Credit growth, bank capital and economic activity

Since the end of 1999, the pace of growth of bank loans to the non-financial private sector in Germany has been showing a steady decline. The outstanding volume of lending virtually stagnated in 2003 and even decreased last year. At the same time, there has been a marked slowdown in macroeconomic growth, which might be an indication that the stagnation in banks' lending has been due to a reduced demand for credit.

Some observers suspect, however, that this development might be partly due to a supply-side lending squeeze, which, in turn, could impair economic growth. Seen from this perspective, the cyclical weakness causes credit defaults which result in more restrictive lending owing to their effects on the banks' capital base and their capital needs.

This article investigates this hypothesis. Empirically, there is indeed a connection between economic activity and credit growth. Nevertheless, the evidence does not suggest that the economic downturn in Germany has been identifiably accelerated by such a credit supply restriction.

Introduction

"Credit crunch"

According to the cyclically induced "credit crunch" theory, a low rate of expansion of

the credit volume is not only a symptom of weak economic growth but can also be one of its causes. This is explained by the fact that a downturn in the real economy triggers defaults of and write-downs on loans at the banks. The associated losses lead to a weakening of the banks' capital base. Moreover, there is an increase in their commercial capital needs, ie the amount of capital they need on a microeconomic basis (as opposed to the amount they need for regulatory purposes) relative to the volume of loans outstanding as the banks now have to make greater provision for the higher credit default risk. According to the theory, the banks respond to this by reducing the supply of credit. This, in turn, amplifies the downturn or, at least, could make a rapid recovery more difficult.

Financial accelerator

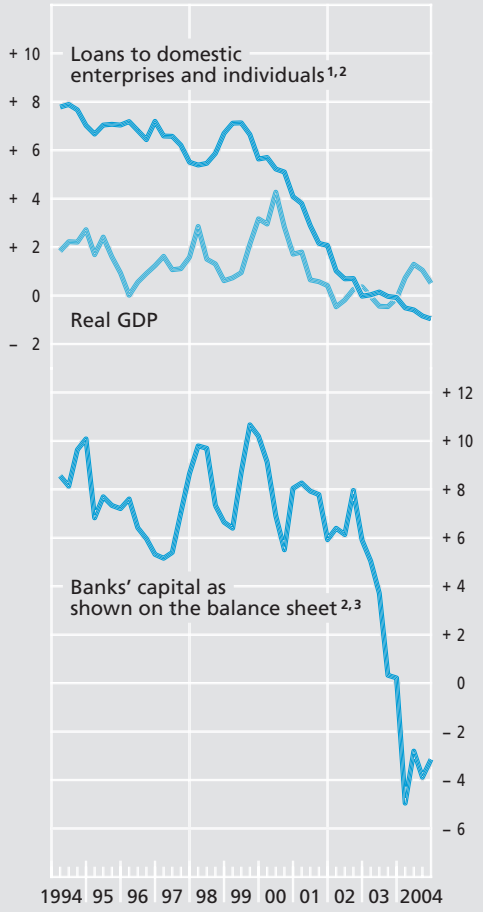
The economic literature generally describes such an amplification of real economic fluctuations by the financial system as a "financial accelerator".[1] In extreme cases, it can trigger a downward spiral, in which the real economic downswing and a reduced availability of credit reinforce each other.[2] Japan is often cited as a recent example of this phenomenon. Some observers also place developments in Germany over the past few years in the same kind of context.

Low growth rates in the banks' capital base

Since the start of 2004, the German banks' stock of capital shown in the monthly balance sheet statistics has indeed been declining, following a steady decrease in the rate of growth in the two preceding years. However, this decline began only comparatively late – growth in real gross domestic product (GDP) had already been slowing two years before

Loans, GDP and bank capital

Seasonally adjusted, annual percentage change



1 Excluding holdings of negotiable money market paper and excluding holdings of securities. — **2** Changes made for statistical reasons eliminated. — **3** As defined in the monthly balance sheet statistics.

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1 A financial accelerator is conceivable even without bank capital playing an active role. It is possible, for example, that, in a downswing, enterprises have to cut back their expenditure more than they want to because the value of their assets eligible as collateral is reduced by declining asset prices, which makes their access to credit more difficult.
2 In principle, a financial accelerator can also amplify upswings, for example, if rising (expected) profits and asset values make access to credit easier, thereby boosting aggregate demand. An amplification of a downswing is therefore often seen as being related to an earlier "exaggeration" (boom and bust cycles), although the amplifying effects in downswings and upswings may be of differing intensity.

that and credit growth almost three years earlier.

