



UNIVERSITÀ DEGLI STUDI DI ANCONA
DIPARTIMENTO DI ECONOMIA

**MONETARY POLICY SHOCKS AND THE
ROLE OF HOUSE PRICES ACROSS
EUROPEAN COUNTRIES**

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Maggio 2002

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***MONETARY POLICY SHOCKS AND THE ROLE OF HOUSE
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Abstract

Housing systems, as a major sector of industrialised economies, might have profound effects on the transmission mechanism of a monetary shock. Despite a progressive convergence, however, EU countries still differ significantly in their housing and credit market institutions. This paper provides a theoretical discussion of the "housing market" channels of the monetary transmission mechanism (MTM) and offers some evidence on institutional differences across EU countries. Using recursive and semi-structural VARs, we identify monetary policy shocks and assess their effects on residential prices in eight European countries over the EMS period. Results show a different degree of sensitivity of house prices, partly consistent with the institutional features of the European housing systems. We then investigate the importance of these policy-induced changes in house prices in transmitting monetary shocks to the private consumption. In some countries, results provide some support for the view that house price channel may be an important source of MTM to consumption.

1. Introduction*

Size and timing of the monetary transmission mechanism (MTM) might differ across the European Monetary Union (EMU) member states. Many argue that the regime switch created with the creation of the ECB makes any attempt to assess real asymmetries no longer relevant. However, it is doubtful that this institutional change brought about behavioural changes in a sharp and discontinuous fashion (Guiso *et al.*, 2000). To this regard, evidence on agents' reaction to previous regimes can provide some useful insights on how they are behaving, and therefore attempts to throw some light on the MTM based on the past experience might still yield informative results.¹

Over the last few years many researchers have been trying to compare and analyse the effects of a monetary policy shock across countries (see for instance Gerlach and Smets, 1995; Ramaswamy and Sloek, 1997; Barran *et al.*, 1998; Kim, 1999; Guiso *et al.*, 2000; Ehrmann, 2000). However, while they all try to interpret the results on the basis of the institutional features characterising the individual countries, few of them attempt to identify the relative significance of specific channels of the MTM. Even fewer have attempted to assess the role of asset prices. This is rather surprising, because over the last three decades we have experienced large asset price fluctuations, which have affected the real activity in many industrialised countries. In this field, a particular emphasis has to be given to housing, which represents more than half of the net wealth of the private sector in most European economies. Moreover, differently from financial assets which are mainly owned by the better-off part of the population (whose propensity to consume out of capital is low), home ownership is spread and distributed much more equally. In this regard, while some authors have pointed out the special transmission mechanism channels through which house price might play a significant role (MacLennan *et al.*, 1998), little empirical evidence has been provided in investigating the quantitative importance of such *channels*. Moreover, European countries present quite divergent housing and mortgage markets (which reflect differences in the intensity of

* With thanks to Ulrich Woitek, Jim Malley, Luca Papi, Campbell Leith, Julia Darby and seminar participants at the University of Glasgow, and to Hassan Molana at the Scottish Doctoral Programme Methodology Conference 2002. I also benefited from useful comments and suggestions at the Scottish Economic Society Conference 2002 (Dundee) and the VIIth Spring Meeting of Young Economists 2002 (Paris). I thank a number of people from different European statistical offices and housing institutions for providing data on house prices.

¹ The perfect study would be to analyse the response of various European economies to the same temporal sequence of monetary policy shocks under the new monetary regime of the EMU. However, this is not clearly possible with the newly constituted Monetary Union and the correspondent short data span.

competition, legal procedures, regulations in the rental sector, fiscal treatment of interest rates, etc). Therefore, under the assumption that these institutional features will converge very slowly (Stephens, 2000), it seems likely that if asymmetries in the MTM across Euro countries linked to this mechanism are significant, they will last in the medium and long-term.

Admittedly, since the early 1980s, major changes of real estate prices have gone hand by hand with the rapid expansion of credit, which followed the financial liberalisation process in several countries. As a result, while the pre-EMU period may be characterised by unusual fluctuations, it is informative to assess the relative importance of monetary policy stance in the transmission mechanism operating through real asset values (Borio and Fritz, 1995). This might provide not only useful indications in those economies like the U.K. and the Scandinavian countries where the financial liberalisation process has already taken place, but also policy implications for those ones in which the process is expected to show its effects in the near future.

The aim of this paper is to provide some qualitative and quantitative evidence on the link between monetary shocks and residential prices and between house prices and economic activity over the EMS period for some European countries.² In particular, the paper is organised as follows. The next Section provides a brief descriptive discussion on the potential “housing-system-related” monetary transmission channels. Section 3 presents a concise attempt to identify the main characteristics of the housing and mortgage systems across the EU countries, highlighting the potential implications for house price sensitivity to monetary shocks, and possible role of residential asset changes in the transmission mechanism to private consumption. Section 4 briefly lays out the econometric methodology, which is based on small structural VARs. The first subsection studies the role of monetary shocks to house price fluctuations by making use of impulse response and variance decomposition analysis from two estimated VAR models. The second sub-section investigates the role of those (monetary-policy induced) residential price changes on private consumption through the implementation of two simulation exercises. Section 5 concludes.

² Due to data availability on aggregate house price indices, the countries under study are Belgium, Finland, Ireland, Italy, the Netherlands, Spain, Sweden and the United Kingdom.

2. The Role of the Housing System in the Monetary Transmission

In the last few decades many economists have been focusing on the important question of whether and how a change in the nominal interest rate affects the level of activity in the economy. While a widespread consensus has been reached on the short run effects of monetary policy shocks on the real output, the debate over the relative importance of monetary transmission channels is still open. Although the two traditional views (the “money view” and the “credit view”) provide different explanations, they share a common understanding of the importance of the housing market and house prices. This is justified by several reasons such as the quantitative importance of housing wealth in most of the industrialised economies, as well as the special characteristics of the housing system in the lending sector. Residential assets, however, are very different from other tangible and financial assets, in the sense that they have the *dual* nature of commodities yielding utility and investment assets (Miles, 1995). Additionally, housing markets are characterised by a number of special features,³ which imply a complex role in the transmission of macroeconomic shocks. It is probably the presence of such factors, which makes it difficult to compare housing systems across countries and, more importantly, identifying a clear-cut classification of the channels through which these markets enter the MTM. In what follows we try to provide a simple attempt, which, based on the traditional MTM channels emphasised by the literature, leads to specific “housing-system-related” channels.

Maclennan (1994) argues that an interest rate decrease has three main first-round effects on the housing sector, which might imply a *direct* or *indirect* role of the housing market in the transmission mechanism:

- (1) they increase new constructions and residential investment;
- (2) first-time buyers and likely moving owners may be encouraged to purchase;
- (3) existing borrowers with variable rate mortgages will face a smaller share of their disposable incomes absorbed by mortgage interest costs.

³ Miles (1995) indicates some special characteristics. They can be summarised as follows: durability, uniqueness and heterogeneity, short-run rigidity of supply, the possibility of raising loans against housing collateral for finance house and non-house purchases, the existence of a well developed secondary market, significant price volatility, housing wealth as the most important component of the value of estates bequeathed, tax treatment,

(1) According to a traditional *cost-of-capital* channel, a decrease of the real interest rate, and consequently of the cost of capital, affects investment decisions on the basis of whether the cost of borrowing will be more than covered by the rate of return on capital. Whereas some authors argue that interest rates have their effects on investment above all (and possibly "only") through expectations of future returns (Oxley and Smith, 1998), the Bank of England (1990) provides strong evidence in favour of considerable and powerful influences running from short-term interest rates to residential investment. Another important piece of evidence comes from Bernanke and Gertler (1995), and Barran *et al.* (1998) who, by estimating standard VAR systems, show the responses to a monetary contraction of some components of private domestic output. They find that residential investment drops sharply following a monetary tightening, confirming the role of this channel.

(2) Lower interest rates are likely to create extra demand for housing from those first buyers and likely moving owners. This effect, together with the short-term inelasticity of real estate supply (due to restricted rental supply and land zoning) pushes residential prices up. Obviously, the sensitivity of the demand for housing to a monetary shock crucially depends on the pass-through from policy-controlled interest rates to bank (in particular, mortgage) interest rates. In this regard, different institutional characteristics of the banking system might play a crucial role. Additionally, the mix of flexible versus fixed interest rate mortgages might result very important. In particular, in countries with a high diffusion of long-term fixed rate credit, monetary policy shocks will be propagated much more slowly and, therefore, housing demand will react with some delay.⁴

The appreciation of the residential prices followed by the upward shift of the demand might have important effects on the real activity.⁵ The special nature of these commodities, however, makes the overall effects difficult to assess. This is further complicated by the presence of effects working in different directions, which might partially offset each other.

large involvement of financial intermediaries in the housing market and the presence of a closely related rental housing market.

⁴ It is clear, however, that actual differences might be expected to disappear in the medium long-term. While the mix between fixed and variable rates reflect differences in tastes and traditions, it is also true that individual inflation histories have played a crucial role. The new environment characterised by low and homogeneous inflation rates across countries will eventually favour a progressive convergence towards fixed rate instruments, and, as a result, a more similar MTM.

⁵ An important effect is based on the so-called Tobin's *q* theory, according to which when the ratio between house prices and construction costs is above unity, it is profitable for agents (i.e. individuals and construction companies developers) to construct new houses.

First of all, for households planning to purchase a house, a rise in house prices is likely to have positive effects on *saving*, above all in countries with high down-payment requirements or with a poorly developed housing finance system which forces a higher use of own funds. In this regard, Kennedy and Andersen (1994) and Muellbauer and Lattimore (1995) point out the fact that non-owner-occupiers may be constrained to save more (and, consequently, consume less) when real house prices rise according to the required down-payment in obtaining a mortgage. This effect clearly depends on the required deposit/value ratios which, in a particularly strong financial deregulation process (like the one observed in U.K. and the Scandinavian countries in the 1980s), or highly competitive lending markets, can be quite low.

Another key channel through which house price can effect the real activity is the so-called *balance-sheet channel* in which homeowners are able to borrow against the (rising) collateral provided by their homes. Miles (1994) and Muellbauer and Murphy (1997) have emphasised the role of housing equity withdrawal (that is, the excess of net (of repayment) new lending for house purchase over all forms of investment in residential property) which, in the financial liberalisation process of the 1980s, provided households with liquidity to use in additional consumption in the U.K.. The impact of withdrawal clearly depends on loan-to-value ratios, second mortgages and availability of interest-only mortgages (Miles, 1994), which differ from country to country.

Additionally, many economists have focused on the housing *wealth effect* to consumption. Miles (1994) argues that it is far from clear why changes in house prices should be expected to affect private spending through wealth effects. The fact that demand increases must be matched by the supply from the selling (or trading-down) agents might be such that, at an aggregate level, gainers and losers might tend to balance out their wealth changes. Therefore, there is no *a priori* reason why an unexpected increase in real house prices should be treated as a boost in real wealth (Miles, 1994). While this may be true for first-time buyers or who those who trade up (or "losers"), together with last-time sellers or those who trade down (or "winners"), the wealth increase effects for non-movers or owner-occupiers and landlords is less debatable. In support of this point, we can take simple life-cycle and permanent income models and argue that a rise in real house prices believed (possibly mistakenly) to be long-lasting by home-owners is expected to have positive wealth effect on non-housing

consumption. In this regard, the perceived *liquidity* (or spendability) of housing assets can play a crucial role. In particular, we can identify the following liquidity factors:⁶

- (i) transaction costs and restrictions;
- (ii) the number of housing transactions;
- (iii) collateral role of the asset.

