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Monetary policy and bank lending: Evidence from German banking groups ☆

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Abstract

This paper analyses the impact of monetary shocks on bank lending in Germany. We follow a cross-sectoral approach by looking at six different banking groups. In general, smaller banks hold a larger buffer of liquid assets which they can use to offset monetary shocks. In addition, the response of bank lending after a monetary contraction is very different across banking sectors. Lending by the credit co-operatives, which are on average the smallest banks, declines most, whereas big banks are able to shield their loans portfolio against monetary shocks. Overall, our results provide support for the existence of a bank lending channel.

JEL classification: E50; E51; G21
Keywords: Monetary policy; Bank lending

1. Introduction

The purpose of this paper is to provide empirical evidence on the role of banks in the monetary transmission process. The implications of the German institutional setting for the impact of monetary policy on bank lending are a priori ambiguous. On the one hand, the mere fact that banks play an important role suggests that the scope for an effective bank lending channel is potentially large. On the other hand, banks

☆ Part of this research has been conducted while Sturm was working at Bond University, School of Business, Australia and the Department of Economics, University of Groningen, The Netherlands.

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may try to shield their loans portfolio from monetary disturbances which may weaken, rather than strengthen, the impact of monetary policy. The latter may be particularly relevant for Germany, given the importance of long-run relationships between banks and clients in this country.

In this paper, we look whether evidence can be found for a 'bank lending channel' of monetary policy, by considering the response of bank lending to monetary shocks. It is well known that this kind of research is complicated by a serious identification problem: is the fall in bank lending after a monetary tightening induced by supply or by demand? Several recent studies based on US data have addressed this problem by analysing disaggregated data, either for borrowers (e.g. Gertler and Gilchrist, 1993a, 1994; Gilchrist and Zakrajšek, 1998) or for lenders (e.g. Kashyap and Stein, 1995, 2000). We follow the latter approach, by considering different banking groups, as defined in the Bundesbank's *Banking Statistics*. In this way, we capture one key element of the bank lending channel, namely that some types of banks (particularly the smaller ones) face more information problems and find it more difficult to neutralise monetary shocks than other types of banks (typically large ones).

Is it still sensible to look at Germany separately after the start of EMU? After all, monetary policy is first and foremost based on euro-wide aggregated data now. However, credit markets are still likely to exhibit specific national characteristics (see e.g. De Bondt, 2000). Hence, as cross-national differences in monetary transmission may complicate the implementation of a common monetary policy, it is still useful to consider individual EMU economies.

The organisation of this paper is as follows. Section 2 discusses recent literature on monetary transmission and bank lending. Section 3 gives an overview of the German banking system and discusses key characteristics of banking groups. In Section 4, we present our empirical results. We look at cross-sectoral differences in balance sheet structure and present dynamic simulations of the response of bank lending to monetary shocks. Section 5 concludes.

2. The bank lending channel

In recent years, a vast literature has developed on the effectiveness of monetary policy and the channels through which this policy works. This renewed interest in monetary transmission must be seen within the context of a revival of theories that stress the impact of the financial system on aggregate economic activity. This literature, known as the 'credit view', takes as a point of departure the assumption that financial markets are characterised by imperfections and that bank assets (loans, securities) are imperfect substitutes (see Bernanke and Gertler, 1995; Kakes, 2000). One of the implications is that monetary policy may affect the economy through a 'bank lending channel'. According to this mechanism, banks respond to a monetary contraction by reducing the supply of loans which, eventually, affects inflation and real activity.

The existence of a lending channel implies that the Modigliani–Miller propositions do not hold for both borrowers and banks. Obviously, a lending channel be-

comes irrelevant if borrowers can easily switch to substitutes for bank loans (e.g. commercial paper). In a similar way, banks may shield their loans portfolio by using their other assets (e.g. bonds) as a liquidity buffer against monetary shocks, or offset the outflow of deposits by attracting nondeposit funding. Kashyap and Stein (1995) and Stein (1998) present stylised models that illustrate how bank balance sheet structure is related to the working of a lending channel.

In the empirical literature, the relevance of the bank lending channel has been a controversial issue, due to a fundamental identification problem (Bernanke and Gertler, 1995; see also Kashyap et al., 1993, 1996, and Oliner and Rudebusch, 1996, for a discussion). Namely, in contrast with the lending channel, a fall in aggregate lending after a monetary contraction may be driven by demand, rather than supply. In that case, other transmission channels (e.g. changes in interest rates or the exchange rate) may cause an economic downturn and bank lending follows passively. Studies that analyse the response of aggregate credit to monetary shocks, in the spirit of Bernanke and Blinder (1992), are therefore inconclusive as regards the existence of a bank lending channel.