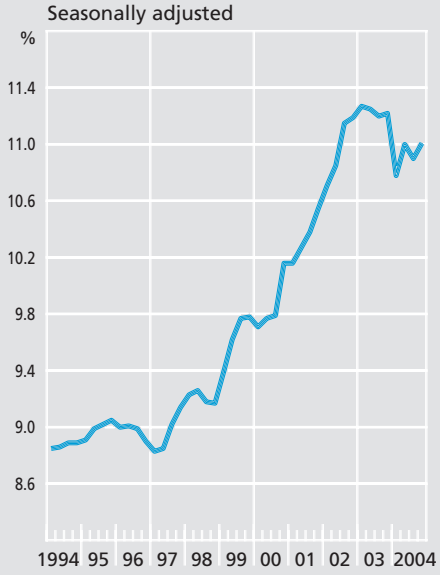
Increase in the ratio of capital to loans ...

In line with the differing growth patterns of banks' equity capital and loans over time, there has been a marked increase in the ratio of capital to outstanding loans since 1999. This might reflect banks' increased commercial capital needs for covering their loan portfolio, which in turn may have led to restrictions on the supply of credit. The higher ratio might also be no more than a mirror image of the weak economy, however, as a result of which the cyclically induced decline in the demand for loans was sharper than the decline in the capital base. Which of these interpretations can most readily explain recent credit developments in Germany is something that requires a more in-depth analysis.

... may be interpreted in various ways

Ratio of bank capital to loans*

Seasonally adjusted



* Ratio of the banks' capital as shown on the balance sheet (as defined in the monthly balance sheet statistics) to loans to domestic enterprises and individuals (excluding holdings of negotiable money market paper and excluding holdings of securities).

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The financial accelerator in theory

Imperfections of financial markets

The existence of the financial accelerator is predicated on imperfections of financial markets. In this connection, the theoretical literature places particular emphasis on the asymmetric distribution of information relevant to decision-making. For example, a borrower is likely to possess more information on the way funds are used than the lender does. Given this condition, in a credit agreement, the debtor has an incentive to employ the funds in a manner that is excessively risky from the point of view of the creditor or to commit insufficient effort and cost to using them in a way that holds out the prospect of success. The reason for this is that fixing the amount to be paid back to the creditor implies that the expected additional return stemming from an increased risk accrues mostly to the debtor, whereas the creditor usually has to bear the higher expected loss arising from the increased probability of default. In principle, however, the creditor can encourage "good behaviour" by the debtor by increasing the latter's loss in the event of failure. This can be achieved, for example, by stipulating a minimum share of equity financing of the project by the debtor or by demanding collateral for the loan.

The role of banks' equity capital under asymmetric information

Essentially, the problem of asymmetric information also exists between a bank and its creditors. Accordingly, the bank's capitalisation has a particular role to play in this context, too. All other things being equal, the larger the bank's capital base, the more un-

likely it is that it will be unable to pay off its creditors in full in the event of large losses. And the larger its equity ratio is, the greater is its incentive to ensure a good result, for example, by carefully screening and selecting its borrowers and/or by intensively overseeing and monitoring them. The costs to a bank of an additional unit of equity capital will therefore probably tend to fall as the share of own funds in its overall financing rises. At the same time, however, equity capital is comparatively expensive since its suppliers demand a premium for the risk of receiving no repayment or only a small repayment of their capital in the event of a debtor's default on account of the subordinated nature of their claim. For the individual bank, therefore, there is an optimal level of capitalisation.

Differences between optimal micro and macroeconomic capitalisation

Even so, this optimal microeconomic level of capitalisation may be too low from a macroeconomic point of view. The interlinkages within the financial system harbour the danger that the problems of one bank will spill over to other parts of the financial system (systemic risk).[3] The upshot of this is that, whereas a bank receives more or less in full the higher return from a self-chosen riskier strategy, in the event of failure, costs and losses arise that are borne not just by the bank alone but also by others. If such "negative external effects" are not factored into the individual bank's optimisation strategy, the optimal level of their capital tends to be too low in macroeconomic terms.

