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The Transmission of Monetary Policy in European Countries

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TABLE OF CONTENTS

RÉSUMÉ

Les effets de la politique monétaire peuvent varier d'un pays à l'autre pour différentes raisons. L'action de la politique monétaire, même si elle est centrée sur le taux d'intérêt, a des répercussions multiples : sur le crédit, sur la quantité de monnaie et sur la substitution aux autres produits financiers. Son résultat sur l'activité réelle et sur les prix dépend de l'ensemble de ces canaux de transmission et de leur intensité respective. Le cadre réglementaire et les pratiques bancaires en vigueur dans chaque pays ainsi que les structures d'actifs et passifs financiers jouent aussi un rôle dans la réaction que peuvent adopter les agents non financiers aux variations des taux. Cette question est cruciale dans le cadre de l'union monétaire en Europe. Si une politique monétaire commune est mise en place, il faut qu'elle puisse produire des effets similaires d'un pays à l'autre.

Ce texte se propose d'identifier les sources de divergence possibles au niveau du système financier et ensuite de vérifier économétriquement si les réponses de l'économie à un choc de politique monétaire sont très différentes d'un pays à l'autre. L'échantillon considéré porte sur l'ensemble des pays européens, pour lesquels les données étaient disponibles : l'Allemagne, l'Autriche, le Danemark, l'Espagne, la Finlande, la France, l'Italie, les Pays-Bas, le Royaume-Uni.

Une première source de divergence réside dans la façon dont une variation du taux directeur de la banque centrale se trouve répercutée sur les autres marchés. Une variation d'un point du taux du marché monétaire ne se répercute pas à la même vitesse sur le taux de base bancaire. L'ajustement semble particulièrement lent en France, au Danemark, en Finlande et très rapide au Royaume-Uni. Les pratiques d'indexation des crédits varient aussi beaucoup en Europe. Pour les crédits hypothécaires par exemple, les taux sont très majoritairement fixes en France et en Autriche, mais variables dans les autres pays. La facilité d'accès au crédit semble aussi hétérogène entre les pays européens, du moins pour le crédit au logement; c'est ce que montre l'indicateur de l'apport initial minimum requis pour obtenir un crédit hypothécaire.

Les estimations économétriques sur modèle VAR montrent qu'un choc de politique monétaire produit un impact sur le PIB assez similaire d'un pays à l'autre en termes d'ampleur et de délai. La décomposition de la demande finale montre que l'investissement est le plus atteint. L'investissement logement des ménages est plus ou moins affecté selon les pays suivant la nature du marché du crédit.

Un autre modèle VAR est utilisé pour tester l'importance des différents canaux de transmission de la politique monétaire. Contrairement à ce qu'on pourrait attendre de pays fortement ouverts sur l'extérieur, le canal du taux de change ne semble pas renforcer l'action de la politique monétaire. Ceci s'explique par l'appartenance au SME de la plupart des pays de l'échantillon et la gestion du change effectuée par les autres, qui tendent à contrer par la politique monétaire les variations de change. Certains tests montrent que le canal du crédit pourrait être effectif dans les pays européens, car le crédit a tendance à se contracter après un choc monétaire davantage que la monnaie. Cependant

des tests plus détaillés par secteur institutionnel sur la France et sur l'Allemagne ne semblent pas confirmer cette hypothèse.

SUMMARY

The effects of monetary policy may change from one country to another for various reasons. The impact of monetary policy, even when such policy is concentrated on interest rates, may have numerous repercussions: on credit, on the quantity of money and on the substitution of other financial products. Its consequences for real activity and prices are determined by monetary policy transmission channels taken as a whole, and by their respective importance. The regulatory framework of banking, as well as banking practices specific to each country and the structure of assets and liabilities may also play a role in the various reactions by non-financial agents to interest rate changes. This issue is crucial to European Monetary Union. If a common monetary policy is implemented, it will have to be able to produce the same results from one country to another.

This text sets out to identify the sources of possible divergence at the level of the national financial systems, and then seeks to verify econometrically if the real economic responses to a shock in monetary policy are very different from one country to another. The sample covered includes all the European countries for which data were available: Austria, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, and the United Kingdom.

A first source of divergence stems from the way that variations in the bank rate of central banks are spread to other markets. A 1 percentage point change of the money market rate does not impact as quickly on the base rate. The adjustment appears to be particularly slow in France, Denmark, and Finland, but very rapid in the United Kingdom. Credit indexation practices vary greatly in Europe. For example, mortgage credits are accorded mainly at fixed rates in France and Austria, but are variable in other countries. Ease of access to credit also seems to be heterogeneous across the continent, at least as far as housing credit is concerned, as demonstrated by variations in minimum down-payment conditions.

Estimates on a VAR model show that the impact on GDP of a shock to monetary policy is fairly similar in scale and in time across countries. A breakdown of final demand, however, shows that investment is affected more. Residential investment is affected more or less from country to country, depending on the nature of the credit market.

Another VAR model is used to test the importance of different transmission channels of monetary policy. Contrary to what one would expect for very open economies, the exchange rate channel does not seem to reinforce the impact of monetary policy. This may be explained by the fact that most of the countries in the sample are members of the EMS, and by the management of exchange rates carried out by the other countries, which tend to counter variations in exchange rates using monetary policy. Some tests show that the credit channel could be effective in the European countries, as credit has a tendency to contract more than money, in the wake of a negative monetary shock. However, more detailed tests by institutional sector, for France and Germany, do not seem to confirm this hypothesis.

