

Hiltrud Nehls and Torsten Schmidt

# Credit Crunch in Germany?

No. 6



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**Hiltrud Nehls and Torsten Schmidt\***

## **Credit Crunch in Germany?**

Abstract

This paper evaluates whether the Germany economy is currently affected by a credit crunch, i.e. a supply-side restriction of loans that is not in line with market interest rates and profitability of investment projects. With help of a disequilibrium-model, we calculate a credit supply and a demand-function. We compare estimated demand with estimated supply, finding a considerable excess-demand particularly in the second half 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 situation in the former is more severe than in the latter.

JEL: C32, E51, G21

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## I. Introduction

After the recession 2001/2002, the economic perspectives in Germany are still grim. Consumers' and investors' confidence remain low, growth is far from satisfying and, in addition, while interest rates are quite low at the moment, banks seem to reject their economic function: anecdotal evidence reports a "credit crunch" and even the Bundesbank cannot deny that "the slowdown in credit growth was somewhat stronger than in earlier periods in which the economic climate had cooled" (Bundesbank 2002: 32). On the other hand, it emphasises that there have been several similar situations in the past that did not result in financial crisis, concluding "Nonetheless, the econometric results for the various credit aggregates also show that other factors may well also be causing weak credit growth. ... By contrast, there are signs of a certain lending restraint among banks." (Bundesbank 2002: 45).

Of course, it is difficult to decide whether the slowing credit is still in line with the not-so-well economic situation and cloudy business outlook in Germany, or whether it is the beginning of a financial and economic crisis. However, if the current situation turned out to be a credit crunch, the consequences could be problematic: if the banks refuse to expand lending regardless of the expected yields, the private sector in Germany is cut off its most important source of outside capital. That means that business investment will be cut short, with the subsequent implications for the business cycle and growth. Secondly, it implies that monetary policy loses some of its effectiveness. Any cut in interest rates remains "stuck" in the banking sector without being transmitted further into the real sphere of the economy. Therefore, one important and powerful instrument of economic policy is – to some extent – lost.

In this paper, we try to disentangle the different influences on business loans in order to find evidence for or against a credit crunch in Germany. This subject has been brought up by a study coordinated by the Kreditanstalt für Wiederaufbau (KfW 2002). In a survey, 6000 German enterprises were asked about the availability of credit, with the result that there is a considerable excess demand for loans, especially by small and medium firms. Two other studies (Bundesbank 2002, Sachverständigenrat 2002) both exclusively concentrating on demand-side factors, confirmed that credit allotment was lower than can be explained by fundamental determinants. However, the theory of credit markets rather sees the supply-side dominating demand (Stiglitz, Weiss 1981). We intend to trace both sides of the market, following Pazarbasioglu (1997) and others (Ghosh, Ghosh 1999; Barajas, Steiner 2002). They apply the conceptual framework of a disequilibrium-model allowing for conclusions on credit market restrictions.

The paper is organised as follows: in the first part, we give an overview of the stylised facts on business loans in Germany that led to the discussion about a

credit crunch. The second section is dedicated to the presentation of the analytical framework of this study – a disequilibrium model – and the data we use. In the succeeding part the results of our estimations are shown. In the final section we provide a brief summary and conclusions.

## **II. Credit crunch? Economic concepts and stylised facts on credit in Germany**

There is no common definition of a “credit crunch”. In their seminal paper, Bernanke and Lown defined it as “a significant leftward shift in the supply curve for bank loans, holding constant both the safe real interest rate and the quality of potential borrowers” (Bernanke, Lown 1991: 209). Anyway, Friedman commented (Bernanke, Lown 1991: 240) that this definition still allows for an adjustment by higher interest rates, without some clients being completely cut off new credit. This notion does not fully coincide with the widespread idea of a credit crunch as a crisis of bank lending, pushing an economy on the edge of a recession. Without going further into detail, we therefore adopt the concept of the “Council of Economic Advisers” saying “A credit crunch occurs when 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).<sup>1</sup>

From the banks’ point of view, reducing loans without allowing for interest rate adjustment can be rational, though, at the first glance this might seem aberrant. Economic theory, however, provides two major concepts to explain this sort of rationing behaviour. Firstly, in the adjacent theoretical strand of monetary policy transmission, this phenomenon is known as the bank lending channel (Bernanke, Blinder 1980; Bernanke, Gertler 1995: 40f). Its most simple version is a stop of bank lending following regulatory changes. For instance, in the case of the central bank demanding higher minimum reserves, loan supply might be restrained because the bank lacks own capital. Although in the Euro-Area and hence Germany minimum reserve requirements have lost some relevance as an instrument of monetary policy, the Basle accords might have a similar effect on the banks’ behaviour. The (risk-weighted) capital-to-loan-ratio, as fixed in the Basle I accord, declined significantly in many banks due to the stock market plunge. Moreover, the rules for measuring and weighting the risks of loans are being overhauled in the course of the Basle II process, probably leading to significant changes in the evaluation of risks and hence the capital requirements. One way to achieve a higher capital-to-loan-ratio in the short run is to cut loans.

