Procyclicality of the financial system and financial stability: issues and policy options

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1. Introduction

In recent decades, developments in the financial sector have played a major role in shaping macroeconomic outcomes in a wide range of countries. Financial developments have reinforced the momentum of underlying economic cycles, and in some cases have led to extreme swings in economic activity and a complete breakdown in the normal linkages between savers and investors. These experiences have led to concerns that the financial system is excessively procyclical, unnecessarily amplifying swings in the real economy. In turn, these concerns have prompted calls for changes in prudential regulation, accounting standards, risk measurement practices and the conduct of monetary policy in an attempt to enhance both financial system and macroeconomic stability.

In this paper, we examine these concerns and discuss possible options for policy responses. It is not our intention to formally model the complex interactions between the financial system, the macroeconomy and economic policy. Rather, we have the more modest goal of stimulating discussion on some of the key linkages between developments in the financial system and the business cycle. Our main focus is on the intrinsically difficult issues of how risk moves over the course of a business cycle and on how policymakers might respond to reduce the risk of financial instability, and attendant macroeconomic costs, that can arise from the financial system's procyclicality.

A common explanation for the procyclicality of 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, these firms are able to gain access to external finance and this adds to the economic stimulus. This explanation of economic and financial cycles is often known as the "financial accelerator".[2]

While the financial accelerator presumably plays a role in all business cycles, it is not sufficient to generate the widespread financial instability that periodically leads to very large swings in economic activity. In this paper, we argue that an additional material source of financial procyclicality is the inappropriate responses by financial market participants to changes in risk over time.[3] These inappropriate responses are caused mainly by difficulties in measuring the time dimension of risk, but they also derive from market participants having incentives to react to risk, even if correctly measured, in ways that are socially suboptimal.

The measurement difficulties often lead to risk being underestimated in booms and overestimated in recessions. In a boom, this contributes to excessively rapid credit growth, to inflated collateral values, to artificially low lending spreads, and to financial institutions holding relatively low capital and provisions. In recessions, when risk and loan defaults are assessed to be high, the reverse tends to be the case. In some, although not all, business cycles these financial developments are powerful amplifying factors, playing perhaps the major role in extending the boom and increasing the severity and length of the downturn. We argue that the worst excesses of these financial cycles could be

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[2] It has a long history, reaching back at least to Fisher (1933), and has recently been subject to extensive theoretical modelling by, amongst others, Bernanke and Gertler (1995) and Kiyotaki and Moore (1997). For a recent survey, see Bernanke et al (1999).

[3] In recent times, although from a somewhat different perspective, the role of financial excesses has been stressed by, amongst others, Kindleberger (1996) and (1995) and Minsky (1982).

mitigated by increased recognition of the *build up* of risk in economic booms and the recognition that the *materialisation* of bad loans in recessions need not imply an increase in risk.[4]

These measurement biases, which we argue go hand in hand with economic agents being better at measuring *relative* than *absolute* risk, can arise from a variety of sources. One such source is difficulties in forecasting overall economic activity and the link with credit losses; difficulties in assessing how *correlations* of credit losses across borrowers and, more generally, across institutions in the financial system change over time are part and parcel of the same problem. This tends to contribute to excessively *short horizons* and to an extrapolation of current conditions into the future. The short-term focus is also encouraged by incentive structures that reward short-term performance, and by certain aspects of accounting and regulatory arrangements. We argue that good risk management requires both a horizon for measuring risk that is longer than one year – the typical industry practice – and a consideration of system-wide developments. Not only would such an approach contribute to the soundness of individual institutions, it would also reduce the financial amplification of economic cycles.

Looking forward, proposed changes to the way in which bank capital is regulated are likely to increase the importance of accurately measuring changes in the absolute level of risk. The proposed changes are primarily designed to rectify current problems with *relative* capital charges. They represent a major step forward in aligning regulatory capital charges with the relative riskiness of banks' credit exposures (eg public sector versus private sector, high- versus low-risk corporates). As such, they significantly strengthen the soundness of individual institutions. At the same time, the proposed changes will naturally result in capital requirements on a *given* portfolio changing over time, as the assessed risk of that portfolio evolves. If risk is measured accurately, this has the potential to further enhance banks' soundness and reduce the procyclicality of the financial system. However, exploiting this additional potential arguably calls for improvements in current risk measurement practices and/or greater reliance on the supervisory review process. The New Basel Capital Accord, which proposes a strengthening of the supervisory review process, could provide a sounder basis for such increased reliance.

To the extent that procyclicality stems from inappropriate responses by financial system participants to changes in risk over time, we argue that there is a case for a public policy response. Four types of responses are possible. The first is the promotion of a *better understanding of risk*, through the publication of risk assessments by the authorities or through supervisory reviews of risk management practices. The second is the establishment of *supervisory rules* that, while not explicitly contingent on the cycle, promote better measurement of the time dimension of risk and make the financial system more robust to misperceptions of risk. Examples of such rules include requiring longer horizons for risk measurement, the use of stress testing and forward-looking provisioning. The third is the use of supervisory instruments in an explicitly *countercyclical* fashion in an effort to limit the development and consequences of serious financial imbalances. The common element of the two supervisory responses is that they directly or indirectly *encourage the building-up of a protective cushion in good times that can be drawn down in bad times.* The fourth response is to use *monetary policy* in an effort to contain the development of financial imbalances. We see scope for the application of all four types of policies, although we argue that *discretionary* countercyclical adjustments in either supervisory instruments or monetary policy aimed directly at addressing financial imbalances should only occur in those cycles in which financial overextension is playing a pre-eminent role.

Throughout the paper, we stress the endogeneity of the business cycle with respect to the collective decisions of financial institutions. In other words, misperceptions of the evolution of risk over time and inappropriate responses to it, as reflected in lending and financial investment decisions, serve materially to amplify economic fluctuations. At the same time, *it is important to emphasise that the appropriateness of the policy options we discuss does not hinge on this premise.* These options would still apply even if the course of the economy were completely unaffected by decisions in the financial sphere. Underestimating the risk of a downturn in economic activity and its impact on credit losses, as reflected in financial institutions' lending, provisioning and capital decisions, can be sufficient to generate financial instability. Policies designed to limit instability need to take this into account. *This is true regardless of whether that instability takes the form of financial distress at individual institutions,*

[4] See also Crockett (2000a) and (2000b) and Borio and Crockett (2000). This perspective is also emphasised in Kent and D'Arcy (2001).

typically the supervisors' concern, or of system-wide difficulties. Factoring in the financial amplification of economic fluctuations simply reinforces the argument for a policy response.

The remainder of the paper is structured as follows. Section 2 begins by setting out various definitions and concepts of risk. It distinguishes between relative and absolute risk and pays particular attention to the concept of systematic risk. It then discusses why the measurement of the evolution of risk over time – particularly its systematic component – is especially susceptable to error, and why, even if it were measured properly, financial market participants might still respond inappropriately. Section 3 briefly documents the procyclicality of the financial system. It provides a brief overview of the main stylised relationships between, on the one hand, business and financial cycles and, on the other, the performance of the banking industry and measures of financial system risk. In particular, it stresses how various measures suggest that assessed risk falls during upswings and increases during downswings. It also indicates that, at least in those countries that have experienced widespread financial difficulties, the capital cushion rose only after the bad loans materialised, and then started to decline when the economic upswing became firmly entrenched. Section 4 examines in more detail the risk measurement methodologies currently employed by banks, rating agencies and supervisors. It documents the focus on relative risk, the limited headway made in measuring correlations and, in most cases, the short-term horizon employed, all factors that can potentially promote misperceptions of risk. Section 5 focuses more specifically on capital and provisions and their relationship to risk. It lays out a normative framework against which their observed evolution can be assessed. It argues that capital and provisions should, in principle, rise as booms mature so as to act as an effective buffer once risk materialises in the downswing. It then considers factors that can help explain the observed cyclical patterns, focusing primarily on regulatory, accounting and tax elements, and briefly discusses the potential impact of the New Capital Accord. Section 6 examines the impact of practices and regulations concerning loan-to-value ratios and of the supervisory review process on procyclicality. Section 7 then discusses possible policy responses to cycles in systematic risk, and finally the Conclusion provides a brief summary of the main points of the paper.

2. Risk: concepts, measurement and incentives

"Risk" is a multifaceted concept. In order to understand better the themes developed in what follows, it is necessary to clarify various definitions and dimensions of risk. Of particular relevance are the distinctions between expected and unexpected losses (in the statistical sense), between relative and absolute risk, between idiosyncratic and systematic risk and between the risk of individual portfolios and that of the financial system as a whole. Armed with this classification, we then develop the basic thesis of the paper. In particular, we lay out the reasons why financial system participants may tend to misassess the evolution of risk over time, especially the systematic component associated with economic activity, and to respond to it in ways that may be socially suboptimal, thereby sowing the seeds of financial instability.

2.1 Basic terminology: definitions and dimensions of risk

One popular way of characterising risk is to describe it in terms of a probability distribution over future outcomes. In the case of credit risk – the focus of this paper – the term "risk" is normally used to refer to at least two quite distinct concepts, namely expected and unexpected losses, depending on which features of the distribution one focuses on.[5] "Expected losses" refer to the average or mean losses anticipated over a particular period, while "unexpected losses" refer to a measure of the dispersion, or degree of uncertainty that surrounds that outcome. This second notion of risk is closer in spirit to classical definitions of risk.

[5] Of course, as amply demonstrated in the paper, credit risk and market risk are intimately related, as asset prices are a major cause of credit losses and as market gains on certain instruments, by generating market losses to counterparties, increase the likelihood of their default. The Asian and Russian crises were prime example of this. Box 1 addresses the relationship between credit risk and market risk, broadly defined as deriving from asset price movements generally. See eg Borio (2000) (and references therein) for a discussion of the relationship between market risk on marketable instruments and credit risk at times of stress, including the implications for market liquidity. Several of the policy lessons are analogous to those drawn in this paper for credit risk at business cycle frequencies.

To illustrate the two concepts, consider two banks of the same size. Bank A makes 100 loans for $1 million each, while Bank B makes only one loan, but for $100 million. Suppose that all loans have a 5% chance of default with no recovery in case of default, and that the correlation between defaults is zero. Both portfolios have expected credit losses of $5 million, and therefore the two banks would be viewed as equally risky using the first concept of risk. However, using the second concept, Bank B is clearly more risky. It has a 5% chance of losing the entire $100 million, while Bank A has virtually no chance (precisely $(0.05)^{100}$) of losing this amount. By virtue of Bank A's diversification, there is relatively little uncertainty about its future returns.

In the course of the paper, we use the term "risk" to refer to both the level of expected losses and the potential for large unexpected losses. When the analysis refers specifically to one or the other concept, we make this distinction clear.

Whether measuring the value of expected losses or the potential for large unexpected losses, it is important to distinguish between two dimensions of risk: relative and absolute risk.

Relative risk relates to the risk, in a cross section, of a particular financial instrument, portfolio or institution. This is the dimension involved in statements such as "Bond A is riskier than Bond B" or "Institution X is more risky than Institution Y".

Absolute risk relates to the specific value that the measure of risk takes at a particular point in time. Much of the paper relates to how the level of absolute risk varies over time. In what follows, we refer to this as the time dimension of (absolute) risk. For example, the statement "Portfolio X is more risky today than it was last year" concerns this time dimension of risk.

Focusing now on absolute risk, it is useful to distinguish between the risks of portfolios, institutions and groups of institutions (or "the system as a whole"). A bank, for instance, will be concerned with the credit risk associated with its portfolio of loans which, through the capital cushion, will map into the risk of default of the institution. This is also the risk with respect to which regulatory capital requirements are set. Crucially, the risk in the portfolio will depend on the correlation of the risk of default of the bank's counterparties. In much the same way, the risk of a group of institutions, or the system as a whole, will depend not just on the risk of the component institutions but, importantly, on the correlation between the risk of the individual institutions.

To bring out more clearly the relationship between the risk of individual institutions and that of the system as a whole, one can think of the financial system as a portfolio of securities, with each institution representing a security. The overall risk of the portfolio is not just the sum of the risk of individual institutions but depends fundamentally on the correlation between them. This distinction will play a key role in much of what follows. For instance, if capital requirements were to be set with a view to limiting the risk of the system as a whole, they might look rather different than if they simply focused on the risk of each institution separately, as is currently the case (see Section 5).[6]

Pursuing further the analogy with the portfolio of securities, the risk for each of these two types of "portfolios" can in turn be broken down into two components, the systematic and *non-systematic* (or *idiosyncratic*) component (Box 1).[7] The systematic component is, by definition, the one associated with the correlation between the component securities.[8] Conceptually, it can be thought of as arising from exposures to common factors, such as specific industries or the business cycle. There can, of course, be several such factors. In what follows, we will focus primarily, and somewhat loosely, on the systematic risk arising from exposure to the common factor associated with the business and financial

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6 These points are elaborated in Crockett (2000b), where the supervisory perspectives that focus on individual institutions and the system as a whole are referred to as, respectively, "microprudential" and "macroprudential".

7 A useful exposition of these concepts as applied in portfolio theory can be found in standard finance textbooks, such as Elton and Gruber (1991).

8 This is also the component that cannot be diversified away simply by adding securities to the portfolio.

cycle.[9] In particular, we pay special attention to its time dimension. This can refer to the systematic risk in individual portfolios or banks or, depending on the context, to the system as a whole.[10]

2.2 The measurement of systematic risk: challenges and views

Measuring the time dimension of risk, especially its systematic component, is fundamentally difficult. For an individual institution it entails assessing not only how the riskiness of each individual borrower is changing over time, but also how the correlations between borrowers are changing. From the point of view of the system as a whole, a further complexity is the need to understand the correlations amongst individual financial institutions that arise from their exposure to common factors. In addition, while an individual institution might reasonably assume that the evolution of the economy is exogenous with respect to its actions, this is not true for the system as whole. The actions of individual institutions collectively affect the health of the economy, and the health of the economy affects the collective health of individual institutions.

Understanding the evolution over time of the systematic component of risk and hence the endogenous relationships between the financial sphere and the macroeconomy is central to the measurement of financial system risk. In particular, experience indicates that widespread financial system stress rarely arises from the contagion or domino effects associated with the failure of an individual institution owing to purely institution-specific factors. More often, financial system problems have their roots in financial institutions underestimating their exposure to a common factor, most notably the financial/business cycle in the economy as a whole.[11] This form of instability is also the more costly in terms of output forgone, with costs sometimes estimated to run well into double digits as a percentage of GDP.[12]

Despite this, there is no consensus as to how the overall level of risk in the financial system moves over the economic cycle. As Section 4 explores, many of the risk measurement methodologies used by banks, rating agencies and bank supervisors imply that risk falls during booms and periods of financial market stability and increases only during recessions and periods of financial turmoil. The view developed here is that it is better to think of risk as increasing in booms, not recessions, and that the increase in defaults in recessions simply reflects the materialisation of risk built up in the boom.

At its heart, the difference between these two views reflects a difference in opinion about the nature of economic processes that underlie the business cycle.

The view that regards risk as moving in line with current economic conditions is more consistent with the interpretation that the economy is best characterised by a series of frequent and small unpredictable developments, or shocks, that alter the economy's equilibrium, with the adjustment being smooth and rapid. As a result, by default, current conditions are seen as the best, if rather imprecise, guide to future conditions (Box 1). This view means that any observed cycles are mainly the result of the configuration of shocks, which by definition cannot be predicted ex ante.

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9 By "financial cycle" we essentially mean the sequence of rapid expansion in credit and asset prices, often accompanied by a relaxation of price and non-price terms in access to external funding, that then moves into reverse and can ultimately be followed by financial distress. See Section 3.

10 What is the difference between *systematic* risk for the system as a whole and *systemic* risk? One possible way of thinking about it is that systemic risk refers to the risk faced by the system as a whole, regardless of the source. For instance, systematic risk would not cover self-fulfilling crises driven by liquidity concerns (Diamond and Dybvig (1983)) or contagion from the failure of an institution due to purely idiosyncratic factors (eg gross mismanagement of operational risk) unless these causes are in turn thought of as separate common factors. In addition, from the viewpoint of the financial system in a *single country*, international diversification of system-wide risk is of course possible, so that a residual idiosyncratic component remains. For some related definitions and a survey on systemic risk, see De Bandt and Hartmann (1998).

11 See Section 3. History suggests that even bank panics, or widespread bank runs, in the pre-safety net era bore a consistent relationship to the business cycle, tending to occur close after the peak (see Gorton (1988), for the United States, and Palgrave (1894), for the United Kingdom). Wood (1999) reviews this evidence critically.

12 For a review of episodes and associated costs, see IMF (1998) and Hoggarth et al (2000).

Box 1

The basic hypotheses: a slightly more formal treatment

This box attempts to couch the basic hypotheses about the time dimension of risk that underpin our thinking in a factor analysis framework. In this framework, individual asset returns are assumed to have a systematic component which is a function of a number of stochastic risk factors common to all and an idiosyncratic component specific to the individual asset. For given stochastic properties of the factors, the sensitivities to each common risk factor are known as factor loadings and determine the correlation between any two assets' returns.

From this perspective, one can think of the basic hypotheses put forward in the paper as translating into statements about the stochastic properties of the risk factors and the factor loadings. In understanding this translation, it is important to realise that the main focus of the paper is on credit risk. Statements about credit risk require some mapping between asset returns and credit losses. The asymmetric nature of credit risk plays a significant role here. While the framework outlined above explains the fluctuation of asset prices in terms of the variation in the set of risk factors, credit risk relates to events that are realised in extreme negative states. Consider these points in turn.

The paper concentrates primarily on the behaviour of one specific factor, which for the moment can be thought of as overall economic activity. Other factors, such as the degree of sectoral diversification, are not explicitly considered, although they are obviously relevant for the assessment of systemic risk in the financial system. The basic claim made is that the stochastic process of the factor in question has some well defined time-varying properties. Specifically, it is argued that *movements in the factor are at least partially predictable and have a mean-reverting element.* This can be best thought of as representing the sequencing, not necessarily regular in timing, of upswing and downswing phases in economic activity. The obvious alternative would be to assume that the factor follows a random walk and is, in this sense, "unpredictable". The main text attempts to provide some economic justification for these different views.

One key implication of the mean reversion property is that if output is above trend, the (conditional) probability of a downswing increases with the forecast horizon. This implication underlies the bulk of the conclusions. And it holds regardless of whether financial mechanisms are a causal factor behind the cycle. As long as credit losses rise in a downswing, both expected and, under typical assumptions about their probability distribution,[1] unexpected losses would rise as the upswing proceeds.

The mapping between asset returns (as determined in the framework outlined above) and credit losses has some significant implications for the time properties of credit risk. These arise from the variables involved in the mapping, namely debt and the level of equity prices relative to the contractual value of debt, which can help in arriving at statements about the probability of default and loss given default, two key components of credit losses.

First, if asset returns are mean reverting, credit losses will also be mean-reverting. The time series pattern of the latter, however, is likely to exhibit greater "clustering", because in "good states", when equity prices are high relative to debt levels, defaults will be low, but they will be high in bad states. Likewise, it might be expected that, all else equal, loss given default would follow a similar pattern, at least for those credits backed by forms of collateral whose value is procyclical. One way of thinking of this is that in credit loss or default space the factor loading on (contemporaneous) business conditions is high in bad states and low in good states. This puts a premium on the need to rely on longer horizons.

[1] For example, the result follows automatically for binomial or Poisson distributions for the probability of default (Saunders (1999)) even disregarding correlation effects, which are discussed below.

Second, for *given* correlations of asset returns, correlations of credit losses will be higher, the higher is the probability of default.[2] The intuition is that the probability of one borrower defaulting conditional on another borrower doing the same is a decreasing function of its credit quality. That is, this probability is higher the closer the value of the borrower's assets is to that of its debt (ie the closer is the firm to its insolvency boundary). Thus, in contrast to asset returns, other things equal, higher expected losses also imply higher unexpected losses through this correlation effect. In addition, higher volatility of asset returns implies higher probabilities of default. This tightens the relationship between asset price volatility and default losses and correlations.

Third, in economic terms, there are a number of reasons why correlations of credit losses might be expected to rise in a downswing, more so than correlations of asset returns. During this phase, the actual incidence of defaults is more likely to reflect movements in the common factor than idiosyncratic elements specific to individual borrowers. For much the same reason, losses given default are likely to be more highly correlated. The changes in behavioural patterns that are typically associated with financial distress would contribute to heightening further these correlations and could lead to a stronger positive relationship between defaults and losses given default compared with normal times. In addition, credits have a strong "ageing effect",[3] whereby default rates peak three to four years after the credits have been granted. Since more new loans and bonds are issued as the upswing gathers pace, defaults would tend to bunch up with a lag. Any systematic misperceptions and underpricing of risk in the upswing would, of course, reinforce this phenomenon, by increasing vulnerabilities in balance sheets.

Here again, any mean-reverting, predictable element in the common factor plays a significant role. As a result of this property, lengthening the horizon would "telescope" the corresponding ex ante (conditional) correlations into the upswing phase. In other words, such (conditional) correlations would increase as the upswing proceeds.