The Transmission of Monetary Policy in the European Countries

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The graphs are not available on this file. To receive a copy of them, mail to colombel@cepii.fr

INTRODUCTION

In most industrialised countries, central banks monetary procedures have converged to control money market interest rates. However, despite the generalised use of this instrument, the interaction with the real economy is complex, and monetary policy does not act through a single transmission channel. Numerous recent studies have focused on this issue of transmission channels and their links with financial system. Three different channels are commonly considered [3]. First, the effects of monetary policy are felt through the demand for money and the short term interest rate, which affects investment and output. This is the traditional "money view", based on the standard IS-LM model. Monetary policy works through income and substitution effets and floating exchange rates can strengthen the transmission on final demand. A second approach emphasises the role of the "lending channel". In contrast to the "money view", bank loans and bond issues are considered as imperfect substitutes. Monetary policy may have amplified effects on aggregate demand by modifying the availability or the terms of new loans. This approach emphasises the role of the asset side of banks' balance sheets and is based on the existence of bank dependent borrowers and the specificity of bank loans. The existence of this lending channel relies on two basic conditions: on the one hand, monetary authorities should be able to affect the supply of bank loans through open market operations or other monetary instruments; on the other hand, there should be no perfect substitutes to bank loans for at least some types of borrowers. These conditions clearly depend on the structure of the financial system and its regulation. Third, the monetary policy may influence aggregate demand by affecting borrowers' balance sheets. A rise in interest rate is often followed by a fall in asset prices, which shrinks the value of borrowers' collateral. This so-called "balance sheet" channel emphasises the role of credit market imperfections

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[3] See the surveys of Gertler and Gilchrist (1993) and Bernanke (1993)

and of borrowers' balance sheets in reducing incentive problems and thus agency costs, in credit markets.

The relative importance of these different channels conditions the effectiveness of monetary policy. It seems likely that these transmission channels may differ from one country to another, or even from one period to another within the same country. Therefore, a certain monetary stance may have different macroeconomic consequences from one country to another. This issue is especially important within the context of Stage III of EMU. If a common monetary policy is implemented, the likely effects of a change in interest rates need to be fairly similar from one country to another, or else unwanted distortions may follow. From an international perspective, studies by BIS (1993,1994), Borio (1995), Tsatsaronis (1995), Barran, Coudert and Mojon (1995a,b), among others, have analysed the effects of monetary policy actions. Dale and Haldane (1993) have provided further evidence for the United Kingdom by using sectoral data.

This paper investigates the effects of monetary policy in the nine countries of the European Union - Austria, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain, and the United Kingdom - for which quarterly national accounts are available in sufficiently large samples. We use identified-VARs for assessing the effects of monetary policy on economic activity. In order to facilitate the comparison, the same identifying assumptions have been made in each country. The money market rate is assumed to be the monetary policy instrument and monetary authorities are assumed to react to contemporaneous variables that enter into their reaction function.

Section 2 reviews some key characteristics in the financial systems, which may constitute sources of divergence in monetary transmission across countries. Section 3 addresses methodological issues, especially the question of identifying monetary policy shocks. In section 4, the response of the economy to an interest rate shock is compared between countries using a VAR model. The issue of transmission channels is also addressed. Section 5 deepens the analysis of a possible credit channel by using sectoral estimates. Section 6 briefly concludes the paper.

I. FINANCIAL PRACTICES AND POSSIBLE DIVERGENCE IN THE TRANSMISSION OF MONETARY POLICY

Financial institutions, regulations and operation procedures of monetary policy may be responsible for differences across countries in the channels, timing and amplitude with which monetary policy actions influence economic activity. In the first instance, the intensity of transmission is linked to the speed and degree to which the interest rate controlled by the central Bank affect interest rates accorded to non-financial agents.

The speed of adjustment of bank credit rates

Cottarelli and Kourelis (1994), Borio and Fritz (1995) have shown that the rigidity of bank credit interest rates differs from one country to another. They estimated the response of the bank credit rate to a 1 percentage point rise in the money market rate, and found a coefficient close to 1 in the long term for most countries. Nevertheless, the speed of adjustment differs substantially across European countries, as shown in Table 1.

Table 1: Effects on the Lending Rate of Changes in Money Market Rate

	Impact		3 months		6 months		Mong run	
Sources :	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Germany	0,38	0,11	0,67	0,45	0,83	0,61	1,04	1,05
Netherlands	0,52	1,08	0,97	0,96	1,03	1,04	1,04	1,08
France	-	0,43	-	0,45	-	0,51	-	0,74
Italy	0,11	0,26	0,40	0,69	0,61	0,84	1,22	1,22
Portugal	0,28	-	0,77	-	0,97	-	1,12	-
Spain	0,35	0,00	0,80	0,30	0,98	0,51	1,12	1,17
United-Kingdom	0,82	1,00	1,02	1,01	1,04	1,01	1,04	1,01
Denmark	0,07	-	0,25	-	0,38	-	0,71	-
Finland	0,13	-	0,20	-	0,27	-	0,60	-

Sources :(1) Cottarelli and Kourelis (1994), p. 16, model (in level)1,
(2) Borio and Fritz (1995) p. 125, effect after one month for the impact effect.

