

Credit channels in Europe: a cross-country investigation *

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1. Introduction

The monetary transmission mechanism has always been a topic of great interest to economist and monetary policy authorities. According to the money view only money is crucial for the monetary transmission process. In contrast, the credit view literature focuses on the role of credit in particular (see among many others, Gertler and Gilchrist 1993, Ramey 1993, Dimsdale 1994, Bernanke and Gertler 1995, Cecchetti 1995 and de Bondt 1998b). The credit view in a broad sense suggests two transmission channels over and above traditional money view channels: a bank lending and balance sheet channel. The credit channel literature particularly attempts to identify the credit effects of monetary policy by analysing the response of different types of borrowers and lenders, especially small versus large, to a monetary policy shock.

Although the credit channel theory does not tie down explicitly the timing of aggregate time series, our strategy to identify credit channels is to examine cross-country differences in responses to a monetary tightening in relation to differences in financial structure, as summarised in Kashyap and Stein (1997b) and de Bondt (1998a). These response patterns are based on estimated quarterly vector error-correction models (VECM) for the years 1980-96. This period is par-

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ticularly interesting to examine, because financial liberalisation and deregulation during these years may have weakened the credit channels of monetary policy. The bank lending channel can be reduced by a larger use of non-deposit funding sources. The balance sheet channel may also have become weaker, since more net worth changes can be hedged by the introduction of new financial products. Besides the short-term interest rate and credit to households and firms, the VECM contains two credit *supply* factors to explore the relative importance of the two credit channels: banks' holdings of securities (bank lending channel) and net wealth of households and firms (balance sheet channel). Credit *demand* effects are assumed to be captured by real gross domestic product (GDP). In contrast to the primarily US-oriented literature about credit channels of monetary policy the focus is on Europe. The European countries considered are Germany, France, Italy, the United Kingdom, Belgium and the Netherlands. In terms of total output these countries represent about 80% of the EU-15 countries.

The main empirical findings are the following. The first finding is that credit to households is more responsive to a contraction in monetary policy than credit to firms. This holds for all countries studied, except Belgium and the United Kingdom. The response is most prominent in Germany and Italy, providing evidence for the existence of credit channels of monetary policy. Secondly, the empirical results suggest that the bank lending channel is a particularly relevant transmission channel in Germany, France and Italy. It seems to be the case that monetary policy is less effective in directly constraining bank lending in the United Kingdom, Belgium and the Netherlands. In these three countries the minimum reserve requirements were less strict and banks shield their loan portfolios from monetary policy changes because of a better access to non-deposit funding sources. The third main finding is that the balance sheet channel is particularly relevant in Germany and Italy again.

The remainder of the paper proceeds as follows. Section 2 introduces the money and credit view literature. Section 3 describes cross-country differences in credit channel indicators and examines the existence of credit channels by distinguishing between households (small borrowers) and firms (large borrowers). Section 4 discusses the relative importance of a bank lending and balance sheet channel by

assessing impulse response functions from a VECM. Finally, Section 5 provides concluding remarks. In the Appendix the VECM specification procedure is described in detail.

2. Money and credit view

In the *money view* there are only two classes of financial assets: money and all other assets not used for transaction purposes. It is assumed that monetary authorities control the supply of money and the relative price of the two assets by adjusting the relative supply. In the usual Keynesian-type models, like the IS-LM model where prices do not adjust instantaneously, a rise in the nominal interest rate leads to an increase in the real interest rate which depresses aggregate demand. Since output is determined by demand in the short run, real activity declines. The money view rests on two assumptions. First, there must be some well-defined asset called money, which is essential for transactions. Secondly, monetary authorities must be able to control the supply of money. The major problem with the money or traditional view of monetary policy is the sharp two-asset dichotomy that underlies the theory. The money view works through the liability side of banks balance sheets, since the money supply consists of bank liabilities.

The *credit view* in a broad sense, also known as the financial market imperfections approach, assumes that imperfections on financial markets play a role in the monetary transmission process. Theory predicts that the impact of monetary policy may differ substantially across agents in the economy along with the degree of financial market imperfections. Imperfections in credit markets drive a wedge, the so-called external finance premium, between the cost faced by potential borrowers and the expected return received by lenders. According to the credit view a change in monetary policy tends to change the external finance premium in the same direction. Because of this additional effect of monetary policy on the external finance premium, the impact of the initial monetary shock is magnified. The external finance premium is affected by monetary policy through the bank lending and balance sheet channel. The bank lending channel focuses narrowly on the possible effect of monetary policy actions on the

supply of loans by banks. The balance sheet channel stresses the potential impact of changes in monetary policy on borrowers' balance sheets and income statements, including variables such as borrowers' net worth, cash flow and liquid assets (Bernanke and Gertler 1995).

The point of departure of the *bank lending channel* is the rejection of the notion that all non-transaction assets are perfect substitutes. Three financial asset types are distinguished: money, bonds and loans. The special response of banks to changes in monetary policy is their lending response and not just their role as deposit creators. Therefore, the ambiguity over what constitutes money is much less important. The bank lending channel works by affecting bank assets, *i.e.* loans, in addition to bank liabilities, *i.e.* deposits. Two necessary conditions must be satisfied for a bank lending channel to be operative. First, bank credit is special; both from a lender and borrower perspective there is no perfect substitute available for a bank loan. This condition emphasises the role of bank dependence; some spending that is financed with loans will not occur if banks cut loans. Secondly, monetary policy directly constrains bank lending by adjusting bank reserves. Criticism is centred mainly on the validity of the second hypothesis. Romer and Romer (1990) argue that because banks can fund loans at the margin using managed liabilities, the direct impact of a contraction in monetary policy is minimal. Banks mitigate effects of tight money on lending by issuing large certificates of deposits (CDs) and other kinds of managed liabilities to offset any drop in deposits.

With the *balance sheet channel* credit market imperfections play a role in propagating the effects of monetary policy, even if monetary policy authorities do not directly constrain bank credit. Informational problems between borrowers and lenders lead to a positive external finance premium, which depends inversely on borrowers' net worth relative to the obligations on the loan. A contraction in monetary policy directly and indirectly deteriorates the balance sheet position of the private sector, leading to a decline in credit supply and a rise in the external finance premium. A rise in interest rates directly weakens balance sheets of households and firms by reducing cash flows net of interest and by lowering the value of collateral assets. The indirect channel predicts that monetary contraction engineers an initial decline in spending, leading to a fall in cash flows and asset values.

As preliminary analysis Figure 1 plots the impulse responses for a horizon of 20 quarters of the short-term interest rate, money and credit to a one standard deviation short-term interest rate innovation shock.¹ Money is defined as harmonised M3 and credit is total outstanding credit to households and firms. In most cases money and credit react as expected; a monetary policy tightening leads to a fall in both money and credit. In particular the decline in money is insignificant in Germany and the Netherlands as is the fall in credit in Belgium.

Strictly speaking, however, the credit channel theory does not require that households and firms literally reduce their borrowing following a monetary tightening, rather the theory predicts that they will borrow less than they would if credit markets were perfect. Moreover, based on these impulse responses it is totally unclear whether the decline in credit is driven by demand factors (money view) or also supply factors (credit view).

3. Credit channels: a closer look

3.1. Credit channel indicators

Table 1 shows various potentially important credit channel indicators, which are somehow related to the necessary conditions for the existence of a bank lending and balance sheet channel. Indicators are only mentioned once, although some are a proxy for more than one necessary condition. For example, borrower size is not only a proxy

¹ The impulse responses are calculated from a VECM with an unrestricted intercept, a cointegration rank of 1 and a lag length, which differs between 2 and 5. They are based on innovations orthogonalised by the conventional Choleski decomposition due to the short sample. The effective sample period of each country starts in the first quarter of 1980 and ends in the last quarter of 1996. The ordering of the three model variables is as presented above. All variables, except the short-term interest rate, have been rendered real by using the private consumption deflator. All quarterly series are expressed in logarithms, except the short-term interest rate, which reads in decimals. Data are taken from the database of the macroeconomic model for the EU of De Nederlandsche Bank (de Bondt, van Els and Stokman 1997), unless stated otherwise. Throughout the paper significance refers to a significance level of 5%, unless stated otherwise.

