Bank credit in the transmission of monetary policy: A critical review of the issues and evidence

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Abstract:
The "credit view" emphasizes the impact of monetary policy on the amount and conditions of credit supplied by the banking sector as a main transmission channel. A review of the literature shows that the view that banks are in some sense special is widely accepted. However, whether the bank credit channel is an important part of the aggregate monetary transmission remains questionable. There is no evidence for credit rationing, at least not at the macroeconomic level. Many of the empirical results on the credit channel have alternative interpretations. Much of the debate on a bank credit channel appears to deal with effects of second-order importance.

JEL: E51, G21

1 INTRODUCTION

For modern industrial countries the usual starting point for a discussion of monetary transmission channels is the effect of monetary policy on interest rates. Policy changes are transmitted from interest rates to aggregate demand through various channels. First, increases in interest rates reduce the expenditures of the private nonfinancial sector by raising the cost of obtaining funds. Second, expenditure of the private nonfinancial sector is curbed by negative wealth effects as increases in various interest rates reduce the value of such assets as bonds, equities, and land. Third, interest rates affect the exchange rate and stimulate or restrain the economy by changing the international price competitiveness of domestic firms. These combined channels of monetary policy have become known as the "money view" of monetary policy. The term is perhaps somewhat unfortunate, but results from the fact that in traditional ISLM models monetary policy is seen to affect interest rates by changing the money supply relative to money demand.[1]

In recent years, an alternative channel of monetary policy has (again) received attention in the literature. The "credit view" emphasizes the impact of monetary policy on the amount and conditions of credit, either as supplied by the banking sector (referred to as the bank lending channel) or the amount and conditions of credit in general (referred to as the financial accelerator mechanism). The appropriate theoretical analysis builds on information failures in financial markets. Banks are credit institutions that specialize in project screening and long-term relationships with individual clients to overcome these informational failures. As a result, banks provide financing to creditworthy borrowers who perhaps would not otherwise have had access to external finance. Monetary policy actions that change the loan supply behaviour of banks may alter the transmission of monetary policy.[2]

In this paper I provide a critical review of the theoretical and empirical literature on the bank credit channel. I also provide some empirical results using macroeconomic time-series data for four countries: the United States, Germany, the Netherlands and the United Kingdom. The paper proceeds as follows. The next section briefly reviews the relevant theoretical background concerning the bank credit channel for monetary policy. Section 3 discusses the existing empirical literature and presents some additional empirical results for the role of bank loans in four countries. Section 4 contains concluding remarks.

2 THE SPECIALNESS OF BANK CREDIT

2.1 The economics of imperfect information

Traditional macroeconomic analysis assumes that credit markets work reasonably smoothly and can usually be ignored. Important exceptions are the studies dealing with special circumstances such as the Great Depression (for example, Fisher, 1933; Bernanke, 1983) or episodes of "credit crunches" (for

[1] The "money view" must not be confused with the monetarist approach to macroeconomics. For example, the monetarist model developed by Brunner and Meltzer incorporates both "money" and "lending" views (see for example, Brunner and Meltzer, 1993; Neumann, 1995). The monetarist view of the transmission mechanism also includes non-interest, non-credit effects from directly spending “excess” money on consumer and investment goods.

[2] Romer and Romer (1990) suggest a different perspective on money versus credit in monetary policy. In their view it is not a dichotomy between interest rate and credit effects, but a different approach to the source of interest rate changes. The money view is that a fall in bank reserves causes interest rates to rise because a lower supply of transaction deposits faces a stable demand for money. Imperfect substitution between different sources of credit is not a major problem. The lending view is that a fall in bank reserves causes interest rates to rise because a lower supply of bank loans faces a stable loan demand based on the uniqueness of bank credit. In this case, money is merely a financial asset with many close substitutes.

example, Wojnilowner, 1980). Recently, the economics of imperfect information and credit markets has gained a more prominent position in macroeconomic analysis.

Financial intermediaries (such as banks, investment companies, pension funds, life insurance companies, brokers/dealers) specialize in gathering information, evaluating projects, and monitoring performance. If banks create economies of specialization, economies of scale, or economies of scope, they can play a special role in the process of credit creation.[3] But financial intermediation is not merely a matter of efficiency and low costs of obtaining credit. Asymmetric information between suppliers and demanders about the quality of goods and services may result in a complete breakdown of markets, with no trading at all or only a limited amount of trading being accomplished (Akerlof, 1970). Establishing borrower creditworthiness is a prime example of asymmetric information. Without the means to establish the ability and inclination of a borrower to repay principal and interest at some future date, potential lenders are unlikely to entrust them with their savings.

Because banks cannot screen out bad borrowers sufficiently, interest rates are not necessarily the equilibrating mechanism in the credit market (Stiglitz and Weiss, 1981). Profits of a bank (Π) are a function of the spread between loan and deposit interest rates (i_L and i_D) earned on loans extended (L), after correction for the proportion of defaults on loan and interest payments (d) and bank overhead costs (O)

$$\Pi = [(1-d)(1+i_L) - (1+i_D)] L - O.$$

When interest rates rise, the riskiness of a bank's loan portfolio also increases if relatively safe borrowers, unwilling to pay higher rates, drop out of the loan market (the adverse selection problem). Additionally, borrowers who are willing to borrow at high interest rates may do so only because their probability of repayment is low (the moral hazard problem). With a riskier loan portfolio expected bank profits do not necessarily rise when interest rates increase. On the contrary, expected profits could easily fall because $\partial d/\partial i_L > 0$. To avoid such a scenario, banks would choose not to use interest rates to equilibrate loan supply with loan demand, but would ration borrowers by limiting the total amount of loans. Some potential borrowers are unable to obtain bank loans and their spending plans will be curtailed. Note however that even without the assumption of credit rationing changes in the allocation of credit can affect the real economy. If bonds and bank loans are imperfect substitutes, shocks that reduce the supply of bank credit will reduce the economy-wide total amount of credit extended and increase the cost of external finance. There appears to be a broad consensus among economists on the idea that the interaction between risk, net worth, and the composition of financial balance sheets reduces the prospects for external finance. There is, however, much less consensus on whether observed reductions in external finance reflect shifts in supply or perhaps shifts in demand. The case for a change in the supply of credit is evident from the previous discussion. It is also true that uncertainty and balance sheet conditions affect the demand for external finance. Risk-averse agents who face substantial costs of default and bankruptcy reduce the demand for external finance when uncertainty increases and/or when their balance sheets comprise relatively few liquid and relatively many illiquid assets. The reduction in the demand for external finance is not normally considered part of the credit channel. Identifying supply and demand shocks proves to be the main problem in research on the credit channel.

2.2 Bank credit and monetary policy

[3] Note that Fama (1980) argues that the specialness of banks is limited to providing investment fund services.

Figure 1 displays stylized financial balance sheets of the central bank, the commercial banks, and households (incl. all nonbank financial intermediaries). Household financial assets comprise claims on the banking sector and all nonbank credit to enterprises. The assets of the commercial banks are reserves (vault cash and deposits with the central bank), tradable securities (bills, bonds, shares), and nontradable bank loans. Bank liabilities consist of different types of deposits (demand and "time" deposits), in practice usually carrying different reserve requirements, and bank borrowing, i.e. securities issued by banks (incl. commercial banks' equity). Central bank assets consist of gold, foreign reserves and securities (public and/or private). The liabilities are reserves held by commercial banks and currency in circulation with the nonbank public.

INSERT FIGURE 1 Simplified balance sheets of the banking sector and households

Monetary policy can be implemented in several ways, but a key element is a change in bank reserves. For example, open market purchases of securities from the public by the central bank increase bank reserves as well as demand deposits of households. Similarly, interbank operations between the central bank and the commercial banks increase bank reserves and reduce bank holdings of securities. Discount window operations change bank reserves and bank borrowing. Each of these operations changes the ratio between bank reserves and deposits, and bank reserves and loans. Portfolio theory suggests that the resulting situation requires a portfolio adjustment by banks. Banks will increase their loans and portfolio of securities, interest rates are likely to fall, credit standards and collateral requirements are likely to be lowered.

Several conditions must be present simultaneously for a bank credit channel of monetary policy to operate (Kashyap and Stein, 1994). First, monetary policy must be able to affect the total volume of bank intermediation (securities and loans). Reserve requirements imposed on deposit liabilities are an argument for monetary control, but not all bank liabilities are subject to reserve requirements. Banks can borrow (CDs, equity, bonds, loans) to finance intermediation. Even if bank credit is special, the leverage of monetary policy over bank lending may be limited (Romer and Romer, 1990). At some point, banks may choose to become similar to other credit intermediaries, for example finance companies.

A second element necessary for the credit channel is the link between the banks' total volume of intermediation and the supply of bank loans. Banks must view loans and securities as imperfect substitutes. Standard theory of the banking firm supports this view (see for example Baltensperger, 1980). A profit-maximizing bank chooses a balance sheet structure knowing that loans provide a return on their informational advantages and economies of scale and scope. However, because bank loans are highly illiquid assets, banks facing uncertainty also hold marketable securities with a somewhat lower return and higher liquidity. In general, in response to a change in circumstances, banks may reduce their holdings of government and private securities to protect their loan portfolio. In fact, precisely because banks hold securities for liquidity, some degree of insulation is very likely (Bernanke and Blinder, 1992).

