University of Groningen

Monetary transmission and bank lending in Germany

Kakes, Jan; Sturm, Jan-Egbert; Philipp Maier, [No Value]

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
1999

[Link to publication in University of Groningen/UMCG research database](#)

Monetary transmission and bank lending in Germany

Jan Kakes[*]   Jan-Egbert Sturm[†]   Philipp Maier[†]

April 1999

Abstract

This paper analyses the role of bank lending in the monetary transmission process in Germany. We follow a sectoral approach by distinguishing corporate lending and household lending. We find that banks respond to a monetary contraction by adjusting their securities holdings, rather than reducing their loans portfolio. Most lending categories even show an *in*crease following a monetary tightening. The main implication of our results is that a bank lending channel is not an important transmission mechanism. On the contrary, by insulating their loans portfolio from monetary shocks, banks are more likely to weaken than to strengthen the impact of monetary policy.

Keywords: monetary transmission, bank lending channel, Germany
JEL Classification No.: E44, E51, E52

---

[*]Corresponding author: Jan Kakes, De Nederlandsche Bank, Monetary and Economic Policy Department, PO Box 98, 1000 AB Amsterdam, the Netherlands. Email: J.I.Kakes@dnb.nl

[†]University of Groningen, Faculty of Economics, the Netherlands.

1 Introduction

Germany is widely considered as one of the most typical examples of a bank-based economy. Over 70% of firms' external finance is provided by banks, which is in contrast with market-based systems like the United States, where only 25% of the financing needs comes from banks.[1] As a result, one may expect that the German banking sector plays a key role in the transmission of monetary policy.

In this paper, we consider the relevance of a bank lending channel in Germany over the period 1970–1997. According to this transmission mechanism, banks respond to a monetary contraction by reducing the supply of bank loans which has, eventually, a negative impact on inflation and real activity. However, the implications of the German institutional setting for the effectiveness of monetary policy through 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 huge. On the other hand, banks may try to shield their loans portfolio from monetary disturbances which may weaken, rather than strengthen, the impact of monetary policy. This may be plausible for Germany, given the importance that is attached to long-term relationships between banks and their clients.

The importance of a bank lending channel is therefore an empirical matter. Empirical studies have come to different conclusions. On the basis of a number of qualitative indicators Kashyap and Stein (1997a) conclude that a lending channel in Germany is more likely to be relevant than in most other countries of the European Union. VAR studies by Barran *et al.* (1995, 1996) and Guender and Moersch (1997), however, suggest that a bank lending channel is not important in Germany.

We extend the existing VAR literature by considering several types of bank loans, distinguishing two sectors (firms and households) and different maturities (short-term, medium-term and long-term loans). As we will explain below, a disaggregated approach is one of the possible ways to deal with an important identification problem. Our results imply that a bank lending channel is not relevant for either of these lending categories. On the contrary, as the responses of most credit aggregates following a monetary contraction are positive or insignificant, bank lending probably decreases the impact of monetary policy on real activity.

Because the start of EMU in 1999 marks the end of independent German monetary policy, one may question to what extent our findings are still relevant today. It should be noted, though, that the monetary strategy of the Eurosystem is not fundamentally different from the Bundesbank's monetary strategy. In addition, the institutional setting underlying the monetary transmission mechanism is not likely to change immediately.

The remainder of this paper is organized as follows. In Section 2, we briefly discuss monetary transmission, particularly the theory underlying the bank lending channel. Subsequently, we present our empirical results in Section 3. Section 4 concludes.

---

[1] *The Economist*, November 21, 1998, pp. 75–76.

2 Monetary transmission and bank lending

In recent years, a vast literature 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.

In the first decades after the war, the role of credit market imperfections in the monetary transmission process was largely ignored in the mainstream literature. This conventional approach is also known as the *money view*. Following *e.g.*, the IS-LM model, only two financial assets are distinguished, money and bonds, of which the latter is supposed to be representative for the whole capital market. Since banks do not play an essential role in this world, there is no need to distinguish bank loans from other bank assets. According to this approach, monetary policy works primarily through its impact on the capital market interest rate.

In contrast, an important strand of the recent literature, gathered under the name *credit view*, focuses on financial phenomena that are likely to play a role in the transmission of monetary policy, such as financial intermediation and credit rationing. Starting from the assumptions that the capital market is characterized by imperfections and that bank assets—in particular bank loans and security holdings—are imperfect substitutes, various transmission channels may work on top of the standard interest rate channel.[2] One of these channels is the *bank lending channel*. The relevance of this mechanism follows directly from the fact that banks have a specific function as financial intermediaries, which is in contrast with their role in the money view. Hence, the focus is on the specialness of the asset side of the banking sector's balance sheet. If part of the borrowers are bank dependent—*i.e.*, they cannot easily switch to alternative forms of external financing—and if banks consider bank loans as imperfect substitutes for other entries on the asset side of their balance sheets, monetary policy may operate through a bank lending channel.[3] These are in fact necessary conditions for a bank lending channel to be operative. Otherwise, banks could use their other assets as a liquidity buffer against monetary shocks which enable them to protect their loans portfolio, while borrowers could easily neutralize the impact of monetary policy by attracting alternative sources of funding, making a bank lending channel impotent.