In order to address the identification problem, several recent studies have considered disaggregated data. The advantage of disaggregated data is that the response of bank lending can be analysed in combination with other hypotheses that follow from the underlying theoretical literature. Information asymmetries, for instance, are presumably more relevant for particular categories of borrowers. In general, firm size is considered a natural proxy for information asymmetry. Gertler and Gilchrist (1993a, 1994) and Gilchrist and Zakrajšek (1998) use quarterly panel data of nonfinancial firms in the United States and conclude that, following a monetary contraction, bank credit to small firms is reduced more than bank credit to large firms. Kashyap and Stein (1995, 2000) analyse disaggregated data of banks and find that large banks are better able to neutralise monetary shocks than small banks. Just like small nonfinancial firms, small banks face more credit market imperfections and have only limited access to alternative sources of finance, so they cannot absorb monetary shocks as easy as larger banks. Kashyap and Stein (2000) also find that, within the category of small banks, lending is reduced most by institutions with less liquid balance sheets.

2.1. Previous work with German data

Empirical studies have come to different conclusions about the importance of a bank lending channel in Germany. On the basis of a number of qualitative indicators, Kashyap and Stein (1997) conclude that a bank lending channel is more likely to be relevant for Germany than for most other European countries. Ehrmann (2000) provides further support based on disaggregated data: monetary policy has more of an impact on small firms than on large firms. However, VAR studies by Barran et al. (1997), Guender and Moersch (1997), Küppers (2000) and Kakes et al. (2001) suggest that a bank lending channel is not important. See also Worms (1998) for an overview of issues related to bank lending and monetary transmission in Germany.

Favero et al. (1999) and De Bondt (2000) perform cross-section analyses with disaggregated bank balance sheet data. Favero et al. (1999) focus on the year 1992, when the Bundesbank tightened monetary policy. They conclude that large banks shield their loans portfolio, while small banks even expand their lending, which is in contrast with the lending channel. However, De Bondt (2000) finds support for a bank lending channel: larger and/or more liquid banks are better able to absorb monetary shocks. These diverging conclusions might be due to the fact that both studies consider a different subsample of German banks and look at different periods. [1] A drawback of these cross-sections is that they focus on a short period. Unfortunately, detailed time series at the individual bank level are not publicly available for Germany over a sufficiently long period.

2.2. Our approach

By looking at time series for different banking groups over a relatively long sample, we present a useful alternative to the studies of Favero et al. (1999) and De Bondt (2000). The Bundesbank publishes balance sheet data for each banking group on a quarterly – in some cases even monthly – basis, which enables us to perform dynamic simulations in the spirit of Kashyap and Stein (1995). Hence, the value-added of our approach is that adjustment processes can be better modelled while it is unlikely that possible idiosyncrasies of a particular period drive the results. However, as we do not have data at the individual bank level, we cannot test whether banks *within* each class respond differently, as Favero et al. (1999) and De Bondt (2000) do. Our approach should be seen as complementary to these studies: our analysis is more general because we consider a larger sample period and look at a more representative picture of the banking sector. At the same time, our approach is less rigorous because we consider groups of banks rather than individual bank level data.

Our central hypothesis is that it is more difficult to neutralise monetary shocks for small banks than for large banks. Hence, one would expect that smaller banks (i) need to hold more liquid assets as a buffer against monetary shocks and (ii) need to reduce their lending activity more sharply after a monetary contraction. Large banks, by contrast, are supposed to have better access to nondeposit funding, which enables them to neutralise an unanticipated withdrawal of deposits more easily. These two predictions follow from the underlying theory of the bank lending channel and have been established empirically by Kashyap and Stein (1995, 2000) for banks in the United States. Note that (i) and (ii) are to some extent interdependent, as a larger liquidity buffer enables a small bank to shield its loans portfolio. [2] Hence, one would expect that if a small bank's lending does not respond significantly to a monetary contraction, this should be reflected in a substantial reduction in its secu-

[1] In Section 4 we present similar 'perverse' results for so-called 'private banks' – a subcategory of relatively small institutions – as Favero et al. (1999) find for small banks in general, which might suggest that private banks are over represented in their sample.

