed, then we will make calculations for LGDs as a function of PDs. There are several studies to prove that there is positive correlation between PDs and LGDs, which naturally has an

impact on the capital requirements of banks as well, meaning that this relation has to be taken into consideration for these calculations.⁸ Therefore, as an alternative scenario a simple relation between PDs and LGDs is assumed, which is still consistent with the results of empirical studies. In our analysis, in the environment of long-term average PDs the LGD is assumed to be 45%, however, the more significant fluctuations seen in the PDs are assumed to have an impact on the LGDs as well. The assumed relationship between PDs and LGDs is shown in the table below.

Accordingly, if the 5-year average PD is at least 25% greater (smaller) than the long-term 24-year average from between 1983 and 2006, according to our estimate the LGD changes from 45% to 50% (or 40%). If the 5-year average PD is at least 50% greater than the long-term average, we will apply an LGD value of 55%, or 35% if it remains that much behind.

Naturally, these assumptions are arbitrary, merely attempting to provide a more accurate understanding of the impact mechanisms and systemic consequences of Basel II. All of the banks using the more advanced IRB approaches will have their own estimates of PDs and LGDs, and the correlations calculated on their own portfolios could even be different, however, they are unlikely to deviate substantially on average from the assumptions made in this study, in line with those commonly supported by academic literature.

CYCLICALITY OF UNEXPECTED LOSSES (CAPITAL REQUIREMENTS)

The Moody’s database is an adequate tool to define average default rates for each rating categories and to monitor changes in the default rates within the various categories during the economic cycles. According to the database, the average long-term PD of the Baa2 rating category is 0.107%, that is practically the same as the 0.1% average PD assigned to the portfolio of our model bank with a ‘good’ rating, therefore, in our analysis we presume that this portfolio will behave during the cycle as the portfolio rated Baa2 by Moody’s. Similarly, the average long-term PD for Moody’s Ba1 rating category is 0.636%, that corresponds with the

Table 2

Assumptions relating to LGDs

	$PD5 < PD24 \cdot 0,5$	$PD24 \cdot 0,5 \leq PD5 < PD24 \cdot 0,75$	$PD24 \cdot 0,75 \leq PD5 \leq PD24 \cdot 1,25$	$PD24 \cdot 1,25 < PD5 \leq PD24 \cdot 1,5$	$PD24 \cdot 1,5 < PD5$
LGD	35%	40%	45%	50%	55%

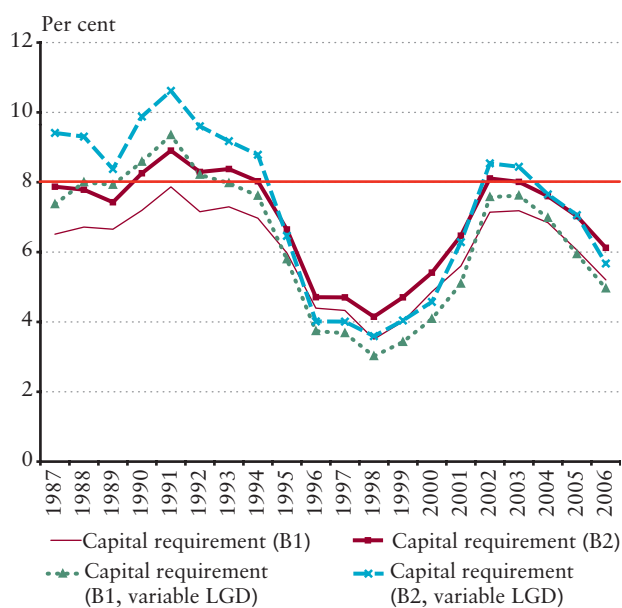
Note: ‘PD5’ means the 5-year average PD, while ‘PD24’ means the long-term (24-year) average PD.

⁸ For more details concerning the findings of the studies and a list of references, see Zsámboki (2007).

0.5% PD assigned to the portfolio of our model bank with 'average' rating. As for the portfolios rated 'poor' we apply two alternative assumptions: one is to make calculations for the B1 rating category, whose average PD is 3.132%, and for the B2 rating category with an average PD of 7.004%. The share of each rating category within the entire corporate portfolio is determined in accordance with QIS 5.