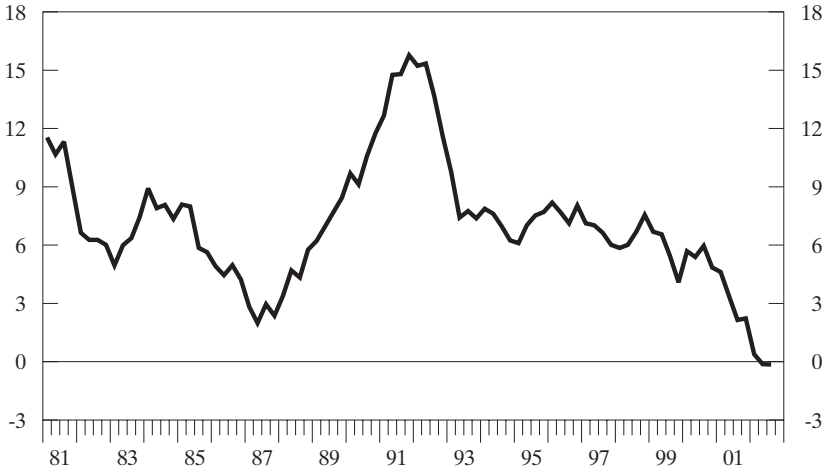
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<sup>1</sup> For differing concepts see Ding et al. (1998).

Figure 1

**Total lending to enterprises and self-employed persons**

1981 to 2002; change against previous year in %



Source: Deutsche Bundesbank.



A second approach explaining the banks' behaviour is the portfolio theory<sup>2</sup>, according to which a bank chooses between different assets, aiming at an optimal mix of risk and return. If the risk contained in the portfolio rises unexpectedly (for instance because of a weakening stock market) the whole portfolio needs to be restructured. In extreme, all risky assets (including business loans), regardless of their expected return, need to be reduced in favour of risk-free assets.

In Germany, a strong slowdown in business loans can be observed since 2000 (Figure 1), and a downright decline since the second quarter of 2002. With a long-run average growth rate of more than 6 % (without the time-span that is obviously distorted by the reunification-boom, the average is still 5 ½ %), the standard deviation is about 2 %, so the current rate is obviously far from "normal".

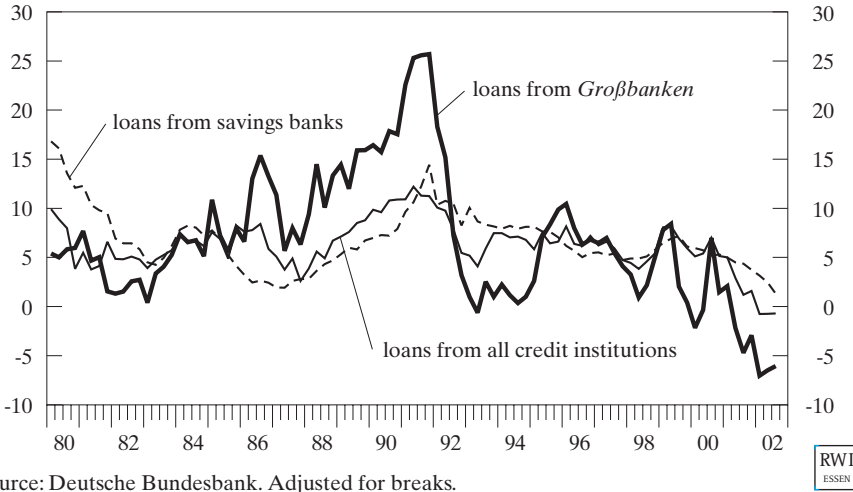
Several facts support the idea of a credit crunch. In the first place, the banks themselves cannot deny falling returns and high costs. Insisting on the non-existence of a liquidity crisis, they admit a profitability crisis (HVB Corporates & Markets 2002: 17; Bundesverband deutscher Banken 2002: 27). The main reasons are to be seen in the economic slowdown, the downturn in the financial markets and the connected slump in investment banking, but of course, struc-

<sup>2</sup> For a good overview on this literature see Freixas Rochet 1998: 272ff.



Figure 2

**Total lending to enterprises and self-employed persons by different credit institutions**  
1980 to 2002; change against previous year in %



Source: Deutsche Bundesbank. Adjusted for breaks.



tural shortfalls such as the large number of branches, the fragmented banking system and the high labour costs are also likely to play a major role. Whatever the causes are, the global rating agencies have already taken action, highlighting the distress in the German financial sector by downgrading the ratings for some German commercial banks in 2002. This translates into a higher risk-premium and therefore higher capital costs. Hence, the strategy of reducing loans firstly because of the higher costs and secondly in order to limit risk and to lift the equity ratio might be a banks' plausible reaction.

