Cyclical patterns in profits, provisioning and lending of banks and procyclicality of the new Basel capital requirements *

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1. Introduction

Supervisors worldwide work for the financial soundness of banks, in an increasingly market-oriented fashion. The upcoming new Basel accord on capital requirements, expected to enter into force end 2006, is a topical case in point (BCBS 2001). The main purpose of the new accord is to introduce a more risk-sensitive method for determining the minimum capital required to absorb losses, in particular credit losses. The current capital requirements under the Basel accord are mainly determined by fixed weights attached to categories of borrowers, such as businesses, government or banks, and disregard any variation within categories as to creditworthiness. Categorisation into risk classes is crude, so that as reflections of the actual risk, the accompanying risk weights are inadequate to the point of arbitrariness, while improvement or deterioration of creditworthiness with the ups and downs of the business cycle is disregarded in determining capital requirements. In reaction to this, many banks have reshuffled their

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assets in such a way that the accompanying capital requirements are (too) low in comparison to the actual risks involved.

Under the proposed new capital accord, risk weighting for the purpose of determining capital requirements does take in the creditworthiness of individual firms. In many cases, the Standardised Method will be used, under which banks may use ratings determined by external rating firms – such as S&P and Moody's – to weight risks for loans to businesses. A change in creditworthiness will be expressed in the ratings and hence in capital requirements. Under certain conditions, more sophisticated banks may apply the *internal rating-based* (IRB) method, whereby they attach their own ratings to credits. Whereas external ratings, in principle, aim to remain constant through the business cycle (the so-called *through-the-cycle* ratings), internal ratings depend on the current phase in the business cycle (the so-called *point-in-time* ratings). The most sophisticated banks are allowed to go much further in classifying assets and the collateral that covers them. This development, whereby banks are allowed to classify loans into risk categories according to their own internal rating methods, is a revolutionary and market-oriented innovation in banking supervision.

The new accord thus promotes the financial soundness of individual banks and the financial stability of the banking system. A possible disadvantage, however, is that the novel risk sensitiveness of capital requirements could exert a procyclical influence on the macroeconomy, where banks play a major role, as suppliers of credit. When during a downward slope of the business cycle the risk of business loans and the related capital requirements increase, there is the danger that banks become less forthcoming in extending loans, thus reinforcing the cyclical slowdown in what is called a *credit crunch*. It should be noticed that the procyclical effect of the new accord should certainly not be overestimated, as in reality capital and reserves are significantly higher than minimum capital requirements for almost all banks.[1] Apparently, banks typically aim at a considerably higher external credit rating than corresponding with the minimum requirements. For that reason it is actual and not regulatory capital that counts in practice. Even under Basel II, the business cycle swing in the minimum capital

[1] Also the first capital accord has only improved the level of capital of the worst capitalised banks (Jackson 1999).

requirements is expected to be limited compared to the capital surplus most banks hold up. Based on the second consultative BIS document of January 2001, Ervin and Wild (2001) show that this swing could amount to 19%. Thereafter, the Basel Committee has reduced the risk sensitivity and hence the cyclical effect of capital requirements by at least one-third.

At this stage, the degree to which the new accord will turn out to reinforce the procyclicality of banks' risk management is difficult if not impossible to determine. Even under the present accord, with capital requirements insensitive to the business cycle, the banking system is in some respects procyclical. In the first place, there is the possibility that loans will be extended less liberally during a cyclical downswing, the argument being that risk premiums are, in fact, assumed to be insufficient cover for the increased risk or inadequate due to adverse selection and moral hazard problems (Stiglitz and Weiss 1981). Secondly, there are several channels through which the business cycle impacts a bank's profits, such as decreased demand for credit and stock market transactions, provisions necessitated by the deterioration of existing loans and in some cases a less favourable interest structure. Thus, less profits are added to capital and reserves, while at the same time it is harder to raise new capital on the stock market.

On the basis of the above, it is relevant to analyse in what ways and to what extent banks' characteristics (such as profitability), activities (such as lending) and their actions (such as making provisions for (future) losses) relate to the business cycle. Such an analysis will also indicate how procyclical the current arrangement already is. For instance, greater profits imply the possibility to enlarge the capital buffer and increase lending. These issues are addressed by the present analysis.

The structure of this article is as follows. The next section provides a bird's eye view of empirical literature on procyclicality in banking. Section 3 presents an empirical research into banks' profitability and the way it relates to the business cycle, while Section 4 takes a similar approach to the making of provisions for future credit losses. Section 5 then provides an empirical study of lending practices, with special focus on demand and supply factors because of their pivotal role in the so-called *bank lending channel* theory. The article ends with a summary and conclusions.

2. Procyclicality in banking

As already said, banks, as suppliers of credit, can play an important role in the business cycle, if during a cyclical downswing their lending policy becomes less liberal. This will reinforce trends in the real world and therefore be procyclical in effect. However, whether a drop in lending is actually the result of demand or of supply factors is difficult to determine in practice. *Bank lending channel* theory argues that monetary policy influences expenditures via the supply of bank credit (Bernanke and Gertler 1995, Berk 1998).[2] Tightening of monetary policy causes a decrease in banks' liabilities, followed by a decrease of bank credit, at its worst referred to as a *credit crunch* (Kliesen and Tatom 1992). If the credit supply decreases mainly through a decline in banks' capital, we speak of a *capital crunch*. This is the kind of situation which, some fear, could materialise under the new capital accord during a cyclical downturn: increased risk causes capital requirements to grow so much that the capital available for lending becomes too small. However, the new accord precisely encourages banks to pursue more prudent policies, promoting the financial soundness of the banking system. Thus, in principle, the accord aims at mitigating the risk of the most serious credit crunch, i.e. a dry-up of lending in a banking crisis.[3]

In *balance sheet channel* theory, fluctuations in lending are explained not from supply but from demand factors (Bernanke and Gertler 1995). Here the central tenet is that changes in net capital positions of businesses and households caused by the business cycle may be responsible for a decline in credit demand. The economic downturn confronts businesses with declining sales and households with decreasing dwelling and stock prices, taking away the need for new credit. The decline in net capital positions will, in fact, not only push down credit demand but also the willingness to extend loans.

Many analysts have linked the strong decline in lending in the US over 1989-92 to the 1990-91 recession and regarded it as an exem-

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[2] A different cause might be that asymmetrical information in credit markets might induce banks to ration credit in order to avoid adverse selection and moral hazard; see Stiglitz and Weiss (1981).