[2] By using data at the individual bank level, Kashyap and Stein (2000), Favero et al. (1999) and De Bondt (2000) are able to consider these two effects separately.

rities holdings. Large banks, on the other hand, should be able to insulate their loans portfolio from monetary shocks without having to sell their liquid assets.

It should be taken into account that we only focus on the 'first stage' of the bank lending channel. Obviously, if banks respond to monetary shocks in the way predicted, it is still possible that borrowers who face a fall in loans supply can switch to alternative sources of finance. Hence, our analysis should also be seen as complementary to other studies like Ehrmann (2000), who focuses on differences in the responses of real activity across classes of nonfinancial firms in Germany.

3. The organization of the German banking system

One of the key features of the German banking system is its fragmented structure. Different types of banks have co-existed for a long time. The Bundesbank's monthly banking statistics reports figures of each of these 'banking groups', which makes it possible to follow their deposits and lending activities through time. Fig. 1 gives an overview of the structure of the German banking system (the number of banks within each group is presented in parentheses). A first distinction is between universal banks and specialised institutions. The latter consist of mortgage banks and banks with special functions (e.g. export finance, start-up finance for German enterprises). As the specific characteristics of these institutions complicates a direct comparison with other banks' behaviour, we focus on universal banks, which represent the bulk (about 75%) of banking activity in German. As the name suggests, universal banks offer a broad range of activities.

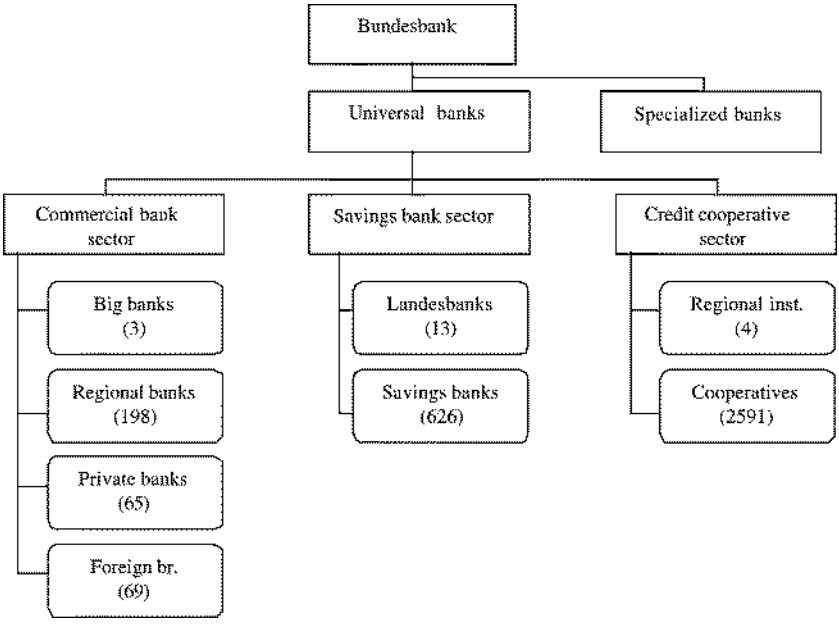

Fig. 1. Structure of the German banking system (in parentheses: number of institutions in 1995).

The universal bank sector comprises three main categories, which can be further divided into banking groups (see Edwards and Fischer, 1994, for a more extensive discussion):

1. *The commercial bank sector*. The first group within this sector comprises the so-called *big banks*, which currently consist of four banks (Deutsche Bank, Commerzbank, Dresdner Bank, Hypo-Vereinsbank). The second category consists of the *regional banks*, which usually concentrate on particular regions, although some are active on a national basis. These banks are on average much smaller than the big banks, but some of them are among the ten largest banks in Germany. [3] The third group comprises the private banks. These are typically very small and are often specialised in particular activities such as export finance or securities trading. As a group, however, they are engaged in a broad range of 'investment bank' activities. Finally, there is a category of *branches of foreign banks*, but this group is (as yet) hardly significant within the German banking system.

2. *The savings bank sector*. This sector consists of two groups, which act as a two-tier system. First, there are a large number of local *savings banks* which are usually allowed to be active only in their own region. The second group consists of the *Landesbanks* (also known as 'state savings banks' or 'central giro institutions'). These banks are among the largest in Germany and function as clearing houses for the local savings banks in their region. Both categories are owned by their local governments and traditionally have a public function, such as providing services to the public authorities and financing local investment. Over time, however, they have become more and more involved in commercial activities (see Sinn, 1999).