IMPULSE RESPONSES DUE TO SHORT-TERM INTEREST RATE SHOCK

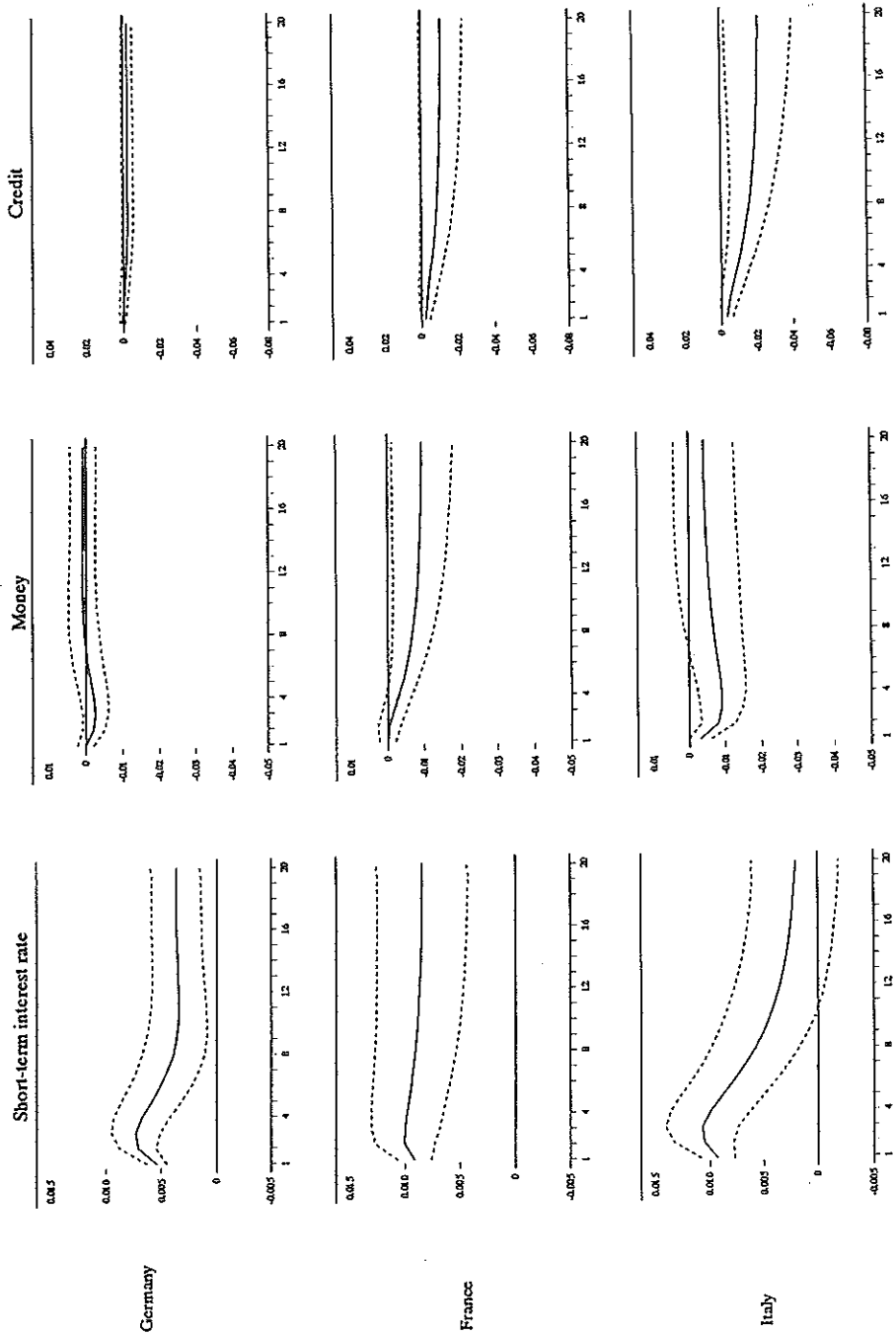
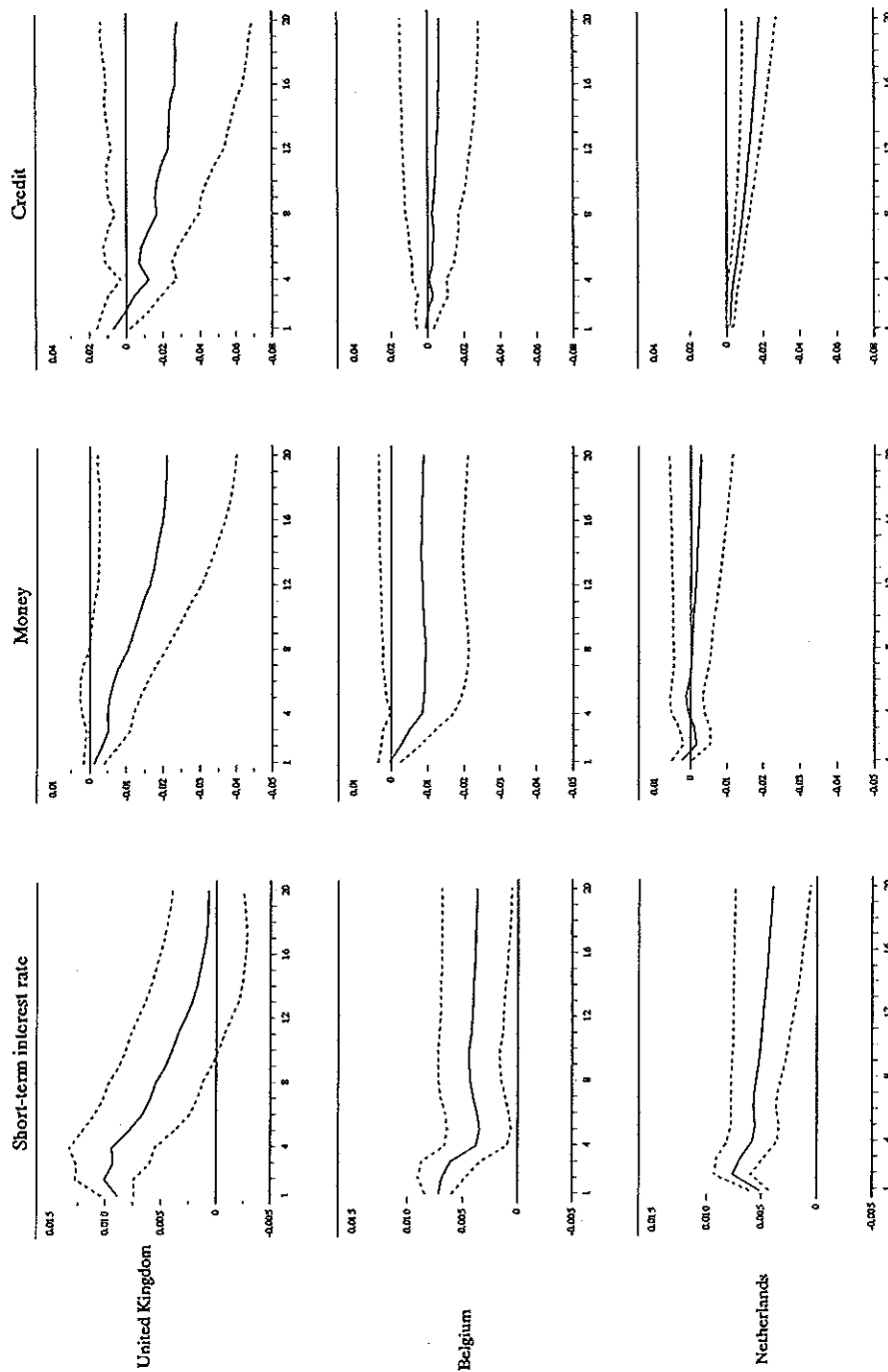


FIGURE 1 (cont.)



for credit market imperfections but also for the degree of bank dependence. The reader should also keep in mind that the qualitative evaluations presented in Table 1 are based on papers written at different moments and referring to different periods. The presented credit channel indicators are, however, highly illustrative for our sample period 1980-96.