[3] For a survey of possible shortcomings and risks of both the old and new Basel accord, see Tonveronachi (2001).

plary case of credit crunch.[4] It is unclear, however, whether the decline in lending was caused mainly by a decrease in demand or by a decrease in supply (Kliesen and Tatom 1992, Peek and Rosengren 1995). Sharpe (1995) juxtaposes a number of macro- and microeconomic analyses of credit crunches as they relate to capital requirements, disequilibrium and supervisory practices. Kliesen and Tatom (1992) used a macroeconomic model to study the relationship between interest and credit, and concluded that demand factors far outweighed supply factors. Such models, however, underrate the transmission channel and the role played by bank capital. Microeconomic models focus directly on the impact of capital requirements. Peek and Rosengren (1995) found a positive effect of bank capital on credit growth during 1990-91, while Bernanke and Lown (1991) also detected a positive, albeit marginal, correlation. Brinkmann and Horvitz (1995) conclude that banks which do not meet capital requirements are, in fact, far less successful in realising credit growth. Wagster (1999) finds for Canada, the United Kingdom (UK) and the US that during 1990-92, due to stricter supervision, less credit was extended towards lower-risk investments such as government bonds. Nevertheless, these authors, and others such as Akhtar (1994) and Berger and Udell (1994), emphasise the role of both demand and supply factors in a lending decline. Lown and Wenninger (1994) perceive different correlations in different periods, the decline in lending during 1990-91 in the US being mainly caused by a drop in demand, whereas during 1988-89 supply played the larger role.

Summing up, we conclude that empirical research into lending suggests a possible but usually very restricted role for demand; convincing empirical support for *bank lending channel* theory has failed to materialise. A positive effect of capital (requirements) on lending supporting either a credit or a capital crunch is found, but here, too, the evidence is rather weak. Almost invariably, demand factors dominate the picture. Berk (1998) who refers to other empirical studies than mentioned above, draws the same conclusion. Sharpe (1995) therefore concludes that empirical research has so far failed to come up with sufficient evidence to support the thesis that the decline in lending was

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[4] Another example is the situation wherein Japanese banks found themselves after the burst of the speculative bubble in the real estate prices at the beginning of the nineties.

caused by changes in capital requirements. Thus, while procyclicality of banks' behaviour and the perceived increased procyclicality caused by the new capital accord are genuine problems, they are unlikely to have a substantial unfavourable effect on macroeconomic stability.[5] By contrast, the new accord does help to enhance the financial health of the banking system, thereby diminishing the risk of the worst possible credit crunch – that caused by a banking crisis.

3. Banks' profits and the business cycle

Against the backdrop of the concern that has arisen over the procyclical effects of the new capital accord, it is interesting to find out what degree of correlation there is between banks' profitability and the business cycle. In the literature, two types of causality have been investigated for the correlation between the banking system and macroeconomics. Some scholars have studied the influence of the development of the financial system on economic growth, on the one hand, focussing on the long term, finding a positive effect (e.g. Levine 1997; Van der Zwet and Swank 2000; Arestis, Demtriades and Luintel 2001; Fase 2001), and on the other hand concentrating on the short term, as discussed in the former section. Others analysed the influence of economic development on banks' profitability. In this line Demirgüc-Kunt and Huizinga (1998) explain banks' profitability and interest margins during 1988-95 and across 80 countries using macroeconomic as well as banking-specific and institutional factors.[6] Taking into consideration differences in types of banking activity, leverage and macroeconomic developments, they emphasise the explanatory powers of institutional factors, such as differences in financial and legal structure, capitalisation and taxation.[7] Cavello and Majnoni

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[5] Of course, apart from the fact that credit risk will be incorporated in the minimum capital requirements, the lending channel itself may be affected by the new accord, as the pricing of credit risk will improve substantially. This might work out procyclical, as the interest rate of credit may rise at a downturn, or countercyclical, as it may prevent banks from credit rationing during downturn.

[6] Interest margin is the ratio of net interest income and total assets.

[7] Their results show, for instance, that well-developed banks realise higher net interest margins and are more profitable. Also, banks in more competitive sectors ap-

(2002) brought forth a similar study. Although these articles do cover macroeconomic factors, the role of these determinants remains underexposed and the results are not very plausible.[8] Arpa *et al.* (2001) do focus more on the influence of macroeconomic developments in explaining (components of) bank incomes and provisions for future credit losses over 1990-99. They demonstrate that Austrian banks make more provisions for credit risk as Gross Domestic Product (GDP) growth figures decline (with a procyclical effect) and as net income rises (with a countercyclical effect).

Following Demirgüc-Kunt and Huizinga and Arpa *et al.*, we will focus on the influence of the business cycle (and banking-specific factors) on profits, bringing macroeconomic influences more to the fore than the former studies and considering far more countries than the latter. In order to clarify the influence exerted by the business cycle, we collected data on a period covering several decades. Moreover, we used data from many countries in order to gain an overall view of the banking system in the industrial world, where the new capital accord will be adopted, and also to obtain a large number of observations for our empirical analysis. Thus we arrive at a collection of macroeconomic and banking-specific determinants of banks' profits, which are described in detail in Appendix 1.

Following the usual practice in the literature, we use two possible definitions for the dependent variable *profits*: the margin or returns on (all) assets (ROA) and the returns on equity (ROE), both expressed as percentages. These variables make it possible to compare data across countries and through time. Returns are always taken before taxes and therefore undistorted by taxation differences across countries. For subsequent analyses of portions of the returns, it is useful to know that returns before taxes, as referred to in this article, is a bookkeeping concept calculated as shown in Table 1.

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pear to work for lower margins and to bring less profit. The size of banks and their degree of concentration, by contrast, appear to have positive effects, while institutional and legal indicators such as efficiency of legislation, compliance with contracts, high taxation and the absence of corruption appear to influence interest margins and profitability in a negative sense. Finally, and surprisingly, neither GDP growth nor GDP per capita appear to have significant influences on interest margin and profitability.

[8] Demirgüc-Kunt and Huizinga (1998) used GDP per capita, real GDP growth, GDP inflation and real short-term interest rate as macroeconomic indicators.