3. *The credit co-operative sector*. Like the savings bank sector, this is a two-tier system. First, there are a large number of small *credit co-operatives* with a local function. Second, there are regional *co-operative institutions*, which provide clearing services to these credit co-operatives and are engaged in other activities such as securities trading and (international) investment banking. Credit co-operatives are owned by their members (local individuals, firms); co-operative institutions are usually owned by their local credit co-operatives.

The market shares of banking groups, in terms of business volume, have been rather stable during the past three decades (see Table 1). The savings banks sector is by far the most important: the local savings banks and the Landesbanks together account for almost half of aggregated banking activity. Hence, the share of government-owned banks is remarkably large, compared to other European countries and the United States (Sinn, 1999). Big banks, regional banks and credit co-operatives also have a significant market share, whereas the role of co-operative institutions and private banks is very modest at the aggregate level.

A crucial difference across banking groups, which we exploit in this paper, concerns the average size of individual banks in each category. This is shown in

[3] Examples are the Bayerische Vereinsbank and the Hypo Bank (see Edwards and Fischer, 1994). Since 1999 (not in our sample), these two banks have merged into Hypo-Vereinsbank and are classified as big banks.

Table 1
Market shares of banking groups

	1975	1980	1985	1989	1990	1995
Big banks	12.8	12.4	11.0	12.2	11.5	12.0
Regional banks	13.5	13.8	13.4	15.1	19.7	16.4
Private banks	2.5	1.9	1.5	2.0	1.5	0.9
Landesbanks	21.8	21.1	20.4	19.8	18.8	23.4
Savings banks	28.7	28.6	28.2	27.3	26.6	25.8
Cooperative institutions	5.7	5.6	5.8	5.5	5.3	4.5
Credit cooperatives	12.1	14.2	16.5	15.6	14.6	15.1
Other	3.0	2.5	3.2	2.4	1.9	1.8

Market share (in % of universal banks' volume of business).
Source: Bundesbank.

Table 2
Average size of individual banks within each banking group

	Class	1975	1980	1985	1989	1990	1995
Big banks	Large	100.0	100.0	100.0	100.0	100.0	100.0
Landesbanks	Large	85.4	84.9	92.6	88.2	135.5	45.2
Cooperative institutions	Large	22.1	26.8	34.8	44.9	77.1	28.2
Regional banks	–	5.6	6.7	7.5	4.4	8.3	2.1
Savings banks	Small	2.0	2.3	2.6	2.3	3.0	1.0
Private banks	Small	0.9	1.2	1.2	1.1	1.5	0.4
Credit cooperatives	Small	0.2	0.3	0.3	0.2	0.4	0.2

Relative size (volume of business) in terms of average big banks (%).
Source: Bundesbank.

Table 2, in terms of business volume, as a percentage of the average size of big banks. [4] Banking groups are presented in the order of average bank size. Besides big banks themselves, Landesbanks and co-operative institutions clearly show up as large organisations. At the other end of the spectrum are the credit co-operatives, while the savings banks and private banks can also be classified as small. Regional banks are somewhat problematic to interpret as a homogeneous category because, as we already indicated, this group includes some very big institutions and several smaller ones. Hence, we do not include this category in our empirical analysis in Section 4.

4. Empirical results

In this section, we discuss some of the main differences between banking groups' lending behaviour in relation with monetary shocks. First of all, we present key

[4] In 1990, immediately after German unification, the number of 'big banks' increased from 6 to 10, whereas the average size of these additional banks was relatively modest. Hence, the relative size of other banks in terms of the average size of big banks increased substantially in that year. In subsequent years the reverse took place due to consolidation within the group of big banks, causing the relative size of other banks to fall.

statistics to illustrate cross-sectoral differences in balance sheet structure. Second, we perform impulse response simulations in order to analyse the dynamic impact of monetary shocks on balance sheet variables. We use bank balance sheet data that are published by the Bundesbank in its Banking Statistics and Monthly Report. We will mainly focus on domestic lending to the private sector, deposits and securities holdings. More detailed information about the data is given in the appendix.