TABLE 1

CREDIT CHANNEL INDICATORS

Variable	Germany	France	Italy	United Kingdom	Belgium	Netherlands
Direct credit	■	◇	■	◇	■	■
Stock market	■	◇	■	□	■	◇
Firm debt rating	■	□	■	□	■	■
Commercial paper	■	□	■	□	■	◇
Reserve rules	■	◇	■	□	□	□
Bank health	◇	■	■	□	◇	□
Foreign banks	■	■	■	□	◇	◇
Small firms	□	◇	■	□	◇	■
Small banks	■	◇	◇	◇	□	□
Loan spread	◇	◇	◇	□	◇	□
<i>Bank lending channel</i>						
Credit is special	■	◇	■	□	◇	◇
Credit constrained	■	■	■	□	◇	◇
<i>Balance sheet channel</i>						
Imperfections	◇	◇	■	□	◇	◇

Explanatory notes: black means potentially sensitive for credit channels.

Sources: Alworth and Borio (1993), de Bondt (1998a and 1999a), EC (1997), EMI (1996), Groeneveld and van Velden (1999), Gual and Neven (1993) and Kashyap and Stein (1997b).

A necessary, but not sufficient, condition for the bank lending channel to be operative is that *credit is special*. In Germany, Italy and the Netherlands the dependence on finance from financial intermediaries is stronger than in the other countries. Financial intermediaries account for about 95% of credit to the private sector in the first group of countries, against 90% in the other group. Bank-dependent borrowers are in general households and (small) firms not listed on the stock market. Based on stock market capitalisation figures the degree of bank-dependence is high in Germany and Italy and low in the United Kingdom (de Bondt 1998a). Although equity financing is rarely an important source of funding for most firms, deep equity

markets are often correlated with the existence of other public markets that might be tapped when bank credit contracts. In most European countries non-financial firm debt rating, useful for bond financing, is still in its infancy. The main exceptions of this general picture are France and the United Kingdom where 30 to 50 firms and 60 to 90 firms, respectively, are rated by major rating agencies (EC 1997). Commercial paper markets opened in the mid-1980s in some European countries and gradually developed (Alworth and Borio 1993 and EC 1997).² At the end of 1991 the ratio of commercial paper to bank credit outstanding is around 2% in France, the United Kingdom and the Netherlands and less than 1% in the other countries.

The ability of *monetary policy* authorities to *directly constrain bank lending* by adjusting bank reserves is related to the minimum reserve requirements and to the access of banks to finance loans by non-deposit funding sources, since the bank lending channel assumes that monetary shocks alter the relative cost of loanable funds for banks. The reserve requirements in the European countries considered during the years 1980-96 differ with respect to the reserve base, reserve ratios and the penalties for reserve deficiencies and compensation for holding the reserves (Gual and Neven 1993, Table A2, and EMI 1996). The stricter the rules the more potentially the bank lending channel is effective. The minimum reserve rules are most strict in Germany and Italy and relatively loose in the United Kingdom, Belgium and the Netherlands. Groeneveld and van Velden (1999) show that the introduction of common reserve requirements for the EMU countries since the introduction of the euro leads, compared to the pre-euro reserve requirements, to a significant benefit for banks in Italy and to a lesser extent also in Germany and France.

If banks are healthy, that is well capitalised and making a good profit, they have a much easier time going to securities markets to raise funds in face of an adverse deposit shock. Looking at bank ratings and return on assets in the 1990s the banking sector is healthy in the United Kingdom and the Netherlands and less healthy in France and Italy (Kashyap and Stein 1997b). Another dimension of the accessibility of loanable funds is that foreign-owned or internationally operating banks may have better access to international capital markets

² Commercial paper is a type of fixed-maturity unsecured short-term negotiable debt issued generally in bearer form and primarily by non-banks.

and other foreign sources of funds than domestic banks. For Spain, Pill (1997) provides empirical evidence that monetary policy contractions are tempered by the ability of foreign banks to borrow funds offshore. Witteveen (1998) also argues, in the light of the financial economic crisis in Asia in 1997 and 1998, that bank credit has become financially internationalised and is financed by attracting funds in euromarkets and offshore markets and is therefore shielded from domestic central bank influence. For the US, Jayartne and Morgan (1997) show that bank holding companies, mostly internationally operating, mitigate capital market frictions by forming internal markets for allocating insured deposits among affiliated banks. For the years 1990-95 de Bondt (1999a) reports that in the United Kingdom, Belgium and the Netherlands about 30-40% of all banks are foreign, while in the other countries this figure is less than 10%.

Proxies for *credit market imperfections* are the size of borrowers and lenders and the loan-deposit spread. The monitoring costs of banks, contract enforcement, informational asymmetries and incentive problems between banks and firms are larger and stronger for small firms than for large firms. Looking at the 1990 size distribution of employment small firms are particularly important in Italy and the Netherlands (Kashyap and Stein 1997b). The degree of asymmetric information between lenders and borrowers on credit markets is also negatively related to bank size. Large banks may have more and better information with respect to credit markets than small banks. Of course, bank size may also be a proxy for the ability to obtain non-deposit financing (bank lending channel). According to bank concentration ratios, as reported by Kashyap and Stein (1997b) and de Bondt (1998a), banks are relatively small in Germany and to a lesser extent also in France and Italy. Another proxy for credit market imperfections is the loan-deposit spread. An increase in transaction costs and information asymmetries leads to an increase in the difference between the loan rate charged by banks and the deposit rate paid. The loan-deposit spread is lower for firms than for households, because firms operate at a large scale and can easily provide information to banks by showing their financial statements (de Bondt 1998a). According to this proxy credit market imperfections are low in the United Kingdom and the Netherlands.

Based on the qualitative evidence presented in Table 1, it is expected that credit channels of monetary policy are relatively impor-

tant in Italy. In contrast, for the United Kingdom credit effects of monetary policy are taken to be relatively weak. In Germany the bank lending channel is expected to be strong whereas the picture for the balance sheet channel is less clear. The potency of bank lending and balance sheet channels for France, Belgium and the Netherlands is likely to be in between the extreme cases of Italy and the United Kingdom.

3.2. Existence of credit channels

3.2.1. Empirical findings in literature

The existence of credit channels has primarily been tested by examining cross-sectional differences in types of credit (Kashyap, Stein and Wilcox 1993 and 1996; Oliner and Rudebusch 1996), types of borrowers (Gertler and Gilchrist 1993 and 1994, Escrivá and Haldane 1994, Dale and Haldane 1995, Barrán 1996, Bernanke, Gertler and Gilchrist 1996 and Kakes 1999) and lenders (Kashyap and Stein 1995 and 1997a, de Bondt 1999a). These studies examine the distributional consequences of credit channels of monetary policy.³

Kashyap, Stein and Wilcox (1993 and 1996) compare the behaviour of bank and non-bank sources of credit and find that commercial paper, as an important non-bank source, expands relative to bank lending in downturns. They argue that the increased share of commercial paper in short-term external finance following a monetary policy tightening supports the bank lending channel; monetary tightening limits the supply of bank credit, which forces borrowers to substitute away from bank loans into commercial paper. Oliner and Rudebusch (1996), however, find little evidence that a monetary shock changes the mix of bank and non-bank debt for either small or large firms. Their main finding is that monetary contractions induce a wide spread shift in total spending away from small firms, supporting the balance sheet channel.