It is important to note that the credit view does not preclude the mechanism underlying the money view, but rather provides a more general approach, allowing for various mechanisms that either exacerbate the effects of the interest rate channel, or can be considered as an additional monetary transmission channel. Obviously, if financial market

---

[2]In the modern theoretical literature, these capital market imperfections are attributed to information asymmetries (see *e.g.*, Bernanke and Gertler, 1989; Greenwald and Stiglitz, 1993; Kiyotaki and Moore, 1997). The underlying ideas build upon early literature that can be traced back to prewar theories (see *e.g.*, Schumpeter, 1934 [1911]; Hayek, 1933).

[3]Another transmission mechanism that has received much attention in the credit view literature is the *balance sheet channel*, also denoted as 'financial accelerator' or 'broad' credit channel (Bernanke and Gertler, 1995). This mechanism emphasizes the role of borrowers' financial structure in the propagation of financial and real shocks. Note that the balance sheet channel can be considered as more general than the bank lending channel: the latter, which is sometimes referred to as 'narrow' credit channel, focuses on the fact that financial market imperfections give rise to financial intermediation through banks.

imperfections do not play an important role in the transmission process—which is, in the end, an empirical issue—the transmission of monetary policy can be captured by the standard money view.

As yet, most empirical evidence for the existence of a bank lending channel has not been very conclusive. To a large extent, this is due to the fact that most studies based on aggregated data suffer from a severe identification problem: the inability to establish whether the decrease in credit that is observed after a monetary contraction is induced by bank supply or driven by a fall in borrowers' demand.[4] In the latter case, a lending channel would be irrelevant. In this respect, recent studies based on disaggregated data are more informative. The advantage of disaggregated data is that the response of credit variables can be analysed in combination with other hypotheses that follow from the theoretical literature underlying the credit view. Information asymmetries, for instance, are presumably more relevant for specific categories of borrowers which suggests that banks may try to adjust their loans portfolio following a monetary contraction, substituting high-quality loans for low-quality loans, known as 'flight to quality.' Gertler and Gilchrist (1993b, 1994) , Oliner and Rudebusch (1996), and Gilchrist and Zakrajšek (1998) use quarterly panel data of a large number of nonfinancial firms in the United States, taking into account heterogeneity among borrowers. It appears from this research that, following a monetary contraction, the amount of bank credit to small firms is reduced while large firms initially even attract more (mostly short-term) credit as a buffer to compensate for declining cash flows. Yet, although this is obviously consistent with the credit view in the sense that credit is 'special,' there still is no general agreement to what extent these findings should be interpreted as self-evident support for a bank lending channel.[5]

Unfortunately, detailed time series at the individual firm or bank level are not available for most countries. Studies at a sectoral level may be a useful, albeit less rigorous, alternative.[6] In most of these studies, bank lending is split into loans to the corporate sector and loans to the household sector. It seems plausible that information asymmetries between banks and households are greater than those between banks and firms.

3 Empirical results

We analyse quarterly data over a sample that runs from 1970:1 up to 1997:4. In the next subsection we will give a more detailed description of the data (see also Appendix A). Then, we present our empirical findings, which consist of impulse-response simulations. We consider several VARs, starting with a specification based on aggregated data, *i.e.*, without making a distinction between sectors. Subsequently, we report the results using more disaggregated VAR models which focus on the corporate sector and the household sector.

---

[4]See *e.g.*, Barran *et al.* (1996) for an analysis of nine European countries, Guender and Moersch (1997) for Germany and Garretsen and Swank (1998a) for the Netherlands.

[5]See Oliner and Rudebusch (1996) and Kashyap *et al.* (1996) for a discussion.

[6]See Escrivá and Haldane (1994) for Spain, Dale and Haldane (1995) for the United Kingdom, and Kakes (1998) and Garretsen and Swank (1998b) for the Netherlands.

3.1 Data and pre-testing

The data we use can be divided into four categories:

Policy variable: Following Bernanke and Blinder (1992) and most of the subsequent VAR-based literature on monetary policy transmission, we include a short-term interbank interest rate as our policy variable in all specifications. The corresponding equation in the VAR can be interpreted as the Bundesbank's reaction function, while innovations of the short-term interest rate reflect unanticipated monetary policy shocks.[7]

Key macroeconomic variables: We include real activity and prices, since these are the main variables that reflect the eventual effects of monetary policy. We use real GDP and the GDP deflator in our aggregated VAR and corresponding alternatives in our sectoral specifications. In addition to bank balance sheet data (see below), we include two standard transmission variables: the long-term interest rate and, in order to account for the openness of the economy, the effective exchange rate.[8]

Bank balance sheet data: The only bank liability we include is money, either a narrow aggregate (M1) or a broad aggregate (M3). We include two bank assets: securities holdings and bank loans. We disaggregate bank lending in two ways. First, we take into account sectoral differences by distinguishing a corporate sector and a household sector. Second, bank loans are split into short-term, medium-term and long-term lending. Figures 1 and 2 show the developments of these bank assets over our sample. Looking at the magnitude of the lending categories, it appears that for all maturities corporate lending is larger than lending to households. Particularly for short-term credit, the bulk of loans is supplied to firms. Both for firms and households, most bank lending consists of long-term loans. Looking at the corresponding growth rates for each lending category, presented in Figure 2, it can be seen that the development in short-term and medium-term lending is relatively volatile.[9] Presumably, this is because the demand for short-term and medium-term loans can more rapidly be adjusted to changes in interest rates and income. Long-term lending, by contrast, shows a more stable growth pattern. The proportion of banks' securities holdings, finally, has become more and more important. Particularly in the last part of the sample, securities are growing fast. Like short-term and medium-term lending, the growth rate of securities is rather volatile.

