The Credit Channel of Monetary Policy: Evidence from the Housing Market[**]

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Abstract

This paper tests a credit channel of monetary policy (especially a bank-lending channel) in the housing market. We argue that the relevance of the credit channel depends on the structural features of the housing finance system, in particular efficiency and institutional organisation. We employ a VAR approach to analyse this issue in four housing markets (Finland, Germany, Norway and the UK). Our results support the existence of a broad credit channel and, in some contexts, of a bank-lending channel. More importantly, the findings show across countries a clear-cut relationship between presence of a credit (bank-lending) channel, efficiency of housing finance and type of institutions active in mortgage provision.

Keywords: Monetary transmission, bank-lending channel, housing market, vector autoregressions

JEL Classification No.: E44, E51, E52, G21, C22

1. Introduction

Since Bernanke and Blinder (1988), the literature has shown a renewed interest in the credit channel of monetary policy. According to this view, widespread imperfections in the credit market, such as asymmetric information or imperfect contract enforceability, result for consumers and firms in a wedge between the opportunity cost of internal funds and the cost of external funds. In turn, this *external finance premium* depends on monetary policy. Tight monetary policy not only raises market rates of interest but also the external finance premium, thus discouraging investment and consumption. The explanations of this link are twofold. The *balance-sheet* view argues that the bridge between monetary policy and the external finance premium is represented by the financial position of borrowers. Tight money affects borrowers' net worth, either reducing their current cash flows (increasing interest on debt burdens) or the value of their pledgeable assets. This feeds back on the external finance premium required by external lenders. The *bank-lending channel* view, on the other hand, focuses on lenders' financial status. Tight money drains reserves and retail deposits on the liability side of banks' balance-sheets. Faced with this deposit drain, banks can react by increasing their funding through managed liabilities (such as certificates of deposit) or shrinking assets (loans and securities). In the presence of an upward sloping supply for managed liabilities, banks may find it too costly to fully offset the reduction in retail deposits and opt to reduce their assets. The lending view argues that the impact is relatively stronger on loans than on securities. In fact loans and securities are imperfect substitutes because loans are riskier and less liquid. Therefore tight money causes an inward shift of credit supply that especially affects borrowers with limited access to non-bank sources of external funding.

The credit channel literature has produced mixed results (see Bernanke and Gertler, 1995, and Baum, Caglayan and Ozkan, 2003). A strong focus has been placed on identifying contractions in credit aggregates resulting from inward shifts in the demand for funds (fully consistent with the traditional monetary transmission mechanism) from shifts in supply resulting from a credit channel. A second crucial issue of this empirical literature has been to disentangle the bank-lending from the balance-sheet channel (Kashyap, Stein and Wilcox, 1993). In this sense, much work has been done on the relative impact of monetary policy on firms with different dependence on bank funds, such as small and big firms (see Gertler and Gilchrist, 1994).[1]

This paper extends the analysis of the credit channel of monetary transmission on the households' demand side focusing on the housing market. Our aim is twofold. On the one hand, we want to assess the presence of such a channel in the housing market (possibly disentangling a bank-lending from a balance-sheet channel). Secondly, we want to relate its presence, as far as possible, to the structural characteristics of the housing finance system, especially its institutional organisation and its level of efficiency. Clearly, the paper has implications that go beyond the housing market. Housing plays an important role in the business cycle, not only because housing investment is a very volatile component of demand (Bernanke and Gertler, 1995), but also because changes in house prices can have important wealth effects on consumption (IMF, 2000) and investment choices (Topel and Rosen, 1988).

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[1] Other studies use microeconomic data and exploit cross sectional differences among banks or firms to disentangle a bank-lending channel. Using data from the Call Reports submitted by insured banks to the Federal Reserve, Kashyap and Stein (2000) find that small and illiquid banks react more strongly to monetary shocks, arguing that these banks cannot protect their loan portfolios by shrinking their stock of securities. Baum, Caglayan and Ozkan (2003) show that the results of Kashyap and Stein (2000) can be explained by a different behaviour of banks in the presence of financial sector uncertainty rather than by a bank-lending channel. Ashcraft (2001) argues that the result that small banks react to monetary shocks more strongly than big ones could be driven by the fact that large banks fund mainly large firms. In general, a shortcoming of these studies using microeconomic data is that they do not ascertain whether the bank lending channel affects aggregate economic activity.

There are three main motivations for our paper. First, housing markets feature puzzles in terms of quantity and of price dynamics hard to reconcile with the traditional monetary transmission mechanism. For instance, as Bernanke and Gertler (1995) observe, the response of residential investment to innovations in short-term rates is generally sharp and persistent. This feature does not match the dynamic response of long-term rates (the ones that mainly drive residential expenditure) that traditionally under-react to innovations in short-term rates and revert fast to their initial level. Secondly, as argued in Section 2.1, there are reasons to expect that the housing market is particularly exposed to the credit channel, hence representing a better environment to capture its presence than the broader economy. Finally, by exploiting the cross-country heterogeneity in housing finance systems, we can verify whether there exists a "reasonable" link between institutional context and evidence of a credit channel, thus offering an important robustness check for our findings.

The rest of the paper is organised as follows. Section 2 analyses the credit channel in the housing market emphasising the role of the structural features of the housing finance system (2.1), especially its institutional framework (2.2) and its *efficiency* (2.3). Section 3 explains the empirical methodology (3.1 and 3.2) and presents the results of the empirical analysis (3.3). Section 4 concludes. Appendix 1 and 2 respectively describe the structural characteristics of the housing markets analysed and the data used.

2. The credit channel and housing finance systems

2.1. The credit channel sensitivity of housing

The credit channel of monetary policy can be expected to be relatively effective in the housing market. Starting from the balance-sheet channel, "housing demand is linked directly to consumer balance-sheets by features like down-payment requirements, up-front transaction

costs, like closing costs and 'points' and minimum income-to-interest payment ratios"
(Bernanke and Gertler, 1995, page 45). [2]

The lending channel is also likely to be relatively strong both at the source (depository
institutions) and at the destination (households). At the source, in countries where mortgage
standardisation and securitisation are not widespread, the relative illiquidity of mortgages
could matter. If banks want to keep a buffer against liquidity shocks, they might be encouraged
to shift from less to more liquid loans or to securities. At the destination a fall in bank
mortgages will probably result in actual lack of funds for house purchases whenever mortgage
funding from specialist mortgage lenders or from the State is not a sufficient buffer. In fact,
households have inherently less financing opportunities than firms.

2.2. Credit channel and the institutions for real estate finance

The first structural aspect that can affect the credit channel in the housing market
(especially the bank-lending channel) is the institutional organisation of the housing finance
system. Broadly speaking, the systems of the countries that we analyse (Finland, Germany,
Norway, and the UK) can be grouped as follows:

i. Bank model (Finland, UK, in part Germany);

ii. Mortgage bond model (in part Germany);

iii. State model (Norway and in part Finland).

The bank model is characterised by a strong presence of depository institutions (banks and
mortgage banks) in mortgage provision. In the early 1990's, Finnish banks provided about
80% of housing funding (Nordic Council, 1992). In the UK, depository institutions have a
market share of around 90%. In Germany, commercial and savings banks and credit
cooperatives cover about 45% of the market competing mainly with mortgage banks and

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[2] In countries where equity withdrawal is not widespread, we can also expect that homeowners' housing demand
is strongly tied to their housing wealth.