For the US, Gertler and Gilchrist (1993) find that the distinction between bank and non-bank credit is less important than between small and large borrowers. Following tight monetary policy, bank loans to households decline while bank loans to businesses actually

³ For a more extensive overview of the distributional consequences of credit channels in Europe see de Bondt (1998b).

rise slightly. They further show a strong compositional effect on small versus large firms. After tight money, lending to small firms declines relatively to lending to large firms. Gertler and Gilchrist (1994) and Bernanke, Gertler and Gilchrist (1996) obtain a similar finding: lending to small firms contracts substantially relative to large firms following a monetary policy tightening and these cross-sectional differences are large enough to be potentially significant for aggregate economic dynamics.

Escrivá and Haldane (1994) and Dale and Haldane (1995) examine sectoral differences in the monetary transmission process in Spain and the United Kingdom, respectively, by distinguishing between households and firms. For households, the slowdown in borrowing clearly precedes that in expenditure following a monetary tightening. Money, by contrast, only becomes negative after the effects of the monetary shock upon expenditure have first peaked. These timing patterns point towards the existence of credit channels of monetary policy. For firms, however, money appears to lead output movements whereas credit clearly lags behind. These patterns in turn are supportive to the money view. Barrán (1996) also finds for Germany that both business investment and credit to firms start to decrease only three quarters after the monetary policy shock. Credit commitments and the increase of credit demand to finance unexpected increases in inventories during recessions may explain this behaviour. For the Netherlands it is also found that credit to households is more responsive to monetary policy shocks than credit to firms (Kakes 1999).

Kashyap and Stein (1995 and 1997a) and de Bondt (1999a) examine the distributional effects of monetary policy by focusing on the behaviour of lenders rather than borrowers. These bank studies show that credit market imperfections commonly found for non-financial firms apply to banks as well; bank lending by small banks and banks with illiquid balance sheets are more responsive to a monetary contraction than large and liquid banks.

3.2.2. Households versus firms: own findings

The bank lending and balance sheet channels predict that small borrowers (households) are more responsive to a monetary tightening than large borrowers (firms), since small borrowers are bank-dependent and face severe credit market imperfections. Therefore, we

examine empirically the existence of credit channels by investigating the response of credit to households relative to total credit to the private sector following a short-term interest rate shock. Total credit of Figure 1 is replaced by the ratio between credit to households, consisting of housing mortgage loans and personal consumer loans, and total private sector borrowing, a so-called credit mix variable.⁴

Figure 2 plots the impulse response of the credit mix variable due to a short-term interest rate shock. The pattern shows that after four quarters credit to households is more responsive to a contraction in monetary policy than overall credit in all countries, except Belgium and the United Kingdom. This is in favour of the existence of credit channels of monetary policy, since small borrowers are relatively sensitive to a monetary policy tightening along with the degree of bank-dependence and credit market imperfections. Moreover, cross-country differences in the extent and significance of the fall in the credit mix variable confirm more or less the qualitative evidence of credit channels as summarised in Table 1. For Italy the decline in the credit mix variable is strongest, followed by Germany and France and next by the other countries. The negative impact of the interest rate shock on the credit mix variable is significant in Germany and Italy. Again, this is in accordance with the overview of credit channel indicators.

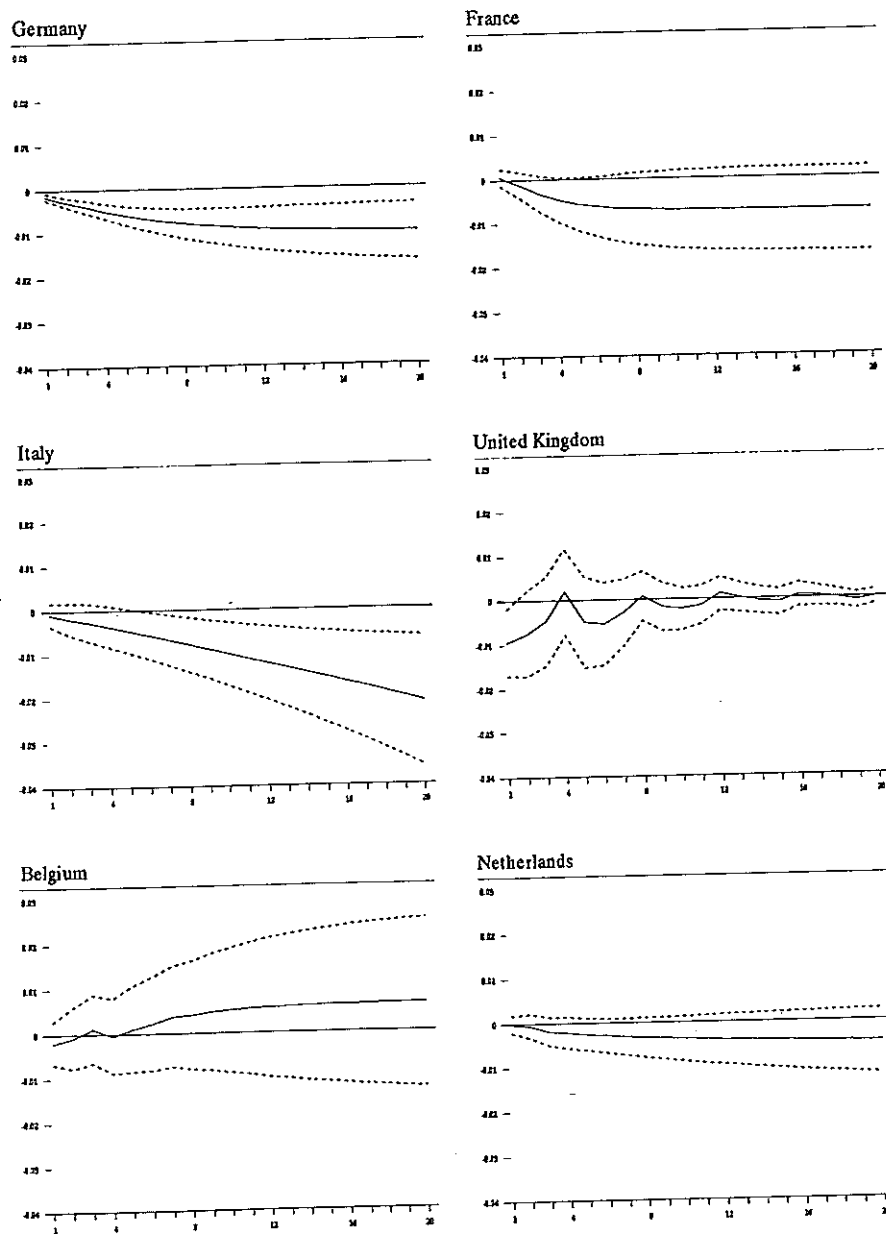
4. Relative importance bank lending and balance sheet channel

4.1. Selection of model variables

As argued by Bernanke and Gertler (1995), the timing pattern of credit aggregate responses is uninformative about the existence or importance of the credit channels, because credit is determined jointly by supply and demand. What is needed is a variable that is known to shift loan supply but not loan demand and *vice versa*. Therefore, we attempt to identify credit supply and demand effects of monetary policy by including in a VECM at least one variable, which is

⁴ As pointed out by an anonymous referee, one has to realize that family businesses are included in the business sector and not in the household sector.

FIGURE 2

IMPULSE RESPONSE OF CREDIT MIX VARIABLE
DUE TO SHORT-TERM INTEREST RATE SHOCK

related to credit supply and less to credit demand and *vice versa*. To address the issue of relative importance of the bank lending and balance sheet channel of monetary policy two credit *supply* variables, that is banks' holdings of securities and net wealth of households and firms, are considered. Both variables are expressed relative to credit to households and firms.

