Applied Financial Economics, 2000, **10**, 15–26

The impact of monetary policy and banks' balance sheets: some international evidence

PHILIPPE BACCHETTA and FERNANDO BALLABRIGA*

Studienzentrum Gerzensee, Switzerland, Institut d'Analisi Econòmica (CSIC), Barcelona CEPR and **ESADE, Barcelona*

There has been extensive empirical research on the role of credit markets in the transmission of US monetary policy, but the evidence for other countries is scarce. This paper compares the US experience with a set of 13 European countries by examining monetary VARs including banks' balance sheets in the spirit of Bernanke and Blinder (1992). It is shown that the VAR methodology provides plausible results for interpreting interest rate shocks as monetary policy shocks in most countries. The evolution of bank lending after a monetary contraction is then analysed. For most countries, it is shown that bank loans decline more than money in the medium run. In the short run, however, loans are sticky and react less than money. Also, loans and output responses to an increase in interest rate tend to be more synchronized than those of money and output. This evidence is similar to the US and is consistent with the broad credit channel of monetary policy.

I. INTRODUCTION

There has been long standing research attempting to understand the potential impact and the channels of transmission of monetary policy. In recent years, much attention has been given to the role of credit markets, and in particular of banks. On the one hand, theoretical literature has developed based on recent developments in financial contracts under asymmetrical information.[1] On the other hand, empirical research has increasingly included financial variables, especially bank lending, in the analysis of the effectiveness of monetary policy.

The possible special role of credit or of bank loans is often referred to as the lending or the credit channel of monetary policy. The empirical analysis usually deals only with bank lending and most of the evidence is for post World War II US data.[2] At this stage, however, there is no consensus as to the magnitude or even the existence of a credit channel.[3] Since most of the evidence is for the US economy, it is important to extend the analysis to other countries for at least two reasons. First, it is useful to determine whether the US debate can be extended to other countries with different financial systems and monetary policy procedures. Second, the evidence from other countries may help in the understanding of the role of credit in the monetary transmission mechanism in general.

At least three alternative views of the role of banks in the monetary transmission mechanism have been proposed in the literature. First, there is the standard 'money' view of monetary policy, where bank loans have no special role. Monetary shocks affect output through changes in monetary aggregates, as in the traditional IS-LM model. Bank loans are simply determined by demand and consequently tend to move with investment and output. In this case, we can think of money causing both output and lending. The second approach consists of the narrow credit channel or

[1] See, for example, Batthacharya and Takhor (1993) for a recent survey of the microeconomic literature and Bernanke (1993) or Bernanke *et al.* (1996) for some of its macroeconomic implications.
[2] See Hubbard (1994), Kashyap and Stein (1994) or Barnanke and Gertler (1995) for a review of bank lending and monetary policy. Christiano *et al.* (1996) and Oliner and Rudebusch (1994) provides evidence with total credit. Friedman and Kuttner (1993) examine several alternative financial variables. Miron *et al.* (1994) analyse a longer period for the US.
[3] See Thornton (1994) for a recent survey of this debate.

the bank lending channel (as described, for example, in Bernanke and Blinder, 1988). Under this explanation, monetary policy changes directly affect banks' balance sheets with a reduction in bank loans, which in turn affect output. In this case, output changes are directly caused by changes in bank loans. The third view is called the broad credit channel (Oliner and Rudebusch, 1994) or the balance sheet channel (Gertler and Gilchrist, 1994). Monetary policy affects interest rates and output in a way similar to the money channel or influences output through a different channel. Because of asymmetric information in credit markets, however, outputs might react more strongly than the simple money view would predict. For example, a monetary tightening reduces firms' collateral or cash flow, which makes it more risky to lend to some firms and implies a 'flight to quality' in lending. In other terms, bank loans magnify the impact of monetary policy.[4]

Early literature has examined this issue by looking at the relationship between money and output and bank loans and output either through correlations or through Granger-causality tests.[5] It has generally concluded in favour of the money channel. Using a somewhat different approach, Romer and Romer (1990) (henceforth RR) and Thornton (1994) also favour the money view and reject the narrow credit view. On the other hand, Bernanke and Blinder (1992) (henceforth BB) use Vector AutoRegressions (VARs) to examine the role of bank loans. They conclude that their evidence is consistent with the broad credit channel, as the response of unemployment after a monetary shock is related to the one of bank loans. Actually, the evidence presented by BB and RR is similar. They both show that just after a monetary contraction, monetary aggregates and bank liabilities contract more than bank loans. After several months, however, bank loans have declined more than money. Furthermore, bank loans move contemporaneously with real activity.

The evidence on the timing of the response of aggregate banks' balance sheets and real activity to monetary shocks is of interest in and of itself. Any serious macroeconomic model with financial intermediaries should be able to reproduce this behaviour. Moreover, this evidence represents the starting point in the understanding of the role of credit or financial intermediaries in the transmission channel of monetary policy. Although the aggregate evidence may not be sufficient to determine the precise transmission channel, as the different interpretations by BB and RR illustrate, it should at least be consistent with theoretical predictions.

The purpose of this paper is to provide systematic evidence on the evolution of banks' balance sheets and output in response to a monetary shock by examining 13 European countries in addition to the US. We apply monetary VARs in a way similar to BB and use the International Monetary Fund (IMF) *International Financial Statistics* (IFS) data. We apply the same VAR methodology to our sample of 14 countries and examine the impact of shocks to the money market interest rate and to bank reserves on four other variables: bank deposits (money), bank loans, consumer prices, and output. The advantage of our approach is to use the same methodology and data source for all countries.

There are actually two basic issues involved in such an exercise. The first one is the identification of monetary policy in VARs. Monetary policy procedures vary across countries and over time, so that the identification of policy changes should be done on a country by country basis. For example, BB go at great length to show that in the US the Fed funds rate is an adequate measure of monetary policy for the period 1959 to 1979. Is it possible to use interest rate shocks as measures of monetary policy in other countries as well? The answer to this question is crucial and is preliminary to the analysis of other variables. Positive evidence on this question is given by Sims (1992) who analyses monetary VARs for the G-5 countries. We provide evidence for 10 additional European countries. We show that an intertest-rate shock has a similar impact in most countries (with three exceptions). On the other hand, shocks to bank reserves have different impacts across countries and are usually insignificant. Consequently, and similarly to most of the recent literature, we consider interest rate innovations as good proxies for monetary policy stance in most countries.