As far as the transaction costs are concerned, costs of property (or real estate agents and lawyers), taxes and stamp duties are all restrictions on resale. They also reduce the probability of speculative frenzies by affecting and limiting the demand changes deriving from interest rate movements. The number of transactions in the housing market is another factor of liquidity. This strongly depends on the presence, as well as the efficiency of real estate agencies in letting demand and supply for housing meet relatively easily. Another factor is provided by the collateral role of the housing wealth and, in particular, the loan-to-value ratios, which reflect the characteristics of the credit market institutions as well as the legal and tax system. MacLennan *et al.* (1998) argue that, where housing is regarded as a good collateral, housing wealth is more spendable and, therefore, can affect the non-housing consumption to a greater extent. To the above points, it is worth emphasising the role of asset price volatility. In fact, MacLennan *et al.* (1998) argue that consumers are very much concerned about capital losses and the risk of loan default (above all in the presence of a history of recent falls) and that extreme volatility can reduce the spendability of housing wealth. In our opinion, however, it is important to differentiate by real asset fluctuations due to inefficiency, speculative and illiquidity features of the housing market from those linked to fundamentals.

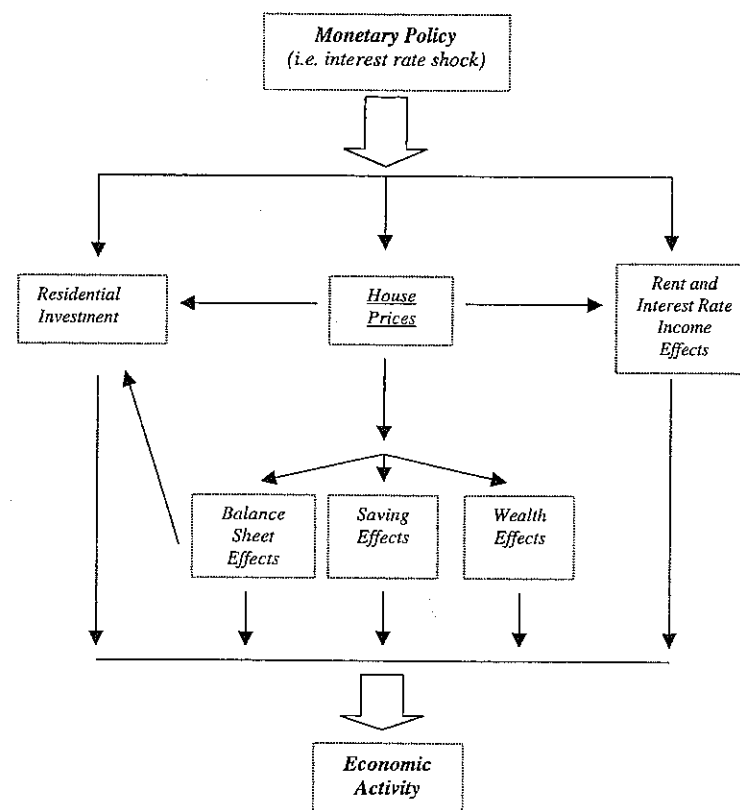
(3) Beside the above channels in which housing can affect the economic activity, another relevant effect is given by the *interest-rate-income effects*, according to which the existing borrowers with variable mortgage interest rates will take advantage of the lower cost of borrowing by increasing their consumption in other goods. On the other hand, there are also income implications deriving from the market rented sector, that is, rising house prices can cause higher future rents for tenants who will then face negative income effects. Higher revenues for landlords or institutional investors owning rental housing can partially offset this

⁶ These factors are clearly important in explaining the degree of sensitivity of housing demand and house prices.

channel. Under the assumption of a lower marginal propensity to spend for the latter agents, however, we can expect negative renting income effects.

In order to summarise the above discussion, Diagram 1 shows the main housing-system-related channels of the monetary transmission mechanisms with the main inter-linkages. It is clear, however, that given the special nature of housing and the presence of distributional effects, it is difficult to assess the net effect on the economy of a monetary shock to the real activity through the housing system. Moreover, the diagram does not take into account other significant influences that monetary policy can have on real assets through its effects on the economic activity and real variables.

DIAGRAM 1 The "Housing-Related" Monetary Transmission Channels.



3. Housing and Mortgage Systems across EU Countries

In the previous Section we saw how the importance of the size of the owner-occupied and private rented sectors, the size of transaction costs in housing, the fiscal treatment of the house financing costs, the characteristics of the credit markets, the predominance of fixed or variable interest rate mortgages, and the correspondent house price volatility can represent crucial factors in the transmission of a monetary shock into the households' spending decisions. In particular, as pointed out by MacLennan *et al.* (1998), one would expect that *"the countries with high transaction costs, low loan-to-value ratios, a small owner-occupied sector, a large tenure proportion in the private rented sector, and a large proportion of fixed interest mortgage loans, should experience relatively low real house price volatility, small house price effects on consumption and small role for housing in interest rate transmission mechanism."*

In this Section,⁷ we will provide some evidence on the major housing institutional differences between the EU countries and try to assess whether the housing sector could play an important role in the MTM across European countries. In analysing such features, it is important to point out that the comparability and availability of data represent one of the main weaknesses of cross-country studies due to varying definitions and statistical sources.

Bearing this in mind, Table 1 shows the overall tenure structure of the EU countries distinguishing between home-ownership, social housing and privately owned renting. This classification is particularly interesting because a rise in real housing prices can be thought of as having positive wealth effects for owner-occupiers and negative income and substitution effects for tenants in the market rented sector. As a result of this, the higher the percentage of owner-occupiers and the lower the proportion of households renting a house, the larger the house price effect will be on consumption decisions. Table 2 shows pronounced cross-country differences. As far as the importance of owner-occupied dwellings is concerned, Ireland, Spain Italy and Greece and Luxembourg range between 72% and 80% while Belgium, Finland, Portugal, Sweden and UK between 61% and 67%. All the remaining countries (Austria, Germany, France, the Netherlands and Denmark) are particularly notable for low owner-occupation. Although the size of the rental stocks is decreasing in most of the countries,⁸ the weight of the private rented housing stock is still very high in Portugal, Austria and Germany (respectively, 30%, 35% and 40%). Belgium, Italy and Greece range between

22% and 27% and all the remaining EU members are low private rental (in particular Ireland and the United Kingdom). As emphasised by MacLennan *et al.* (1998), however, the size of the private rented sector has to be analysed with the presence of rent controls, which can be significant.

TABLE 1 Housing tenure structure across Europe

Country	Owner Occupied	Social Rented	Private Rented	Other
Monetary Union Members				
Austria	50 (1991)	15	35	0
Belgium	65 (1996)	8	27	0
Finland	62 (1995)	16	14	8
France	54 (1996)	21	17	8
Germany	40 (1993)	20	40	0
Greece	75 (1991)	0	24	0
Ireland	80 (1991)	10	10	0
Italy	75 (1991)	3	22	0
Luxembourg	72 (1995)	23	2	3
Netherlands	50 (1997)	36	14	0
Portugal	66 (1991)	4	30	0
Spain	78 (1991)	0	18	4
Members of EU not in EMU				
Denmark	53 (1996)	21	18	8
Sweden	61 (1995)	22	17	0
United Kingdom	67 (1996)	23	10	0

Sources: estimated from a variety of sources including the EMF (Hypostat, 1987-97, and Annual Report), Oxley and Smith (1996) and MacLennan D. *et al.* (1998).

Notes: Tenure expressed as % housing stock. Data are not fully comparable for the presence of different definitions. See the above references for detailed definitions.

These figures can be better evaluated in relation to other important factors which directly affect the sensitivity of the demand for housing as well as the perceived *liquidity* or spendability of housing assets, that is, presence of low transaction costs, easy credit availability, high loan-to-value ratios, large diffusion of floating rate mortgages.

Unfortunately, as far as the transaction costs are concerned, no data are available for all the EU countries. However, the figures provided by MacLennan *et al.* (1999) show how Spain and France present the highest proportion of total transaction costs which respectively account for 10.4% and 13.8% of the property house price. While the UK (2% of the house price) presents the lowest percentage in Europe, Italy and Germany (7.4% and 7.1%, respectively) are

⁷ The structure, as well as the content, of this Section strongly draws on the paper by MacLennan *et al.* (1999).

⁸ See Oxley and Smith (1998) for a discussion.

somewhere in the middle.⁹ Another important element of transaction costs that the authors take into account is the relevance of Stamp Duties. Data are not fully comparable in this case either. Nevertheless, it can be shown that Denmark, UK, Sweden, Germany, Austria and Finland (between 1% and 6%) present the lowest rates. On the other side of the spectrum, we find Belgium (12.5%), Greece and Portugal and France (10%). Italy, Spain, the Netherlands and Ireland are somewhere in the middle with rates ranging between 6% and 9%.¹⁰ As emphasised in the previous Section, another important factor affecting the sensitivity as well as the spendability of house prices can be provided by the number of housing transactions, which provides a measure of liquidity of the housing market. Taking European Mortgage Federation data, figures show a quite heterogeneous pattern. In fact, over the period 1992-97, the (yearly) number of transactions per 1,000 residents was the following: Italy 8.7, Belgium 10.3, Ireland 13.5, Finland 14.8, Denmark 15.1, the Netherlands 15.2, Sweden 17.8, United Kingdom 20.6.

The second and possibly more influential characteristic of the housing market refers to the credit availability and, in particular, to the mortgage loans for owner-occupation and rental purposes. Despite the deregulation and globalisation process of the 1980s and 1990s, from Table 2 it is possible to see how there are still quite pronounced differences across European countries. In particular, we notice that the ratio of mortgage debt to GDP ranges from 5% in Austria, 7% in Greece and 8% in Italy, to 65% in the Netherlands and 69% in Denmark. Also Sweden, UK and Germany present high ratios (between high 50% and 57%). Data on number of new residential mortgage loans provides another indicator of credit easy. In particular, over the period 1992-97 the number of new mortgages per 1,000 residents in Belgium, Ireland and Spain was respectively 13, 12.9 and 10.1. On the other side of the spectrum, we find the Netherlands, Denmark and the U.K. with 26.2, 44.4 and 17.7.

Data on the maximum loan-to-value (LTV) ratios available to borrowers are shown in column five. With the only exception of Italy, which presents an extremely low 50 per cent ratio, the remaining EU countries show ratios around 70-80 per cent, which are still well below the 95 per cent ratio required by the British banks. These figures are particularly informative because they provide a measure of the down-payment requirements, as well as an indicator of the collateral role of housing.

As far as the typical term maturity and the interest adjustments are concerned, column three and four of the table provide further evidence of heterogeneous mortgage markets. Denmark is again an extreme case with wide diffusion of mortgages with an interest rate fixed for the entire 25-year term. High levels of fixed interest rate are also observable in France, Italy and Belgium. At the other end of the spectrum, we find Portugal, Finland and Spain with, respectively, 100, 90 and 80% of variable interest rates, the UK, with almost all the mortgages categorised as renewable or re-viewable, and all the remaining countries characterised by the presence of a mixture of fixed, variable, reviewable and renegotiable interest rates. It is clear, however, that even under the presence of similar mix of variable versus fixed interest rates, the size and the timing of the pass-through of policy rates to mortgage rates have a crucial role in the sensitivity of the demand for housing to monetary shocks and, consequently, of residential prices. To this regard, some authors (BIS, 1994; Borio and Flitz, 1995; Cottarelli and Korelis, 1995; Mojon, 2000 and Toolsema *et al.*, 2001) examine the short-term and long-term pass-through of money market rates to various bank retail rates across a number of countries. Although results are not clear-cut and must be considered with caution due to the specific rates used, they show that there is a significant heterogeneity, which can be explained by country-specific legal aspects of the banking sector (Cecchetti, 1999), as well as the degree of competition in the banking sector and integration of financial markets. Looking at the effects on the lending rate of changes in the money market rate, they show that the United Kingdom and the Netherlands show the fastest response, whereas Italy, Germany, Spain and Finland present a much lower degree of pass-through. As for the mortgage rates,¹¹ BIS (1994) and Mojon (2000) show that Spain, Italy, Germany and France present relatively slow short-term pass-through, whereas in the United Kingdom and the Netherlands it is quicker. The last column provides some evidence on the tax treatment of mortgage interest payments. All EU countries, with exception of Germany, allow at least partial interest deductibility, although they present different limits.¹²

⁹ These data refers to the first column of Table 5, page 20 in MacLennan *et al.* (1998).

¹⁰ These figures have to be taken with caution because the estimates differ quite significantly according the data providers (namely ENHR and Woolwich Building Society).

¹¹ The definition of mortgage rates differs widely across countries. Consequently, a row comparison of the results is not warranted.