The bank lending channel of monetary policy implies a shift in loan supply, which is hard to observe and measure, since loans are determined jointly by supply and demand. A relatively rapid change in banks' holdings of securities (BIS-code CGBA), however, may signal such a shift. For banks, security holdings are more liquid than loans, therefore securities decline on an earlier stage and more rapid than illiquid bank loans following a monetary tightening. The quasi-contractual nature of bank loans makes the adjustment in loans a slow process, but after a while loan supply will be reduced to restore the preferred allocation of assets over loans and securities. A seminal study in this field by Bernanke and Blinder (1992) shows that banks in the US indeed seem to shield their loan portfolios in the short run by selling of securities after a monetary policy tightening. Thus, evidence in favour of the bank lending channel is a decline in bank securities relative to credit, especially in the short run. Under the money view there is no reason for bank assets to bear any systematic relationship to the stance of monetary policy, since bank credit and other bank asset items are assumed to be perfect substitutes.

Although such buffer stock behaviour by banks suggests that a direct reduction of the availability of bank credit after a monetary tightening is plausible, some authors also emphasize that this behaviour tends to mitigate and delay the impact of a restrictive monetary policy (Garretsen and Swank 1998 and Kakes 1999). Furthermore, by selling securities banks induce a decrease in their price, with a 'balance sheet' effect on the economy. In sum, the main argument to investigate in our empirical analysis movements in bank securities to detect bank lending effects is that if banks are forced to reduce credit supply following a monetary tightening, then they will first or at the same time choose the easiest way to offset the monetary contraction, namely sell securities.

Evidence in favour of the balance sheet channel is a decline in private sector's wealth together with a decline in credit after a monetary policy contraction. The deterioration in wealth leads to a decline

in loan supply and a rise in the external finance premium. In our empirical analysis we consider net financial wealth of the non-monetary private sector as the relevant wealth variable. As described in Fase and Winder (1998) net financial wealth of the private sector is defined as the differential between total assets – the sum of M1, quasi-money, claims on the banking sector and on the government and net foreign assets – and claims of the monetary authorities and the banking sector on the private sector. A more general wealth concept, which includes not only financial wealth but also non-financial components like the capital stock, residential property and durable consumption goods, has not been considered, because data for these debt instruments are not readily available. However, even if a broader wealth concept is more appropriate, the results in the present study remain valid if it is assumed that financial wealth is a good proxy for total wealth.

We assume that real economic activity in terms of GDP captures credit demand effects. Of course GDP is also determined by credit supply factors, but we implicitly assume that they are small compared to credit demand factors. Another reason to use GDP is that this is, according to our view, the best available proxy for credit demand. In sum, the VECM includes the short-term interest rate, capturing the stance of monetary policy, both credit supply variables, GDP and credit to households and firms.

4.2. Assessment impulse responses

This section assesses impulse response functions to examine the relative importance of the bank lending and balance sheet channel. The VECM specification procedure is described in the Appendix and the VECM is estimated by the now familiar procedure of Johansen (1988 and 1991) and Johansen and Juselius (1990, 1992 and 1994). Figure 3 plots the impulse responses due to a one standard deviation short-term interest rate shock.⁵ The response of the variables to this interest rate shock is interpreted as the reaction of the variables to an unanticipated monetary policy tightening.

⁵ See footnote 1. A reversed ordering does not change the impulse responses qualitatively with the exception of the outcomes for bank securities. This is not surprising, since bank securities are in most cases only endogenous in the short run and are expected to react relatively rapidly to a monetary policy shock.

In all countries the short-term interest rate increases significantly in the first year with about 50 basis points. In the long run the rise in the short-term interest rate dies out in all countries except the Netherlands, where the short-term interest rate is still significantly above base value after 20 quarters. A decline in credit takes place in all countries, indicating that monetary policy directly and/or indirectly affects credit.

4.2.1. Bank lending channel: evidence from impulse responses

In Germany, France and Italy banks adjust securities in the first four quarters significantly more rapidly than credit following a monetary policy tightening, suggesting a fall in credit supply. However, the existence of credit lines and the lack of a secondary market for intermediated loans prevent banks from cutting back their credit supply drastically in the short run. Banks prefer to sell securities, involving low adjustment costs. In the longer run, however, loans have to be reduced more to restore the former ratio with securities. This happens exactly in Germany and Italy where in the long run bank securities relative to credit return to their original values and the entire decline in bank liabilities is reflected in a fall in credit on the asset side of bank balance sheets. In France, however, bank securities are not completely rebuilt to their former level relative to credit. The United Kingdom, Belgium and the Netherlands, if anything, show an increase in bank securities compared to credit after a monetary policy tightening, an opposite pattern as predicted by the bank lending channel theory. This result suggests that credit falls relatively strong, probably due to credit demand effects or that in these countries banks issue money market liabilities such as large CDs instead of using securities as a buffer stock.

The empirical evidence in favour of a bank lending channel found for Germany, France and Italy together with a lack of evidence for the other countries suggests that direct credit constraints due to monetary policy are important (see also Table 1). The finding of no bank lending effect for the United Kingdom, Belgium and the Netherlands could be related to less strict minimum reserve requirements. It could also be the case that internationally-oriented banking industries as in the United Kingdom, Belgium and the Netherlands shield borrowers from changes in the stance of monetary policy by