Chart 2 contains a summation of our calculations and shows the supposed trends in the capital requirements of banks covering expected losses during the period under review, if we were to calculate them according to the Basel II rules, and if we were to apply the positive correlation between PDs and LGDs. Apparently, there is considerable fluctuation in corporate capital requirements in spite of applying a 5-year average PD, that has a smoothing effect on the cycles in question. Moreover, relative to the fixed 45% LGD hypothesis, variations in LGD, depending on the PDs, have an additional cycle-strengthening impact on capital requirements. The chart below indicates the supposed course of capital requirements under B1 and B2 ratings for the 'poor' category.

Chart 2
Changes in corporate capital requirements



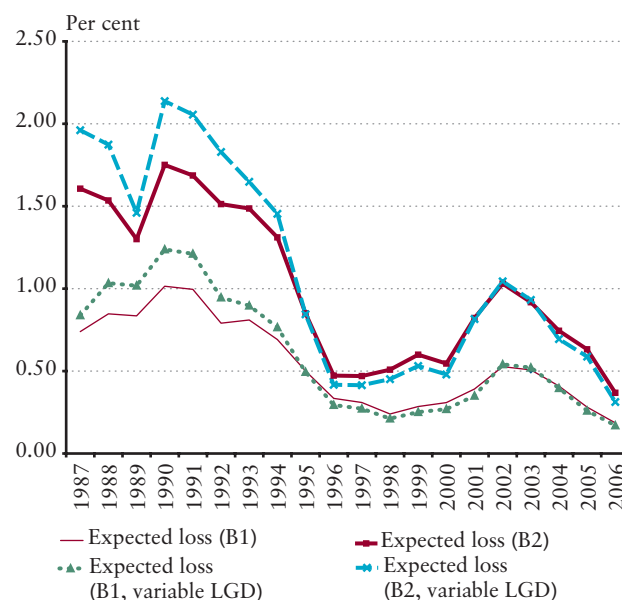
The results indicate that capital requirements remain, on the average, below the 8% prescribed in Basel I, and that they could be somewhat higher in times of recession, or drop to close to half in times of economic boom. It is also apparent that our alternative assumptions on the portfolios with 'poor' rating have only moderate effect on the level of capital requirements, and they do not influence the shape of the curve materially. Consequently, if we were to apply the changes in the average PDs, and the positive correlation

between PDs and LGDs, capital requirements may vary considerably, even assuming a constant portfolio composition.

CYCLICALITY OF EXPECTED LOSSES

Leaving our PD and LGD assumptions unchanged, Moody's database can be used for the estimation of expected losses as well. Chart 3 demonstrates changes in expected losses during the period under review. Contrary to the results contained in the previous chapter, our alternative assumptions on the portfolios with 'poor' rating have a substantial impact on the size of expected losses; the difference between the need for making provisions could be twofold. Furthermore, it is also apparent that the amount of expected losses was significantly higher during the early 1990s, when the deterioration in portfolio quality mostly affected the portfolios with 'poor' rating, while deterioration in portfolio quality during the early part of 2000 surfaced in the 'average' and 'good' categories, which did not have a major impact on expected losses, but did have a considerable impact on capital requirements, as risk weight functions are more sensitive to any decline in the quality of exposures with higher ratings.

Chart 3
Changes in expected losses



The combined effect of expected and unexpected losses, i.e. provisioning and capital requirements is demonstrated through a simple example. If our model bank has a corporate exposure of EUR 100 million in 1998, which is considered as a year with a low default ratio, and the composition of portfolio in terms of rating and the correlation between risk parameters is consistent with our previous assumptions, our bank should have to set aside EUR 212,000 in provisions for

expected losses if the portfolio was rated B1, with EUR 3 million in capital requirements according to Basel II. Under the same conditions, in 2002, which was considered a recession year, the requirement for provisioning would have been EUR 541,000, with EUR 7.5 million in capital requirements. What all this indicates is that significant changes are expected to take place over a span of a few years in terms of capital requirements and provisioning, even if the portfolio composition remained unchanged.

