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Credit Crunch in Germany?

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I. Introduction

In Germany, credit expansion slowed dramatically in 2001, and in 2002 and 2003 the volume of loans to enterprises and self-employed persons even shrunk (Figure 1). The question arises whether this was a normal consequence of weak economic activity or caused by an unusual reduction in credit supply. The latter would mean that a *credit crunch* occurred or, in other words, that "the supply of credit is restricted below the range usually identified with prevailing market interest rates and the profitability of investment projects." (Council of Economic Advisers 1992: 46). A credit crunch may have a dampening effect on economic growth: if banks do not expand lending regardless of the expected return, the private sector is cut off from an important source of external funds. That means that business investment will be hampered, with the subsequent implications for the business cycle and growth. Moreover, it implies that monetary policy loses some of its effectiveness. A cut in interest rates remains "stuck" in the banking sector without being transmitted further into the real sphere of the economy, in other words, the "credit channel" of monetary influence will be shut down (Bernanke 1991: 228 f.).

The discussion about the origins of the present slowdown in credit started in 2002 by the Kreditanstalt für Wiederaufbau (Kreditanstalt für Wiederaufbau 2002). In a survey, 6000 German enterprises were asked about the availability of credit, with the result that there was a considerable excess demand for loans, especially by small and medium firms who felt that banks were unusually reluctant to lend. Two studies, by the Bundesbank (Deutsche Bundesbank 2002) and the German Council of Economic Experts (Sachverständigenrat zur Begutachtung der gesamt-

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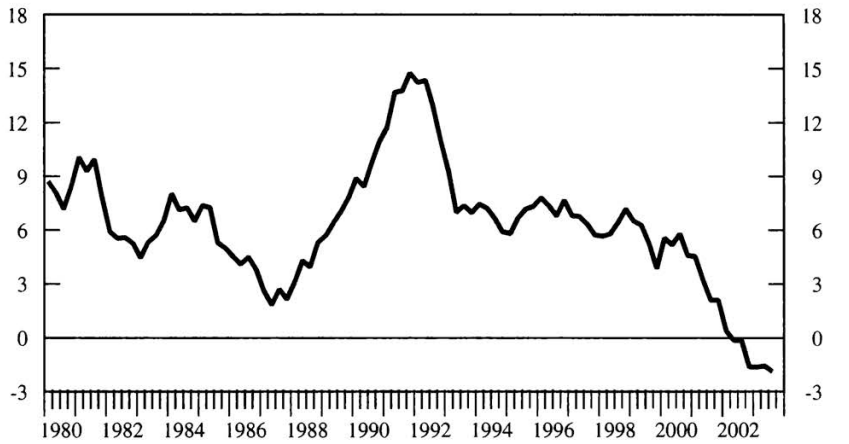
Total lending to enterprises and self-employed persons
1980 to 2003; change against previous year in %



Source: Deutsche Bundesbank

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Figure 1

wirtschaftlichen Entwicklung 2002) followed, both with a different approach and a different conclusion. Estimating a long-run function for loans, the authors were able to explain most of the development. Only since 2000 credit allotment has been lower than predicted by the equation. Neither institution differentiated in their calculations between loan supply and demand, assuming that the credit market was mainly driven by demand. Hence, they did not provide an explanation for the substantial deviation from the estimated credit volume: The Bundesbank saw "signs of a certain lending restraint among banks" but at the same time "the econometric results for the various credit aggregates also show that other factors may well also be causing weak credit growth." (Deutsche Bundesbank 2002: 45).

However, the question whether a credit crunch was in effect, i.e. the supply restrained lending not in line with the current economic conditions, essentially requires a differentiation between the supply and the demand side. In the context of an empirical analysis this means that only the (simultaneous) estimation of the two equations allows tracing back the influential determinants and the limiting market side. Hence, a disequilibrium model of the credit market is employed. This approach was

applied in the context of a credit crunch in Finland by Pazarbasioglu (1997). Ghosh and Ghosh (1999) analysed East Asia with the help of this analytical framework, and Barajas and Steiner (2002) three Latin American countries.

In this paper we aim at finding new evidence about whether in the years 2001–2003 there was a credit crunch in Germany, or not. Adding a supply function we challenge the approach of estimating a demand equation only. Our hypothesis is that there is a connection between the slowdown in loan expansion and the decline in share prices. We apply the framework of an empirical disequilibrium model to the German banking market and draw the conclusion that in effect, since the end of 2002, in Germany estimated demand for loans has been largely exceeding estimated supply. We also have a look at two different groups of banks (*Großbanken* and other banks)[1] and their lending behaviour, finding that the big private banks conducted a more restrictive lending policy than the other banks taken together.