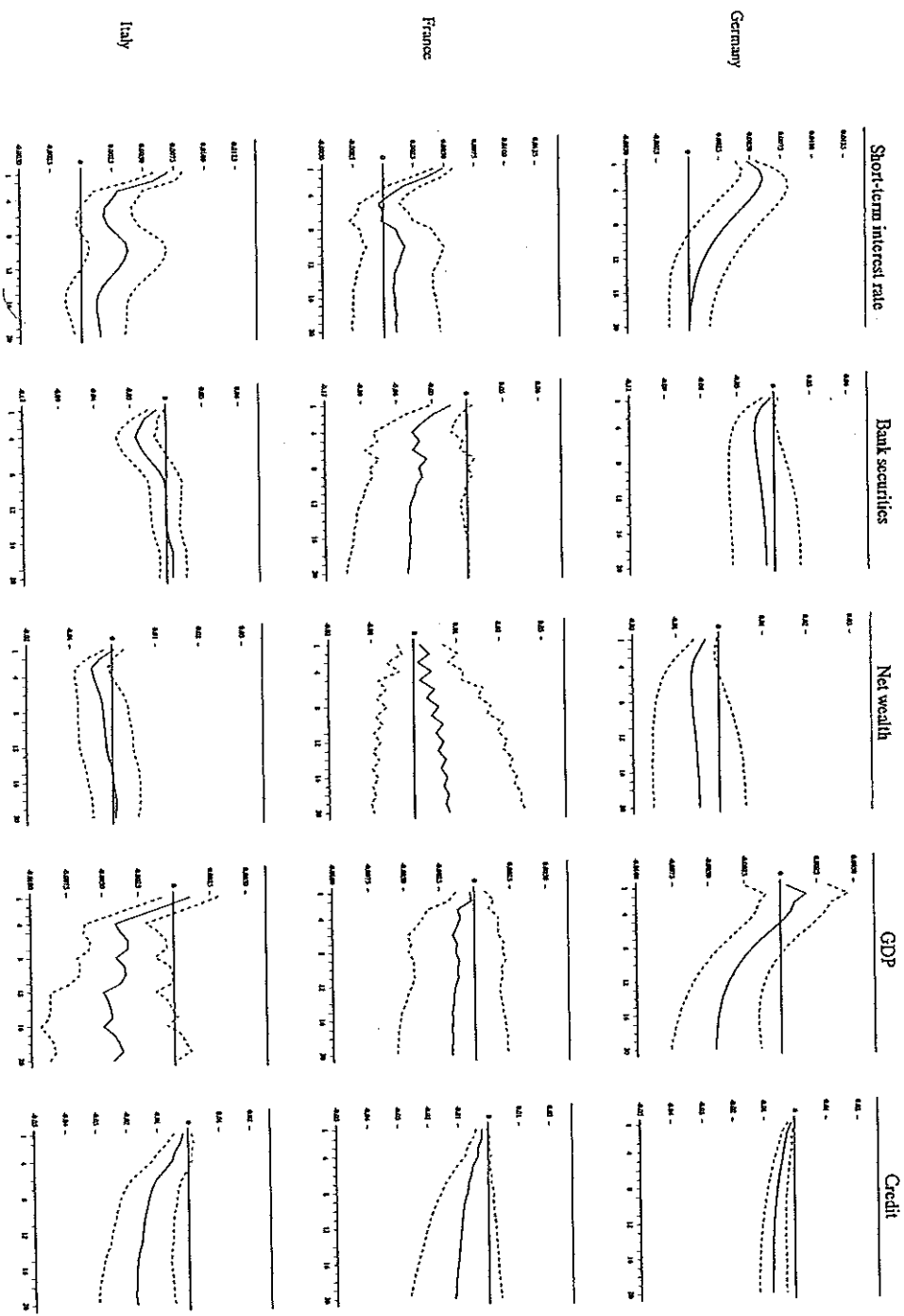
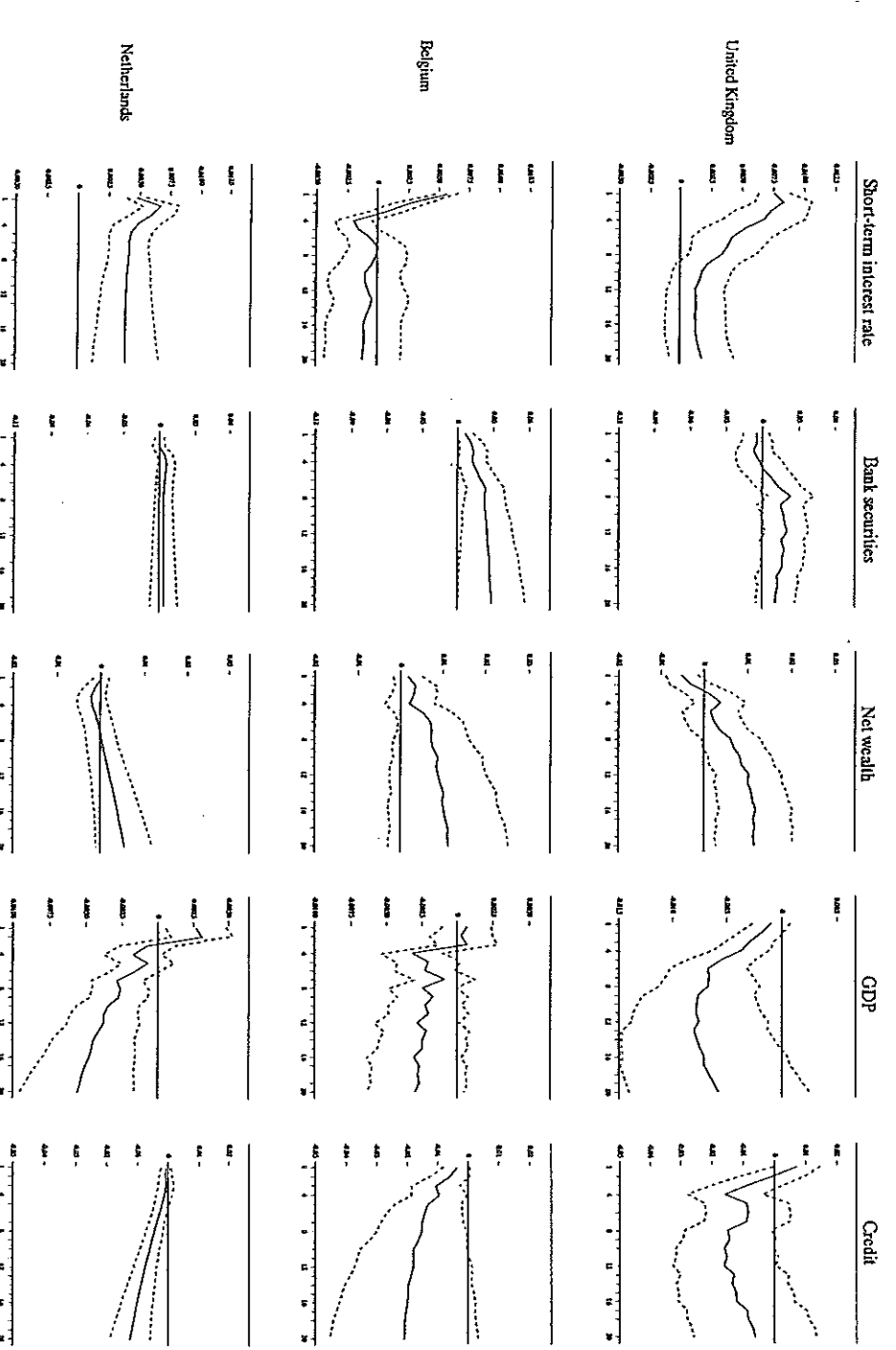


FIGURE 3 (cont.)



attracting foreign sources of funds, coming either from euromarkets and offshore markets or from affiliated banks abroad. Another argument is that in response to monetary policy tightening banks issue money market liabilities, such as large CDs, as emphasised by Romer and Romer (1990). This holds potentially for the United Kingdom, where the CDs market is relatively well developed. A relatively unaffected liability side of bank balance sheets after a monetary tightening implies no need to a change on the asset side and therefore no bank lending effects at all.

Empirical evidence in favour of buffer stock behaviour of securities held by banks is also reported for the US by Bernanke and Blinder (1992) and Gertler and Gilchrist (1993). For the Netherlands Garretsen and Swank (1998) and Kakes (1999) find that banks hold a buffer stock of bonds to offset monetary shocks. Moreover, Dutch banks initially protect their loan portfolio by reducing foreign assets and primarily cut loans of bank-dependent borrowers, *i.e.* mortgages (Jansen and Moonen 1998), supporting the credit channel literature. The outcome for the United Kingdom confirms the finding of Tsatsaronis (1995). He finds no conclusive evidence in favour of a bank lending channel in the United Kingdom.

In contrast with our findings, other studies show no evidence in favour of the bank lending channel of monetary policy in Germany. The response of German bank balance sheets for the years 1963-90 is supportive to the money view (Tsatsaronis 1993). In addition, the timing of money and loan responses following a monetary policy tightening is not consistent with the bank lending channel (Tsatsaronis 1995). Guender and Moersch (1997) also find no conclusive evidence for the existence of a separate credit channel of monetary policy in Germany, relying on a number of tests based on aggregate data. All these results suggest, in contrast to our finding, that monetary policy in Germany works only through the conventional money channel.

4.2.2. Balance sheet channel: evidence from impulse responses

Net financial wealth relative to credit decreases significantly in Germany and Italy in the short run and remains below base value in the long run in Germany following a monetary tightening. Given an immediate fall in credit this result is supportive to the existence of a

balance sheet channel; the deterioration of the balance sheet position of households and firms in Germany and Italy forces banks to reduce credit supply. For the United Kingdom, net wealth is only below base value in the first three quarters and for the Netherlands only in the first six quarters. In France and Belgium net wealth increases in the short run, although insignificantly, after a short-term interest rate shock. In the long run net financial wealth relative to credit increases in all countries, except Germany and Italy, indicating a stronger fall in credit in the long run than in net wealth.