In addition, the new standards for risk measurement set by the Basle II-agreement are often quoted as an important factor for the reluctance of banks to provide credit, even though that treaty will not be implemented earlier than 2006. With the new needs for individual risk-calculations, deficits in the accounting systems of many small and medium enterprises became apparent. Often, lacking formal financial statements were excused, as in the German system of "Hausbanken" with long-run relationships between bank and customer, the banks felt that they can rely on enough "first hand" information. In some cases the closer look into the books might have altered this view. In some cases however, Basle II might have been a welcomed excuse for cutting business connections to small, low-potential customers, even if the investment project would provide some positive yield.

Another fact hints into the direction of a supply-side problem (Figure 2): disaggregating total loans by credit institutions illustrates that the slowdown

in credit expansion was far more severe in the *Großbanken*<sup>3</sup> than in the other credit institutes (savings banks etc.). Given, that the clients' characteristics and demand are roughly the same in all types of banks (or, at minimum, that they change in parallel), it appears to be rather a shift of strategy towards consolidation of outstanding loans than a fall of demand. As the *Großbanken* suffer most from the strong declines in the segment of investment banking and the plummeting share prices, as they were far more involved into both, gives even more weight to this argument.

On the other hand, the low volume of credit could also result from weak demand. As mentioned above, with worsening business outlooks, the number of profitable investment projects declines and therefore the need for liquidity reduces. As economic activity in Germany is little more than stagnant since early 2001, credit demand might also have weakened. However, the relatively low interest rates and therefore low cost of credit should stimulate the demand, hence the outcome for credit demand is ambiguous.

A second demand-side explanation could be the phenomenon of "disintermediation": in the recent years, firms attract more and more capital directly on the financial markets and rely less and less on bank loans as a source of liquidity. Indeed, in the last few years the growth rates of substitutes for bank loans (i.e. in particular bonds) have been impressive. Anyway, the growing importance of the bond-market could be as well *consequence* of the reluctant loan-supply. In that case the quick expansion of the bond market up until this year is a sign of undampened demand for external funds (Westermann 2003: 30ff.).

Whether the current situation is a credit crunch or a less severe problem of low demand, cannot be identified by examining the market results. One has to distinguish between demand-side factors and supply as neatly as possible. In order to analyse the two sides separately, we use the disequilibrium-model that is described in the following section.

### III. A disequilibrium-model for German credit

#### 1. Are loans constrained by the demand or by supply?

Recent empirical investigations of the German credit market by the Bundesbank (2002) and Sachverständigenrat (2002) identify two main deter-

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<sup>3</sup> Following the systematics of the Deutsche Bundesbank the "Großbanken" comprise the four big banks Deutsche Bank, Commerzbank, Dresdner Bank and Hypo Vereinsbank, 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. Mortgage banks and 7. Banks with special functions.

minants of loan demand: economic activity (i.e. GDP) and financing costs (i.e. interest rates or bank lending rates). However, both may also affect credit supply, making it impossible to distinguish demand from supply effects. As both studies precluded all methods distinguishing demand from supply, they assume that actual loans are dominated by the demand-side. Hence, they identify a demand-function that represents the “explicable credit growth”. In an error correction model, they find a discrepancy between explicable and actual credit growth, but they can only state that irregularity, without answering whether this is indeed a credit crunch.

In theory, however, loans are more likely to be restricted by the supply-side (for an overview on credit rationing see Jaffee and Stiglitz (1990)). In their seminal paper, Stiglitz and Weiss (1981) argue that banks are confronted with information asymmetries. 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.

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, the interest rate does not fully reflect risk and the supply-side dominates the demand-side.<sup>4</sup> Hence, it seems reasonable to examine closely the behaviour of the banking sector and the determinants of their lending strategy.

Models on credit rationing have been examined by Kugler (1987) and by Winker (1996)<sup>5</sup> for (West-) Germany in the 1970s and 1980s. Both studies found substantial evidence for credit rationing and indications that supply-factors play an important role. An investigation by the IMF (2002) failed to specify a supply equation but found a significant influence of supply side variables in an equation with demand and supply variables.

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<sup>4</sup> Asking for collateral does not improve the situation either, as similar adverse selection effects may occur (Stiglitz, Weiss 1981: 408). In addition, one can also think of potential borrowers not having enough collateral to offer. This demand for credit will always remain unsatisfied.

<sup>5</sup> Kugler examines, apart from West Germany also the U.S., U.K. and Switzerland.