The second issue is the behaviour of banks' balance sheets as described above. Basically, one can ask whether this evolution is similar across countries. Evidence in this direction has been provided by Buttiglione and Ferri (1994) for Italy, Copelman and Werner (1995) for Mexico, Dale and Haldane (1995) for the UK, Escrivá and Haldane (1994) for Spain, and Tsatsaronis (1995) for the UK, Germany and Japan.

By applying a common methodology, and despite the numerous country-specific institutional details and potential differences in data definition, we show that for most European countries the reaction of banks' balance sheets to an interest rate shock is similar to the US. One or two years after an interest rate increase, bank loans decline more than money. In the short run, however, loans appear to be more sticky and money initially declines more. Also, after a positive interest rate shock, the decline of output tends to be more synchronized with the decline of loans. Overall, the evidence can be

[4] A fourth view would be that both money and loans react to non-monetary shocks as in King and Plosser (1984).
[5] See King (1986) for an early study and Ramey (1994) for a survey.

interpreted as consistent with the broad credit channel, but not with the narrow one.

The rest of the paper is divided as follows. The next section briefly discusses the data and describes the general specification of our analysis. Section III presents the results and Section IV provides a discussion and conclusions. A final Appendix gives a more detailed description of the data used.

II. THE METHODOLOGY

We follow a methodology similar to BB. They estimate a VAR with six variables (the Federal funds rate, the unemployment rate, the consumer price index, bank deposits, bank loans, and bank holdings of securities) and compute the impulse response functions from a shock to the Federal funds rate. We also present evidence for a six-variable VAR, but instead of bank holdings of securities[6] we include bank reserves. We do so because bank reserves are sometimes used as a measure of monetary policy changes as they are under the control of the central bank.[7] This specification includes the relevant bank variables, but probably omits other important variables.[8]

More specifically, we consider the following six variables: real bank reserves, H, a short-term money market interest rate, R, real bank deposits, D, real bank loans, L, a consumer price index, P, and industrial production, Y. All data come from the IMF *International Financial Statistics* and the precise series are defined in the Appendix. We use quarterly data for 14 countries: US, UK, Germany, France, Italy, Spain, Austria, Denmark, Netherlands, Sweden, Norway, Finland, Switzerland and Ireland. The sample period varies from country to country and is displayed in the Appendix. The longest sample is 1963:1–1933:2 for the UK and the shortest is 1978:3–1992:4 for Ireland. The same exercise was conducted with monthly data for some of the countries with very similar results. As fewer countries have monthly data, we have opted to work with quarterly series.

Although the systems considered may contain integrated or even cointegrated variables, we have proceeded to estimate by Ordinary Least Squares (OLS). Sims *et al.* (1990) show that in the context of unit roots and potential long-run relationships the OLS procedure provides consistent estimates. Further, Park and Phillips (1989) and Ahn and Reinsel (1990) show that the OLS estimator has the same asymptotic properties as the maximum likelihood estimator with the cointegration restrictions imposed.

The main issue with monetary VARs is the well-known identification problem. The objective of a VAR is to determine the impact of unanticipated changes in monetary policy. The challenge is to distinguish policy changes from endogenous changes in monetary variables. As the issue has been discussed more formally by other authors (e.g. see Sims, 1988; Bernanke and Blinder, 1992; or Christiano and Eichenbaum, 1992) we only provide an informal discussion.

The most common solution to this problem is to diagonalize the variance–covariance matrix of the VAR system using a triangular orthogonalization scheme; the so-called Choleski scheme. While this approach has the advantage that shocks to the VAR system can be identified as shocks to the endogneous varaibles, it relies on a particular ordering of variables. Policy variables are often placed first in the system, implying that these variables respond only to the lagged values of other variables, like output and inflation, while the latter respond contemporaneously to the policy variables. When the off-diagonal elements of the variance–covariance matrix of innovations are large, this approach is obviously restrictive. In the literature, the problems associated with such a specification have been tackled in various ways. First, one might use different orderings of the variables in the VAR (as, for example, in Christiano *et al.*, 1996). An alternative direction is to use additional tests to determine the variable that will be placed first in the VAR. This is the approach taken by BB for the US. As this depends strongly on the institutional set-up and the operating procedure of monetary policy, applying such an approach to 14 countries would represent a formidable task. Finally, one might impose more structure on the VAR (for example, as in Bernanke, 1986; Galí, 1992; or Gerlach and Smets, 1995). As with Choleski schemes, the problem here is that the results tend to depend on the specific set of identifying restrictions, but in contrast these restrictions tend to be more credible.

The ordering has little or no effect, however, if the contemporaneous correlations are low among, at least, the relevant innovations for the empirical facts analysed. This is actually the case in this study, since the correlations among the monetary block innovations (H, R) and between the block itself and the rest of the system turn out to be low in general. This implies that the effects of shocks to monetary variables are basically independent of their position in the orthogonalization ordering. Because of this, and for

[6] An approximation of their behaviour can be deducted by subtracting loans from deposits.
[7] Christiano and Eichenbaum (1992) argue that in the case of the US, only a fraction of bank reserves, non-borrowed reserves, should be used. In the analysis, we consider total reserves as this distinction cannot be generalized to other countries.
[8] The exchange rate is a strong candidate as shown in Eichenbaum and Evans (1995) for the US. Moreover, as European economies are more open the exchange rate might be even more important.

symmetry with BB, we have chosen the specification where monetary variables come first. Then, as an identification test, we check whether macroeconomic variables respond in 'plausible' ways to monetary policy changes.[9] As we show below, shocks to short-run interest rates broadly satisfy such a test for most countries, while bank reserves shocks do not.