TABLE 1

BREAKDOWN OF BANKS' PROFITS

Interest income
Interest expenditure –
Net interest income
Non-interest earnings +
Gross profits (operational profits)
Operational expenditure –
Net profits (operational results)
Provisions –
Profits before taxes

3.1 *Data used*

The macroeconomic data used for the combined time series/cross section analysis were provided by Datastream[9] and the data specific to the banking sector were taken from *Bank Profitability: Financial Statements of Banks* published by the OECD (2000). There are no OECD data going back to before 1979, which is why our analyses refer to the years 1979-99. Using longer series increases the accuracy of estimates but goes with the risk of ignoring changes in the underlying processes. In this trade-off we choose for the longer estimation period, also because shorter periods are inadequate to cover a sufficient number of business cycles, but we checked for regime changes by re-estimating each model for two subperiods: the *pre* Basel I years (1979-90) and the *post* Basel I years (1991-99).[10]

Of the 29 OECD countries, 26 had sufficient data available to participate in the analyses: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, Turkey, the UK

[9] See Appendix 2 for the sources used.
[10] The 1988 Basel capital accord became effective at the beginning of 1991.

and the US.[11] For the sake of comparability across countries and through the years, all data are presented as growth figures, percentages or ratios, so as to avoid scaling difficulties. Data on differences between countries in financial structure, taxation regime, market structure, institutional conditions or management culture were not available for the entire period under review. In order to take country-specific factors into account despite the lack of data, we introduced a dummy variable for each country by way of simple approximation.

3.2. *Empirical results of profit margins on assets*

Above, we have indicated in what way banks' profitability and profit margins correlate with the business cycle, while Appendix 1 describes the macroeconomic variables and banking sector-specific factors involved in that correlation. Departing from these, we formulate the following base model:

$$\begin{aligned} \text{profits}_t = {} & \alpha_1 \text{GDP}_t + \alpha_2 \text{unemployment}_t + \alpha_3 \text{inflation}_t + \\ & \alpha_4 \text{share price}_t + \alpha_5 \text{M3}_t + \alpha_6 \text{loans}_t + \alpha_7 \text{interest differential}_t + \\ & \alpha_8 \text{non-bank deposits}_t + \alpha_9 \text{capital and reserves}_t + \\ & \Sigma_{i=1\ldots26} \alpha_{9+i} d_i + u_t \end{aligned} \quad (1)$$

with variables either described summarily or abbreviated. In variant versions of the model, more explanatory variables have been included, while the interest differential may be substituted by its two components, short-term and long-term interest rates. Some variables have been delayed. Bottom index t refers to time (1979-99). The country dummies are referred to as d_i. If all 26 countries have a dummy variable, the intercept becomes superfluous.[12] The error term is referred to as u_i. Equation 1 constitutes an unbalanced, fixed-effect panel data model,[13] which is estimated by OLS (Baltagi 1995). As the variable to be explained, we will first take returns on assets, and afterwards returns on equity, both calculated before taxes.

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[11] Data for all variables and for all years are not available for every country. In the case of Czech Republic, Hungary and Poland, crucial data are lacking.

[12] Identical outcomes are obtained if one keeps the intercept and leaves out one country dummy; see below.

[13] 'Unbalanced' as a number of year-country combinations is lacking and 'fixed effects' as country effects are measured by dummy variables.

Table 2 orizz. (parte 1)

Table 2 orizz. (parte 2)

Table 2 presents results for two variants: *i*) a base model including all explanatory variables examined, regardless of significance, and *ii*) a reduced model with significant variables only (see Columns 1 and 2).[14] The first variant shows the 'raw' estimation results, whereas the second presents a model 'sparsely' equipped with variables. Also, the second variant is based on more observations because fewer variables were required.[15]

Both contemporaneous and delayed real GDP growth were included, because cyclical effects could conceivably have a delayed impact on profit margins, for instance through delayed adjustments of interest rates or staff size, or by way of delayed customer response. Both the contemporaneous and the delayed coefficient of GDP turn out to be positive, indicating how strong the correlation is between profit margins and the business cycle or, more particularly, real economic growth, presumably owing to demand effects. When GDP growth is over 2%, profits turn out to be almost 2.5 times as high as when GDP growth is under 2%. This result is more plausible than the ones found by Arpa *et al.* (2001) or Demirgüc-Kunt and Huizinga (1998), neither of which studies found any effects of GDP growth on profits. The unemployment coefficient carries, as expected, a significantly negative sign. Here, too, the correlation between profit and business cycle is in evidence. Where GDP growth reflects cyclical *change*, unemployment indicates the *phase* of the business cycle, although usually with some delay. A larger structural component of unemployment, moreover, indicates economic unbalance and less favourable economic conditions, which have their own adverse effects on profit margins.

Inflation, as was also found by Arpa *et al.* (2001), carries consistently positive coefficients. Possibly, nominal interest rates vary with inflation, so that real interest rates are more constant. In principle, this effect ought to be explained by the interest rates, but neither the interest rates[16] themselves nor the interest differential are found to carry a significant coefficient, as also found by Arpa *et al.* Presumably, long-term and short-term interest rates are inadequate proxies of, re-

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[14] On the basis of the 95% level of confidence.

[15] An alternative method reducing bias as compared to the original would be to use the same data set as in the base variant, with the disadvantage of having the same (lower) number of observations.

[16] The estimated results are not shown in this article.

spectively, credit and deposit rates. Later on, we will discuss other possible causes of distortion with respect to interest rates.

The significant negative relation between loans and profit margin is remarkable, since a positive relation had been expected *a priori* (see Appendix 1). The premium put on the long-term interest rate, as included in the credit rate, is possibly insufficient cover for processing costs, credit losses and the cost of required capital reserves, which is not uncommon practice. This might be explained by increased competition in the banking market, and by the impact of the capital market and of new entries in the banking market. The coefficient of capital and reserves is significantly positive. A possible explanation for this is that capital and reserves contribute to ROA as a 'free' source of finance. Finally, share prices, real money supply and non-bank deposits seem to have no significant effect on profit margins.

In order to obtain meaningful coefficients and t-values for the dummy variables, the intercept in the model was maintained while one country dummy (that of Sweden) was left out.[17] The country-specific differences pointed up by the dummies (i.e. differences not included in the model) were found to be significant in the case of some countries.[18] In the non-European Anglo-Saxon countries Canada, New Zealand and the US, profit margins are significantly higher than elsewhere, as could be expected, while the same is true in Turkey, possibly in compensation for the substantial volatility of margins. Owing to various causes, profit margins in Finland, Japan, Luxembourg and South Korea are significantly lower than elsewhere.