The paper is organised as follows: In the next part, we will discuss possible triggers for German banks to reduce lending. The third section is dedicated to the presentation of the model and the data we use. We specify the demand equation in a common way to compare our results with previous studies. Our main focus is on the specification of the supply equation. In the succeeding part the results of our estimations will be shown. In the final section we will provide a brief summary and conclusions.

II. Bank Capital and Stock Markets

In recent years, there were at least two developments that may have caused banks to reduce their lending to a greater extent than in previous phases of economic weakness, and therefore caused a credit crunch. The first is the strong decline of share prices that started in spring 2000; the second is the preparation of the new Basle Accord on capital accounting. The academic literature has established some agreement about potential

[1] Following the classification of the Deutsche Bundesbank the big banks *("Großbanken")* or large private banks comprise *Deutsche Bank, Commerzbank, Dresdner Bank* and *HypoVereinsbank,* as opposed to 1. Regionalbanks and other commercial banks, 2. branches of foreign banks, 3. *Land* banks, 4. Savings banks, 5. Regional institutions of credit cooperatives, 6. Credit Cooperatives, 7. Mortgage banks, and 8. Banks with special functions.

origins of credit crunches: The most important one is seen in banks' problems fulfilling capital requirements, either due to a depreciation of banks' assets or following increased regulatory standards.[2] For instance, previous studies show that a decline in equity prices contributed to the decline in loans in Japan during the early 1990s (Brunner, Kamin 1998; Kim, Moreno 1994), and an increase of regulatory standards in 1988 probably caused a credit crunch at least in some parts of the United States (Bernanke, Lown 1991; Peek, Rosengren 1995).

Applying these ideas to Germany, the strong depreciation of share prices in the years 2000 to 2003 seems to be crucial. The coincidence of falling share prices and slowing loans is striking: After its peak in February 2000, when the CDAX counted more than 500 points, it steadily fell to 160 points in March 2003. Business loans, after having steadily expanded at rates about 6–9% p.a. for several years in a row[3], have started to slow in 2000, and have continued in a downright decline since the second quarter of 2002. The link between the stock market and the banks' lending activity consists in the banks' ownership of shares.

Banks in Germany are entitled to offer services concerning both sides of the balance sheet, commercial banking as well as investment banking; they are allowed to act as *universal banks*. Hence – unlike the Anglo-American banking system – the banking sector holds substantial amounts of private capital in the form of shares and bonds: in 2002 they amounted to roughly 10% of total assets of the banking sector. Being part of the asset-side of the balance sheet, stock price fluctuations affect the capital position of a bank. According to the rules of the Basle Accord from 1988 (Basle Committee on Banking Supervision 1988), banks have to reach a risk-adjusted capital-to-asset ratio of 8%. Unrealised gains are counted as a part of the capital[4], so a depreciation of share prices might bring a bank closer to this boundary. This is particularly relevant

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2 In the theoretical context of monetary policy transmission, these mechanisms are known as the *bank lending channel* (*Bernanke, Blinder* (1988); *Bernanke, Gertler* (1995), 40 f.). However, the bank lending channel is considered as being a regular channel of monetary transmission and does not, like a credit crunch, cumulate in a financial crisis.

3 The effects of the reunification of course, heavily influence the development in the years 1989–1993.

4 The banks' capital is defined in two "Tiers": Tier I capital comprises shareholders' equity and disclosed reserves from post-tax retained earnings and has to amount at least 50% of the bank's capital base. Tier II, the "supplementary capital" includes subordinated debt, preferred shares and unrealised gains on stockholding.

for German banks, as their capitalisation is known as comparatively thin (Padberg 2003).[5] The affected banks might not be willing or able to raise new external capital in the short run, as the financial environment is obviously unfavourable, and as the financial markets on their part might ask for a higher risk-premium for banks displaying the urgent need for capital.[6] Hence, the easier way to improve the capital-to-asset ratio is to cut back loans (Berger et al. 2000: 2).[7]

In particular *Großbanken* were prone to the rise and fall of the stock market, as firstly their involvement in the business segment of investment banking was more intensive and, secondly, because they were holding relatively more shares. Disaggregating total loans by credit institutions (Figure 2) illustrates that the slowdown in credit expansion was far more severe in the *Großbanken* than in the other credit institutes (savings banks etc.).