To be concrete, the results shown in this paper correspond to the ordering (R, H, D, L, P, Y,). This VAR ordering is such that policy variables may contemporaneously affect banks' balance sheets, which may also affect prices and output. It relies on the assumption that because of delays in the release of economic data, the monetary authority will not respond contemporaneously to developments in the private sector,[10] which may on the contrary react to policy actions. The order of policy variables itself implies that interest rate innovations may account for part of the contemporaneous variability in bank reserves. However, the main results of the paper do not depend on the specific ordering. Similar results (not shown in the paper) are obtained when policy variables are placed last in the VAR. This confirms the conclusions drawn from the contemporaneous correlations matrix.

Notice that our model includes two monetary aggregates. First, H is a proxy for monetary base (without currency in circulation) and, second, D, is a proxy for a broader monetary aggregate (like M2, but without currency). This is unusual in monetary VARs. We include them because, as we have mentioned, bank reserves are sometimes used as a measure of monetary policy changes as they are under the control of the central bank. On the other hand, we include a broader aggregate, as we would like to shed some light on the distinction between the 'money' and the 'lending' channel. Presumably, if there exists a lending channel, it must be reflected in credit movements that are different from movements in a monetary aggregate broader than bank reserves.

As for the interest rate R, we use a short-term money market rate. These rates are generally not controlled directly by the central bank. However, they closely reflect the changes in monetary policy as they basically represent the price of liquidity to financial intermediaries (see Bank for International Settlements, 1994).

Several modifications of the model described above have been examined. In particular, we use monetary and banking variables in nominal instead of real terms. We also replaced bank reserves with the monetary base to represent H. Although there were some marginal differences, the general outcome remained robust to these changes.

III. THE RESULTS

Using the above specification, we estimated the VARs for the 14 countries. Then we computed the impulse response functions from a one standard-deviation shock to each variable with plus and minus one standard-deviation bands. The latter were computed with a Monte Carlo experiment involving 100 draws from the distribution of the estimated VAR coefficient vector.[11]

In this section, we examine the results relevant for the two issues outlined in the introduction. First, we consider the output response to monetary shocks which we use to evaluate the identification problem. Second, we examine the behaviour of bank variables. We leave aside other, potentially interesting, issues. For example, we find the so-called price puzzle, where the price level increases after a monetary contraction (see Sims, 1992; Christiano *et al.*, 1996), in 10 out of 14 countries. Moreover, we find evidence that is generally consistent with the so-called liquidity effect, i.e. a negative relationship between monetary aggregates and short-term nominal interest rates (see Christiano and Eichenbaum, 1992).

The output response to monetary shocks

Figure 1 shows the output response to an interest rate shock over 12 quarters. The dashed lines represent the one standard-deviation bands. The striking result is the negative response of output in 11 out of 14 countries. The decline is larger than the one standard-deviation margin. The exceptions are Norway, Finland and Switzerland, where the output response is small and even somewhat positive. The widespread negative impact of the interest rate on output is an interesting result[12] and will be discussed further in the following section.

On the other hand, the output response to shocks in bank reserves (not shown here) turns out to be small in all countries. As a matter of fact, the one standard-deviation bands usually include the zero line, which indicates that once sampling uncertainty is taken into account we cannot assert that shocks to bank reserves have an impact on output. Norway and Finland are the only exceptions to

[9] This identification procedure is typically used in the literature, but is obviously based on a weak criterion. See Rudebusch (1996) or Thornton (1996) for a critical discussion.

[10] Although the absence of contemporaneous reaction of R to Y and P is more difficult to advocate with quarterly than with monthly data, the results are similar with the two frequencies.

[11] This makes a total of 504 impulse response functions. Only a subset is shown in this paper, but all graphs are available from the authors upon request.

[12] This result was also obtained by Sims (1992) for five of the 14 countries examined here.