Third, on a macroeconomic level the bank credit channel depends crucially on the "uniqueness" of banks as providers of funds for a significant number of borrowers. This requires that alternative sources of financing (private bond and stock markets, international credit markets, commercial paper, selling liquid assets) are not readily available, or that their substitutability with bank loans is very limited. A particularly important question is how much banks differ from other financial intermediaries. Firstly, it is one thing to

believe that certain firms are dependent on the services of financial intermediaries because they have limited access to public capital markets. It is quite another to believe that these firms fully depend on bank credit. Banks are only one type in a range of possible credit intermediaries. Secondly, although on a microeconomic level certain firms may be identified that depend on bank credit, their macroeconomic importance may be small and the credit not provided to this group of firms may be channelled to other worthy borrowers instead.

2.3 Why do we need to know about a credit channel?

The recent increase in research on a credit channel for monetary policy can be attributed to four main motives. First, a desire for new policy instruments in addition to the traditional instruments money supply or interest rates. A bank credit channel might allow central bank actions to affect the real spending of borrowers directly and improve the trade-off between inflation and output objectives, or exchange rate and domestic economic objectives. This concept of credit controls is reminiscent of policies used in many countries until the late 1970s. These experiments with direct credit controls were abandoned because they distort competition between financial institutions and are generally very difficult to enforce.

The second motive results from the observation that financial deregulation and innovations have reduced the share of bank credit in the total amount of funds available to the private sector (for the U.S. see for example Edwards, 1993; Gorton and Pennacchi, 1993).[4] If the economic effect of monetary policy depends on the influence that central banks have on the lending behaviour of commercial banks, monetary policy may be in danger of losing its effectiveness (Thornton, 1994; Cecchetti, 1995). Furthermore, some authors have argued that deregulation, innovation and global integration of financial markets tend to reduce the influence of central banks on market interest rates. While bank credit becomes a reduced factor in funding the private sector, central banks may increasingly have to rely on a bank credit channel to affect the economy.

The third motive to examine the credit channel is to develop a (more) reliable information variable for monetary policy. The experience in many countries is that the short-run relationship between money aggregates and the economy tends to break down from time to time. If the credit channel is important, (bank) credit aggregates may be more reliable indicators of monetary policy effects than money aggregates (for example, Friedman, 1983). Changes in the way banks create deposit money (their portfolio mix of securities and loans) may provide useful information on the relationship between money

[4] Alternative evidence provided by Kashyap and Stein (1994, table 7.1), Himmelberg and Morgan (1995, table 1) shows that for manufacturing firms there is no evidence of a declining role of bank credit. There have been changes in the composition of bank debt: shifts between short-term and long-term debt, and between large, medium and small firms. It is also useful to distinguish between two versions of the credit view (see Gertler and Gilchrist, 1993). According to the pure credit view, monetary policy works by and large because it directly regulates the flow of bank credit (monetary aggregates are assumed to be largely unimportant variables, see for example Stiglitz, 1989). The pure credit view is thus very pessimistic about the short-term real effects of monetary policy when financial deregulation and innovation diminish the role of bank credit in the economy. A related but different interpretation of the credit view of monetary policy is that credit market frictions are part of a more general financial propagation mechanism. A reduction in bank credit as a response to a tight monetary policy enhances the overall impact of the shock. Credit market imperfections act as a "financial accelerator" because investment and aggregate demand fall by more than through only the effects of conventional channels (Gertler, 1988; Gertler and Hubbard, 1988; Bernanke and Gertler, 1989; Bernanke, Gertler and Gilchrist, 1996). In this view monetary policy need not become impotent when the bank credit channel is limited or even absent.

and the economy.[5]

The fourth use of a credit channel is to strengthen the case for the proposition that monetary policy affects the real economy. Despite a large body of statistical evidence in favour of short-term real effects of monetary policy, the transmission mechanisms remain unclear. It has remained a somewhat troublesome proposition that relatively small changes in (real) interest rates cause such pronounced effects on investment, consumer expenditure, etc. (Bernanke and Gertler, 1995). Bernanke and Blinder (1988), Greenwald and Stiglitz (1990) show how interaction with bank credit increases the real effect of monetary policy, while at the same time mitigating the effect on market interest rates. Gertler and Hubbard (1988) and Bernanke, Gertler and Gilchrist (1996) argue the case for a general "financial accelerator".

Uses of a credit channel depend on the relationship between money effects and bank credit effects on economic activity. Money and bank credit are two sides of the same balance sheet and bank loans are the main source of the expansion of deposit money in modern fractional-reserve banking systems. The money view of the transmission of monetary policy posits that, as a first approximation, the volume and not the composition of bank credit is important. The credit view of the transmission of monetary policy argues that bank loans to the private sector are special.

Bernanke and Blinder (1988) provide a model of the effect of the bank credit channel. A simple bank balance sheet carries as bank assets R bank reserves, B^b bonds purchased by banks, L^s loans supplied by banks, and bank liabilities deposits D. Equation 1 describes the balance sheet constraint. We assume that bank holdings of reserves (required and voluntary) are a fraction of deposits (eqn. 2). Monetary policy determines the supply of reserves to banking system. The volume of total bank credit is given by $B^b+L^s = (1-\tau)$ D. The proportion of loans λ is positively related to the interest rate on bank loans ρ and negatively related to the interest rate on bonds i (eqn. 3). Bonds and loans are also imperfect substitutes from the perspective of borrowers, and the demand for bank loans is a negative function of the interest rate on bank loans ρ, a positive function of the interest rate on bonds and positive function income/expenditure as the relevant scaling variable (eqn. 4). The private sector demand for bank deposits or money is conventional and depends on the bond market interest rate as the relevant opportunity cost and income as the relevant scale variable (eqn. 5). Finally, the goods market is summarized in a conventional IS curve where spending depends on the two interest rates that determine the return on savings and the cost of funds (eqn. 6).

(1)	$R + B^b + L^s = D$	
(2)	$R = \tau D$	
(3)	$L^s = \lambda(\rho, i) (1-\tau) D$	$\lambda'_\rho >0,\ \lambda'_i<0$
(4)	$L^d = L(\rho, i, y)$	$L'_\rho <0, L'_i <0, L'_y >0$
(5)	$D^d = D(i, y)$	$D'_i <0, D'_y >0$
(6)	$y = y(i, \rho)$	$y'_i <0, y'_\rho <0$

Equilibrium in the bank loan market can be used to solve for the interest rate on bank loans. The bank loan interest rate is a function of the alternative rate on bonds, income and the supply of bank

[5] Examples of the possible usefulness of credit market information are the failures of banks and savings and loan associations in the U.S. during the 1980s, the so-called credit and capital crunch around 1990, and the recent behaviour of Japanese banks facing large losses from bad loans.

reserves.

$$\rho = \Theta(i, y, R) \qquad \Theta'i > 0, \Theta'y > 0, \Theta'R < 0$$

The bank loan rate can now be substituted in the IS equation to obtain

$$y = y(i, \Theta(i, y, R))$$

Together with the equilibrium relationship in the money market this system of 2 equations (refered to as LM and quasi-IS or CC) can be presented graphically as in Figure 2. In this extended ISLM model the response to a monetary contraction (expansion) is not only that the LM curve shifts to the left (right), but the additional market for bank credit causes both the LM and the IS curve to shift in the same direction. The bank channel magnifies the change in output as a result of a monetary policy, while the effect on market interest rates is limited, because the spread with bank loan rates is now an additional part of the transmission mechanism. However, note that a bank credit channel is only one possible cause. In monetarist models the direct effect of excess money balances on spending, other than through the interest rate channel, causes similar effects.

INSERT FIGURE 2 Bernanke-Blinder ISLM credit model

A different graphical illustration may also be useful.[6] Figure 3(a) shows the aggregate market for total credit. Note that the vertical axis shows the average cost of credit, the cost of obtaining loans from different types of credit intermediaries and not just the open market interest rate (compare the diagram in Bernanke and Blinder, 1988). When there are no banks, the downward sloping demand (D) and upward sloping supply of credit (S) correspond to the demand for investment and the supply of savings from households. The existence of a nonbank financial sector to intermediate between savers and investors is one of the determinants of the location of the credit supply curve. Efficient financial intermediation reduces the overall cost of credit. Following the model of Stiglitz and Weiss (1981), problems of asymmetric information may cause equilibrium credit rationing. As a result, additional credit may not be forthcoming beyond a certain level of interest rates.

Introducing a banking sector has the following implications. First, banks are not merely intermediaries that transform savings into equivalent amounts of credit. The central position of banks in the payments system and fractional reserve requirements means that banks can operate a money and credit multiplier. Banks increase the available amount of credit and means of payment.[7] The availability of additional resources from banks shifts the supply curve to the right. This element is independent of the special role of bank loans vis-à-vis expansion of deposits through purchasing securities and also independent of the actual volume of intermediation going through the private banking sector because central banks can achieve the same result by expanding open market operations and distributing currency. What is important is that banks, on initiative from the central bank, can act as marginal suppliers of additional

[6] Compare also the expositions in Thornton (1994) and Oliner and Rudebusch (1996). For example, Oliner and Rudebusch model the supply equation for credit as $r = r^f + \theta + (\lambda r^f)(I-F)$. Here r^f refers to the general availability of credit, θ is the appropriate risk adjustment, and $(\lambda r^f)(I-F)$ reflects the additional cost of external funds for investment I and internal funds F. Most importantly, a reduction in the general availability of credit (an increase in r^f) affects not only the level, but also the slope of the supply curve.