The response pattern in favour of the balance sheet channel for Germany and Italy is more or less consistent with the qualitative evidence of the existence of a balance sheet channel as set out in Table 1, since it is especially Italy which is expected to be sensitive to the balance sheet channel. The finding that in Germany and Italy both the bank lending and balance sheet channel are evident confirms also the empirical evidence in de Bondt (1999a). This bank-level panel data study finds empirical evidence in favour of a bank lending channel in continental Europe and of a balance sheet channel in Germany and Italy. The evidence in favour of a balance sheet channel in Germany and Italy confirms de Bondt's (1999b) finding that a financial accelerator effect with respect to private consumption exists in Germany, Italy and the Netherlands.

4.2.3. Credit demand

In all countries excluding France and the United Kingdom credit demand, captured by GDP movements, is in the first quarters after the short-term interest rate shock above baseline value, although in most cases insignificant. An explanation for a rise in credit demand in the short run is movements in inventories, quoting Gertler and Gilchrist (1993, p. 51): "Following tight money, banks may not be able to reduce lending immediately because they may force many borrowers prematurely into bankruptcy. Indeed, credit demand may actually rise, because of the need to finance inventories". In Germany the rise in credit demand even remains in the first five quarters. This strong countercyclical credit demand can be explained by close relationships between firms and banks. House banks provide liquidity insurance in situations of unexpected deterioration of borrower ratings (Elsas and Krahen 1998) and relationship variables are

particularly relevant for loan collateralisation and availability (Harhoff and Körting 1998).

For the US, Bernanke and Gertler (1995) document that in the first six months after an unanticipated monetary policy tightening, inventories build up before beginning to decline. Bank loan demand and inventories might move together because banks always stand willing to lend and firms finance changes in inventory levels with bank loans. Kashyap, Lamont and Stein (1994) argue that firms that are bank-dependent are much more prone to shield inventories than their non-bank-dependent counterparts during periods of tight monetary policy. They conclude that this finding is consistent with the bank lending channel and that the lending channel is likely to be particularly important in explaining inventory fluctuations during downturns.

In the long run GDP falls following a one standard deviation short-term interest rate shock 0.2% in France, around 0.5% in Germany, Italy and Belgium and 0.6% in the United Kingdom and the Netherlands. The largest decrease in GDP is recorded for the United Kingdom. This result confirms the relatively large fall in output in the United Kingdom according to several macroeconomic structural models following a temporary increase in the short-term interest rate (de Bondt 1997, Figure 3). The GDP decline in the United Kingdom according to small structural models, (structural) VARs and reduced form equations is, however, not exceptional large (Ramaswamy and Sloek 1997 and OECD 1998).

5. Concluding remarks

This study shows conclusive statistical evidence that a bank lending and balance sheet channel of monetary policy are relevant phenomena, at least in Germany and Italy. One should keep in mind, however, that bank lending and balance sheet effects are perhaps underestimated, because necessarily banks' holdings of securities are the only bank asset item considered to detect bank lending effects and a non-market value concept of net worth is used which includes only financial capital.

Besides cross-country differences in credit channel indicators, the existence of credit channels and the relative importance of bank lending and balance sheet channels, other monetary policy implications emerge from the empirical analysis. Cross-country differences in the importance of the bank lending channel could be explained by the ability of monetary policy authorities to directly constrain credit. Differences between EMU countries in minimum reserve requirements, however, no longer exist with the start of Stage Three of EMU. Therefore, the bank lending channel of a common European monetary policy presumably becomes less effective in Germany and Italy and/or more effective in Belgium and the Netherlands. Moreover, the impact of monetary policy contractions may be tempered by the access of internationally oriented banking industries to foreign sources of funds, coming from international interbank markets or from affiliated banks abroad. If this is the case, a growing international orientation of the banking industry in the near future may reduce the relevance of the bank lending channel, particularly in Germany, France and Italy. On the other hand, the sensitivity of bank lending to funding shocks on euromarkets, offshore and CDs markets may increase.

APPENDIX

A.1. VECM representation

A VECM is a vector autoregressive (VAR) model that incorporates sensible long-run restrictions based on cointegration relations in the form of error-correction terms. In a VAR model a number of variables are explained in terms of their own lags and those of the other variables considered. A VECM representation is given in equation (1).

$$\Delta Y_t = \Gamma_1 \Delta Y_{t-1} + \dots + \Gamma_{k-1} \Delta Y_{t-k+1} + \Pi Y_{t-k} + \Phi D_t + \varepsilon_t \quad (1)$$

D_t is a deterministic term containing a constant, trend, and seasonal and intervention dummies. The $(p \times p)$ parameter matrix, Π , characterises the long-run relationship between the $(p \times 1)$ vector of Y variables. The rank of Π equals the number of cointegrating relationships. Three cases can be distinguished. The rank of Π is zero, then all variables are $I(1)$, but there are no cointegration relations. In this case equation (1) reduces to a standard VAR model in first differences. Another extreme case is if Π has full rank equal to

p . All series are stationary in levels and there are no cointegration relationships (VAR model in levels). Finally, cointegration is indicated if the rank of Π is r , where r lies between zero and p , and equals the number of cointegration vectors. In this case Π is decomposed as $\Pi = \alpha\beta'$, where α and β are ($p \times r$) matrices. The rows of β' are the cointegrating vectors and determine the long-run equilibrium relationships between the variables. The α -matrix is a weighting matrix and represents the speed of adjustment of the variables to equilibria.

A.2. Preliminary analysis with model variables

Cointegration exists if a linear combinations of I(1) variables are stationary. Therefore, as a preliminary exercise, the Phillips-Perron (1988) test on unit roots has been applied to the time series involved.¹

Table A.1 shows the Phillips-Perron unit root test results on levels and first differences, using in the test regressions an intercept.² The test outcomes provide conclusive evidence that all model variables are I(1). Qualitatively the same results are obtained based on a model including an intercept and a time trend and/or different lags.

A.3. Lag length

The lag length has been analysed by calculating Information Criteria of Akaike (AIC), Hannan-Quinn (HQC) and Schwartz (SC) for lags 1 to 6. The optimal lag length, k^* , may differ between the information criteria and for $T \geq 16$ it holds that $k^*(SC) \leq k^*(HQC) \leq k^*(AIC)$.³ Table A.2 shows the range of the optimal lag order based on AIC, HQC and SC. In all countries this range varies between a lag of 1 or 2 and 5 or 6. Table A.2 also reports a Likelihood Ratio (LR) test corrected for degrees of freedom, which test between serial correlation at lag order k and $k-1$. The lag order is set so low as possible given the range of the optimal lag order derived from the

¹ This non-parametric test has an advantage over the conventional augmented Dickey-Fuller (1979) test in that nuisance parameters are (asymptotically) eliminated if disturbances are not independent and identically distributed. The Phillips-Perron test makes a non-parametric correction to the t-statistic of the AR(1) coefficient from the test regression to account for serial correlation in the residuals. A truncation lag of four for the Newey-West correction is used. The asymptotic distribution of the Phillips-Perron t-statistic is the same as the augmented Dickey-Fuller t-statistic.

² Computations are done in a modified version of the Rats package Malcolm (Mosconi 1998 and Vlaar 1998).

³ See Lütkepohl (1990, proposition 4.3, p. 133).

information criteria and the serial correlation according to the LR tests, since overparameterisation is considered to be a larger problem than underestimation of the lag order.