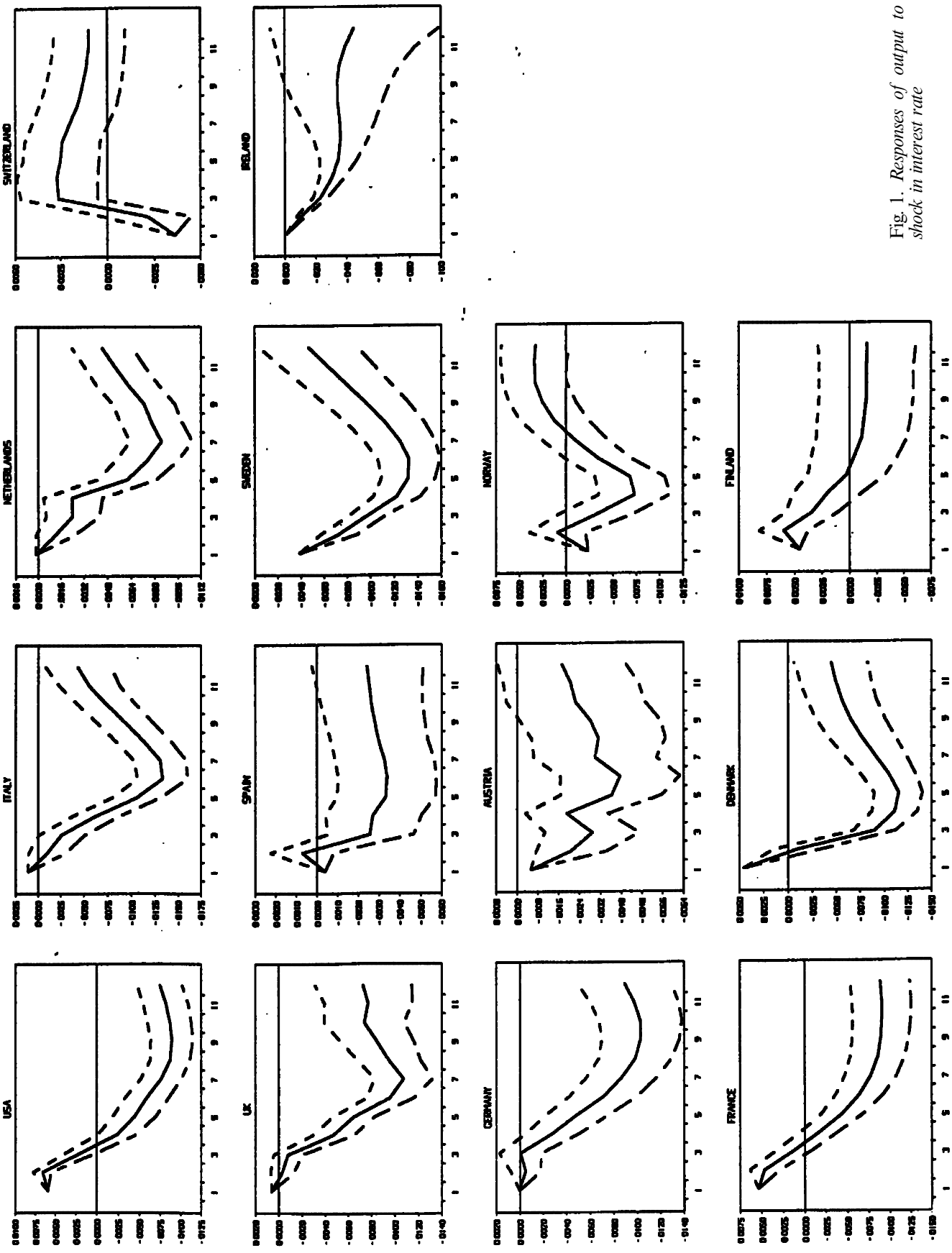

Fig. 1. *Responses of output to a shock in interest rate*

this pattern, with small but positive and significant output response to a bank reserves expansion.

Banks' balance sheets

We now focus on the impact of an interest-rate shock on bank deposits and loans. In Fig. 2, we present the impulse response functions of loans and deposits to a one standard-deviation interest rate shock (for clarity, we do not include standard-deviation bands in this case). The evidence for the US is similar to BB's findings. After an interest rate shock, both variables tend to decrease (in BB, loans initially rise slightly). The initial decrease in deposits, however, is larger than the decline in loans. Over time, it is the drop in loans that becomes larger than the drop in deposits. BB take this evidence as consistent with the credit view of monetary policy. We will discuss the interpretation of the results in the following section.

If we consider the European countries where interest rate innovations can be taken as proxies for monetary policy stance, in basically all cases loans and deposits decline after a monetary tightening (the exception is Austria, with an increase in loans), although the extent of the decline differs from country to country. Some countries, like the UK or the Netherlands, experience only a small decline in both loans and deposits. Other countries have a reaction more similar to that of the US. The interesting issue, however, is the differential reaction of loans and deposits. Aside from Austria, in most countries the reaction is similar to the US: initially, bank deposits decline more than loans (except in Sweden and Ireland), but over time the decline in loans is larger (except in France).

It was mentioned in the previous subsection that shocks to bank reserves in Norway and Finland might also represent changes in monetary policy, as they have a positive effect on output. In these countries, it turns out that the reaction (not shown) of bank deposits to these shocks is initially larger than the one of bank loans, but over time the increase in loans is larger.

If we now compare the reaction of output with that of loans and deposits, we observe that deposits tend to lead output (Fig. 3) in all the European countries which reproduce deposits and loans reaction patterns to shocks in the interest rate similar to those of the US. On the other hand, loans and output responses tend to be more synchronised (Fig. 4), except for Denmark; this is even the case for Ireland and France, which conforms only partially with the US pattern. However, with the exception of Ireland, France, and maybe the Netherlands, this synchronization tends to be weaker than in the US case.

IV. INTERPRETATION AND CONCLUSIONS

The previous section has presented evidence on monetary VARs including banks' balance sheets for the US and 13 European countries. First, it has been shown that an interest-rate shock has a clear negative impact on output in 11 out of 14 countries. This evidence could be interpreted as an indication that interest rate innovations are reasonable proxies of monetary policy changes, as it is compatible with models embedding sources of short or medium run non-neutralities.[13] This is an interesting result, since monetary policy procedures and other institutions vary sometimes substantially across countries. It may imply that such differences have a small impact on macroeconomic performance. This interpretation would be in line with the recent literature on monetary VARs. However, as stressed by Rudebusch (1996), the atheoretical nature of VARs does not allow for an unambiguous interpretation of the results and other mechanisms may be consistent with the evidence. A more careful study of the identification problem of monetary policy in each country, including institutional differences, should shed more light on the issue. This analysis would also be facilitated by a better theoretical framework to interpret the evidence.[14]

The other important result from our analysis is the reaction of banks' balance sheets. If we consider interest-rate shocks in the 11 countries mentioned above and bank reserves shocks in Norway and Finland, the reaction is similar to the US case. In the medium run (after one or two years) the decline in bank loans is stronger than the decline in deposits. The only exceptions are France and Austria. On the other hand, in the short run, bank deposits initially react more than loans. The exceptions here are Sweden and Ireland. Hence, the reaction of banks' balance sheets to monetary shocks is similar to the US in most European countries. Further research should attempt to explain the exceptions to this general pattern.

The differential reaction of loans and deposits might shed some light on the transmission channel of monetary policy. Right after a monetary contraction, banks experience a decline in their deposits which is larger than the decline in their loans. Hence, banks have to change the portfolio composition of their assets by reducing the proportion of non-loans, typically government securities.[15]

[13] Of course, a more sophisticated data pattern compatible with an explicit non-neutrality mechanism could be required as an identification test; for instance, one compatible with a liquidity effect transmission channel, which, as we have mentioned, is consistent with our empirical results. We take, however, the output contraction as the key identification piece of a monetary policy tightening.

[14] See Cochrane (1995) for a step in this direction.

[15] The behaviour of securities has not been examined explicitly in the analysis, but can easily be examined by using banks' balance sheets. BB show the evolution in their VAR impulse responses.