Moreover, the rules for measuring and weighting the risks of loans are being overhauled in the course of the Basle II process. Although the new Accord will not be officially implemented before 2007, many German banks already started to adjust their lending policies to the new rules, demanding a formal risk-assessment of the loan-portfolio of a bank. Why this is more likely to cause a credit crunch in Germany than in other countries is due to a special feature of the German banking system, the *"Hausbankensystem"* (see for instance Harhoff, Körting 1998) that typically implies long and exclusive business relationships between firms and banks. The great advantage of this informal commitment is a substantial reduction of information asymmetries between borrowers and lenders, and lower transaction costs of co-ordination (Kester 1993). The need to come to a more formal appraisal of risks in the course of the

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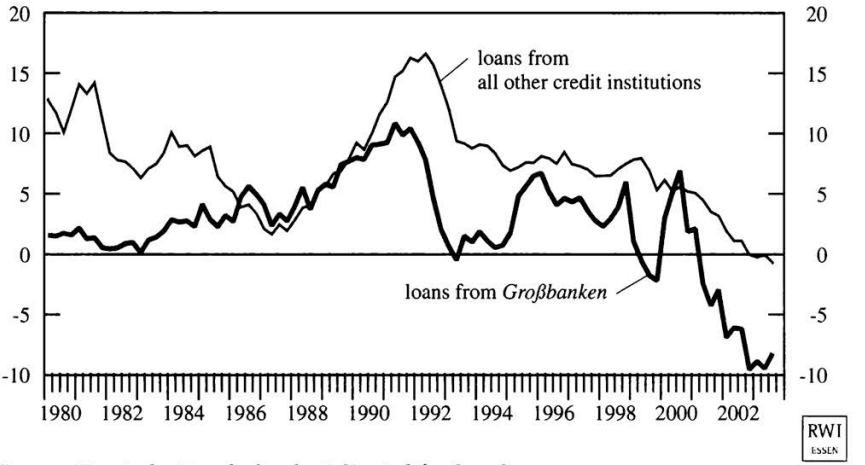
5 Of course, apart from the supervisory authorities the "markets", stockholders and investors, urge banks to an "adequate" capitalisation. In their name, rating agencies, too, closely monitor the capitalisation of banks.

6 In 2002, many important banks in Germany were downgraded by international rating agencies.

7 This policy is well documented for the case of Japan in the 1990s by *Kim* and *Moreno* (1994). In Japan, the banks always held great amounts of shares and were closely interwoven with the industrial conglomerates. After the bubble in the stock and real estate market burst, and when in 1992 the capital adequacy rules of Basle I were introduced, the banks turned out to be deeply undercapitalised. They reacted by drastically reducing lending, leading to the well-known depression in the Japanese economy in the following years. Anyway, the authors would like to emphasise that the parallels between Germany and Japan should only be seen in the nature of the mechanisms, not in the magnitude of their effects.

Total lending to enterprises and self-employed persons by different credit institutions
1980 to 2003; change against previous year in %



Source: Deutsche Bundesbank. Adjusted for breaks.

Figure 2

Basle II process might have altered the assessment of some firms and consequently the willingness to lend, especially to small and medium enterprises.

III. A Disequilibrium-Model for German Credit

1. The Model

As pointed out above, Bundesbank (2002) and Sachverständigenrat (2002) analysed the German credit market by determining a long-run relationship between economic activity, financing costs and loans. In line with the accepted parallels between money and credit demand, they assumed that credit growth was always determined by the demand-side and therefore interpreted their loan equations as loan demand equations. If, however, loans are discussed in a context of asymmetric information, they are more likely to be restricted by the supply-side. In their seminal paper, Stiglitz and Weiss (1981) bring up the problem of credit rationing[8] arising from information asymmetries between creditors and lenders.[9] In

[8] For an overview on credit rationing see *Jaffee* and *Stiglitz* (1990).

this set-up, the bank is aware that it will never achieve a correct pricing-to-risk; therefore the only way of controlling the exposure of its loan portfolio is curbing the volume of credit. As a consequence, even in equilibrium, the supply of loanable funds does not meet demand and the interest rate does not fully reflect risk.

The question to what extent credit markets are restricted by the supply side was empirically analysed by methods following Laffont and Garcia (1977) and Sealey (1979), using disequilibrium models of the credit market. For (West-) Germany in the 1970s and 1980s models on credit rationing were examined by Kugler (1987) and by Winker (1996). Both studies found substantial evidence for credit rationing and indications that supply-factors play an important role. This does not imply a credit crunch. The distinction is that credit rationing is an equilibrium outcome of credit markets as a consequence of asymmetric information. In contrast, a credit crunch is a negative supply shock, resulting from a decline of the banks' resources or regulatory changes and is of transitory nature. However, the empirical outcome is similar in the short run: demand exceeds supply.