Exogenous variables: To account for supply shocks, we include the oil price as an exogenous variable. We further add four seasonal dummies and a permanent dummy for the period from 1990:1 onwards in order to take into account structural changes due to German reunification.

According to Dickey-Fuller tests that we carried out, all series can be considered as I(1) variables. Since cointegration can be established for all specifications, we estimate our

---

[7]See *e.g.*, and Gertler (1996) and Berger and Woitek (1999).

[8]Instead of taking the effective exchange rate, we also experimented with the DMark/Dollar exchange rate. Our conclusions do not change.

[9]Presented are growth rates with respect to the corresponding quarter one year earlier.

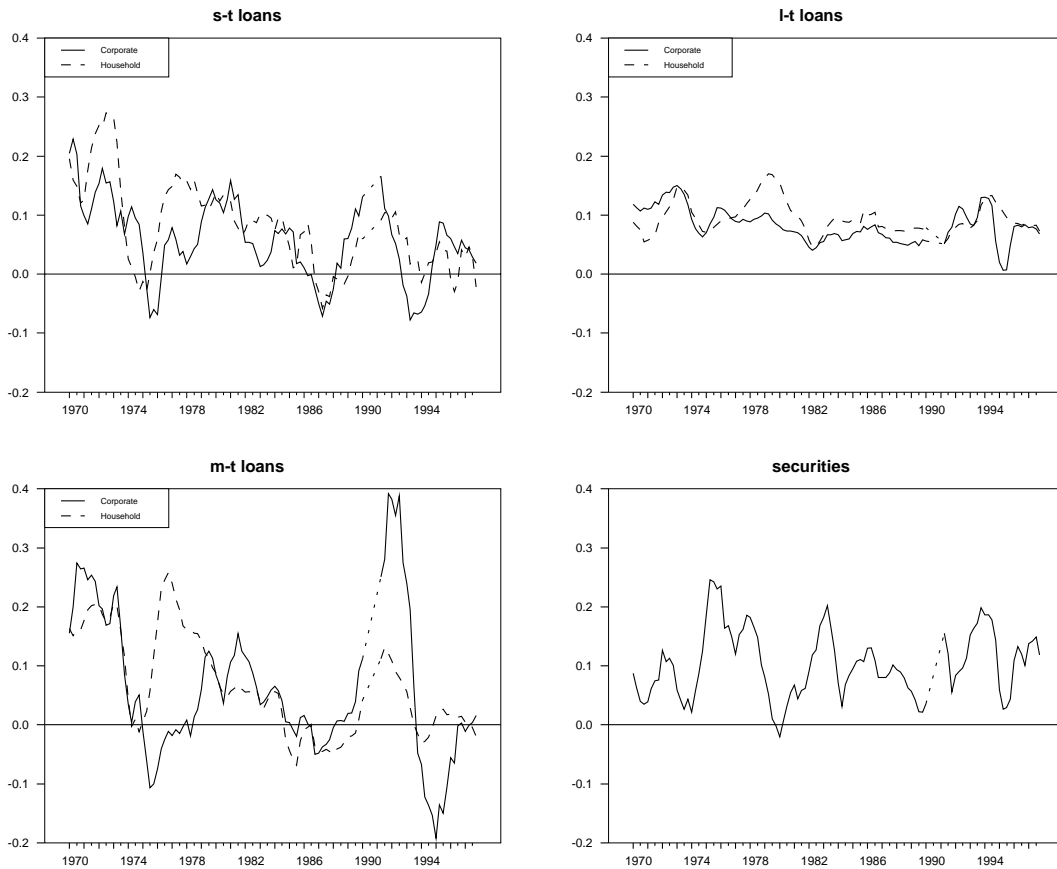Figure 1: Bank balance sheet variables (in billions of Dmarks)[*]
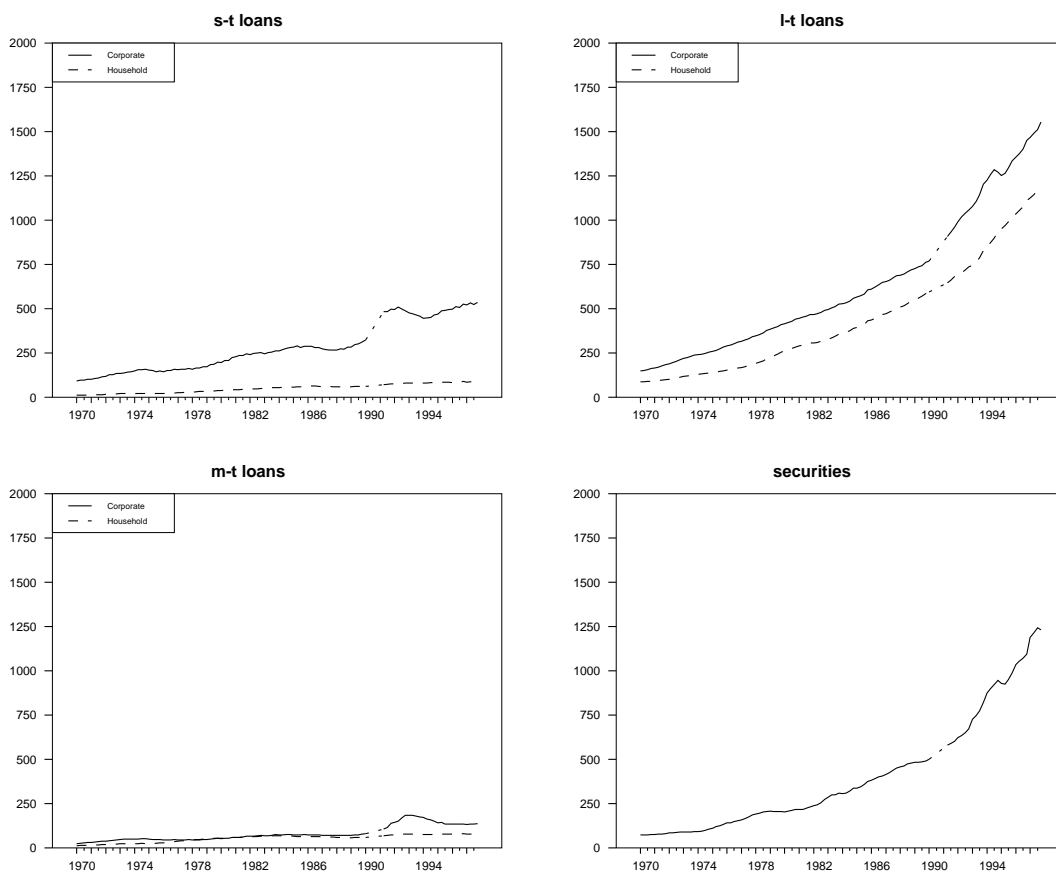
[*]s-t, m-t and l-t stand for respectively, short-term, medium-term and long-term. We skip the observations in 1990 because these include a break that reflects German reunification.