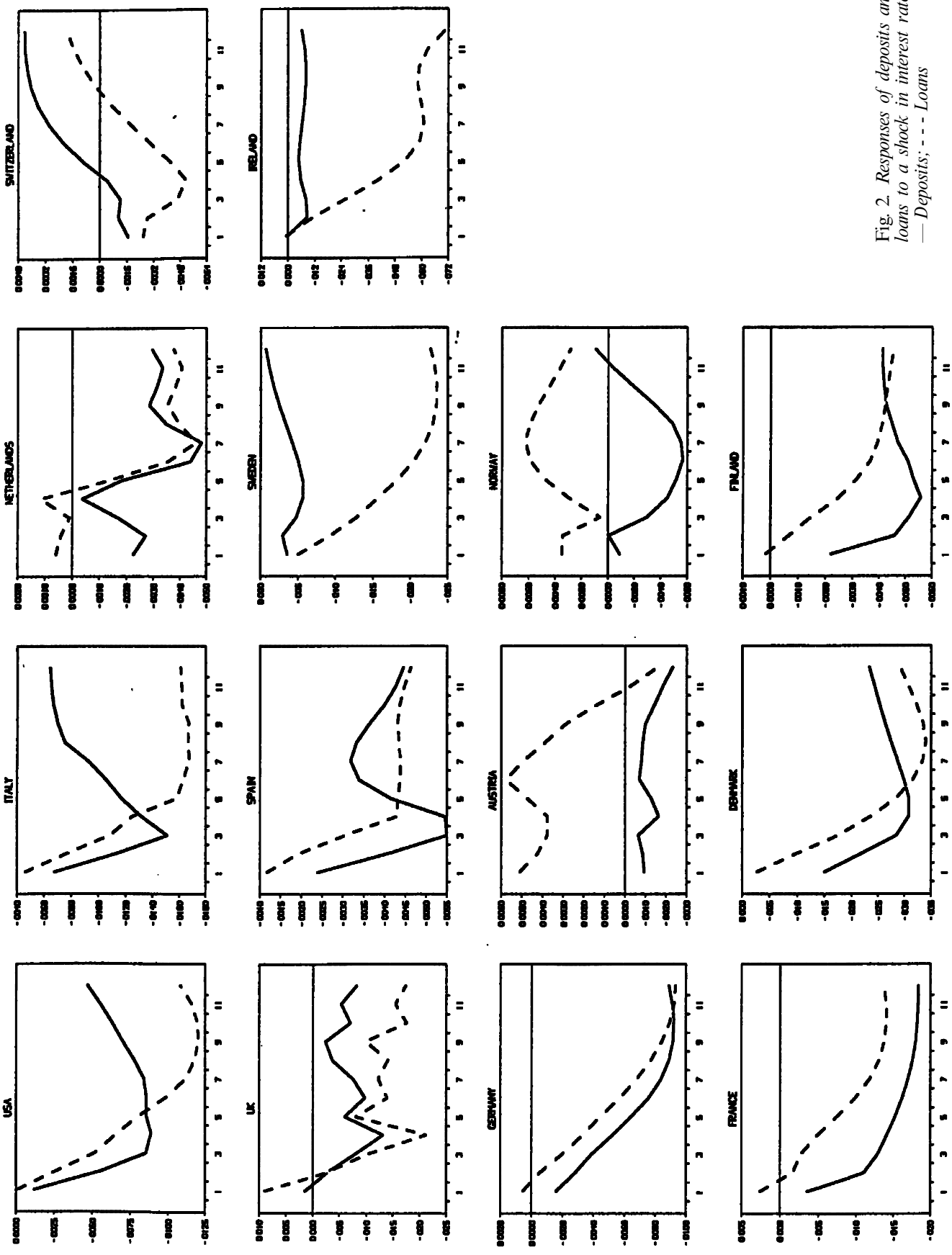

Fig. 2. *Responses of deposits and loans to a shock in interest rate.* — *Deposits;* - - - *Loans*