The time dimension appears not to play a relevant role in this panel analysis. The coefficient of an added time trend, for instance, is found to be non-significant. In the first column, the DW of 1.60 is within the critical limit,[19] so that a positive auto-correlation is absent.

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[17] Sweden is the most 'average' country: in the initial estimate of the base variant, its dummy coefficient came out closest to the arithmetic average of all country dummies. This is not necessarily true, however, of the later variants.

[18] In this and all subsequent estimates, the country dummies were also found to be jointly significant.

[19] This limit is derived from an estimated critical lower limit, D1, which is downward-distorted as the number of explanatory variables (k) increases. The usual DW tables run to $k=6$ as a maximum with a DW index of 1.57. As this model and subsequent models all contain considerably more than six variables and considerably more observations, we may deduce that the critical D1 is below 1.57. An alternative might be the inclusion in the model of an autoregressive term. While significant, however, this term turns out not to have any sizeable effect on the results.

The R^2 adjusted for degrees of freedom at 0.51 is satisfactory for a panel analysis.

3.3. *Selection of countries*

The non-significance of the interest difference coefficient may be attributable to an inverted interest structure or unreliable interest data for some countries. Greece and Turkey in particular show highly volatile interest rate developments, with short-term rates sometimes far exceeding long-term rates. Iceland and Mexico, too, have seen highly fitful interest rate developments, with extremely high long-term and short-term rates. In order to find out to what extent this effect distorted estimates, therefore, we looked at a variant including a smaller group of selected countries where financial and economic conditions have been stable. For this reason, Greece, Iceland, Mexico, South Korea and Turkey were left out, either on account of unreliable interest rate data or extreme interest rate values, or because of their less developed financial and economic systems.

For this group of selected countries, a positive effect of economic growth on profits was found to be significant (see Columns 3 and 4 in Table 2). The effects of unemployment and loans is also significant, as before, while the country dummies display a pattern similar to that of the base variant (cf. Column 1). This time, interest rate differential, in contrast to the base variant, appears to have a significantly positive effect on profits, owing, probably, to a more stable development of interest rates in these selected countries, or to more reliable interest data.

3.4. *Risk-weighted assets ratio*

In order to find out how strong the effect of banks' risk profile on their profit margin is, we estimated a final variant including a *risk-weighted assets ratio* (RWAR) as an extra explanatory variable. RWAR was left out of the base variant because data were available for far fewer countries, and only for the more recent years: the number of observations is a mere 130, as against 400 in the base variant. Columns 5 and 6 of Table 2 show that high-risk credit portfolios carry a sig-

nificantly lower profit margin. Apparently, the extra profit margin on high-risk loans in no way compensates for the losses suffered from the additional risk.[20] This outcome should be regarded with some caution, because the Basel risk weights – on which the RWAR is based – are very crude and imprecise. In comparison to the earlier estimates, two changes stand out. First, the loans variable has ceased to be significant. This should not surprise us, because this variable also acted as an approximation of the risk profile, a function fulfilled here by RWAR. Secondly, the share price index now carries a significant coefficient. This, too, is according to expectations, because the demand for banking services depends in part on developments on the stock exchange.

3.5. *Return on equity*

Besides returns on assets (ROA), returns on equity (ROE) are also used in the literature as a measure of profit. Therefore, the above analyses were repeated with ROE as the variable to be explained. ROE results, by and large, confirm the ROA analysis – i.e. no significant differences are found – and are therefore not discussed separately here.

3.6. *Pre and post Basel I subperiods*

The estimations have been repeated for two subperiods, respectively before and after the beginning of 1991, when the 1988 Basel capital accord became effective. The estimation results of the later subperiod are similar to those in Table 2 with even more significant coefficients, reflecting strong cyclical effects on bank profits. Hence, for those years the same conclusions apply as drawn above. In the former subperiod, the relationship is weaker, nevertheless showing a significant effect of GDP on profits. Differences between the two periods are probably due to changes in bank behaviour or economic and institutional conditions and cannot be attributed to the first Basel accord.

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[20] This conclusion was drawn before, on the basis of the negative effect which loans have on profits.

4. Credit loss provisioning and the business cycle

As is shown by Table 1, profits are calculated by deducting credit loss provisions from net profits. Even more so than profit itself, credit loss provisions embody the relation between credit risk and capital, for provisions made to absorb (expected) credit losses press down profits before they are added to capital and reserves. In this section, we look more closely at the coherence between provisions for credit losses and the business cycle, in order to gain better insight into the possible risks of procyclicality. As was mentioned earlier, credit quality of loans is expected to move up and down with the business cycle. During a cyclical downturn, banks must take larger amounts away from – already low – profits on behalf of provisions, while in times of favourable cyclical developments the provisions for expected credit losses go down, augmenting profits. The countercyclical behaviour of provisions would thereby reinforce the cyclical nature of profits. Indeed, Cavello and Majnoni (2002) have observed such behaviour for the non-G-10 countries. However, for the G-10 countries, they recorded that banks look further ahead or, as they call it, even out their profits rather than allow them to fluctuate more strongly; thus during a cyclical boom, when net profits are high, they also make large provisions. Arpa *et al.* (2001) found the same countercyclical behaviour to be true for Austria. In addition to profit stabilisation, Kwan and O'Toole (1997) mention the influence of tax legislation and the Basel capital requirements as determinants of provisions for credit losses. Provisions, Kwan and O'Toole note, tend to be larger if credit losses are tax-deductible. In some countries, provisions for credit losses are grouped under Tier 2 capital, so that under Basel capital requirements they count as capital only up to a certain limit, while in other countries they are not treated as capital at all. Such regulations make this type of provision less attractive. Cavello and Majnoni (2002) also found a clear negative influence of public debt – as an indicator of heavier taxation in the future – on provisioning practices. These analysts, however, focus more on institutional factors, such as legislation, taxation and banking supervision, than on macroeconomic influences.