models as unrestricted VARs in which each series is included in levels. We use likelihood ratio tests and a ten per cent significance level to determine the number of lags in our VARs. In most cases the number of lags equals six.[10]

Our results consist of innovation analysis which can be performed with an estimated VAR model, transformed into its moving average representation. Innovations of 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, and the other variables in the order presented in the impulse-response graphs. We also investigated alternative orderings, but these did not lead to very different outcomes. Each time, we use a simulation period of four years (16 quarters).

[10]We tested our VAR models for misspecifications using the Ljung-Box Q (1978) test against higher-order serial correlation and the Bera-Jarque (1981) normality test. No serious problems were encountered.

6

Figure 2: Bank balance sheet variables (in growth rates)[*]

[*]s-t, m-t and l-t stand for respectively, short-term, medium-term and long-term. We skip the observations in 1990 because these include a break that reflects German reunification.
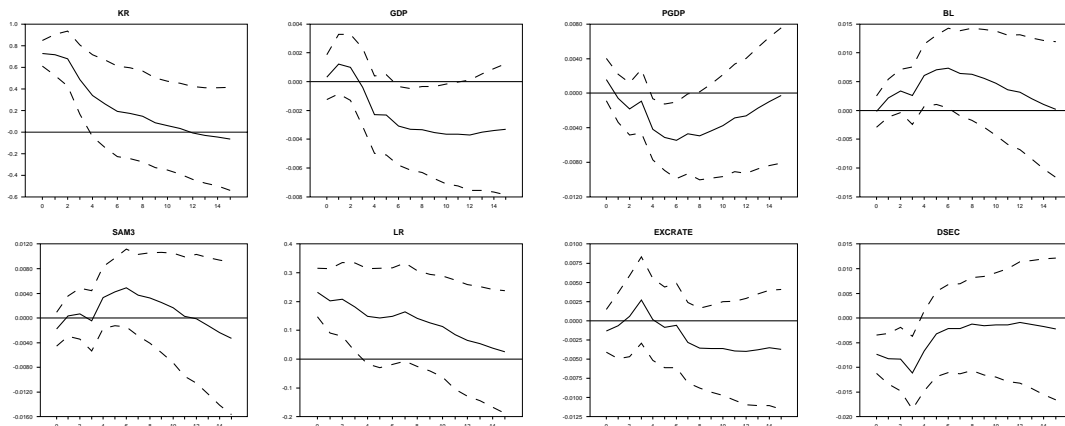
3.2   Innovation analysis

Aggregated VAR: We first analyse a VAR model that only includes aggregated data: the short-term interest rate, GDP, the GDP deflator, total bank loans, money (M3), the long-term interest rate, the effective exchange rate and banks' securities holdings. All variables included are in real terms (except both interest rates and the price level) and in logs (except both interest rates).

Figure 3 plots the dynamic response of each variable following an unanticipated monetary contraction, represented by a shock of about 75 basis points to the short-term interest rate.

Within four quarters, the policy variable returns to a level not significantly different from zero.

7

Figure 3: Aggregated impulse-responses following a monetary contraction[*]

Both GDP and the price level show a negative response that becomes significant after about a year, which is a plausible reaction to a monetary contraction. The long-term interest rate rises about 25 basis points and returns to its initial level, following the same pattern as the short-term rate. The effective exchange rate does not show any significant response, which suggests that the exchange rate is not an important transmission variable.

Banks' securities holdings fall immediately after the monetary contraction, but return to their baseline level within a year. This suggests that banks use their securities as a buffer stock to offset monetary disturbances.

Bank lending shows a positive response, which is not consistent with the standard interpretation of a monetary contraction. Apparently, banks do not only shield their borrowers from monetary disturbances, but even extend their loans supply. This might be explained by increased demand for—particularly short-term—bank credit by firms in order to build a liquidity buffer.