## 2. The model

Although in theory there is a clear difference between credit rationing and a credit crunch – the former being an equilibrium outcome of credit markets as a consequence of asymmetric information, moral hazard and adverse selection, the latter representing an acute negative supply shock, resulting from a decline of the banks' resources or regulatory changes that is transitory – the empirical outcome is (in the short run) the same: demand exceeds supply. Therefore, it is not astonishing that the framework of disequilibrium models were also applied for analysing potential credit crunches. Pazarbasioglu (1997), Ghosh and Ghosh (1999) and Barajas and Steiner (2002) scrutinize the bank lending in different countries with 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 the credit. This strategy avoids the usual identification problem of equilibrium models as either the demand- or the supply-function determines the volume of credit. 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. To keep the model as transparent as possible, we use the disequilibrium model in a most simple version. We also refrain from an additional equation for the interest rate adjustment, as implemented in similar models (Laffont, Garcia 1977, Sealey 1979, Kugler 1987, Winker 1996), because theory – as mentioned above – does not accept the interest rate as the matching mechanism between demand and supply. The general form of the model can be written as follows:

$$(1) \quad D_t = X_{1t} \alpha + v_{1t}$$

$$(2) \quad S_t = X_{2t} \beta + v_{2t}$$

$$(3) \quad C_t = \min(D_t, S_t).$$

With  $D_t$  as credit demand at the time  $t$ ;  $S_t$  as credit supply in  $t$ ;  $X_t$  being the respective vector of determinants;  $v_t$  is the respective error term and  $C_t$  the observed credit volume.

For the demand function, we follow the specification of the Bundesbank (2002) and Sachverständigenrat (2002); our specification of the supply function comes close to that of Pazarbasioglu (1997) in many respects.

The function of real credit demand ( $D_t$ ) consists of the following equation:

$$(4) \quad D_t = a_1 + a_2 r_{Cap} + a_3 y_t + v_{1t},$$

with  $(r_{cap})$  being the nominal capital market rate, and  $(y_t)$  real GDP. For the former we would expect a negative sign, as with falling cost of capital, demand should rise, for the latter, a proxy for the overall economic activity, the sign should be positive.

Our credit supply-function is specified as follows:

$$(5) \quad S_t = b_1 + b_2 s_t + b_3 LC_t + b_4 cdax_t + b_5 span_t + v_{2t}.$$

In (5) real credit supply ( $S_t$ ) is determined by a portfolio management approach. Assuming the ordinary price-quantity link, with rising interest rate on short-term business loans ( $s_t$ ), credit supply is extended, as profitability rises.<sup>6</sup> The (real) volume of deposits plus banks' equity ( $LC_t$ ) gauges the available resources of the banks, so this is a proxy for the ability of the banks to lend. Share prices, measured by the price performance index of German shares ( $cdax_t$ ) can cause a decline in credit supply via two channels. Firstly, a decline in share prices can reduce the net worth of borrowing firms and the collateral value owned by borrowers. Secondly, a reduction in bank capital forces banks to increase the liquidity and safety of their assets by a reduction in lending activity (Bernanke 1995: 18; Nanjo 2002: 8).<sup>7</sup> According to both interpretations, a falling  $cdax$  goes along with a slowdown in credit supply. The difference between interest rate on business loans and the interest rate on deposits ( $span_t$ ) also 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). This notion is in line with the Stiglitz and Weiss (1981) argument of the interest rate as a "screening device", saying that high interest rates will often only be accepted, because the borrower's project is very risky, indicating a high probability of default. The expected sign for the first three determinants is positive, the fourth negative.

In this type of model, a second step is needed to associate a particular observation in time to the demand- or the supply-equation.<sup>8</sup> 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

<sup>6</sup> As mentioned before, in presence of information asymmetries and adverse selection, this price-quantity link should not hold. Anyway, a specification without interest rate deteriorates the regression (see below).

<sup>7</sup> We assume that the availability of funds for banks mainly depends on the overall market performance, therefore the CDAX is a better indicator than the banking sector share price index. Anyway, as both of them move nearly synchronously during the 1990s, the estimation outcomes are similar.

<sup>8</sup> Other models introduce an additional assumption to assign the observations either to the demand or the supply equation (for an overview see Maddala 1987).

that the credit volume of this observation is supply-constrained. By this means, the probability that an observation is demand- or supply-constrained can be calculated. Alternatively, graphical inspection (see below) can give useful results on whether supply or demand is “short”.

### 3. Data and estimation

For our analysis, we mainly relied on the sample period from 1992 to 2002, trying to avoid the structural break caused by the German reunification. To get an intuition of the robustness of our results, we also estimated the various specifications with the sample period 1980-2002. All series we used are on quarterly basis.

The German Bundesbank provided all data, except for GDP and the GDP deflator, for which the Federal Statistical Office Germany is the official source. All series except interest rates are seasonally adjusted. As the credit variable ( $C$ ) we used total loans to enterprises and self-employed persons, deflated with the consumer price index. The lending capacity ( $LC$ ) includes sight deposits plus time deposits for up to one year plus the bank’s capital, and is deflated with the GDP deflator. Both series are in log-form. The series of credit volume had to be adjusted for statistical breaks. Following the Bundesbank, the series were constructed by adding the Bundesbank’s adjusted 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. The interest rate on credit in the current account ( $s$ ) proxies the credit price. The variable  $span$  was calculated as the difference between this interest rate on credit ( $s$ ) and the interest rate on deposits with agreed maturity up to one year. Interest rates are in nominal terms. As an argument in the demand equation we employed the yields on bonds outstanding issued by residents ( $r_{cap}$ ).