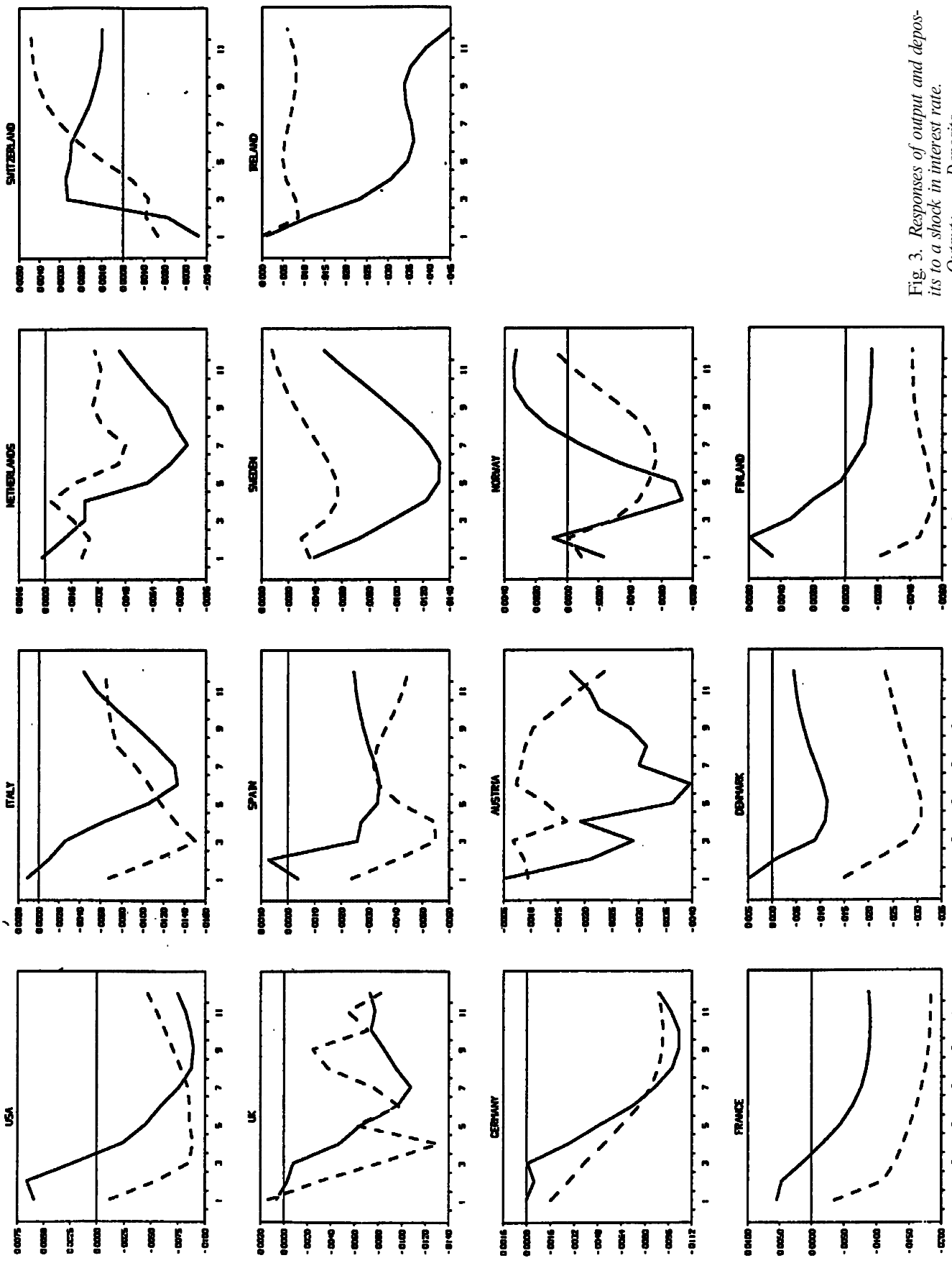

Fig. 3. *Responses of output and deposits to a shock in interest rate.* — *Output*; - - - *Deposits*

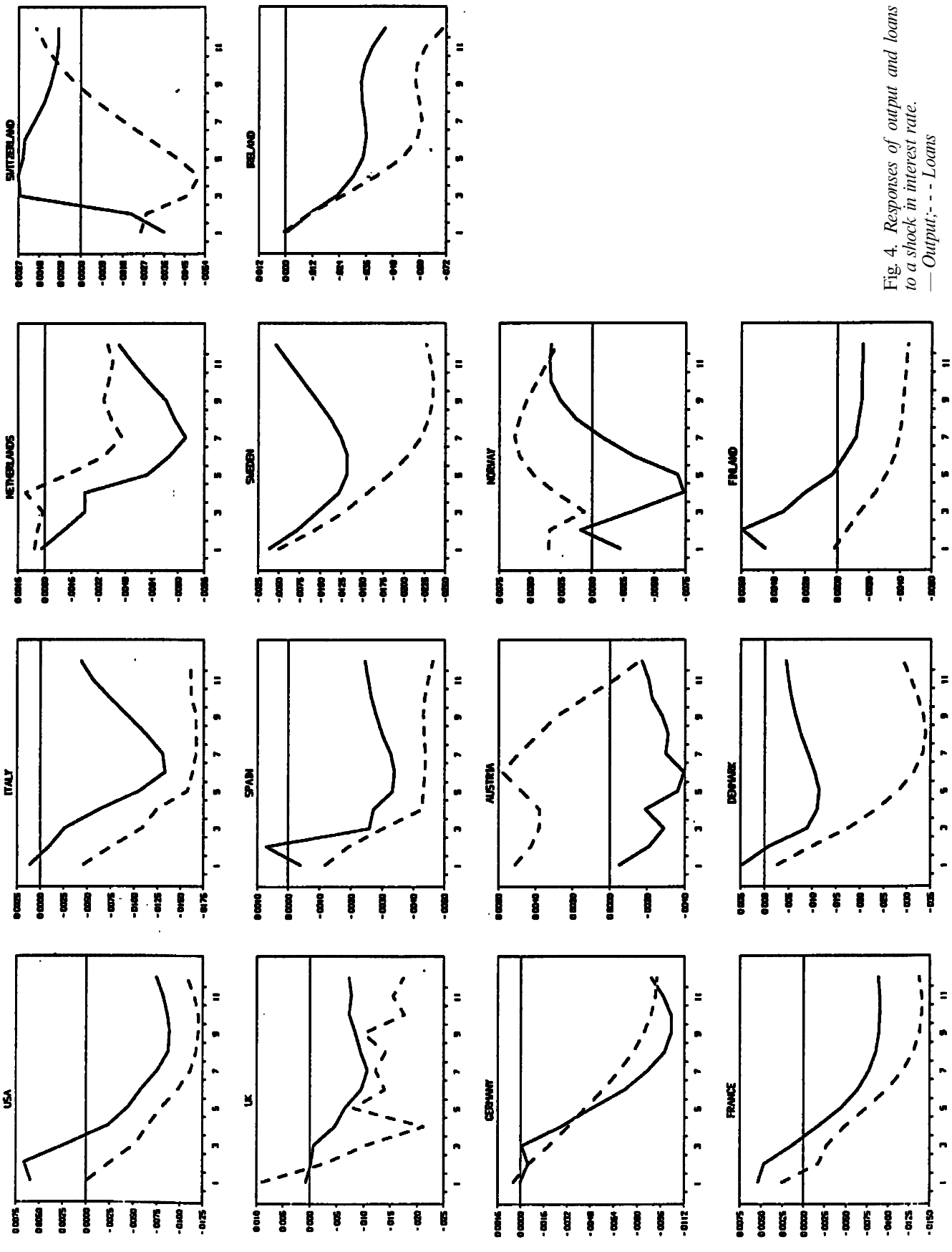

Fig. 4. *Responses of output and loans to a shock in interest rate.*
— Output; - - - Loans

Over time, however, the portfolio composition of banks evolves and the proportion of securities increases to a level higher than before the shock.

These results do not represent any real test of theory, but empirical regularities against which various theoretical conclusions may be compared. Several explanations have been offered in the literature. First, the initial stickiness of bank loans is justified by BB as due to the existence of contractual commitments (e.g. credit lines) between banks and their customers. These commitments are much more limited for deposits. On the other hand, RR argue that banks have no reason to change their bank loans after a monetary contraction and compensate the decline of deposits by issuing CDs that are not subject to reserve requirements. While relevant for the US, the latter explanation may not apply to other countries with different institutions. However, Bacchetta and Caminal (1993) show that CDs are not necessary to observe such behaviour,[16] as banks can sell their securities to consumers. As deposits by consumer decrease, their bond holdings are likely to increase (for a given interest rate) and this increase may be larger than the increase in bonds supply implied by a restrictive open market operation. Consequently, banks can easily decrease their securities holdings more than loans. This explanation is in line with the money view.