[7] Note that what matters is the amount of real money and real credit. For simplicity, the effects of continuous money and credit expansion on the rate of inflation are ignored.

money and credit. The second element is that bank credit can be special, because banks are efficient credit intermediaries. When an increase in money is achieved more through bank loans than through open market transactions there could be a reduction in the average, overall cost of credit in the economy. Any additional efficiency of financial intermediation through the banking system, the introduction of bank loans, shifts the credit supply curve down. Finally, equilibrium credit rationing can occur in bank credit, although comparative advantages of banks in monitoring their loan customers may mean that the threshold for the interest rate is at a higher level. Assume that the total supply of credit by banks and nonbanks is S.

INSERT FIGURE 3 The aggregate market for total credit

Much of the macroeconomic debate about a bank credit channel for monetary policy can now be described in terms of supply shifts in the model represented by figure 3. There are three cases: (1) monetary policy affects the amount of total available real (credit) resources, (2) monetary policy affects the efficiency of total credit intermediation, (3) monetary policy affects the amount of credit rationing. As a result of the loss of reserves following restrictive monetary policy actions, banks must reduce the amount of money and credit. In figure 3(b) available real (credit) resources fall as the supply curve of total credit shifts leftwards. Of course, banks can always attempt to maintain their initial level of intermediation by borrowing, but this constitutes primarily a change in market share between bank and nonbank credit intermediaries. In figure 3(c) bank loans are special in the sense that banks achieve economies of scale, scope and specialization. A loss of bank credit also changes the slope of the credit supply curve. The main difference with the previous case is that the change in the average cost of obtaining credit and the fall in total credit volume are larger. It is clear that distinguishing special and nonspecial bank credit effects will be extremely difficult, because the direction of the changes is the same and only the size of the effect is different. It is not clear what additional analytical insights are gained from this distinction. Figure 3(d) illustrates the case of effective credit rationing. Credit demand for basically sound and creditworthy investment projects is larger than the supply of credit because credit suppliers in general are unable to separate good and bad borrowers. The theory of equilibrium credit rationing shows that monetary policy actions affect the effective supply of credit, but will not in general change the equilibrium interest rate.

It appears that, except in the special case of credit rationing, the question of a special role for bank credit in monetary policy can be reduced to a debate about the relative size of the shift in total credit supply and the effect on the overall cost of credit intermediation. Arguably, the effect of monetary policy on the volume of purchasing power is generally the first-order effect. The specialness of bank loans is probably the second-order effect.[8] Because of the systematic patterns and because the bank credit channel is of second-order nothing substantial is gained or lost in our usual view of monetary policy.[9] Only the

[8] Ramey's (1993) estimates of the additional effect of bank loans suggest a very small contribution of the bank loan channel. A few other studies found similar results.

[9] In practice two qualifications to this statement appear important. First, the usual analysis of monetary policy focuses on market interest rates, but the importance of credit intermediaries suggests the much broader concept of "average cost of credit". Second, credit market shocks (creditworthiness, etc.) suggest an additional source of long and variable lags in the transmission of monetary policy. These elements were already part of earlier discussions

phenomenon of nonprice credit rationing is a fundamental insight.

3 EMPIRICAL EVIDENCE

3.1 The existing literature

Historically, the debate and research on money versus credit can be traced as far back as the currency versus bullionist controversy (see, for example, Humphrey, 1988). A next phase of high interest is associated with the writings of Gurley and Shaw (1955, 1960), the 1959 Radcliffe Report on U.K. monetary policy, and the Commission on Money and Credit in the United States. The current phase can be identified with the work of Wojnilowner (1980), Benjamin Friedman (1982, 1983a,b), and Bernanke (1983, 1986). The review here follows recent surveys of the same literature such as Bernanke (1993), Gertler and Gilchrist (1993), Kashyap and Stein (1994), Bernanke and Gertler (1995), Hubbard (1995) and the papers in Peek and Rosengren (1995a), Hubbard (2000). However, this review takes a more critical stance towards the evidence presented in favor of credit effects, pointing out conflicting results and alternative interpretations.

(i) The time-series approach to money and credit

Most of the earlier empirical work on the bank credit channel focused on the correlations between aggregate output, bank assets and liabilities, and indicators of monetary policy. For example, Bernanke and Blinder (1992) showed that following a contraction in U.S. monetary policy, measured as a change in the federal funds rate, securities held by banks and deposits decline in the first nine months whereas loans change very little. Subsequently, security holdings recover while loans fall.[10] The fall in loans coincides with a rise in the unemployment rate. Romer and Romer (1990) obtained similar results with a somewhat different empirical methodology.

True causal relationships between movements in money, credit, and economic activity are very difficult to establish, but several studies have examined whether movements in bank loans or credit systematically precede movements in economic activity and/or whether credit aggregates outperform money aggregates in forecasting ability.[11] Campbell (1978), Batavia and Lash (1982), King (1986), Ramey (1993) and Walsh and Wilcox (1995) found little support for these hypotheses. Generally, these studies show that once the monetary variable is included credit variables no longer contribute to the explanation of movements in output following a change in monetary policy. On the other hand, Bernanke (1986), Lown (1988, 1990) found that movements in bank credit do precede changes in economic activity.

Kahn (1991) examined the relationship between money and bank loans in the U.S. It appears that the evidence for the relationship between money and bank loans is dominated by correlations during several large swings in their growth rates. Given the banks' balance sheet constraints finding such a relationship is hardly surprising. Historically, money growth appears to lead bank loan growth by about 1 year, but Kahn found no statistically significant relationship in the second half of his sample period (1982-1991).

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between Keynesian and monetarist economists.

[10] Cecchetti (1995) shows that the differences between loan and security responses to monetary policy shocks are not statistically significant. The impulse responses shown in his figure 4 are also clearly much less pronounced. Cecchetti extended Bernanke and Blinder's sample period 1959-78 to 1959-90. The different results perhaps suggest that recent changes in the banking sector and financial markets affect the results.

[11] Several earlier studies examined bank credit measured as the sum of bank loans and investments (see Radecki 1990). If banks are special it is because of the supply of bank loans, not the purchase of marketable securities.

Robinson (1993) examined the relationship between money and bank loans in a model also including income and the federal funds rate. These results show that both money and loans are systematically predicted by the federal funds rate. The relationship between shocks to money and loans, however, is not stable across subsamples.

A problem with the time-series approach to money and credit is that the balance sheet identity requires that changes in bank assets (loans and securities) equal changes in bank liabilities (deposits and borrowing). Thus, money aggregates and bank credit are not independent variables. Furthermore, evidence that output and bank loans fall after a monetary tightening cannot help identify whether the decline in loan volume reflects a restriction of loan supply (i.e. the bank lending channel), or a decrease in loan demand, for example because higher interest rates reduce desired investment and consumer spending.

(ii) Direct evidence on nonprice credit rationing

The problem of identifying loan demand and loan supply effects disappears when independent evidence shows that banks use nonprice credit rationing. Nonprice credit rationing must be defined as the situation where, at current interest rates, creditworthy potential borrowers are denied credit even though they are clearly capable and willing to pay a higher rate of interest. In other words, nonprice credit rationing is characterized by persistent excess demand for credit and a failure of interest rates to adjust to clear the market.

Several studies have tested credit rationing using variation in non-interest terms of loan contracts. This evidence is inconclusive, however, because non-interest terms such collateral, compensating balances, loan maturity, etc. can very well be seen as part of a broader measure of the cost of bank credit. Increases in collateral, shorter loan maturities, etc. may also signal responses of banks to changes in perceived riskiness of their customers (compare Baltensperger, 1978).

Another approach to examine credit rationing is to estimate bank loan demand and supply directly. King (1986) estimated that loan supply is positively related to the volume of deposits, suggesting that banks are liquidity constrained. He also estimated that the loan market is dominated by periods of excess demand (i.e. estimated demand exceeded actual loans in 63 out of 99 observations). On the other hand, however, the estimated loan supply schedule is also upward sloping with respect to the loan rate. This contradicts the credit-rationing hypothesis. It is also unclear whether the estimates of excess demand are within normal standard errors of the estimated equations.

Berger and Udell (1992) examined the evidence for sluggish adjustment of bank loan rates. Details of individual loan contracts show that about half of the sluggish adjustment resulted from prior commitments that fixed the loan rate. In general, rate stickiness for loans made under previous commitments cannot be associated with credit rationing, because these contracts preclude rationing. Under a loan commitment agreement, a bank promises to issue a borrower a loan up to an agreed amount as long as the borrower satisfies the terms of the contract. Particularly in markets characterized more by price setting than auction-based prices, there are other reasons why loan rates exhibit stickiness, such as competitive pressures (e.g. follower-leader problems in game theoretic models), confusion about temporary vs. permanent shocks, etc.