We used a simple form of a disequilibrium-model, estimated by maximum-likelihood. Using equations (1)–(3) and assuming that the errors  $v_{1t}$  and  $v_{2t}$  are normally independently distributed with variances  $\sigma_1^2$  and  $\sigma_2^2$  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

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

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

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

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

To maximise (10) we used the Marquardt procedure implemented in the Eviews-package. The starting values were calculated by an OLS-estimation. Alternatively, we tried a two-step-estimation, its results were nearly identical. In general, convergence was achieved with at most 20 iterations.

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 on 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). For this purpose, we used the Reimers small sample correction to calculate the Johansen trace statistic (Reimers 1992).

#### IV. Results

The estimation results are presented in Table 1. All coefficients have the expected sign.<sup>9</sup> Specification (1) relies on equations (4) and (5). The coefficients of the demand equation are quite close to the results of the Bundesbank (2002 p. 38) and the standard errors are small. The interest rate spread has a negative impact on credit supply, confirming its interpretation as a risk-measure.

In alternative calculations, (Table 1, specifications 2–4) we varied the specifications to test for robustness. First (specification 2), in the demand equation we replaced the capital market rate by interest rates for short-term credit for

<sup>9</sup> The purpose of this study is to find one or two (demand or/and supply) cointegration relations explaining loans. The interpretation of the coefficients as elasticities or semi-elasticities additionally require to model of the short-run dynamics (Gonzalo 1994: 206).

Table 1

**Estimates for different credit demand and supply functions**

(Maximum likelihood estimation)

	Lending to enterprises and self-employed persons, total				
	Specification (1)	Specification (2)	Specification (3)	Specification (4)	Specification (1)
	1992:1 to 2002:4				1980:1 to 2002:4
<b>Demand</b>					
Const.	-10.43 (0.365)	-11.75 (0.562)	-10.31 (0.488)	-10.57 (0.533)	-7.46 (0.218)
Long-term Interest Rate	-0.03 (0.004)		-0.03 (0.001)	-0.03 (0.004)	-0.02 (0.003)
Lending Rate		-0.02 (0.004)			
Real GDP	2.10 (0.063)	2.32 (0.098)	2.08 (0.077)	2.12 (0.086)	1.61 (0.034)
Sigma	0.012	0.023	0.013	0.012	0.018
<b>Supply</b>					
Const.	-7.55 (0.819)	-7.37 (1.704)	-4.52 (0.112)	-9.47 (0.317)	-9.82 (0.583)
Lending Rate	0.09 (0.041)	0.08 (0.029)		0.133 (0.018)	0.03 (0.015)
Real Deposits	0.99 (0.072)	0.97 (0.066)	0.68 (0.010)	1.26 (0.035)	1.25 (0.076)
Share Price Index	0.10 (0.035)	0.08 (0.020)	0.09 (0.008)		0.05 (0.039)
Interest Rate Spread	-0.12 (0.049)	-0.10 (0.034)	-0.03 (0.006)	-0.19 (0.024)	-0.03 (0.020)
Sigma	0.018	0.015	0.020	0.034	0.029
Log Likelihood	128.86	121.73	126.27	119.29	218.08

Authors' calculations. Standard errors in parenthesis.



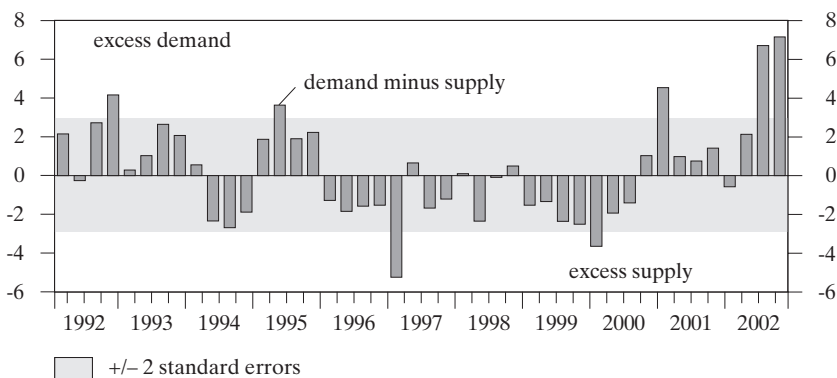
enterprises, as it seemed to be a more direct measure of the cost of capital. Unfortunately, this did not improve the results; at least, all variables kept their sign and the magnitudes varied moderately. In a second variation (specification 3) we tried to implement the notion of Stiglitz and Weiss (1981), by disregarding the interest rate completely. The standard error and the likelihood value of the supply function indicate that the overall fit declines slightly. To gauge the influence of the share price index, in specification (4) we excluded it from the supply equation, which leads to more obvious deterioration of the overall fit.