A comparable systemic risk also exists if the actual or merely expected insolvency of one bank leads to panic-like withdrawals of deposits at other banks as well because the depositors fear the loss of their deposits. This risk of a run on the banks can be contained effectively by a deposit insurance scheme. Nevertheless, the signal and incentive function of the bank's capital described above then tends to become less important, even though this function continues to exists for the banks' liabilities that are not covered by the insurance scheme.[4] The introduction of a deposit insurance system – which is meaningful for the reasons cited above – might therefore, in theory, strengthen the tendency for a bank's microeconomically optimal capital base to be too small from a macroeconomic perspective. This is due to the fact that the potential costs of misconduct do not have to be borne entirely by the bank but partly by the institutions taking part in the deposit insurance scheme and/or by the general public.

Regulatory capital requirements for the protection of creditors and the financial system

The preceding theoretical considerations show that the optimal capitalisation of an individual bank may be too low from a macroeconomic point of view. In general, this prob-

3 See, for example, C Upper and A Worms (2004), Estimating bilateral exposures in the German interbank market: is there a danger of contagion?, *European Economic Review*, 48/4, pp 827-849.

4 In Germany, protected deposits essentially cover account balances and claims in respect of registered debt securities. Claims arising from bearer or order bonds do not fall under the definition of protected deposits. The claim to compensation is limited to 90% of the unfulfilled claims and the equivalent value of €20,000 per creditor. Nevertheless, this statutory minimum protection may be supplemented by the respective credit institution's voluntary membership in a deposit guarantee scheme of the banking associations. These depositor protection schemes are not to be confused with the institution protection schemes of the cooperative banks and the savings banks. See Deutsche Bundesbank, Deposit protection and investor compensation in Germany, *Monthly Report*, July 2000, pp 29-45.

lem can be mitigated by regulatory capital requirements.[5] These place minimum requirements on the banks and are designed to induce them to hold an adequate amount of capital in order to ensure the protection of creditors and the viability of the financial system.[6]

Bank capital and economic activity

Cyclical influences

In principle, cyclical influences may cause cyclical movements in the banks' capital base and in their commercial capital needs and may thus alter their credit supply behaviour. Both the probability of default and the loss given default are likely to vary over the business cycle, for example.

- In a cyclical downturn, the borrowers' probability of default tends to increase since their earnings situation deteriorates. As a result of the concomitant higher default risk, a bank has an increasing need to make capital provision. At the same time, its existing capital base is lowered by the losses sustained from defaults that have already occurred.

- In a cyclical downswing, the average amount of the loss suffered through default is likely to be higher than during other cyclical phases because the falling tendency of asset prices in a downswing leads to a fall in the recovery value of assets upon default.

Two hypotheses may be derived from this.

- Per se the banks' capital base fluctuates procyclically: losses tend to rise in a downswing, which means that the existing capital base shrinks.

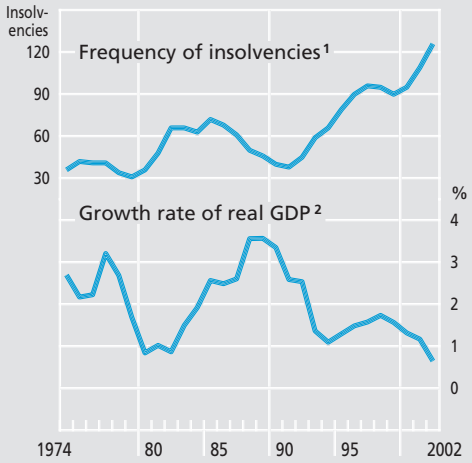
- By contrast, the banks' commercial capital needs relative to their loan portfolio change anticyclically. In a downturn the banks have to offset the increased losses and, furthermore, make greater risk provisioning through a larger capital cover.[7]

5 See Deutsche Bundesbank, Credit institutions' capital viewed from a business and a regulatory perspective, *Monthly Report*, January 2002, pp 39-57.

6 The current regulatory capital requirements are based on the 1988 Basel Capital Accord (Basel I). The regulations for the German credit institutions are laid down in the German Banking Act (*Gesetz über das Kreditwesen*) and in Principle I concerning the capital of institutions (*Grundsatz I über die Eigenmittel der Institute*). Accordingly, a bank has to maintain regulatory capital amounting to a minimum of 8% of its risk-weighted assets. To calculate a bank's risk-weighted assets, the risk assets are first assigned to credit quality categories according to the borrower (government, bank, enterprise) and then aggregated using a specific risk weighting for each category. This method has been criticised as too generalised, however. For example, all claims on enterprises are entered into the calculation with the same 100% weighting, ie the existing capital requirements do not make a distinction between enterprises with a high or low credit rating. The Basel Accord has therefore been revised (Basel II). A key aspect of the revised capital standard is the introduction of advanced approaches to calculating the capital requirements, which allow a more nuanced risk weighting.