Therefore, it is not astonishing that the framework of disequilibrium models was also applied for analysing potential credit crunches. Pazarbasioglu (1997), Ghosh and Ghosh (1999) and Barajas and Steiner (2002) scrutinise the possibility of a credit crunch with the help of this framework. They estimate a credit demand- and a credit supply-function under the restriction that the "shorter side" (the minimum of the two) determines credit. This strategy avoids the usual identification problem of equilibrium models as either the demand- or the supply-function determines the volume of credit in a given period. Hence, this approach is designed to reveal some of the causes of declining loans; moreover, it allows making a statement on a credit crunch. We therefore adopt this method in our examination.

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[9] The creditor never exerts full control over an investment project and most of the time, he knows less about the risk of default than the debtor, leading to the problem of *moral hazard*: As soon as the loan is granted, the debtor might choose a risky technology that, in case of success, yields higher returns than a second, safer technology. In case of default he loses – in these models – less than his expected return in case of success. Therefore, for the debtor the risky project is more attractive although the expected return of the safer project may be higher. Moreover, an *adverse-selection* problem exists, too. A high interest rate deters the "credible" debtors with low but safe returns, as with the higher costs of capital the investment project becomes less profitable. Only those borrowers accept the high interest rate, who expect very high returns but also a potential default.

To keep the model as transparent as possible, we use the disequilibrium model in a most simple version. The general form of the model can be written as follows:

$$D_t = X_{1t}\alpha + v_{1t} \tag{1}$$

$$S_t = X_{2t}\beta + v_{2t} \tag{2}$$

$$C_t = \min(D_t, S_t) \tag{3}$$

With D_t as credit demand at the time t; S_t as credit supply in t; X_{it} being the respective vector of determinants; v_{it} is the respective error term and C_t the observed credit volume. The disequilibrium assumption is stated in (3). In the presence of a credit crunch the observable credit volume should be strongly restricted by credit supply. In contrast to credit rationing this phenomenon should vanish after some time.

For the demand function, we extend the specification of the Bundesbank (2002) and Sachverständigenrat (2002), whose determinants were a capital market interest rate and GDP, by the inclusion of alternative sources of finance (*bonds*). With this modification we account for the possibility that the process of disintermediation increasingly reduces credit demand. The function of real credit demand (D_t) consists of the following equation:

$$D_t = a_1 + a_2 r_{t-1} + a_3 y_{t-1} + a_4 bonds_{t-1} + v_{1t}, \tag{4}$$

with r_{t-1} representing the cost of external funds. We expect a negative sign, as with falling costs demand should rise. One obvious measure would be the interest rate for loans. Anyway, for longer maturities loan rates are quite close to capital market rates and many empirical studies use a nominal capital market interest rate as the proxy for the cost of funds. To make our results comparable with these studies we, too, rely on a capital market rate. In using the nominal rate, we avoid problems in measuring inflation expectations. Real GDP (y_{t-1}) covers the transactions demand for credit; therefore we expect a positive sign. An increase of the outstanding amount of industrial bonds ($bonds_{t-1}$) should lead to a reduction of credit demand. All explanatory variables are lagged by one period to introduce – though crudely – dynamic aspects.

Our specification of the supply function comes close to that of Pazarbasioglu (1997) in many aspects. It is specified as follows:

$$S_t = b_1 + b_2 BC_{t-1} + b_3 cdax_{t-1} + b_4 span_{t-1} + v_{2t}. \quad (5)$$

In (5) real credit supply (S_t) corresponds to a simplified bank balance sheet. The (real) volume of banks' capital (BC_{t-1}) is a proxy for the banks' ability to lend (Hülsewig et al. 2001). Because of the above mentioned low equity ratio of German banks, capital is a limiting factor for credit supply. To complement this argument, the share price index ($cdax_{t-1}$) gauges unrealised gains or losses contained in the banks' balance sheets. As these assets contribute to the capital endowment of banks, too, a strong decline in share prices may go along with a slowdown in credit supply. The difference between the interest rate on business loans and the interest rate on deposits ($span_{t-1}$) can be interpreted as a risk-measure. Supposing that this *span* is the sum of a constant margin plus all fixed costs including the agency costs, and supposing that the agency costs rise with higher risk involved, an elevated span indicates higher risks (Pazarbasioglu 1997: 322). Calculating the *span* we use the loan rate and not the capital market rate because the former is more under control of banks than the latter. The right-hand-side variables of the supply-function, too, are all lagged by one period.

In this type of model, a second step is needed to associate a particular observation in time to be restricted by demand or supply. To obtain an impression of which side of the market determined the actual market result (i.e. the volume of credit) one has to compare the estimated demand and supply. If in one period the estimated supply is smaller than the estimated demand, it is likely that the credit volume of this observation is supply-constrained. By this means, the probability can be calculated whether an observation is demand- or supply-constrained. Alternatively, graphical inspection (see below) can give useful results on whether supply or demand is "short".