Lown (1990), Sofianos, Wachtel and Melnik (1990), Morgan (1992) examined the evidence on credit rationing with loan commitment data. Because rationing can only affect firms that do not have such agreements, the percentage of total loans made under commitments should increase in periods of tight

credit. Lown (1990) found that the percentage of new loans made under commitment has a significant negative relationship with real output. Hirtle (1990) found that noncommitment loans appear to (weakly) Granger cause output, whereas commitment loans do not. Morgan (1992) confirmed that loans made under commitment track movements in economic activity. Loans not made under loan commitments begin to fall relatively quickly, responding as fast and as sharp as monetary aggregates in response to movements in monetary policy. Contrary to previous results, Berger and Udell (1992) found that the proportion of new loans extended under previous commitments does not rise when credit markets are tight. Their dataset suggests that the number of all types of commercial loans tends to increase, including noncommitment loans. Morris and Sellon (1995) point out that loan commitments exhibit an upward trend. Consequently, there is a tendency to find an increase in loan commitments in any period, including periods of tight monetary policy, at least since the mid-1970s. After eliminating trending behaviour, there is no evidence that commitment loans rise following tight monetary policy. One possibility is that the loan commitment evidence is a reflection of the well-known large firm - small firm effect (see below). Large firms are more likely to have arranged bank loan commitments than small firms. Avery and Berger (1991) and Berger and Udell (1992) argue that commitment loans are usually available to higher quality, less risky borrowers. They find it unlikely that these borrowers would be rationed in the spot loan market or the capital market. ***(iii) Large firms, small firms and access to external finance***

Kashyap, Stein and Wilcox (1993) approached the demand-supply identification problem by examining the relative movements in bank loans and commercial paper. They argue that if the underlying shock is a change in the demand for credit this would affect all types of finance, whereas a monetary shock that operates through a bank credit channel affects only the supply of bank credit. Empirical evidence suggests that the ratio of commercial paper to bank loans increases following restrictive monetary policy. But Oliner and Rudebusch (1993), Gertler and Gilchrist (1993) show that the decline in the aggregate bank loan to commercial paper ratio is not conclusive evidence of a bank credit channel. They find that a monetary contraction causes a shift of all types of external financing towards large firms. Whereas bank loans to small businesses fall (as well as loans to consumers and loans for real estate), loans to large firms actually increase so that total bank loans to businesses do not change after a monetary contraction. One reason why the overall bank share in external finance declines is that large firms rely less heavily on bank debt than do small firms. Once firm size is taken into account the mix of financing is left unaffected. So while small firms use less credit and large firms use more credit, the macroeconomic effect of this change in distribution is unclear. Furthermore, as discussed below, other differences in small firm - large firm characteristics may account for the changes.

The shift towards commercial paper after a reduction in bank credit supply can also explain why the increase in the spread between commercial paper rates and Treasury bill rates forecasts economic activity (see Bernanke, 1990; Friedman and Kuttner, 1993). Kashyap, Stein and Wilcox (1993) and Romer and Romer (1993) show that the spread between the prime rate on bank loans and the commercial paper rate increases after a monetary contraction. Thus, large firms with good credit ratings would have an incentive to replace costly bank finance with commercial paper. (Note that bank CD rates move very closely with commercial paper rates and both appear to rise relative to TBill rates during times of tight monetary policy.) In this case the increased use of commercial paper reflects a demand effect that results from relative price changes rather than a supply effect through nonprice credit rationing.[12] The alternative

[12] Freedman (1993, p.124) argues that the dynamic pattern of the prime-CP rate spread has been misconstrued. After

interpretation of the increase in the CP-TBill spread can be a cyclical increase in the risk premium for commercial loans[13], or a term structure effect[14].

The empirical evidence appears to indicate that a monetary contraction causes a re-shuffling of all credit lines as banks attempt to move liabilities off their balance sheet and bank customers search for sources of low cost financing. Interpreting this re-shuffling as a result of nonprice credit rationing by banks is debatable. In addition, Post (1992) documents that commercial paper issues must be supported by a backup source of liquidity, generally a bank line of credit or a standby letter of credit. Indirectly, commercial paper remains a liability for banks, albeit one that does not appear on their balance sheets. Small firms may protect their operations from a decline in bank loans by turning to an increased use of trade credit from larger firms (an option suggested by Meltzer, 1960). Calomiris, Himmelberg and Wachtel (1995) present evidence that accounts receivable for CP-issuing firms rise, possibly to finance trade credit to smaller firms. Supporting evidence is found in Gertler and Gilchrist (1994), Eichenbaum (1994) who show that total indebtedness (bank loans, commercial paper, and "other" debt) of small firms initially rises after monetary tightening.

Gertler and Gilchrist (1994) show that after some time small firms reduce both their inventories and their short debt positions in line with a fall in sales. Large firms on the other hand do not. The usual explanation is that large firms do not face the credit constraints that small firms do. Friedman and Kuttner (1993) also argue that reduced cash flows from an (expected) economic downturn and inventory accumulation create a financing deficit for firms. This argument requires that, facing adverse economic conditions and declining sales, it is the optimal response of firms to maintain production at a high level and build inventories. However, the desire to reduce inventory and production as a result of uncertainty and risk aversion may very well counterbalance the usual argument of high costs of adjusting production. The alternative hypothesis must be that small firms are perhaps able to respond more flexibly to changes in economic conditions. Through adjustments in production, employment and inventories, small businesses are possibly more able than large firms to reduce their demand for bank credit. A second alternative hypothesis is that the size distribution of firms differs between industries. Small firms could be concentrated in cyclically sensitive industries (for example construction).

The results on inventory behaviour following monetary policy actions are linked to many studies on the "excessive" sensitivity of business investments to cash flows. Using firm level data, Fazzari, Hubbard and Petersen (1988) found that U.S. firms that do not pay dividends are more sensitive to cash flows and

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adding the contemporaneous change in the policy variable (e.g. federal funds rate), the initial response of the prime-CP spread is negative, because the bank prime rate is sluggish. The initial negative effect on the spread from a rise in interest rates is then gradually reversed (assumedly by an increase in the prime rate) with a very small and insignificant steady state result for the spread.

[13] A problem with the risk-premium explanation is that default by issuers of prime commercial paper is rare. Also, other measures of default risk do not provide similar predictive power for economic activity. In order to exclude the risk premium it would be interesting to examine the spread between commercial paper and bank loan rates. There exists however a serious data problem because the "true" price of bank loans is imperfectly observable as a result of the widespread use of non-price terms of the credit (i.e. covenants, collateral, quantity rationing, etc.).

[14] If the maturities of the two rates in the spread are not carefully matched, a rise in the spread may also represent a term structure effect (Freedman 1993, p.125). Monetary policy changes are usually implemented in small steps. The longer term rate may rise more because of the expectation of further monetary tightening in the near future.

liquidity. Gertler and Hubbard (1988) showed that this applies to tight monetary episodes. In support, Kashyap, Lamont and Stein (1994) find that companies without a bond rating exhibit more sensitivity of inventory investment to liquidity positions. Hoshi, Kashyap and Scharfstein (1991) find that Japanese firms not belonging to bank-centered industrial groups exhibit greater sensitivity of investment to cash flows. The usual interpretation of the "excess sensitivity" results is that a portion of firms faces credit constraints. However, Gilchrist and Himmelberg (1993) show that even in the sample of high-dividend firms cash flow appears to have explanatory power for investment (beyond its role as a projection of future profitability). In general, firms paying high dividends are not likely to be credit constrained. Erickson and Whited (2000) show that earlier results are biased due to measurement error and they find no evidence of liquidity constraints when measurement error is taken into account.

(iv) Banks facing capital and credit constraints

Kashyap and Stein (1995, 2000) find that following a monetary contraction the quantity of loans by small banks falls while that of large banks does not. They interpreted this result as evidence that banks are themselves subject to credit constraints caused by capital market imperfections. However, it is also possible that this phenomenon is a just another demonstration of the large and small firm effect. Elliehausen and Wolken (1990) show that smaller firms tend to do business with local and therefore generally smaller banks. Angeloni, et al. (1995) show for Italy that there is the tendency for large banks to specialize in large loans/firms and for small banks to lend to small firms and Rondi et al. (1993) found that in Italy small firms experience larger drops in sales and inventories, and in bank and trade debt than large firms. On the other hand, Kishan and Opiela (2000) show that undercapitalized small banks respond to monetary policy shocks, emphasizing the capital constraint.

Peek and Rosengren (1995b) find that during the 1990-91 recession in the U.S. state of New England banks that were poorly capitalized shrunk more than comparable institutions with higher net worth. The implication would be that capital market imperfections also apply to banks, because banks cannot (or at least do not) raise the required additional funds, either through increased deposit rates or through more (interbank) borrowing, to avoid balance sheet shrinking. However, again there is a different explanation. The behavioural model used by Peek and Rosengren also shows that banks shrink when certain risk parameters change. For example, banks' balance sheets shrink when the perceived loss ratio for bank loans increases (reducing the net return to the bank) and when poorly capitalized banks must pay a risk premium for deposits or borrowing. These possibilities are normal equilibrium effects and not related to market failure in terms of nonprice credit or capital constraints.[15]

3.2 Additional evidence on monetary policy and bank loans

This section has basically two objectives. First, examine the transmission of monetary policy shocks through the balance sheets of commercial banks. Second, provide further evidence on the importance of bank loans as a possible causal factor for economic activity. The time-series approach is well known to be very limited, but it is useful to provide a cross-country perspective on empirical results. Presented here are results for four countries: Germany, the Netherlands, United Kingdom, and United States. Most monthly and quarterly data on bank deposits, bank loans, bank securities, economic activity and prices are for the period 1957-1993. A data appendix (available on request) provides more specific information on data definitions and sources. In addition to the cross-country perspective, sensitivity to sample periods is examined in a subsample which covers the period since 1977. Choosing the sample splitting date is

[15] For a more extensive review of these studies see Sharpe (1995).

always somewhat arbitrary, but this sample contains most of the experience in the present more deregulated financial systems.