¹² See Lea *et al.* (1997), table II-5, page 46 for more details.

TABLE 2 Mortgage systems in the EU countries.

Country	Residential Mortgage Loans as % GDP	Interest Adjustment	Typical Term (years)	Typical LTV Ratio	Interest relief
Monetary Union Members					
Austria	5	Some F Mostly N and R	20-30	80%	Yes
Belgium	25	N (40%) F (60%)	20	80%	Yes
Finland	30	V (90%)	10-15	70-80%	Yes
France	21	F (80%) V (20%)	15-20	70-80%	Yes
Germany	53	F (20%) N (40%) R (40%)	25-30	60-80%	No
Greece	7	F (12%) R (72%) N (16%)	15	50-75%	Yes
Ireland	27	F (64%) R (31%)	20	90%	Yes
Italy	8	V (40%) F (60%)	10	50%	Yes
Netherlands	65	V (10%) N (65%) F (25%)	30	75%	Yes
Portugal	26	V (100%)	15	80%	Yes
Spain	24	V (80%) F (20%)	15-20	70-80%	Yes
Members of the EU not in EMU					
Denmark	69	V (10%) F (90%)	25	80%	Yes
Sweden	50	Mainly R and Short Term N	20-30	70-75%	Yes
United Kingdom	57	R (70%) N (39%)	25	100%	Yes

Source: EMF Annual Report (1998) and Lea *et al.* (1997).

Notes: EMF data (1998) are mortgage loans for owner-occupation and rental purposes (not fully comparable) and refer to 1998. Fixed (F): rate fixed until final maturity; Renegotiable (N): rate not fixed over entire term, but more than one year; Variable (V) rate adjustable according to index; Re-viewable (R): rate adjustable at discretion of lender.

- the ratio between size of the rented market and ownership tenure;
- the number of housing transactions and the presence of low transaction costs;
- the mortgage availability;
- the loan-to-value ratio;
- the mix between variable/fixed interest rate and "pass-through".

Focusing only on the countries we are going to study, for each factor in each country, we have assigned three symbols ranging between "○", "◐" and "●", which indicate a relatively "low", "medium" and "high" values. Although it is difficult to assess the "weight" and relative importance of each factor, a visual inspection of the table suggests a relatively low potential role of house prices in the MTM in Belgium, Spain and Italy, while a relatively more significant one in Sweden, Finland and the United Kingdom.

TABLE 3 Relative Potential Role of House Prices in the MTM

Country	Tenure (Rented vs Ownership)	Number of Transactions and Transaction Costs	Mortgage availability and Number of New Mortgages	Loan-to-Value (LTV)	Fixed vs Variable interest rate Pass-through
Belgium	◐	○	○	◐	○
Finland	◐	●	●	◐	◐
Ireland	◐	◐	○	◐	◐
Italy	◐	○	○	○	○
Netherlands	○	◐	●	◐	●
Spain	●	○	○	◐	○
Sweden	◐	●	●	◐	●
United Kingdom	◐	●	●	●	●

Notes: in all columns ○ indicates "relatively low", ◐ a medium and ● a "relatively high" potential propagating role of the house price in the monetary transmission mechanism.

From the above analysis, it is difficult to draw a clear-cut identification of the countries, which might have house prices as a significant propagating role in the MTM. However, it might be useful to attempt a rough classification on the basis of the main institutional feature outlined above. In this regard, in Table 3 we provide the results of an "experiment" which is constructed on the basis of five main factors of the housing and mortgage markets that we think might be particularly informative. They can be summarised as follows:

In what follows, we try to quantitatively investigate the role of housing for consumption in the transmission of a monetary policy shock in two stages. First we study the sensitivity of residential prices to interest rate policy changes in two parsimonious VAR systems. Subsequently, we try to quantify the role of those policy-induced residential price fluctuations for consumer spending decisions.

4. The Empirical Methodology and Results

Although central banks have displayed much interest in the role of asset prices in the formulation of monetary policy (see BIS, 1998 and Cecchetti *et al.*, 2000), relatively little empirical work has been done on the significance of house prices. It could be argued that monetary policy is not the main factor affecting residential prices, and that other fundamental, as well non-fundamental factors, account for most of their variability.¹³ However, the significant house price fluctuations of the last decades in many regions and the role of these assets in households' portfolios deserve some investigation.

The empirical method we adopt is motivated by two recent studies, which have tried to analyse how the impact of real asset values can magnify the effects of monetary tightening on the economy. In particular, Kwon (1998) extends existing work focusing on the transmission mechanism of monetary policy in Japan to a model with land prices, which play a primary collateral role in investment financing of Japanese firms. Following the standard empirical literature based on SVARs with restrictions on the contemporaneous interactions between variables, he extends Clarida and Gertler (1996) to a model with land prices and studies the effects of monetary policy on the variables of the system. In finding that a tightening of monetary policy leads to a significant and persistent decline in land prices and output, he compares the decline in the latter variable in a model that does not include land prices. The two main results can be summarised as follows. First, the decline in output produced by a negative monetary shock appears more severe and deeper than a model without land prices predicts. Second, monetary policy shocks turn out to be an important source of output fluctuations when considering the propagating role of movements in land values.

Another recent and significant piece of evidence has been provided by Iacoviello (2000), who estimates a structural VAR for six EU countries (i.e. France, Germany, Italy, Spain, Sweden and the U.K.) by using the common trends approach developed by King, Plosser, Stock and Watson (1991) (KPSW). In specifying a five dimensional VAR with output, real house prices, real money balances, short-term nominal interest rates and inflation as endogenous variables, he shows that: (i) an adverse monetary shock has a significant negative impact on real house prices (with timing of the response in house prices matching that of output), (ii) the magnitude of the response in house prices to a monetary shock is partly explained by institutional differences in the housing and financial markets, and (iii) monetary and demand shocks affect

house prices in the short run. In particular, by looking at the impulse response functions of the six countries to a standard (50 basis points) short-term interest rate shock, Italy and UK present the largest fluctuations, with France and Germany at the other end of the spectrum. Spain and Sweden are somewhere in the middle. With the only exception of Italy, the results on the house price responses to monetary shocks are consistent with the stylised facts observed on the housing and mortgage markets. Although interesting, his analysis takes some short-cuts, which ought to be pointed out. First of all, the estimation period differs from country to country, making any quantitative as well qualitative comparison harder to assess. Moreover, it includes the post Bretton Woods flexible exchange rate regime and the semi-fixed or pegged exchange rate following the launch of ERM after 1979. To this regard, his specification might not be rich enough in that it omits variables (i.e. exchange rates or foreign macro and financial variable), which might help to better identify a monetary policy shock in small open countries. Additionally, his system does not include variables (i.e. private consumption) which are directly affected by house prices, making the role of housing assets in the MTM difficult to quantify.

Given the main focus of this paper (i.e. the investigation of the role of house prices in propagating the effects of monetary policy shocks), we follow Kwon (1998) and use structural VARs with restrictions on the contemporaneous interaction between variable. This method has the clear advantage over the KPSW approach used in Iacoviello (2000), in that we avoid imposing "unknown" long-run cointegrating relationships, which can lead to biased estimates. Differently from Kwon (1998), however, we assess the role of the real asset value in the monetary transmission mechanism through the use of a counterfactual simulation, which we outline in the last subsection.

4.1 The Structural Var Approach

Letting x_t denote the $(nx1)$ vector of endogenous variables and ε_t the $(nx1)$ vector of structural shocks, we assume that the economy is represented by a linear, stochastic dynamic system of the following *structural* form:

$$(1) \quad B_0 x_t = B_1 x_{t-1} + \dots + B_p x_{t-p} + \varepsilon_t$$

where B_i , $i = 0, \dots, p$, are (nxn) matrix of coefficients and where we assume that the structural disturbances ε_t are mutually orthogonal and have unit variance, implying that $E(\varepsilon_t \varepsilon_t') = I$.

¹³ We refer to non-monetary demand and supply shocks, demographic, legal and institutional factors, credit and financial determinants as well as speculative bubbles.

The moving average (MA) representation for x_t is given by

$$(2) \quad x_t = [B(L)]^{-1} \varepsilon_t$$

where L is the lag operator (that is, $L^k x_t = x_{t-k}$) and $B(L) = B_0 - B_1 L - B_2 L^2 - \dots - B_p L^p$.

Eq. (1) can be written in a *reduced* form, which can be directly estimated by OLS, as:

$$(3) \quad x_t = A_1 x_{t-1} + \dots + A_p x_{t-p} + u_t$$

where the innovations u_t are assumed to have variance-covariance matrix $E(u_t u_t') = \Sigma$.

Noting that $A(0) = B_0^{-1}$, we can write $A_i = A(0)B_i$, for $i = 1, \dots, n$, and the relationship between the innovations and the structural shocks as

$$(4) \quad u_t = A(0)\varepsilon_t \quad \text{or} \quad \varepsilon_t = B_0 u_t$$

from which it can be easily seen that

$$(5) \quad E(u_t u_t') = \Sigma = A(0)A(0)'$$

From eq. (2), we can calculate the impulse response functions (IRFs) to the *structural* shocks

ε_t as $x_t = [B(L)]^{-1} \varepsilon_t = \Phi(L)\varepsilon_t$ where, from eq. (3) and eq. (4), we have that

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

While OLS can be used to obtain consistent estimates of the parameters in (3) as well as an estimate of the symmetric variance-covariance matrix Σ , in order to identify the structural shocks ε_t and the above IRFs coefficients, we need to determine the n^2 elements of $A(0)$.

As is well known in the literature, system (5) provides n^2 equations in only $n(n+1)/2$ restrictions defined by Σ . Just-identification of such a model and, therefore, estimation of the matrix $A(0)$ and the structural innovations ε_t require $n(n-1)/2$ additional restrictions.¹⁴

As comprehensively explained in Favero (2001), the most common strategies used by the VAR literature imply the imposition of restrictions (i) on the contemporaneous effects of shocks $A(0)$ (Sims, 1980 and 1992); (ii) on the contemporaneous effects of the endogenous variables B_0 (Bernake, 1986 and Sims, 1986); (iii) long-run *a priori* theoretical restrictions on $B(1)$ or $A(1)$ (Blanchard and Quah, 1989; Clarida and Gali, 1994); and some combination of (i), (ii) and (iii) (Christiano *et al.*, 1999 and Gali, 1992).

A standard way to add the required additional restrictions is to use a Cholesky decomposition of the variance-covariance matrix Σ and, therefore, assume that $A(0)$ is lower triangular.

This assumption implies a recursive economic structure, in which a shock on variable i affects all the variable j if, and only if, $j > i$.

4.2 The Role of Monetary Shocks for House Price Fluctuations

For a real asset price channel to exist, two conditions have to be satisfied. First, significant effects in the house prices should accompany shocks in the interest rates. Second, these fluctuations should affect the economic activity mainly through movements of the private consumption, and, consequently, output.

In this Section, we start by estimating a recursive VAR model to focus on the first condition and to assess the role of monetary policy shocks for housing price developments. The eight countries under investigation are Belgium, Finland, Ireland, Italy, the Netherlands, Spain, Sweden and the U.K. The estimation period is 1979:2-1998:4 for all countries with the exceptions of Spain (1987:1-1998:4) and Belgium (1981:1-1998:4). Our specification includes in the following order: the CPI, real GDP, the real house prices and the money market interest rates.¹⁵ Given the short run focus of our analysis, we assume that the stock of houses is fixed and do not include any housing supply variable. This is not a particularly important omission, because house supply in Europe has been shown to be very inelastic in the short-term (Ball and Grilli, 1997). In imposing a Cholesky decomposition, we assume that the monetary policy does not have any contemporaneous effect on the economic variables and that authorities are assumed to take into account the simultaneous developments of the economic variables for setting their policy.¹⁶ All variables are taken in natural logarithms, with the exception of the money market rates, which are in level. Some of these variables might be non-stationary. Nevertheless, in this paper, the loss of information which derives from an estimated VAR in first differences is given priority over the loss of efficiency occurring from the estimation of an unrestricted VAR in levels (see Hamilton, 1994 and Hendry, 1996 for a discussion). We estimate our benchmark system in levels with two lags,

¹⁴ It is correct to say that exact identification requires not only this order condition, but also a rank condition. See Hamilton (1994) for a discussion.