7 This would presumably apply even if there were no regulatory capital requirements or if they were not binding. It is nevertheless conjectured that the existing regulatory capital requirements promote an anticyclical evolution of the banks' perceived commercial capital needs since, in a downswing, the banks tend to want to create a "safety cushion" over and above the required minimum capital cover of 8% owing to the increased risk. Furthermore, some observers fear that the envisaged innovations of Basel II will additionally amplify the anticyclical effects on the banks' perceived capital needs. This is because, in contrast to the existing regulations, Basel II raises the risk weights in a downswing and, therefore, the stock of risk-weighted assets per se also increases. This reduces the regulatory capital ratio, which additionally increases the banks' commercial capital needs. On this subject, see, for example, C Goodhart, B Hofmann and M Segoviano (2004), Bank regulation and macroeconomic fluctuations, *Oxford Review of Economic Policy*, 20, pp 591-615.

Insolvencies and economic activity



1 Number of insolvencies (enterprises and professions) relative to 10,000 enterprises; up to 1993, western Germany: from 1994, Germany as a whole. Source: Federal Statistical Office. — **2** Moving five-year average of the annual percentage growth rates. The underlying GDP data have been adjusted for the statistical effects of reunification.

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The individual bank's response to increased capital needs in a downswing

An individual bank can generally respond to rising commercial capital needs in a downswing by increasing its equity capital and/or by reducing its stock of risk-weighted assets. If the bank manages to expand its capital base, the latter itself behaves anticyclically – the expanding capital base during the downswing is then a reflection of the increased risk to which the bank sees itself exposed.

However, in a downswing it is naturally harder to reinforce the capital base internally by retaining profits. The raising of fresh equity capital externally – eg by issuing new shares – generally entails comparatively high transaction costs and also takes a relatively long time. Added to this is the fact that equity capital tends to become more expensive in a downturn, first, because the providers of capital are likely to demand a higher risk premium and, second, because potential new investors might interpret the procurement of additional capital as a sign that the bank's existing providers of capital want to shift some of the increased risk on to them.

Furthermore, the procurement of external equity capital is subject to a number of additional sector-specific constraints. In the case of the cooperative banks, for example, it is linked to an increase in its members' capital contributions. The savings banks can essentially increase their capital externally only by means of additional financial contributions from their public owners – in other words, the respective municipality or state government. If these are struggling with a tight budgetary situations themselves, the savings banks, too, will probably find it more difficult to raise outside capital.[8]

Reduction of risky assets

Hence, it may be concluded that there are indeed some circumstances in which a bank has to reduce its stock of risk-weighted assets in a downswing in order to raise its ratio of capital to risk-weighted assets. It may do this by altering the structure of its assets or by reducing the overall volume of its risk-weighted assets. At the macroeconomic level, this leads to a decrease in the supply of credit and, therefore, to essentially less favourable finan-

8 This does not necessarily imply, however, that the capital base of these two categories of banks was more strongly affected by cyclical fluctuations in the past few years than was the capital base of the other categories of banks, as their performance has been comparatively stable. See, for example, Deutsche Bundesbank, The performance of German credit institutions in 2003, *Monthly Report*, September 2004, pp 15-41.

cing conditions for enterprises and households – with the potential consequence that firms and individuals alike have to cut back their spending, which in turn amplifies the downturn. For the individual bank, this has a "backlash effect" in the shape of even higher probabilities of default and falling profits. This tends to additionally push up their commercial capital needs and to weaken their existing capital base even further. The appropriate response of the individual bank in microeconomic terms – namely, reducing the stock of risk-weighted assets in order to increase its own capital ratio – might therefore amplify the downswing at the macroeconomic level. It also has to be borne in mind in this context, however, that the demand for credit likewise tends to fall in a downswing. This may result in the capital ratio being increased sufficiently without the credit supply having to be reduced.