Tables 1 and 2 provide evidence on the empirical relationship between monetary policy, bank lending and money growth. The equations were estimated using quarterly data. To identify monetary policy actions and the associated money supply and credit supply shocks, the short-term interest rate (call money or TBill) is used.[16] Money is defined alternatively as narrow M1 and broad M2/M3. There is no motivation for restricting the analysis to a single money aggregate and one type of bank deposit. Furthermore, national definitions of deposit types differ and any economic significance depends on institutional characteristics with respect to the use of available deposit types. Nominal income is defined as GNP/GDP and is included to capture changes in aggregate demand for money and credit.

Probably the first most important result to examine is the response of both money growth and bank lending to monetary policy actions. Tables 1 and 2 show that bank loans are significantly related to the short-term interest rate, except in the U.K. post-1977 sample period. (Note that significance is determined by the inclusion in the equation based on the final prediction error (FPE) criterion, not by the t-statistics on significance of the long-run effect). The interest rate is significant in explaining M1 money growth in all countries (Table 1), both in the full sample and the post-1977 subsample. The interest rate does not always significantly explain the broader M2/M3 aggregates (Table 2): in the United Kingdom not at all, in Germany not in the most recent period, and in the Netherlands not in the pre-1977 data. The sum of the lagged coefficients provides evidence on the likely long-run effects of a permanent change in the interest rate.[17] A pattern in the results for M1, and to a minor extent for M2/M3, is that the long-run interest rate effect is larger and more significant in the post-1977 samples.[18] Note that, in contrast, the interest rate effect on loans is generally smaller in the post-1977 samples.

An interesting question is also whether money and bank loans are related when we hold monetary policy constant. One strand in the literature argues that bank loans represent the more crucial financial variable, and that money growth is merely a derivative of credit growth. The results are mixed and difficult to interpret. Loans directly affect particular money aggregates in Germany and the U.K. (M1 in the post-1977 sample, M3 before 1977), but not in the U.S. and the Netherlands. In all countries money was clearly a significant influence on bank loans before 1977. But only broad money M2/M3 in the U.K. and the U.S. still affects bank loans after 1977.[19]

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[16] See Bernanke and Blinder (1992) and others. Using (changes in) interest rates as an indicator of policy shocks depends very much on central bank operating procedures and policy reaction functions. The recent VAR and Granger-causality literature emphasizes the problem of shock identification. See, for example, Christiano, Eichenbaum and Evans (1998).

[17] It is important to note that for a given growth rate of nominal income, a hypothetical permanent change in the nominal rate can be seen as a change in the real interest rate. This depends on the assumption that the growth rate of nominal income acts as a sufficient proxy for expected inflation.

[18] A problematic result is the significantly positive long-run response of U.S. M2 to a permanent change in the interest rate in the post-1977 sample. This may represent a small sample bias. Most likely, it is related to findings by other researchers of a "price puzzle" (the observation that restrictive monetary policy is followed by a rise in the price level). The consensus view of this "puzzle" today is that the central bank probably responds to information about future prices, etc., but succeeds in only partially offsetting undesirable developments.

[19] It is difficult to say to what extent these results are affected by changes in the link between the supply of reserves and deposits and deposits and loans, or by changes in financial markets that have removed some constraints on

INSERT TABLE 1 Relationships between monetary policy, bank loans and M1

INSERT TABLE 2 Relationships between monetary policy, bank loans and M2/M3

Figures 4 and 5 show the dynamic effects of monetary policy on bank balance sheets. These graphs follow Bernanke and Blinder (1992) and show the 48-month impulse responses to a shock in the interest rate. Deposits and/or securities evidently react first to a tightening of monetary policy. Bank loans to the private sector are temporarily protected from falling but do fall eventually (note however that significance levels of the responses are missing). The time period associated with loan adjustment differs notably between the U.S. and Germany on the one hand and the Netherlands and the U.K. on the other hand. Banks in the U.K. and the Netherlands protect their loan portfolio for approximately 14 and 20 months, against 4-8 months for the U.S. and Germany. Figure 5 shows the adjustment of bank balance sheets in the more recent period, when banks operated in a more deregulated and more sophisticated financial market environment. There are a few noteworthy changes in the responses. First, in the U.S. banks' responses to interest rate shocks are generally somewhat smaller in the most recent period. In Germany much more of the shock is transferred to banks' securities. In the Netherlands, loans decline much earlier and banks show more eagerness to rebuild their securities portfolios on short notice. Finally, in the U.K. banks apparently succeed in fully shielding loans to the private sector from tight monetary policy.

INSERT FIGURE 4 Banks' balance sheet adjustments after an interest rate shock

INSERT FIGURE 5 Banks' balance sheet adjustments after an interest rate shock, post-1977 sample

Figure 6 provides the impulse response functions of economic activity with respect to tighter monetary policy. The interesting experiment here is to examine whether across countries differences in bank balance sheet adjustments are reflected in corresponding differences in the response of the real economy. Note that in the U.S. bank loans and economic activity tend to follow similar time paths. It has been suggested that this signals a strong link between bank loans and the economy, albeit without clear proof of the direction of causality. Note also however, that in the Netherlands and the U.K. the fact that banks are able to protect their loans from falling does not prevent a very quick decline in industrial production after a rise in interest rates. Apparently the link between economic activity and bank loans is not very strong in a cross-country perspective. Similar examples are found in the post-1977 data.

INSERT FIGURE 6 Response of industrial production to interest rate shocks

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funding loan growth from nondeposit sources.

Some additional insight on the role of bank loans can be gained from comparing the size of output responses in the four countries to the relative share of intermediated credit (loans) in total credit. Table 3 presents data from Borio (1995) on the structure of financing of the non-government sector. This table illustrates a general tendency for all countries to increase the share of market-traded securities in total credit. It is also clear that intermediated credit, including bank loans, still represents the majority of total credit in all countries. More important to the debate on bank loans as a transmission mechanism for monetary policy is the evidence that the relatively strong output responses to monetary policy shocks in the UK and the US do not correspond to the in fact smaller shares of loans in total credit. The same conclusion results when only bank loans are considered.[20]

Table 3 Breakdown of credit to the non-government sector (percentages of total credit)

	Loans from credit intermediaries (by banks)		Traded securities	
country	1983	1993	1983	1993
Germany	98 (82)	94 (84)	2	6
Netherlands	96 (64)	97 (71)	4	3
United Kingdom[a]	97 (54)	81 (45)	3	19
United States	83 (54)	80 (40)	17	20

Source: Borio (1995). [a] When UK building societies are classified as banks the bank loan shares of total credit increase to 93 and 75 percent in 1983 and 1993 respectively.

The final piece of evidence from the estimated VARs is whether shocks to bank loans are likely sources of independent effects in business cycles. Figure 7 shows the responses of industrial production to a positive bank loan shock. These results do not appear to provide very much support for the bank loan channel. Only the U.K. sample shows a strong positive response. The German and U.S. data are more consistent with a positive shock to loan demand in anticipation of worsening economic conditions. In the Netherlands, there is no response at all.

INSERT FIGURE 7 Response of industrial production to loan shock

5 CONCLUDING REMARKS

The credit view emphasizes the impact of monetary policy on the amount and conditions of credit supplied by the banking sector as a main channel of transmission. That banks are in some sense special is

[20] There are two opposing influences at work here. First, the increased dependence on bank credit indicated by the larger share of bank loans in external finance. This causes increased exposure to monetary policy effects through the banking system. Second, stronger customer-bank relationships that may shield bank customers from loan contractions. Banks will make more extensive use of sales of securities portfolios. Following the study by Edwards and Fischer (1994) one must caution against putting to much weight on the differences in institutional characteristics of external finance.

widely accepted. However, whether the bank credit channel is an important part of the aggregate monetary transmission remains questionable. Two elements should be distinguished in the role of bank credit. First, in a system of fractional reserve banking there is a money and credit creation element through which banks increase the amount of economy-wide purchasing power. Second, bank loans to the private sector may be special because banks are highly efficient credit intermediaries. Unfortunately, money, bank credit, and bank loans appear on two sides of the same banking-sector balance sheet and the portfolio adjustments of banks after policy shocks exhibit strong systematic patterns. Consequently, we will probably never be able to estimate with any high degree of confidence the effect associated with the special role of bank loans on a macroeconomic level. At the same time, because of the systematic patterns and because the bank loan channel is likely to be of second-order importance nothing is really gained or lost in our usual view of monetary policy.