2. *Data and estimation*

All series we used are on quarterly basis. For our analysis, we mainly relied on the sample period from the first quarter of 1993 to the second quarter of 2003, avoiding the structural break caused by the German reunification. The end of the sample period is set by the Bundesbank changing the concepts of lending and deposit rates in 2003:2. To get an intuition of the robustness of our results, we also estimated the model with the sample period 1980:1–2003:2.

The German Bundesbank provides all data, except for GDP and the GDP deflator, which the Federal Statistical Office Germany made available. All series except interest rates and the share price index are seasonally adjusted, deflated with the GDP deflator and in logs. As time series for credit (C) we used total loans to enterprises and self-employed persons. The series were adjusted for statistical breaks by adding the Bundesbank's corrected quarter-to-quarter changes. Only one break, in 1998, remained in the series. For the equity prices we chose the CDAX Performance Index that includes more than 750 German traded stock listings. This index is also deflated with the GDP deflator and in logs. The interest rate on credit in the current account (s) proxies the credit price. The variable *span* was calculated as the difference between the just mentioned interest rate on credit (s) and the interest rate on deposits with agreed maturity up to one year. Interest rates are in nominal terms.

We employed a simple form of a disequilibrium-model, estimated by maximum likelihood. Using equations (1)–(3) and assuming that the errors ν_{1t} and ν_{2t} are normally independently distributed with variances σ_1^2 and σ_2^2 the joint probability density of D and S can be written as (Maddala 1987):

$$(6)\quad g(D,S) = g_1(D)g_2(S) = \frac{1}{2\pi\sigma_1\sigma_2}\exp\left[-1/2(D - X_1\alpha)^2/\sigma_1^2\right]\exp\left[-1/2(S - X_2\beta)^2/\sigma_2^2\right]$$

The two conditional probability density functions of C are

$$(7)\qquad h(C|C = D < S) = \int_C^\infty g(C,S)dS = g_1(C)\int_C^\infty g_2(S)dS$$

$$(8)\qquad h(C|C = S < D) = \int_C^\infty g(D,C)dD = g_2(C)\int_C^\infty g_1(D)dD$$

From (7) and (8) the unconditional density of the observable credit volume (C) then is:

$$(9)\quad h(C) = h(C|C = D < S) + h(C|C = S < D) = g_1(C)\int_C^\infty g_2(S)dS + g_2(C)\int_C^\infty g_1(D)dD$$

The associated log-likelihood function then is

$$(10)\qquad \sum_{i=0}^{T}\log h(C_i).$$

To maximise (10) we used the Marquardt procedure implemented in the Eviews-package. The starting values were calculated by an OLS-estimation. In general, convergence was achieved quickly.

As all series are non-stationary, the estimation in levels only allows for an interpretation of the credit demand- and supply-equations as cointegration vectors. This implies that the *t*-statistics cannot be interpreted as a formal test of significance. Nevertheless, the standard errors provide a measure of precision of individual estimators (Ghosh, Ghosh 1999: 11). To check the validity of the interpretation as cointegration vectors, we tested the credit demand and supply for cointegration with the observed credit volume (Ghosh, Ghosh 1999).

IV. Results

The estimation results are presented in Table 1. All coefficients have the expected signs. The coefficients of the interest rate and real GDP in the demand equation come quite close to the results of the Bundesbank (2002: 38). Most of the standard errors are small. The only exception is the standard error of *bonds* indicating that the impact of the issuance of bonds on credit demand is not too large. The interest rate spread has a negative impact on credit supply, confirming its interpretation as a risk-measure. The positive sign and small standard errors for the coefficient of the share prices confirm the effect of share prices on credit supply.

We further tested the normality of the residuals of the demand and supply equation by using the Jarque-Bera Test (JB). The test statistics of both equations indicate that it is not possible to reject the hypothesis of normality at the usual significant levels. As the data is non-stationary, we used cointegration tests for a formal check of our specification. Thereby we tested whether credit demand and credit supply respectively was cointegrated with the observed credit volume. The idea is that if the credit market is generally restricted by supply (demand), the observed credit volume should be cointegrated with supply (demand). In this case it is possible that there is only a weak cointegration relation with credit demand (supply). If the credit market were not predominantely restricted by one side of the market, one would expect that both, credit demand and supply, are cointegrated with the observed credit volume.

The normality of the residuals allows to use the Johansen test for cointegration. In a first specification of cointegration equations without constant term these tests indicated two cointegrating vectors, what is im-

plausible because we only have two variables. We therefore added a constant term in the cointegrating equation. In this case we have found one cointegrating equation for credit supply. For credit demand both cointegrating equations persisted. The finding of a linear long-run relation between credit supply and observable credit volume and none for credit demand and observable credit volume leads to the conclusion that the German credit market was primarily restricted by credit supply during this period. This is in line with previous studies for the German credit market (Kugler 1987, Winker 1996).