¹⁵ As Sims (1986 and 1992) and the subsequent VAR literature, we use innovations in short-term interest rates as a measure of shocks to monetary policy. Although we are aware that central banks have a wider set of policy instruments at their disposal, in achieving a common specification of instruments, which might help a minimum of comparability, the assumption that, during the sample period 1979-98, the individual European CBs have used short-term interest rates as their main tool does seem more than reasonable (Borio, 1997).

¹⁶ Alternatively, we can order the policy variables first, assuming that monetary shocks can contemporaneously affect the other variables of the system and that monetary authorities do not consider the simultaneous innovations of the economic variables (Sims, 1992). While this identification assumption might be reasonable for high frequency (i.e. monthly) data, our ordering choice seems more appropriate for quarterly series.

which seems to be a good compromise between the selection made by the Akaike and the Schwartz criteria, as well as being appropriate to get serially uncorrelated residuals. For Ireland and Belgium three lags were necessary, while we include four in the Italian system. Longer lag lengths do not affect the main results. In order to increase efficiency of the estimation, a number of dummies have been included for Ireland, Italy, the Netherlands and Sweden to take into account outliers that were quite significant in the interest rate equations during the exchange rate crisis of 1992-93.

The above specification describes a close economy. This might not be optimal if the aim is to identify unexpected monetary shocks for relative small and open economies. Moreover, the estimated period has been characterised by exchange rate targeting and management of the currency parities. As a result of this consideration, we augment the system with the inclusion of the exchange rate versus the DM and test whether the results are consistent with the benchmark model. Under the Cholesky decomposition, it is hard to find an ordering which can be unquestionable. Ordering the exchange rate before the interest rate would imply the assumption that the latter does not contemporaneously affect the former. The reverse would impose no current feedback reaction of the monetary authorities to exchange rate fluctuations over the same quarter. Aware of this, we have tried both ordering and found no evidence of significant differences. More importantly, the estimated IRFs for all the economic variables are basically unaffected. The presence of exchange rate puzzle, however, brings us to choose the basic closed-economy specification as the benchmark system.

Figure 1 shows the point estimates (and correspondent two-standard error bands) for responses of the CPI, real GDP, real house price index and money market rate to a one standard deviation monetary policy shock. In the Netherlands and Finland, the restrictive monetary shock results in a temporary, but quite persistent, increase of the consumer price index, which, however, permanently decreases after 15-20 quarters. This "price puzzle" has been found in several empirical studies and, given the low number of endogenous variables included in our model, it could be due to a miss-specification of the system, where leading indicators for inflation to which central banks react might be omitted (Sims, 1992). Also by adding the relevant variables, it might be the case that monetary authorities do not react with sufficient commitment to offset future inflationary pressures, because of the necessity of smoothing changes of interest rates over time. The main successful solution proposed by the empirical U.S. literature relies on adding current and lagged values of commodity prices into the monetary authorities reaction function and ordering the short term interest rate after this variable (Christiano *et al.*, 1999). We do so by including a world export price index. As in

Sims (1992), results are not particularly satisfactory for European countries. In fact, the point estimates of the response of the price index remain unaffected. The restrictive monetary shock generates a significant and temporary decline in output for all countries. The only exception is Spain, where the real output fall is relatively small and not statistically significant. Once we take into account the size of the shock to the MMR, differences in the timing and size are very noticeable and similar to previous empirical studies.

As far as the real house price effects are concerned, we can identify three main groups of countries, which are roughly consistent with the descriptive analysis of the housing and mortgage systems across Europe. Although it is worth pointing out that a rigorous comparison of the point estimates might be misleading because of heterogeneous definitions and construction of the data (see Appendix 1 for a discussion), this exercise is still informative if the focus is on the general dynamics of the house prices and the statistical significance of the IRFs. In particular, on one side of the spectrum we find Spain and Belgium with a small and not significant temporary decrease of the real house price index. In Italy we can observe an anomalous response with an increase of the residential price index over the first 8-10 quarters, which quickly reverses to a significant but temporary medium-run decrease. The relative delay effect of residential prices in Italy are consistent with the wide diffusion of long-term fixed mortgage interest rates which might slow the response of demand for housing. On the other side of the spectrum, Finland, Sweden and the U.K. show the most significant and large decline. Ireland and the Netherlands are somehow in the middle. Figure 1.1 graphs the point estimates of the house price responses to a normalised (100-point) shock of the interest rate and helps to identify the heterogeneous sensitivity of residential prices to monetary shocks.

Similarly to Iacoviello (2000), the timing and the responses in house prices matches that of real output, providing some evidence of the fact that the effects monetary shocks to house prices work through real output changes.

We carry out a sub-sample stability analysis to verify the robustness of the above results. In particular, given the limited number of observations, we decide to re-estimate the models over the sample period 1985:1-1998:4. The choice of this sample is twofold. First, we can check the stability of our point estimates under only one monetary regime, coinciding with "hard" EMS (Ehrmann, 2000). Secondly, we can verify the importance of short-term interest rate shocks during the period of major expansion of mortgage credit liberalisation process which started in the early 1980s but, in many countries, developed fully during the second half of that decade. We have also estimated the system by adding a proxy for the credit availability

over this sample. Results are substantially unaffected, suggesting that this simple recursive structure represents a robust specification.

While recursive identifications schemes with an appropriate choice of endogenous variables have shown to provide satisfactory results for closed economies like the U.S. (Christiano *et al.*, 1998), the Cholesky decomposition has been less successful in studying the MTM in small open economies. Following Sims (1986) and Bernanke (1986), and more recently Kim (2001) and Kim and Roubini (2000), we implement a structural VAR with identification based on contemporaneous exclusion restrictions on the coefficient matrix $A(0)$. This generalised method is particularly appealing, because it explicitly allows for simultaneous interactions among variables.¹⁷

In particular, we estimate a SVAR common to the countries augmenting the previous specification with nominal exchange rates. While this choice clearly satisfies the necessary requirements of an identical structure, it does not reflect actual differences in the CBs reaction functions due to heterogeneity of the information set available to the monetary authorities (Ehrmann, 2000). We partly allow for heterogeneous specifications by including appropriate dummies for special events, but leave the construction of models *ad hoc* for future work. This is clearly costly in that some puzzling responses to monetary policy shocks still remain, but at the same time it provides an alternative specification which can reinforce the results of the recursive model.

The estimated system is given by the following variables: CPI, real GDP, MMR, real house price and NER (that is, nominal exchange rate versus the DM).¹⁸ Following Sims (1986) and Bernanke (1986), in order to achieve identification of the structural parameters and innovations, we impose a set of zero (exclusion) restrictions on the contemporaneous structural parameters B_0 , which can be summarised by the following system:

$$(7) \quad \begin{bmatrix} \varepsilon_{cpi} \\ \varepsilon_{gdp} \\ \varepsilon_{ms} \\ \varepsilon_{hp} \\ \varepsilon_{ner} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & a_{35} \\ a_{41} & a_{42} & a_{43} & 1 & 0 \\ a_{51} & a_{52} & a_{53} & 0 & 1 \end{bmatrix} \begin{bmatrix} u_{cpi} \\ u_{gdp} \\ u_{mmr} \\ u_{hp} \\ u_{ner} \end{bmatrix}$$

where ε_{cpi} , ε_{gdp} , ε_{ms} , ε_{hp} and ε_{ner} are the structural disturbances, that is, CPI shocks, GDP shocks, money supply shocks, house price shocks and exchange rate shocks,¹⁹ respectively, and, u_{cpi} , u_{gdp} , u_{mmr} , u_{hp} and u_{ner} are the innovations of the reduced form equations which represent the unexpected movements of each endogenous variable and provided the information set of the system.

This structural decomposition differs from a standard Cholesky factorisation in two equations. The interest rate equation is assumed to be a reaction function of the monetary authorities, who, within the quarter, can observe the current value of the price and output level, as well as the nominal exchange rate. The nominal exchange rate equation is assumed to be dependent on all variables in the system except for the real house price index, which, apart from being publicly available with delays, might be expected to have a secondary role in the exchange rate determination. The remaining zero contemporaneous restrictions in the other equations are consistent with a Word ordering given by {CPI, real GDP, MMR, HP, NER} and have been widely accepted as reasonable by the relevant literature. The system is just-identified and the contemporaneous coefficient matrix $A(0)$ has been estimated by maximum likelihood estimation. All variables enter in logarithms except for interest rates. A complete set of seasonal dummies is used in all estimations and each variable enters each equation with two lags. Higher orders have been tested and do not affect the main results.

Figure 2 reports the IRFs to the identified monetary policy shock. A temporary price puzzle still occurs in some countries, but, in all cases, it is not statistically significant and much less persistent than in the recursive structure.²⁰ The short-run appreciation of nominal exchange rate in all countries provides some positive support in favour of a successful identification of the monetary policy shock. As far as the real GDP responses, the imposed structure seems to match the recursive system results. In the case of Finland, however, the effects of monetary policy on real HP are reduced in size. Similarly to the above, we have re-estimated the same

¹⁷ In the Cholesky decomposition, by including some variable in the monetary reaction function, we assume that monetary policy shocks do not affect those variables contemporaneously, and vice versa. While this assumption is not particularly costly with economic variables, the inclusion of nominal exchange rates in the specification model makes the recursive identification theoretically weak.

¹⁸ Following Ehrmann (2000) for Ireland we take the Pund/Sterling exchange rate and for Finland the Markka/US\$ exchange rate. While from a theoretical point of view this is justified by monetary authorities which might be more directly affected by those rates, this choice prevents any puzzling response to monetary policy shocks.

¹⁹ Given that this is a model geared to provide monetary policy shocks, we do not try to impose alternative identifying restrictions which might help to interpret the other structural shocks of the system.

²⁰ The CPI response becomes permanently negative after 10 quarters after the monetary shock.

model during the so-called “hard” ERM and found that the main qualitative results are not affected, although the loss of degrees of freedom makes the estimated responses less stable.

At this point, it is interesting to study the variance decomposition of the real house price index, and verify which weight can be attributed to the different innovations of the system and, in particular, to the identified monetary policy shock. Figure 3 shows the share of the total variance of the real house price index attributable to the variance of each structural shock. It is worth pointing out, however, that the contemporaneous restriction SVAR we have estimated in this Section is mainly designed to identify monetary shocks, and, differently to the common trends methodology used by Iacoviello (2000), we do not try to label or interpret the remaining shocks.²¹ The figure indicates that in all countries residential price volatility is mainly driven by structural innovations in the real house price equation. However, consistent with the above IRF analysis, the Netherlands, Sweden, the United Kingdom and, to some extent, Finland are the countries where monetary shocks play a relatively more significant role (after the 4-5 quarters it goes from 5% to 42%). On the other side of the spectrum there are Spain, Italy, Belgium and, to some extent, Ireland, where the role of interest rate shocks is marginal or very small. Shocks to the real GDP equation are particularly relevant in driving house price fluctuations (between 20-40%) at any time horizon in Belgium, Ireland, Spain, Finland and Italy. Similarly to Iacoviello (2000), the identified monetary shocks seem to play an influential role in the housing market. However, our systems provide some evidence on the possibility of cross-country differences which are consistent with the institutional features of the European housing and mortgage markets outline in Section 3.

4.3 Counterfactual Experiment: The Role of House Prices in the MTM

So far we have focused our attention on how monetary shocks affect house prices. However, in the theoretical discussion in Section 2, we have emphasised the potential role of house price fluctuations in affecting private consumption. The purpose of this Section is to investigate the quantitative significance of these effects in the transmission of monetary policy shocks to consumer spending.