Several empirical regularities regarding financial variables seem to be broadly consistent with the picture just described. The mean-reverting element over long horizons in asset returns, including equities, has been amply documented. The same is true of the relationship between these returns and business conditions, at least over periods spanning some of the shorter postwar cycles.[4] Measured asset correlations are known to rise, alongside volatility, during bear markets, peaking during periods of financial stress.[5] There is evidence of a negative relationship between credit quality, as proxied by credit ratings, and historical correlations of default. [6] And defaults of course tend to bunch up during recessions.[7]

[2] See Zhou (1997), Gersbach and Lipponer (2000) and Erlenmaier and Gersbach (2001).

[3] See, for instance, Saunders (1999) and references therein.

[4] For equities, see Fama and French (1988) and, in particular, Fama and French (1989), which also examines the relationship to business conditions and corporate spreads.

[5] For correlations, see Eng et al (1994), Solnik et al (1995) and Lin et al (1994), and for volatility, see eg Schwert (1989). There is a debate about how far the well documented increase in correlations during times high volatility, and hence possibly financial stress, reflects changes in underlying behavioural patterns or is purely a statistical property (eg Forbes and Rigobon (1999) and English and Loretan (1999)).

[6] See Lucas (1995).

[7] See also Carey (2000), who shows that simulated tail losses on portfolios, drawing randomly from "good" and "bad" years from a rating agency's database of loss experience on bonds, differ substantially. The author also notes that the difference does not capture the range of possible outcomes, since the period available (1970-98) does not include experience with a depression or with severe stress in many specific industries.

The view we prefer emphasises the relevance of sporadic but larger unpredictable developments, such as a clustering in technological innovations, and structural behavioural patterns that result in a cyclical response in the economy. Accordingly, the forces that lead to the upswing carry the seeds of the subsequent downswing. The financial cycle supported by credit expansion, asset price developments and their interaction with expenditure decisions, in particular capital accumulation, is a prime source of the cyclical pattern.[13] Such cycles cannot be predicted exactly. And their amplitude, length and characteristics will depend in part of the nature of the original unpredictable developments or triggers and the policy response.[14] But they are in the nature of economic processes. Moreover, there are observable factors that can be relied upon to help form useful conditional judgements about the likelihood and severity of recessions and financial system problems, although their timing may be close to impossible to establish with any precision (Box 1).[15] Such factors can be used as inputs into assessments of systematic risk.

The difference in the two views is not surprising given the experience of forecasters in predicting short-term macroeconomic developments. Despite recent research suggesting that a number of financial variables are useful in predicting recessions, macroeconomic forecasters have a poor record in predicting the exact timing of recessions or turning points in the business cycle.[16] This record has led some to eschew incorporating business cycle effects into risk measurement methodologies. To the extent that these methodologies focus on risk over a one-year horizon, this might be a reasonable approach. However, if longer horizons are used, as we argue should be the case, the approach is less justifiable. While a long-running business expansion might continue for another year, it is much less likely that it will continue for another five years. *Being able to predict the exact timing of a downturn is by no means necessary to design an appropriate response to it.* Using longer horizons would help lessen some of the emphasis on short-term forecasting, and promote a more thorough analysis of financial vulnerabilities associated with business and financial cycles. This would promote better assessments of systematic risk.

2.3 Factors underlying misperceptions of, and inappropriate responses to, risk

More generally, it is worth standing back and examining the set of factors that can result in either misperceptions of risk per se or inappropriate responses to it. Observationally, however, it is often hard to distinguish between the two.

The first set of possible factors includes the use of the "wrong" model of the economy to interpret developments. The economics profession is now accustomed to analysing economic processes on the assumption that agents understand what drives the economy and have sufficient information to infer, up to an unbiased error, where the economy is going (so-called "rational" or "model-consistent" expectations).[17] This assumption may be helpful in capturing the behaviour of agents in a very stable environment, where economic processes are characterised by regular, recurrent patterns.[18] It is less

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[13] In this sense, this view has a long historical tradition. For example, the Austrian school, with its emphasis on waves of technological innovation and the role of credit in generating or supporting unsustainable booms, through their interaction with capital formation, is highly relevant here (eg von Mises (1912), Hayek (1933) and Schumpeter (1939)).

[14] The potential amplitude of the financial cycle just described arguably depends on the set of institutional arrangements in the financial and monetary spheres. For example, during the period when high inflation coexisted with less liberalised financial markets, expansions would more naturally be brought to an end by contractionary monetary policy aimed at containing inflation. The scope for the financial cycle is likely to be greater when inflation is under control and markets are liberalised. See Crockett (2000a) and Borio and Crockett (2000) for an elaboration on these issues from a historical perspective and Gertler and Lown (2000) for evidence consistent with this hypothesis in the United States since the 1980s.

[15] In the terminology of Box 1, output growth would be seen to follow a random walk, rather than having a mean-reverting component.

[16] See, for instance, Andersen (1997), Artis (1996) and Granger (1996).

[17] The formalisation of this very influential view goes back to Muth (1961) and Lucas (1976). After some resistance, it has become the prevailing paradigm, mainly because of the perceived intellectual ad hocery of alternative views and the difficulties of rigorously modelling looser notions involving rational learning. See also Lucas and Sargent (1979).

[18] Even then, the fact that economic outcomes in turn depend on the beliefs themselves raises daunting identification problems. Ironically, it is precisely the endogeneity of beliefs with respect to the economic environment that has made rational expectations so influential and useful in analysing policy.

well suited, however, as a description of the evolution of beliefs in the real world. The observation of reality is generally not sufficient to adjudicate between alternative hypotheses in a definite way. Beliefs can reasonably differ, even substantially, without necessarily being contradicted by events, depending on the priors held by individuals and the weight that they attach to different observations.[19] An obvious example is the debate about the scope and implications of the so-called New Economy and the present wave of technological change.

This approximate "observational equivalence" of different paradigms can provide fertile ground for the formation of persistent misperceptions of risk. It can do so by failing to anchor expectations sufficiently tightly to the actual economic environment. The measurement of systematic, as opposed to idiosyncratic risk, is more likely to involve such misperceptions, not least owing to the dearth of observations available regarding business cycles in comparison with the relative default experience of borrowers and the conceptual difficulties involved, as discussed above.[20] Beliefs can therefore be more vulnerable to the attraction of short-cuts, such as the use of short-term horizons and extrapolative expectations, or to cognitive biases.

Two types of well-documented cognitive biases consistent with the misperceptions of risk stressed in this paper are "disaster myopia" and "cognitive dissonance".

Disaster myopia refers to the tendency to underestimate the likelihood of high-loss low-probability events.[21] This, in turn, derives from certain cognitive biases, confirmed by psychological controlled experiments, which indicate that individuals tend to put excessive weight on recent events and too little weight on those whose likelihood is regarded as "too" small.[22] Cognitive dissonance refers to the tendency to interpret information in a biased way, so that it reinforces the prevailing belief entertained by the economic agent.[23]

These cognitive biases could easily generate perceptions of risk that move procyclically. As the expansion proceeds, the memory of the materialisation of risk diminishes and incoming data are interpreted as reinforcing the view that the economy is moving along a sustainable higher expansion path. What are short-run cyclical movements are perceived as part of a new, longer run trend. This process then moves into reverse, as actual defaults and other incoming information unambiguously contradict the prevailing paradigm.

In addition to misperceptions of risk, complementary explanations of excessive procyclicality point to actions that, when taken in isolation, may appear reasonable, if not compelling, but that collectively add up to undesirable social outcomes. In other words, risk may be correctly perceived, but the response to it may not, in the aggregate, be appropriate. This outcome may result from a failure to internalise the consequences of the actions of others, the impossibility of coordinating responses or simply the fact that the costs would be borne by other groups in society.

Certain types of response may be reasonable when seen from the perspective of individual agents regardless of what the others do.[24] For instance, in a downturn, it may be compelling for an individual bank to tighten lending terms.[25] Others, faced with the similar situation, would have the incentive to do

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19 One version of this notion, known as "rational beliefs", has recently been formalised by Kurz (1997) and (1998), who also derives implications for the behaviour of financial markets generally and asset prices in particular.

20 In statistical terms, the problems of limited power that plague tests of the validity of estimates of the tails of probability distributions for market risk (Kupiec (1995)) are therefore compounded in the case of credit risk (eg Saunders (1999)). The problems are particularly acute in the case of estimates of parameters such as correlations of default (McCallister and Mingo (1996)).

21 See the original treatment by Guttentag and Herring (1984) and (1986). See also Herring (1999) for a discussion of disaster myopia in the context of recent techniques for the measurement and management of credit risk.

22 These are known, respectively, as "availability heuristic" and "threshold heuristic". On the former, see Tversky and Kahneman (1982); on the latter, see Simon (1978) and Slovic et al (1977). Kunreuther et al (1978) contains experimental evidence in favour of these hypotheses. See also Herring (1999).

23 The theory was developed by Festinger (1957).

24 This is known as the "prisoner's dilemma" or more correctly, in the case of many agents, the "tragedy of the commons".

25 This is almost certainly the case if others do not tighten. It also makes sense if others do tighten, since 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. The exception might be highly concentrated banking systems.

likewise. The result, however, would be a widespread reduction in the availability, and increase in the cost, of external funding, which would protract the slowdown. Analogous incentives might help lengthen the upswing. In the pursuit of long-term profits and out of fear of losing customers, lenders can face strong incentives to keep lending.[26] But if everyone does so, at some point overextension may result.

Other courses of action may appear reasonable from the perspective of individual institutions precisely as long as others do likewise. This can result in so-called "herding behaviour", where agents conform their behaviour to that of their peers.[27] Herding may relate to the use of information, in which case it could be a direct source of misperceptions of sustainable asset values and risk.[28] More generally, it can provide fuel for lending booms and contractions, amplifying the financial cycle. Arguably, the most common factor behind herding behaviour is reward structures that limit blame in the case of collective, as opposed to individual, failure. There may be, for instance, a strong tendency not to blame individual managers for the failure of their bank if failures are widespread. Collective failure would signal homogeneous managerial skills, pointing to realistically small gains from a change in management.[29] Moreover, the authorities might be perceived as more likely to support institutions in the event of widespread financial difficulties in an attempt to limit the severity of the crisis.[30] In such situations, the pressure to conform to the norm can be quite strong. Formal compensation schedules that emphasise relative performance can exacerbate this tendency.[31]

More generally, inappropriate responses to risk may derive from shortcomings in contractual arrangements.[32] Arrangements that stress short-term performance are one such example. If rewards are front-loaded in comparison with penalties, there is little incentive to take a longer-term view.[33] The problem is compounded if remuneration is not risk-adjusted. Such arrangements, in fact, are quite common. Obvious cases in point include the payment of fees up front and of bonuses related to unadjusted profitability or to the volume of business, such as to loans extended or funds under management.[34]

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[26] For instance, in interviews following the Asian crisis, bankers noted that they were indeed cognisant that the spreads "dictated" by the market underpriced risks, but that they had strong incentives to keep lending (invest in securities) owing to longer-term considerations. See CGFS (1998).

[27] Devenow and Welch (1996) provide a short review of rational theories of herding behaviour. Not all such herding behaviour need result in undesirable collective outcomes. Herding may also reflect cognitive biases and more deep-seated traits of human nature (eg Daniel et al (1998) and Prast and Herding (forthcoming)). Evidence of herding has been documented for institutional investors (Nofsinger and Sias (1999)), for investment newsletters (Graham (1999)), for stock prices (Avery and Zemsky (1998)) and for bank lending decisions (Jain and Gupta (1987)). Welch (2000) has also found evidence that herding in the advice of securities analysts based on the prevailing consensus is more likely to take place when the outcome later turns out to be wrong, pointing to undesirable collective outcomes.

[28] The theory of so-called informational cascades is one such example. See, for instance, Bikhchandani et al (1992) and Barnejee (1992).

[29] See, for instance, Rajan (1994).

[30] Acharya (2000) shows formally how this can result in herding behaviour that is socially suboptimal, as systematic risk is increased excessively.

[31] For example, formal assessment of performance in relation to the median is common in the asset management industry in the United Kingdom (Blake et al (1997)).

[32] Note that what are referred to here as shortcomings in contractual arrangements may represent difficulties in reconciling fundamental differences in interests and perspective. For example, a diversified shareholder would not be concerned with the idiosyncratic risk associated with the share in an individual company/bank nor, given limited liability, would it care about the loss given failure, as a regulator would. The oft-heard complaint by managers or risk controllers that shareholders are demanding returns not commensurate with risk may reflect at least in part such differences in perspective, quite apart from any overly optimistic expectations about risk/return trade-offs.

[33] Herring (1999), for instance, discusses the benefits of having risk-based compensation systems.

[34] A common explanation for distorted incentives leading to increased likelihood of systemic distress is the moral hazard associated with mispriced implicit or explicit government guarantees, such as those associated with bailout expectations or deposit insurance schemes. This can indeed fuel lending booms, sowing the seeds for subsequent crises. At the same time, the value of the corresponding implicit subsidies would, if anything, move countercyclically alongside perceptions of risk, falling in booms and increasing in recessions.

The bottom line is that several, often related and mutually reinforcing factors provide fertile ground for misperceptions of risk, or inappropriate responses to it, that can lead to excessive procyclicality in behaviour. By the same token, they can also amplify the financial and business cycles. These factors are reflected in financial quantity and price indicators that behave as if risk was perceived to decline in the upswing and rise only once it materialised. Such excessive waves of apparent optimism and pessimism in turn heighten the risk of financial instability.

3. Financial and business cycles and financial indicators of risk

Empirical evidence is generally consistent with the view that the procyclicality[35] of the financial system can be at the root of financial instability and that measures of risk behave as if risk declined during the upswing phase and rose only close to the peak or as the downswing set in. While it is beyond the scope of this paper to present new evidence, it is helpful to document in stylised terms the highly cyclical nature of the financial sector and of measures of financial system risk.

The procyclicality of credit and asset prices has been amply documented and is summarised for a sample of industrial countries in Figures 1 and 2. Periods of robust economic growth tend to be associated with significant increases in the ratio of credit to GDP, and recessions with declines in this ratio. Likewise, episodes of strong credit growth tend to go hand in hand with large increases in equity and property prices, and, to varying degrees, these prices tend to decline as credit contracts in the downswing.[36] *Ex post*, a financial cycle is clearly apparent.

There are, of course, several possible reasons for such co-movements. And there is a debate regarding how far developments in the financial sphere cause, rather than reflect, the evolution of economic activity. This is true, in particular, for those changes in the cost and availability of external financing associated with imperfect substitutability between internal and external funding,[37] such as the easier extension of credit as the net worth and value of collateral held by borrowers increases. There are, however, good a priori grounds to believe that the process feeds on to itself. Moreover, it also stands to reason that the influence of financing constraints should become especially relevant as economic agents, suppliers and recipients of funds alike, face financial distress. In industrial countries, typical examples include the financial "headwinds" that appeared to inhibit the recovery following strains in the US banking system in the early 1990s and more recently, the serious difficulties faced by the Japanese economy following the banking crisis.[38] More generally, the recent record of financial crises, especially those in Latin America and Asia in the 1990s, amplified by boom and bust movements in international capital flows, has been interpreted as providing evidence of a sizable causal role of financial factors.[39]

Above all, experience suggests that overextension in the financial system, in the form of rapid credit expansion and unusually sharp increases in asset, especially property,[40] prices during the economy's

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35 To avoid confusion, in what follows the movement in a financial indicator is said to be "procyclical" if it tends to amplify business cycle fluctuations. According to this definition, for instance, provisions behave procyclically if they *fall* in economic upswings and *rise* in downswings.

36 Formal econometric evidence on credit/asset price cycles in industrial countries can be found in Borio et al (1994). Kent and D'Arcy (2001) examine four major credit and property price cycles and their relationship with financial stability in Australia since the 1870s.

37 This is the "financial accelerator" hypothesis, as articulated in detail by Bernanke et al (1999) in particular. Much of the formal statistical evidence testing this hypothesis relies on panel data and applies to the United States (Hubbarb (1998). More recently, the hypothesis has been tested with some success with time series macroeconomic data, with the spread between low- and high-quality corporate bonds being used as a proxy for the premium on external funding costs (Gertler and Lown (2000)).

38 See Gibson (1995) and Peek and Rosengren (1997) and (2000) for evidence that Japanese banking troubles had real effects. Hancock and Wilcox (1998) provide similar evidence for US banks.

39 See for example the papers in Gruen and Gower (1999).

40 Borio et al (1994), BIS (1993) and various issues of the BIS Annual Report document in detail the behaviour of residential and commercial real estate prices across countries. A classic reference on historical cycles in property prices in the United States is Hoyt (1933).

upswing, tends to sow the seeds for subsequent strains in the financial system, once the movements reverse. In the industrial world, this was the case, to varying degrees, in those countries that experienced banking system problems in the early 1990s, including the United States, Japan, the United Kingdom, Australia, Sweden, Norway and Finland. Similar evidence can be gleaned from the more virulent episodes of financial instability in emerging market countries in the 1980s and 1990s, where boom and bust cycles tend to be more pronounced.[41]

While the behaviour of credit and asset prices just described is broadly consistent with the view that assessments of risk are procyclical, more direct evidence can be obtained from the evolution of credit spreads on bonds traded in financial markets, credit ratings and bank provisions.[42]

Typically, bond spreads are negatively correlated with the business cycle, with spreads between corporate and government securities tending to narrow in booms and widen in recessions or in periods of financial turmoil. As an illustration, Figure 3 shows the evolution of credit spreads in the United States and Korea. In the United States, spreads generally narrowed in the run-up up to the recession that began in late 1990 and then widened during the recession.[43] Spreads also increased during late 1998, in the aftermath of the Russian debt default and the problems experienced by the hedge fund Long-Term Capital Management.[44] The data for Korea focus on this latter period and show that spreads did not widen before the crisis, but increased by nearly 600 basis points at the same time that the currency was depreciating dramatically.

The picture is not fundamentally different if the ratings from credit rating agencies are examined. For instance, Figure 4 shows the recent movement of sovereign credit ratings for Korea and Thailand assigned by the three largest credit rating agencies, Standard & Poor's, Moody's and Fitch IBCA. In both countries, ratings were stable during the period of rapid growth, and were only adjusted after the currencies depreciated dramatically; in Korea's case, repeated downgrades saw the country's rating fall from a AA credit to a junk rating in a matter of months. Then, as currencies strengthened, credit ratings were upgraded. More generally, the evidence suggests that credit rating agencies fail to predict changes in the probability of crises, with downgrades occurring during a crisis, rather than before.[45]

Bank provisions are even more strongly procyclical, being highly negatively correlated with the business cycle (Table 1). Figure 5 shows that provisions typically do not increase until after economic growth has slowed considerably and often not until the economy is clearly in recession. This pattern is clearest in Australia, Sweden, Norway and Spain. In each of these cases, provisions failed to increase substantially in the late 1980s, when credit and asset prices were growing rapidly and the financial imbalances were developing. In each case, the peak in provisions did not occur until at least one year after the economy had clearly slowed. In Japan, the picture is broadly similar, with the level of provisions increasing substantially only in the second half of the 1990s, long after the problems in the Japanese banking system had been widely recognised.[46]

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41 For instance, a review of the 1997 Asian crisis stressing these elements can be found in BIS (1997). The role of lending booms, possibly fuelled by financial liberalisation and increasing competition, is stressed, among others, by Gavin and Hausmann (1996), Honohan (1997), Kaminsky and Reinhart (1999), Gourinchas et al (1999) and Eichengreen and Arterta (2000). The dearth of data on property prices makes it hard to test formally for their significance, although their role has been widely recognised; see BIS (1997).

42 In addition, recently Lown et al (2000) have provided evidence for the United States on the procyclicality of non-price terms on lending.