... and macroeconomic backlash effects

In a downswing also decline in credit demand

Empirical analysis

A parallel development in credit and capital during an economic downturn may therefore be the outcome of both a credit crunch and of a low credit demand. This difficulty in identifying movements in the supply of and demand for credit proves to be a core problem in relevant empirical studies and an obstacle to satisfactorily estimating the impact of possible credit supply restrictions on real economic activity. The empirical literature therefore concentrates mainly on the analysis of other aspects which are central to this financial accelerator. For example, there is evidence that, given an increased risk, banks augment their capital.[9] Equally, there are indications that a bank's capitalisation has a significant impact on its lending.[10] These studies, however, are based on the analysis of micro-data, which makes it difficult to assess the macroeconomic relevance of the links identified. Below, therefore, we use macro-data to investigate whether response patterns can be found in Germany that might point to a credit crunch. This is not a stringent test for its existence but can provide useful hints on its macroeconomic relevance.

Identification problem

Owing to the interacting linkages between bank capital, the volume of credit and real economic activity, an empirical analysis should a priori neither rule out the possibility of certain relationships between the observed variables nor give them especial emphasis. Generally, this can be achieved with a vector autoregressive model.[11] Estimating such a model econometrically provides a description of the joint dynamics of the incorporated variables which takes account of all the interactions between these variables.

Estimation of a vector autoregressive model

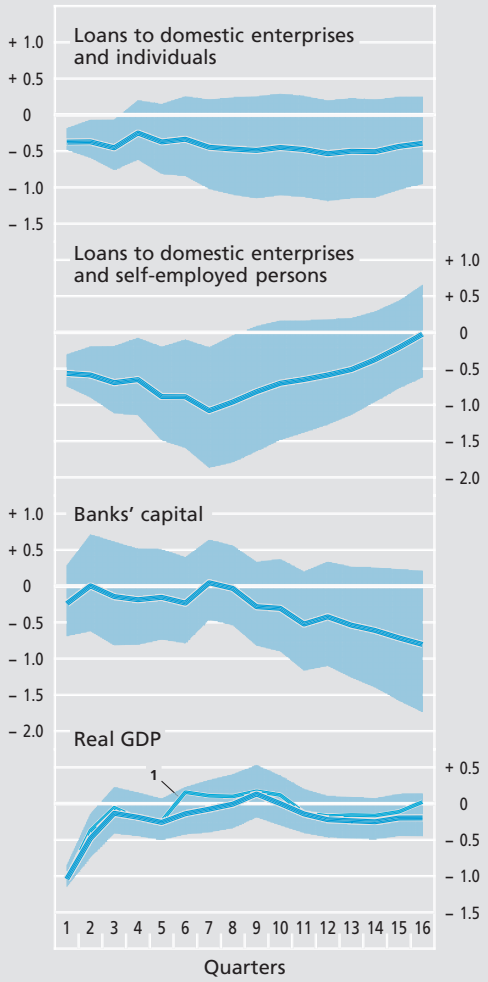
The outcome of the empirical analysis can be shown as impulse response functions. This is the response of the particular variable under consideration to an assumed shock. The

Impulse response functions

9 See, for example, R Shrieves and D Dahl (1992), The relationship between risk and capital in commercial banks, *Journal of Banking and Finance*, 16, pp 439-457.
10 See, for example, L Gambacorta and P Mistrulli (2004), Does bank capital affect lending behaviour?, *Journal of Financial Intermediation*, 13, pp 436-457.
11 The results are based on B Hofmann and A Worms (2005), Does bank capital amplify cyclical fluctuations? Evidence for Germany, Deutsche Bundesbank Research Centre, discussion paper, scheduled to appear in summer 2005.

Impulse response functions*

Percentage deviations from the basis scenario



* Responses to a simulated 1% decline in real GDP with a 90% confidence band (shaded area). — **1** Excluding feedback effects via the banks' capital and the loans.

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model estimated here was used to simulate the dynamic effects of a 1% reduction in real gross domestic product (GDP) on lending to domestic enterprises and households, lending to domestic enterprises and self-employed persons, banks' capital as well as real GDP itself. The chart above shows the dynamic response of these four variables in a 90% confidence band (shaded area), which reflects the statistical uncertainty of the estimation.

The simulations show that overall lending falls significantly in the first three quarters following the reduction in real GDP. In the case of loans to enterprises, a stronger and longer-persisting reaction is observed. This would be compatible with the hypothesis that it is mainly riskier loans that are affected by a downswing. Nevertheless, this still does not tell us whether the effect is to be explained in terms of the supply side or demand side. As expected, the banks' capital also responds negatively to the decline in GDP. However, this response is insignificant, ie not statistically different from zero, and, moreover, begins much later. This outcome suggests that a negative real economic impulse does not lead to a significant weakening of bank capital.