Bausparkassen. The banking system is the strongest candidate for a bank-lending channel. The dependence of borrowers on depository institutions is generally high. Moreover, the amount of loanable funds is likely to depend strongly on monetary policy, because of the general reliance of banks on reservable retail deposits. In particular, banking systems with low concentration are more prone to the existence of a lending channel, given the traditional difficulty of small banks in accessing wholesale funding (Guiso et al., 1999).

The mortgage bond model is characterised by the strong role of specialist mortgage institutions (mortgage banks). These intermediaries fund themselves mainly through the wholesale market. For instance, German mortgage banks fund themselves issuing mortgage and municipal bonds to institutional investors. German Bausparkassen, instead, rely on savings generated from long-term (6-18 years) housing linked contracts and on government subsidies. Because of this funding mechanism, the mortgage bond model is less likely to be characterised by a bank-lending channel. Monetary policy is likely to have limited credit supply effects if specialist mortgage lenders with easy access to wholesale funding are major players and offer contracts highly substitutable to those of depository institutions.

Finally, the State model is characterised by a relevant State involvement (directly or indirectly trough public banks). In Finland, the State Housing Fund provides between 10% and 20% of mortgage loans. In Norway, this figure has averaged around 40% in the 1990's. State mortgage loans are generally restricted to social housing (Finland) or to particular categories of beneficiaries (Norway).

2.3.   Credit channel and the efficiency of housing finance

The second structural feature that is likely to affect the importance of a credit channel is the "efficiency" of the housing finance system. In particular, three aspects are relevant for the presence of a credit channel:

a) depth of the funding system for housing finance institutions;

b) presence of a diversified range of mortgage lenders and

c) sharing of credit risk.

A deeper market for wholesale funding can undermine *at the source* the effectiveness of a bank-lending channel by reducing the dependence of housing finance institutions on retail deposits. A wider, diversified range of mortgage finance institutions can weaken *at the destination* the bank-lending channel reducing the dependence of households' house purchases on bank credit. The sharing of credit risk, instead, mainly determines the strength of the balance-sheet channel, as we clarify below.

The efficiency of a housing finance system is the result of the historical evolution of the system and of regulatory constraints. A regulatory ceiling on deposit rates can prevent banks, after tight money, from offsetting the drain in deposits by increasing the return paid to depositors. Similar arguments apply for restrictions on market funding. In the past, depository institutions in some countries have been prevented from issuing bonds in the open market[3], which has implied a strong link between retail deposits and assets. Entry restrictions are again likely to strengthen the bank-lending channel allowing a smaller range of lenders alternative to depository institutions. For these reasons, the lending channel is likely to have become weaker after the financial liberalisation that occurred in many countries during the 1980's. [4]

Risk sharing is mainly reflected in the level of minimum income-to-interest-payment ratios and of down-payment requirements. These quantitative controls affect the link between borrower's net worth and the availability of funds from bank and non-bank intermediaries. It is unclear in this case whether financial liberalisation has significantly altered the strength of these balance-sheet effects (see Bernanke and Gertler, 1995).

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[3] This was for instance the case for UK Building Societies whose ceiling on funds raised from the market was increased from 20% to 40% by the Building Society Act of 1987.

[4] The abolition of interest rate ceilings and of portfolio and entry restrictions would have respectively deepened the market for banks' liabilities and reduced the dependence of households on banks for mortgage funding.

Table 1 classifies the housing finance systems of Finland, Germany, Norway and the UK according to institutional framework and level of efficiency[5], in the three aspects previously indicated.[6] As the Table shows, we choose this set of countries because they display strongly diverse housing finance systems, hence fulfilling the heterogeneity criterion mentioned among the motivations of the paper. Appendix 1 provides additional evidence in support of this argument: however, the classification is only meant as an approximate qualitative guide for the interpretation of the empirical results and should not be overstated.[7]

3. Econometric evidence

Several studies provide a theoretical background for our econometric analysis, even though they focus on the aggregate economy rather than on the housing market[8] Bernanke, Gertler and Gilchrist (2000) analyze the transmission of monetary policy in a general equilibrium framework in which the strength of firms' balance-sheets affects their debt capacity. Bernanke and Blinder (1988) provide instead a theoretical analysis of the bank-lending channel in an extended IS-LM framework.

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[5] For this purpose, we refer mainly to the works by Diamond and Lea (1992), Booth et al. (1994), Lea, Welter and Dubel (1997) and the European Mortgage Federation (EMF, 2000).

[6] Given the impossibility of distinguishing, even at a qualitative level, whether the presence of the state affects the effectivenes s of the bank-lending channel, state and banking model are bundled together.

[7] The literature has recently considered the financial conditions of depository institution in explaining the short-run relevance of the lending channel. Intuitively, the cost for a bank of wholesale funding is correlated to its financial health, as measured by its capitalisation, profitability or share of non-performing loans (Kashyap and Stein, 1998). However the financial status of depository institutions is likely to change often and can be of limited use in explaining the medium-long run relevance of the lending channel.

[8] We believe that extending these theoretical frameworks to the housing market would add little to the message of the paper. Moreover, such a theoretical exercise is well outside the scope of this paper.

3.1. Empirical methodology

For each country, we run four VARs in order to assess the presence of a credit channel of monetary transmission and to disentangle a balance-sheet from a bank-lending channel.[9] As explained in the next subsection, we follow Gali (1992), Gerlach and Smets (1995) and Angeloni at al. (2003) in identifying periods of tight money using a combination of long-run restrictions (corresponding to the long-run neutrality of monetary shocks) and of the more widely-used short-run restrictions, namely delays in the effects of interest rate shocks on GDP and prices.[10]

1) The first VAR includes: *GDP, CPI inflation, a short-term interest rate, real house prices, housing loans by banks and other depository institutions, and total loans by banks and other depository institutions.* The results from this VAR are substantially uninformative for detecting a credit channel. A reduction in loans after tight money could reflect a fall in loan demand, therefore being consistent with the traditional monetary transmission mechanism.[11] However the change in housing loans can give a clue on the quantitative relevance of a possible credit channel.

2) The second VAR includes: *GDP, CPI inflation, a short-term interest rate, real house prices and the Spread between a mortgage interest rate on housing loans and a benchmark interest rate.* A rise in the Spread between the mortgage rate and a safe rate of comparable maturity (e.g. a government bond yield) could capture the increase in the external finance premium associated with a credit channel. However, the analysis of the

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[9] The variables used and the identification scheme are summarised in Table 2. Appendix 2 describes data sources and time periods used in the regressions.

[10] See Christiano, Eichenbaum and Evans (1998) and Rotemberg and Woodford (1997) for models that generate long-run monetary neutrality while being consistent with the assumption that contemporaneous output and the price level do not respond to a monetary policy shock.

[11] A reduction in loans is not even a necessary condition for a credit channel: households could try to compensate a reduction in wealth by borrowing more from external sources. Hence tight money could elicit an increase in loan demand that, if strong enough, could overwhelm any contraction in loan supply resulting from a credit channel.