4.1. *Determinants for additions made to provisions for credit losses*

In this article, cyclical influence on the making of additions to provisions for credit losses is analysed by means of three macroeconomic variables (real GDP growth, unemployment and inflation) and three banking-specific variables (loans, net interest income and failures), which except for net interest income have already been discussed in Section 3. The model describing provisions for credit losses is as follows:

$$\begin{aligned} \text{provisions}_t = {} & \alpha_1\ \text{GDP}_t + \alpha_2\ \text{unemployment}_t + \alpha_3\ \text{inflation}_t + \alpha_4\ \text{loans}_t + \alpha_5\ \text{net interest income}_t + \alpha_6\ \text{failures}_t \\ & + \alpha_{i=1\ldots21}\ \alpha_{7+i} d_i + u_t \end{aligned} \quad (2)$$

The dependent variable *provisions* is defined as the net addition to provisions for credit losses in proportion to loans outstanding. Net interest income is scaled in relation to balance sheet total. Similar results are obtained when net interest income is replaced by net profits (see Table 1). For Australia, Luxembourg, New Zealand, Switzerland and the UK, provision data are unavailable, so that 21 countries remain.

The first two columns of Table 3 clarify the large extent to which provisions for credit losses depend on the business cycle: the coefficients of real GDP growth – both contemporaneous and delayed – and inflation turn out to be significantly negative, while the coefficient of unemployment is significantly positive, implying that provisions increase during cyclical lows. When GDP growth is less than 2%, provisions are 2/3 larger than at times of higher GDP growth, and when GDP growth is lower than –2%, they are almost 2.5 times larger. Arpa *et al.*, too, found a negative sign for the GDP coefficient. Such countercyclical behaviour acts procyclically on the macroeconomic level.

A second important result is that in years of high net interest income,[21] significantly more is added to provisions for credit losses, in line with what was found for Austria by Arpa *et al.* (2001) and for the G-10 countries by Cavello and Majoni (2001).[22] Apparently, in (rela-

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[21] After the level of GDP growth (and other variables) have been taken into account, as is self-evident in multiple regression analyses.

[22] The same result is obtained if instead of net interest income operational profits are used (as Arpa *et al.* do).

tively) good years for banks, there is a tendency to reserve more, for instance because as a precaution – more provisions are made in fat years for use in lean ones – or, as is suggested in the literature, for *credibility* (not to say window dressing), that is presenting a fairly constant profit over the years. As a result of such prudent (countercyclical) provisioning policy, banks are significantly less procyclical than would appear to follow from their dependence on the business cycle. Under the new Basel accord, therefore, such prudent behaviour ought to be encouraged in the context of the Supervisory Review of Pillar II, as is envisioned. Under Pillar II banks are obliged to show how the creditworthiness of their lending portfolio and the value of the corresponding collateral deteriorates when the business cycle goes down. Furthermore, they need to demonstrate that their capital is sufficient to meet the minimum capital requirements under such a downswing in conditions.

Finally, we find only little differences in provisioning from country to country (see country dummies in Column 1).

Provisions for credit losses strongly depend on business failures, or rather, expectations regarding business failures. Therefore, a failures variable was included in a variant on the base model, where it was given a one year lead, because provisions are made in anticipation of future failures, while failures lag behind the business cycle. For when failure is declared, it is the final moment in the survival process. Failures have not been used before in this article, because data are available for five countries only. Yet the number of failures turns out to be a highly significant contributor to the explanation of provisions – see Columns 3 and 4. As the failures variable itself also follows a strongly cyclical pattern, its inclusion contributes to sharp shifts in the coefficients of the other cycle-related variables, net profits among them. Another reason for these sharp shifts is the more limited number of observations. At any rate, the failures variable, in line with expectations, turns out to be an important determinant of credit risk provisions.

Re-estimation of equation 2 for the two distinguished subperiods provides fairly similar results as presented in Table 3, somewhat more significant in the latter period, and a bit less significant in the former. In both periods, we find significant impact of GDP as well as net interest income on credit loss provisioning.

TABLE 3

EXPLANATION OF CREDIT LOSS PROVISIONING FOR 21 COUNTRIES (1979-99)*

	Base model				**Including failures**			
	All variables		*Sign. variables*		*All variables*		*Sign. variables*	
Column	*1*		*2*		*3*		*4*	
Explanatory variables	*Coeffi-cient*	*t value*	*Coeffi-cient*	*t value*	*Coeffi-cient*	*t value*	*Coeffi-cient*	*t value*
Real GDP growth [a]	–0.11	–5.0	–0.11	–5.1	–0.07	–1.5		
Idem, delayed	–0.06	–2.4	–0.06	–2.4	–0.03	–0.6		
Inflation	–0.02	–2.6	–0.02	–2.7	0.05	1.6	0.09	3.6
Unemployment	0.07	2.0	0.07	2.0	0.08	1.3	0.12	3.4
Loans [b]	0.18	0.1			–2.11	–0.8		
Net interest income [b]	65.65	7.0	65.62	7.0	0.00	0.0		
Failures [c]					28.81	5.1	28.10	8.1
Country dummies:								
Austria	0.05	0.1	0.15	0.4				
Belgium	–0.66	–0.8	–0.59	–1.0	–1.90	–1.4	–3.34	–5.5
Canada	–0.50	–0.5	–0.36	–0.8				
Denmark	0.44	0.6	0.53	1.3				
Finland	0.08	0.1	0.21	0.6				
France	–0.11	–0.1	–0.03	–0.1	0.07	0.4	–0.86	–1.9
Germany	0.12	–0.1	–0.01	0.0				
Greece	0.31	0.5	0.38	0.8				
Iceland	0.74	0.7	0.89	2.8				
Ireland	0.03	0.0	0.15	0.2				
Italy	–0.17	–0.2	–0.09	–0.2				
Japan	0.19	0.2	0.31	1.2				
Mexico	1.32	1.4	1.44	3.3				
Netherlands	–0.29	–0.3	–0.17	–0.4	0.20	0.1	–1.71	–4.6
Norway	0.35	0.3	0.49	1.6	0.56	0.3	–1.51	–3.9
Portugal	1.11	1.6	1.19	2.9				
South Korea	1.69	2.1	1.79	4.7				
Spain	–0.83	–0.8	–0.72	–0.9	0.44	0.2	–1.83	–2.3
Sweden	0.05	0.1	0.15	0.5				
Turkey	0.97	1.0	1.07	1.4				
United States	–0.28	–0.3	–0.16	–0.4				
No. of observations	286		286		54		56	
$\bar{R}^2$	0.40		0.41		0.66		0.66	
F-test entire model [d]	8.42		8.79		10.31		16.39	
F-test dummy variables [e]	3.39		3.69		13.95		14.43	
Durbin-Watson	1.09		1.09		1.82		1.73	

* For the sake of readability, all coefficients were multiplied by 100 (i.e. growth figures as ratios, and ratios in percentages of the denominator variable).