Because of the non-stationarity of the data, we used cointegration tests for a formal check of these specifications. Cointegration tests for specifications (1)–(3) indicate exactly one cointegrating vector for estimated demand with the observed credit volume, and also exactly one for the estimated supply with



Figure 3

**Excess demand respectively excess supply for loans to enterprises and self-employed persons**  
1992 to 2002; in % of credit supply



Authors' calculations.



the observed credit volume (details of the specification see appendix). In specification (4) we exclude the share price index from the supply equation. In this case, estimated supply is no longer as clearly cointegrated with observed credit as before, verifying the impact of share prices on credit supply. As, all in all, the results of specification (1) are most convincing, our conclusions are drawn from its results.

We also tried a longer sample period, beginning in the first quarter 1980. Despite the obvious problems connected with the structural break caused by the German reunification, the results remained plausible. Other variables, for instance the number of defaults as a risk-indicator, or the inclusion of other credit variables gave less encouraging results. When testing a variety of different specifications, it was interesting to notice that the demand-function of the model exhibited a high degree of robustness, whereas the supply was not quite as stable. Also the normality assumption of the residuals is more valid for the demand equation than for supply.

In a next step, we interpret the difference between the calculated credit demand and supply at a ratio of estimated supply, as an indicator of excess demand and excess supply respectively (Figure 3). As mentioned above, credit rationing is, to a certain extent, 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 actually 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" in this context

Table 2

**Estimates for credit demand and supply functions for different banking sectors**

Maximum likelihood estimation

	Lending to enterprises and self-employed persons, total			
	<i>Groß-</i> <i>banken</i>	All other banks	<i>Groß-</i> <i>banken</i>	All other banks
	1992:1 - 2002:4		1980:1 - 2002:4	
Demand				
Const.	6.49 (0.544)	-4.80 (0.695)	2.82 (0.236)	-1.33 (0.197)
Long-term Interest Rate	-0.008 (0.009)	-0.03 (0.009)	0.008 (0.005)	-0.02 (0.004)
Real GDP	0.19 (0.094)	2.28 (0.115)	0.78 (0.039)	1.71 (0.029)
Sigma	0.015	0.012	0.035	0.010
Supply				
Const.	5.55 (0.341)	2.37 (0.746)	5.62 (0.326)	0.44 (0.46)
Lending Rate	0.17 (0.030)	0.04 (0.033)	0.16 (0.029)	-0.002 (0.015)
Real Deposits	0.15 (0.058)	0.84 (0.092)	0.14 (0.055)	1.20 (0.077)
Share Price Index	0.19 (0.017)	0.12 (0.027)	0.19 (0.012)	-0.01 (0.028)
Interest Rate Spread	-0.19 (0.037)	-0.05 (0.036)	-0.19 (0.036)	-0.02 (0.022)
Sigma	0.014	0.012	0.013	0.037
Log Likelihood	128.11	136.83	216.99	204.69

Authors' calculations. Standard errors in parenthesis.



means, in Figure 3 we depict a two standard error-band of this model, divided by the average credit supply over the period of interest. In 1992/93, some excess-demand for loans is apparent. By that time, Germany was just about falling into a recession – speaking on itself for a weaker loan demand. On the other hand, in that period, the German economy needed great amounts of liquidity for financing the huge investments in the five new Länder. This extraordinary high demand for capital makes the undersupply for credit plausible, although one has to bear in mind that the figures might be distorted by the extreme expansion of lending in the years before (Figure 1). Roughly since 1999, the development reflects to a large degree the movements of share prices. They rose quickly until reaching their all-time high in the first quarter of 2000 and declining steadily afterwards. Since the fourth quarter of 2000, the excess-supply for credit turned into over-demand lasting – with one short interruption – until the end of 2002. Moreover, the situation deteriorates quickly; since mid-2002 over-demand surpasses the two-standard error band by large. It seems as if the credit crunch-scenario is valid.

One of the stylised facts presented in Part 2 was a more pronounced drop of credits in *Großbanken* than in the credit institutes excluding them. Scrutinising this finding, we apply specification (1) on the *Großbanken* and all other credit institutions separately.<sup>10</sup> Without further adjustment, both estimations remain stable, all coefficients (apart from one constant term) keep their sign (Table 2). However, the characteristics of the equations deteriorate to some extent. The demand equations for both *Großbanken* and other banks lose their cointegrating vectors; in particular loans from *Großbanken* seem to be fully determined by supply, whereas calculated demand has no explanatory power at all. In the light of this, comparing calculated demand with calculated supply is not very informative. Nevertheless, the finding that the decline of loans is mainly driven by the *Großbanken* and that – as previously precluded – this is a supply-driven development, further strengthens our results.