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Spread encounters three major problems. First, the price is only one of the terms of mortgage contracts: for instance, an increase in the default probability of the borrower could result in higher required collateral rather than higher mortgage rate. Second, if quantity rationing were pervasive in the credit market, the Spread would fail to capture an increase in non-price rationing of mortgage demand. Finally, in the 1980's some of the analysed countries have witnessed a progressive shift from long-term, fixed mortgage rates to variable, reviewable and renegotiable ones. The Spread between a variable mortgage rate and a long-term benchmark rate could also reflect a liquidity premium (possibly time-varying) not associated with agency or monitoring costs. As mentioned above, we tried to match the maturity of the benchmark safe rate with the actual length of fixity of the mortgage rate in order to overcome this problem.

Moreover, unavailability of detailed data on mortgage rates applied by different lenders prevents us from using the analysis of the Spread to disentangle a lending from a balance-sheet channel (for instance detecting whether the Spread on bank mortgages increases more than that on mortgages from non-depository institutions). Hence, we generally focus on the spread on mortgages by depository institutions or the spread on an average mortgage rate (Germany) inferring from its behaviour only information on the existence of a broad credit channel (balance-sheet and/or bank-lending).

3) The third VAR includes: *GDP, consumer price inflation, a short-term nominal interest rate, real house prices, and the ratio of housing loans by all "non-depository" financial institutions and the State to all housing loans.* We argue that the analysis of the external finance Mix (that is, the fraction of housing loans by "non-banks") is the best way to disentangle a lending channel. As argued in the introduction, if managed liabilities are not a perfect substitute for deposits, a drain in reserves and deposits will lead to a *relatively* strong contraction in bank mortgages and to an increase in the Mix. The Mix will plausibly increase also as households try to compensate the reduction in bank mortgages

with mortgages by other institutions. However, in the presence of imperfect substitutability be tween bank and other mortgages, this compensation is only partial and the reduction in bank supply affects housing demand. Therefore the analysis of the Mix requires two steps: to analyse whether monetary policy affects the Mix (VAR 3) and if so to analyse whether changes in the Mix affect the housing market (VAR 4).

4) If monetary policy affects the Mix, we run a fourth VAR with *GDP, CPI inflation, external finance Mix and real house prices.* We look at the effects of an exogenous Mix increase, what we call *external finance shock*. If the Mix has any explanatory power in a house price reduced form equation that already includes income and inflation as controls, its incremental explanatory power supports the existence of an independent bank-lending channel.[12]

The analysis of the finance Mix was first proposed by Kashyap, Stein, and Wilcox (1993) (who analysed the response of the Mix between *bank loans* and *commercial paper* to innovations in the Fed Funds rate) and has been used in the analysis of a lending channel in the automobile market (Ludvigson, 1998). As stressed by Oliner and Rudebusch (1996), the Mix does not completely solve the endogeneity problem. In particular, a change of the Mix could capture a change in the quality composition of borrowers. Suppose that banks specialize in funding households with a weak financial position. An increase of the Mix after tight money could reflect a "flight to quality" from risky households to households with a stronger financial status. In this case, the increase of the Mix would be the result of the working of a households' balance-sheet channel rather than of a bank-lending channel.

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[12] Following Ludvigson (1998), we do not include the interest rate in this equation. If the interest rate indicates monetary policy, then including it would mean that changes in the Mix marginally reflect non-monetary effects. If the bank-lending channel is operative, then monetary policy should affect the Mix, and the Mix should affect house prices, but there should be no reason to expect that the Mix affects house prices when some variable that captures monetary policy stance is included in the VAR. Therefore the innovation in the Mix captures both monetary policy shocks and non-policy induced shocks, like, for instance, credit crunch episodes.

Therefore, whenever the combined evidence from the third and the fourth VARs hints at the presence of a bank-lending channel, we will carry out a robustness analysis to rule out this alternative explanation. In particular, in order to assess whether depository institutions fund riskier households than non-depository ones, we will use evidence on the risk of mortgages, as proxied, for example, by the default ratio of mortgages, by the number of repossessions, or by the amount of loan loss provisions made by the mortgage financiers.

In all the specifications we use house prices as a cyclical indicator in the housing market. In principle, another way to test for the presence of a credit channel in the housing market would be to analyse the behaviour of housing investment. There are reasons to believe that house prices are more suitable to our analysis. First of all, since in the housing market quantities adjust sluggishly, prices could be more informative in capturing changes in housing demand in the short run. Secondly, house prices can play a crucial role in the transmission of monetary policy working through credit supply shifts. On the one hand, house prices affect borrowers' (homeowners) wealth and credit capacity (for theoretical models see Stein, 1995, and Ortalo-Magnè and Rady, 1999).[13] On the other, they influence lenders' net worth and, potentially, the amount of credit they extend. Specifying the VARs using quantities rather than prices would omit these interactions.

3.2. Identifying the shocks

We identify the monetary shocks in VARs 1, 2 and 3 using a combination of short and long-run restrictions. In particular, we adopt the common trends approach as developed by King, Plosser, Stock and Watson (KPSW, 1991). The approach uses the cointegration properties of the data to achieve identification using both short and long run restrictions. When a group of variables in a VAR is cointegrated, a useful specification for their dynamics is a

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[13] For a financial accelerator in an aggregate environment based on changes in the price of hard assets see Kiyotaki and Moore (1997).

vector-error-correction model (VECM). A VECM places reduced rank restrictions on the matrix of long run impacts from a VAR. KPSW distinguish between structural shocks with permanent effects on the level of the variables from those with only temporary effects. The permanent shocks are the sources of the so-called common stochastic trends among the series. The number of these shocks equals the number of variables in the system less the cointegrating relationships between them. The remaining transitory shocks equal the number of cointegrating relationships (intuitively, a cointegrating vector identifies a linear combination of the variables that is stationary, so that shocks to it do not eliminate the steady state in such a system).

The VAR model needs not to be fully identified: partial identification of either the transitory or permanent shocks is possible. Furthermore, one can separate the transitory shocks by adding some untested restriction on their impact effect. *We identify the monetary shock as the transitory innovation that does not affect contemporaneously GDP and CPI inflation, but that can have impact effects on all the other variables. In addition, the shock also has to satisfy long run neutrality, both by having zero long run effect on GDP (and the other real variables) and by keeping relative prices of houses and consumer goods constant.* [14] Therefore, GDP, inflation, real house prices and all other variables will revert back to their initial steady state once the effects of the shock die out.

We run augmented Dickey-Fuller unit root tests on the levels of the series. [15] The tests suggest that the variables are integrated of order 1. [16] The results from the cointegration tests are mixed, but tend to indicate, in the first three VARs, at least three cointegrating vectors: one vector could correspond to a long-run stationary real interest rate (cointegration between

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[14] The monetary shock will not affect the relative prices of the two goods in the long run, but the permanent shocks in the VAR (that we do not focus upon here) in general will. However, it can affect the CPI and house price index (by the same amount), since we impose the zero long run restriction on CPI changes, not on levels.