The empirical evidence on nonprice credit rationing by banks appears to be negative. In addition, some micro evidence that suggests credit rationing exists for some borrowers is insufficient evidence that rationing also exists on a macro level and that it has large effects. It must be proved that resources denied to one section of borrowers (e.g. small firms) are not channelled to alternative borrowers (e.g. large firms).[21] Furthermore, it must be shown that funds unavailable from one category of credit suppliers (e.g. banks) are not provided by alternative suppliers (e.g. finance companies).[22] Most attempts to establish that changes in bank credit are very special fail to provide conclusive evidence. In general, what appears to be an increase in liquidity and credit constraints may not in fact reflect an inward shift of bank loan supply (the bank lending channel), but a more general deterioration of creditworthiness.[23] In a world of information and/or agency problems, such a "collateral shock" will make it harder for firms to obtain external finance of any sort and banks need not be very special. It is also possible to argue that firms themselves may wish to avoid external finance. Risk-averse agents who face substantial costs of default or bankruptcy reduce the use of bonds and loans when uncertainty increases and/or when their balance sheets comprise few liquid and relatively many illiquid assets.

The empirical results provided in this paper confirm the link between monetary policy shocks and movements in bank loans and money. But, holding interest rates constant, there is no strong evidence that bank loan growth is a primary determinant of money aggregates. There used to be, but less so in the post-

[21] It does not automatically follow that redistribution effects have large macroeconomic consequences.

[22] It does not automatically follow that the higher costs of funds due to less efficient intermediation are excessively prohibitive.

[23] Note that this line of argument is complicated. Wealth effects from changes in interest rates are usually considered a component of traditional analysis! The credit market imperfections approach depends on unfavourable developments in the composition of balance sheets, but for a given level of net worth.

1977 data, a strong relationship from money growth to bank loans. The cross-country evidence on loans and real output does not suggest the presence of macroeconomic credit constraints, because in 3 out of 4 countries an increase in bank loans is linked to a fall in output.

Of the four motives to examine the bank credit channel, both the first and the second require that (bank) credit rationing exists. But the direct and indirect evidence on credit rationing by banks appears to be negative. The third motive requires a stable relationship between changes in (bank) credit and the economy. But the empirical evidence (for example, Friedman, 1988) is that credit and money aggregates share similar breaks and volatility in their relationships with the economy. Elimination of these motives leaves us with just the motive to increase our general understanding of the transmission of monetary policy effects.

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FIGURE 1 Simplified balance sheets of the banking sector and households

Central bank	
Assets	Liabilities
Gold	Bank reserves
Foreign reserves	Currency w/public
Securities w/cbank	

Commercial banks	
Assets	Liabilities
Bank reserves	Demand deposits
Securities w/banks	Time deposits
Loans	Borrowing by banks

Households	
Assets	Liabilities
Currency w/public	Bank loans
Bank deposits	Securities
Securities w/househ	
Borrowing by banks	

FIGURE 2 The Bernanke-Blinder ISLM credit model

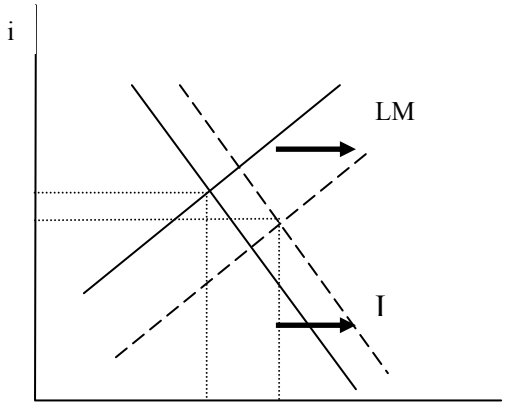


Figure 3 Bank specialness in the aggregate market for total credit

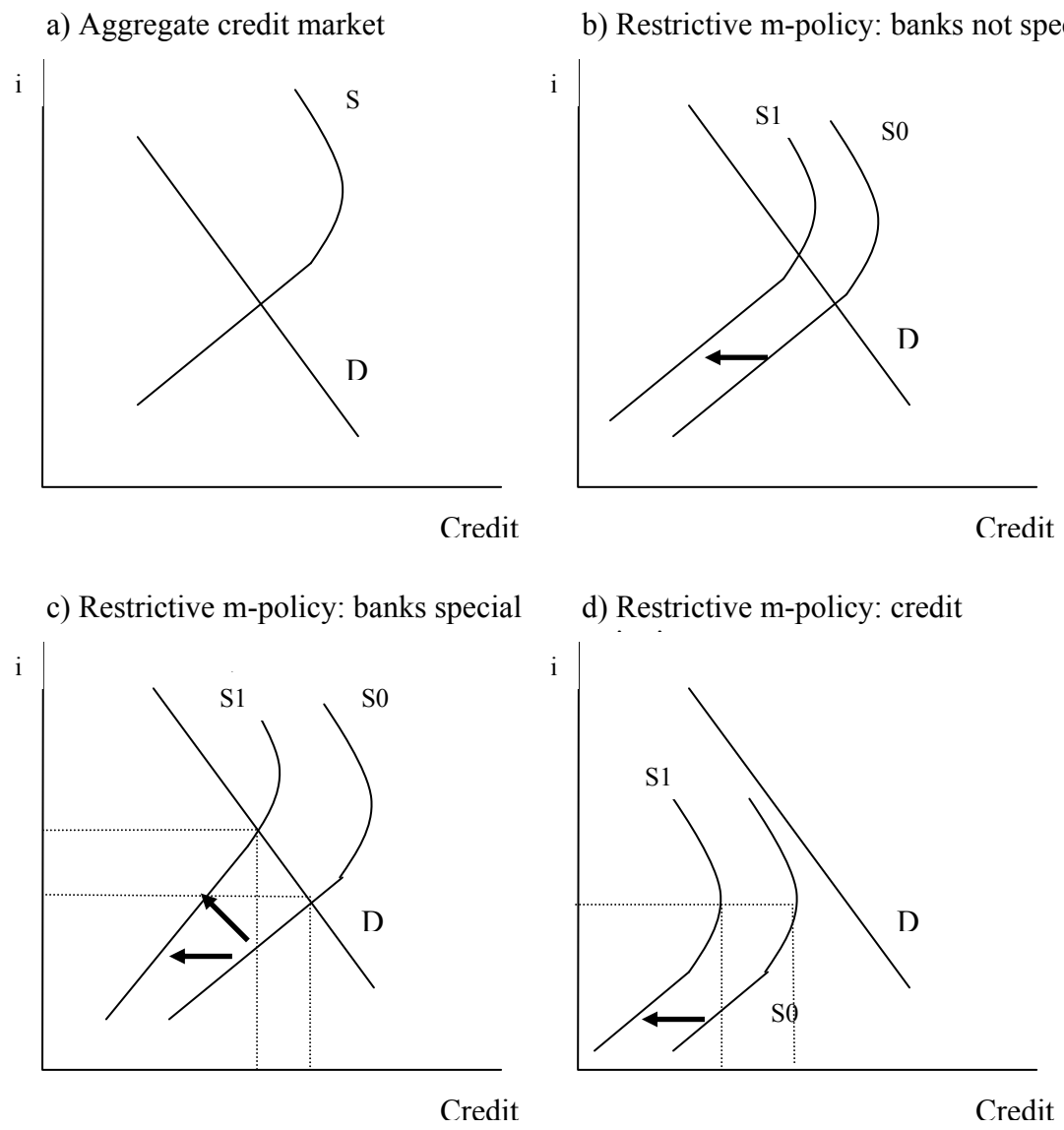
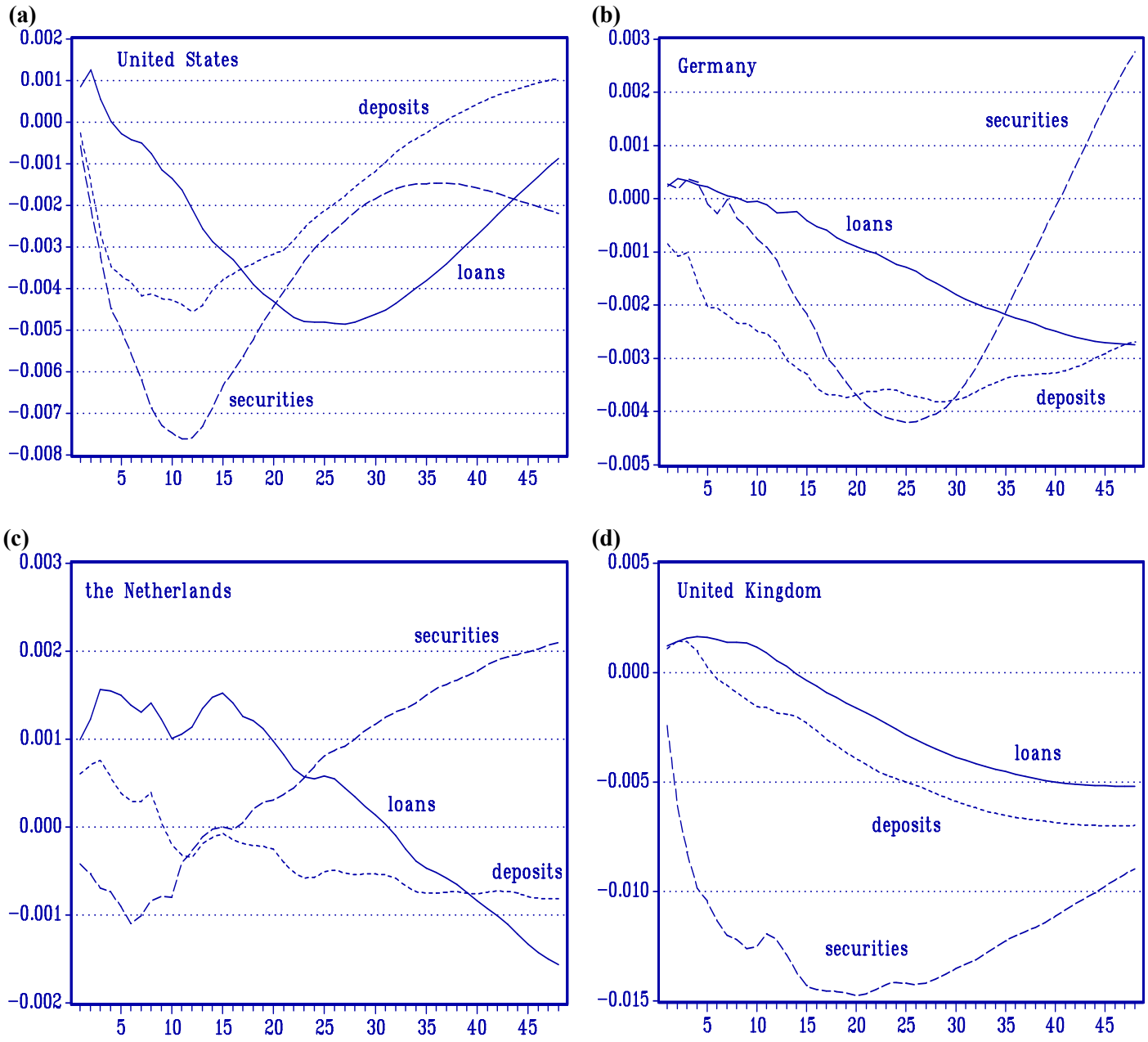
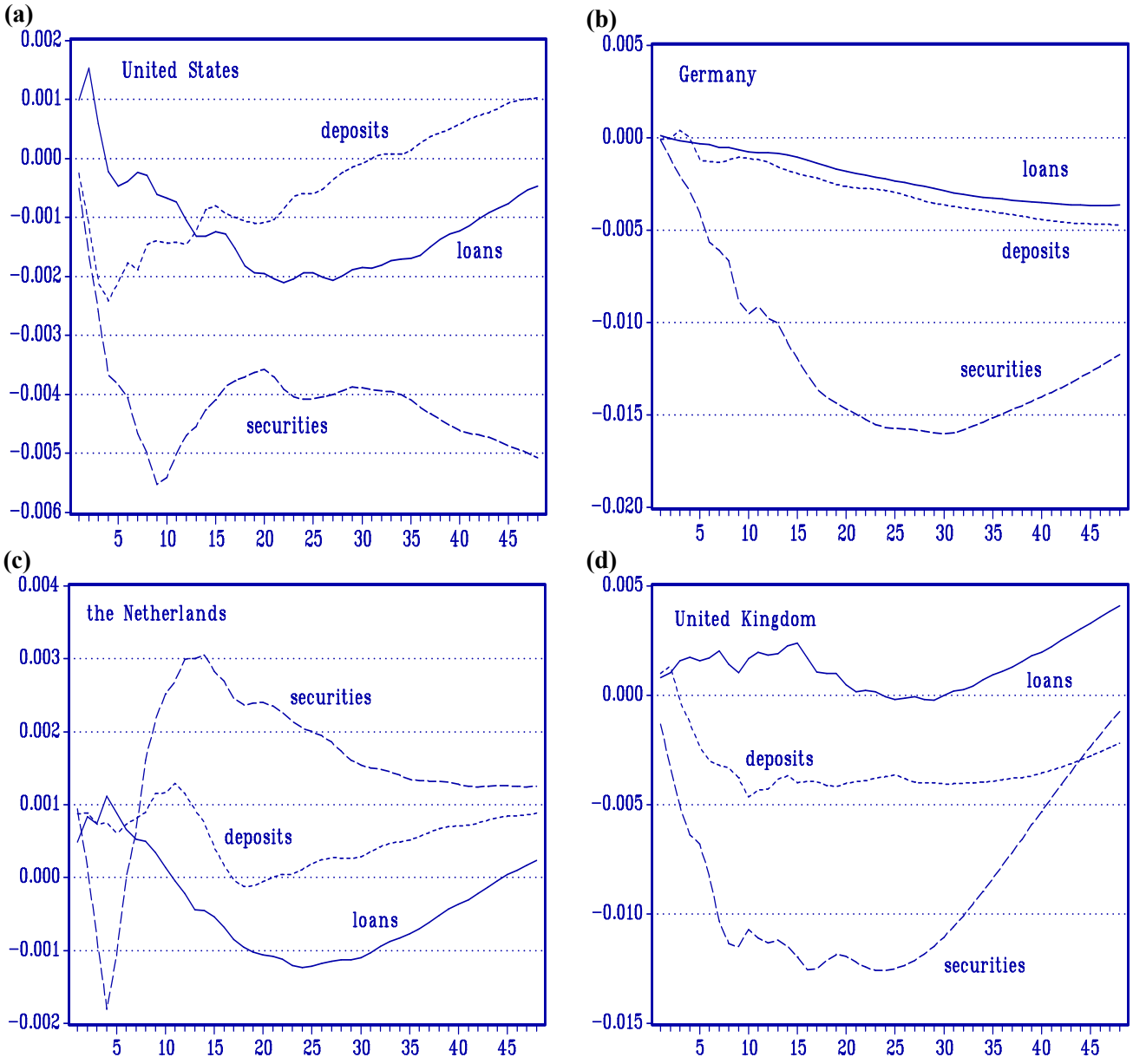