The fastest responses by bank credit rates are to be found in the United Kingdom and in the Netherlands. The effect of a change in the central bank rate is passed on within three months. The short term impact is weaker in Germany and in Italy, standing at between 40 and 69% after three months. France, which is not included in the Cottarelli and Kourelis sample, is a slightly different case, in as far as its long term adjustment is less than 1. Indeed, after six months the response stands at 0.51, which is less than in the other countries. Finland and Denmark show the slowest responses with 20% and 25% respectively after one quarter and 60% and 71% in the long term. Even if these results must be considered with caution, since the interest rates used are not average, but very specific rates varying across countries, they show an important heterogeneity in bank credit markets. The degree of integration of financial markets, the intensity of competition

in the banking sector, the extent to which the financial market is developed, the openness of the economy and the share of subsidised loans are some of the factors that may explain these differences. All these factors may change the speed and degree to which the central bank's controlled interest rate affects the availability or the terms of loans accorded to non-financial agents.

Credit indexation practices

Credit indexation practises may affect the speed of the monetary transmission mechanism. Recent studies by the Banque de France show that indexation with respect to the money market rate has increased, while the bank base rate has been used less as a reference rate for bank credit. In a systematic inventory of credit practises in OECD's countries, Borio (1995) confirms that the Anglo-Saxon countries are characterised by the importance of household borrowing on the one hand and the large use of securities in company financing on the other hand. Furthermore, credit provided to households is largely allocated using floating rates.

The most striking differences are to be found in the mortgage market (Table 2). In France, 95% of such credits are on completely fixed rates, compared to 25% in Italy, and only 10% in the United Kingdom, the Netherlands and Germany. Differences even exist within the category of adjustable rates. In Italy, mortgage credit at adjustable rates is directly indexed on the short term. In the United Kingdom, the bulk of mortgage loans is not indexed on the short term rate, but is lent at rates that may be revised at the discretion of the lender, without any particular reference. In Germany, 45% of loans are at rates that may be revised, and 45% of loans are at re-negotiable rates, which are changed at regular intervals as stipulated in the terms of contract. Therefore, monetary policy transmission may lead to differences among countries: when interest rates move, interest payments of already indebted households are not affected in France, while they may change in the United Kingdom, Germany and the Netherlands.

Table 2: Interest Rates in the Mortgage Market
(approximate percentage of total mortgage loans)

	Germany	France	Italy	United-Kingdom	Austria	Netherlands	Spain
Adjustable Rates	90	5	75	90	25	> 90	80
- indexed	-	5	75	small	-	-	80
- reviewable	>45	-	-	>80	-	-	-
- renegociable	<45	-	-	small	-	-	-
Fully fixed	10	95	25	10	75	< 10	20

Source : Borio (1995), p. 26.

Strong differences also emerge across countries for total credit (see Table 3), even if the estimates are almost certainly fragile and have to be interpreted with care. In the United Kingdom and in Italy, three quarters of all credit is allocated at short term or adjustable rates, compared to 43% in France, and 39% in Germany. On the basis of comparing two points in time (1983 and 1993), Borio (1995) has not found any trend to convergence in credit practices across countries. Credits allocated in foreign currency play a part as well, no doubt by reducing the impact of domestic monetary policy. This type of

credit has developed mainly in Italy and the United Kingdom, where it accounts for about 20% of loans made to companies.

Table 3: Breakdown of loans by type of interest rates
percentage of total amount outstanding

	Germany	France	Italy	United-Kingdom	Austria	Netherlands	Spain
Short term	16	17	51	}73	27	17	40
Adjustable medium and long run	23	27	22		47	>8	22
Predominantly fixed	<62	57	26	27	26	<75	26

Source : Borio (1995), p. 28.

The indexation practices do not explain all the differences in the setting of cost of credit across countries. In many countries, some share of total credit is still subsidised and distributed below market rates, despite the liberalisation. The rates of these preferential loans are generally regulated and their sensitivity to market rates is low, which of course weakens the transmission of monetary policy. Data on these preferential loans are not readily available, so it is difficult to assess their importance. However, the figures cited by the BIS (1994) for France and Germany show that they are not negligible. According to Enfrun and Cordier (1994), the share of preferential rate loans in France, which amounted to 57% of total credit in 1986, was greatly reduced by financial liberalisation but still amounted to 28% of total loans in 1992. These preferential loans are aimed to ease housing financing; hence the impact of market rates on housing in France may be lowered. In Germany, interest subsidies have much increased in recent years for financing reunification. According to Herrmann and Jahnke (1994), approximately half of the loans to eastern Germany were subsidised with rates roughly 2 points below market rates, in 1991-1993. This is not negligible, since a quarter to a third of total credit to private sector has flowed to the new *Länder*.