To test for robustness we varied the specifications. The results were satisfying, taking into account that disequilibrium models in general are less stable than single equations. In order to get an idea about the influence of the sample period, we dropped different numbers of observations at the beginning and at the end of the sample period. Our finding is that the start of the sample period is more crucial for our results than the end and that the inclusion of the first years after the reunification led to particularly poor findings. We therefore decided to begin in 1993.

We also tried a longer sample period, beginning in the first quarter of 1980. Despite the obvious problems connected with the structural break caused by the German reunification, the results remained plausible. The only modification that became necessary was the exclusion of industrial bonds from the demand equation. This amendment obviously corresponds to that the issuance of industrial bonds gained some importance only in the second half of the nineties. The coefficients for the cost of capital and economic activity decrease, which is for the coefficient of economic activity more in line with other studies. Unfortunately, the overall fit deteriorates and only on a 1% significance level it is not possible to reject the hypothesis of normally distributed residuals. For the supply equation it is interesting to note that the coefficients of capital and share price do not change a lot. Only the coefficient of the interest rate spread decreases. At 5% significance level, the residuals are normally distributed, and credit supply and observed credit volume are cointegrated.

In a next step, we interpret the difference between the calculated credit demand and supply at a ratio of estimated supply, as an indication of a credit market restriction by either demand or supply (Figure 3). As mentioned above, credit rationing is compatible with "normal" bank behaviour, complicating the identification of a credit crunch. In addition, we have to bear in mind that our calculated credit demand and supply

Table 1

Estimates for credit demand and supply functions
Maximum likelihood estimation

Lending to enterprises and self-employed persons

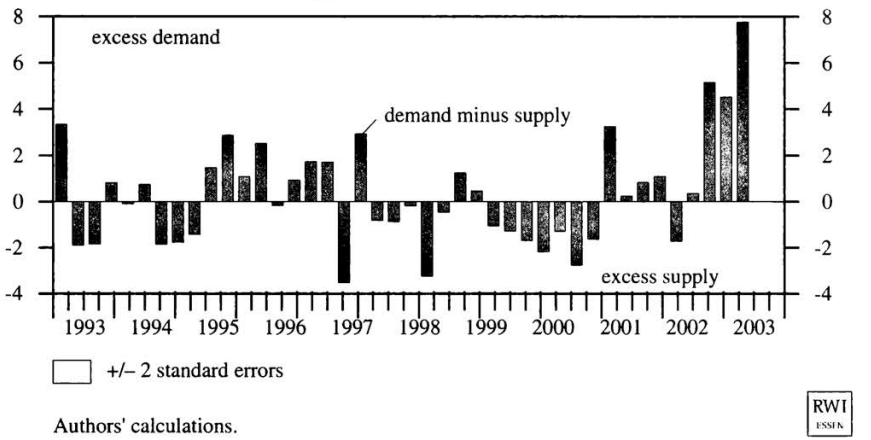
Demand			Supply		
	1993:1–2003:2	1980:1–2003:2		1993:1–2003:2	1980:1–2003:2
Const.	–7.19 (1.590)	–1.75 (0.247)	Const.	5.81 (0.047)	4.37 (0.135)
Interest Rate (s_{t-1})	–0.03 (0.008)	–0-009 (0.004)	Capital (BC_{t-1})	0.47 (0.007)	0.65 (0.023)
Real GDP (y_{t-1})	2.72 (0.261)	1.81 (0.037)	CDAX	0.12 (0.007)	0.04 (0.022)
Industrial Bonds ($bonds_{t-1}$)	–0.02 (0.012)		Spread ($span_{t-1}$)	–0.02 (0.002)	0.003 (0.005)
Sigma	0.018	0.011	Sigma	0.006	0.049
Jarque-Bera	2.36**	7.66*		2.71**	5.27**
Log Likelihood	132.80	182.79			

Authors' calculations. Standard errors in parentheses.
* Significant at the 5 % level.
** Significant at the 1 % level.

also includes the estimation error. Hence, only "large" excess demand should be taken as an indicator of a credit crunch. To get an impression what "large" means in this context, we depict a two standard error-band of this model, divided by the average credit supply over the period of interest. By this measure it is very likely that in the last quarter of 2002 and in the first half of 2003 the German credit market was restricted by credit supply. Keeping in mind that the driving force for the reduction in credit supply is the decline in share prices beginning in 2000, this is in line with the notion of a credit crunch presented above. In 2001 and the first half of 2002, however, our model provides no evidence of a substantial excess demand.