[a] Percentual change.

[b] Divided by total assets.

[c] Divided by population.

[d] All models are accepted at the 99% level of confidence.

[e] In all models, the dummy variables are accepted jointly at the 99% level of confidence.

5. Lending and the business cycle

According to *bank lending channel* theory, the central point in the issue of procyclical behaviour of banks is the passing through of lending into the macroeconomic sphere. Therefore, this section briefly discusses the extent to which lending depends on either demand or supply variables. Naturally, there is a strong correlation between demand for credit and the business cycle, measured by the variables described in Appendix 1. Credit supply may be explained by banking-specific factors. Most important among these are 'capital and reserves', for they are subject to supervision regulations which kick in during a cyclical low when capital and reserves are eaten into by losses while at the same time risks – and hence capital requirements – have increased. It should be mentioned that, in reality, capital and reserves are significantly higher than minimum capital requirements for almost all banks. As banks aim at a higher external rating than corresponding with the minimum requirements, it is actual and not regulatory capital that counts in practice. In addition, profit margin (ROA) is included as a variable, because conceivably banks will lend more generously as their profit margins increase. This variable is not so easy to interpret, however, since a higher profit margin also signals a general improvement of economic conditions, even though these, in principle, are already explained by the cyclical variables. The interest differential, finally, may also serve as a supply variable: the greater the differential, the more attractive lending becomes.

The model for lending, defined as the change in loans divided by total assets, is:

$$\begin{aligned} \text{lending}_t = {} & \alpha_1 \text{GDP} + \alpha_2 \text{ unemployment}_t + \alpha_3 \text{ inflation}_t + \\ & \alpha_4 \text{ share price}_t + \alpha_5 \text{ M3}_t + \alpha_6 \text{ interest differential}_t + \alpha_7 \\ & \text{non-bank deposits}_t + \alpha_8 \text{ capital \& reserves}_t + \alpha_9 \text{ profits}_t + \\ & \alpha_{i=1 \ldots 26} \alpha_{10+i} \, d_i + u_t \end{aligned} \qquad (3)$$

whose variables were all described earlier.[23] Table 4 shows that the influence of the cyclical variables used, such as real GDP growth,

[23] Of course, structural supply and demand equations with the interest rate on credit as equating price would allow a better investigation of demand and supply effects on lending than reduced-form equation 3. However, reliable interest rates on

inflation and real money supply, are significantly positive, while that of unemployment is significantly negative – all as might be expected. Lending, at over 6% GDP growth, is a good 2.5 times higher than at approximately zero GDP growth. Thus lending is shown to be strongly dependent on demand as indicated by cyclical factors. One might expect that this mechanism would be stronger in continental Europe, where banks dominate credit lending, than in Anglo-Saxon countries where, (also) in this respect, the market plays a leading role. However, re-estimation of equation 3 for banking-based countries, using the classification of Demirgüc-Kunt and Huizinga (2000), did not provide any support for this view: the estimation results are almost identical.

By contrast to the strong demand effect on lending, the preeminent supply variable, capital and reserves, turns out to be completely non-significant. This would indicate that (during a cyclical downturn), there is (almost) no evidence of credit rationing, which in turn qualifies the *bank lending channel* hypothesis. That supply does yet have some impact is suggested by the significance of the profit margin, especially if delayed. The delay makes sense because the measure of profitability is something, which becomes evident only after some time, i.e., literally, on the bottom line. Lending increases by 50% if profits are doubled, indicating that much more credit is extended as a bank's profits increase.[24]

The significantly negative coefficient of non-bank deposits is a bit problematic. A possible explanation could be that private deposits are fairly inert to interest rate pressure, and therefore changes are largely exogenous in nature. Hence additional lending would have to be financed from other sources, i.e. on the interbank or capital markets, explaining the negative impact. Lending differs significantly from one country to the next. In some cases there is a simple reason: in countries whose banking systems serve as safe havens for foreign capital, such as Luxembourg and Switzerland, lending is far less dependent on national economic conditions.

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credit are hardly available, if at all, and certainly not for many countries and years. Therefore, all results based on equation 3 should be interpreted with caution.

[24] Possibly, of course, the third-factor effect might be at play here, the third factor being favourable economic conditions boosting both profits and lending. This effect is, however, 'adjusted for' by the macroeconomic variables, included in model equation 3.

In model 3, the price of housing has also been included as an alternative determinant of lending. Because data were available for only seven countries, the number of observations becomes so low as to severely impair the value of the analysis. And even so, housing prices, as an additional variable, just fail to make a significant contribution.[25]

The results of this section coincide to a large extent with the empirical results in the literature as discussed in Section 2: various demand factors contribute significantly to the explanation of lending; the most typical supply factor, capital, is not significant, but the profit margin is. Hence the role of the supply side, though modest, is not negligible so that at least some room remains for the *bank lending channel* of transmission.

Re-estimation of equation 3 for the subperiods 1979-90 and 1991-99 produces pretty similar results as in Table 4. Actually, a stronger impact of capital on lending after the introduction of the Basel capital accord in 1991 would have been plausible. However, we find such effect neither before nor after 1991, indicating limited support for the capital crunch theory. Over time, the demand effect of GDP on lending declines somewhat, whereas the supply effect of profits on lending was not significant in the first decade.

6. Summary and conclusions

According to current proposals for a new Basel capital accord, capital requirements for lending will be determined in greater measure than at present by current credit risk. Many assume that banks during a cyclical downturn are less willing to loan money on account of increased credit risk, thereby reinforcing the cyclical downswing in a so-called *credit crunch*.[26] If banks are forced to maintain larger capital buffers in such circumstances, the presumed procyclical nature of bank lending is liable to become even stronger. Against the backdrop of increasing concerns over procyclical effects caused by the proposed

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[25] That is, at the 95% level of confidence; at the 90% level, it is significant.

[26] This assumption essentially argues that risk premiums are insufficient cover for the increased risk, an argument which is, in fact, supported by empirical evidence, see below.