Substitution effects and the credit channel

Bank practices may also affect household expenditure through substitution effects. For substitution effects to work fully, households have to be able to arbitrate completely between present and future expenditure. Actually, households are often subject to liquidity constraints, generated either by bank practices, or by regulatory constraints. Thus, ceilings on indebtedness and constraints on down-payments in house purchases may shut out the possibilities of intertemporal trade-off. When the constraint is strong, as in Italy for example, the desire by households to raise their spending when interest rates fall will be limited by their current earnings. Jappelli et Pagano (1994) have shown how credit access conditions vary across a sample of 30 countries. They use the maximum loan-to-value ratio applied to individuals seeking a loan to buy a house as an indicator of credit access. Figures are presented in Table 4. The minimum down-payment required to buy a dwelling was especially high in Italy (44%), Austria and Portugal (40%), when compared to France, Germany (20%), and the United Kingdom (13%), for the period 1981-1987. Access to housing credit seems to be easier in Scandinavian countries, since 95% of the house value can be borrowed in Denmark and 85% in Finland. The authors have also shown how this indicator is correlated with the importance of consumer credit relative to GDP. The greater the indicator for the down payment, the more households' access to

credit is constrained, and the less households are indebted. If we compare these data with more recent statistics on household indebtedness by Kneeshaw (1995), it can be seen that asymmetries persist. In Italy, households are relatively little indebted with respect to their disposable income, somewhat more so in France and Germany, whereas they are highly indebted in the United Kingdom (Table 4).

Table 4: Household credit and non-price restrictions

	Maximum loan-to-value ratio (1981-1987)	Household financial liabilities, as % of their disposable income (1993)
Germany	80	77,9
Austria	60	-
Netherlands	75	64,9
France	80	51,0
Italy	56	31,4
Portugal	60	-
Spain	80	88,0
United-Kingdom	87	102,0
Denmark	95	
Finland	85	--

Sources: Jappelli et Pagano (1994), p. 92 et Kneeshaw (1995), p 12.

Jappelli and Pagano consider the share of the required down payment as an explanatory factor for differences in savings levels. The more credit is constrained, the higher the savings rate. For our purpose, it should be added that the more credit is constrained, the less effective monetary policy acting on interest rates will be, as the substitution effect is no longer free to make itself felt. Thus the credit access constraints of certain agents (households, and small- or medium-sized companies) may lead to important changes in the transmission of monetary policy using interest rates. In fact, a rise in interest rates results in a fall in the demand for bank credit, assuming that the rise is passed on the cost of credit. However, when demand is in excess, this will not necessarily lead to a fall in distributed credits.

Income and balance-sheets effects

A variation in the interest rate may also affect agents' income and wealth. On the one hand, a rise in interest rates modifies directly the net flows of interest payments. On the other hand, it affects the value of bonds and shares. The total impact depends on agents financial positions as well as their portfolio composition. Differences are quite remarkable. Cusson (1992) has calculated for France the variations of interest payments and receipts for different agents in the wake of a 1 percentage point fall in the interest rate. He shows that households, as overall creditors, experience a loss of potential earnings following a fall in interest rates. This is likely to be the case in the other countries, given that the financial wealth of households always exceeds their debts. Of course, the effects are likely to be the opposite for the corporate sector. The more financial assets households own, and the more a state is in debt, the less effective monetary policy will be, as a rise in interest rates will raise income and increase public deficit rather than constrain household spending, *ceteris paribus*. This should be the case in Italy, where there is much low-

maturity public debt, largely held by domestic households. Conversely, in the Anglo-Saxon countries where households hold a large proportion of their assets in bonds and shares, they will be encouraged to save more so as to reconstitute their savings, after a rise in interest rates. Moreover, the experience of the last business cycle shows the important effect of balance-sheets on credit. As most credit is provided on the basis of asset-backed collateral, a fall in the value of collateral tends to reduce credit further. Variations in asset prices may therefore amplify the dynamic process affecting the economic cycle (Borio (1994)).

Overall, the transmission channels of monetary policy are numerous and may differ across countries. It is thus interesting to inquire empirically into their relative importance, and to evaluate the consequences for monetary policy in the different European countries.

II. METHODOLOGICAL ISSUES

We use VAR models to estimate the effects of monetary policy across countries and also to assess the importance of the different channels of transmission. Using VAR models provides a good tool for studying the dynamics of the economy, in the aftermath of a monetary policy shock. Numerous studies have been done using VAR monetary models in the United States (Bernanke-Blinder (1992), Friedman Kuttner (1992), Bernanke-Gertler (1995), for a survey see Friedman (1995)). In Europe, several studies were made by central banks (for example Dale Haldane (1994)) and the BIS (Gerlach and Smets (1995), Tsatsaronis (1995)). Here we focus on a comparison of nine European countries: Austria, Denmark, Finland, France, Germany, Italy, the Netherlands, Spain and the United Kingdom. The other EC countries have been left out because they do not publish quarterly national accounts or their series were not long enough.

The main problem when evaluating the effects of monetary policy empirically lies in identifying the monetary policy shocks. Two methods have been used in the recent economic literature. The first one uses an historical approach to identify monetary shocks, as Romer and Romer (1989) did. Using the minutes of the Federal Open Market Committee meetings, they identified the dates at which the stance of the U.S. monetary policy became especially restrictive. Tsatsaronis (1995) extended this method to identifying such dates for the United Kingdom and Germany. When these dates are identified, they can be assigned a dummy variable, which represents a monetary policy shock in an econometric model. This interesting approach has several drawbacks however: these dates give only a qualitative measure and do not reflect the intensity of the monetary restriction. Furthermore, only restrictive shocks were selected and not expansive ones.