Figure 4 Bank balance sheet adjustments after an interest rate shock



Note: The impulse responses are calculated from six-variable VARs that include log industrial production, the 12-month log change in the consumer price index, a short-term interest rate as the indicator of monetary policy, log real bank loans to the private sector, log real non-currency component of the broad money aggregates M2/M3, and log real securities held by banks. The three bank-balance-sheet variables were deflated by the CPI. A final prediction error search procedure was used to determine whether or not to include a variable, with a maximum of 12 lags.

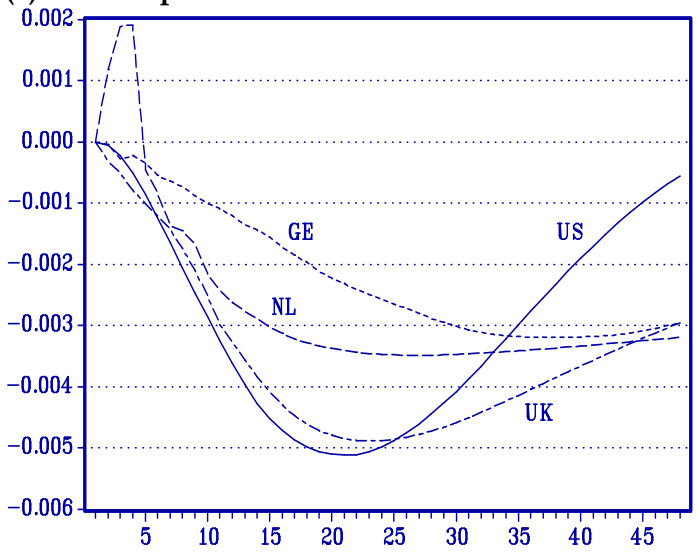
Figure 5 Bank balance sheet adjustments after an interest rate shock, post-1977 subsample



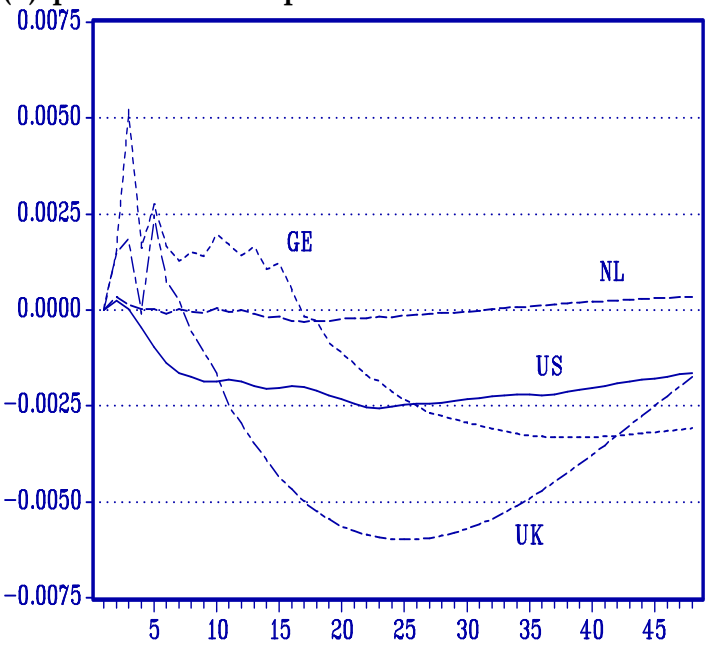
Note: See figure 4.