4.1. Balance sheet structure

One of the key predictions is that small banks need a larger liquidity buffer than big banks, as they are supposed to have less access to nondeposit funding. From Table 3, it can be concluded that this is indeed the case. The table shows how the liquidity of bank balance sheets has evolved over time, where liquidity is measured as the proportion of total assets that consists of cash, central bank reserves, securities and short-term interbank lending. Private banks, savings banks and credit co-operatives have a more liquid balance sheet than big banks and the Landesbanks, which is in line with what we expected. In particular, the similarity between the liquidity structure of savings banks and credit co-operatives is striking. The only banking group that is hard to interpret are the co-operative institutions, which have the most liquid balance sheets, while their average size is substantial. In general, however, we can conclude that there is a negative correlation between average bank size and liquidity, which corresponds to our hypothesis and to the situation in the United States (Kashyap and Stein, 1995, 2000).

Table 4 shows that cross-sectoral differences in the average maturity of loans portfolios are substantial. This may be important, as we will see in the next subsection, because the response of short-term lending to a monetary shock is likely to be very different from the response of long-term lending. In general, the proportion of short-term lending has decreased over time. Short-term lending is particularly important for private banks, for which it includes more than half of the loans portfolio, whereas it is relatively unimportant for Landesbanks and savings banks.

Table 3
Balance sheet liquidity

	1975	1980	1985	1989	1990	1995
Big banks	0.21	0.20	0.21	0.17	0.17	0.18
Landesbanks	0.21	0.18	0.17	0.15	0.20	0.19
Cooperative institutions	0.37	0.39	0.38	0.36	0.40	0.33
Savings banks	0.31	0.26	0.28	0.32	0.35	0.33
Private banks	0.37	0.36	0.38	0.30	0.28	0.31
Credit cooperatives	0.32	0.27	0.29	0.33	0.33	0.33

Liquid assets (cash + central bank reserves + securities + short-term interbank lending) as a fraction of total assets.
Source: Bundesbank.

Table 4
Proportion of short-term lending to firms and households

	1975	1980	1985	1989	1990	1995
Big banks	0.48	0.40	0.43	0.37	0.40	0.34
Landesbanks	0.19	0.14	0.14	0.12	0.16	0.13
Cooperative institutions	0.42	0.47	0.51	0.39	0.48	0.38
Savings banks	0.37	0.23	0.20	0.17	0.18	0.16
Private banks	0.74	0.78	0.78	0.64	0.63	0.54
Credit cooperatives	0.41	0.32	0.27	0.23	0.23	0.20

Source: Bundesbank.

4.2. Impulse–response simulations

In order to investigate dynamic responses of balance sheet variables to monetary policy shocks, we perform impulse–response analysis for each banking group. We estimate vector autoregressions, including the following variables:

1. *Balance sheet variables*: a broad measure of deposits (similar to M3), lending to the domestic private sector and total securities holdings.
2. *Macroeconomic variables*: the short-term interest rate, the long-term interest rate, real GDP and the GDP deflator.
3. *Exogenous variables*: we use four seasonal dummies and dummies to account for German unification and other breaks in the data (see the appendix). In addition, we include the oil price as an exogenous variable, to take into account the effect of the oil crises.

All endogenous variables, except interest rates, are in logs and in real terms, using the GDP deflator. [5] As all variables we analyse are I(1) and cointegration can be established for all specifications, the appropriate model is a vector error-correction model (VECM). We estimate the VECMs with quarterly data over a sample that runs from 1975:1 up to and including 1997:4. Apart from German unification, this is a homogeneous period in which the Bundesbank was to a large extent autonomous in its monetary policy formulation and followed a strategy of money targeting.

First, we carried out likelihood ratio tests on a VAR in levels to determine the number of lags. Subsequently, we employed the Johansen procedure to establish the cointegration rank, using the software package Microfit. Our specification of the cointegration space allows for intercepts in the cointegration relationships and deterministic trends in the levels of the variables. Results are reported in Table 5. The number of lags varies between 4 and 6, and the cointegration rank is 5 or 6 for all specifications. The residuals are normally distributed in all cases except for the private banks model. If we include one more lag, however, the test statistic

[5] We also carried out the analysis with bank balance sheet variables in nominal terms; the results are virtually the same.

Table 5
VECM models

	Rank	# Lags	Normality[a] (*p*-value)
Big banks	5	5	102.7 (0.093)
Landesbanks	5	5	92.5 (0.271)
Cooperative institutions	6	4	95.4 (0.206)
Savings banks	6	6	102.2 (0.098)
Private banks	5	6	192.9 (0.000)
Credit cooperatives	5	5	83.3 (0.532)

[a] Mardia multivariate normality test.

becomes 105.3 (*p*-value 0.067), so normality can be accepted, whereas the simulation outcomes remain virtually the same.