The second approach consists in identifying monetary shocks within the VAR framework. This is a common solution used in the works of Sims (1980, 1992), Bernanke (1986), Bernanke et Blinder (1992), Dale and Haldane (1993), Christiano et Eichenbaum (1994), Gali (1994) and Gerlach and Smets (1994) among others. The basic idea is to assume that the economy is described by a linear, stochastic dynamic system of the following form :

(1) $Y_t = B_0 Y_t + B_1 Y_{t-1} + \quad + B_p Y_{t-p} + \varepsilon_t$

or in MA form :

(2) $Y_t = [I-B(L)]^{-1} \varepsilon_t$.

where B_i, i=0,... n, are n x n matrix of coefficients, Y_t is an n x 1 vector of economic variables and ε_t is an n x 1 vector of structural shocks supposed to be zero mean, orthogonal and of variance-covariance matrix, $E(\varepsilon_t \varepsilon'_t) = Id$. Equation (1) can be written in a reduced form, which is estimated by OLS as:

(3) $Y_t = A_1 Y_{t-1} + ... + A_p \quad Y_{t-p} + u_t$

with the innovations u_t of variance covariance : $E[u_t u_t'] = \Omega$. Noting $A(0) = [IB_0]^1$, we have $A_i = A(0) B_i$, for i=1,...,n, and

(4) $u_t = A(0) \varepsilon_t$

therefore :

(5) $E[u_t u_t'] = \Omega = A(0) A(0)'$.

From (2) , we obtain the impulse response functions to the structural shocks: $Y_t=[IB(L)]^{-1} \varepsilon_t = \Phi(L) \varepsilon_t$.

From (3) and (4), we can calculate $\Phi(L)$ as :

(6) $\Phi(L) =[I-A(L)]^{-1} A(0)$.

In order to identify the structural model and thus, the structural shocks ε_t, we have to determine the n^2 elements of A(0). As the variance-covariance Ω is known from the estimation of the equation (3), we have to solve the equation (5) for A(0) and then deduce ε_t from (4). But system (5) itself provides only n(n+1)/2 non linear restrictions on the n^2 elements of A(0). Hence n(n-1)/2 additional restrictions are necessary for the identification. Three kinds of linear restrictions are generally considered: first on the contemporaneous effects of shocks A(0), second on the contemporaneous effects of variables (B_0) and third long run restrictions on B(1)) or A(1).

A convenient way to add the n(n-1)/2 restrictions is to assume that A(0) is lower triangular and to use a Cholesky decomposition of the matrix Ω. This assumption has become standard since it was introduced by Sims (1980, 1992). It is equivalent to assume that the residuals u_t form a recursive system. We also make this assumption here. The inclusion of exchange rates and interest rates in the model certainly limits the validity of the contemporaneous recursivity assumption, for these two variables adjust to each other very quickly, especially in European countries where parities are managed by central

banks. However, estimated paths obtained with this assumption are plausible in the sense that they are consistent with our *a priori* beliefs.

Because of the assumption of recursivity, the matrix of impact multipliers is lower triangular; hence a shock on variable i affects instantly variable j if (and only if) $j \geq i$. The ordering of the variables in the VAR can therefore affect results, especially if off-diagonal elements of the u_t correlation matrix are high. Ordering policy variables first (like Sims 1992, Bernanke Blinder 1992) implies that monetary policy affects all the variables contemporaneously, while it does not react to simultaneous shocks to the other variables of the system. This ordering implicitly assumes that monetary decisions are made without considering the simultaneous evolution of economic variables. This may occur if data on these variables are not quickly available. In ordering policy variables last, the authorities are assumed to take into account the simultaneous evolution of these variables for setting their policy. In this case, monetary policy does not have any contemporaneous effect. This can be rationalised assuming the existence of convex adjustment costs, building and delivery lags, menu costs, or time dependant rules. We have adopted this latter ordering in the following presentation.

Data are taken from the International Financial Statistics of the IMF and the quarterly national accounts of OECD (see Appendix 1 for more details). Regressions are made with quarterly data for the sample 1976-1 to 1994-4, except for the countries where the data are not available at that time (see Appendix). All regressions include a constant and three quarterly dummies. Lags are set exogenously to 4 quarters. All variables are taken in logarithms, except interest rates which stay in level. Because of the Cholesky decomposition, initial shocks are equal to one standard deviation of the structural shock. The impulse response functions are reported in the following figures for a horizon of 16 quarters. One-standard-error confidence intervals were computed by 100 draws for each model. Although they are not always shown in the figures, when different countries are compared, we use them to refer to « non-significance » of some trajectories.

III. THE RESPONSES TO A MONETARY SHOCK

Output and prices responses

We first use a VAR model (model 1) which includes in the following order: GDP in constant prices, the consumer price index, the exchange rate versus the DM (and versus dollar for Germany) and the money market interest rate[4]. We also include a world export price index to take into account world price movements. Figure 1 shows the point estimates for the responses of GDP to a shock in interest rate in the nine countries; the paths of interest rates are also shown in the figure.