The subsequent evolution of loans can also be explained in different ways. First, as it is approximately synchronized with output, the decline in loans can simply represent a decrease in the demand by firms. This is the money view, supported by RR. Alternatively, in line with the broad credit view, BB argue that over time there is a so-called 'flight to quality', whereby banks are reluctant to lend to the more risky firms and would rather hold safe government securities. Hence, the evolution of bank loans is consistent with both the broad credit channel and the money channel. However, consistently with the results of Thornton (1994), there is little support for the narrow credit channel as the lagged response of loans is difficult to reconcile with the hypothesis that loans cause output.

Since the evidence is generally consistent with the broad credit view in European countries, but cannot be distinguished from the money channel, further research in this direction is warranted. First, countries where the behaviour of bank loans differs should be examined more closely to determine the source of the difference. More generally, cross-country differences may provide useful information. In particular, different institutional set-ups might coincide with differences in banks' behaviour. Hence, comparative analyses of the type conducted by Cottarelli and Kourelis (1994) are of great interest.[17] Another obvious line of research is to go beyond aggregate data, as it has been done for the US.[18] Progress in this direction is obviously constrained by the data availability. In particular, firm-level data, if available, are usually given on an annual basis in most countries.

Finally, more progress could be made on the macroeconomic role of credit markets if we had a better understanding of monetary policy. Whether it is the money view or the broad credit view, our understanding of the real impact of monetary policy is limited. For example, there are few general equilibrium monetary models analysing the impact of monetary policy on banks' behaviour.[19] Any development made on this front would be helpful in understanding the issues examined in this paper.

ACKNOWLEDGEMENTS

We are grateful to Stefan Gerlach, Klaus Neusser, Javier Vallés, Walter Wasserfallen, and an anonymous referee for comments on a previous draft and to Anna Santamaria for help with the data. Partial financial support from CICYT grant #PB/95-0130 (Spanish Ministry of Education and Science) is gratefully acknowledged.

REFERENCES

Ahn, S. K. and Reinsel, G. C. (1990) Estimation for partially nonstationary multivariate autoregressive models, *Journal of American Statistical Association*, **85**, 813–23.

Bacchetta, Ph. and Caminal, R. (1993) Liquidity constraints, banks, and the real effects of monetary policy. Working Paper, Fundacion BBV, December.

Bank for International Settlements (1994) *National Differences in Interest Rate Transmission*, Basle, March.

Battacharya, S. and Takhor (1993) Contemporary banking theory, *Journal of Financial Intermediation*, **3**, 2–50.

Bernanke, B. (1986) Alternative explanations of the money-income correlation, *Carnegie-Rochester Series on Public Policy*, **25**, 49–99.

Bernanke, B. S. (1983) Credit in the macroeconomy, *Federal Reserve Bank of New York, Quarterly Review*, Spring 1992–3.

Bernanke, B. and Blinder, A. S. (1988) Credit, money, and aggregate demand, *American Economic Review*, **78**, 435–39.

[16] They examine two general equilibrium macroeconomic models explicitly incorporating banks' balance sheets and monetary policy, but without asymmetric information. The models include government bonds that are held by both banks and consumers.

[17] They attempt to explain differences in lending rate stickiness across countries.

[18] For example, Gertler and Gilchrist (1993, 1994) disaggregate bank lending between small and large firms. They find that a monetary contraction leads to a sharp restriction of bank loans to small, but not to large firms. Kashyap *et al.* (1993) examine the evolution of commercial paper as an alternative source of funds for firms. Various microeconomic investigations have also been undertaken (See Hubbard, 1994, for a discussion of the results). Several of these studies are consistent with the broad credit view. The work of Dale and Haldane (1993) and Escrivá and Haldane (1994) for European countries goes in this direction with support for the credit view.

[19] See Fuerst (1994a, 1994b) for examples.