One of the stylised facts presented in Part 2 was a more pronounced drop of loans in *Großbanken* than in the other banks. Previous studies

Excess demand respectively excess supply for loans to enterprises and self-employed persons
1993 to 2003; in % of credit supply



Authors' calculations.

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Figure 3

found out that there are differences between the types of banks in reaction to a monetary shock (Küppers 2001). Given, the clients' characteristics and demand are roughly the same in all types of banks, or that, at minimum, they change in parallel, it appears to be rather a shift of strategy towards consolidation of outstanding loans than a fall of demand.

Scrutinising this finding, we applied our specification of credit demand and supply separately to *Großbanken* and all other credit institutions (henceforth: "other banks"). The results for the latter are much in line with the banking sector as a whole. One difference is the smaller coefficient of the interest rate spread. All in all, the residuals are normally distributed and we find one cointegration vector for credit supply and two for credit demand – the same picture as in the calculations for all banks together. For *Großbanken,* however, the standard errors for *cdax* and *span* in the supply equation as well as for *r* in the demand equation are quite large. Moreover, the signs for *cdax* and *r* do not correspond with our expectations. However, the residuals of both equations are normally distributed. The cointegration relations between estimated and observed credit volumes deteriorate to some extent, as we did not adjust the specifications to the different banking groups. Nevertheless, the finding that the decline of loans is mainly driven by the *Großbanken*

Table 2

Estimates for credit demand and supply functions for different groups of banks (Maximum likelihood estimation; 1993:1–2003:2)

Lending to enterprises and self-employed persons, total

Demand			Supply		
	Großbanken	Other banks		*Großbanken*	Other banks
Const.	–3.68 (0.148)	–8.70 (0.125)	Const.	8.26 (0.372)	–4.22 (0.082)
Interest Rate (s_{t-1})	0.01 (0.008)	–0-04 (0.004)	Capital (BC_{t-1})	–0.13 (0.073)	0.67 (0.012)
Real GDP (y_{t-1})	1.87 (0.024)	2.93 (0.021)	CDAX	0.21 (0.071)	0.11 (0.008)
Industrial Bonds ($bonds_{t-1}$)	–0.06 (0.012)	–0.01 (0.005)	Spread ($span_{t-1}$)	–0.007 (0.007)	–0.007 (0.002)
Sigma	0.018	0.018	Sigma	0.024	0.007
Jarque-Bera	2.90**	1.37**		2.09**	3.89**
Log Likelihood	107.21	134.06			

Authors' calculations. Standard errors in parentheses.
** Significant at the 5% level.

sector and that – as previously concluded – this is a supply-driven development, further strengthens our results.

V. Conclusions

This paper analyses whether in the years 2001–2003 the slowdown in German credit expansion was predominantly caused by demand side or supply side factors, in order to evaluate the possibility that there was a situation of a credit crunch. We adopt a definition according to which a credit crunch assigns a supply-side restriction of loans disregarding market interest rates and the profitability of investment projects. Within the framework of a disequilibrium-model we establish a function for loan demand and one for loan supply. The difference between estimated demand and estimated supply can be interpreted as an indication of

whether the credit market is restricted by demand or supply. We have found clear evidence of a substantial supply side restriction since the last quarter of 2002, substantiating the credit crunch-scenario. The most important determinant explaining the unwillingness of the banks to lend seems to be the losses on the stock market. Differentiating between banking groups, it is the *Großbanken* conducting the most restrictive lending policy.

Our findings suggest that the slowdown in credit was not just a consequence of the weak credit demand in Germany, but was amplified by the banking sector. The elemental consequence of this credit crunch was that the financing even of profitable investment projects was hampered. Our approach does not allow for the evaluation of the magnitude of the macroeconomic effects resulting from this credit crunch. Anyway, it is likely that with a consolidation of the stock markets, the situation relaxed.

Appendix 1

Stationarity tests

Variables	1980:1–2003:2	1993:1–2003:2
Real Lending to enterprises and self-employed persons, total	–1.048**	–1.653**
Real Lending to enterprises and self-employed persons, commercial banks		–1.326**
Real Lending to enterprises and self-employed persons, all except commercial banks		–1.502**
Real GDP	–0.462**	–0.780**
Real Lending capacity, all banks	1.002**	–0.268**
Real Lending capacity, commercial banks	1.677**	–0.956**
Real Lending capacity, all except commercial banks	2.454**	–0.560**
Industrial Bonds		3.131
Interest rate spread	–2.492**	–2.434**
Long-term interest rate	–1.469**	–1.666**
Share price index	–1.849**	–1.657**
Credit demand, all banks	–0.525	–2.635**
Credit supply, all banks	–0.169	–2.089**
Credit demand, commercial banks		–1.575**
Credit supply, commercial banks		–0.759**
Credit demand, other banks		–2.162**
Credit supply, other banks		–2.225**

ADF-Test with constant and no trend

** The null hypothesis of a unit root can not rejected at 1% significance based on MacKinnon one-sided p-values.

* The null hypothesis of a unit root can not rejected at 5% significance based on MacKinnon one-sided p-values.