The restrictive shock in monetary policy results in a decline in output in all the countries, ranging from 0,2% to 0,7%. Output begins to fall immediately after the interest

[4] The data and samples used for model 1 are described in the appendix.

rate shock, or after just one quarter. The magnitude seems especially high in Germany (-0.7% for an initial shock of 0.4 point on the interest rate), while the response seems rather small in Scandinavian countries (the decrease in GDP is not significant in Denmark, and smaller than 0.3% in Finland for an initial shock in interest rate of respectively 1.3 and 0.8 point). The effects on the output level are generally transitory and the maximum effects are reached between four and ten quarters in most countries. Delays in the United Kingdom are generally judged as particularly short because most debts are indexed with short-term interest rates. However, they do not appear particularly short in our results. In fact, the response of output follows very close paths in France and in the United Kingdom (Figure 1). Delays in Germany are longer than ten quarters. The GDP decrease bottoms out in Germany and Austria after ten quarters. The lowest effects are found in the countries where the trough is reached faster (within one year). The output paths can be partially explained by the patterns followed by the interest rate after the shock. In the countries where the interest rate shocks are more persistent (e.g. Germany), the decline in output is more pronounced.

In some countries, prices are subject to the so-called « price puzzle » (Sims 1992). They continue to rise for more than a year after a monetary shock. An interpretation of this price puzzle may be that central banks have information on expected prices obtained from the observation of variables which are not included in the model. If central banks have such information about a future increase in inflation, and if they raise their interest rate but not sufficiently to offset the future inflation, then it is possible to observe interest rate shocks followed by price increases. Even if the relevant variables of the reaction function have been considered, a « price puzzle » can be observed if central banks are willing to smooth interest rates and hence do not raise them as much as the offsetting of expected inflation would require. But other types of explanations can be advanced, such as the financial cost of interests payments which can lead firms in imperfect competition to increase their prices after a monetary tightening. This effect can be observed in macro-econometric models with exogeneous exchange rates for France and the UK (Chouraqui, Driscoll, Strauss-Kahn 1988). Smets (1995) also found that the response of the GDP deflator to an increase in interest rate was followed by a very slight increase in price during six quarters in Germany and a much more pronounced one for the UK, when using central bank models. Christiano, Eichenbaun and Evans (1994) have succeeded in solving this problem for the US, by entering a contemporaneous commodity price index into the monetary authority's reaction function, that is by ordering the interest rate after the world price index. In the European countries considered, results are greatly improved by this strategy, also adopted here, although the problem remains for some countries. In any case, increases in prices are very small and are generally non significant, with the exception of the United Kingdom.

We have further analysed the way in which GDP is affected regarding different categories of expenditure. Hence, we have estimated a VAR model (model 2), which adds the main components of final demand to the former model. Private consumption, private investment and residential investment are introduced one-by-one. Since the corporate sector is generally a net borrower, the effect of an interest rate innovation is expected to contract investment more than household consumption. Results presented in Figure 2 show that the decline in investment is greater than that of aggregate output. Delays are

about the same as for output, about a year and half. The adjustment is longer in Germany, where the trough is reached only after two years. Results on residential expenditure are very interesting. Italy and France show the lowest effects, with values ranging between 0.2% to 0.5%. The fact that in these countries households have the smallest indebtedness levels may explain this weak sensitivity to interest rates. Furthermore, the smallest effect is obtained in Italy, where mortgage credit access is restricted by high down-payments. In France, the relatively weak response of residential investment to an interest rate shock may be explained by the large share of housing loans for which rates are regulated and below market rates. Finally, consumption seems to follow a similar path to output in most countries. But further investigations should be made to analyse the response of the savings rate.

The exchange rate channel of monetary policy

In order to assess the importance of the different channels through which monetary policy affects activity, we use the same VAR model (model 3) including different possible transmission variables, such as the exchange rate, credit to private domestic sector and the long term interest rate. The model also includes as the former ones, output, prices, a world price index and the money market interest rate. The impulse response functions for this model, with their confidence intervals, are shown in Figures 3.

In a floating exchange rate regime, an interest rate increase in one country generally yields an appreciation of the national currency, which amplifies the restrictive effects of monetary policy. Nevertheless, in the European countries considered here, the exchange rates cannot be considered as floating, since most countries were members of the EMS for at least several years during the sample period, with the exception of the new EU entrants. Moreover, even outside the EMS, the management of the exchange rate versus mark has been a key objective of their monetary policy (see for example Bénassy-Quéré (1995)). That is why we take into consideration the exchange rate versus DM for all European countries, be they in or out the EMS in the sample. For Germany, we consider its parity against dollar, since it is often regarded as entering the Bundesbank reaction function (see for example Coudert and alii (1988)).

For an exchange rate channel to exist, two conditions must be fulfilled. First the shock in the interest rate should result in an appreciation of the currency. Second, the appreciation should generate a decline in output and prices. The 6th column of the last line in the charts matrix presented in Figure 3 shows the response of the exchange rate to an interest rate shock. According to these simulation results, a rise in the interest rate results in an appreciation of the currency (decrease in the exchange rate) in most countries. However, the size of the effects are small. In Italy, an « exchange rate puzzle » can be observed for the rise in the money market rate is followed by a depreciation, probably because the rise in the interest rate was aimed to defend the parity, but was not sufficient to counter speculative attacks.

The second lines of figures 3 show the effects of a positive exchange rate shock (depreciation). The response of GDP (1st column of the 2nd line) is positive only in Italy and Spain, where a devaluation yields the standard, expansive real effects. Elsewhere, the real effects of a devaluation are not significant, partly because monetary authorities try to

resist further depreciation and seek to limit the effects on prices, by raising their interest rates afterwards. This is the case for France, Austria and the Netherlands[5]. In these countries, the restrictive stance of monetary policy cancels the possible expansive ones of the devaluation and the real effect is not significant. In other countries, like Italy and the United Kingdom, the interest rate decreases after the depreciation. Nevertheless, real activity is boosted only in Italy.