Figure 6 Response of industrial production to interest rate shocks

(a) full sample

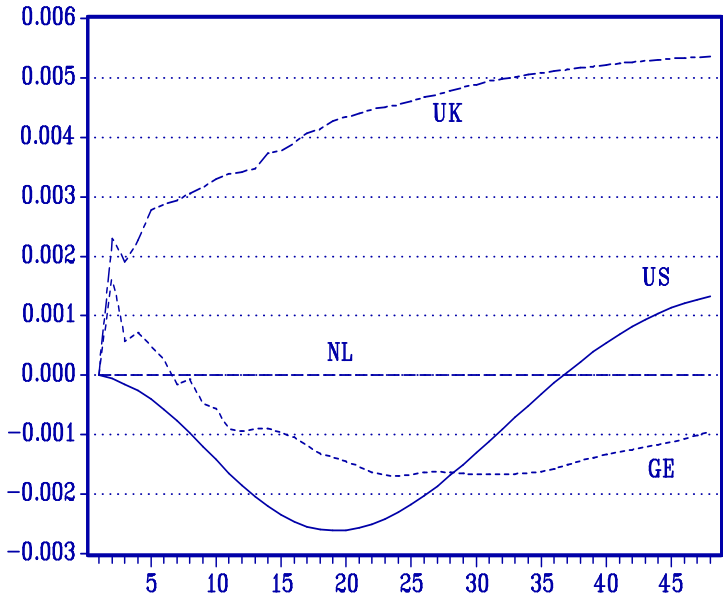


(b) post-1977 subsample



Note: See figure 4.

Figure 7 Responses of industrial production to loan shocks



Note: See figure 4.

Table 1 Relationships between monetary policy, bank loans and M1

	dependent variable				dependent variable			
	M1		LOANS		M1		LOANS	
independent variable	sum coeff. (t-value)	lags	sum coeff. (t-value)	lags	sum coeff. (t-value)	lags	sum coeff. (t-value)	lags
Germany	1962-1989				1977-1989			
M1	0.016 (0.17)	[1]	0.190 (2.92)	[2]	-0.102 (0.73)	[1]	--	
LOANS	--		0.908 (12.9)	[6]	0.174 (0.72)	[6]	0.960 (10.0)	[4]
INCOME	0.180 (2.10)	[1]	0.070 (1.70)	[1]	0.193 (1.47)	[1]	--	
IST	-0.296 (1.43)	[2]	-0.216 (2.06)	[5]	-1.263 (3.89)	[3]	-0.290 (2.55)	[1]
Netherlands	1959-1993				1977-1993			
M1	-0.220 (0.78)	[8]	0.160 (1.22)	[4]	-0.387 (0.72)	[8]	--	
LOANS	--		0.770 (10.9)	[8]	--		0.782 (11.0)	[7]
INCOME	0.707 (3.55)	[6]	--		--		0.464 (3.06)	[6]
IST	0.164 (0.60)	[3]	-0.583 (3.47)	[4]	-0.206 (0.36)	[3]	-0.391 (2.10)	[7]
United Kingdom	1959-1993				1977-1993			
M1	0.833 (11.3)	[6]	0.341 (1.62)	[6]	0.847 (7.06)	[5]	--	
LOANS	--		0.709 (6.25)	[4]	0.212 (2.45)	[6]	0.476 (4.38)	[1]
INCOME	0.193 (2.71)	[2]	0.044 (0.19)	[3]	--		--	
IST	-0.032 (0.26)	[6]	-0.569 (1.64)	[2]	-0.684 (2.31)	[6]	--	
United States	1959-1993				1977-1993			
M1	0.810 (9.64)	[7]	--		0.693 (4.93)	[7]	--	
LOANS	--		0.729 (12.5)	[1]	--		0.586 (5.66)	[1]
INCOME	0.102 (0.84)	[7]	0.170 (2.17)	[1]	0.145 (0.84)	[7]	0.854 (3.86)	[3]
IST	-0.035 (0.44)	[2]	-0.188 (2.14)	[1]	-0.123 (0.99)	[2]	-0.126 (0.98)	[4]

Notes: A search procedure using the final prediction error (FPE) criterion was used to determine whether or not and with how many lags to include a variable in the estimated equation. For each explanatory variable the table presents the sum of the lagged coefficients and its t-statistic, the number of lags is in square brackets. The FPE values (not shown) are taken as the measure of significance. OLS estimates of individual equations.
All variables except interest rates are quarterly log growth rates. Variables M1, LOANS, INCOME, and IST denote M1 money aggregate, bank loans to the private sector, nominal GNP/GDP, and money-market interest rate. The German sample is truncated at the end of 1989 to avoid distortion from unification.

Table 2 Relationships between monetary policy, bank loans and M2/M3

	dependent variable				dependent variable			
	M2/M3		LOANS		M2/M3		LOANS	
independent variable	sum coeff. (t-value)	lags	sum coeff. (t-value)	lags	sum coeff. (t-value)	lags	sum coeff. (t-value)	lags
Germany	1962-1989				1977-1989			
M3	-0.079 (0.28)	[8]	-0.167 (2.70)	[2]	0.430 (1.47)	[4]	--	
LOANS	0.447 (2.91)	[1]	1.047 (13.9)	[6]	--		0.960 (10.0)	[4]
INCOME	--		0.086 (2.11)	[1]	-0.228 (1.84)	[1]	--	
IST	-0.299 (1.55)	[5]	-0.327 (3.17)	[5]	--		-0.290 (2.55)	[1]
Netherlands	1959-1993				1977-1993			
M3	0.502 (3.71)	[8]	0.294 (1.90)	[7]	0.442 (3.13)	[6]	--	
LOANS	--		0.675 (7.86)	[8]	--		0.782 (11.0)	[7]
INCOME	0.318 (3.19)	[4]	--		0.192 (2.31)	[2]	0.464 (3.06)	[6]
IST	--		-0.756 (5.32)	[4]	-0.168 (1.09)	[3]	-0.391 (2.10)	[7]
United Kingdom	1959-1993				1977-1993			
M3	0.818 (7.18)	[8]	0.648 (2.93)	[3]	0.689 (4.92)	[3]	0.577 (2.54)	[3]
LOANS	-0.021 (0.22)	[8]	0.427 (3.21)	[4]	--		0.392 (3.31)	[1]
INCOME	--		--		0.210 (1.17)	[8]	--	
IST	--		-0.980 (2.75)	[1]	--		--	
United States	1959-1993				1977-1993			
M2	0.808 (8.94)	[5]	0.550 (4.84)	[4]	0.863 (7.32)	[7]	0.600 (3.71)	
LOANS	--		0.655 (11.2)	[1]	--		0.458 (4.33)	[1]
INCOME	0.149 (1.20)	[7]	--		-0.031 (0.30)	[2]	0.459 (2.60)	[3]
IST	-0.005 (0.07)	[2]	-0.221 (2.62)	[1]	0.247 (2.74)	[2]	-0.333 (2.57)	[4]

Notes: see table 1.

APPENDIX: Data definitions and sources

Bank deposits, securities, and loans to the private sector. Bank deposits are calculated as the noncurrency compenent of the available money aggregate.

Germany

Bank loans: advances and loans to domestic enterprises and individuals (short term, medium term, long term), plus lending to domestic public authorities (excl. Tbills/Sec/Eq).
Bank securities: banks' holdings of securities (excl. bank bonds).
M1: currency in circulation and domestic nonbanks' sight deposits.
M3: M1, plus domestic nonbanks' time deposits (less than 4 yrs) and savings deposits (3 mth notice).
Sources: Bundesbank database and Monthly Reports.

Netherlands

Bank loans: loans private sector, plus loans to local authorities.
Bank securities: securities total, plus loans to central government.
M1: currency in circulation and domestic nonbanks' sight deposits.
M3: M1, plus domestic nonbanks' time deposits (less than 2yrs), foreign exchange deposits (less than 2yrs), and savings deposits (total).
Sources: DNB worksheets and Quarterly Report.

United Kingdom

Bank loans: advances UK residents total, loans to local authorities, banks acceptances total.
Bank securities: call money and loans discount market, Sterling bills, Sterling investments.
M1: currency in circulation and U.K. nonbank private Sterling sight deposits.
M3: M1 plus U.K. nonbank private Sterling time deposits, plus UK nonbank public Sterling sight and time deposits, plus UK nonbank private and public nonSterling deposits.
Sources: Bank of England Quarterly Bulletin, Statistical Abstract and CSO Financial Statistics Bank of England Quarterly Bulletin, Statistical Abstract and CSO Financial Statistics. Money stock tables and balance sheet monthly reporting institutions.

United States

Bank loans: loans at all commercial banks, excl. interbank loans (sadj). Federal Reserve Bulletin August 1968, November 1973 and Citibase series FCLL
Bank securities: securities at all commercial banks, U.S. government and other (sadj). Federal Reserve Bulletin August 1968, November 1973 and Citibase series FCSGV+FCSNGV
M1: Federal Reserve Bulletin December 1970 and Citibase FM1 (sadj)
M2: Federal Reserve Bulletin December 1970 and Citibase FM2 (sadj)

Other data.

CPI: Basic source is IFS series f64 consumer price index, linked to historical data from OECD Main Economic Indicators Historical Statistics and national source data to avoid rounding errors in index data.
IP: Basic source is IFS series f66c industrial production (sadj), linked to historical data from OECD Main Economic Indicators Historical Statistics and national source data to avoid rounding errors in index data.
Interest rates: Germany IFS f60b, call money rate; Netherlands IFS f60b, call money rate; United Kingdom IFS f60c, 3-mth T-bill rate; United States IFS f60b, federal funds rate.
GNP/GDP: Germany IFS f99ac and f99ar; Netherlands IFS f99bc and f99br, before 1977 national source data; United Kingdom IFS f99bc and f99br; United States IFS f99bc and f99br.