Impulse–response simulations are calculated with the MALCOLM package developed by Mosconi (1998) and modified by Vlaar (1998). Innovations in the short-term interest rate are interpreted as unanticipated monetary policy shocks. These shocks are identified by imposing a Wold causal chain in which the policy variable is ordered first. [6]

Fig. 2 presents the responses of the balance sheet variables to a monetary contraction, simulated as a shock to the short-term interest rate of about 40 basis points (one standard error). The simulation period is three years (twelve quarters); the solid lines are the responses, dotted lines represent 95% confidence interval, calculated from the asymptotic distribution of the moving average parameters (see Vlaar, 1998).

There are significant differences across banking groups. As expected, big banks' assets are not very sensitive to a monetary policy shock, despite an immediate fall in deposits. Lending initially even increases somewhat and remains unaffected during the subsequent quarters. Furthermore, securities holdings do not respond significantly at all, which implies that big banks do not need a buffer of liquid assets in order to absorb monetary shocks. This is consistent with our observation in Table 3 that big banks hold relatively little liquid assets. At the other end of the spectrum, the response of credit co-operatives is also in line with the central hypothesis. These banks react by reducing their loans portfolio and also appear to use their securities holdings as a buffer. The relatively fast response of lending activity suggests that this is induced by supply, as demand effects are likely to coincide with a fall in GDP which becomes significant after about a year.

The interpretation of the other four banking groups' responses is somewhat more subtle. Just like the case of the big banks, lending initially shows a positive reaction for all groups. For Landesbanks, lending declines in the longer run. However, for the private banks and, to some extent, for co-operative institutes, the perverse positive response of bank lending persists for some time and is not followed by a decline. These responses of lending can largely be explained by short-term loans, which are

[6] Our results are robust to alternative orderings. In a previous version of this paper, we performed generalized impulse responses with a VAR in levels (see Pesaran and Shin, 1998), which gave very similar outcomes.

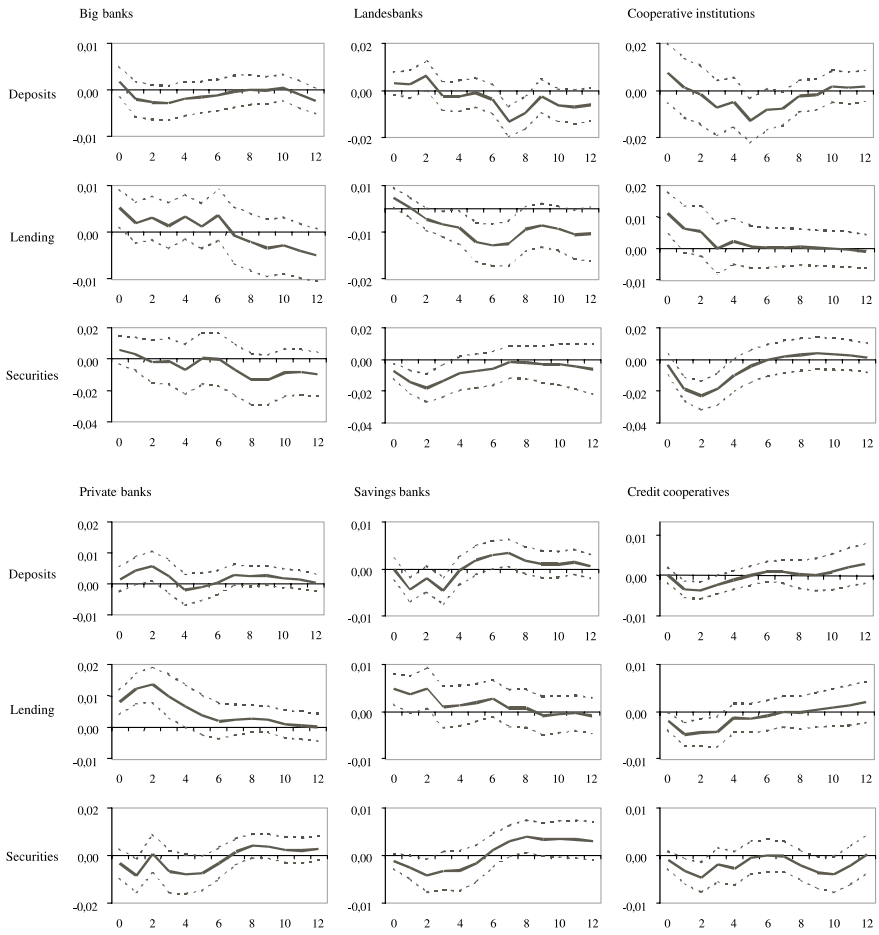

Fig. 2. Responses of bank balance sheet variables to a shock in the short-term interest rate.