The response of M3 is also positive, albeit not very significantly. This is not strange given the fact that money and credit represent two sides of a bank's balance sheet and are therefore related. The fact that the responses of these variables follow a similar pattern confirms this view. Furthermore, it is quite common to find a positive short-term interest rate elasticity of broad money demand (see Fase, 1994). Nevertheless, given the fact that M3 has served as an intermediate target of monetary policy since the early 1980s, one would expect that a monetary tightening has a negative impact on this broad money

Figure 4: Aggregated impulse-response of M1 following a monetary contraction[*]
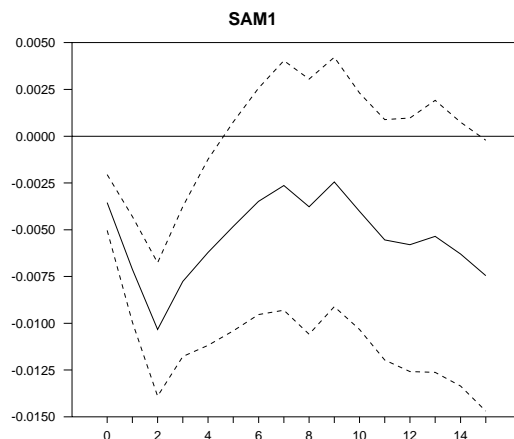
aggregate.[11]

    We repeated the analysis with a VAR in which we replaced M3 by the narrow aggregate M1. This time, money shows an immediate negative response, as can be seen in Figure 4. The responses of the other variables are very similar to those in Figure 3 and are therefore not reported. The result that M1 shows a—plausible—negative reaction can be explained by the fact that a narrow aggregate contains fewer interest-bearing elements, which makes a positive relationship between money and interest rates unlikely. In addition, M1 represents a smaller part of the liability side of the banking sector's balance sheet than M3 and is therefore not as tightly related to developments in bank lending.

Disaggregated VARs: In separate specifications for the corporate sector and the household sector, we replace GDP by industrial production and household expenditures, respectively, and the GDP deflator by the producer price index and the household expenditures deflator. In addition, we include bank lending to firms and households, rather than aggregated credit. The responses of real activity, the price level and credit are reported in Figure 5.

    Regarding the eventual effects of monetary policy on activity and prices, the sectoral differences are substantial. Industrial production shows a borderline-significant decrease,

---

[11]Our findings are consistent with recent studies (Clarida and Gertler, 1996; Bernanke and Mihov, 1997) which conclude that, in spite of its monetary strategy of money targeting, in practice the Bundesbank's monetary policy has been much more pragmatic. In addition, it should be noted that the Bundesbank has actually missed its money growth target in about half of the years since it introduced money targeting.

Figure 5: Sectoral disaggregated impulse-responses following a monetary contraction[*]
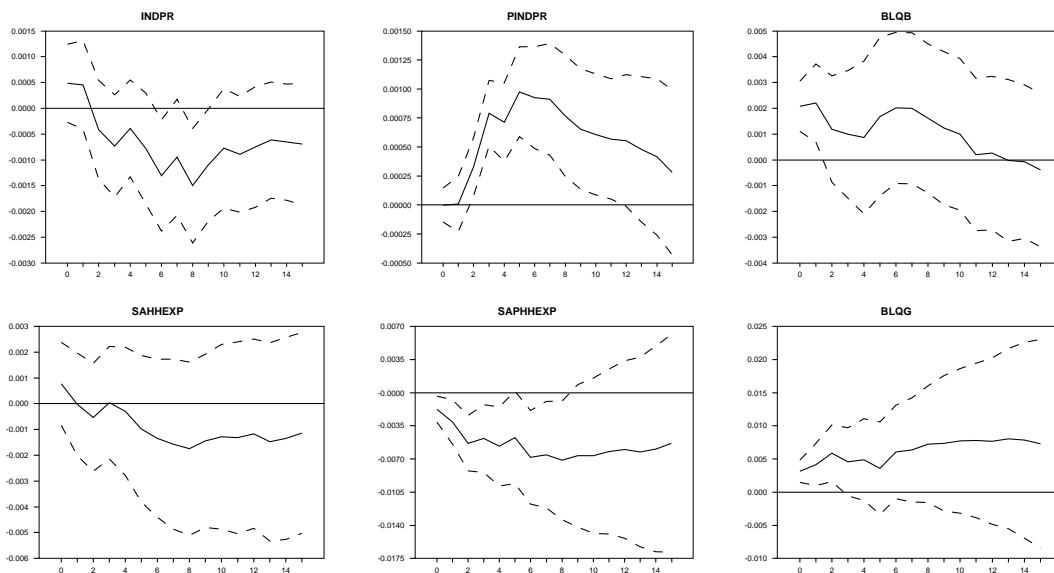
[*]INDPR, PINDPR, BLQB, SAHHEXP, SAPHHEXP and BLQG stand for respectively, industrial production, producer price index, bank loans to enterprises, seasonally-adjusted household expenditures, deflator of household expenditures, and banks' lending to households. These two VARs are estimated using six lags. The dotted lines represent the 95% confidence bounds that are calculated using Monte Carlo integration (see Doan, 1995).

comparable—albeit less pronounced—with the response of GDP in Figure 3. Household expenditures, by contrast, do not seem to respond at all, at least not significantly. Apparently, monetary policy has more real impact on firms than on households. Looking at the response of prices, it is striking that the price index of household expenditures falls, whereas producer prices increase. The latter is obviously in contradiction with the expected result of a monetary contraction, and also with our aggregated VAR simulations. This perverse response of prices shows up in many VAR-based studies and may be an indication that an important variable is omitted. Including the oil price or a commodity price index, as Sims (1992) suggests, in order to take into account supply effects, does not resolve this price puzzle. Dale and Haldane (1995) suggest that the positive response of prices after a monetary tightening may be explained by increasing variable costs which initially translate into higher prices due to cost mark-up pricing. The response of bank credit is very similar for both sectors, showing an increase immediately after the monetary tightening.