[15] More details on this and on the cointegration tests are available from the authors upon request.

nominal interest rate and inflation), another to a long-run housing supply curve (cointegration between house prices and GDP). The third cointegrating vector could hint, depending on the VAR, at a stable long-run ratio between housing loans and total loans (VAR 1), stationary spread (VAR 2), stationary Mix (VAR 3). For this reason we opt in our specifications for a common rank of 3, with the exception of Norway, where the tests strongly indicate 4 cointegrating vectors.[17]

On the basis of this, we specify the first three VARs in the form of a vector error correction model (VECM).[18] As we will see, our way of identifying tight money by use of short and long run restrictions turns out to be successful, as the contractionary monetary shock will elicit a rise in the interest rate and a negative response of GDP and inflation, which are all suggestive of a tight monetary policy stance. As is well known (see Christiano, Eichembaum and Evans, 2000), this is evidence per se of the success of our selection scheme, since our impulse responses can account for the qualitative features of a wide range of monetary business cycle models in which money shocks have delayed, transitory effects on economic activity.[19]

In VAR 4, in order to identify a Mix shock we use a recursive scheme, ordering the Mix after GDP and consumer price inflation and before real house prices. Economic theory is in fact silent about the permanent effects of a Mix innovation.

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[16] In Germany, the unit root null hypothesis for inflation, interest rates and real house prices is rejected. However, it is not necessary that each time series in a common trends model is non-stationary. Loosely speaking, a stationary variable is simply cointegrated with itself, and can therefore fit in a common trends representation.

[17] The identification restrictions imposed on the monetary shock are similar to all other cases.

[18] Each model is estimated with a lag length of 2 to 4, depending on which was sufficient to get serially uncorrelated residuals.

[19] As a robustness check, we also estimated the impulse response without imposing the long run zero restrictions using a Choleski decomposition of the residuals and ordering the interest rate after GDP and CPI inflation. The results of this specification were similar to those reported here.

3.3.   Country specific results

A.   Finland

The evidence supports the existence of a bank-lending channel and leaves room for a balance-sheet channel.

Figure 2.A shows the responses of real housing and total loans to a monetary contraction, using quarterly data from 1978Q4 to 1999Q4, along with one standard error asymptotic confidence bands. Both housing and total loans fall after tight money. Figure 2.B shows the response of the Spread between mortgage rate on new housing loans by banks and 3-year benchmarking interest rate[20] to a negative monetary shock.[21] The Spread increases significantly about three periods after the contraction. Its behaviour hints therefore at the existence of a broad credit channel.

In addition, the analysis of the finance Mix supports the workings of a bank-lending channel. We construct the Mix as the sum of housing loans by the State plus other minor non-depository lenders over housing loans by all institutions (including commercial, savings and cooperative banks) and analyse its behaviour in two steps. First, using data from 1987Q1 to 1999Q4 (that is after the liberalisation of interest rates), we find a significant, persistent increase in the Mix following tight money (Figure 2.C). This result looks consistent with the structural characteristics of the Finnish market for housing finance. Finnish banks rely strongly on retail sight deposits (EMF, 2000) and their access to wholesale funding occurs at a higher cost than for mortgage credit institutions in other Nordic countries (Kosonen, 1993, and Booth et al., 1994). The finding also suggests that financial liberalisation could have had a minor role

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[20] The benchmark rate maturity reflects the fact that in Finland loans have typically adjustable rates with adjustment periods of 3-5 years (Kosonen, 1993).

[21] Here the sample includes quarterly data from 1988Q1 to 1999Q4. Therefore the sample extends entirely after the abolition of interest rate ceilings (occurred in 1987).

in weakening a bank-lending channel *at the source* (i.e. increasing the substitutability between retail deposits and wholesale funding).[22]

We then analyse the impact of the Mix shock (Figure 2.D). Real house prices fall significantly after an increase in the Mix. This suggests that the composition of mortgage finance can play an important role in affecting housing demand. The result appears consistent with the characteristics of the Finnish system. The bulk of mortgages from non-depository institutions come from the State (from 1990, through the State Housing Fund). State mortgages can represent a buffer for shocks in bank funding only to a limited extent. In fact, state funding is restricted to social housing (rental, cooperative and owner occupied) and to financing the construction of single-family houses. Moreover state loans are means-tested. As a result, the substitutability between private-bank and alternative funding is likely to be imperfect, implying the relevance of mortgage distribution for households' house purchases.

As previously argued, an alternative explanation for the response of the Mix to a monetary shock could be that in Finland this response reflects a change in the quality composition of borrowers. A strategy for disentangling a "flight to quality" is analyzing whether depository institutions fund riskier borrowers than non-depository ones.[23] Unlike for the UK (see below), data on mortgage defaults in Finland are not available. Therefore, we test this hypothesis using an indirect approach. We obtained annual data on loan loss provisions of Finnish credit institutions for the period 1996-2000 from the international rating agency Fitch IBCA.[24] The data include loan loss provisions of a major non-depository housing finance institution

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[22] Financial liberalisation in the second half of the 1980's resulted in Finland in the abolition of the ceilings on deposit and mortgage rates and in the progressive deepening of the market for bank bonds.

[23] In the context of the automobile market, Ludgvison (1998) compares the average default rate on automobile loans extended by banks with that on automobile loans extended by car finance companies.

[24] The data are drawn from the Bureau Van Dick/Fitch/IBCA Bankscope.

(Municipality Housing Finance) and of the wide majority of Finnish depository institutions.[25]

We then compared the ratio (loan loss provisions divided by total loans) of the Municipality Housing Finance with the average ratio of the depository institutions in the sample. Since data on loss provisions for depository institutions bundle together mortgages with other types of loans and, hence, can imperfectly capture the risk of mortgages, we also compared the ratio of the Municipality Housing Finance with that of a major depository institution specialized in mortgage financing (Oko Mortgage Bank Ltd.). If depository institutions specialize in financing mortgages with high probability of default, we would expect them to have a higher ratio (loan-loss provisions/total loans). Instead, in both comparisons, this ratio was lower for the Municipality Housing Finance.[27] Clearly, this evidence should be interpreted with caution since it is limited to one non-depository institution, though a major one, and it covers only a sub-period of the Mix analysis. However, it suggests that depository institutions have no systematic tendency to fund riskier borrowers than non-depository ones.

B. Germany

We find evidence of a balance-sheet channel but no evidence of a bank-lending channel.

Figure 3.A shows responses of total loans and housing loans by banks, using data from 1974Q2 to 1998Q4.[28] A monetary contraction leads to a significant decline in total bank loans. Housing loans are virtually unchanged This could be due to long-term relationships between

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[25] Data on alternative measures of the risk of loans, such as loan loss reserves and amount of non-performing loans, were not available for many institutions, including the Municipality Housing Finance.

[27] In particular, the ratio equals 0.28% for the Municipality Housing Finance, 0.28% for the depository institutions and 0.06% for the Oko Mortgage Bank Ltd.

[28] The availability of relatively long time-series and the absence of significant structural changes in the regulation of the housing finance system led us to use relatively long time periods in the analyses. The regression for the Spread starts in 1982, as we found consistent time series for the interest rates only starting after that date.

banks and customers that induce banks to insulate their loan portfolios from monetary disturbances.

The Spread between the average 10 year fixed mortgage rate and the government 10 year bond yield widens after a monetary contraction and stays positive for about 3 years (Figure 3.B). Even if in the 1990's mortgages with fixed rate have been originated also by commercial and savings banks, they are more typical of non-depository institutions, such as mortgage banks or Bausparkassen. Since the latter are shielded from fluctuations in reservable deposits, the increase in our Spread could capture the effect on the external finance premium of deterioration in borrowers' net worth (i.e. a balance-sheet channel).