likely to increase immediately after a monetary contraction. [7] Table 4 shows that for private banks and co-operative institutes, a relatively large proportion of the loans portfolio consists of short-term lending. Furthermore, private banks' deposits also increase after a monetary tightening, which enables them to expand their lending. Finally, it is interesting to see that all four banking groups reduce their securities holdings immediately after the monetary shock, implying that these are used as a liquidity buffer.

[7] Several studies have established that short-term lending initially increases after a monetary contraction (see e.g. Gertler and Gilchrist, 1993b). This may be due to buffer stock behaviour, as firms demand more short-term loans to compensate for declining cash flows or shorten the maturity of their debts as a reaction to increases – and anticipation to future decreases – in the lending rate.

Table 6
Balance sheet liquidity of the four largest banks, 1997

Bank	Size (% of Deutsche Bank)	Liquid assets[a] (%)	Liquid assets[b] (%)
Deutsche Bank	100.0	0.09	0.19
Hypo-Vereinsbank	80.6	0.08	0.24
Dresdner Bank	66.2	0.13	0.32
Commerzbank	52.3	0.11	0.28

Source: Bankscope.
[a] Liquid assets as defined in Bankscope, as a fraction of total assets.
[b] Liquid assets, taking into account interbank deposits, as a fraction of total assets.

4.3. Possible caveats

Our analysis is subject to five potential caveats. First of all, our distinction into banking groups does not exactly match the division into size categories that Kashyap and Stein (1995, 2000) have made for the United States and Favero et al. (1999) and De Bondt (2000) for Germany. We take the groups as these are defined by the Bundesbank. Nonetheless, our results show that important cross-sectoral characteristics are similar, which suggests that our disaggregation is to some extent comparable to that of the other studies. Second, as we already indicated, the fact that we use grouped data does not allow us to analyse behaviour of individual banks within each category. Hence, our approach may 'diversify away' information about choices made by individual institutions, which is more likely to affect the results for large banks than for small banks. In this respect, our findings should be considered complementary to previous cross-section studies. In Table 6, we present data on balance sheet liquidity of the largest four banks in 1997. These are taken from Bankscope, the database that was also used by Favero et al. (1999) and De Bondt (2000). [8] As only a few years of annual data are available, these are not suited for the type of dynamic simulations we performed in the previous section. Nonetheless, the table illustrates that the relationship between bank size and balance sheet liquidity broadly holds within the category of big banks, and hence is in line with our findings in Table 3.

A third potential caveat is that we do not take interbank relationships and ownership structures into account. For instance, big banks have a large stake in mortgage banks which we do not analyse in this paper as these are specialised institutions, and co-operative institutions are partly owned by credit co-operatives. Furthermore, it is not clear to what extent the two-tier structure of the savings banks sector and the co-operative sector has an impact on the responses of the banking groups in these sectors. Fourth, several differences between banking groups are due

[8] The data are based on annual reports that are published by these banks. These may be slightly different from their reports to the Bundesbank which are the basis of our calculations. In addition, as balance sheet items are defined differently, measures of liquidity are not identical to those in Table 3. Based on the available information, we constructed a narrow and a broad measure of liquidity, which lead to the same conclusions.

to institutional factors, such as the restriction on local savings banks to be active only in their own region. Fifth, banking groups may have different types of borrowers. Large banks may have larger clients, whose credit demand is likely to be less susceptible to cyclical influences, while small banks usually have relatively more small firms and households as clients. However, we believe that the impact of borrower heterogeneity should not be overstated. According to the Bundesbank (1996), big banks' lending is largely concentrated in the manufacturing sector. This sector is relatively sensitive to cyclical effects, which to some extent compensates the effect of larger borrowers. Furthermore, insofar as borrower heterogeneity does explain the differences across banking groups, this is fully consistent with the existence of a bank lending channel.