Figure 6 shows the results of simulations with a VAR in which bank lending has been disaggregated on the basis of debt maturity, instead of sectors, distinguishing short-term,

Figure 6: Maturity disaggregated impulse-responses following a monetary contraction[*]
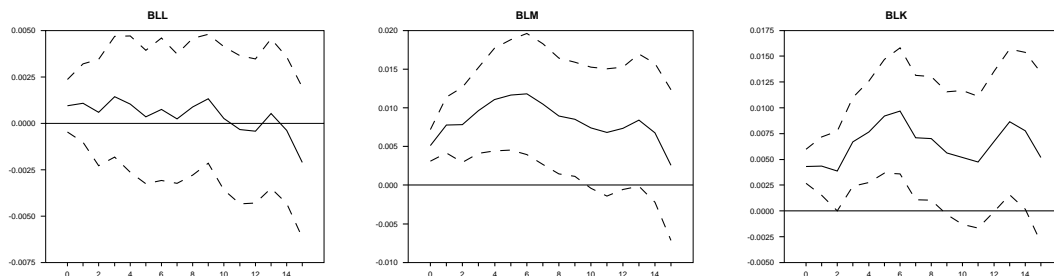
[*]BLL, BLM and BLK stand for respectively, long-term bank loans, medium-term bank loans and short-term bank loans. This VAR is estimated using six lags. The dotted lines represent the 95% confidence bounds that are calculated using Monte Carlo integration (see Doan, 1995).

medium-term and long-term lending (see Figures 1 and 2). It appears that long-term credit—which represents the bulk of total bank lending in Germany—hardly responds, whereas short-term and medium-term credit show a very significant increase. A positive response of short-term credit following a monetary contraction has been observed in many other studies.[12] This may be explained by the fact that borrowers try to shorten the maturity of their (new) debt as a response to increases—and an anticipation to future decreases—in the lending rate. Another explanation, which is perhaps more relevant here, since we observe a borderline-significant decline in GDP and industrial production, is that firms face declining cash flows due to a drop in sales which induces them to demand more short-term credit in order to build a liquidity buffer.

In Figure 7, finally, we present the responses of short, medium and long-term lending for each sector. Interestingly, the 'non-response' of total long-term credit that we just observed appears to be the net result of a decline in long-term lending to the corporate sector and a temporary increase in long-term lending to the household sector. The slow response of long-term corporate lending—which coincides with the fall in GDP and industrial production, see Figures 3 and 5—suggests that this is induced by demand, rather than supply. Presumably, monetary policy has a real impact on the corporate sector through other transmission channels (*e.g.*, the standard interest rate channel) while bank lending follows passively. The initial positive response of long-term household lending is somewhat puzzling. A possible explanation is that the mortgage lending rate is adjusted with a significant lag to changes in the policy-controlled short-term interest rate, which can be a reason to increase the demand for mortgages immediately after a monetary contraction, in order to still benefit from the lower mortgage rate. For short-term and medium-term credit, sectoral differences are not substantial. As we already noted, the positive response of short-term and medium-term lending may be attributed to the fact that borrowers use this type of credit as a liquidity buffer.

---

[12]See *e.g.*, Gertler and Gilchrist (1993a) for the United States and Kakes (1998) for the Netherlands.

11

Figure 7: Sectoral and maturity disaggregated impulse-responses following a monetary contraction[*]
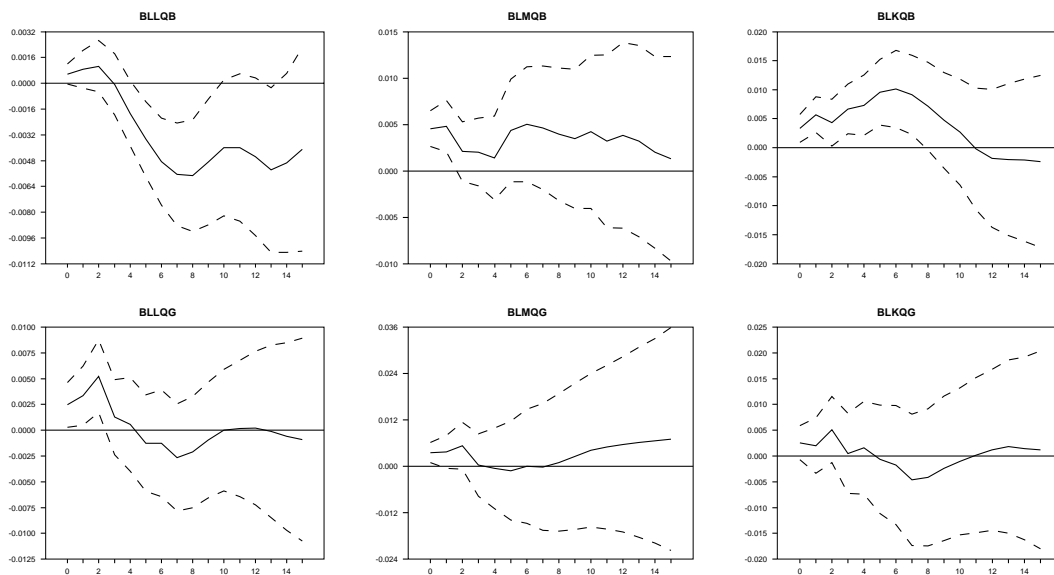
[*]BLLQB, BLMQB, BLKQB, BLLQG, BLMQG and BLKQG stand for respectively, long term bank loans to enterprises, medium-term bank loans to enterprised, short-term bank loans to enterprises, long-term bank loans to households, medium-term bank loans to households and short-term bank loans to households. These two VARS are estimated using respectively six and four lags. The dotted lines represent the 95% confidence bounds that are calculated using Monte Carlo integration (see Doan, 1995).