Bernanke, B. and Blinder, A. S. (1992) The federal funds rate and the channels of monetary transmission, *American Economic Review*, **82**, 901–21.
Bernanke, B. and Gertler, M. (1995) Inside the black box: the credit channel of monetary policy transmission, *Journal of Economic Perspectives*, **9**, 27–48.
Bernanke, B., Gertler, M. and Gilchrist, S. (1996) The financial accelerator and the flight to quality, *The Review of Economics and Statistics*, **78**, 1–15.
Buttiglione, L. and Ferri, G. (1994) Monetary policy transmission via lending rates in Italy: any lessons from recent experience? Banca d'Italia, Discussion Paper No. 224.
Christiano, L. J. and Eichenbaum, M. (1992) Identification and the liquidity effect of a monetary policy shock. In *Business Cycles, Growth and Political Economy,* A. Cukierman, L. Z. Hercowitz, and L. Leiderman (eds), MIT Press.
Christiano, L. J., Eichenbaum, M. and Evans, Ch. (1996) The effects of monetary policy shocks: some evidence from the flow of funds, *The Review of Economics and Statistics*, **78**, 16–34.
Cochrane, J. H. (1995) Identifying the output effects of monetary policy. NBER WP No. 5154, June.
Copelman, M. and Werner, A. M. (1995) The monetary transmission mechanism in Mexico. Board of Governors of the Federal Reserve System, International Finance Discussion Papers No. 521.
Cottarelli, C. and Kourelis, A. (1994) Financial structure, bank lending rates, and the transmission mechanism of monetary policy, *IMF Staff Papers*, **41**, 587–623.
Dale, S. and Haldane, A. G. (1995) Interest rates and the channels of monetary transmission: some sectoral estimates, *European Economic Review*, **39**, 1611–26.
Doan, T. (1992) *RATS User's Manual Version 4.* Estima. Evanston, IL.
Eichenbaum, M. and Evans, C. (1995) Some empirical evidence on the effects of monetary policy shocks on exchange rates, *Quarterly Journal of Economics*, November, 975–1009.
Escrivá, J. L. and Haldane, A. G. (1994) The interest rate transmission mechanism: sectorial estimates for Spain. Banco de España, Working Paper No. 9414.
Friedman, B. M. and Kuttner, K. N. (1993) Economic activity and the short-term credit markets: an analysis of prices and quantities, *Brookings Papers on Economic Activity*, **2**, 192–283.
Fuerst, T. S. (1994a) The availability doctrine, *Journal of Monetary Economics*, **34**, 429–43.
Fuerst, T. S. (1994b) Monetary policy and financial intermediation, *Journal of Money, Credit, and Banking*, **26**, 362–76.
Galí, J. (1992) How well does the IS-LM model fit postwar US data? *Quarterly Journal of Economics*, 709–738.
Gerlach, S. and Smets, F. (1995) The monetary transmission mechanism: evidence from the G-7 Countries. Working Paper No. 26, Monetary and Economic Department, Bank for International Settlements.
Gertler, M. and Gilchrist, S. (1993) The role of credit market imperfections in the monetary transmission mechanism: arguments and evidence, *Scandinavian Journal of Economics*, **95** (1), 43–64.
Gertler, M. and Gilchrist, S. (1994) Monetary policy, business cycles and the behaviour of small manufacturing firms, *Quarterly Journal of Economics*, **CIX**, May, 309–40.
Hubbard, R. G. (1994) Is there a 'credit channel' for monetary policy? Review, Federal Reserve of St. Louis, May/June, 63–77.
Kashyap, A. K. and Stein, J. C. (1994) Monetary policy and bank lending. In *Monetary Policy*, N. G. Mankiw (ed), University of Chicago Press.
Kashyap, A. K., Stein, J. C. and Wilcox, D. (1993) Monetary Policy and credit conditions: evidence from the composition of external finance. *American Economic Review*, **83**, 78–98.
King, S. (1986) Monetary transmission – through bank loans or bank liabilities? *Journal of Money, Credit, and Banking*, **18**, 290–303.
King, R. and Plosser, C. (1984) Money, credit, and prices in a real business cycle. *American Economic Review*, **74**, 363–80.
Miron, J. A., Romer, C. D. and Weil, D. M. (1994) Historical perspective on the monetary transmission mechanism. In *Monetary Policy*, N. G. Mankiw (ed.), University of Chicago Press.
Oliner, S. D. and Rudebusch, G. D. (1994) Is there a broad credit channel for monetary policy? Federal Reserve Board, Economic Activity Section, Working Paper No. 146.
Park, J. Y. and Phillips, P. C. B. (1989) Statistical inference in regressions with integrated processes: Part 2, *Econometric Theory*, **5**, 95–131.
Ramey, V. (1994) How important is the credit channel in the transmission of monetary policy, *Carnegie-Rochester Conference Series on Public Policy*, **39**, 1–45.
Romer, C. D. and Romer, D. H. (1990) New evidence on the monetary transmission mechanism, *Brookings Papers on Economic Activity*, **1**, 149–198.
Rudebusch, G. D. (1996) Do measures of monetary policy in a VAR make sense? Working Paper No. 269, Banca d'Italia.
Sims, C. (1988) Identifying policy effects. In *Empirical Macroeconomics for Interdependent Economies.* R. Bryant, D. Henderson, G. Holtman, P. Hooper and A. Symansky (eds.), The Brookings Institutions, Washington DC, 305–21.
Sims, C. (1992) Interpreting the macroeconomic time series facts: the effects of monetary policy, *European Economic Review*, **36**, 975–1000.
Sims, C., Stock, J. and Watson, M. (1990) Inference in linear time series models with some unit roots, *Econometrica*, **58**, 113–44.
Thornton, D. L. (1994) Financial innovation, deregulation and the 'credit view' of monetary policy, *Federal Reserve Bank of St. Louis*, January/February.
Thornton, D. L. (1996) Identifying the liquidity effect: the case of nonborrowed reserves. Working Paper 96-002, Federal Reserve Bank of St. Louis.
Tsatsaronis, K. E. (1995) Is there a credit channel in the transmission of monetary policy? In *Financial Structure and the Monetary Transmission Mechanism*, Bank for International Settlements, C.B. 394.

APPENDIX: DATA

This Appendix fully describes the data used. The source is the IMF publication *International Financial Statistics*. All series are the same for each country with the following identifying number from the IMF nomenclature.

		Line
P:	*Consumer Price Index*	64
H:	*Real bank reserves*	20/64
R:	*Short-run interest rate*	60
D:	*Real bank deposits*	(24+ 25)/64
L:	*Real bank loans*	32*D*/64
Y:	*Industrial Production Index*	66

Country	Sample	Lags in VAR
US	63:4–92:4	3
UK	63:1–93:2	7
Germany	64:1–93:1	3
France	64:1–92:4	2
Italy	71:1–92:3	3
Spain	74:1–92:4	2
Austria	67:1–92:4	4
Denmark	74:1–92:4	2
The Netherlands	66:1–92:4	4
Sweden	70:1–92:2	2
Norway	71:4–92:4	3
Finland	78:1–92:4	2
Switzerland	75:4–93:1	2
Ireland	78:3–92:4	2

All variables but *R* were logged, and the sample period differs from country to country. Below are the samples used for the analysis with quarterly data as well as the number of lags in the VAR.

In each case, lag selection was done to guarantee the compatibility of the stochastic structure of the error term with the white noise hypothesis, according to the Ljung–Box *Q* statistic as applied in Doan (1992).

A deterministic component was also included in each VAR system. It consisted of a constant term, a complete set of seasonal dummies, as seasonal patterns were present in some of the variables in each country, and the following dummies to account for specific outliers and/or jumps in particular series.

Country	Dummy	Variable
US	91:1 TO 92:3	*H*
UK	87:1 ON	*H, D, L*
	72:1 AND 74:1	*Y*
Germany	90:3 ON	*H, D, L*
	68:1	*L*
	84:2	*Y*
France	78:1 ON	*D, L*
	68:2	*Y*
Italy	80:3	*Y*
Spain	83:1 ON	*H*
Austria	84:1 on	*H*
	92:2 ON	*Y*
Denmark	88:1 ON	*D*
	91:1 ON	*L*
The Netherlands	82:3 ON	*H, D, L*
Sweden	—	—
Norway	—	—
Finland	89:1 ON	*D*
Switzerland	82:3 ON	*D, L*
	88:1 ON	*H*
Ireland	—	—