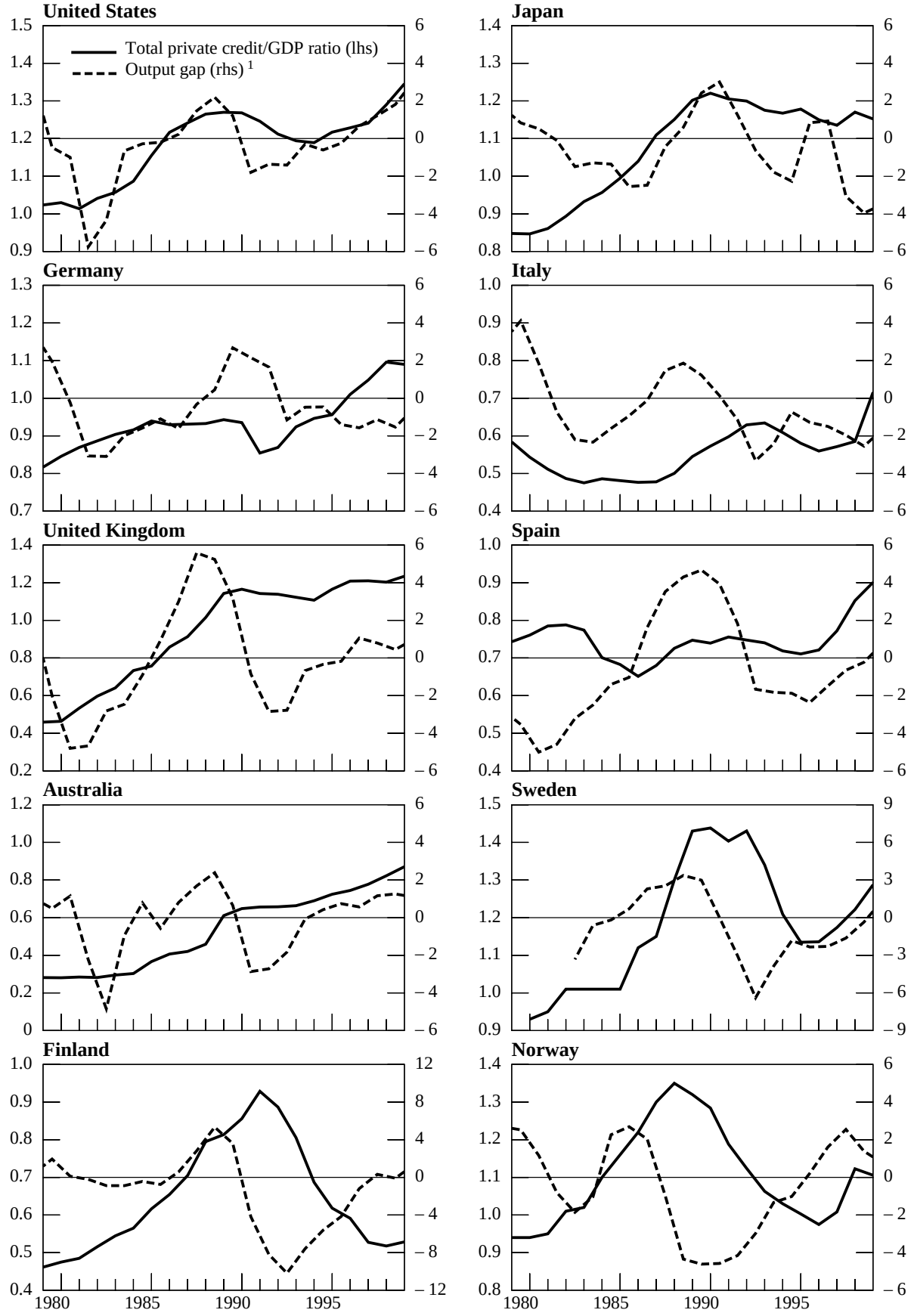
43 Gertler and Lown (2000) find that, in addition to moving contemporaneously with economic activity, the spread between low- and high-quality corporate bonds has some leading indicator properties at one-year horizons. See also Fama and French (1989) for a historical perspective on the relationship between the corporate yield spread and business cycles.

44 Formal econometric evidence of emerging market spreads consistent with this picture can be found in Cline and Barnes (1997), Eichengreen and Mody (2000a) and Kamin and von Kleist (1999). A similar analysis for spreads on syndicated loans can be found in Eichengreen and Mody (2000b).

45 For example, Haldane et al (2000) report that Moody's and Standard and Poor's downgrade sovereign ratings *prior* to a crisis in less than 25% of cases. In most instances, the downgrades occur during, or immediately after, the crisis.

46 The (low) positive correlation between provisions and the business cycle in the United states appears to be driven by the surge in provisions in the second half of the 1980s, which would seem to reflect mainly the delayed cleaning of balance sheets following the developing countries' debt crisis of the early 1980s.

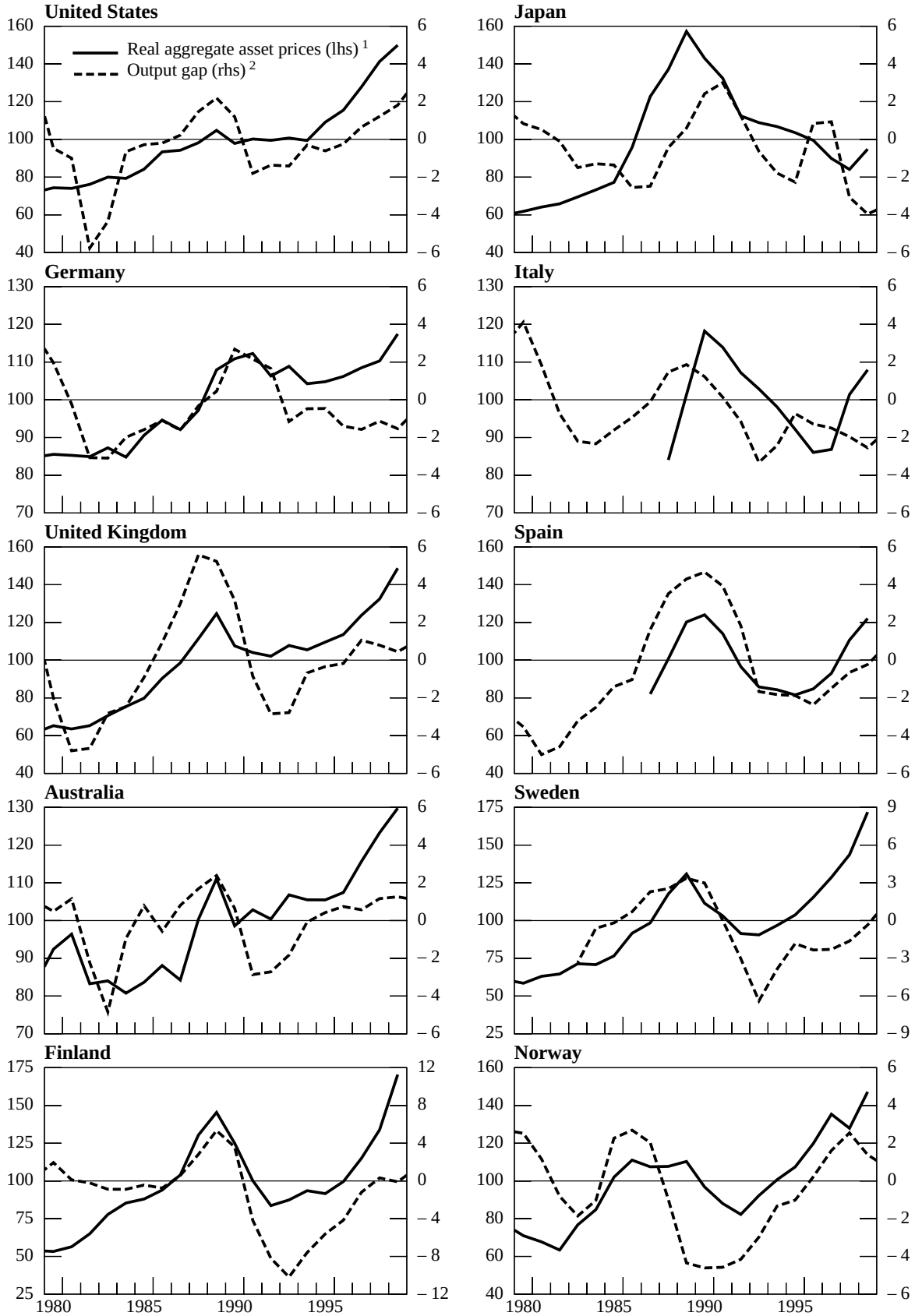
Figure 1: Total private credit



[1] As calculated by the OECD.

Sources: OECD Economic Outlook; national data.

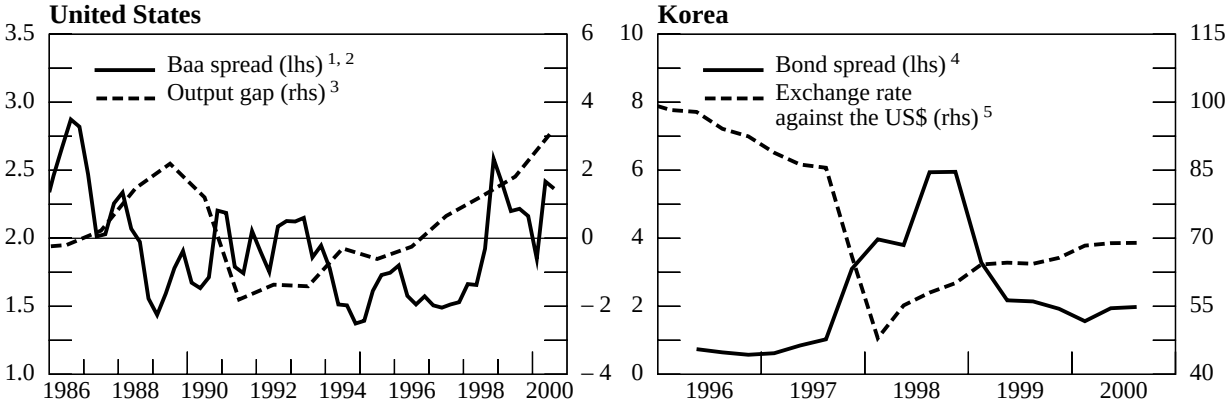
Figure 2: Real aggregate asset prices



[1] Indices, 1980-99 = 100 (for Italy, 1988-99; for Spain, 1987-99); weighted average of equity and residential and commercial real estate price indices deflated by consumer prices; the weights are based on the composition of private sector wealth.
[2] As calculated by the OECD.

Sources: OECD Economic Outlook; BIS calculations.

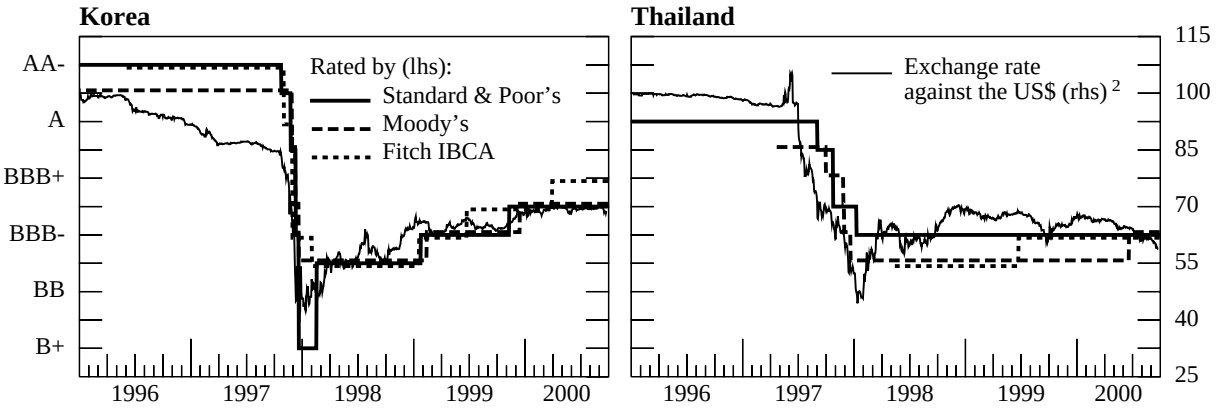
Figure 3: Credit spreads



[1] In percentage points. [2] Spread between corporate and 10-year government bond yield. [3] As calculated by the OECD. [4] Spread between US$ denominated sovereign bond and US Treasury bond. [5] Index end-1995 = 100.

Sources: Board of Governors of the Federal Reserve System; Datastream; Moody's; OECD Economic Outlook; national data.

Figure 4: Sovereign credit ratings [1]



[1] For long-term foreign currency debt; in the notation of Standard & Poor's methodology. [2] Index end-1995 = 100.

Sources: Datastream; Fitch IBCA; Moody's; Standard & Poor's.

Table 1

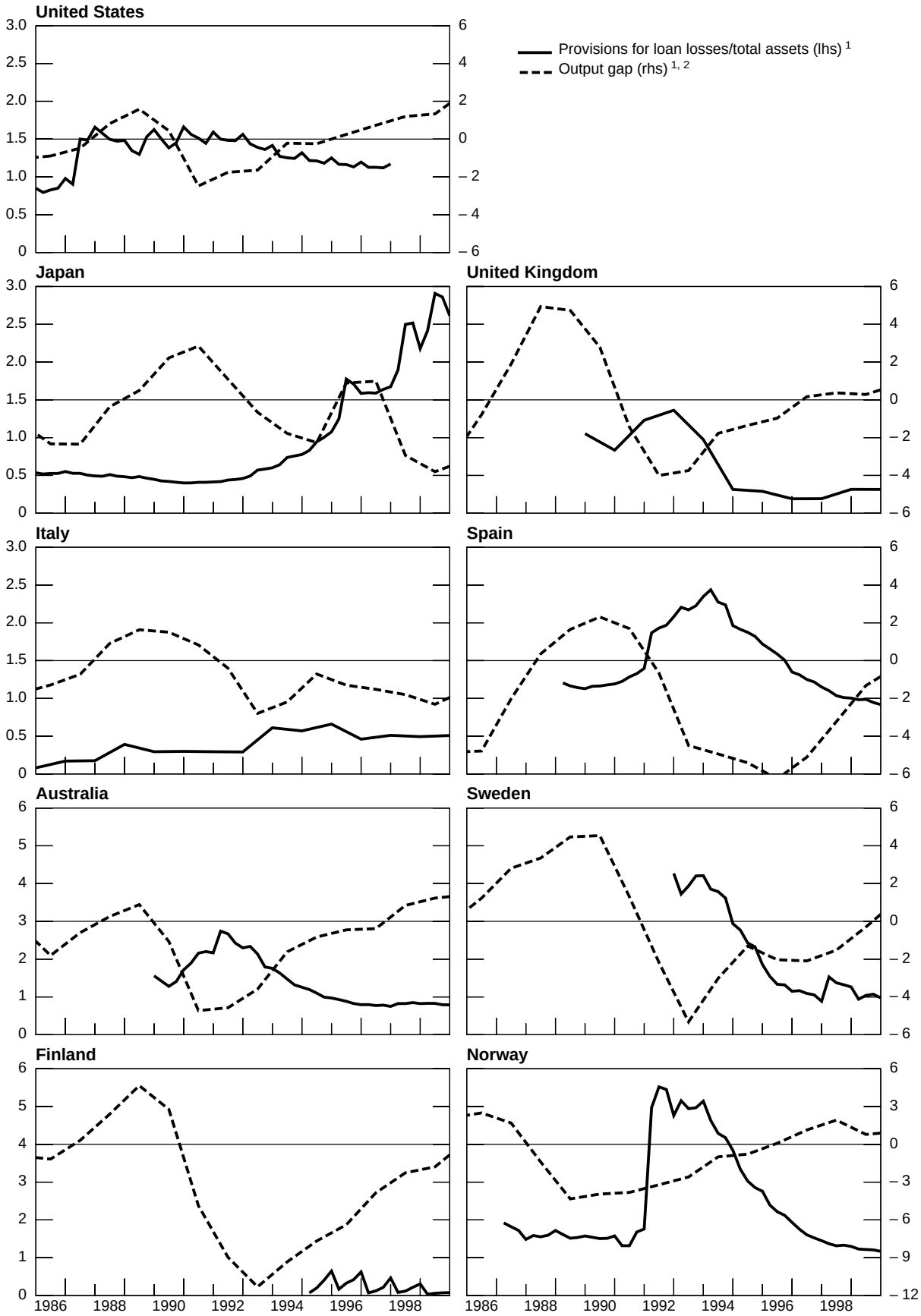
Correlations between the output gap and measures of banking system performance

	Correlation between current output gap and bank:			
	Provisions	**Profitability**	**Equity prices**	**Capital**
Australia	– 0.88	0.71	0.47	– 0.39
Finland	–	0.81	0.43	0.04
Germany	– 0.21	– 0.42	0.18	0.20
Italy	– 0.21	0.25	0.10	– 0.25
Japan	– 0.43	0.22	0.30	– 0.25
Norway	– 0.35	0.54	0.03	0.41
Spain	– 0.41	0.84	0.32	0.06
Sweden	– 0.83	0.60	0.26	– 0.16
United Kingdom	– 0.38	0.12	0.26	0.26
United States	0.14	0.24	0.12	– 0.04

Notes: 1. Profitability = gross profit/total assets; provisions = provisions for loan losses/total assets; capital = capital/total assets; equity prices = deviation of real equity prices (calculated with the CPI) from a log trend (using the HP filter). 2. Data periods vary across series. For most countries, equity prices from at least 1980 are used. For profitability, provisions and capital, data generally commence in the 1980s.

Sources: OECD; BIS survey; BIS calculations.

Figure 5: Bank provisioning



[1] In percentages. [2] As calculated by the OECD.

Sources: BIS survey; OECD Economic Outlook.

In large part, the behaviour of provisions translates into a clear procyclical pattern in bank profitability, which further encourages procyclical lending practices. This pattern appears to be strongest in those countries that experienced banking system problems in the 1990s (Table 1). German banks are the only exception to this procyclical behaviour, given their ability to smooth profits through hidden reserves. The procyclical nature of bank profits has arguably also contributed to bank equity prices being positively correlated with the business cycle, although the correlation is typically somewhat weaker than that for profitability, reflecting the forward-looking nature of the equity market.

The relationship between the business cycle and bank capital is less obvious (Table 1 and Figure 6). While it is clear that the level of bank is positively correlated with the economic cycle, there does not appear to be a robust relationship between measured capital ratios and the business cycle. To some extent, the task of detecting any relationship is made difficult by the introduction of the Capital Accord in 1988, which some have argued caused a structural change in capital ratios in some countries.[47] Analysis is also complicated by the fact that government support schemes have influenced capital ratios. Nevertheless, long-run historical time series do not suggest a strong business cycle effect, with the main stylised fact being a steady decline in capital ratios over the 20th century, before a slight increase over the past decade or so.

At the same time, there are two important qualifications to the conclusion that capital ratios tend to be acyclical. The first is that, to the extent that provisions underestimate expected losses in expansions, *measured* capital ratios overstate *true* capital ratios in expansions. This effect can be significant. For example, if the ratio of provisions to total assets is 1 percentage point below where it should be, then the measured capital ratio is likely to overstate the true capital ratio by at least 10%. If adjustments were made to capital for underprovisioning in economic booms, it is likely that, all else constant, measured capital ratios would fall during expansions and increase during downswings.

The second qualification is that there has been a pronounced cycle in aggregate capital ratios over the 1990s in those countries that experienced problems early in the decade. In the years immediately after the crisis, when conditions were still relatively depressed, banks made a concerted effort, not only to rebuild their capital ratios, but also to substantially increase them above previous levels. Then, starting in the middle of the decade, when economic expansions were firmly entrenched, some of the increase in capital ratios was unwound. This pattern is evident in Australia, Sweden and Norway, and to a lesser extent in Finland.[48]

Further, the cycle in the ratio of capital to risk-weighted assets was much more pronounced than the cycle in the ratio of capital to total assets. This reflects the fact that, in the aftermath of the banking crises, risk-weighted assets fell more strongly than total assets, as banks shifted their portfolios away from commercial lending (which has a relatively high risk weight) towards residential mortgages and public sector securities (both of which have relatively low risk weights).

Overall, these various indicators suggest that perceived risk in the financial system does not increase in business cycle expansions, and that it may actually decline during periods of robust economic growth. They also suggest that typically risk is assessed to have increased only when credit losses materialise, rather than when the problems that underlie the losses are building up.[49] These risk assessments sit uncomfortably alongside recent experiences, which suggest that business cycle expansions underpinned by rapid credit growth, large increases in asset, especially property, prices and high levels of investment (particularly in the property sector) can sow the seeds of subsequent financial system problems. While incorporating the lessons from these experiences into risk measurement systems is not straightforward, doing so would help improve the way in which risk is assessed to evolve over time.