Following Kim (1995), Sims and Zha (1995), Beamanke, Gertler and Watson (1997), and more recently, Lettau, Ludvigson and Stein del (2001), we implement a two-stage approach in a VAR context. In the first stage we estimate a “baseline” structural model that includes real

output, consumer price index, private consumption, MMR, real house prices and exchange rates. Similarly to the semi-recursive system estimated in the previous Section, we identify an exogenous structural monetary shock through restrictions on the structural contemporaneous relationships between the endogenous variables provided by B_0 , which can be summarised by the following system:

$$(8) \quad \begin{bmatrix} \varepsilon_{cpi} \\ \varepsilon_{gdp} \\ \varepsilon_{pc} \\ \varepsilon_{ms} \\ \varepsilon_{hp} \\ \varepsilon_{ner} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & a_{46} \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & 0 & 1 \end{bmatrix} \begin{bmatrix} u_{cpi} \\ u_{gdp} \\ u_{pc} \\ u_{monr} \\ u_{thp} \\ u_{ner} \end{bmatrix}$$

where ε_{cpi} , ε_{gdp} , ε_{pc} , ε_{ms} , ε_{hp} and ε_{ner} are the structural disturbances, that is, CPI, GDP, real private consumption, monetary policy, house price and exchange rate shocks, respectively, and, u_{cpi} , u_{gdp} , u_{pc} , u_{monr} , u_{hp} and u_{ner} are the innovations of the reduced form equations. This structural decomposition is qualitatively similar to the one used in the previous Section, with the only difference that the reaction function of the monetary authorities is augmented with the current value of the real private consumption. Again, the nominal exchange rate equation is assumed to be dependent on all variables in the system except for the real house price index. The remaining zero contemporaneous restrictions in the other equations are consistent with a standard Word ordering implying that real private consumption is not contemporaneously affected by interest rates and house price fluctuations. The latter assumption is suggested by the fact that house price indexes are not readily available within the same quarter and, as a result, consumer spending cannot react to contemporaneous changes in real asset values. Alternatively, we can think of this restriction as sluggish response of consumers making their spending decision. We use this system to estimate IRFs, which provide the total dynamic responses of private spending to the identified monetary policy shock. It is worth pointing out that, in excluding the contemporaneous effect of residential prices to private consumption, we do not constrain the operativeness of the housing channels. In fact, from the structural system provided by equation (1), we can easily see that lagged house prices (whose correspondent parameters are found in the third row of the

²¹ A different identification scheme with some combination of long and short run restrictions would have been more appropriate to identify other temporary or real shocks (Gali, 1992). In future research we are planning to apply this alternative methodology.

structural coefficient matrices B_i , where $i > 1$) can directly affect consumers' decisions through the channels emphasised above.

In the second stage, we simulate the effects of such shocks under a counterfactual regime in which we "shut-off" the effects of house price fluctuations to private consumption. We do so by setting to zero any lagged response of consumption to house prices and keeping the remaining structural parameters fixed to their baseline value. We then re-compute the effects of money market rate innovations on consumption and compare them with the ones estimated in the first stage. Similarly to Lettau *et al.* (2001), we interpret the difference between the two as a measure of the contribution of the house price in propagating a monetary shock to consumption.

Figure 4 shows the responses to a monetary shock in the six-variable system.²² As for the variables common to the previous models, the quantitative and qualitative responses are basically unchanged and support the main findings on the sensitivity of the house prices to the identified monetary policy shock. Additionally, we can find a statistically significant U-shaped response of private consumption. The counterfactual simulation results are shown in Figure 5. From a visual inspection, it is interesting to notice that the propagating role of house price on consumer spending is particularly strong in the U.K., Finland, the Netherlands and Sweden, and marginal in remaining countries, where the two responses almost coincide. This is consistent with the factors of Diagram 1. However, it is worth pointing out that also in the extreme cases the counterfactual estimates lie within the two-standard-error confidence bands of the baseline models. This implies that our model is not able to provide a strong statistical significance of such a house price channel of the MTM to consumption. This might be due to the fact that, as shown in the previous Section, real house prices react only temporarily to a monetary shock and that this transitory, although persistent, effect has a small impact in the monetary shock propagation. Even more importantly, the lack of statistical significance is related to the wide confidence intervals, which are the inevitable price to pay in sacrificing several degrees of freedom in a six-variable system with two/three lags. In this regard, a more conservative specification might reduce the standard error bands and make our conclusions statistically stronger.

Following Morsink and Bayoumi (1999) and Clements *et al.* (2001), we attempt to disentangle and assess the strength of the house price channel by estimating the difference in

the response of consumption to a monetary policy shock when this channel is closed. Differently from the counterfactual simulation above, we first estimate a recursive VAR in level with the following variables: consumer price index, real output, real private consumption, real house prices and interest rates.²³ We then re-estimate this model eliminating the house price equation while maintaining the lagged values of the real house price index in each equation of the system. In doing so, the latter model, in which residential prices are treated as exogenous, blocks off any effect within the VAR that pass-through the endogenous house price response to the interest rate shock. Comparing the responses of the two models to monetary policy shocks provides a measure of the role of the house price channel in the MTM. Table 6 shows the results from which it is possible to confirm the conclusions of the counterfactual simulation.²⁴ In particular, the U.K., Finland, the Netherlands and Sweden are the countries where house prices seem to play a relevant role in the transmission mechanism to private consumption. On the other hand, in Belgium and Italy the two responses are basically identical, providing additional evidence in support of the counterfactual simulation exercise.

²² Due to convergence problems with the six-variable system for Ireland, we do not report the counterfactual experiment results for this country.

²³ In this sub-section we choose to use a close economy specification for two reasons. Firstly, from the above analysis we have shown that inclusion of the exchange rates, while providing a more reliable identification of the monetary shock in the pre-EMU period, leaves the responses of the other variables unaffected. Secondly, we are able to reinforce the counterfactual simulation results in which a different specification and a non-recursive approach have been adopted.

²⁴ Irish and Spanish estimates did not provide reliable impulse responses. As a result, we do not show them.

5. Conclusions

Over the last few years many researchers have been trying to compare and analyse the effects of a monetary policy shock across European countries. While the evidence is inconclusive and rather mixed, few of them focus on single channels of the MTM. Even fewer have attempted to assess the role of house prices. This is rather surprising, because housing represents more than half of the net wealth of the private sector, and plays a crucial role as collateral for households' borrowing. Moreover, over the last two decades we have experienced large residential price fluctuations, which, following the financial liberalisation process in most industrialised countries, have been shown to have affected the real economy. While some authors have provided some empirical evidence in support of a relationship between real house prices and the economic activity (Kennedy and Andersen, 1994; Muellbauer and Murphy, 1997; Girouard and Blöndal, 2001), little work has been done in investigating the role of such *house price channel* in the transmission of a monetary shock. Moreover, European countries present quite divergent housing and mortgage markets, which might provide an interesting source of comparison.

In this paper we provide some qualitative and quantitative evidence of the link between monetary shocks and residential prices, and between house prices and economic activity over the EMS period for eight European countries by using small structural VAR models. From our IRFs and FEVD analyses, we find that house prices are significantly, but temporarily, affected by monetary shock. In particular results show that restrictive monetary policies have negative effects on real house prices. The size of the response is partly consistent with differences in the housing and credit systems, and its timing is similar to that of real variables. We then assess the role of those changes in the MTM to consumption through the implementation of a counterfactual simulation exercise. We find in Finland, Sweden and the UK real house price changes seem to have played an important role in the transmission of a monetary shock to household consumer spending. This implies that European countries (i.e. Italy and Spain) where the financial deregulation process is still at its initial stages, house prices might become a significant intermediate variable that the ECB could monitor for a proper evaluation of the effects of its actions.

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APPENDIX 1

DATA

Data come from the International Financial Statistics of the International Monetary Fund (IFS) and from the Business Sector Data Base (BSDB) of the OECD. This Appendix has the aim of outlining the definition and the main of the data used in the present paper.

GROSS DOMESTIC PRODUCT at constant prices. The quarterly real GDP series are taken from BSDB (series GDPV and GDP, respectively) and are seasonally adjusted;

CONSUMER PRICE INDEX. The series on the non-harmonised consumer price index (CPI) are obtained from IFS (series 64...ZF... for each national series) and the original base year is 1995=100.

PRIVATE FINAL CONSUMPTION at constant prices. The quarterly private consumption series are taken from BSDB (series CPV) and are seasonally adjusted. It includes goods and services, as well as durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings.

SHORT-TERM INTEREST RATES. The nominal interest rate is the money market rate (MMR) and comes from IFS (series 60bZF...). Table A.1 shows the details of the precise definition of each series.

TABLE A.1 Money Market Rates (MMR)

Country	Definition
Belgium	Call Money Rate
Finland	Average Cost of CB Debt
Ireland	1 Month Fixed Rate
Italy	Money Market Rate
Netherlands	Call Money Rate
Spain	Call Money Rate
Sweden	Call Money Rate
United Kingdom	Overnight Inter-bank Rate

HOUSE PRICE INDEX. Table A.2 shows the sources of house price statistics together with their time span availability and description. The data refer to transaction prices recorded by private real estate associations and, in many cases, collected and published by central banks and central statistical offices in different countries. House price developments are at the national level and refer to sales prices of existing dwellings or, when not available, those of new dwellings. The indices do not directly take into account regional house price dynamics, which, as shown by several studies, can differ quite significantly. However, broad measures are used in order to represent the trends in average house prices in each country. Differences in the construction of these indices, in the characteristics of dwellings (i.e. mix of properties traded over time, quality changes, etc), in the composition of the dwelling stock within and across countries makes quantitative attempts to draw strong international comparisons not very robust.

TABLE A.2 House prices

<u>Country</u>	<u>Period</u>	<u>Source</u>	<u>Definition/Notes</u>
Belgium	81Q1-99Q4	AN-Hyp Bruxelles, (Antwarspe Hypotheek Bank) Antwerpen	Price index for small and middle houses
Finland	70Q1-2000Q2	Bank of Finland Huoneistokeskus	Average price for existing flats per m ²
Ireland	78Q1-2000Q3	Department of the Environment and Local Government	Average gross prices of new (and second-hand) houses for which loans were approved by "All Agencies"
Italy	72S1-98S2	Iacoviello (2000) - "Il Consulente Immobiliare"	Residential property index
Netherlands	77Q1-99Q4	NVM (50-60% of total transactions)	Average Selling Price of existing single and multi-family houses
Spain	87Q1-2000Q1	INE - Ministerio de Economía y Hacienda	Residential Property Price Index per Square Meter
Sweden	72Q1-99Q1	Iacoviello (2000) - Central Statistical Office (CSO)	House Price Index as weighted mean of primary and leisure homes
United Kingdom	74Q2-2000Q1	Department of the Environment, Transport and the Regions (DETR)	UK mix-adjusted house price index, all dwellings; based on survey of all lenders

The semi-annual original series for Italy and Denmark were transformed into quarterly series by using the RATS interpolation procedure INTERPOL.SRC, which allows assume alternative ARIMA model. We have estimated a number of alternative models and tested that every generated series were not affecting the main results of the VAR analysis. Figure 1 and Figure 2 show the IRFs with an ARIMA (1,1,0) imposed in the original house price index series.

All series have been deflated using the CPI index. For the United Kingdom the RPIX (which does not include mortgage interest rate payments) has been used.

CREDIT TO PRIVATE DOMESTIC SECTOR. This series is taken from IFS (series 32D...ZF for each country).

COMMODITY PRICE INDEX. This is the world export commodity price index (U.S. Dollar) taken from IFS (series 000176AXDZF...).

EXCHANGE RATE. The nominal exchange rate refers to calculated units of domestic currency per D-Mark and are calculated by using the IFS data (series ...RH..ZF). For Ireland and Finland the relevant rate is Irish Pund/Sterling and Finnish Markka/US\$, respectively.

APPENDIX 2 ESTIMATION RESULTS

FIGURE 1 Impulse Responses to Monetary Shock in the Recursive four-variable VAR model (dashed lines: 2 standard error bands).