In conclusion, no exchange rate channel appears in these results[6], except for Spain which is the only country where the two conditions are fulfilled. It may be surprising that the channel does not operate in largely open economies. But in fact, the semi-fixed exchange rate system for countries in the EMS and the goal of maintaining parity against DM for the other European countries prevent such reactions. For most of the countries considered (except Germany), the largest exchange rate shocks over the whole period were mainly devaluation against mark, or depreciation for countries outside EMS. As devaluation inside the EMS was often followed by an austerity programme implemented to avoid further depreciation, its effects for boosting real activity are not clear.

The long term interest rate

Model 3 can also be used to assess the importance of the long term interest rate. In Figure 3, the first line of the charts matrix represents the evolution of economic variables after a long term interest rate shock. In most countries, a shock in the long term rate makes output decline (first column of first line). However, the fall in GDP is not always significant. The GDP decline is significant in Germany, Austria and the Netherlands, as well as in France and Spain. In contrast, a shock in the long term interest rate has no significant real effect in the United Kingdom and in Italy. This is not surprising, since these latter countries are known for indexing most of their credit on short term interest rates.

The money and credit channels

The fourth column of the last line in Figure 3 presents the responses of credit to a monetary policy shock. Credit rapidly decreases after a monetary shock in all countries, except Germany, UK and Spain. In these latter countries, credit continues to rise during several quarters. Such results confirm those of Tsatsaronis (1994) for the United Kingdom and Germany. Since the impact of the credit shock on output in the VAR model is generally positive, this decline in credit clearly enhances the decrease in output. This

[5] In Spain there is also a rise in interest rate after the devaluation, but it does not prevent the expansive, real effects of devaluation on GDP.

[6] An other way to assess these effects is to compare the responses of GDP to a monetary shock in two models, with exogenous and endogenous exchange rates. The former results of model 1 (where the exchange rate was endogenous) have been compared with the results obtained from the same model swith the exchange rate as exogenous. The results of this comparison show that output responses are very similar in most countries, with or without endogenous exchange rates. Results are not shown because lack of space, but are available by request from the authors.

makes us think that a « credit channel » may exist in European countries. To check this assumption, we have to make sure that the decline in credit does not just reflect the same decline as in money.

We now use a VAR model (model 4) including output, the consumer price index, the world export price index, the money aggregate M2[7], credit to the private sector and the money market interest rate. The paths obtained for money and credit are shown on Figure 4. In most countries except the United Kingdom, credit falls much more than money does. In fact, in five countries, like Germany and Austria, money does not fall for several quarters. Results show that an interest rate shock yields a modification in banks' balance sheets, which diminishes credit relative to deposits. Further tests are necessary to investigate the sectoral effect of credit.

IV. THE CREDIT CHANNEL: A SECTORAL ANALYSIS

In this section we analyse the behaviour of credit and final demand after a monetary shock for three sectors: corporate, personal and housing real estate. The heterogeneity of agents is a key factor in understanding the credit channel. On the one hand, some agents do not rely entirely on bank loans because they can issue liabilities through direct finance. On the other hand, bank dependant agents are more likely to be influenced in their spending by the availability of bank credit.

The analysis was carried out on two countries, Germany and France, for which data are available. For each sector, we use a VAR model (model 5), including in the following order: GDP, the final demand component relevant to the sector (investment for corporate, consumption for the household sector and residential housing for housing), the consumer price index, credit to the sector and the money market interest rate. Following Bernanke and Gertler [1995], a stock price index is included for the corporate sector model (just before credit) in order to catch a possible balance sheet channel. In a broad approach to the credit channel, interest rates shocks may also yield real effects through a decrease in the net value of firms, which would shrink borrowers' collateral and their capacity to lend.

Results show that the impact of a monetary policy tightening is qualitatively similar in the two countries. As shown in Figure 5, sectoral credit and final demand both decrease after a tightening of monetary policy. The decrease is significant, except for personal credit. The residential sector is more sensitive to interest rates in Germany than France, which confirms our previous results. Both investment and credit to firms start to decrease only three quarters after the monetary policy shock in Germany. This delay in the German corporate sector is similar to the one found by Dale and Haldane [1993] for the United Kingdom or to the results of numerous studies for the United States. One interpretation of this result could be that firms use credit in order to smooth the decline in cash flows during recessions (Morgan (1992), Gertler and Gilchrist (1993)).

[7] Results are quite similar using deposits instead of money.

We further investigate the specific impact of credit, by comparing the results of the former model with the results obtained with exogenous credit in the same model. If a credit channel exists, the sectoral expenditure is expected to decrease more with endogenous credit.. However the impulse response functions[8] show that the decrease in sectoral expenditure is not changed when credit is taken as exogenous. The only exception concerns the German corporate sector. But, for this sector, instead of enhancing monetary transmission, credit softens the recessive impact of a monetary restriction. Credit can then be interpreted as smoothing the recessive impact of a positive shock on the interest rate. Hence, these latter simulations of monetary policy shocks do not provide evidence for the existence of a credit channel at the sector level

[8] not reported here, but available by authors.