IMPACT OF CHANGES IN PORTFOLIO COMPOSITION ON CAPITAL REQUIREMENTS

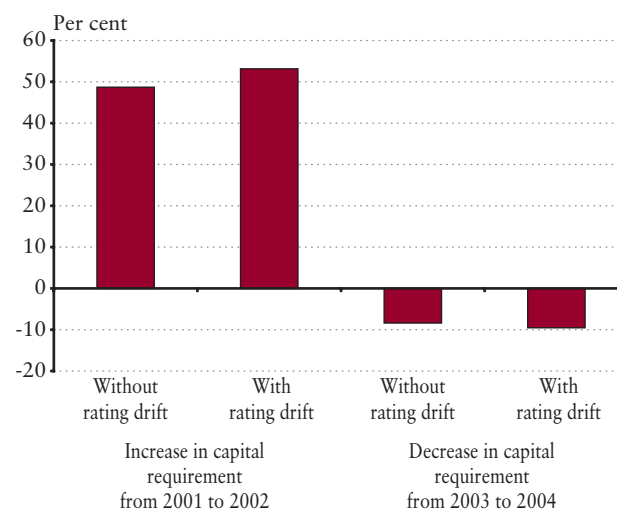
Up to this point, we have applied the same portfolio composition throughout the analysis. However, in times of recession ratings tend to drop, while they are more likely to improve when the economy is booming. This process is seen in the transition matrices calculated on the basis of Moody's database. Changes in the portfolio composition can be estimated based on these transition matrices. Although credit rating agencies prefer to classify their clients in a manner that bridges several economic cycles, it is apparent that changes in their rating tend to follow changes in the economy, i.e. they are procyclical. For the purposes of analysis a year of recession (2002) and a year when the economy was growing (2004) was selected to demonstrate the effects of migration in ratings. The original portfolio composition, calculated on the basis of QIS 5, and hypothetical changes in portfolio composition estimated based in the transition matrixes are shown in Table 3.

Relying on this new portfolio composition we can estimate changes in the capital requirements during the two years under review. The results of these calculations are shown in Chart 4.

Although, according to our calculations, the effects of migration in ratings is not overly significant as regards changes in capital requirements, monitoring these developments might prove important for some undercapitalised banks, as any unfavourable changes in

Chart 4

Estimated effects of migration in ratings on changes in capital requirements



portfolio composition increases their capital requirements, and consequently, it will take less time to deplete their capital reserve, which in turn will force them to face the imposition of regulatory minimum requirements.

CONCLUSIONS

On the basis of Moody's corporate database we examined the hypothetical changes in the capital requirements of banks for the 1987-2006 period, with regard to movements of risk parameters (PD and LGD) within an economic cycle, under varying assumptions as to their correlation. According to our findings, the regulatory minimum requirements calculated by the advanced Basel II method could range within a broad spectrum during the cycle, and it could double within a few years, or may be cut in half, even if we use for the estimation of PDs a 5-year average. Furthermore, we wish to point out that the correlation between risk parameters has the potential to significantly enhance fluctuation in capital requirements. Consequently, it is of particular importance for banks to build up capital reserves above the regulatory minimum requirements when the economy is booming, in order to

Table 3

Estimated effects of migration in ratings on portfolio composition

Quality band	Share (QIS 5)	Estimated share (2002)	Estimated share (2004)
Good	38.5	34	43
Average	31.8	31	30
Poor	27.8	33	25
Defaulted	1.9	2	2
SUM	100	100	100

cover any future losses and any increase in capital requirements.

Another important issue, naturally, is how binding regulatory capital requirements are on banks, and how much institutions tend to rely on their own internal capital calculation models in the process of making business decisions (such as pricing, lending intensity, etc.). These models are typically set to estimate PDs for shorter periods, and they do not attempt to classify their clients in a manner that bridges economic cycles, hence movements in their internal capital requirement could be greater. Consequently, even if regulatory capital requirements are not effectively restrictive upon banks, changes in risk parameters in terms of time could still have an impact on their actions. Keeping a close eye on these factors should be essential for the authorities responsible for promoting financial stability, just as provisioning procedures. In the absence of proper provisioning practices the indicators on capital adequacy cannot be considered reliable, as in this case capital would serve to cover expected losses to some extent as well.

Both insufficient provisions and undercapitalisation could have an impact on the actions of banks and, under unfavourable economic circumstances, some banks in tight capital positions might be forced to cut back their lending activities. The ensuing short supply of loans then may result in further decline in economic growth, which in turn may enhance fluctuations in the real economy, and could compromise the stability of the financial system on the whole, particularly in times of recession. Through the pricing

of bank funds, the market's disciplinary power may play an important role in forcing banks to take a more cautious approach and to follow prudent behaviour even in the case of appropriate capitalisation in times of economic boom. Under Pillar 2 of Basel II, i.e. the supervisory review procedure, supervisory authorities also have a responsibility of paying proper attention to the adequate capitalisation of banks, in response to the expected growth in fluctuations in capital requirements.

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