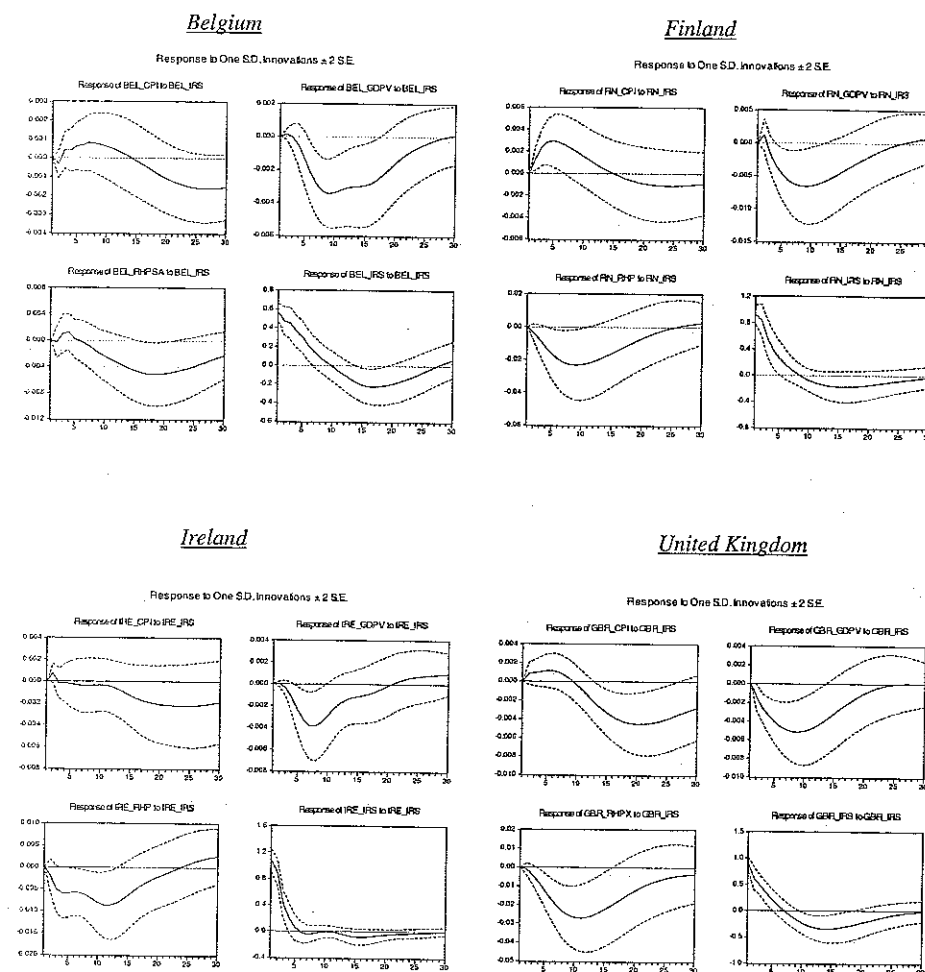


FIGURE 1 Impulse Responses to Monetary Shock in the Recursive four-variable VAR model (dashed lines: 2 standard error bands).

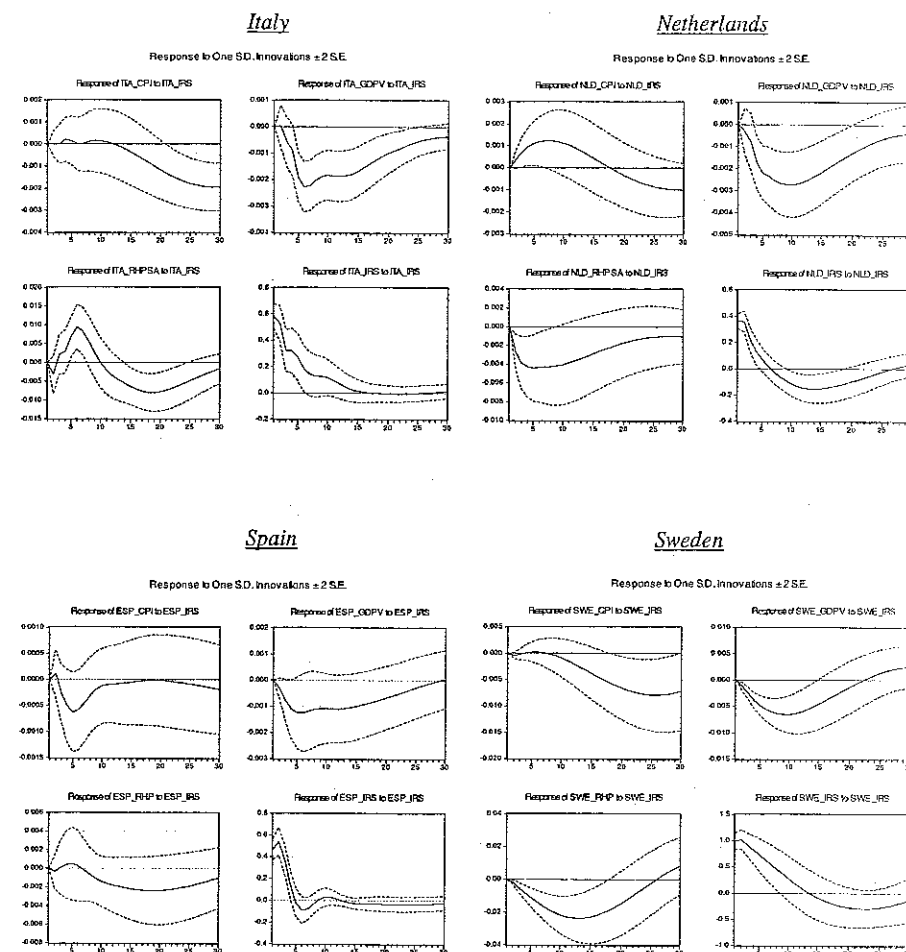


FIGURE 1.1 Real House Price Response to a Normalised Monetary Shock in the Recursive four-variable VAR model

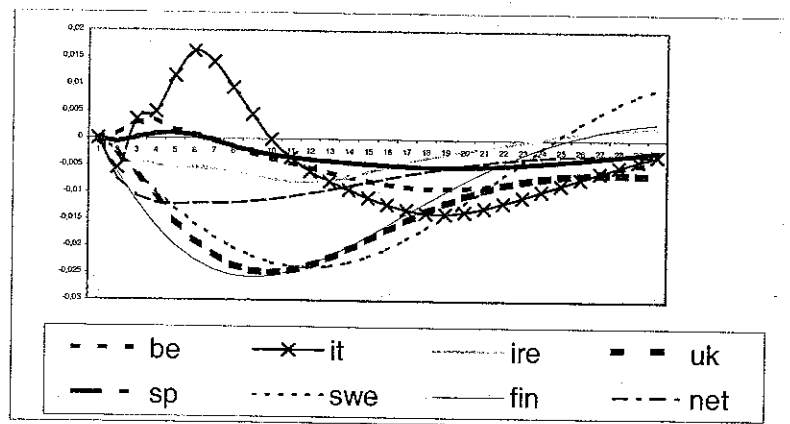


FIGURE 2 Impulse Responses to Monetary Policy Shock in the five-variable SVAR (dotted lines are two-standard deviation confidence intervals)

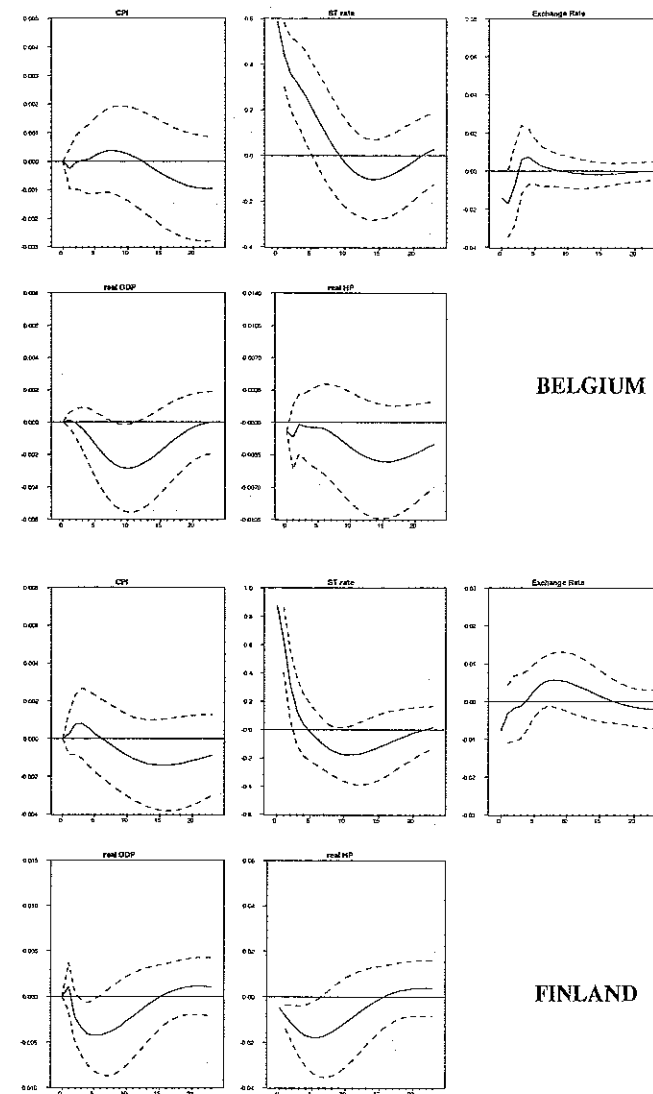


FIGURE 2 Impulse Responses to Monetary Shock in the five-variable SVAR
(dotted lines are two-standard deviation confidence intervals)

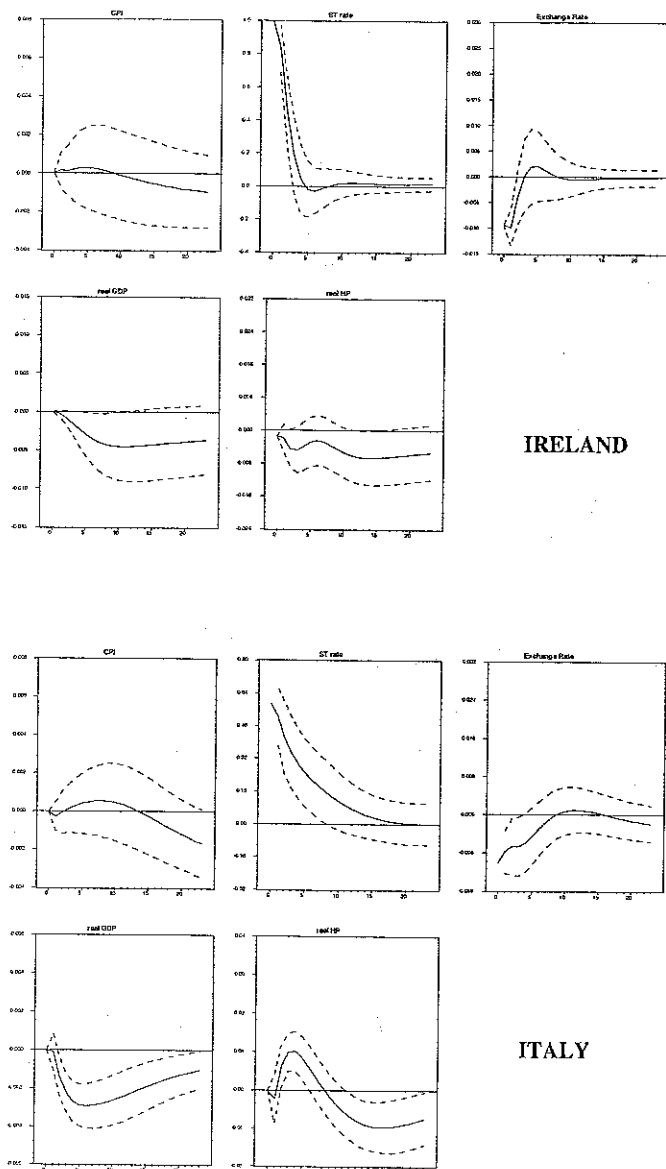


FIGURE 2 Impulse Responses to Monetary Shock in the five-variable SVAR
(dotted lines are two-standard deviation confidence intervals)