Evaluation: In sum, we can conclude that bank lending does not seem to be an effective transmission channel of monetary policy in Germany. The results suggest that both banks and borrowers show buffer behaviour in order to offset the impact of monetary shocks. Banks respond to a monetary tightening by immediately decreasing their securities holdings, whereas they insulate their loans portfolio from monetary disturbances. For banks, securities holdings thus seem to serve as a liquidity buffer. Borrowers, in turn, respond to a monetary contraction by increasing their demand for short-term and medium-term loans, which is satisfied by the banks. Hence, rather than providing an effective transmission channel, banks are more likely to *weaken* the impact of monetary policy.

Presumably, monetary policy may have real affects via other transmission channels—*e.g.*, the long-term interest rate—which are more relevant for firms than for households. In this respect, it is also interesting to note that, insofar as the real effects of monetary policy in both sectors are reflected by household expenditures and industrial production, only the latter falls significantly after a monetary contraction.

The interpretation of our results is consistent with the notion that long-term relationships between banks and their customers are important in Germany. It should be noted,

though, that we have made a relatively crude disaggregation by distinguishing only two sectors, firms and households. Obviously, a further disaggregation of borrower types is needed to draw more rigorous conclusions. As we indicated, client relationships that may offset monetary policy shocks are presumably more relevant for large, creditworthy firms than for smaller borrowers. Panel data studies by Audretsch and Elston (1994), Elston (1996) and Bond *et al.* (1997) conclude that German firms' investments are sensitive to financial constraints. Especially small firms are vulnerable, which suggests that a further disaggregation of the corporate sector is useful. Note, though, that these micro-based studies do not explicitly consider monetary policy.

3.3   Robustness

We estimated all VAR specifications for various sub-samples. We let the sample start in 1973:1, the end of the Bretton Woods system, and in 1975:1, when the Bundesbank started its policy of monetary growth targeting. In addition, we checked what would happen if we end the sample in 1990:1 (German unification). Although these dates mark important shifts in the German economy, neither of these alternative had much impact on our results.

4   Concluding remarks

In this study we have investigated the relevance of a bank lending channel of monetary policy transmission for the German economy. We performed VAR analysis to investigate the effects of unanticipated monetary policy shocks at the aggregate level as well as possible differences between the household sector and the corporate sector. An important conclusion is that banks seem to use their securities holdings as a buffer stock, which enables them to shield their loans portfolio from monetary disturbances. Whereas most other transmission variables show a plausible response following a monetary contraction, we observe that aggregate bank credit increases, which implies that a bank lending channel is not a relevant transmission mechanism of monetary policy. Rather, the opposite seems more likely, as borrowers appear to use their relationship with a bank to increase their lending, which may enable them to offset the effects of monetary policy through other channels such as the interest rate channel and the exchange rate channel.

It is interesting to note that our results do not suggest a 'flight to quality' following a monetary contraction, at least if households are supposed to be the low quality borrowers. Of course, this mechanism could still be relevant among different classes of German firms. Hence, a natural extension of this study would be to make a further disaggregation of the corporate sector.

References

Audretsch, D.B. and J.A. Elston (1994), "Does firm size matter? Evidence on the impacts of liquiduty constraints on firm investment behaviour in Germany", CEPR Discussion Paper 1072, Centre for Economic Policy Research, London.

Barran, F., V. Coudert, and B. Mojon (1995), "Transmission de la politique monetaire et credit bancaire. Une application a trois pays de l'OCDE", *Revue Economique*, **46**(2), 393–413.

Barran, F., V. Coudert, and B. Mojon (1996), "The transmission of monetary policy in the European countries", Document de Travail 93-03, Centre d'Études Prospectives et d'Informations Internationales, Paris.

Bera, A.K. and C.M. Jarque (1981), "An efficient large-sample test for normality of observations and regression residuals", Working Papers in Econometrics 40, Australian National University, Canberra.

Berger, H. and U. Woitek (1999), "Further observations on the political business cycle in German monetary aggregates", Discussion Papers in Economics 9902, University of Glasgow, Glasgow.

Bernanke, B. and A. Blinder (1992), "The Federal Funds rate and the transmission of monetary policy", *American Economic Review*, **82**, 901–921.

Bernanke, B. and M. Gertler (1989), "Agency costs, net worth, and business cycles", *American Economic Review*, **79**, 14–31.

Bernanke, B. and M. Gertler (1995), "Inside the black box: The credit channel of monetary policy transmission", *Journal of Economic Perspectives*, **9**(4), 27–48.

Bernanke, B. and I. Mihov (1997), "What does the Bundesbank target?", *European Economic Review*, **41**(6), 1025–53.