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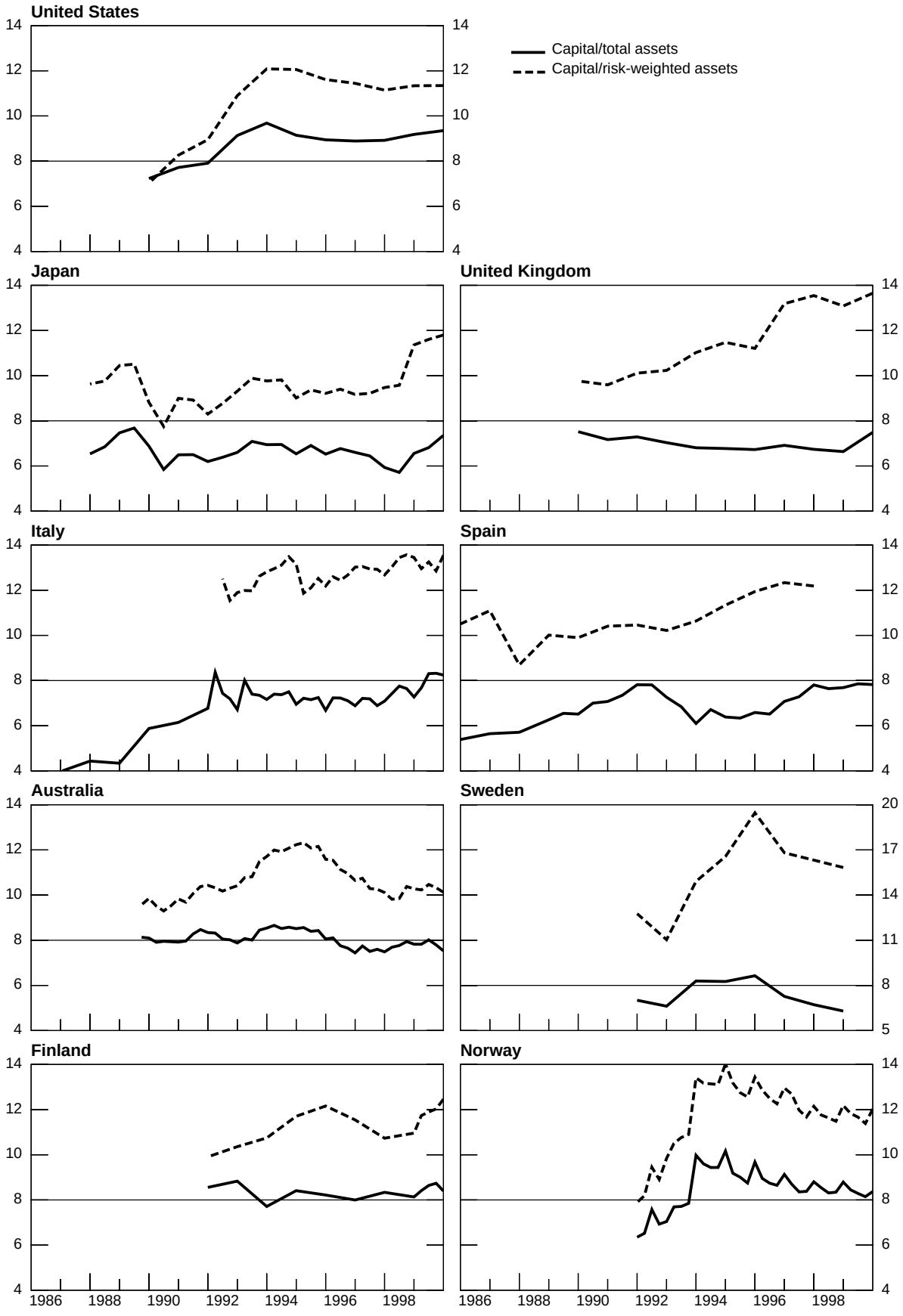
[47] For a survey of the impact of the Basel Capital Accord, see BCBS (1999a).

[48] In Section 5, we consider the reasons for this.

[49] One set of alternative explanations of analogous patterns in asset price behaviour seeks to explain them as reflecting changes in equilibrium required returns by risk averse investors. For instance, Fama and French (1989) document how corporate bond spreads and dividend-price ratios are comparatively high in weak business conditions and low in strong conditions and how these variables can help to forecast future corporate bond and equity returns. Low dividend yields or spreads tend to be followed by sup-par asset price performance. This is interpreted as reflecting comparatively low (high) required returns in good (bad) times. See Campbell et al (1999) for an overview of attempts to explain asset returns along these lines.

Figure 6: Capital-asset ratios [1]



[1] In percentages.

Sources: BIS survey; OECD Bank Profitability.

4. Risk measurement methodologies

As argued in Section 2, a number of factors could explain possible misperceptions of, and inappropriate responses to, risk and contribute to the observed procyclical behaviour in market indicators of risk documented in Section 3. Here, we review in more detail the main risk measurement methodologies actually employed in the financial system, including banks' internal rating systems, ratings by credit rating agencies, credit risk models and the approaches used by bank supervisors and other policymakers. We argue that while, in general, these methodologies are well suited to addressing relative risk, they have difficulty in measuring the systematic component of risk associated with financial and business cycles. This difficulty stems from the relatively short horizons that are often used to assess expected and unexpected losses and from insufficient attention being paid to the movement of correlations over time.

4.1 Commercial banks' internal rating systems

Many banks have recently increased the attention paid to the quantification of risk. This has typically involved the development and implementation of internal grading systems, which classify loans into specific risk categories or ratings.[50] These internal ratings are used as inputs into decisions regarding pricing, capital allocation and provisioning.[51]

Most internal rating systems have a "point-in-time" focus and use a one-year horizon for measuring risk. This means that the systems are designed around the idea of measuring the probability of default over the next year. The choice of a one-year horizon is driven by a variety of factors, including the availability of data, the internal budgeting cycle of the bank, and the interval in which new capital can be raised or loss mitigation action taken.[52]

The nature of the internal rating systems means that the average rating of a bank's loan portfolio is likely to change over the course of the business cycle. When economic conditions are strong, loans are likely to move up the rating scale (to lower-risk ratings) given that the probability of default in the next year is relatively low. Conversely, in an economic downturn the average rating is likely to decline, given the increased probability of default in the short run. As a result, measured risk, as revealed by average internal ratings, is likely to be negatively correlated with the economic cycle - that is, it falls in booms and increases in recessions.

The correlation issue is not relevant for simple rating schemes, although it is critical in assessments of overall portfolio risk; see Section 4.3.

4.2 External rating agencies

The approach used by most credit rating agencies attempts to rate borrowers "through the cycle". This means that ratings are less likely to move over the course of the business cycle, with borrowers being rated on their probability of defaulting in a constant hypothetical downside scenario.[53] Ratings will only change over time if the rating agency changes its assessment of the probability of default in the downside scenario, or changes the scenario itself.[54]

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50 For a recent survey of banks' internal rating systems, see BCBS (2000a).

51 For example, English and Nelson (1998) use survey information for United States banks to document the fact that lower-rated credits are charged a higher price (both in terms of interest rates and non-price terms of credit).

52 See the survey by the BCBS (2000a). The survey also notes that banks that use a longer horizon do so because their exposures are typically held to maturity and because of a lack of markets in which their credits can be traded.

53 For a comprehensive overview of the credit rating industry, its approach to measuring risk, and its successes and failures, see BCBS (2000b).

54 Carty and Fons (1994) report that during the period 1980-1993, 88% of all ratings remained unchanged over a one-year horizon. This number is lower than the 95% stability of ratings reported for the 1950-1980 period. Lucas and Lonski (1992) have also documented the volatility of ratings, reporting that 1% of issues rated AAA and 9% of issues rated Baa were downgraded to speculative grade within five years.

The through-the-cycle approach does not guarantee that the ratings will be acyclical. In particular, an economic downturn that is worse than expected is likely to lead to ratings being downgraded. Table 2 summarises evidence from a recent study that documents this empirical fact.[55] The authors' estimates show that the probability of being downgraded, particularly for bond issues at either end of the rating scale, rises during recessions and falls during booms. Despite this, it remains likely that these ratings are less procyclical than internal bank ratings (Box 2).

Historically, the agencies have been relatively successful at measuring the cross-sectional dimension of risk.[56] As discussed in Section 3, however, they have been less successful in downgrading ratings prior to a borrower defaulting.[57]

4.3 Quantitative credit risk models[58]

Given that the focus of internal and external ratings is on measuring the risk of individual instruments or borrowers, such systems do not explicitly consider the correlations between ratings and how these correlations change over time. Thus, such ratings by themselves cannot easily be used to address the credit risk of large and complicated portfolios. As a result, a number of financial institutions have recently developed, or purchased, quantitative credit risk models.

While the various models have different structures, most tend to extrapolate recent history in one way or another, so that good current economic conditions signal good future prospects.[59] Moreover, while the various approaches incorporate correlations, the treatment is often simplistic, with correlations either fixed or dependent on the recent history of financial markets.

One of the most commonly used approaches relies on equity price data and option pricing theory to construct measures of risk. In these "Merton-type" models, a rise in a firm's indebtedness, a fall in its equity price or an increase in the volatility of its equity price leads to an increase in the measured probability of default (all else constant) of the firm over the next year.[60] Even where estimates can be calculated over a multi-year horizon, the assumptions made result in simple extrapolations that effectively rule out business cycle effects. [61] The correlations between firms are derived on the basis of past movements in equity prices.

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55 See Nickell et al (2000).

56 See Moody's (2000). A more scientific documentation of the success that rating agencies have had in distinguishing the cross-sectional dimension of risk can be found in Brand and Bahar (1999) and Keenan (1999).

57 More generally, credit ratings are less successful at measuring the time dimension of risk. For instance, Cantor and Packer (1994) document that the default rates associated with each rating change significantly over time. For example, over the period 1970 to 1989, the five-year default rates associated with a BBB rating ranged anywhere from 0.8% to nearly 5%.

58 A review of the historical developments in credit risk modelling can be found in Altman and Saunders (1997). A summary of the most popular models currently in use can be found in Saunders (1999), which also contains an extensive bibliography on the measurement of credit risk. Crouhy et al (2000) and Gordy (2000) provide a more technical and detailed comparative analysis of the models.

59 While there are a number of papers that compare and contrast the different models, we know of no literature that compares how aggregate measures of risk generated by these models are likely to move over the course of the business cycle. Given the increasing importance of these models, this seems a useful area for future research.

60 The original papers on which this methodology is based are Merton (1973) and (1974).

61 One such model employing the Merton approach and allowing risk to be measured over different horizons has been developed by KMV. Since KMV forecasts equity price movements by essentially assuming that stock prices follow a random walk, increasing the horizon over which KMV forecasts expected default probabilities leads to a mechanical adjustment rather than to a thorough assessment of longer-term vulnerabilities. Moreover, the assuption fails to capture the mean reverting properties associated with equity returns over longer horizons (Box 1).

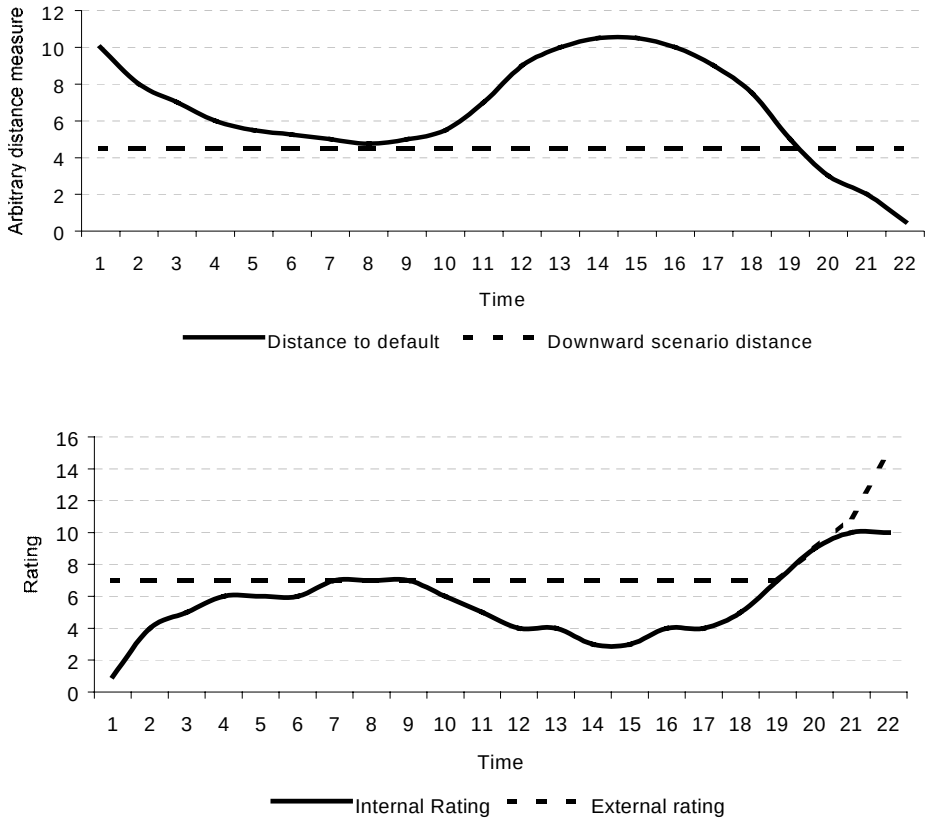
Box 2

Point-in-time and through-the-cycle measurement systems

Figure 1 depicts the behaviour of a point-in-time system and a through-the-cycle risk measurement system and has been adapted from Carey and Hrycay (2000).

The bold line in the top panel shows the distance to default. Initially, the borrower is very unlikely to default (indicated by a large distance to default), but over time the likelihood of default goes through a cycle, perhaps following the trend of the general macroeconomy. The dashed line in the top panel depicts the stress distance to default, here assumed to be 4.5, used by the external credit rating agency. When the actual distance to default falls below the stress distance of 4.5, the financial condition of the borrower has degraded beyond what the external rating agency had expected to occur in a downside scenario.

Figure 1: Point-in-time vs through-the-cycle



The bottom panel depicts how internal and external ratings would change over time. The point-in-time internal rating approach/system initially assigns the very best internal rating of 1 given the large distance to default. As the actual distance to default falls, the internal rating rises to reflect the greater risk. The external rating is, however, constant given that it was assigned based on what was perceived to be a reasonable distance during a downside stress scenario. As the figure is scaled, when the actual distance to default equals the downside scenario distance, the internal rating has adjusted to equal that given by the external rating. The other point to notice in the bottom panel is that as long as the actual distance to default remains above the stress distance, the borrower's external rating does not change. When the distance to default eventually falls below that assumed in the stress scenario, both internal and external ratings are downgraded accordingly.

Figure 1 leads to two generalisations about how external and internal ratings move over time. First, provided that rating agencies are not constantly re-evaluating the exposure of firms to the downside scenario, or the scenario itself, external ratings are likely to be more stable over time than bank internal ratings. Second, when re-evaluations occur, the time series pattern of both types of ratings will be similar, although it is possible that the rating agencies will move in larger steps.

Table 2

Downgrade probabilities (%) and business cycles

Initial rating	State of business cycle	
	Trough	Peak
Aaa	16.9	12.2
Aa	15.0	9.1
A	5.9	6.0
Baa	1.9	2.0
Ba	4.1	3.6
B	5.4	4.1
Caa	25.6	15.8
Ca/C	46.3	30.9

Source: Nickell et al (2000), Tables 6 and 7.

The procyclical nature of equity prices discussed in Section 3 suggests that Merton-type measures of credit risk may tend to fall during booms, unless debt rises sufficiently to actually increase the debt-to-market value ratios, and rise during recessions, as equity prices fall and debt takes time to be worked off.[62] More specifically, fundamental to these models' ability to measure changes in systematic risk is the requirement that the equity market reflect economic fundamentals.[63] If misperceptions of risk affect equity prices, then the implied probabilities of default are likely to themselves be distorted. Consider, for instance, the case in which misassessments of risk led to significant increases in equity prices. All else constant, this would imply a decline in the measured average probability of default, and perhaps also a decline in the corresponding correlations of default.[64] This would be so despite the fact that inflated equity values would be associated with overextension in the financial system, and thus increased risk. Thus, if the development of financial imbalances in the economy is often accompanied by overinflated stock markets, this may be a serious limitation of the methodology.

An alternative, and also widely used, approach is based on the credit rating transition matrices first developed by the external rating agencies.[65] In effect, this approach attempts to mark to market a bank's loan portfolio and then calculate the potential variability in the value of the portfolio due to changes in credit quality. It does this by assigning loans to particular ratings and then using the historical transition matrices and credit spreads to calculate the "value at risk". Correlations between individual credits are derived from equity prices in a similar fashion to that used by Merton-type models. This general approach is sometimes interpreted as being forward-looking, since a loan's current implicit price is a function of possible future events. However, these future events and their probabilities are determined mechanically by the transition matrix, and are not conditioned on any economic or financial variables. Moreover, the overall measure of risk generated by this approach depends heavily on the nature of the rating system. As we argued earlier, the rating systems themselves may well deliver procyclical measures of risk. Another source of procyclicality is the tendency for the credit spreads that are used to calculate implicit market prices to narrow in booms and widen in recessions.

62 Related to this is the fact that KMV estimates equity volatility using actual equity price movements. To the extent that volatility is greater in falling equity markets (Schwert (1998) and Hardouvelis et al (1997)), all else equal, the KMV methodology will yield lower measures of risk in upswings than in downswings (see Box 1). This, of course, is not to deny that equity prices do have some predictive power, as reflected in their widespread inclusion in leading indicators of economic activity.

63 This property is commonly referred to as "informational efficiency". Note, however, that in the presence of a time-varying risk premium, even if markets are efficient in the sense that returns in excess of equilibrium ones are unpredictable, biases may arise if the models do not take into account the mean-reverting properties of equity returns and their relationship to the business cycle. This would presumably tend to underestimate the probability of default in good times, at least over the longer horizons (see also Box 1).

64 For a given correlation in asset values, the higher the probability of default, the higher the correlation between default probabilities (see Box 1).

65 CreditMetrics is the best known example of this type of model.

Another approach focuses more narrowly on the risk of losses from defaults, ignoring the risk arising from changes in credit quality short of default.[66] A critical input to this "default-mode" approach is the bank's internal loan gradings and their associated probabilities of default. The model's ability to identify changes in systematic risk is thus inexorably linked to that of the rating system. Since a "point-in-time" rating system will tend to indicate less risk in economic booms, so too will this approach to credit risk measurement. Correlations between defaults are modelled as a function of a set of industries or country factors which are derived from historical experience.

Another approach to quantitative risk measurement explicitly incorporates the state of the macroeconomy.[67] In this approach, predicted default rates depend, amongst other things, upon forecasts of future macroeconomic variables. Since the forecasts are generated from simple time series models, the macro variables are, by construction, mean reverting processes, so that both good and bad times are not expected to last forever. The approach also allows default rates to be calculated over longer horizons using model-based forecasts for the macroeconomic variables. Like many default-mode models, the evolution of the default probability of individual credits is modelled as a function of factors, although in this case the factors are macroeconomic variables.

Although the methodologies employed by the various quantitative credit risk models vary, all models calculate the probability of individual credits either defaulting or changing quality. They further make some assumptions regarding the correlation between defaults/quality changes and between losses given default to calculate the full distribution of future losses. The main emphasis of the models is on a one-year horizon, with defaults rates or potential changes in credit quality over longer horizons being the result of mechanical adjustments that typically do not take into account business cycle effects. Whereas much effort has been devoted to forming accurate measurements of the probability of credit losses, the approach to assessing the relevant correlations remains quite simplistic. As the Basel Committee survey notes, "in virtually all credit risk models the only correlation effects considered at present are the correlations between defaults/rating migrations of different customers" (p 32). Further, most models relate these correlations to simple functions of equity prices, industrial sectors or macro variables. With regard to more sophisticated treatment of loss correlation, the "models generally assume zero correlation among the LGDs (loss given default) of different borrowers, and hence no systematic risk due to LGD volatility" (p 36). This is despite the fact that in downturns, asset prices tend to be falling, and losses on all defaults tend to be higher. More generally, it might be expected that correlations move over time (see below). In particular, during booms exposures to common factors are likely to increase, to be subsequently revealed in recessions in the form of more widespread actual defaults.

4.4 Bank supervisors

Bank supervisors also spend considerable resources on assessing risk. There is no standardised approach here, although a recent review of supervisory risk measurement practices in a number of G10 countries documented that, to varying degrees, supervisors tend to emphasise the cross-sectional or relative, as opposed to time, dimension of risk.[68]

Historically, perhaps the most common supervisory method of identifying risky financial institutions has been peer group analysis (for example, the BAKIS system used in Germany). By definition, this approach attempts to measure the cross-sectional dimension of risk and has limited, if any, ability to identify changes in systematic risk over time.

As a complement to peer group analysis, supervisors in a number of countries have developed rating systems that translate current financial information into a more scientific measure of default risk; the CAMELS and SEER approaches in the United States and the PATROL system in Italy are examples. These are point-in-time approaches and are meant either to reflect the financial condition of an institution when the rating is assigned or to forecast potential near-term distress. They are thus useful in allocating scarce supervisory resources to the most immediate problems. This focus necessitates a

[66] CreditRisk+ is the best known example of this approach.

[67] One such model of this type has been developed by McKinsey.

[68] See Van den Bergh and Sahajwala (2000) and the references therein for a more extensive discussion.

relatively short horizon that ultimately reduces the possibility of usefully incorporating assessments of systematic risk.[69] In these systems, a general decline in economic conditions would be expected to lower supervisory ratings and indicate an increase in risk in recessions. Similarly, such systems would most probably indicate a decline in risk during booms.

More recently, supervisors have developed more comprehensive assessments of the common risks facing financial institutions; the RATE system in the UK is an example. An explicit goal of this type of approach is to identify exposures to common factors across institutions and to discuss these exposures with bank management. By relying more strongly on the supervisor's qualitative assessment and beliefs about future prospects, comprehensive systems are potentially the most useful supervisory tool for effectively assessing changes in risk over time. This depends, however, on whether the supervisory horizon is sufficiently long and whether supervisory authorities can identify the important common factors that drive systematic risk.

Typically, the main focus of bank supervisors is the riskiness of individual institutions, rather than the riskiness of the financial system as a whole. In part, this reflects the fact that in most countries an important rationale for bank supervision is the protection of depositors in individual banks. While some supervisors view their mandates more broadly, their regulatory frameworks remain largely designed around their depositor protection responsibilities. As a result, historically they have not given a high priority to measuring correlations across institutions and system-wide financial vulnerabilities. Over the last few years, however, this has began to change. We now briefly consider the efforts being made in this direction.