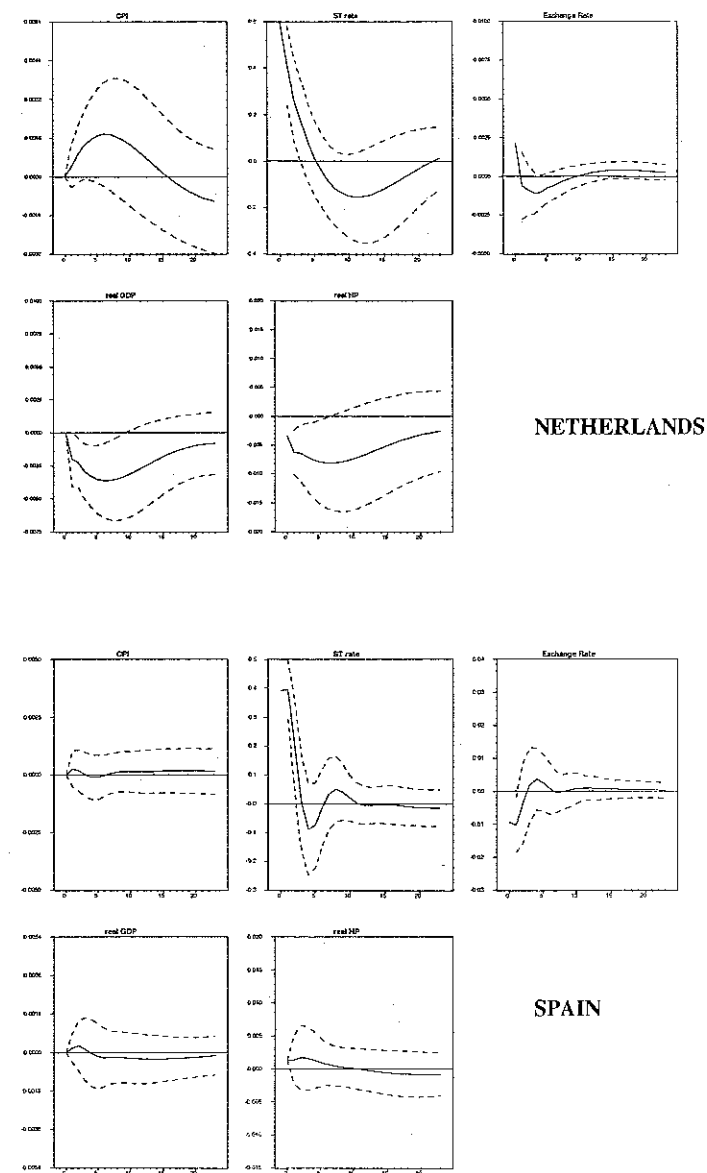


FIGURE 2 Impulse Responses to Monetary Shock in the five-variable SVAR
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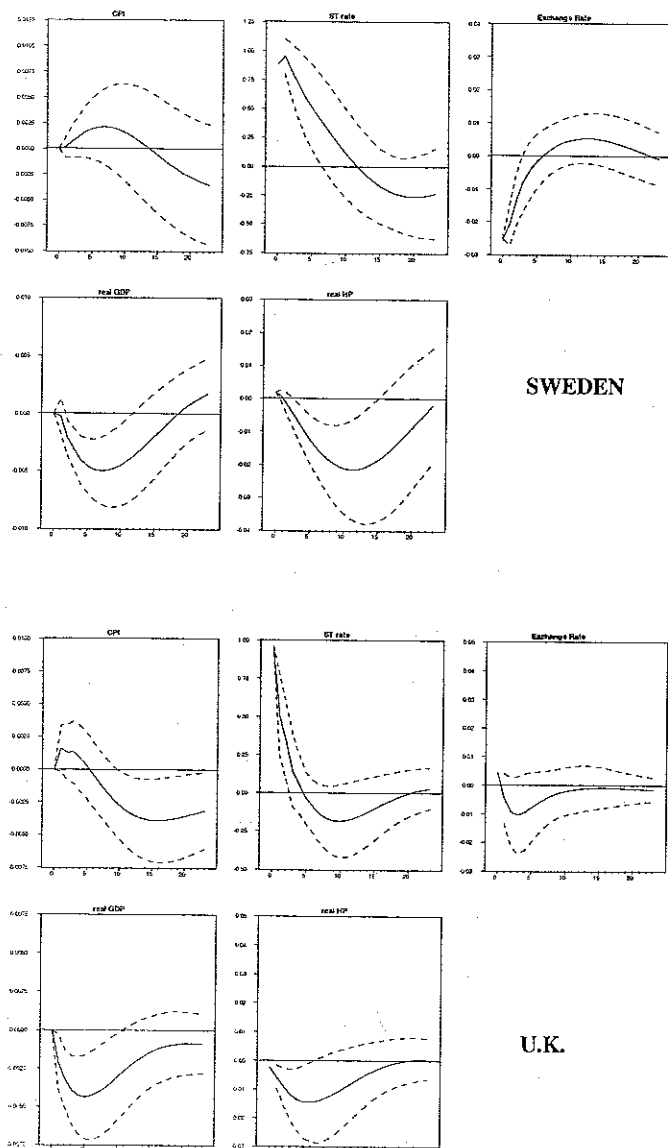


FIGURE 3 Forecast Error Variance Decomposition for Real House Price

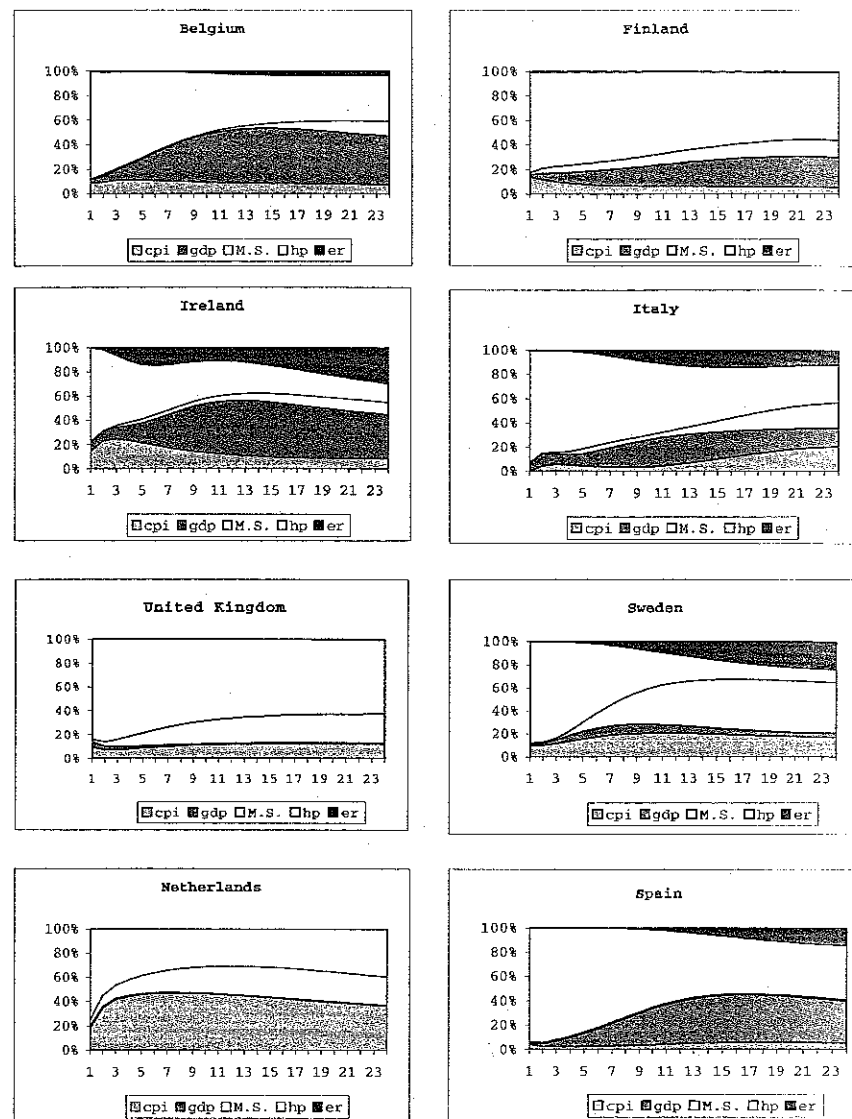


FIGURE 4 Impulse Responses to Monetary Shock in the six-variable SVAR
(dotted lines are two-standard deviation confidence intervals)

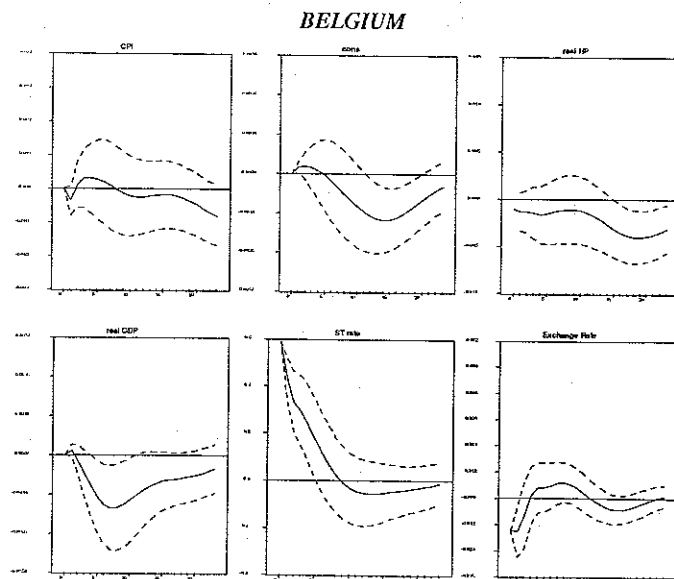
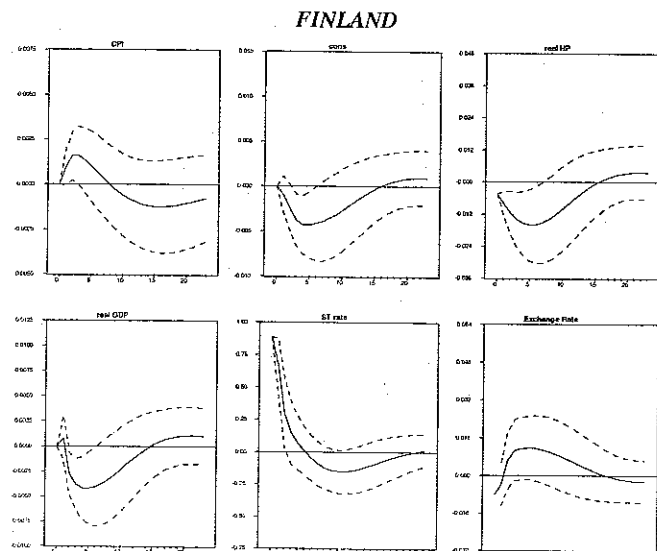


FIGURE 4 Impulse Responses to Monetary Shock in the six-variable SVAR
(dotted lines are two-standard deviation confidence intervals)

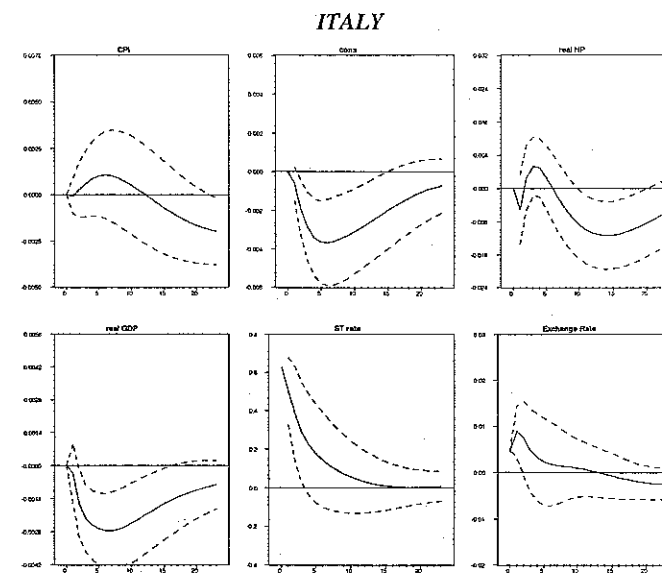
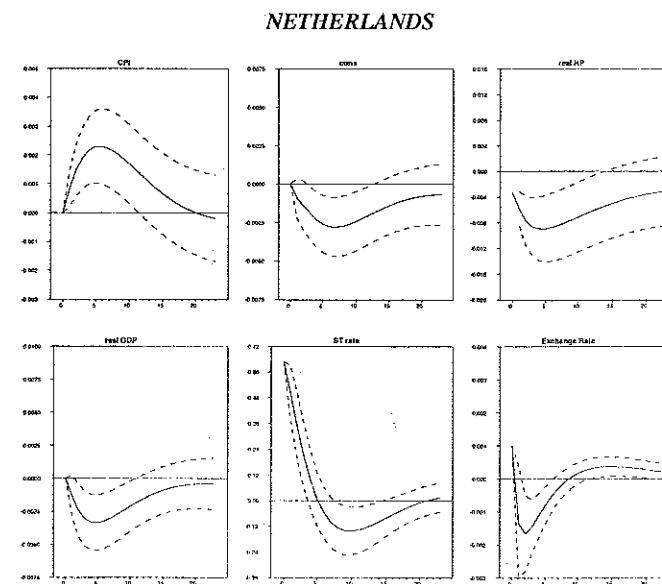