Ratio of bank capital to loans

A comparison of the impulse response functions of capital and loans reveals that, following a 1% reduction in real GDP, lending initially declines more sharply than capital. Accordingly, the ratio of capital to loans tends to increase. This outcome might reflect either the banks' greater commercial capital needs to cover the loans owing to the increased risk or merely the time differentials in the passive response of the credit demand and the banks' profits to the decline in GDP.

Effects not amplified by bank capital and lending

The response of real GDP itself to the initial shock assumed in the model simulation (1% decline in GDP) is very short-lived and ceases to be significant after only three quarters. In order to throw more light on the role of credit

Estimation of the vector autoregressive model

In a standard vector autoregressive model (VAR) each included variable is explained by its own lagged values and the lagged values of the other variables included in the model. Consequently, the analysis of the interrelationships is entirely agnostic, ie no restrictions are placed on the estimated relations a priori. This means, however, that a relatively large number of parameters have to be estimated additionally for each variable considered. Thus, in order to maintain adequate degrees of freedom only a few variables can be included in the analysis. The vector autoregressive model examined here therefore comprises only four variables, namely the banks' real capital, the real credit volume, real GDP and a long-term interest rate, which was included in the system to capture interest rate effects on GDP, capital and the credit volume.

The equity capital of the entire banking sector (taken from the monthly balance sheet statistics) serves as the capital variable. There are several advantages to this variable. First, it is available on a monthly as opposed to an annual basis and can therefore be expressed as a quarterly figure, thus matching the frequency of the GDP data. Second, over time it behaves similarly to regulatory capital but extends further back in time, which is necessary for such a data-intensive estimation. Nominal variables are converted into real variables on the basis of the GDP deflator. This also applies to the real credit variable. The domestic credit institutions' loans to domestic enterprises and households are initially taken as the measure of credit. To test whether the results change if loans to enterprises are viewed in isolation, the estimation is repeated using the lending of domestic credit institutions to domestic enterprises and resident self-employed persons. The yield on domestic bearer securities serves as the long-term nominal interest rate.

As there are instabilities in the empirical credit equations as a result of German reunification,[1] the estimation period does not begin until the start of 1991 and terminates at the current end of the data (fourth quarter of 2004). Before the estimation was performed, all the variables – except for the interest rate – were transformed to natural logarithms. On the basis of statistical tests a specification with six lags was chosen, meaning that each variable depends upon six lags of its own and six lags of each of the other variables.

A 1% decline in real GDP is simulated for calculating the impulse response functions. The identification is made on the basis of the assumption that this shock may influence all the relevant variables in the same quarter but that, conversely, real GDP in the same quarter does not react contemporaneously to changes in the other three variables ("Choleski decomposition").

1 See Deutsche Bundesbank, The development of bank lending to the private sector, *Monthly Report*, October 2002, pp 31-46.

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supply effects in the possible amplification of real economic impulses, the simulation of the reaction of GDP was repeated under the constraint that bank capital and lending do not respond to the contractionary GDP impulse. This "eliminates" any supply-side feedback and amplification effects on GDP due to the weakened capital base and the higher commercial capital needs. The impulse response function of real GDP calculated in this way is shown as a thin line in the chart on page 22. Although the response of real GDP is somewhat weaker once the amplification effects of bank capital and lending have been eliminated, the difference is not statistically significant. This suggests that the credit supply responses that might result from a weakening of the capital base and the banks' increased commercial capital needs have no significant amplifying effect on the impact of a real economic impulse.

Summary

Empirical evidence gives no indication of a credit crunch

The econometric analysis thus gives no indication that the real economic downswing in Germany has been reinforced by the financial accelerator effects under consideration here. It was possible to establish that there is a significant reduction in lending, especially to enterprises, following an exogenous decline in real GDP. However, taken as a whole, the banks' capital base responds only weakly to an impulse of this kind. There is therefore no indication that a real economic shock has a significantly negative impact on bank capital. The finding that the effect of a real economic decline is not significantly amplified by feedback effects via bank capital and lending may likewise be interpreted as evidence against the hypothesis of reinforcing credit supply effects.