4.5 Financial system stability policymakers

A recent focus of attention for a number of central banks and other authorities responsible for the stability of the financial system has been the identification, measurement and monitoring of *macroprudential indicators* of systematic risk.

This work has started from the proposition that macroeconomic and financial aggregates contain useful forward-looking information about vulnerabilities in the financial system. It has built on previous empirical studies that use past episodes of financial instability to uncover factors that help predict the occurrence of financial system problems.[70] These studies point to a number of variables, although the particular combination varies from paper to paper. Amongst the identified variables, exchange rate misalignments, credit booms and asset price booms seem particularly relevant.

This approach differs from the others discussed in this paper in that it is directly concerned with how risk moves over time for the system as a whole. To date, however, there has been little success in incorporating this type of analysis into quantitative indices of risk or into banks' credit risk models. Arguably, progress would call for greater and more selective attention to be paid to the recurrent features of financial cycles, including the distinction between cumulative and marginal processes and the *interaction* between different variables, as well as for a more careful treatment of relevant horizons.

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[69] Berger, Kyle and Scalise (2000) provide a useful review of the accuracy and timeliness of supervisory assessments in the United States. They note that many of the early studies concluded that supervisors did not have more timely information than market participants. More recent studies (eg Berger and Davies (1998) and Jordan (1999)), however, have suggested the opposite, with a number of papers finding that changes in regulatory ratings help predict changes in bank stock prices and yields on debentures. On the issue of accuracy, the recent research is mixed. For example, Berger, Davies and Flannery (2000) find that supervisory assessments in the United States are less accurate than those made by financial markets, with the exception that supervisors may be more accurate when inspections are recent. Berger, Davies and Flannery interpret their results as suggesting that supervisors have a tendency to be more concerned with assessing the *current* condition of the bank, rather than its *future* condition. The reason for this is that assessments of the current conditions can be used more effectively to exert pressure on institutions to resolve problems.

[70] IMF (1998) is a useful starting point for an examination of this burgeoning literature. See, for example, Kaminsky and Reinhart (1999), Sachs et al (1996), Frankel and Rose (1996), Edison (2000) and Hawkins and Klau (2000).

5. Provisions and capital

Any limitations in risk measurement methodologies discussed in the previous section would inevitably also be reflected in banks' decisions concerning provisions and capital. In turn, the procyclical behaviour in provisions and, possibly, in "true" capital reviewed in Section 3 can make banks more vulnerable to, and contribute to amplifying, financial and business cycles. Looking forward, any limitations in risk measurement methodologies are bound to have more significant implications once capital adequacy standards come to depend more closely on banks' own assessment of risk, as is proposed by the Basel Committee on Banking Supervision.[71] Likewise, policies geared to capital and provisioning are potentially key tools for addressing any excessive procyclicality in the financial system. In recent years, for instance, there have been calls for more forward-looking capital and provisioning decisions, although there is little consensus about the way in which this should be achieved.[72]

In this section, we examine these issues in more depth. We begin by setting out a simple conceptual framework for provisions and capital and for how they should vary over time. We pay particular attention to the time horizons over which risk should be measured, the impact of loan pricing on provisioning decisions, and how capital requirements designed to protect the stability of the financial system might differ from those designed to protect individual institutions. We then examine some possible reasons why actual practices differ from theoretical ideals and consider the possible implications of the recent proposals to modify the Capital Accord. This analysis forms the basis for the discussion of policy options in Section 7.

The main points are:

(i) Contrary to current practice, provisioning decisions should be based on the entire future profile of expected losses. While a shorter time horizon is relevant for capital calculations, the appropriate horizon is probably longer than one year.

(ii) Provisioning decisions should not be independent of the way in which loans are priced.

(iii) Capital and provisions should both rise during periods in which imbalances are developing in the financial system. Given that such episodes are likely to be characterised not just by an increase in the correlation of credit risk among borrowers in individual bank portfolios but also among bank portfolios themselves, higher capital ratios are particularly important from the perspective of the stability of the system as a whole. Such a rise is essential if capital and provisions are to perform as effective buffers in an economic downturn.

(iv) Accounting standards, and to a lesser extent taxation arrangements, stand in the way of proper economic provisioning. The standards contribute to artificial procyclical fluctuations in bank profitability and distort the measurement of true economic capital available to cover unexpected losses.

(v) The proposed changes to the Capital Accord will more closely align regulatory capital with measured risk. Whether or not the proposed changes increase or decrease the procyclicality of the financial system will depend, at least in part, on how well the time dimension of risk is measured. Arguably, improvements in risk measurement practices are required to reap the full benefits of the proposed changes.

5.1 Conceptual issues

As has now become widely accepted, it is best to think of the role of capital as that of providing protection against *unexpected* losses, and of the role of provisions as that of providing cover against *expected* losses.

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[71] For details of the Basel Committee's proposals see BCBS (2001).

[72] For example, the Governor of the Bank of France has recently argued that "one of the best ways of avoiding earnings volatility is to anticipate cyclical downturns by developing a system of provisioning based on new loan production" (Trichet (2000)). A similar point has been made by the Bank of Spain (Poveda (2000)). See also Crockett (2000b).

This distinction between capital and provisions is sometimes seen as artificial, since both provide the bank with similar protection against losses. It could be argued that all that matters is that the sum of capital and provisions is sufficient to cover expected and unexpected losses; if provisions are "too low", then the bank can simply hold additional capital to achieve its acceptable probability of failure.

The distinction, however, is important for at least two reasons. The first is that having provisions against expected losses (properly measured) is likely to lessen fluctuations in recorded bank profitability at business cycle frequencies even if it does not affect the solvency probability of the bank. Reducing this variability in profits could mean that bank behaviour becomes less sensitive to the economic cycle. The second is that if the balance sheet is to represent the true value of both the gross and net assets of the bank, then gross asset values need to be recorded net of expected losses. As we discuss below, given current accounting arrangements, this can only be done through the creation of provisions.

5.1.1 Provisions

In general, the value of a loan recorded on the balance sheet is equal to the bank's recorded investment (ie the amount outstanding or face value), less a provision for bad and doubtful debts. The need to create provisions arises because the loans are not recorded at market value, typically because imputed market values are either empirically difficult to obtain due to an absence of traded markets or they rely on judgemental assumptions.[73] For assets valued at market prices, as a first approximation all changes in value would be unexpected,[74] and there would be no need to create provisions against expected losses.

The *current value* of a loan *(V)* at time *t* can be thought of as being equal to *the present discounted value* of the expected future cash flows generated by the loan. That is:

$$V_t = \sum_j \frac{E\left(C_j\right)}{(1+r)^{j-t}} \qquad j = t,\ldots,T \tag{1}$$

where $E(C_j)$ is the expected cash flows generated by the loan in period j, r is the discount rate, which we take as the risk-free interest rate, and T is the point at which the loan matures.[75] If we assume that operating costs are zero, the expected cash flow in each period is given by the contracted interest and principal payments on the loan, *less* the expected value of losses from the non-repayment of the contracted amounts. Further, if F is the face value of the loan and the loan interest rate is equal to the risk-free rate plus a default premium to compensate the bank for the probability that the borrower will not repay the loan, we can rewrite the current value of the loan as:

$$V_t = F_t + \sum_j \frac{E(d_j)}{(1+r)^{j-t}} - \sum_j \frac{E(l_j)}{(1+r)^{j-t}} \tag{2}$$

where d is the *default premium* and $E(l)$ is the expected loss from non-repayment of contracted amounts. It is important to note that the fact that $E(l)$ is positive does not mean that the bank expects to incur an overall loss on the loan; the default premium also needs to be taken into account.

Given equation (2), the current value of the loan will only equal its face value if the present discounted value of expected default premiums is equal to the present discounted value of the expected losses.

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[73] Obtaining reliable estimates of market value is empirically difficult when it is hard to find a traded asset with similar characteristics. The exercise is complicated for bank loans since one reason that loans are not traded is the existence of the private information that made the loan possible in the first place. This information is difficult to convey credibly to outsiders, and as a result the value to the issuing bank is likely to be greater than to potential buyers. See eg Berger et al (1991).

[74] Strictly speaking, all changes in future asset values would be unexpected, other than those necessary to generate the equilibrium rate of return. In the following discussion, we implicitly assume that markets work efficiently. If markets were not efficient there would be predictable excess returns, and one could imagine, at least conceptually, financial accounts making allowances for these predictable returns.

[75] The issue of what discount rate should be used to value assets is keenly debated by accounting authorities, although there is a broad consensus that if cash flow assumptions reflect certainty-equivalent cash flows (as is the case here), the discount rate should reflect the risk-free rate. An alternative approach would be to discount the contracted payments with an interest rate that incorporates a risk premium. If this risk premium exactly covers the default risk the two approaches are equivalent.

This condition is most likely to be satisfied at the time of origination, although this need not be the case if pricing decisions are distorted by competition or other factors. For example, the existence of a long-term multidimensional relationship with a borrower, or the need to build market share, may lead a bank knowingly to price a loan at a rate which does not cover expected losses. In this case, the current value of this loan would be less than its face value. Conversely, if a bank enjoys market power, the current value of the loan might exceed its face value.

If provisions are to equal the difference between the face and current values of a loan, equation (2) can be easily rearranged to show that provisions equal the difference between the present discounted value of expected losses and the present discounted value of the expected default premiums, that is:

$$\text{Provisions}_t = F_t - V_t = \sum_j \frac{E(l_j)}{(1+r)^{j-t}} - \sum_j \frac{E(d_j)}{(1+r)^{j-t}} \qquad (3)$$

Two important points follow from this formulation. The first is that the *entire future profile* of expected losses and default premiums is relevant, not just the outcomes over the next year. This result is independent of the bank's ability to sell or liquidate assets over a particular horizon. This is because the current price of the loan will be affected by expected losses at any point in the future, irrespective of the time over which the bank can close out its exposure.

The second point is that if the default premium adequately compensates the bank for the expected non-repayment of principal and interest *there is no need to make a provision*. If this condition is met, the expected losses from non-repayment of the contracted amount will be exactly offset by the default premiums. If things work out as expected, the bank will not experience an overall loss. Losses worse than expected are by definition unexpected and would therefore need to be covered by the bank's capital. This point highlights the fact that provisions are needed only to cover *expected credit losses beyond those covered by the default premium built into the loan rate*.

It is sometimes claimed that a provision should be created even in cases in which overall expected losses are zero, due to the fact that a default could occur before the default premium has been earned.[76] However, while defaults can occur at any time, it cannot be the case that loans are expected to *systematically* default before the payment of interest. In expectation, the rate of default on a fairly priced loan portfolio should match the rate of accumulation of the default premiums. If this is not the case, then a provision is required.

To illustrate the implications of this approach to provisioning, consider two special cases (numerical examples are provided in Box 3):

Case 1 *Default premiums are correctly set when a loan is originated and cannot be changed over the life of the loan; at origination, the risk of default is expected to increase over time.* This case might be relevant in a period in which the bank expects economic conditions to deteriorate, and the loan rate (or at least the default premium) is fixed. Provided that the loan is priced appropriately, no provisions are required at origination. Early on, when economic conditions are good and default experience is low, the bank records strong net interest income and only a small expense for bad debts. In the profit and loss statement, however, this favourable outcome is offset by the creation of a provision to cover the fact that as time progresses the default premium built into the loan rate no longer covers the expected losses over the remaining term of the loan. This divergence arises because the default premium is fixed, while the present discounted value of losses increases over time as the expected deterioration in economic conditions gets closer. *When the deterioration eventually occurs, and defaults increase, the provisions built up in good times are drawn down, so that profits are not adversely affected in the period in which the risk actually materialises.* The end result is stability in bank profits despite the cycle in defaults.

Case 2 *Default premiums can be adjusted each period (say quarterly) and are set to cover the expected loss over the next period.* This case might capture floating rate loans in which margins are reviewed continuously. In this case, provisions are always zero, with the default premium always equal to expected losses. Any change in expected credit losses is immediately reflected in lending rates.

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[76] This argument has recently been suggested by Jackson and Lodge (2000).

While this second case is a neat theoretical example, it is not very realistic. Not only might continuous re-evaluation of default premiums not be justified on cost grounds, it might also be counterproductive as it could make the probability of default endogenous, driven up by an increase in the borrower's interest burden. Moreover, there is an extensive literature that argues that increasing loan rates might actually decrease bank profitability by causing a deterioration in the quality of borrowers. A consequence of this is that, to some extent, default spreads are relatively sticky, with changes in risk reflected in adjustments to quantities, as well as lending rates.[77] Case 1 then represents the more realistic example. It suggests that if risk increases as economic booms mature, provisions should increase even if loans are being priced accurately.

As noted above, this approach to provisioning is likely to contribute to a reduction in cyclical fluctuations in published bank profitability. Provisions would rise when loan losses were low, and would be run down when loan losses were high. Such stability is sometimes pejoratively termed "profit smoothing", and is often frowned upon by accounting and taxation authorities (see below). In this example, however, there is nothing artificial about the stability of profits. To see this, note that if we were to use market value accounting, and if market values reflected present value as specified in the example,[78] the value of the bank would also be constant over time, since we assume that nothing unexpected occurs. As mentioned earlier, provisioning can be seen as a way of replicating, *in terms of logic though not necessarily in terms of inputs*, market value outcomes within the context of a book value accounting system.

In the above example, provisions became necessary as the time profile of risk evolved in the expected fashion; in addition, this approach would suggest that provisions be created in a number of other circumstances. The first is the case in which a bank underprices a loan for reasons of competition or in order to retain a customer relationship.[79] The second is when an unexpected deterioration in credit quality occurs and loan rates cannot be adjusted. The third is when market interest rates increase and loan rates are fixed. In each of these cases, a divergence between the present discounted value of default premiums and the present discounted value of expected losses creates the need for a provision. Given these various factors, one could imagine a bank's financial statements *disclosing both the change in the level of provisions and the various factors behind the change.*

Proposals for forward-looking provisioning have been subject to two quite different forms of criticism. The first relates to the room for discretion left to banks, the second to the implications of attempting to approximate market outcomes too closely.

The first concern is that forward-looking provisioning opens up the potential for banks to artificially smooth their profits, making it more difficult for investors to assess the true position of the bank.[80] This is a legitimate concern, as the estimation of expected losses is judgmental, and it may be difficult for outside investors to assess the appropriateness of the judgments made by the bank. However, this concern can be substantially alleviated through improved disclosure by banks regarding the methods and processes that they use to calculate provisions. Indeed, it is arguable that more comprehensive disclosure combined with forward-looking provisioning is likely to give investors a better view of the true state of the bank than is currently available. Moreover, discretion could be constrained by accountants, auditors or supervisors based on clear criteria (see Section 7).

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77 At the theoretical level, this point was first developed by Stiglitz and Weiss (1981). At the practical level, ECSC (1992) documents that in the interbank market, changes in the riskiness of banks are reflected mainly in a reduced willingness of other banks to provide funds, rather than in an increase in interest rates.

78 A situation in which market values reflect the present value of fully informed estimates of future outcomes is sometimes known as "informational efficiency".

79 If the amount of the provision is left entirely up to the bank, the bank should be underpricing the loan *knowingly*. Auditors and supervisors may, of course, have the power to question and influence the amount of the provision. Herring (1999) argues that banks often cite relationships as a motivation for making loans of dubious quality.

80 For example, Goldschmid (1999) sets out the US Security and Exchange Commission's concerns about the creation of provisions against losses from events that have not yet occurred.

Box 3

Provisions, expected losses and default premiums

We begin by assuming that the bank has a portfolio of two-period loans, with each loan having a face value of $100. Further, we assume that the banks understand the time profile of risk, that the discount rate is equal to 10%, and that operating costs and the equilibrium rate of return are zero.

In the first case, we assume that the economy is currently experiencing a boom so that the probability of default in period 1 is relatively low (1%). The strong current conditions are, however, not expected to continue, leading to a higher probability of default in period 2 (3%). As outlined in the text, it is assumed that the bank does not change the loan rate after the loan is established. As a result, when setting the loan rate it must look at the entire profile of expected losses, not just expected losses in the current period. To ensure that the present discounted value of expected cash flows covers the bank's cost of funds, it would need to charge a loan rate of 12.19%. In the first period, this means that the bank is earning default premiums which more than cover its bad loan expense, so that net interest income would be relatively high. However, in the profit and loss statement, this would be offset by the need to make a provision for the fact that at the end of the period the default premium no longer covered the expected losses. With the default premium fixed at 2.19% (discounted value of 1.99) and expected losses in period 2 equal to 3.37% (discounted value of 3.06), the current provision would equal 1.07%, so that profits would be zero. In period 2, the provisioning cushion built up in period 1 would be used to compensate for the fact that the interest margin did not cover the default losses.

In the second case, the bank can adjust the interest rate at any time. We begin by assuming that the bank expects the probability of default to be constant and low (1%) through time. Thus, in the first period, it will set a loan rate of 11.11%, with the default premium of 1.11% covering the expected losses from the non-repayment of principal (0.01 x $100) and interest (0.01 x $10) in that period. Provided things turn out as expected, the interest income earned through the default premium will exactly offset the credit losses, with the bank earning zero profit. Now, at the end of period one, we assume that unexpected adverse economic events lead the bank to increase its estimate of expected losses to 3%. In this case, the bank simply increases its loan rate to 13.40% to reflect the higher default probability. Again provided things turn out as expected, profits would be zero. Provisions are not required in either year.

	Case 1: default premium is fixed		**Case 2: default premium is variable**	
	Period 1	**Period 2**	**Period 1**	**Period 2**
Discount rate	10.00	10.00	10.00	10.00
Probability of default	1.00	3.00	1.00	3.00
Loan rate	12.19	12.19	11.11	13.40
Default premium	2.19	2.19	1.11	3.40
Profit and loss				
Contracted interest income	12.19	12.19	11.11	13.40
Other interest income[1]	–	0.11	–	–
Less interest expense	10.00	10.00	10.00	10.00
Less loan losses	1.12	3.37	1.11	3.40
Net interest income (after loan losses)	**1.07**	**– 1.07**	**0.00**	**0.00**
Less provisioning expense	1.07	– 1.07	0.00	0.00
Net Profit	**0.00**	**0.00**	**0.00**	**0.00**

[1] Generated on the net interest income earned in the first period (assuming funds are invested at the discount rate).

The second criticism is that, rather than leading to reduced volatility of bank profitability, a move to forward-looking provisioning (which depending upon how it is done could amount to the effective replication of *full fair value accounting*[81]) would lead to increased volatility in bank profits.[82] This concern arises partly because of the volatility in the market interest rates that might be used for discounting future cash flows on both the asset and liability sides of the balance sheet.[83] Regardless of the validity of this concern, the adoption of forward-looking provisioning does not necessarily need to be accompanied by a complete move to fair value accounting. In one sense, forward-looking provisioning could be seen as a reasonable intermediate step in which loan values are appropriately adjusted for expected credit losses, but movements in market interest rates are not instantaneously reflected in the value of non-traded assets and liabilities. This approach might deliver the profit stabilising effects that we argue would follow from appropriate economic provisioning, while avoiding the volatility that some fear would result from full market value accounting.

The bottom line is that, given our view that risk (expected losses) rises as the boom matures, in ideal conditions (ie if risk is correctly perceived) one should see provisions increase during this phase of the cycle, rather than only once losses materialise. Such forward-looking behaviour would also reduce the need to make large additional provisions when developments turn out worse than anticipated.

5.1.2 Capital at a point in time: the perspective of an individual bank

A common view on the appropriate level of capital for an individual bank is that it should be sufficient to reduce the *probability of failure* over a particular time horizon to some specified level. This applies both to the economic capital with which a bank would wish to operate and to the (minimum) regulatory capital determined by supervisors, although the corresponding probabilities of failure would presumably differ. Once this level is set, the amount of capital depends upon the *variability* of expected cash flows over the chosen horizon. This variability would, in turn, depend crucially on the *correlation* between exposures.

Unlike for provisions, the relevant time *horizon* is not the entire life of the loan, but rather depends upon the time taken for a bank to raise additional capital or to remove risks from its balance sheet.[84] At one extreme, suppose there is no possibility of raising capital in the future and that once a loan has been made, the exposure remains with the bank until maturity. In this case, the amount of capital required today depends upon the variability of the discounted cash flows in each and every future period until the loan's maturity. At the other extreme, suppose that capital can *always* be raised instantaneously. In this case, there is no need to hold any capital, with the bank simply making a call on its owners or outside shareholders whenever asset values fall. Similarly, if exposures can be quickly removed from the balance sheet, the horizon for capital calculations can be quite short, irrespective of the term of the loan and the bank's ability to raise new capital. For example, if the bank held a portfolio of 10-year commercial loans, the relevant horizon would be the time it would take to completely remove these loans from the balance sheet. This might be a matter of months, or it could be a matter of years depending upon the structure and liquidity of markets and the ability of the bank to change the structure of its assets through outright sales or hedging.

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[81] The "fair value" is normally defined as the amount for which an asset could be exchanged between knowledgeable, willing parties in an arm's length transaction. In principle, fair value accounting tries to approximate as closely as possible the value that the asset would have if it were traded in the market. Some limited deviations may be allowed in practice, however. For example, the proposals by the Joint Working Group of Standard Setters (2000) envisage that, in some circumstances, "fair values" be calculated using banks' internal credit grading models.