CONCLUSION

Recent empirical works have shown how bank practices were different across countries, even within the European Union. Our empirical estimates using identified-VARs show that main standard effects of monetary policy can be found in most European countries, and that these countries were similar in the sense of responses and lags. However, the magnitudes involved seem different. Moreover, different bank practices and regulation across countries lead to some differences in the response of the final demand components. For instance, for those countries where credit access is more restricted, e.g. Italy, monetary policy shocks seem to have less impact on residential investment, as well as for countries like France, where preferential loans are still large. Aggregate estimates show that a tightening in monetary policy makes credit decline in most countries, except the UK and Germany. However a sectoral analysis for Germany and France does not provide evidence for a credit channel in these countries.

Some differences in the transmission of monetary policy may disappear with the monetary union. That is the case of the exchange rate channel, the intensity of which is linked to the openness of the economy, and also to the degree of commitment to exchange rate targets of the monetary authorities. This may typically constitute now a source of divergence among European countries, which will immediately disappear with monetary union. However, some of the differences reviewed here may persist at least for several years after monetary union. Access to credit for example could be harmonised, as competition between European retail banks will be boosted by monetary union. However, the harmonisation will take time. The delay necessary to equalise indexation practices will be still longer. They are linked to cultural preferences, which stem from the collective consciousness of a people and depend on the history of inflation in each particular country. This kind of collective perception of risk is very slow to change.

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APPENDIX: DATA SOURCES AND AVAILABILITY

Data come from the International Financial Statistics of the International Monetary Fund (IFS) and from Quaterly National Account of the OECD (QNA).

model 1 includes

- Gross Domestic Product, at constant prices — QNA — GDPEV
- Consumer Price Index, — IFS — 64...ZF...
- World Export price index — IFS — 00176AXDZF...
- Exchange rate: market rate, unit per dollar — IFS: — ..RF.ZF for Germany
  calculated unit per D.M for the other countries.
- Call money market rate — IFS: — 60b..ZF
  except for the United Kingdom, where the « call money rate maximum » is taken from OECD Interest Rates data and for Spain, where the IFS « bank rate », code 60... has been chosen for better availability.

Regression sample:
Germany, France, Austria, U.K. and Spain: 1976:1-1994-4; Netherlands, Denmark: 1978:1-1994:4; Italy: 1976:1 1993:4; Finland: 1979:1-1994:4.

model 2 includes
same data as model 1, adding one of the following variables just after GDP:

- Gross fixed capital formation by institutional sector, — QNA — GFOV
  other than general government, at constant prices
- Gross fixed capital formation by type of capital good, — QNA — GFRBC
  Residential, Buildings and Construction, at constant prices
- Private Final Consumption Expenditure, at constant prices — QNA — PCV
- Private Final Consumption Expenditure, by type — QNA — PCDGV
  of Expenditure, Durable Goods, at constant prices

Regression sample: same as model 1. Austria has been excluded, since no quarterly data were available.

model 3 includes
same data as model 1 adding two more variables just after the world export price index :

- Government bond yield — IFS — 61...ZF...
- credit to private domestic sector — IFS — 32D..ZF

Regression sample
Germany, Austria: 1976:1-1994-4; France: 1976:1-1994-2; U.K: 1976:1-1993-4;
Spain: 1979:2-1994-4; Netherlands, Denmark: 1978:1-1994:4; Italy. 1976:1 1993:3. Finland has been excluded, since its long term rate was not available on long period.

model 4 includes
same data as model 1 adding two more variables just after the world export price index :
credit to the private sector as above, and

- money M2 = money+quasi-money — IFS — 34...ZF...+ 35...ZF...+

Regression sample
Germany, Austria: 1976:1-1994-4; France: 1976:1-1994-2; U.K: 1976:1-1993-4;
Spain: 1979:2-1994-4; Netherlands, Denmark: 1978:1-1994:4, Italy.1976:1 1993:4,
Finland: 1979:1-1994:4.

model 5, for Germany and France, includes
same data model as 1, adding successively investment, consumption and housing investment with the corresponding sector credit. A stock price index is added for the corporate sector:

- French credit variables: credit to corporate, total credit to households, housing credit, source: Banque de France, Bulletin statistique mensuel, table 36 "
- German credit variable: total credit to corporate sector, total credit to households, total housing credit, source: Deutsche Bundesbank Monatsbericht, table: All Banks domestic lending by borrower
- Stock price index: IFS ...62...

Regression sample :
Germany: 1976:1-1994:4; France: 1979:1-1994:04.

FIGURE 1 : RESPONSES OF GDP TO AN INTEREST RATE SHOCK

FIGURE 2 : RESPONSES OF FINAL DEMAND COMPONENTS TO AN INTEREST RATE SHOCK

——— Private investment

- - - - - - Residential investment
—-— Consumption

FIGURE 3 : AUSTRIA

FIGURE 3 : DENMARK

FIGURE 3 : FRANCE

FIGURE 3 : GERMANY

FIGURE 3 : ITALY

FIGURE 3 : NETHERLANDS

FIGURE 3 : SPAIN

FIGURE 3 : UNITED KINGDOM

FIGURE 4 : RESPONSES OF MONEY AND CREDIT TO AN INTEREST RATE SHOCK

FIGURE 5 : RESPONSES OF SECTORAL EXPENDITURE AND CREDIT

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