4.4. Evaluation

For most of the banking groups, cross-sectoral differences are consistent with the two basic predictions that smaller banks (i) hold a larger buffer stock of liquid assets and/or (ii) find it more difficult to insulate their lending activity from monetary shocks than large banks. Those categories where average bank size is relatively small have more liquid balance sheets. Impulse–response analysis shows that only the big banks are able to shield their loans portfolio without having to reduce their securities holdings. The credit co-operatives, which are on average the smallest banks, react to a monetary contraction by reducing both their lending activity and their securities holdings. Landesbanks and savings banks take an intermediate position, as they are able to protect their loans portfolio in the short run, but also need to use their securities holdings as a liquidity buffer.

The behaviour of two banking groups, the private banks and the co-operative institutes, is difficult to interpret. Both respond to a monetary policy contraction by significantly *extending* their lending activity. As we already indicated, this can be partly explained by the maturity structure of their loans portfolio. In particular for private banks, the bulk of lending consists of short-term loans. In addition, these banks focus on 'investment bank' activities. Interestingly, the results for private banks – an extension of bank lending after a monetary contraction, financed by an increase in deposits – are very similar to the conclusions of Favero et al. (1999) for small German banks in general, which might suggest that private banks are overrepresented in their sample. [9] Favero et al. explain the expansion of loans by the higher intermediation margins due to increased interest rates. Notwithstanding the fact that the behaviour of private banks and co-operative institutions are inconsistent with an explanation along the lines of the credit view, it should be noted that their market shares are very limited compared to the other banking groups (see Table 1). Hence, their impact on the aggregate picture should not be exaggerated.

[9] This also appears from their discussion of the example of Bankhaus Carl F. Plump & Co., which is a private bank, suggesting that this is a typical small bank in Germany.

5. Concluding remarks

In this paper, we have analysed the response of bank lending to monetary shocks, focusing on differences between German banking groups. We discussed the main features of these groups, presented the most important differences in balance sheet structure, and carried out impulse–response simulations to show the main differences in lending behaviour. We focused on two key predictions: (i) for small banks it is more important to invest in a buffer of liquid assets than for large banks, and (ii) small banks find it more difficult to shield their loans portfolio after a monetary contraction than large banks. If these hypotheses can be established empirically, this would support the existence of a 'bank lending channel'.

Especially for the largest and the smallest banks, our results are consistent with both predictions. Big banks have relatively little liquid assets and are nevertheless able to insulate their lending activity from monetary disturbances, whereas the credit co-operatives have a relatively large amount of liquid assets but still have to reduce their loans portfolio after a monetary contraction. The outcomes for two banking groups, private banks and co-operative institutions, are hard to interpret along the lines of the bank lending channel. However, as these two banking groups have a very small market share, they have little consequences for our overall conclusion.

Although our results offer some support for the existence of a bank lending channel, one should be cautious, as the limitations of our approach do not allow strong conclusions. We only focused on the 'first stage' of this transmission channel, i.e. the impact of monetary policy on bank lending. In addition, we analysed banks at a sectoral level, whereas a further disaggregation would make it possible to perform more precise tests of bank behaviour. It would be useful to carry out a similar analysis with bank level data, as Kashyap and Stein (2000) have done for the United States, in order to obtain more rigorous conclusions.

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Appendix A. Data appendix

Balance sheet data are published in the Bundesbank's monthly report and banking statistics. Most of these series are taken from the CD-ROM 50 *Jahre Deutsche Bundesbank* or from Datastream. Other variables are taken from the IFS.

- *Bank balance sheet data*. The data in Tables 1–3 apply to total bank activity, including interbank lending. In Table 4 and for the estimation of VECMs we used data on lending and deposits vis-à-vis the nonbank private sector. Our definition of deposits is virtually equal to M3.
- *Macroeconomic variables*. Nominal and real GDP are taken from the IFS database. From 1990 onwards, these data include the new states of the former GDR. The short-term interest rate is the three-month interbank rate, and the long-term interest rate is the government bond yield, both taken from the IFS.
- *Exogenous variables*. We use seasonal dummies and dummies to correct for breaks. For German unification we include a dummy which is equal to one from 1990:2 onwards. Further, we include specific dummies for each banking groups to correct breaks in the bank balance sheet data (due to definition changes etc.). Finally, we include the oil price in the VECM.

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