[82] Jackson and Lodge (2000) provide an overview of the debate on fair value accounting. The Joint Working Group of Standard Setters (2000) sets out the arguments in favour of fair value accounting, while the Joint Working Group of Banking Associations on Financial Instruments (1999) summarises the banking industry's objections.

[83] Another concern, already discussed above, relates to the practical and conceptual difficulties in finding reliable market inputs for the measurement of value, given the different characteristics of traded and non-traded assets.

[84] The different time horizons for capital and provisioning calculations reflect the fact that expected events beyond the holding period affect current asset values (and thus the appropriate level of provisions), while the *variability* of expected returns beyond the holding period does not affect the variability of returns during the holding period (and thus does not affect the appropriate level of capital). This result would need to be qualified if people were risk averse. In this case, an increase in the variability of future returns should also affect the current value of the asset.

In practice, it is difficult to raise capital during periods in which loan losses have been unexpectedly high, and it is often problematic to cleanse the balance sheet of risky loans at short notice, particularly if those loans are already performing poorly. This means that *optimal calculations of capital need to consider the variability of expected returns over relatively long time horizons, arguably considerably longer than one year*, which is the current practice.

5.1.3 Capital at a point in time: the perspective of the system as a whole

Bank capital regulation can be thought of as the regulator setting a floor on the probability of failure of an individual bank in order to protect the interests of depositors. An alternative approach would be for regulators to set the minimum level of bank capital with the explicit goal not of protecting depositors, but of protecting the stability of the financial system as a whole.[85] From this perspective, one could think of the amount of regulatory capital (as opposed to internal economic capital) being calibrated to ensure that the *probability of a systemic event* is acceptably low, where a systemic event was defined as stress in financial institutions on a sufficient scale to cause noticeable macroeconomic damage. In the terminology used in Section 2, this could be thought of as setting a threshold level for the loss in the "portfolio" made up of individual financial institutions.

The acceptable probability of a systemic event should arguably be lower than that of the failure of individual institutions, since the associated costs in terms of output are greater. This may well imply a higher overall level of capital in the system as a whole under most circumstances. Even so, as already noted, a key issue in determining the appropriate level of capital is the strength of the *correlations* between the performance of the individual institutions as well as their size. If institutions are small and the correlations between them are close to zero, then the overall capital requirement could be relatively low, as the probability of the simultaneous failure of a large number of institutions would be quite low. Conversely, and all else equal, if institutions were large and/or correlations high, a much higher level of capital would be required.[86]

Similarly, the *horizon* for calculating the capital cushion seen from the perspective of the system as a whole should arguably be longer than that seen from the perspective of an individual institution. The reason is that the difficulties in raising the necessary additional capital are likely to be greater when financial stress is widespread, as macroeconomic constraints would become binding.

5.1.4. Capital over time

Conceptually, there are two distinct reasons why capital should change over time. The first is to reflect the changing riskiness of the relevant portfolio (individual institution or system) so as to maintain constant the *target probability* of failure. The second relates to *intertemporal arbitrage*, so as to reduce the costs of raising capital under different conditions (for an individual institution or the system) and hence its impact on financial distress. To different degrees, both of these arguments suggest that capital should be raised in booms to be drawn upon as risk materialises.

A central thesis of this paper is that the potential for unexpected losses is likely to increase as a boom matures.[87] While this view is not universally accepted, we argue that it is a reasonable proposition that uncertainty about future returns and the direction of the economy tends to grow in the late stages of business cycle expansions, especially if the expansion is characterised by excesses in the financial system. The possible presence of such imbalances would naturally tend to increase the range of potential outcomes, especially the potential for unusually large losses. In addition, as argued above, expected losses also tend to increase. It can also be shown that as probabilities of default rise, so also does the correlation of defaults.[88] This would affect both the correlations in the portfolios of individual

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85 See Crockett (2000b) for a further elaboration of this point. See also Acharya (2000) for a preliminary formalisation of some of its aspects.

86 In part this will depend on the strength of factors other than the common exposures to the systematic cyclical factor(s), such as the risk of unwarranted contagion.

87 See Kent and D'Arcy (2001) for a formalisation of the basic point from the perspective of an individual institution.

88 See Box 1. On the basis of simulations and adopting a Merton-type approach, Gersbach and Lipponer (2000) actually argue that as much as half of the overall increase in credit risk associated with an increase in default probabilities could reflect this correlation effect. More generally, a positive relationship between expected and unexpected losses is consistent with the

institutions and those between institutions. More generally, correlations between the present discounted values of expected losses are likely to be higher in periods in which financial imbalances are developing, given the increased exposure to the common factor and the heightened possibility of adverse feedback effects on the macroeconomy. Arguably, these elements are more significant for the correlation across banks, given their greater vulnerability to contagion (see also Box 1).

Just as importantly, it is easier, and less costly, to raise capital in booms. An implicit assumption in the previous discussion was that if risk increased, the bank could simply raise new capital through either paying lower dividends or issuing more shares at no additional cost.[89] In practice, things are not so straightforward. Dividend policies are sometimes difficult to change and shareholders may be reluctant to contribute additional capital in periods in which risk has increased. The cost and difficulties are of course greater if distress is generalised. By holding *additional* capital over and above that needed to achieve the target probability of default at a particular point in time, each individual bank can smooth its cost of capital over time and increase its survival prospects. This is a critical insurance function. From the perspective of the system as a whole, raising capital in good times to be drawn upon in bad times has the additional benefit of limiting the amplification of the financial and business cycle, especially the headwinds that accompany periods of widespread bank retrenchment.

5.2. Actual practices

In practice, neither provisions nor capital behave as we suggest. In what follows, we examine possible reasons for this, paying particular attention to accounting and regulatory factors.

5.2.1 Provisioning: accounting and taxation rules

Provisioning policies tend to be backward looking.[90] There are two important reasons for this. One is the way in which risk is measured by financial institutions, as already discussed in previous sections. The second is the nature of accounting and taxation rules, which themselves tend emphasise realised losses instead of ex ante risk.

Accounting and taxation rules in most countries have as a basic principle that financial statements should reflect the outcomes of events that have *already* occurred and should not attempt to reflect events that have not yet happened.[91] This stands in stark contrast to the approach suggested above, in which provisions are created against events that have not yet occurred, but that have some probability of happening.[92] It also stands in contrast to the important role that expectations of future events play in determining the market's valuation of assets.

In most countries, the accounting standards distinguish between specific and general provisions.[93] Specific provisions are normally made for expected losses on individually assessed loans and can

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measurement approaches adopted by many banks. In particular, it is common practice to use distributions for loan losses in which the variance of losses is a function of the mean of the distribution (for example, Poisson and binominal).

89 More precisely, the implicit assumption was that differential costs/rationing prospects did not have an impact on the bank's decision about when to raise capital.

90 A useful overview of provisioning practices available in the public domain is provided in Beattie et al (1995).

91 See Wall and Koch (2000) for a useful summary of accounting concepts in the United States and their relationship with relevant economic concepts.

92 The tension between the two views is illustrated by the recent debate between the US Securities and Exchange Commission (SEC) and the Federal Reserve. A task force of the American Institute of Certified Public Accountants (AICPA), established to study the issue of provisioning, has recently agreed with the position put forward by the SEC that banks' provisions should only cover loans that have already been downgraded by the lender or have gone into default. In response, Federal Reserve Chairman Alan Greenspan has argued that the proposal would be "counterproductive to the safety and soundness of the banking system" and lead to "a very significantly sub-optimum degree of bank reserving". For a summary of the debate, see Garver (2000) and Anason (2000).

93 In a number of continental European countries, a Fund for General Banking Risks (FGBR) and/or hidden reserves are seen as a complement to general provisions. However, both the FGBR and hidden reserves are probably better thought of as elements of a bank's capital. Transfers to the FGBR must be made out of after-tax income, and sit on the liability side of the balance sheet, rather than representing a writedown of asset values, as is usually the case with provisions. While these reserves might serve as an additional buffer against unexpected losses, they do not serve the same purpose as provisions in insulating bank profitability from the cycle in expected default rates.

usually be made only when there is a strong expectation that a loss is "probable". Often, the bank needs tangible grounds for believing that default is likely. In some cases, accounting standards go as far as to specify the nature of these events (for example, the failure by the borrower to make contractual payments for a specified period of time).

The range of practice with respect to general provisions is somewhat wider. In some countries, general provisions are analogous to specific provisions (in that a deterioration in credit quality must have already occurred before a provision can be created) but differ in the fact that the credit evaluation is done on the basis of a group, or portfolio, of loans, rather than on a loan by loan basis.[94] Often, this group evaluation is conducted on portfolios of small homogeneous retail loans, where credit assessment of individual loans is either too difficult or too costly. In other countries, general provisions are more forward looking in that they may be created for losses arising from events that have not yet occurred but that the bank can reasonably expect to occur. In some countries that use this broader concept, banks are permitted to use statistical models to estimate expected losses. This approach, which is often known as *ex ante*, or *dynamic provisioning*, is closer in spirit to the approach outlined above, although the time horizon used in the calculations is typically relatively short, business cycle effects are often ignored and consideration is not given to whether default premiums cover expected credit losses.

Taxation arrangements can also have a major influence on banks' incentives to create provisions. In almost all countries, bad loans are ultimately tax-deductible, either at the point when a provision is made, or at the point when the loan write-off actually occurs. Arguably, allowing tax deductibility of provisions encourages earlier recognition of potential problems, and thus more forward-looking provisioning.

Taxation arrangements differ greatly around the world, although most countries permit specific provisioning expense as a tax deduction (although restrictions often apply). The major exception is the United States, where all provisions are essentially disregarded for tax purposes. In the United States, tax deductions are only available when loans are charged off, although this normally occurs earlier than in many other countries.

The situation with respect to general provisions is more varied. For example, in the United Kingdom, general provisions are not allowed as a tax deduction,[95] and in Germany, the tax deductibility of general provisioning expense is severely limited. In contrast, in a range of other countries, including Switzerland and Australia, general provisions are tax-deductible, although the taxation authorities are able to question the appropriateness of the deduction.

One country that has a long history of fairly liberal provisioning policies and full tax deductibility of provisions is Denmark. Arguably, this tradition helped insulate the Danish banking system from the worst of the problems that beset other Nordic banking systems in the early 1990s. Unfortunately, however, Denmark now finds itself under increasing pressure to more closely align its approach with that of other European countries, partly due to concerns that the more liberal approach gives a competitive advantage to Danish banks.

In principle, if the appropriate basis for taxation is the change in the current value of a bank's net assets, then all provisioning expenses should be tax-deductible. From an economic point of view, whether or not the provision is created in response to an observed or an expected event is irrelevant. What is relevant is the change in the net value of the bank's assets.

In sum, accounting and tax constraints, together with the methodologies used to measure risk, lead to provisions increasing in downturns, rather than being built up during periods of strong economic growth. More forward-looking provisioning requires the removal of these constraints. It also requires more forward-looking risk assessment, which involves not just a lengthening of time horizons but also an evaluation of vulnerabilities in the financial system.

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94 In some countries, this type of portfolio provisioning might be included in specific provisions.

95 An exception is made for homogeneous groups of small loans for which it is not practical to calculate a specific provision on a loan by loan basis.

5.2.2 Capital: regulation

Capital regulation can play an important role in the evolution of bank capital. A bank's capital ratio, as calculated by the regulatory formula, is often used by the market as an indicator of the strength of the bank. Moreover, individual banks may themselves wish to keep a capital buffer between their actual capital ratio and the regulatory minimum. The way in which the minimum standards are specified can also influence how banks think about and measure capital.

To date, the capital standards, embodied in the 1988 Capital Accord, have not had a strong cyclical component.[96] Indeed, under current arrangements, capital requirements change over time only if the structure of a bank's assets changes, for example through a switch out of residential mortgages and into corporate loans. Currently, capital requirements do not change with changes in the credit quality of a given portfolio, or with changes in the correlations between returns earned by individual banks.

In contrast, the proposed modifications to the Capital Accord have the potential to lead to larger changes in capital requirements over time.[97] While the proposals are aimed primarily at making *relative* capital requirements more sensitive to *relative* risk, a natural consequence of this is that the capital requirement for a given portfolio will change over time as the bank's assessment of the riskiness of that portfolio changes. Accordingly, if the average assessed credit quality of a given portfolio of loans deteriorates, the minimum amount of capital that the bank is required to hold will increase. As is the case now, the proposed modifications to the Capital Accord do not envisage capital requirements being a function of the correlations between institutions.

The modifications will significantly increase the importance of accurately measuring the time dimension of risk. If measured risk falls in economic booms and increases in recessions, then regulatory capital requirements might themselves fall in booms and increase in recessions. All else constant, this would obviously have implications for the robustness of individual institutions and the procyclicality of the financial system more generally.

The current proposals envisage risk being assessed either by external credit ratings or by internal ratings. Of these two approaches, the internal ratings approach could be more exposed to the possibility of procyclical risk assessments. There are at least two reasons for this. First, as discussed in Section 4, banks' internal measures of risk almost universally have a "point-in-time" focus and a one-year horizon, meaning that changes in current economic conditions are likely to generate a change in the measured riskiness of loans. Second, under the internal ratings approach, the capital charge will depend not only on the probability of default, but also on the loss given default, with the loss depending in part on the collateral that underpins the loan. If, in periods of strong economic growth, collateral values become inflated, required capital may well fall, when in fact the reverse should be the case.

Even so, external ratings, while arguably less sensitive to the cycle, are not immune from procyclical movements, with many more downgrades occurring in recessions than in booms. In addition, when downgrades happen, they may well occur in larger steps and only after the materialisation of risk. This might lead to larger discrete jumps in capital requirements than would be the case with internal ratings.[98]

In terms of reducing procyclicality, one possible advantage of both approaches (relative to current arrangements) is that they may lead to earlier recognition of problems by markets and supervisors. If more timely recognition leads to earlier corrective action, then the potential for problems to escalate is reduced. This issue is discussed in more detail in Section 6.

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96 A number of authors, however, have argued that existing capital regulation reinforces macroeconomic fluctuations by requiring banks to raise additional capital in economic downturns; see for example Blum and Hellwig (1995) and Goodhart (1995). Jackson et al (2000) provide an overview of the empirical evidence.

97 These changes to the Accord are motivated largely by the distortions that have arisen from the crude differentiation of risk embedded in the 1988 Accord. For a discussion of the distortions, see BCBS (1999b), Jones (2000) and Carey (2000).

98 Altman and Saunders (2001) argue that linking capital requirements to external ratings could increase financial instability due to the tendency for ratings downgrades to occur more frequently in recessions than in booms.

5.2.3 Capital: market pressures

Even if capital regulation is not procyclical, bank capital ratios might still fall in booms and increase in recessions owing to market-based pressures.

The experience of the countries that had banking system problems in the early 1990s is illustrative here (see Section 3). Soon after the problems were recognised, the management and in some cases the new owners of the banks made a concerted effort to establish quite high capital ratios. This was not so much driven by the requirements of the supervisors, although in some countries this did play a role, but rather by a belief that, after experiencing problems, the banks needed to demonstrate their financial strength and their commitment to better risk management. One way of doing so was to report a high capital ratio, even if this meant severely cutting back the size of the balance sheet and sacrificing long-term banking relationships.

One way of interpreting this experience is that the capital ratio demanded by the market is path-dependent. That is, the market requires a higher capital ratio for a bank that has experienced losses, relative to an identical bank without the history of losses. The market, however, does not demand the higher capital ratios indefinitely. Once the bank has regained the market's confidence and economic recovery has become entrenched, lower capital ratios are acceptable. Indeed, in the countries concerned, the market's focus shifted to the rate of return on equity, and the high capital ratios tended to be seen as an impediment to shareholder value. The result is a decline in capital ratios at the same time as strong economic growth is occurring.

6. Lending practices, loan-to-value ratios and supervisory review

While capital and provisions are key channels through which potential misassessments of risk can weaken banks' balance sheets and amplify the financial cycle, they are not the only ones. Two other mechanisms that can play a similar role, and by the same token can be a policy tool to address the problem, are the interaction of bank lending strategies with collateral valuation practices and regulatory restrictions, and the supervisory review process. If bank lending is highly dependent upon collateral values, and if the risks associated with collateral are misassessed, the scope for large credit cycles is increased. Similarly, the scope for credit cycles is also greater if the intensity of supervisory review also changes with the stage of the cycle. This section discusses these two issues.

6.1 Loan-to-value ratios

The interaction between practices concerning the valuation of collateral and loan-to-value ratios has potentially major implications for the procyclicality of bank lending. There are at least three relevant factors: valuation methodologies, average loan-to-value ratios and the cyclical behaviour of loan-to-value ratios.

Valuation methodologies that deliver collateral values that move closely with the cycle are likely to generate greater procyclicality. The combination of inflated property markets and *market* valuation of collateral is particularly problematic. Procyclicality is also likely to be greater, the higher the average loan-to-value ratio. The reason is that the higher the ratio, the higher is the marginal amount of new lending that can be granted for a given change in the value of the collateral.[99] Finally, if competition or mis-assessments of risk cause loan-to-value ratios to rise in booms, the potential for procyclicality is increased. The interaction of these three factors is especially important. Biases in the measurement, or response to risk can have an impact on any of the three elements, potentially leading to excessive procyclicality. The overall relevance of this channel will depend on the extent to which collateral is used as a risk mitigation device and on the ratio of the aggregate value of collateral to GDP.

Significant as the three factors are, there is comparatively little systematic information about actual practices or indeed empirical evidence on their implications for procyclicality. In what follows,

[99] Generally, if "x" is the loan-to-value ratio, then "x" also represents the change in the amount of the loan that can be supported by a given change in the valuation of the collateral.

therefore, we simply begin to put a picture together. We focus on real estate, by far the most important type of collateral in this context.

Approaches to the valuation of collateral have been classified into two broad and stylised categories: the *open market value* and the *mortgage lending value.*[100] The first approach focuses on the value of the asset if exchanged between a willing buyer and seller in an arm's length transaction after a period of proper marketing. The second approach, while still based on an arm's length transaction, is designed to arrive at an estimate of the realisable value of the property that is sustainable in the longer term.

How far these approaches are used in different countries is not entirely clear; moreover, in some cases combinations of the two are not uncommon. At the same time, available information indicates that the mortgage lending value is more prevalent in a number of continental European countries, notably Germany, Austria and Denmark; the open market value is more common elsewhere (Table 3).

Other things being equal, approaches to valuation that are very sensitive to market values or which extrapolate cash flows and other parameters on the basis of short-term horizons would tend to be more procyclical. On this basis, the open market concept would arguably induce a higher procyclicality in valuations than the mortgage lending methodology. The former places comparatively more emphasis on the current transaction value of property, short-term financing conditions and capital gains; the latter is based on an analysis of long-term market trends and discount factors and is designed to produce more stable valuations.[101] The counterargument is that long-term valuations can be used to avoid recognition of losses, with the effect of ultimately prolonging a recession by delaying the resolution of asset quality problems on banks' balance sheets.

Information on standard *loan-to-value ratios* is rather patchy. Practices seem to exhibit significant variation across countries (Table 3).[102] Typically, banks in English-speaking countries have been prepared to lend up to 85% (and sometimes 100% or more) of the value for residential mortgages. In contrast, banks in continental Europe have generally limited residential mortgages to 80% or less of the value of the property.

There is also limited information concerning the *behaviour of these ratios over the credit cycle*. On a priori grounds, there may be good reasons to believe that the ratios tend to remain constant over the cycle or, if they vary, to do so procyclically, along with other lending standards and pricing. There are, for instance, indications that practices were relaxed during the upswing in property prices in Japan[103] and the United Kingdom during the 1980s. To our knowledge, however, no systematic information has been put together on this issue. On the other hand, there is clear evidence that competitive pressures have tended to raise acceptable loan-to-value ratios, notably within Europe. Cross-border competition, for instance, has helped narrow cross-country differences in practices.[104] If competitive pressures increase in the upswing of a credit cycle, this could by itself be sufficient to lead to a relaxation of loan-to-value standards.

Aside from the supervisory review process, regulators and supervisors can in principle influence the procyclicality of bank practices by setting rules for the valuation of collateral, by establishing maximum loan-to-value ratios or by linking these ratios to other regulatory tools, such as capital requirements. A look at current practices suggests that, in general, the degree of influence actually exercised is not great, although it does vary considerably across types of instrument and countries (Table 3).

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[100] We follow the distinction made by the European Mortgage Federation (1998) and applied to methodologies in Europe. See also Dübel and Pfeiffer (1995).

[101] Dübel and Pfeiffer (1995) elaborate on the distinction between the two approaches and their cyclical properties. They argue that the mortgage lending value approach tends to prevail in countries where mortgage lending banks take the lion's share of the financing of property. In contrast, the open market value would be more likely to be used where non-leveraged institutional investors such as pension funds and insurance companies invest heavily in real estate.

[102] See European Central Bank (2000) for a brief overview of standard loan-to-value ratios in the European Union.

[103] Anecdotal evidence suggests that LTV ratios in excess of 100% were not uncommon.