Johansen tests of cointegration between credit demand and supply with observed real credit

		Hypothesized No. of CE(s)	Trace-Test	Indicated No of CE(s)	Max-Eigenvalue-Test	Indicated No of CE(s)
All banks	Supply	0	49.28	1*	41.46	1*
		1	7.82	1**	7.82	1**
	Demand	0	64.76	2*	51.39	2*
		1	13.38	2**	13.38	2**
Commercial banks	Supply	0	10.47	1*	10.01	1*
		1	0.47	0**	0.47	0**
	Demand	0	6.82	0***	6.41	0***
		1	0.41		0.41	
All other banks	Supply	0	73.87	1*	66.15	1*
		1	7.72	1**	7.72	1**
	Demand	0	89.92	2*	68.96	2*
		1	20.96	2**	20.96	2**
All banks	Supply	0	97.25	1*	95.83	1*
1980:1–2003:2		1	1.42	1**	1.42	1**

Johansen Test of Cointegration assuming no deterministic trends and no intercept in the cointegrating equation (CE) and using no lag in first differences for *Großbanken*. For all banks and all other banks this test indicates two cointegrating relations, which is not possible for two variables. Therefore we allow a constant in the cointegration relation. Critical values are taken from Osterwald-Lenum (1992).

* Number of cointegration equations at the 10% significance level.
** Number of cointegrating equation(s) at the 5% significance level.
*** Number of cointegrating equations at the 1% significance level.

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Summary

Credit Crunch in Germany?

This paper evaluates whether the German economy was affected by a credit crunch from 2001 to 2003, i.e. a supply-side restriction of loans that is not in line with market interest rates and profitability of investment projects. With the help of a disequilibrium-model, we calculate a credit supply and a demand-function. We have compared estimated demand with estimated supply, finding evidence for a substantial supply side restriction of the German credit market, particularly since the end of 2002. The main reason for this restriction is the drop in earnings in the banking sector. Applying the model to *Großbanken* (big banks) and other credit institutions separately shows that the former were more affected than the latter. (JEL C32, E51, G21)

Zusammenfassung

Gibt es eine Kreditklemme in Deutschland?

Der vorliegende Beitrag geht der Frage nach, ob die deutsche Wirtschaft in den Jahren 2001 bis 2003 von einer Kreditklemme betroffen war, d.h. einer angebotsseitigen Beschränkung des Kreditmarktes, die nicht im Einklang steht mit der Höhe der Finanzierungskosten und der Rentabilität geplanter Investitionsprojekte. Dazu werden im Rahmen eines Ungleichgewichtsmodells des deutschen Kreditmarktes Angebots- und Nachfragefunktion für Kredite an Unternehmen und selbstständige Privatpersonen simultan geschätzt. Der Vergleich der geschätzten Werte für Angebot und Nachfrage zeigt sehr deutlich, dass der Kreditmarkt insbesondere Ende 2002 und in der ersten Hälfte 2003 durch die Angebotsseite beschränkt wird. Der Hauptgrund dürfte in dem starken Rückgang der Aktienkurse und seinen Folgen, auch für den Bankensektor, liegen. Ein Vergleich der deutschen Großbanken mit den übrigen Banken zeigt, dass die Großbanken in besonderem Maße von dieser Entwicklung betroffen waren.

Résumé

Resserrement de crédit en Allemagne?

Cet article examine si l'économie allemande a été affectée de 2001 à 2003 par un resserrement de crédit, c'est-à-dire par une restriction de l'offre du marché financier qui ne concorde pas avec le montant des coûts de financement et la rentabilité des projets d'investissement planifiés. Pour ce faire, les auteurs utilisent un modèle de déséquilibre du marché financier allemand et y estiment simultanément la fonction d'offre et de demande de crédits pour les entreprises et personnes privées indépendantes. La comparaison des valeurs estimées pour l'offre et la demande montre très clairement que l'offre du marché du crédit a été restreinte particulièrement fin 2002 et dans la première moitié de 2003. La raison principale de

ce phénomène est la chute importante des cours des actions et ses conséquences, également pour le secteur bancaire. Une comparaison des grandes banques avec les autres banques montre que les grandes banques ont été particulièrement touchées par cette évolution.