FIGURE 4 Impulse Responses to Monetary Shock in the six-variable SVAR
(dotted lines are two-standard deviation confidence intervals)

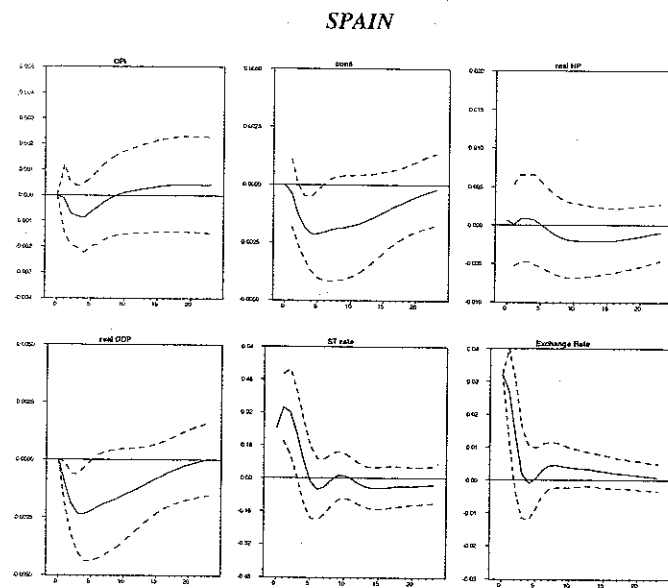
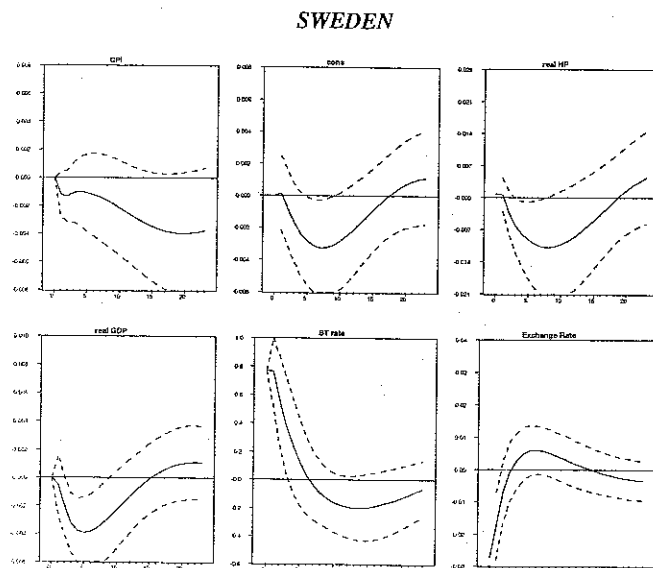


FIGURE 4 Impulse Responses to Monetary Shock in the six-variable SVAR
(dotted lines are two-standard deviation confidence intervals)

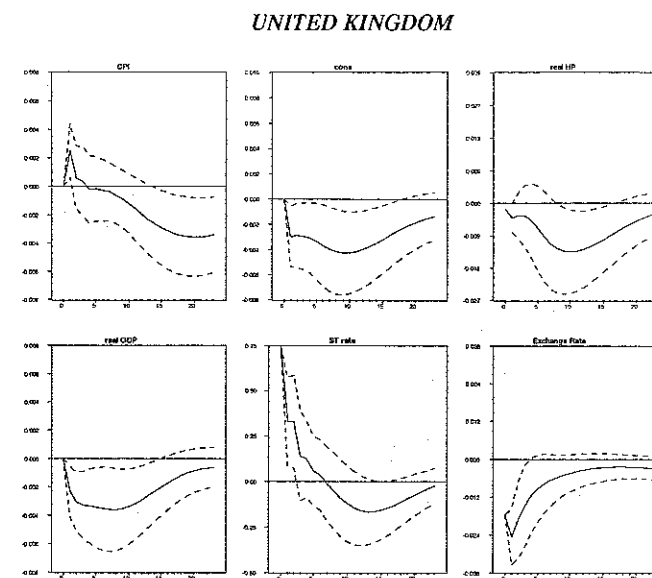


FIGURE 5 Response of Real Private Consumption to Monetary Shock Counterfactual Simulation (solid line: baseline - dotted line: counterfactual scenario)

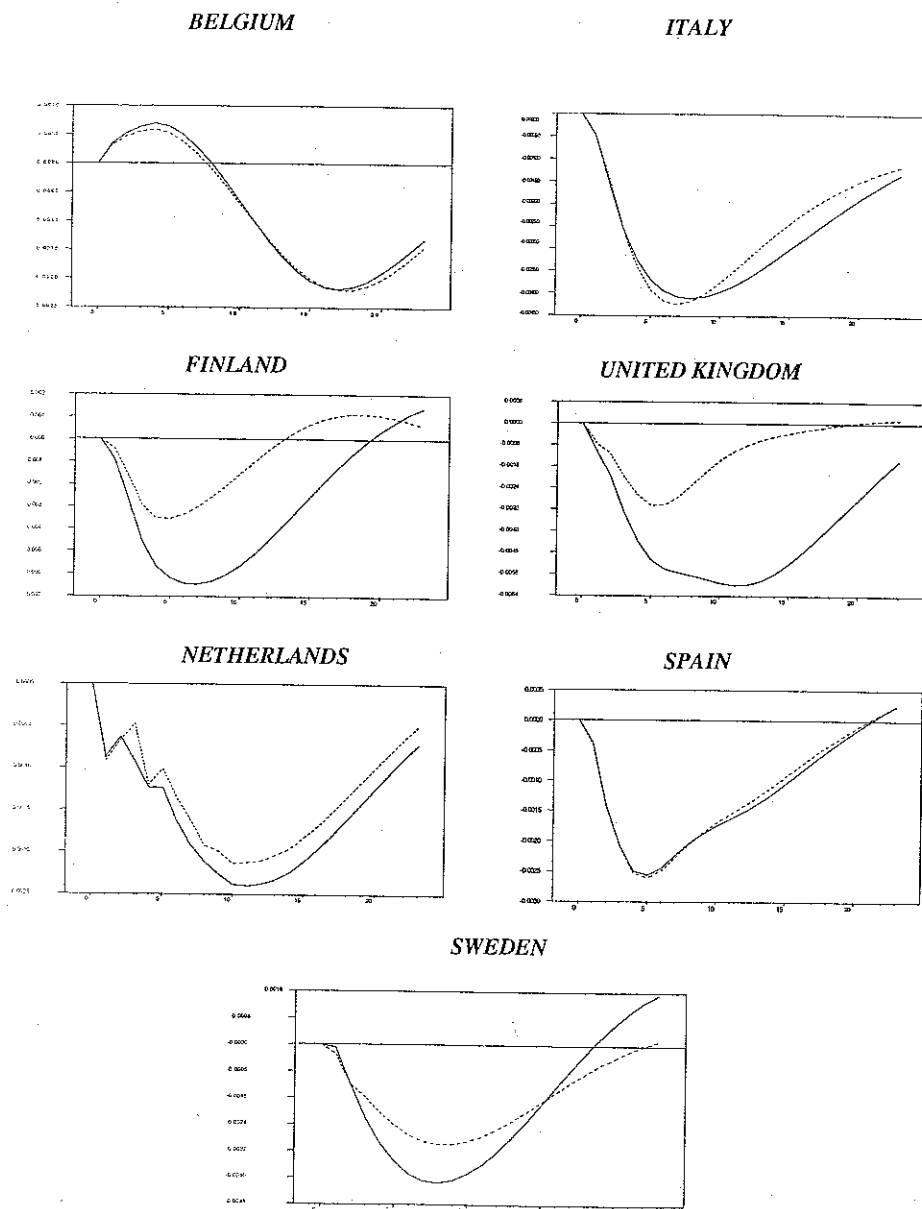
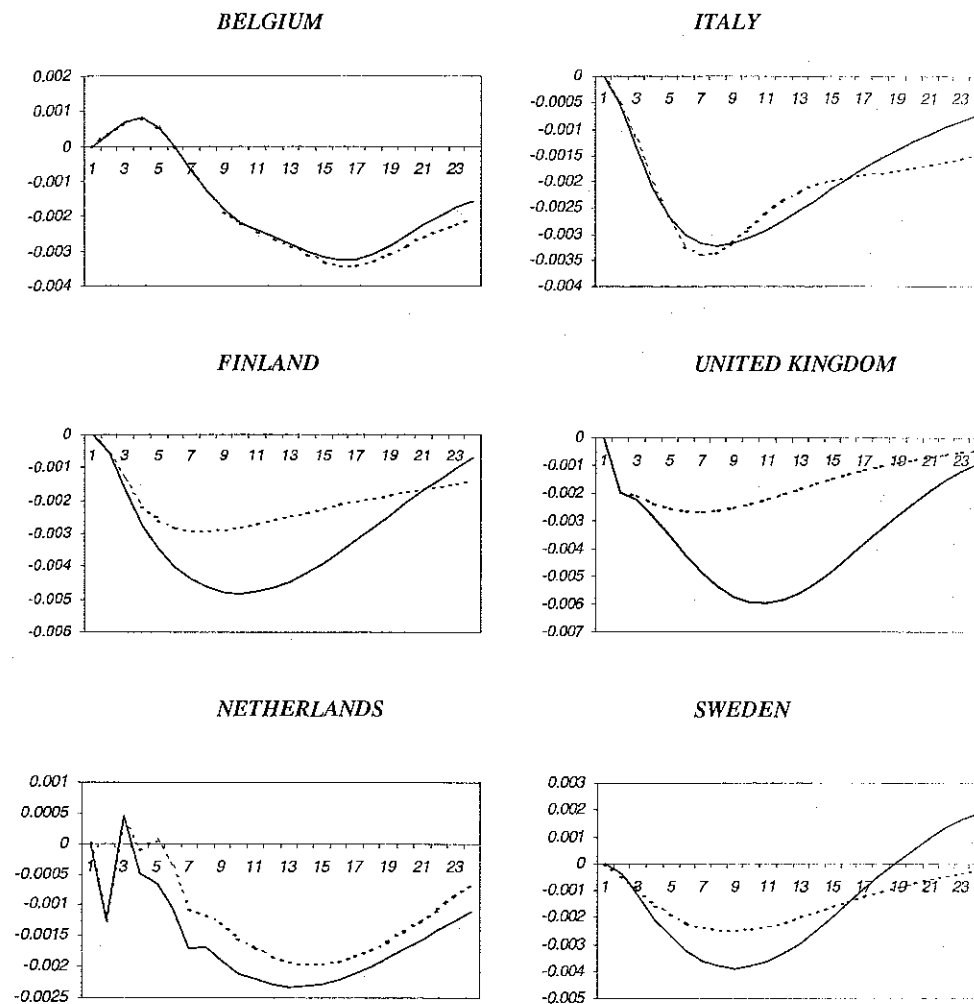


FIGURE 6 Response of Real Private Consumption to Monetary Shock (solid line: house price endogenous, solid line: house price exogenous)



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