[104] See European Central Bank (2000).

Table 3

Loan-to-value ratios in selected countries

	AU	BE	CA	CH	DE	ES	FI	FR	HK	JP	MX	NL	UK
Practice													
Valuation	OM	OM/ML	OM	ML	ML	OM	OM[1]	OM	OM	OM	OM	OM	OM
Typical LTV ratios							60-75						–
• Residential loans	..	..	..	75	..	70	..	..	60-71	..	..[2]	..	65-90
• Commercial loans	..	..	..	60	..	70	..	..	..	..	..[2]	..	
• Mortgage bonds/MBS	70	..	..	..	60	70	..	..	..	..	..	..	..
Restrictions (by whom)													
Valuation	Y(P)	N	N	Y(P)[3]	Y(P)[4]	N	N	Y(P)	N	Y(P)[5]	Y(P)[6]	N	N
LTV ratios													
• Authority	Y(P)	N	Y(L)[7]	Y(P)[8]	Y(L)[9]	N	Y(L)	Y(L)[10]	Y(P)	Y(P,L)[11]	N	Y(P)[12]	Y(P)[13]
• Maxima	N	N	Y	N[8]	N	N	Y	Y	Y	Y	N	N	N
Residential loans	N[14]	N	75[7]	N[8]	N	80[16]	75	80[10]	70/60[15]	80[11]	N	N	N[13]
Commercial loans	N	N	75[7]	N[8]	N	80[16]	75	60[10]	N	N	N	N	N
Mortgage bonds/MBS	N	N	75[7]	N[8]	60[9]	80[16]	60[17]	N	N	N	N	N	N
Capital adequacy risk weights	Y	Y	Y	Y	Y	N	Y	N	Y	N	N	Y	Y[18]
• Residential	Y	Y	Y	Y	Y	N	Y	N	Y	N	N	Y	Y[18]
• Commercial	N	Y	N	Y	Y	N	N	N	N	N	N	N	N
Other	N	N	N	N	N	Y[16]	N	N	N	N[11]	Y[6]	N	N

Key to symbols:

Y = yes; N = no; - = not applicable; .. = not available; OM = (variant of) open market value; ML = (variant of) mortgage lending value; P = prudential supervision; L = other legislation/regulation.

[1] Market value for residential property; discounted cash flow method for commercial and industrial property.

[2] Some evidence of loan-to-value ratios in the region of 90% in 1991. Should be lower now.

[3] No restrictions have been set by supervisors; the authority exists but is not used.

[4] Conservative and detailed valuation principles set out in the Mortgage Bank Act.

[5] Disposal value equal to 70% of market value.

[6] In general, for the purposes of provisioning (loan grading), a 50% discount is applied to the appraisal value. Provisions are lower for guaranteed portions.

[7] Bank Act for commercial property lending; Bank Act and Trust/Loan Act for residential property lending, but not applicable if guaranteed under Federal Government's National Housing Act. Such guaranteed mortgages can be securitised. Mortgage finance by finance companies ("sub-prime lending") is not subject to maximum LTVs.

[8] LTV ratios need to be approved by the Swiss Federal Banking Commission; approval is given on the basis of expert judgment.

[9] Mortgage bonds only, which have to be backed by first mortgages, to which the 60% LTV ratio applies.

[10] Since 1999, applicable only to specialised mortgage institutions, which were created in that year.

[11] The supervisors have the authority to restrict effective LTV ratios that they judge to be imprudent. This could involve higher provisioning requirements or reclassification of the loan. In addition, separate regulation sets a maximum LTV ratio of 80% for loans granted by the House Loan Corporation.

[12] For banks.

[13] The supervisory authority has the authority to, but does not, set limits to LTV ratios. Some restrictions apply, however, to Building Societies (eg. three-quarters of the residential loan book must be fully secured and there is a limit to the amount of lending with an LTV ratio of 90% or higher).

[14] Residential LTVs in excess of 80% require full insurance in order to meet the criteria for the 50 per cent preferential capital adequacy risk weight.

[15] Since 1994, 70% maximum LTV ratio for residential mortgages granted by authorised institutions; in 1997 the maximum LTV ratio was lowered to 60% for properties with values exceeding HK$12 million. No restrictions on specialised mortgage institutions, but the Hong Kong Mortgage Corporation Limited will only purchase mortgages with LTVs ratios of up to 70% (without insurance) and 85% (with insurance) respectively.

[16] Indirect ceiling established through more stringent loan loss provisions if LTV ratios exceed 80% if the loan becomes impaired (1% rather than 0.5%).

[17] For Mortgage Credit Banks. An additional loan may be granted up to 100% of the value of the collateral. The total of such additional loans should not exceed one-sixth of the total amount of mortgage loans granted according to the above conditions.

[18] For Building Societies only.

Key to symbols:

Y = yes; N = no; - = not applicable; .. = not available OM = (variant of) open market value; ML = (variant of) mortgage lending value; P = prudential supervision; L = other legislation/regulation.

Box 4

Arrangements linking loan-to-value ratios and capital adequacy standards

Australia (AU)	Residential: 50% risk weight subject to conditions, including insurance above an 80% LTV ratio. Commercial: None.
Belgium (BE)	Residential: 50% risk weight subject to the condition that the valuation of collateral does not exceed the prudently estimated pledge value. Commercial: 50% subject to the LTV ratio not exceeding 50% of open market value and 60% of the mortgage lending values.
Canada (CA)	Residential: 50% risk weight subject to maximum 75% LTV ratio but 0% if insured according to Federal government programmes. Commercial: None.
Switzerland (CH)	Residential: 50% risk weight when the LTV ratio does not exceed 66%. Commercial: 75% risk weight when the LTV ratio does not exceed 50%
Germany (DE)	Residential: 50% risk weight for first mortgages, which have a maximum LTV ratio of 60%. Commercial: 50% risk weight for first mortgages, which have a maximum LTV ratio of 60% (currently EU regulation only).
Spain (ES)	None.
Finland (FI)	Residential: 50% risk weight when the LTV rates does not exceed 70%. Commercial: None.
France (FR)	None.
Hong Kong (HK)	Residential: 50% risk weight for a first legal charge mortgage if the principal sum does not exceed 90% of the purchase price or the market value of the property at the time the mortgage was approved, whichever amount is the lower. Same LTV requirement also applies to the underlying properties of the MBSs. Commercial: None.
Japan (JP)	None.
Mexico (MX)	Residential: 100% risk weight. Residential with at least 50% guaranteed by government programmes: 50%. Commercial: None
Netherlands (NL)	Residential: 50% risk weight for that part of the loan up to the 75% LTV ratio. Commercial: None.
United Kingdom (UK)	Residential: (for Building Societies only) 60%, rather than 50%, risk weight for mortgages with an LTV ratio in excess of 90%.

Key to symbols:

Y = yes; N = no; - = not applicable; .. = not available; OM = (variant of) open market value; ML = (variant of) mortgage lending value;
P = prudential supervision; L = other legislation/regulation.

Supervisors typically do not set the parameters to be used in valuations.[105] In some countries, however, they do specify some inputs for the calculation of discounted present values, such as minimum discount factors, conservative principles for the calculation of rents and forecast horizons. For example, in Germany the Federal Supervisory Authority sets minimum discount factors that vary between residential and commercial property, requires rents to be valued at whichever is the lower of the comparative and the contractual value, and recommends a minimum forecast period. Denmark, too, has some less formal bank regulations on discount factors used in valuation. Likewise, in some cases supervisors set specific haircuts on market or appraised values, including, for instance, in Japan and Mexico. In others, the incentive to limit loan-to-value ratios is more indirect; for example, in Spain required provisions may depend upon the loan-to-value ratio.

While it is not necessarily beyond their authority, supervisors do not generally set maximum loan-to-value ratios. One notable exception is Hong Kong, where a "recommended" maximum loan-to-value ratio of 70% has been in place since the 1990s (see Section 7). At the same time, in other countries maximum loan-to-value ratios may be constrained in other ways. In particular, in several European countries the law establishes maximum loan-to-value ratios for those loans that are admissible as collateral for mortgage bonds. These limits can be uniform, such as in Germany, Austria and Finland, or differentiate between types of collateral, notably between residential and commercial real estate, such as in Italy, Norway and Sweden, or even more finely, as in Denmark. The maximum ratios range from as low as 60% (Germany, for Pfandbriefe) to 80-85% (Norway and Sweden). In some cases, however, it might be possible for mortgage banks to exceed the lending limits by granting lower-ranking loans provided that they are secured by the public authorities, credit institutions or insurance companies. Borrowers may also be free to go to a commercial bank for a top-up loan.

In a number of countries, loan-to-value ratios are also influenced by capital adequacy standards (Box 4). For example, in some European countries mortgage loans with a loan-to-value ratio below a certain level attract a preferential capital weighting of 50%. Differentiation based at least partly on loan-to-value ratios is also practised for some residential mortgages in the United States, Canada and Hong Kong.

Historically, restrictions on loan-to-value ratios and conservative valuation methods have probably helped to mitigate the amplitude of credit-asset price cycles or at least protected banking systems from their disruptive effects. Arguably, it is no coincidence that banking problems in real estate lending have been less evident in some of the countries using conservative approaches. Even so, attractive as the case may be on conceptual grounds, little systematic research has been done on these issues, not least owing to serious data limitations.[106] More definite conclusions about the economic significance of these factors will require further empirical work.

Looking forward, one key issue is the impact of an increasingly deregulated and competitive environment on the viability and ultimate effectiveness of restrictions such on loan-to-value ratios. In particular, in such an environment it becomes easier for borrowers to avoid regulations by obtaining top-up loans from other institutions. Since higher overall ratios increase the sensitivity of the availability of lending to collateral values and reduce the safety cushion of lenders, they heighten the need for reliance on proper valuation methodologies. As in the case of provisioning, methodologies should take due account of the evolution of systematic risk over time, and hence of the losses that could arise from sharp reversals in asset prices associated with the financial and business cycles.

6.2 Supervisory review

The response of supervisory agencies to changes in economic developments and bank profitability can also affect lending behaviour.[107] If supervisors make tougher assessments of banks following an

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[105] The information for this and the next paragraph is drawn from a survey of central banks and regulatory authorities (as reflected in Table 3) and from Dübel and Pfeiffer (1995).

[106] For some very preliminary cross-country evidence on the role of collateral in amplifying the impact of monetary policy and the asset price-credit cycle, see BIS (1993) and Borio (1997). Data limitations are discussed in Borio et al (1994), Borio (1997) and, in particular, Dübel and Pfeiffer (1995).

[107] For example, the President of the Federal Reserve Bank of Boston argued that the effect of a shift in regulatory sentiment about New England banks in the early 1990s may have had a perverse effect on the economy as a whole (Syron (1991)).

increase in loan losses, banks might respond by restricting the supply of credit, ultimately creating a credit crunch. Similarly, if supervisors reduce their intensity of supervision in a boom, they might help fuel the boom and the development of imbalances in the financial system.

Supervisors might make tougher assessments and impose tougher standards after loan losses for a number of reasons. First, as discussed earlier, most supervisory risk measurement approaches indicate an increase in risk at the time of high loan losses. Second, supervisors might overreact to losses in the hope that by tightening standards, they can deflect criticism of their own performance by being seen to be "doing something". Third, in those countries where the rationale for supervision is the protection of depositors, supervisors might see it as in the interests of the depositors for each bank to have a less risky profile after an episode of higher than expected losses. This is despite the fact that tighter standards might be contrary to the collective interests of all depositors, for the reasons discussed in Section 2.[108]

In economic booms, the reverse process may be at work, with reduced supervisory attention contributing to lending booms. Even if supervisors do not lessen the intensity of their supervision, they might find that they have less authority to act in good times. When economic growth is strong and bank profitability is high, supervisors can find it difficult to gain the broad political support needed to impose tighter standards on institutions, particularly if banks and the general public see the strong current performance of the banking sector as evidence that risk is low. This could lead to a de facto reduction in supervisory oversight in booms, and a de facto tightening in recessions, even if supervisors do not change the basis on which risk assessments are made.

Evaluating the empirical validity of these concerns is difficult, as the intensity of supervision is generally not observable. Even so, a few recent studies have used data on supervisory assessments in the United States to provide some support for two propositions. The first is that supervisors have tended to make tougher assessments in recessions and easier assessments in booms. The second is that supervisory assessments do affect bank lending behaviour. At the same time, however, these studies suggest that the effect on overall bank lending is relatively small, and that changes in the toughness of supervisory review play only a relatively minor role in explaining the credit cycle.[109]

Looking forward, the proposal by the Basel Committee to make the process of supervisory review a core pillar of the revised capital adequacy framework has the potential to increase the impact of supervisory judgements on banks' actions. The current proposal, while recognising that risk management is primarily the responsibility of bank management, recommends that supervisors assess each bank's internal risk management processes. It also recommends that supervisors intervene at an early stage if there is a danger that the level of bank capital will fall below required minimum levels. In evaluating the level of capital, one factor that supervisors might consider is the exposure of a bank to the business cycle. The success of the supervisory review may depend, at least to some extent, on how supervisors assess this exposure and respond to business cycle effects.

7. Policy options

We now consider a range of policy options for dealing with the problems examined in the previous sections. In particular, we consider various alternatives that policymakers might have in dealing with the financial vulnerabilities and amplification of the business cycle caused by biased assessments of,

[108] The Federal Reserve, for instance, has argued that the problems following the Latin American debt crisis of the early 1980s and the real estate-induced problems of the early 1990s would have been greater if the regulators' desire to see an improvement in the health of financial institutions had led to an aggressive tightening of lending standards.

[109] Peek and Rosengren (1995) find that banks in New England that were subject to supervisory enforcement actions in the early 1990s reduced lending by more than other banks in the region with the same capital adequacy ratio. Berger et al (2000) provide support for the view that supervisory "toughness" moves over the economic cycle and that this has a small effect on bank lending.

and inappropriate responses to, the time dimension of risk. We group the various options under the following broad headings:[110]

- the promotion of an improved understanding of risk;
- the discretionary use of supervisory instruments;
- regulatory, supervisory and accounting rules; and
- the use of monetary policy.

Before examining the various options, we discuss two issues that are relevant, to varying degrees, to all four options: the ability of the authorities to identify changes in system-wide risk; and the potential creation of moral hazard by the authorities responding to changes in their own assessments of risk.

Our main points can be summarised as follows:

(i) Policymakers need to be able to respond to the development of financial imbalances that have adverse implications for the business cycle and financial stability. The costs of not doing so can be very high.

(ii) There is no single instrument that can be assigned exclusively to this task.

(iii) To the extent that existing instruments need to be used, there is the potential for an apparent conflict between the financial stability objective and the instruments' primary objectives. This means that short-term compromises between objectives may need to be made. It also means that authorities with different responsibilities need to coordinate their responses.

(iv) While rule-based countercyclical changes in supervisory instruments have a number of attractions, designing robust rules is likely to be difficult. A more promising approach may therefore be to implement supervisory rules and encourage practices that can reduce procyclicality without leading to cycle-related frequent changes in supervisory requirements. Common to most of these rules is a lengthening of the time horizon for the assessment of risk.

(v) The prime example of this is provisioning rules. Supervisors could engage the accounting profession in a more active dialogue and encourage institutions to adopt longer time horizons in their assessments of risk. We also suggest that it might be useful in future to give further consideration to possible responses in areas such as loan-to-value ratios and capital requirements.

(vi) Discretionary adjustments in both supervisory instruments and monetary policy have a role to play in responding to changes in system-wide risk. Such policy responses, however, should probably occur only infrequently and only when major financial imbalances are developing.

7.1 Some common issues

7.1.1 The identification of changes in systemic risk

A common response to those who propose that policymakers react to the development of system-wide vulnerabilities is that these vulnerabilities cannot be identified ex ante, or at least cannot be identified any better by policymakers than by the market as a whole. As a result, the best that policymakers can do is to establish a regulatory framework that contributes to financial stability, and be prepared to act quickly whenever financial instability threatens the health of the macroeconomy.

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[110] This list of options to address procyclocality is not exhaustive. For example, we do not consider tax policies and a range of possible more direct controls on lending (see eg McCauley et al (1999)). Likewise, we also exclude from consideration a number of aspects of the financial infrastructure that are crucial to ensuring well functioning financial markets and overall financial system stability. These include solid legal, accounting and disclosure regimes, a robust payment system, high-quality prudential supervision, well designed financial safety nets and sound macroeconomic policies. This is done, not because these elements are unimportant, but rather because they are not specifically addressed to the issue of financial system procyclicality. See eg Goldstein and Turner (1996) and Group of Ten (1997).

Whether or not policymakers can judge financial vulnerabilities any better than the market is difficult to determine. On the one hand, policymakers might be expected to have longer time horizons, access to a broader set of information and perhaps a more thorough understanding of the aggregate feedback effects between the financial sector and the real economy. This might allow them to more quickly and accurately identify changes in system-wide risk. On the other hand, in many cases the authorities have a poor record as regards outperforming the market in assessing likely future developments and predicting stresses in the financial system.

Less contentious is the proposition that policymakers' incentives and responsibilities are different from those of private sector participants. As a result, their response to financial system developments may well differ from those of market participants. For example, faced with signs of financial overextension, such as rapid credit growth and asset price increases, the authorities may judge it appropriate to increase capital requirements in order to safeguard system-wide stability, not least owing to higher exposures to common factors *across* financial institutions (see Section 5). In contrast, individual institutions are likely to have less of an incentive to take corrective action.

As in other areas of public policy, assessing the balance of risks is critically important in framing policy responses. In the above situation, if the authorities imposed higher capital ratios, the efficiency of the banking system might be impaired if it turned out that the credit and asset price increases were sustainable. Conversely, if higher capital ratios were *not* imposed, and asset prices subsequently fell significantly, financial distress might be the outcome. Determining the appropriate policy in a world of uncertainty requires balancing the costs of both Type I and Type II errors. In balancing these costs, public authorities would make different judgments to those of the private sector.

7.1.2 Moral hazard

Another recurrent issue is whether policy responses create moral hazard problems that ultimately lead to less careful risk management by financial institutions and thus an increase in aggregate risk.

To illustrate the possible problem, consider the scenario in which it becomes widely understood that the authorities have adopted a regime in which policy instruments are adjusted in a discretionary fashion on the basis of the authorities' own assessments of financial system risk. These policy instruments might include, amongst others, minimum capital ratios, maximum loan-to-value ratios, interest rates and "open-mouth operations" (see below). In this scenario, given the intrinsic difficulty of measuring risk, the private sector might condition its own assessments of risk on those of the public sector as revealed through changes in the policy instruments. If this was the case, then the absence of a policy change in response to some event (say a large increase in asset prices) might be taken by the market as a signal that the authorities were relatively relaxed about the level of risk in the system. Moreover, if the private sector thought that the authorities would take action to contain the overall level of risk in the financial system, they might be less careful in their own risk management. The end result might be an increase in risk-taking.

Another concern is that if the authorities' assessments ultimately turn out to be incorrect, their reputation will have been harmed and there could even be claims on the public sector for compensation for private losses incurred as the "result" of the policy error. The errors might also mean that authorities feel that they shoulder some of the blame, and thus they may be reluctant to take the necessary corrective action. This could lead to delay in addressing problems, and ultimately to problems that are larger and more difficult to solve. Another concern is that the supervisory authorities might be subject to political pressure to intervene, or not intervene, and that ultimately politically induced interventions would be destabilising and create additional pressure on the public sector to bail-out institutions.

While this general scenario may be extreme, it does highlight the concerns that are shared by many policymakers. There is general reluctance to adjust policy instruments in response to changes in assessments of financial system risk. This reflects concerns about moral hazard and the fact that responding in this way could put the authorities in the uncomfortable position of being the arbiters of the appropriate level of risk in the financial system.

While identifying system-wide risk and moral hazard are issues common to all policy options, the extent to which these are affected varies depending on their nature. For instance, the balance between Type I and Type II errors is arguably rather different in the case of monetary policy and supervisory instruments. Likewise, as we discuss below, moral hazard considerations have

implications for the balance between rules and discretion and for the modes of intervention more generally. We now consider four specific policy options.

7.2 Specific options

7.2.1 The promotion of an improved understanding of risk

Given that a central theme of this paper has been that the time dimension of risk is difficult to assess, one approach would be for policymakers to promote an *improved understanding of risk* and its relationship with the business and financial cycles.

This could be done through a number of channels, including the publication of analysis and research on financial system issues, and speeches by senior officials discussing vulnerabilities in the economy and the financial system. Such an approach could be thought of as being analogous to the "open-mouth operations" that have sometimes been used by monetary authorities to influence expectations of inflation, interest rates or exchange rates. Supervisors could also suggest that banks undertake stress tests that are specifically designed to highlight the risks associated with current vulnerabilities in the financial system. These stress tests could then form the basis of a dialogue between the supervisory authorities and each of the banks.

The central banks in Norway, Sweden and the United Kingdom have already taken steps along this road with the publication of financial stability reports on a regular basis. In a number of cases, these reports have highlighted developments in credit and property markets and raised concerns about the sustainability of current trends. To date, this has been done in a way which has helped improve dialogue between the authorities and the private sector, and has avoided the central bank being seen as an arbiter of the actual or appropriate level of risk in the financial system.