## V. Conclusions

This paper analyses the recent developments for credit allocation in Germany in order to evaluate the possibility that, at present, we are in the 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 indicator of excess demand and excess supply respectively. We find a substantial over-demand in the last two quarters, or, with interruptions, since the beginning of 2001, substantiating the credit crunch-scenario. The most important determinant explaining the unwillingness of the banks to lend seems to be the strong decline in profits, associated with 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 is not just a consequence of the weak credit demand in Germany but it is also likely that the restrictive lending policy of the banks is aggravating and prolongating the current economic slump. The elemental consequence of a credit crunch is that profitable investment projects are cancelled or delayed, dampening GDP growth directly, being a part of it, and indirectly by reducing the potential output. Our approach does not allow for the evaluation of the macroeconomic effects resulting from this credit crunch. It is likely that the magnitude of the effects depend to a large extent on how long this situation will continue and whether the economy will enjoy some catch-up effects later on. This leads to the conclusion

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<sup>10</sup> We use separate data on loans, sight deposits, time deposits and capital. The series, adjusted for breaks are available at the Bundesbank. All other series are employed as described above.

that it will be crucial for the business cycle in Germany that the financial situation in the banking sector improves quickly. With a consolidation of the stock markets, part of the problem will vanish. Hiving off loans into securitisation, as recently planned in the “true sales initiative” by a syndicate of thirteen German banks, also might be a step into the right direction.

## References

- Barajas, A. and R. Steiner (2002): Why Don't They Lend? Credit Stagnation in Latin America. *IMF Staff Papers* 49: 156–184.
- Bernanke, B.S. (1995): The Macroeconomics of the Great Depression: A Comparative Approach. *Journal of Money, Credit, and Banking* 27: 1–28.
- Bernanke, B.S. and A.S. Blinder (1988): Is it Money or Credit, or Both, or Neither? Credit, Money, and Aggregate Demand. *American Economic Review* 78: 435–439.
- Bernanke, B.S. and M. Gertler (1995): Inside the Black box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives* 9: 27–48.
- Bernanke, B.S. and C.S. Lown (1991): The Credit Crunch. *Brookings Papers on Economic Activity* 1991 (2): 205–248.
- Bundesverband deutscher Banken (ed.) (2002): *Neue Strukturen für die Zukunft – Wandel in der deutschen Kreditwirtschaft*. [http://www.bankenbericht.de/pdf/Basis-Grundsatz-2\\_B.pdf](http://www.bankenbericht.de/pdf/Basis-Grundsatz-2_B.pdf).
- Council of Economic Advisers (1992): *Economic Report of the President*. Washington, United States Government Printing Office.
- Deutsche Bundesbank (ed.) (2002): The development of bank lending to the private sector. *Deutsche Bundesbank Monthly Report* 54 (10): 31–46.
- Ding, W., I. Domac and G. Ferri (1998). Is there a credit crunch in East Asia? *Asia Pacific Journal of Economics and Business* 2: 4–32.
- Freixas, X. and J.C. Rochet (1998): *Microeconomics of Banking*. Cambridge, Massachusetts. The MIT Press.
- Gonzalo, J. (1994): Five alternative methods of estimating long-run equilibrium relationships. *Journal of Econometrics* 60: 203–233.
- Ghosh, S.R. and A.R. Ghosh (1999): East Asia in the Aftermath: Was There a Crunch?. IMF Working Papers 99/38, 1–21.
- HVB Corporates & Markets (ed.) (17.12.2002): *Deutschland wird kein zweites Japan*. <http://www.hypovereinsbank.de/pub/templates/index.jsp?pageurl=/pub/io/rese/87853.jsp&id=19&mcontext=menu&von=hohttp://www.hypovereinsbank.de/pub/templates/index.jsp?pageurl=/pub/io/rese/87853.jsp>

&id=19&mcontext=menu&von=homepage&nach=research\_deutschland\_nicht\_japan\_studie&typ= text.