We then analyse the Mix, using data from 1974Q2 to 1998Q4. To obtain the Mix, we consolidate all the institutions traditionally relying on reservable, short-term retail deposits. We then construct the Mix as the sum of housing loans from Bausparkassen and Mortgage Banks over total housing loans from all financial institutions. [29] Tight money (Figure 3.C) leads to a rise in the Mix, which displays a hump-shaped response, peaking after two years and returning to the baseline after four. This seems consistent with the characteristics of the German market for funding. According to Diamond and Lea (1992), German funding markets are segmented. First, they feature relative *sluggishness of market deposit rates.* More important is the *segmentation of the bond market.* In particular, commercial and savings banks can issue unsecured debt but cannot issue mortgage bonds (unlike mortgage banks). They are also strongly discouraged by the regulator from issuing derivative securities. As a result, banks rely mainly on retail general funding and especially on savings deposits (EMF, 2000). The behaviour of the Mix can also be explained by the degree of concentration of the banking system. Except for the three big banks, the system is made by a network of small banks with

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[29] The denominator includes therefore, besides mortgages from the two mentioned institutions, mortgages from commercial, savings, regional banks and from credit cooperatives. The definition of housing loans includes

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difficult access to the wholesale marke t. In particular, the main financiers of house purchases are savings banks and credit cooperatives (approximately two thirds of bank housing loans once we exclude mortgage banks). There is a vast range of sizes among these banks but the majority is small and operates on a regional basis.

The Mix shock (Figure 3.D) does not affect real house prices significantly, indicating good substitutability of depository institution mortgages with mortgages from other institutions. This result is not surprising. The mortgage market in Germany appears well diversified and competitive (Diamond and Lea, 1992). Although depository and non-depository institutions offer contracts which are not entirely homogeneous , especially in the length and in the rate (fixed or renegotiable), these differences do not appear to justify a marked non-substitutability.

C. Norway

We find lack of evidence of a credit channel.

Figure 4.A shows total loans and housing loans by depository banks in response to a monetary shock, using data from 1988Q3 to 1999Q4. Loans and real house prices fall significantly.

The response of the Spread between the mortgage rate [30] and the 5-year government bond yield provides weak evidence for the credit channel hypothesis. The Spread (Figure 4.B) is not significantly affected by a monetary contraction. Further evidence comes from the analysis of the Mix (Figure 1, bottom row). Over the sample period, Government Lending Institutions have originated an important fraction of mortgages. At the end of the 1990s, commercial and

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mortgages secured by real estate (about 90% of the aggregate) and a residual category of "other" housing loans (for redevelopment etc.).

[30] Interest rates on mortgage loans from banks were available for Norway starting only in 1995. Before that date, we used the interest rate on long and medium term loans. The bulk of mortgage loans in Norway have reviewable rates, but a non marginal fraction has renegotiable rates. For this reason, and for the likely pooling with loans with medium-long-term fixed rates, we opted for a medium term rate as benchmark.

savings banks' share in the market had risen to around 80%. Finally, finance and credit companies that fund themselves mainly through the wholesale market cover a minor share. We construct the Mix as the sum of loans from state and non-depository financial institutions over total housing loans. [31] Figure 4.C shows its response to a negative monetary shock. The response appears insignificantly different from zero. If anything, the Mix seems to drop.

This result could reflect the deepening of the market for bank funding in the Norwegian housing finance system. According to Lea, Welter and Dubel (1997), the access to the wholesale market has improved for depository institutions over the 1990's, reducing the banks' dependence on retail deposits (even if deposits represent the main source of funding, with an approximate share of about 60% of banks liabilities). The EMF (2000) maintains that banks have increasingly enjoyed easy access to wholesale general funding (in the form of bank bonds, loans from other monetary financial institutions and other general funding). [32] Quite interestingly instead, arguments related to the average size of Norwegian banks are not of help. In fact, concentration in the banking system is quite low with the strong presence of a myriad of small savings banks alongside a few medium-sized commercial banks.

D. The United Kingdom

The evidence supports the existence of a bank-lending channel and leaves room for a balance-sheet channel.

[31] As shown in Figure 1, because of the declining importance of public funding the Mix exhibits a strong decline over the whole sample passing from 45% in late 1980's to a value of little more than 15% at the end of the 1990's.

[32] The EMF also reports that "*from 1995 until 1998 Norwegian banks have faced a much faster growth in lending than in deposits and have increasingly relied on funding from other sources...*" (2000, page 29)

[34] Here the VAR runs from 1985Q1 to 1999Q4 (a period that extends after the UK housing finance system reforms of the 1980's including the 1986 Building Societies Act). We choose a three-month rate as benchmark because the majority of mortgages in UK have a rate reviewable at the discretion of the lender.

The first VAR runs from 1978Q1 to 1999Q4. Tight money reduces on impact mortgages of depository institutions. Total loans decline only slightly and with some lag (Figure 5.A). Real house prices react with the expected negative sign.

The response of the Spread between the average mortgage rate on building societies mortgages and the 3-months Treasury bill rate (Figure 5.B) offers tentative evidence of a broad credit channel.[34] The Spread stays marginally positive for about 3 years.

We construct the Mix as housing loans of non-depository financial institutions, insurance companies, pension funds and the State (excluding banks and building societies) over total housing loans by all institutions. From the late 1980's, real estate agents and centralised mortgage lenders have competed with building societies and banks in mortgage provision. The bulk of funds of these non-depository institutions (and of insurance companies) come from the wholesale market, shielding them from fluctuations in retail deposits. The Mix increases following a negative monetary innovation (Figure 5.C), showing evidence of a fall in bank and building societies mortgage supply stronger than the shrink in the mortgage supply of non-depository institutions. In turn, a positive innovation in the Mix reduces significantly real house prices that are below the baseline around 8 quarters after the shock (Figure 5.D). The results from the third and fourth VAR tend therefore *to support the hypothesis of a bank-lending channel.* On the one hand, the causality from monetary actions to the Mix shows that monetary policy can affect the composition of mortgage supply. On the other, the good marginal explanatory power of the Mix hints at the relevance of the composition of external finance for housing demand.

As for Finland, an alternative explanation for the response of the Mix to a monetary shock could be a change in the quality composition of borrowers. To assess this alternative

hypothesis, we obtained data on property repossessions and mortgage arrears.[36] Under the hypothesis that non-depository mortgage institutions fund less risky borrowers, the number of repossessions and mortgage arrears should fall when the Mix increases. We regressed the number of repossessions[37] as a fraction of mortgage loans on the Mix and on cyclical indicators of the housing market (house prices) and the economy (GDP and inflation). We found that an increase of the Mix positively affects the ratio repossessions over mortgage loans.[38] This would suggest that in the UK, contrarily to the "flight to quality" argument, non-depository mortgage financiers tend to fund riskier borrowers than depository institutions.

The relevance of monetary policy for the Mix would appear controversial. Several studies[39] suggest that the UK has a fully integrated and developed funding market. Banks have relatively easy access to the wholesale market and the constraint imposed on Building Societies wholesale funding is not binding. Diamond and Lea (1992) report the limit imposed to issuance of unsecured debt by Building Societies as a major inefficiency. In such a fluid and liberalised context it would have been equally plausible to find a weak link between monetary policy and the composition of finance.

The effect of the Mix on house prices is instead in line with reasonable expectations. Having aggressively entered the mortgage market in the 1980's, non-depository institutions

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[36] The data are provided from the Council of Mortgage Lenders (CML). They are available on a half-annual basis from 1991H1 to 2001H2 on mortgages in arrear between three and six months, between six and twelve months and beyond twelve months.