One attraction of this approach is that it addresses an important *source* of financial procyclicality (ie the measurement of risk), rather than dealing with the consequences of mismeasurement. A second attraction is that, by comparison with some of the other policy options discussed below, the moral hazard problem is likely to be less severe, although if the authorities take strong positions and push their views aggressively, moral hazard may be created. Nevertheless, the private sector is free to ignore the comments of the authorities.

The approach will, however, only be successful if participants in the financial system take heed of the analysis of the authorities. Thus, its strength from the perspective of moral hazard is also arguably its main weakness. A system of supervisory sticks and carrots may play a useful complementary role in promoting a better understanding of risk (see below).

7.2.2 The discretionary use of supervisory instruments

The authorities could adjust their supervisory instruments, if and when required, in a *discretionary* fashion on the basis of their own views about the level of risk in the financial system.[111] This approach would be consistent with a strengthening of the macroprudential focus of financial regulation.

An example of this approach would be for supervisors to induce an increase in capital cushions during an economic boom in which they judged, based on overall available evidence, that risk was being misassessed by financial institutions. Another example would be an increase in capital requirements during a period of increased systemic risk due to, for example, an increase in the riskiness of international capital flows.

An increase in capital could be achieved by supervisors raising the required regulatory minimum for all banks, or by using the process of supervisory review to induce banks with the largest exposures to the domestic business cycle (or to foreign funding) to hold additional capital.[112] At least conceptually, one

[111] Depending on the legal and institutional setup in each regulatory jurisdiction, this could be done by changing regulatory requirements or enforcing more stringent standards above those minima through the supervisory review process.

[112] Or, more generally, the economic cycle (common factor) to which they are exposed.

way of doing this would be to link capital requirements or cushions above the minima to the outcomes of stress tests. From a system stability perspective, supervisors might also raise regulatory capital ratios if they thought that the correlation between expected defaults by individual banks had increased due to common exposure to particular vulnerabilities in the financial system (for example due to an overextension of the commercial property market).

A complementary instrument would be the imposition of minimum provisioning rates, which could vary over time. Again, this could be done for the system as a whole, or on a bank by bank basis.

Another potential discretionary instrument is loan-to-value ratios. Whenever it is within their power, supervisors could change minimum ratios or the size of haircuts to collateral values in response to their evolving judgments of risk. The most obvious area in which this could be done is the loan-to-value ratios that apply to property lending. For instance, if supervisors were of the opinion that property price increases were excessive and that some correction was likely, the maximum loan-to-value ratio might be lowered. The ratio could then be increased after a downward adjustment in prices. Such an approach might reduce the amplitude of the property price cycle and at the same time cut the exposure that banks have to the cycle. To a limited extent, this approach was used in Hong Kong in the 1990s, although the authorities there do not view loan-to-value ratios as a countercyclical instrument.[113]

Whatever the conceptual attractiveness of using supervisory instruments in a countercyclical fashion, there are a number of practical problems. First, there is a measurement issue. To the extent that such adjustments should be calibrated with reference to the exposure to systematic risk, it is not obvious how regulatory minima might be adjusted for banks that operate across national boundaries or have different domestic exposures. For example, home supervisory authorities may wish to impose higher capital ratios on banks operating domestically because of a belief that the cycle is being amplified by banks' misassessment of risk. It might, however, find it difficult to justify imposing a higher capital ratio on a consolidated group of a bank with international operations, since domestic developments may have only a small effect on the bank's overall risk profile. This problem is likely to be less severe if the cycle in risk is being driven by developments in the world economy, as opposed to the domestic economy. In such cases, higher capital ratios might be appropriate globally. The difficult question then becomes how this might be achieved.

Second, imposing standards on regulated entities that are tougher than those demanded by the market might simply encourage innovative ways of avoiding them. For example, during the mid-1990s boom in Hong Kong, the 70% maximum loan-to-value ratio led some institutions to offer "top-up" loans, which ostensibly were for the purpose of decorating a new apartment, but in reality were part of a "package" designed to circumvent the regulation. It is also likely that the authorities' actions would push financing into unregulated sectors. If this were to occur on a large enough scale, the stability of the system as a whole might even by reduced by the regulators' actions, even if the stability of the regulated entities was improved.

Third, measurement difficulties and the possibility of circumventing requirements highlight potential level playing field concerns. Discretionary supervisory adjustments would be likely to meet with stiff opposition from the regulated entities unless they were seen to be based on objective criteria and justified by the financial situation.

Fourth, discretionary adjustments could create the possibility of regulatory forbearance. If capital ratios are increased in booms, they might need to be lowered in recessions. In some circumstances, supervisors might use the "financial system stability" argument to avoid taking necessary action against troubled banks, or lower capital ratios excessively. To some extent, this problem could be mitigated by placing constraints on the supervisors' discretion, perhaps through setting a floor below which capital ratios could not fall without specific action being undertaken. This floor would be constant through the cycle.

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[113] In 1991, the Hong Kong Monetary Authority (HKMA) recommended that banks adopt a maximum loan-to-value (LTV) ratio of 70% for property lending. In December 1996, in the face of a very strong property market, the recommended maximum LTV was reduced to 60% for properties with a value of over HK$ 12 million. After the decline in property prices in 1998, these ratios remained in place, although in March 1999 the HKMA introduced a mortgage guarantee scheme that enabled homebuyers to secure mortgage loans of up to 85% of the value of the property. This limit was subsequently increased to 90% in July 2000. For a fuller description, see Hong Kong Monetary Authority (1998a) and (1998b).

Finally, supervisors would need to be careful not to overstep the mark and become excessively involved in the management of risk in individual institutions. If changes in supervisory instruments occurred on a relatively regular basis, a bank's management might pay less attention to internal risk control. As discussed above, the result could be an increase in overall risk. In addition, if system-wide problems did develop the authorities might feel that they were partly to blame, and might thus be slow to take appropriate action.

Taken together, these practical problems probably mean that discretionary adjustments in supervisory instruments in response to changes in the business cycle or system-wide risk are difficult to implement and should not occur *on a regular basis*. This, however, does not mean that such adjustments should never be made. In particular, the use of discretionary supervisory instruments can play an important role in lessening the potential macroeconomic costs of financial overextension in situations where the authorities judge that, on balance, the business cycle is sustained or accompanied by serious financial imbalances. On the basis of past experience at least, such discretionary adjustments should be expected to take place only in some business cycles.

7.2.3 Regulatory, supervisory and accounting rules

The authorities could establish *rules* that help reduce the procyclicality of the financial system. Two types of rules are possible. The first are rules for the adjustment of supervisory instruments over time. The second are rules that reduce financial procyclicality but do not lead to cycle-related changes in supervisory requirements.

The first type of rules could be used in place of discretionary changes in supervisory requirements. For example, minimum capital ratios, provisioning rates or maximum loan-to-value ratios could be linked in a *mechanical* way to variables such as the rate of growth of credit, the length of an economic expansion, or changes in property prices. Such an approach has both advantages and disadvantages relative to discretionary changes.

One advantage is that rules can act as a precommitment device. This limits the ability of participants in the financial system to put pressure on the authorities to delay adjustments in policy instruments, and also reduces the ability of the authorities to engage in regulatory forbearance. A second advantage is that rule-based changes in requirements would reduce, although probably not eliminate, the moral hazard problem. While the authorities would need to justify the rule, they would not need to provide continuous commentary on their own views of the level of risk in the financial system.

The main disadvantage of rule-based adjustments in supervisory instruments is that rules are difficult to specify. Typically, it is the interaction of a variety of factors that leads to an increase in financial system risk. Modelling these interactions is very difficult, as it is problematic to assign time-invariant weights to the various factors and to capture the important multidimensional interactions. These difficulties are compounded in an environment in which the financial system is undergoing significant structural change. Another disadvantage of preannounced rules is that they are likely to increase the incentives for and ability of banks to develop ways around the regulation, and to heighten level playing field concerns.

The second type of rules avoids explicit changes in regulatory requirements over time. Instead, they focus on ensuring that the basic regulatory structure does not unnecessarily amplify the business cycle.

An obvious starting point is the rules that govern provisioning. As discussed in Section 5, the current arrangements are far from optimal and lead to distortions in the measurement of both bank profitability and bank capital. Supervisors could play a potentially important role in improving the situation in this area. In particular, they could enter into a more active dialogue with accounting authorities, pressing the point that provisions need to be forward-looking. As more banks use internal rating systems to explicitly measure expected losses, the tension between the accounting treatment of expected losses and the way that banks and regulators think about expected losses is likely to grow. If progress proves too slow or difficult, supervisors could require deductions from regulatory capital to offset underprovisioning.

A related option is for supervisors to require banks to use horizons longer than one year when calculating expected losses and the expected variability of losses. While most banks' information systems have been designed around the one-year horizon, this horizon is not immutable and could change, in time, under supervisory pressure. For example, as part of the process of approving the use of internal ratings for the purpose of calculating minimum capital requirements, supervisors could

require institutions to move towards measuring risk over longer horizons and to use measurement methodologies that incorporate business cycle effects.

A third option is to establish more constraining supervisory rules to smooth the procyclical fluctuations of provisions, effectively increasing provisions in periods of historically low loan losses. Such an approach has recently been introduced in Spain.[114] Under new provisioning rules, banks are required to take a charge to their profit and loss for *statistical* provisions, where the charge is calculated using a long-term average of loss experiences. Then, provided the fund for statistical provisions is large enough, the charge for specific provisions will effectively be made from the statistical fund, rather than from the current year's profit and loss. The effect is to reduce the fluctuation in a bank's year-to-year profitability, with the provisioning charge being driven by average loss experiences rather than year-to-year loss experiences. This profit stabilising mechanism is, however, not unlimited. If loan defaults are high and unusually large specific provisions are required, the statistical fund could be exhausted, and specific provisions would need to be made directly from the current year's profit. Conversely, once the statistical provision fund has reached a certain level, no further charges to profit are required.[115]

This approach can be interpreted as forward-looking even though it does not require the banks or the supervisors to forecast future economic conditions or to evaluate financial vulnerabilities when making provisioning decisions. One attraction is that it lessens the potential moral hazard problem, as supervisors are not required to make constant judgments about the appropriate level of provisions. On the other hand, the ratio of provisions to total assets is likely to be relatively constant over time, and so may not track changes in actual expected losses very closely. This potential problem could be alleviated by allowing banks to use their internal models (as is ultimately envisaged in Spain), rather than supervisory guidelines, to estimate the statistical provision. This would of course require that the internal models not be subject to the biases that we discussed earlier.

A complementary option might be to require banks to use default probabilities calculated over an entire cycle, rather than at a point in time, when calculating minimum regulatory capital. As we argued earlier, the through-the-cycle approach is likely to be less cyclical than the point-in-time approach. Another possibility would be for supervisors to set target capital ratios as well as minimum capital ratios. In normal times, banks would then be expected to maintain their capital ratio above the target ratio, but would be permitted to go below the target when economic conditions were depressed. In such circumstances, supervisory action would only be taken when the capital ratio was below the minimum. This approach ensures an additional capital buffer is in place in good times while also addressing concerns about forbearance at times of financial distress.

A final area of potential policy action is minimum loan-to-value ratios. As discussed in Section 6, the *level* of the ratio acts as a kind of multiplier, as it determines the amount of additional lending that can be sustained by a given change in asset value. Moreover, low minimum loan-to-value ratios would reduce the likelihood that the value of the collateral would fall below that of the loan, limiting losses and hence headwinds during the downswing. One possibility would be to apply conservative valuation approaches, either by focusing on sustainable cash flows from the asset or by linking valuations to historical stress episodes of declines in prices. Another possibility would be to set low values for the minimum ratio itself. The potential to get round such regulations would of course limit their effectiveness, but strengthened supervisory review could help to restrain such circumvention.

7.2.4 Monetary policy

The authorities could use *monetary policy* to address imbalances in the financial system. This option has recently received increased attention in the debates about how monetary policy should respond to movements in asset prices.[116]

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[114] For a description of the Spanish approach, see Poveda (2000) and Fernández de Lis et al (2001).

[115] The accumulation of statistical provisions will cease when the statistical fund reaches three times the annual charge.

[116] See Crockett (2000a) and Borio and Crockett (2000) for a discussion of these issues within the broader context of the relationship between financial and monetary stability. See also BIS (1997), Chapter VIII. Three useful volumes devoted to the issue of monetary policy and asset prices are BIS (1998), CEPR/BIS (1998) and Federal Reserve Bank of Kansas City (1999).

One view is that financial stability considerations may, in certain circumstances, warrant an increase in interest rates larger than that justified in terms of short-term inflation control. The rationale for doing so is that by containing the development of financial imbalances today, the central bank might help avoid financial instability in the future. It may well be desirable for the central bank to deviate slightly from its inflation objective in the short run, if in so doing it is able to reduce the probability of serious financial problems and thus the expected variability of inflation in the future.[117]

For instance, given the important role of commercial property in generating banking system problems, the central bank might increase interest rates in response to an unsustainable commercial property lending and price boom, even if there were no short-term pressures on the prices of goods and services. One benefit, relative to increasing capital ratios on regulated entities, is that the higher interest rates would affect regulated and unregulated entities alike. Another is that a decision to increase interest rates is unlikely to generate criticism that the authorities are interfering in the management of individual firms.

The alternative, and more commonly encountered, view is that monetary policy should be directed exclusively at control of the inflation rate over the central bank's forecast horizon. Financial stability considerations are then only relevant to the extent that they bear on the expected inflation rate over that horizon. This view reflects, in part, an assessment that financial imbalances, and asset price misalignments in particular, are too difficult to identify and that systematically reacting to them might be destabilising.[118]

Those who take this position typically also argue that it is supervisory instruments that should be used to address financial imbalances. However, if at the same time supervisors were to argue that supervisory instruments should not be used to address system-wide vulnerabilities associated with macroeconomic developments, there would be a risk that financial imbalances could go unaddressed. Coordination between monetary and supervisory authorities is therefore particularly important. This is especially the case in those countries in which the supervisory responsibility does not lie with the central bank.

While there is a case for using monetary policy to address financial imbalances, such an approach confronts a number of problems in addition to that of identifying the imbalances.[119]

First, it might be difficult to explain convincingly to the public why interest rates are being *increased* for financial stability reasons if there are no immediate inflation pressures. This difficulty is likely to be compounded if, as is often the case, the very developments that the central bank views with concern are viewed by others as evidence that things are going well (booming equity or property prices might be one example). In contrast, central banks are likely to find it easier to explain why interest rates are being *reduced* for financial stability reasons. For example, the Federal Reserve Board in the United States appeared to have little trouble explaining the reductions in interest rates that followed the financial market turmoil around the time of the Russian default and Long-Term Capital Management's problems. This introduces the possibility of asymmetric responses, which in turn could induce excessive risk-taking behaviour, an insidious form of "moral hazard".

Second, if higher interest rates are successful in containing the build-up of financial risk, but at the cost of slower growth or a fall in asset prices, the central bank might come under heavy criticism for undermining what appeared to be a sustainable non-inflationary boom. This could ultimately be harmful to the central bank's reputation and its ability to pursue its price stability objectives.

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[117] Kent and Lowe (1997) provide a rigorous theoretical justification of this view; Shiratsuka (2001) makes a similar point with reference to the notion of "sustainable" price stability. See also Borio et al (1994) and Cecchetti et al (2000) and, with reference to the recent Japanese experience, Okina et al (2000) for arguments in favour of raising interest rates on financial stability grounds. Goodhart (1995), drawing in part on the theoretical paper by Alchian and Klein (1973) on the correct measure of inflation, also highlights the need to take the behaviour of asset prices into account in the setting of monetary policy.

[118] This argument has recently been made by Bernanke and Gertler (1999). See also Vickers (1999) and some of the views expressed in CEPR/BIS (1998).

[119] For a vivid account of the dilemmas faced by the Bank of Japan at the time of the asset price bubble, and an elaboration of these considerations, see Yamaguchi (1999).

Third, relatively small changes in interest rates might have little effect on developments in the financial system. They might actually be counterproductive if they lead to greater confidence in the central bank anti-inflation commitment and hence boost asset prices and financial overextension further.[120] One implication of this is that large changes in interest rates might be needed to make a material difference. This is likely to be the case given that the environment in which monetary policy would be used in this way is probably one in which credit is growing very strongly, asset prices are rising rapidly and people are (excessively) optimistic about the future.

The impact of large increases in interest rates on asset markets and the economy is, however, difficult to quantify. Thus, one cost of using monetary policy, rather than supervisory instruments, might be that the results are more difficult to predict and the costs of getting things wrong might be higher. An increase in required capital ratios, when in reality none was necessary, may be less damaging than an inappropriate large increase in interest rates.

Despite these difficulties, just as there is a case for discretionary adjustments in supervisory instruments, there is a case for monetary policy to respond to financial system imbalances. Indeed, the central bank's financial and monetary stability responsibilities may both require it to do so, particularly if the imbalances are making the macroeconomy and financial system highly vulnerable to an episode of instability.[121] As with supervisory instruments, however, such monetary policy adjustments should probably not be made every business cycle.

8. Conclusions

Developments in the financial system can amplify swings in the macroeconomy and sow the seeds of widespread financial instability. In this paper, we have argued that an important source of this amplification is the inappropriate responses by financial market participants to changes in the time dimension of risk, especially in its systematic component. These responses primarily reflect the mismeasurement of changes in the absolute level of risk over time, but also the incentives that are faced by individuals and institutions. Moreover, even if they did not contribute to amplifying the business cycle, such responses would still be sufficient to undermine the soundness of financial institutions, by heightening their vulnerability to a downturn in economic activity.

The mismeasurement of risk arises partly from the short horizons that underlie most risk measurement methodologies and partly from insufficient attention being paid to the correlations across borrowers and institutions. Combined, these two shortcomings mean that changes in risk associated with the economic cycle tend to be misassessed. In particular, risk is often underestimated in booms and overestimated in recessions. Longer horizons and a greater appreciation of correlations would contribute to better risk measurement, both at the level of individual institutions and for the system as a whole.

One consequence of current measurement practices is that bank provisions and capital ratios fail to increase in economic booms. This contributes to the procyclicality of the financial system by increasing the cyclicality of bank profitability and creating additional pressure for banks to raise capital and, more generally, constrain lending in recessions.

We argue that financial stability would be enhanced by provisions and capital ratios increasing in economic booms. This would track risk better. As economic expansions mature, there are reasons to believe that the riskiness of *individual* borrowers tends to increase, as do the *correlation* in default risk *between individual borrowers* and the *correlation* of the probability of losses *across financial institutions* themselves. In addition, an increase in provisions and capital ratios in a boom would act as a built-in stabiliser. Capital is generally cheaper and easier to raise in booms than in recessions. By creating *additional cushion*s in good times that can be drawn down in bad times, higher capital ratios

[120] Yamaguchi (1999) stresses this point. Goodfriend (2000) highlights more generally the paradoxical risks that can stem from the credibility of the central bank's anti-inflation commitment.

[121] The case is made stronger if regulatory policy is unable to address the system-wide vulnerabilities.

and provisions could help to limit the exacerbation of financial instability through the financial system's amplification mechanisms.

We argue that public policy should, and could, respond to cycles in financial system risk that threaten financial stability or significantly amplify the business cycle. The policy options include: the promotion of improved measurement of risk; discretionary countercyclical adjustments in supervisory requirements; the establishment of supervisory rules that make the system more robust to misassessments of risk; and the use of monetary policy to contain the development of financial imbalances.

Each of these options has advantages and disadvantages, with the appropriate response depending very much on the particular circumstances. Given the current state of knowledge about financial and business cycles, we regard provisioning as the area deserving the most immediate attention and holding the greatest promise of progress. At the same time, we believe that it might be useful in future to give further consideration to possible responses in areas such as loan-to-value ratios and capital requirements. We also see scope for the use of both monetary policy and discretionary adjustments in supervisory requirements, although we argue that these policy instruments should be used infrequently, and then only when serious financial imbalances are developing.

A common factor underlying the policy responses proposed is a lengthening of the horizon over which risk is measured and managed. This is all the more important given our limited ability to predict turning points in the cycle and the timing of financial instability. This lengthening is explicit in the case of policy options for current provisioning and capital practices; it is implicit in the proposed shift in focus towards further reliance on stress testing, as a means of identifying vulnerabilities, and on less cyclically sensitive measures of value.

Addressing the risks to financial stability arising from excessive procyclicality highlights a number of coordination issues among policymakers. The task involves authorities with different perspectives and responsibilities. Indeed, some of the policy instruments lie in the hands of authorities whose main task is not to safeguard financial stability at all, even though their tools and decisions can have a significant impact on the outcome. For instance, more forward-looking economic provisioning clashes with accounting rules that require an event to have already occurred before a provision is created, and could meet with objections from securities and tax authorities. Similarly, it is frequently argued that the task of monetary policy is to focus exclusively on price stability narrowly defined and that prudential regulation and supervision should not be concerned with the financial cycle. In the absence of a consensus on diagnosis, remedies and allocation of responsibilities, there is a risk that the problem will remain unaddressed.

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