TABLE 4

EXPLANATION OF LENDING FOR 26 COUNTRIES (1979-99)*

	All variables		Significant variables	
Explanatory variables	*Coefficient*	*t value*	*Coefficient*	*t value*
Real GDP growth [a]	0.48	5.1	0.44	5.3
Idem, delayed	–0.04	–0.4		
Inflation	0.15	6.1	0.25	12.0
Unemployment	–0.67	–5.5	–0.65	–5.8
Share price index [a]	0.00	0.7		
Real money supply [a]	0.15	3.5	0.18	4.3
Interest differential	–0.10	–1.6		
Non-bank deposits [b]	–9.23	–2.9	–9.07	–3.0
Capital and reserves [b]	–5.11	–0.6		
Profits [b]	49.56	1.3		
Idem, delayed	163.74	4.1	174.80	4.7
Country dummies:				
Australia	0.93	0.6	0.67	0.4
Austria	–1.69	–1.2	–1.77	–1.2
Belgium	0.14	0.1	0.12	0.1
Canada	2.15	1.7	2.14	1.6
Denmark	–0.98	–0.8	–1.19	–1.0
Finland	2.61	2.0	2.26	1.7
France	–1.04	–0.6	–0.94	–0.6
Germany	–	–	–	–
Greece	2.41	1.4	2.02	1.2
Iceland	–0.18	–0.1	2.71	2.0
Ireland	3.81	1.6	3.55	1.5
Italy	0.54	0.4	0.38	0.3
Japan	–0.99	–0.6	–1.02	–0.7
Luxembourg	–9.04	–5.9	–8.88	–5.6
Mexico	2.48	1.5	0.29	0.2
Netherlands	1.28	1.1	1.26	1.0
New Zealand	5.44	2.9	5.75	3.0
Norway	2.40	1.8	2.41	1.8
Portugal	1.03	0.6	1.00	0.8
South Korea	–2.51	–1.5	–3.15	–1.9
Spain	8.24	4.2	7.46	4.1
Sweden	–2.63	–2.1	–2.31	–1.9
Switzerland	–3.53	–2.3	–3.51	–2.4
Turkey	–3.26	–1.3	–8.15	–3.7
United Kingdom	3.28	2.1	3.13	2.0
United States	–1.13	–1.0	–1.03	–0.8
Intercept	10.73	5.1	10.00	4.9
No. of observations	333		377	
$\bar{R}^2$	0.62		0.67	
F test entire model [c]	15.94		25.20	
F test dummy variables [d]	4.51		6.46	
Durbin-Watson	1.76		1.54	

* For the sake of readability, all coefficients were multiplied by 100 (i.e. growth figures in perunes – i.e. 1 per 1 – and ratios in percentages of the denominator variable).

[a] Percentual change.

[b] Divided by total assets.

[c] All models are accepted at the 99% level of confidence.

[d] In all models, the dummy variables are accepted jointly at the 99% level of confidence.

new accord, our study investigated, first, to what extent banks' profits, additions to provisions for future credit losses and lending in 26 OECD countries related to the business cycle over the twenty-year period 1979-99.

Real GDP growth and other cyclical variables all turn out to have a significant effect on profits or profit margins. Profits, at a GDP growth level of over 2%, turn out to be almost 2.5 times those at GDP growth levels below 2%. This mechanism demonstrates how capital and reserves (augmented by profits after deduction of taxes and dividends) generally accumulate much faster during a multi-year cyclical boom than in adverse cyclical years, while at the same time additional capital is far easier to come by during an economic boom.

Other determinants of bank profits also carry plausible coefficients. A salient outcome is that lending portfolios carrying high risk profiles yield significantly lower profit margins. Apparently, the extra profit margin on high-risk loans is far from able to make up for the additional costs and losses. Hopefully, the new capital accord will encourage banks to pursue a more rational – *i.e.* risk sensitive – pricing policy, in order to better cover credit losses and the costs of capital requirements (and to raise social welfare by improving the allocation of credit). This could work out procyclical when higher interest rates for credit would prevent businesses from taking out loans, but more probably countercyclical, as it would prevent banks from credit rationing during downturns. In any case, it would improve the financial soundness of banks.

Enlargement of provisions for (future) credit loss also turns out to depend strongly on the business cycle in the sense that provisions increase in bad times. It appears that the augmentation of provisions at times of less than 2% GDP growth is 2/3 higher than it is in times of faster GDP growth, while it is almost 2.5 times higher when GDP growth is below –2%. Importantly, banks contribute significantly more to credit loss provisions in years of relatively high net profits. Apparently, banks reserve more in these good years, because as a precaution or, possibly, to present flattened out profits. Irrespective of the underlying motives, such provisioning policy causes the banking sector to be less procyclical than would, at first sight, seem to follow from the dependency of banks' profits on the business cycle. This prudent provision policy is strongly encouraged under the new Basel accord where, in the context of the Supervisory Review of Pillar II, banks

need to show that they have surplus capital and provisions to also meet the minimum capital requirements when the business cycle deteriorates.

Finally, given the direct link between lending and economic activity as perceived by *bank lending channel* theory, we investigated to which extent lending depends on demand or supply. Surprisingly, the preeminent supply variable, capital and reserves, turns out to be non-significant as a determinant of lending. This is an indication that credit rationing during a cyclical downturn is driven in only a minor degree, if at all, by a shortage of capital, as assumed by the *capital crunch* hypothesis. It should be noted that for most banks actual capital is substantial higher than regulatory capital (as is also expected under the new capital accord), so that the restraining effect of the latter in periods of recession is most probably limited. Lending *is* impacted by supply inasfar as this significant determinant correlates positively to the profit margin, but lending is dominated by demand. For instance, lending, at 6% or higher GDP growth, is over 2.5 times the figure at close to zero GDP growth. These outcomes underline findings in the empirical literature that the influence of demand factors dominates the market and that – barring exceptional circumstances such as banking crises – it is fairly difficult to observe demonstrably supply-driven *credit crunch* effects.

APPENDIX 1

Macroeconomic and banking-specific factors of profitability

Macroeconomic factors

1) *Real GDP growth (% change).* The GDP growth figure is the most general and most direct measure of macroeconomic developments. In our context, it is first and foremost an indicator of the demand for banking services, including the extension of loans, and the supply of funds, such as deposits, and as such is a direct determinant of profits. As a growth figure, it is the single most useful indicator of the business cycle, while the costs of banks are also expected to be linked to the GDP cycle. The GDP growth figure is made real by deflating it with GDP inflation.