[37] We did a similar exercise for mortgage arrears, obtaining similar results.

[38] For reasons of space, we do not report the estimation results, which are available from the authors. We tried several specifications. In the most parsimonious ones, we included only the Mix and house prices as regressors, while in the extended regressions we also included the indicators for macroeconomic conditions and a linear trend variable. We also tried different lag structures, including the regressors in their contemporaneous values, lagged one or two semesters. Consistently across regressions, the coefficients on the explanatory variables had the expected signs. In particular, house prices and GDP inversely affect repossessions (arrears), while the interest rate has a positive effect on them.

[39] See Diamond and Lea (1992).

have seen their market share declining in the 1990's (Figure 1, bottom row[40]).[41] With a market share of less than 10%, they probably represent too tiny a buffer to effectively shield households from a reduction in mortgages from banks and building societies. As suggested by Kashyap and Stein (1994), in the presence of non-negligible costs from switching from one lender to the other the argument of the "marginal" lender could fail, and the relative sizes of the bank and non bank intermediary sectors could matter.[42]

4. Conclusions

We have analysed and tested the presence of a bank-lending channel and more generally of a credit channel in four European housing markets characterised by different institutional frameworks and different levels of efficiency in the funding and mortgage systems. The results suggest that, despite the process of integration, residual heterogeneity characterises European housing markets and eventually, the transmission mechanism of monetary policy. Table 3 summarises the econometric evidence. While robust evidence of a bank-lending channel emerges for Finland and the UK, we find at most evidence of a balance-sheet channel for Germany, and lack of evidence of a credit channel for Norway.

The Finnish housing finance system, despite financial liberalisation, is affected by frictions: banks heavily rely on retail deposit funding and have a predominant role in mortgage origination. Similarly, despite mortgage product standardisation and a competitive environment, the UK housing finance system heavily relies on depository institutions with a limited role for alternative mortgage lenders. At the opposite extreme, Norway has enjoyed a

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[40] The figure also includes a negligible, declining market share of the Government.

[41] According to Lea, Welter and Dubel (1997), following the sharp rise of market rates in 1988, centralised lenders were hit both financially and in originations with heavy pre-payments as they had to adjust their rates when the funding rate index (Libor) changed. Banks and building societies could avoid this adjustment because retail savings rates sluggishly responded to market rates.

clear improvement in the funding mechanisms of housing finance institutions and greater competition among mortgage financiers. Finally, the rigidity of the German markets, marginally affected by deregulation, explains the evidence of a balance-sheet channel suggested by the behaviour of the Spread; the lack of a bank-lending channel could be the by-product of the historical richness of non-depository mortgage providers.

Throughout the paper we have avoided quantitative comparisons across countries, limiting our analysis to *qualitative differences* in the sign, shape and significance level of the VAR impulse responses. We think that, in order to address the transmission of monetary policy, this approach is relatively safe even if our conclusions should still be treated with caution.

The normative implications of the paper for the conduct of monetary policy are relevant. In a framework with a single monetary policy (which is the case for Germany and Finland and in perspective for the UK), the choice of the appropriate intermediate targets can encounter relevant difficulties with strongly asymmetric transmission channels. The question then becomes whether the process of integration or phenomena like the diffusion of mortgage securitization will progressively sweep these asymmetries away.

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[42] It would seem therefore that neither the increased freedom of entry in the market for housing finance nor the relaxation of funding restrictions and liberalisation of market rates have led to a full flexibility of the UK system.

Appendix 1: Structural features of the housing markets

Institutional framework
Main mortgage lenders and percent recent market share
Finland: Deposit banks and Bank of Finland (68), State and other specialist lenders (32) (source: Statistics Finland)
UK: Banks (68.6), building societies (24.9), other specialist lenders (6.5) (source: Lea, Welter and Dubel, 1997).
Norway: Savings banks (40.8), commercial banks (33), mortgage institutions (1.5), State banks (16.1), insurance companies (8.2), other (0.4) (source: Lea, Welter and Dubel, 1997).
Germany: Private commercial banks (21), mortgage banks (16), credit co-operatives (14), savings banks (25), Bausparkassen (11), regional banks (13) (source: Lea, Welter and Dubel, 1997)

Funding methods (depository institutions)
Sources of funding for banks and other depository institutions (retail deposits include accounts and savings deposits; wholesale general funding includes bank bonds, loans from other monetary institutions and other minor techniques)
Finland: *banks*: retail deposits (90%), wholesale general funding (10%) (Source: EMF 2000)
UK: *banks* (exact figures not available); *building societies*: retail deposits (75%), wholesale general funding (25%) (Source: EMF 2000)
Norway: *commercial banks*: retail deposits (50%), wholesale general funding (47%); *savings banks*: retail deposits (61%), wholesale general funding (37%); (source: EMF 2000)
Germany: Mortgage bonds, mortgage backed securities, deposits (exact figures not available)

Maximum Loan to value ratios
Finland 70-80% (source: OECD, 2000)
UK 100% (source: OECD, 2000)
Norway 80% (source: OECD, 2000)
Germany 60-80% (source: OECD, 2000)

Degree of liberalisation

Set 1: Ceilings on deposit and lending interest rates; funding restrictions

Finland: Abolition of ceilings on loan rates in 1987
UK: End of collusive interest rate cartel with the abolition of the Corset (direct incremental control on the growth rate of interest bearing deposits, time deposits and CDs) in 1980. Relaxation of constraints on funding of Building Societies in 1986 (Building Societies Act)
Norway: Abolition of ceilings on bank-lending rates in 1985
Germany: Abolition of "the regulation on interest rate adjustment (Zinsverordnung)" in 1967. Persisting collusive mortgage rates

Set 2: Entry and portfolio restrictions

UK: Abolition of the Corset in 1980.

Appendix 2: Data description

Summary tables of time periods and variables used in the regressions (source in brackets).

Loans regressions

Country	Years	Variables
Finland	78Q4 – 99Q4	$\underline{HP}$ = Residential Property Prices *(source: BIS)* R = Money Market Rate *(Datastream (DS))* $\underline{HL}$ = Banks' Outstanding Housing Loans *(Statistics Finland)* $\underline{BL}$ = Banks' Lending Outstanding *(Statistics Finland)*
Germany	74Q2 – 98Q4	$\underline{HP}$ = Residential Real House Price Index *(Aufina/ERA; the original annual series was made quarterly through interpolation assuming an ARIMA(0,2,0) in the original series))* $\underline{R}$ = 3 months Money Market Lending Rate *(DS)* $\underline{HL}$ = Private Commercial Banks Housing Loans *(DS)* $\underline{BL}$ = Private Commercial Banks Total Loans *(DS)*
Norway	88Q3 – 99Q4	$\underline{HP}$ = New Detached Houses, Price Index *(DS)* $\underline{R}$ = 3months Forward Rate *(DS)* $\underline{HL}$ = Housing Loans Commercial Bank + Savings Banks *(Statistics Norway)* $\underline{BL}$ = Total Loans Commercial Bank + Savings Banks *(Statistics Norway)*
UK	78Q1 – 99Q4	$\underline{HP}$ = Nationwide East Anglia House Price Index *(DS)* $\underline{R}$ = Inter-bank 3 months interest rate *(DS)* $\underline{HL}$ = Building Societies Loans For House Purchase + Bank-lending Secured On Dwellings *(DS)* $\underline{BL}$ = Total Loans, Banks And Building Societies *(DS)*