Bond, S., J. Elston, J. Mairesse, and B. Mulkay (1997), "Financial factors and investment in Belgium, France, Germany and the UK", NBER Working Paper 5900, National Bureau of Economic Research, Cambridge, MA.

Clarida, R. and M. Gertler (1996), "How the Bundesbank conducts monetary policy", NBER Working Paper 5581, National Bureau of Economic Research, Cambridge, MA.

Dale, S. and A. G. Haldane (1995), "Interest rates and the channels of monetary transmission: some sectorial estimates", *European Economic Review*, **39**(9), 1611–1626.

Doan, T.A. (1995), *RATS for Windows (v 4.20)*, Estima, Evanston.

Elston, J.A. (1996), "Investment, liquidity constraints and bank relationships: evidence from German manufacturing firms", CEPR Discussion Paper 1329, Centre for Economic Policy Research, London.

Escriva, J.L. and A.G. Haldane (1994), "The interest rate transmission mechanism: sectoral estimates for Spain", Documento de Trabajo 9414, Banco de Espana, Madrid.

Fase, M.M.G. (1994), "In search for stability: an empirical appraisal of the demand for money in the G7 and EC economies", *De Economist*, **142**(4), 421–454.

Garretsen, H. and J. Swank (1998a), "The transmission of interest rate changes and the role of bank balance sheets: a VAR analysis for the Netherlands", *Journal of Macroeconomics*, **20**, 325–339.

Garretsen, H. and J. Swank (1998b), "The bank lending channel in the Netherlands: the impact of monetary policy on households and firms", mimeo, University of Nijmegen.

Gertler, M. and S. Gilchrist (1993a), "The cyclical behaviour of short-term business lending", *European Economic Review*, **37**, 623–631.

Gertler, M. and S. Gilchrist (1993b), "The role of credit market imperfections in the monetary transmission mechanism: arguments and evidence", *Scandinavian Journal of Economics*, **95**(1), 43–64.

Gertler, M. and S. Gilchrist (1994), "Monetary policy, business cycles, and the behavior of small manufacturing firms", *Quarterly Journal of Economics*, **109**(2), 309–340.

Gilchrist, S. and E. Zakrajšek (1998), "The importance of credit for macroeconomic activity: identification through heterogeneity", in *Market behaviour and macroeconomic modelling*, MacMillan, London, chapter 5, 129–157.

Greenwald, B. C. and J. E. Stiglitz (1993), "Financial market imperfections and business cycles", *Quarterly Journal of Economics*, **108**, 77–114.

Guender, A. and M. Moersch (1997), "On the existence of a credit channel of monetary policy in Germany", *Kredit und Kapital*, **30**(2), 173–185.

Hayek, F. A. (1933), *Monetary Theory and the Trade Cycle*, Jonathan Cape, London.

Kakes, J. (1998), "Monetary transmission and bank lending in the Netherlands", SOM Research Report 98C30, University of Groningen, Groningen.

Kashyap, A. K. and J. C. Stein (1997a), "The role of banks in monetary policy: a survey with implications for the European monetary union", *Federal Reserve Bank of Chicago Economic Perspectives*, **Sept/Oct**, 2–18.

Kashyap, A. K., J. C. Stein, and D. W. Wilcox (1996), "Monetary policy and credit constraints: evidence from the composition of external finance: reply", *American Economic Review*, **86**, 310–314.

Kiyotaki, N. and J. Moore (1997), "Credit cycles", *Journal of Political Economy*, **105**, 211–248.

Ljung, G.M. and G.E.P. Box (1978), "On a measure of lack of fit in time series models", *Biometrika*, **67**, 297–303.

Oliner, S. D. and G. D. Rudebusch (1996), "Monetary policy and credit constraints: evidence from the composition of external finance: comment", *American Economic Review*, **86**(1), 300–309.

Schumpeter, J. A. (1934), *The theory of economic development*, Harvard University Press, Harvard [English translation of Theorie der wirtschaftlichen Entwicklung (1911).].

Sims, C.A. (1992), "Interpreting the macroeconomic time series facts: the effect of monetary policy", *European Economic Review*, **36**(5), 975–1000.

A   Data

For most series, we use seasonally unadjusted data. Seasonal effects are taken into account by including a dummy for each quarter. Most data are taken from the Bundesbank, the IMF's International Financial Statistics (IFS) and Datastream.

- *Bank balance sheet data.*   Banks' securities holdings and credit aggregates are taken from the Bundesbank CD-ROM, which contains data reported in the Bundesbank's *Monatsberichte* (monthly reports). We corrected for a break in the credit aggregates in 1980Q3 by premultiplying the earlier observations by the ratio of the values at 1980Q3 under the new and old definition. M3 and M1 are taken from the IFS in seasonally adjusted form.

- *Real activity, prices.*   For the aggregated model, we include real GDP as a measure of real activity, and the implicit GDP deflator as the price index. Both are taken from the IFS. For the corporate sector, we use industrial production and the producer price index from the IFS. For the household sector, we use the volume of total household expenditures and the corresponding deflator, both taken from Datastream in seasonally adjusted form. In order to allow a direct comparison of the magnitudes of these variables among the models, we normalized all activity and price indices by dividing them by their 1980Q1 observation. In all models, we include the oil price, taken from the IFS.

- *Exchange rate, interest rates.*   In each model, we include the nominal effective exchange rate, based on unit labour costs, taken from the IFS database. An increase in this variable reflects an appreciation of the Dmark. 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.