2) *Long-term interest rate (10 year government bonds).* Most loans extended by banks to businesses or homeowners are long-term, and therefore carry an interest rate based on the long-term rate.[1] Banks' interest receipts, therefore, depend in large measure on the long-term interest rate. And since the actual credit rate is not available, the long-term rate is used as an approximation. Apart from this direct effect of the long-term rate on banks' profits, there is the indirect interest effect, caused by the (negative) long-term influence of the long-term rate on economic growth. We assume that in the relation under discussion, the direct (positive) short-term effect is more important.

3) *Short-term interest rate (three-month money market).* Moneys banked by businesses and private households, especially in the form of deposits, are usually short-term in nature and therefore carry an interest rate linked to the short-term rate. Thus the short-term rate is a factor in determining funding costs, and a high short-term rate will eat into the bank's profits. And as the actual figure we need, the (average) deposit rate, is not available for every country, the short-term rate is used as an approximation. In addition, the short-term rate is an indicator of monetary policy. The *interest differential* (long-term rate minus short-term rate) could perhaps replace the individual long- and short-term rates as an explanatory factor.

4) *Share price index (% change).* The share price index impacts banks' profits directly inasfar as it indicates the demand for stock exchange-related banking services, such as share issues, transactions and portfolio manage-

[1] Interest on consumer credit is, in principle, based on short-term rates, marked up for risk and costs.

ment. In addition, share prices reflect expectations as to businesses' financial positions and future economic growth (Berk and Bikker 1995, Arestis *et al.* 2001). As such, the share price index is also an indicator of (expected) cyclical development.

5) *Unemployment (%).* Unemployment does not directly influence profitability, but it is a major cyclical indicator. If short-term unemployment is primarily a reflection of the business cycle, long-term unemployment especially indicates structural disequilibrium in the economy. In addition, unemployment is a measure of the current *phase* in the business cycle, whereas a figure like GDP growth merely indicates the *degree of change* in the business cycle.

6) *Failures (per million inhabitants).* The failures variable is a direct indicator of credit risk and loss on loans outstanding. The number of failures usually increases during a cyclical downturn. If official administration of failures lags behind as a result of time-consuming legal procedures, the failures variable should be included with a proportional *lead* (or negative lag). Failures are quoted in proportion to population in order to allow comparisons across countries and across time.

7) *Inflation (%).* Inflation directly diminishes the real value of net assets. In addition, inflation impacts profitability through various indirect channels: it passes through into business and family spending, into nominal interest rates, into share prices and into the real money supply. Inflation also reflects (an aspect of) the business cycle. Because of its many indirect effects, the inflation coefficient is difficult if not impossible to interpret; inflation is used primarily as a *control* variable.[2]

8) *Real money supply (M3; % change).* The money supply is represented by the monetary aggregate M3, defined as the sum of cash and non-cash balances held by the public, short-term deposits, foreign-exchange holdings and short-term savings.[3] Growth of the money supply makes real growth possible, and is primarily an indicator of future growth potential (see Boeschoten, van Els and Bikker 1994; Berk and Bikker 1995). In the first place, it reflects the availability of money, which is strongly linked to the creation of money by banks through lending. Excessive money growth implies a risk of overheating the economy and its concomitant, rising inflation.

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[2] In other words, while inclusion of this variable may reduce the bias in the estimates of the other parameters, it plays no part in achieving the objectives of this article.

[3] For the Czech Republic, Norway and Poland, M2 was chosen because M3 was unavailable for the period under review.

The ECB therefore regards excessive M3 growth as a preamble to rising inflation.[4] The impact of money supply on profits is mostly indirect, which is why this variable, too, functions mostly as a *control* variable. Like real GDP, the real money supply is deflated by GDP price increase.

9) *Housing prices (% change).* Housing prices are important because they are partly responsible for mortgage loan demand. In addition, they affect the risk run by banks on such loans caused by the collateral value. For the years reviewed, however, housing prices were available for a limited number of countries only, so that this variable in this article was used only once.

Banking sector specific factors

i) Loans (as a share of total assets). This variable represents the (relative) size of lending. Generally speaking, loans have a positive influence on profitability, because as a bank's core business, they are a major generator of interest income. But lending also entails operational costs and credit losses. If costs and risks are not expressed adequately in the price of credit (i.e. the interest rate), for instance, as a result of cross subsidisation, then lending becomes a loss-making business. In any case, this variable serves to characterise a bank's balance sheet. Like the variables that follow below, the loans variable is divided by total assets in order to standardise it and allow comparisons across countries and years.

ii) Risk-weighted assets ratio (RWAR). This ratio is composed of the risk-weighted assets on the balance sheet plus the risk-weighted off-balance credit, divided by total assets, and is a measure of banks' risk profile. The risk weights are determined by the Basel capital accord of 1988 and are independent of cyclical influences.[5] As is the case with 'loans', the impact of RWAR on profits depends on the extent to which risk has been factored into pricing. It should be noted, moreover, that the (old) Basel risk weights are usually very crude and imprecise.

iii) Capital and reserves (as a share of balance sheet total). This includes paid-up capital, reserved funds, retained profits and other capital funds. Generally speaking, capital and reserves constitute the 'own funds' or core capital of a bank and – as an item in the balance sheet total – its solvency. The more

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[4] Bikker and Kennedy (1999), however, think that for most of the countries under review, money supply is an inadequate predictor of inflation.

[5] In the proposed new accord, rating-based weights are introduced which move up and down with the business cycle.

risk investments carry, the more capital is needed, so that the coefficient may become negative. While high-risk investments bring in more returns, greater capital could go together with high profits, so that a positive coefficient may be expected as well, depending on the degree to which risk pays off. If profits are defined as *returns on equity*, then a relatively small capital may leverage high profits, and one should expect to see a negative coefficient. If profits is defined as the margin on assets, capital and reserves become a 'free' source of finance, so that from this perspective one must expect a positive coefficient. Thus, on account of the many possible ways they may pass through to the results, the capital and reserves variable is primarily a *control* variable.

iv) Non-bank deposits (as a share of balance sheet total). Non-bank deposits include all deposit liabilities of banks except interbank deposits. This variable characterises the funding structure of the banking system.

Appendice 2

Appendice 2 (*cont.*)

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