- International Monetary Fund (ed.) (2002): The Slowdown in Credit Growth. IMF Country Report 02/240, 75–84.
- Jaffee, D. and J. Stiglitz (1990): Credit Rationing. In Friedman, B. and F. Hahn (eds.): *Handbook of Monetary Economics*. Volume II. Amsterdam, Elsevier Science Publishers B.V, 838–888.
- Kreditanstalt für Wiederaufbau (ed.) (2002): *Unternehmensfinanzierung im Umbruch*. Die Finanzierungsperspektiven deutscher Unternehmen im Zeichen von Finanzmarkt看andel und Basel II. <http://www.kfw.de/DE/Research/Sonderthem68/Unternehmensfinanzierung.pdf>.
- Kugler, P. (1987): Credit Rationing and the Adjustment of the Loan Rate: An Empirical Investigation. *Journal of Macroeconomics* 9: 505–525.
- Laffont, J. and R. Garcia (1977): Disequilibrium Econometrics for Business Loans. *Econometrica* 45: 1187–1204.
- Maddala, G. (1987): *Limited-dependent and qualitative variables in econometrics*. Cambridge, Cambridge University Press.
- Nanjo, T. (2002): Developments in Land Prices and Bank Lending in Interwar Japan: Effects on the Real Estate Finance Problem on the Banking Industry. Bank of Japan IMES Discussion Paper 2002-E-10, 1–40.
- Pazarbasioğlu, C. (1997): A Credit Crunch? Finland in the Aftermath of the Banking Crisis. *IMF Staff Papers* 44: 315–327.
- Reimers, H.-E. (1992): Comparisons of tests for multivariate cointegration. *Statistical Papers* 33: 335–359.
- Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2002): *Zwanzig Punkte für Beschäftigung und Wachstum*. Jahresgutachten 2002/03. Stuttgart, Metzler/Poeschel.
- Sealey, C. (1979): Credit Rationing in the Commercial Loan Market: Estimates of a Structural Model Under Conditions of Disequilibrium. *Journal of Finance* 34: 689–702.
- Stiglitz, J.E. and A. Weiss (1981): Credit Rationing in Markets with Imperfect Information. *American Economic Review* 71: 393–410.
- Westermann, F. (2003): The Credit Crunch: A Comparison of Germany and Japan. CES ifo forum 1: 36–41.
- Winker, P. (1996): Rationierung auf dem Markt für Unternehmenskredite in der BRD. Schriften zur angewandten Wirtschaftsforschung 75. Tübingen: Mohr-Siebeck.

## Appendix

Table A1

### Stationarity tests

1980 bis 2002

Variables	1980:1 to 2002:4	1992:1 to 2002:4
Real Lending to enterprises and self-employed persons		
total	-1.284**	-1.514**
<i>Großbanken</i>	-1.803**	-0.790**
all other banks	-1.177**	-1.610**
Real GDP	-0.398**	-0.313**
Real Lending capacity		
all banks	0.351**	-0.521**
<i>Großbanken</i>	1.677**	0.108**
all other banks	2.454**	-0.222**
Short-term loan rate	-2.746**	-2.577**
Interest rate spread	-2.467**	-2.188**
Long-term interest rate	-1.742**	-2.541**
Share price index	-1.793**	-1.337**

Authors' calculations. – 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.



Table A2

### Johansen tests of cointegration between credit demand and supply with observed real credit for *Großbanken* and all other banks

		Hypothesized No. of CE(s)	Trace-Test	Indicated No of CE(s)	Max-Eigen-value-Test	Indicated No of CE(s)
<i>Großbanken</i>	Supply	0	29.21	1*	28.32	1*
		1	0.89	1**	0.89	1**
	Demand	0	7.10	0*	6.88	0*
		1	0.22	0**	0.22	0**
Other banks	Supply	0	18.77	2*	14.24	2*
		1	4.52	1**	4.52	0**
	Demand	0	11.85	0*	10.02	0*
		1	1.83	0**	1.83	0**

Authors' calculations. – Johansen Test of Cointegration assuming no deterministic trends and no intercept in the cointegrating equation (CE) using one lag in first differences. The trace test statistics are based on Reimers small-sample correction of the Johansen statistics (Reimers 1992). – \*Number of cointegrating equation(s) at the 5 % significance level. – \*\*Number of cointegrating equations at the 1 % significance level.



Table A3

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

		Hypothesi- zed No. of CE(s)	Trace-Test	Indicated No of CE(s)	Max- Eigen- value-Test	Indicated No of CE(s)
Specification (1)	Supply	0	20.77	1*	19.09	1*
		1	2.59	1**	2.72	1**
	Demand	0	13.56	1*	14.24	1*
		1	0.0001	0**	0.0002	0**
Specification (2)	Supply	0	19.47	1*	17.68	1*
		1	2.63	1**	2.76	1**
	Demand	0	12.85	1*	11.55	1*
		1	1.85	0**	1.94	0**
Specification (3)	Supply	0	17.95	1*	16.21	1*
		1	2.51	1**	2.64	1**
	Demand	0	13.09	1*	13.75	1*
		1	0.004	0**	0.004	0**
Specification (4)	Supply	0	15.56	1*	13.40	1*
		1	2.79	0**	2.93	0**
	Demand	0	14.68	1*	15.39	1*
		1	0.02	0**	0.02	0**
Specification (1) for 1980:1 to 2002:4	Supply	0	21.46	1*	20.96	1*
		1	0.97	1**	0.99	1**
	Demand	0	23.61	1*	20.88	1*
		1	3.19	1**	3.26	1**

Authors' calculations. – Johansen Test of Cointegration assuming no deterministic trends and no intercept in the cointegrating equation (CE) using one lag in first differences. The trace test statistics are based on Reimers small-sample correction of the Johansen statistics (Reimers 1992). – \*Number of cointegrating equation(s) at the 5 % significance level. – \*\*Number of cointegrating equations at the 1 % significance level.