Spread (SP=RM-RL) *Regressions*

Country	Years	Variables
Finland	88Q1 – 99Q4	$\underline{RM}$ = Interest Rate On Banks New Housing Loans *(Bank of Finland)* $\underline{RL}$ = Long Benchmarking Interest Rate, 3 Years *(Bank of Finland)*
Germany	82Q4 – 99Q4	*Industrial Production And Producer Price Inflation were used instead of $\underline{Y}$ And $\underline{DP}$* $\underline{RM}$ = Mortgage Rate, 10 year Fixed Average *(DS)* $\underline{RL}$ = 10 year Government Bond Yield *(DS)*
Norway	88Q3 – 98Q4	$\underline{RM}$ = Interest Rate On Long-term And Medium Term Loans Until 95Q4; Interest Rate On Mortgage Loans From Banks From 96Q1 *(Statistics Norway)* RL = Interest Rate O n 5 Year Bonds *(Statistics Norway)*
UK	85Q1 – 00Q2	$\underline{RM}$ = Building Societies, Mortgage Average Rate *(DS)* $\underline{RL}$ = Treasury Bill Rate (Office for National Statistics)

Mix Regressions

Country	Years	Variables
Finland	87Q1 – 99Q4	$\underline{MIX}$ = Housing Loans from all other lenders / (Housing loans from all other lenders + Housing Loans from Depository Banks and Central Bank)
Germany	74Q2 – 98Q4	$\underline{MIX}$ = Housing loans from Bausparkassen and Mortgage Banks / Total housing loans from all the financial institutions
Norway	88Q3 – 99Q4	$\underline{MIX}$ = Housing loans from state and non-depository fin. institutions / Total housing loans
UK	87Q1 – 00Q2	$\underline{MIX}$ = General Govt + Insurance Companies and Pension Funds + Other Financial Intermediaries Loans Secured on Dwellings / Total Loans Secured on Dwellings

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Table 1: **Structural features of housing finance systems**

Country	Institutional framework	Efficiency		
		Funding Market[*]	**Mortgage market**	**Risk-bearing**
Finland	Banking and state system - Strong role of banks - State funding restricted in scope and beneficiaries	- Strong reliance of banks on retail deposits and limited use of general wholesale funding (like bank bonds) - Limited use of mortgage bonds; no use of mortgage backed securities (EMF)	- Limited possibility of diversifying away from banks - State funding limited to particular types of mortgages/borrowers (BGMR)	- LTV ratios around 70-80%
UK	Banking system - Strong role of depository institutions (banks and building societies)	Competitive (DL) - Good access of depository institutions to wholesale general funding - Building societies can issue mortgage backed securities Sources of inefficiency: - limits on building societies unsecured debt - capital requirements unfavourable to issuing mortgage-backed securities (DL and EMF)	- Weak role of non-depository mortgage lenders - Integrated and competitive system - No restrictions on contracts (DL)	- LTV ratios up to 80% (without insurance) and 100% with insurance
Germany	Banking and mortgage bond system - Low concentration in banking system	Segmented (DL) - strong reliance of banks on retail deposits (mortgage backed securities issued at a very small rate) Sources of inefficiency -Deposit rates sluggish below market rates -Banks cannot issue mortgage bonds -Only Bausparkassen can issue contract savings -Limits on insurers favour mortgage bonds (DL and EMF)	- Strongly competitive - Well diversified range of alternative mortgage-lenders - Commercial and savings banks have overcome the funding segmentation through ownership of the specialised institutional funding sources (DL)	- LTV ratios> 80% restricted only to repeat buyers - Regulator constrains LTV ratio below 80% for mortgage bank and Bausparkassen mortgages
Norway	Banking and state system	- Good access of commercial and savings banks to wholesale market (bank bonds and other general funding) (EMF)	- Strong and increasing competition in market for mortgage loans (LWD)	LTV ratios around 80%

Note: DL refers to Diamond and Lea (1992); LWD refers to Lea, Welter and Dubel (1997); BGMR refers to Booth et al. (1994), EMF refers to European Mortgage Federation (2000).

Table 2: **Overview of the econometric Specifications**

VAR	VARIABLES (regression)	IDENTIFICATION OF	IDENTIFICATION SCHEME
1	Y, DP, R, HP, HL, BL (Loans regression)	MONETARY POLICY SHOCK	Combinations of short and long run restrictions; monetary shock does not affect contemporaneously Y and DP and has zero impact on all the variables in the long run.
2	Y, DP, R, HP, SP (Spread regression)		
3	Y, DP, R, HP, MIX (Mix regression)		
4	Y, DP, MIX, HP	MIX SHOCK	Recursive. The MIX shock does not affect contemporaneously Y and DP

Variables: Y (real GDP), DP (consumer price inflation), R (money market rate), HP (real house prices), HL (real housing loans from banks), BL (real total loans from banks), SP (mortgage rate, RM, *minus* benchmark safe rate, RL), MIX (ratio of housing loans from "non-banks" to total housing loans).

Table 3: **Summary of the Empirical Findings**

Country	Response to a negative monetary shock			Response to Mix increase	Credit channel?	
	Bank loans and housing loans	Spread = bank mortgage - benchmark rate	Mix (Housing loans non bank / Total Housing loans)	Real House Prices	Balance-sheet	Bank-lending
Finland	BL ⇓ HL ⇓	SPREAD ⇑	MIX ⇑	HP ⇓	Possible	Yes
Germany	BL ⇓ HL ⇔	SPREAD ⇑	MIX ⇑	HP ⇔	Yes	No
Norway	BL ⇓ HL ⇓	SPREAD ⇔	MIX ⇔		No	No
UK	BL ⇔⇓ HL⇓	SPREAD ⇔⇑	MIX ⇑	HP ⇓	Possible	Yes