TABLE A.1

PHILLIPS-PERRON TESTS, ABSOLUTE T-RATIOS

	Germany	France	Italy	United Kingdom	Belgium	Netherlands
<i>Interest rate</i>						
Level	1.02	1.18	1.11	1.48	0.80	1.30
First difference	6.07***	6.66***	6.62***	7.18***	7.02***	5.54***
<i>Bank securities</i>						
Level	0.07	0.92	1.98	1.29	0.46	0.45
First difference	6.00***	9.12***	7.72***	11.97***	8.03***	7.49***
<i>Net wealth</i>						
Level	1.43	0.21	0.30	0.60	1.17	1.09
First difference	8.81***	11.79***	7.19***	10.32***	8.41***	7.54***
<i>GDP</i>						
Level	0.41	0.72	1.48	0.05	1.14	0.21
First difference	13.16***	7.49***	27.80***	10.79***	39.56***	37.35***
<i>Credit</i>						
Level	1.19	1.09	0.37	0.98	0.33	0.41
First difference	9.21***	8.11***	8.76***	11.18***	10.14***	7.70***

Explanatory notes: intercept and four lags included in the test regression; ***, ** and * denote significance at the 1%, 5% and 10% level respectively, according to MacKinnon (1991) critical values, which are 3.58, 2.93 and 2.60 respectively.

Following this procedure the lag order is set to 2 for Germany, 3 for the Netherlands, 4 for Italy and 5 for France, the United Kingdom and Belgium. The LR tests show at all lags above the lag chosen no significant serial correlation of the residuals.

A.4. Deterministic component

The VECM includes seasonal dummies and dummies to take into account German unification and exceptional changes in credit, because bank(s) are additionally included into the definition of credit institutions. With respect to intercepts and time trends we distinguish between an intercept and time trend in the first differences representation (short-run relation) and in the level representation (long-run relation). A model without trend terms is most

plausible and we test which intercept is statistically appropriate (see Table A.3). The null hypothesis is no constant or a restricted constant, which means only an intercept in the cointegration relations. In both cases, the alternative hypothesis is an unrestricted intercept, that is an intercept in both the short and long-run relations. Table A.3 indicates that an unrestricted intercept is most appropriate for all countries at a significance level of 10%.

TABLE A.2

LAG ORDER TESTS

	Lag length					
	1	2	3	4	5	6
<i>Germany</i>						
AIC	-44.008	-44.963	-44.893	-45.044	-45.303	-45.667*
HQC	-43.396	-44.020*	-43.617	-43.436	-43.363	-43.395
SC	-42.456	-42.568*	-41.654	-40.962	-40.378	-39.899
LR test, p-value		0.000***	0.163	0.056*	0.069*	0.105
<i>France</i>						
AIC	-39.870	-39.872	-39.932	-40.366	-40.620	-40.644*
HQC	-39.402*	-39.078	-38.812	-38.920	-38.849	-38.548
SC	-38.686*	-37.865	-37.102	-36.713	-36.145	-35.346
LR test, p-value		0.023**	0.028**	0.001***	0.030**	0.366
<i>Italy</i>						
AIC	-40.718	-41.000	-41.371	-42.010	-41.968	-42.090*
HQC	-40.115	-40.069	-40.113	-40.424*	-40.054	-39.848
SC	-39.192*	-38.645	-38.186	-37.996	-37.125	-36.417
LR test, p-value		0.001***	0.001***	0.000***	0.389	0.310
<i>United Kingdom</i>						
AIC	-38.542	-38.463	-38.236	-38.475	-38.703	-38.781*
HQC	-38.008*	-37.604	-37.051	-36.964	-36.867	-36.620
SC	-37.193*	-36.291	-35.241	-34.657	-34.063	-33.319
LR test, p-value		0.073*	0.445	0.014**	0.048**	0.314
<i>Belgium</i>						
AIC	-41.346	-41.444	-41.564	-41.414	-41.818*	-41.804
HQC	-40.887*	-40.650	-40.444	-39.969	-40.047	-39.708
SC	-40.162*	-39.437	-38.734	-37.762	-37.342	-36.507
LR test, p-value		0.006***	0.014**	0.370	0.007***	0.434
<i>Netherlands</i>						
AIC	-45.763	-45.735	-45.924	-45.954	-45.939	-46.332*
HQC	-45.156*	-44.798	-44.657	-44.357	44.012	-44.075
SC	-44.225*	-43.360	-42.713	-41.906	-41.055	-40.612
LR test, p-value		0.050**	0.011**	0.142	0.356	0.075*

Explanatory notes: * indicates optimal lag length and bold the lag length chosen; ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

TABLE A.3

TESTS FOR INTERCEPT, P-VALUES

H ₀	Germany	France	Italy	United Kingdom	Belgium	Netherlands
No constant	0.008***	0.000***	0.000***	0.018**	0.001***	0.008***
Restricted constant	0.016**	0.000***	0.061*	0.008***	0.003***	0.007***

Explanatory notes: ***, ** and * denote H₀ is rejected with a significance level of 1%, 5% and 10%, respectively.

A.5. Cointegration rank

A priori a cointegration rank of at least two is expected, since variables are chosen to distinguish between credit supply and demand effects. To test for cointegration we use the trace and λ -max test statistics as described in Johansen (1988) and Johansen and Juselius (1990). The null hypothesis is that the variables are not cointegrated, or equivalently, that the number of cointegrating vectors is zero. This hypothesis is rejected for sufficiently large values of the test statistics.

Table A.4 reports the trace and λ -max statistics without and with correction for the number of estimated parameters. Given equal weight to the (corrected) trace and λ -max test, two appears to be the appropriate rank of cointegration for all countries, except Italy where the cointegration rank is three.

TABLE A.4

COINTEGRATION RANK TESTS

Rank test	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4
	<i>Germany</i>				
Trace	106.15***	58.98***	16.29	6.86	0.07
Trace corrected	90.99***	50.55**	13.96	5.88	0.06
λ-max	47.17***	42.69***	9.43	6.79	0.07
λ-max corrected	40.43***	36.59***	8.08	5.82	0.06
	<i>France</i>				
Trace	128.24***	73.36***	29.90**	13.84	3.52*
Trace corrected	109.92***	62.88***	25.63	11.86	3.02*
λ-max	54.88***	43.46***	16.06	10.32	3.52*
λ-max corrected	47.04***	37.25***	13.77	8.85	3.02*
	<i>Italy</i>				
Trace	147.09***	74.35***	44.60***	18.11**	2.00
Trace corrected	126.08***	63.73***	38.23***	15.52**	1.71
λ-max	72.74***	29.75**	26.49***	16.11**	2.00
λ-max corrected	62.35***	25.50*	22.71**	13.81*	1.71
	<i>United Kingdom</i>				
Trace	87.94***	55.16***	27.74*	8.86	0.70
Trace corrected	75.38**	47.28**	23.78	7.59	0.60
λ-max	32.78*	27.42**	18.88*	8.16	0.70
λ-max corrected	28.10	23.50	16.18	6.99	0.60
	<i>Belgium</i>				
Trace	88.43***	49.36**	23.57	8.42	1.39
Trace corrected	75.80**	42.31	20.20	7.22	1.19
λ-max	39.07***	25.79*	15.15	7.03	1.39
λ-max corrected	33.49**	22.11	12.99	6.03	1.19
	<i>Netherlands</i>				
Trace	88.65***	49.00**	21.53	3.48	0.13
Trace corrected	75.99**	42.00	18.45	2.98	0.11
λ-max	39.65***	27.47**	18.05	3.35	0.13
λ-max corrected	33.99**	23.55	15.47	2.87	0.11
	<i>Critical value Osterwald-Lenum (1992)</i>				
Trace test 99%	76.07	54.46	35.65	20.04	6.65
Trace test 95%	68.52	47.21	29.68	15.41	3.76
Trace test 90%	64.84	43.95	26.79	13.33	2.69
λ-max test 99%	38.77	32.24	25.52	18.63	6.65
λ-max test 95%	33.46	27.07	20.97	14.07	3.76
λ-max test 90%	30.90	24.73	18.60	12.07	2.69

Explanatory notes: ***, ** and * denote significance at the 1%, 5% and 10% level, respectively.

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