Figure 1: The data used. HP: log of real house prices; Y: log of GDP; R: short-term interest rate, percentage. SP: Spread between mortgage rate and a safe rate of same maturity, percentage. HL: log of real loans from banks for housing; BL: log of real loans from banks for all other purposes. MIX: ratio between housing loans from State and non-depository institutions versus total housing loans.
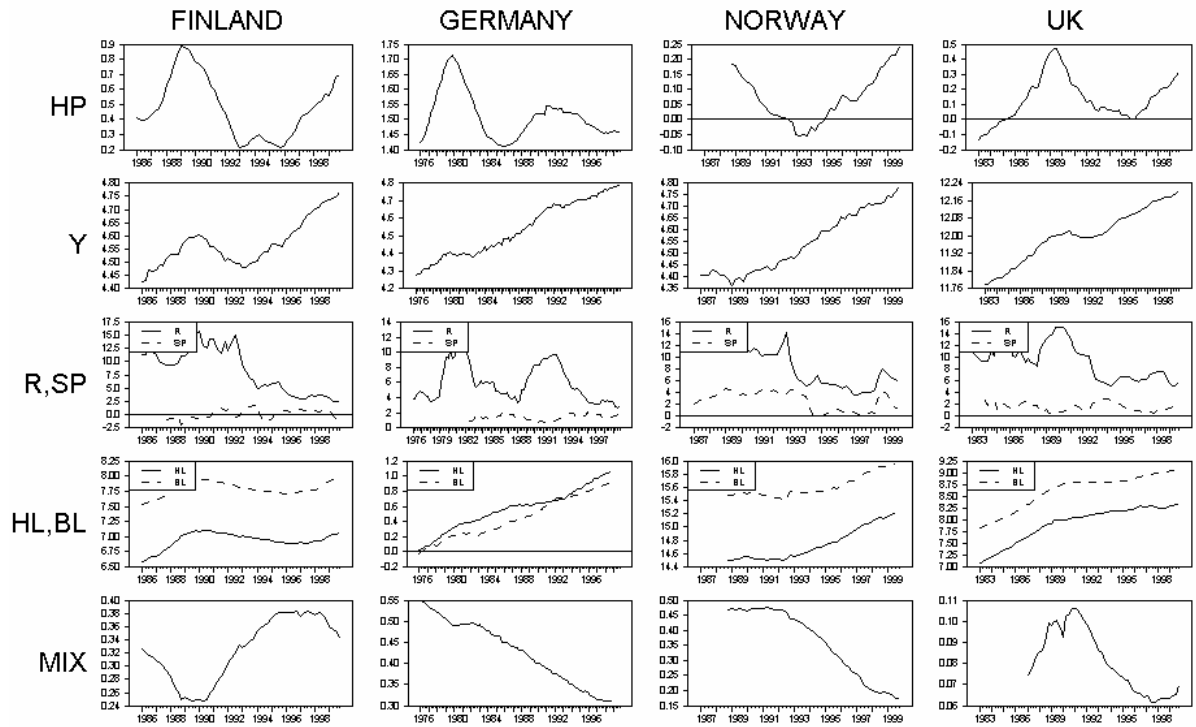
Impulse responses of the VAR. For each country, Figure A shows response of total real bank loans, bank housing loans and other macro variables to a monetary contraction. Figure B shows responses of mortgage rate and long-term safe rate of equal maturity to a monetary contraction. Figure C shows the response of Mix (housing loans from non-banks over total housing loans) to a monetary contraction. Figure D shows the response of the macro variables to a positive innovation in the Mix.

Figure 2.A: FINLAND: RESPONSES ±1S.E. BANDS TO A MONETARY SHOCK, LOANS REGRES.
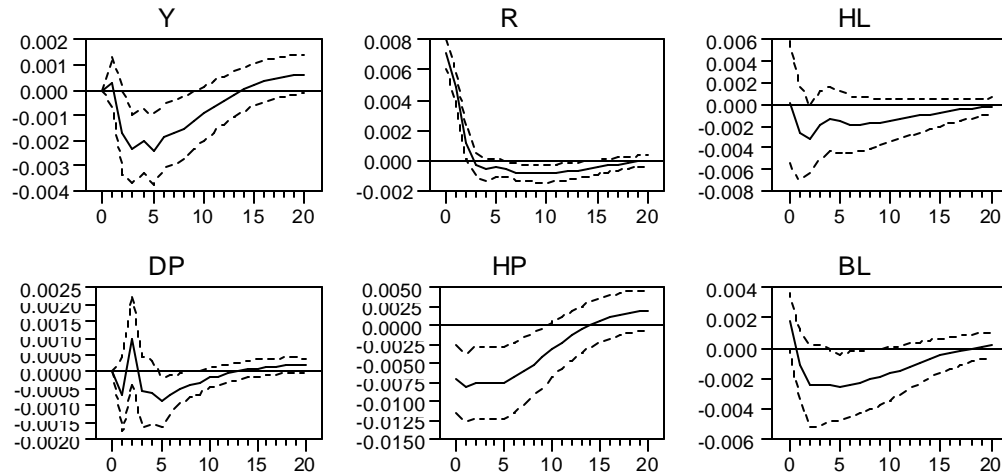
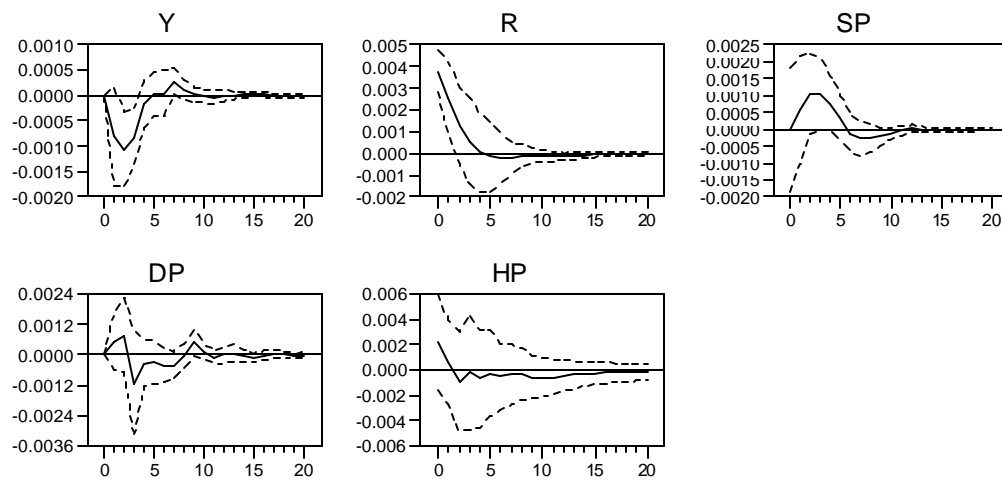**Figure 2.B:** FINLAND: RESPONSES ±1S.E. BANDS TO A MONETARY SHOCK, SPREAD REGR.
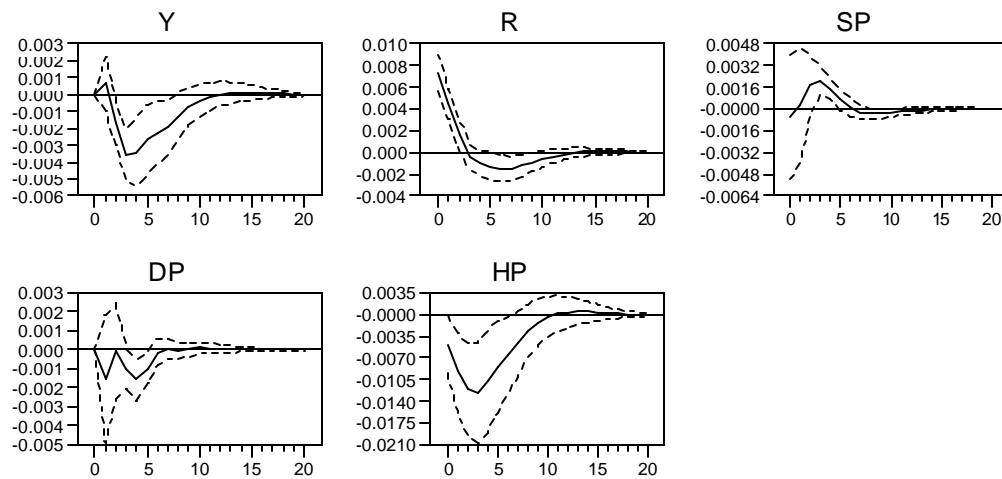
Figure 2.C: FINLAND: RESPONSES ±1 S.E. BANDS TO A MONETARY SHOCK, MIX REGRESS.
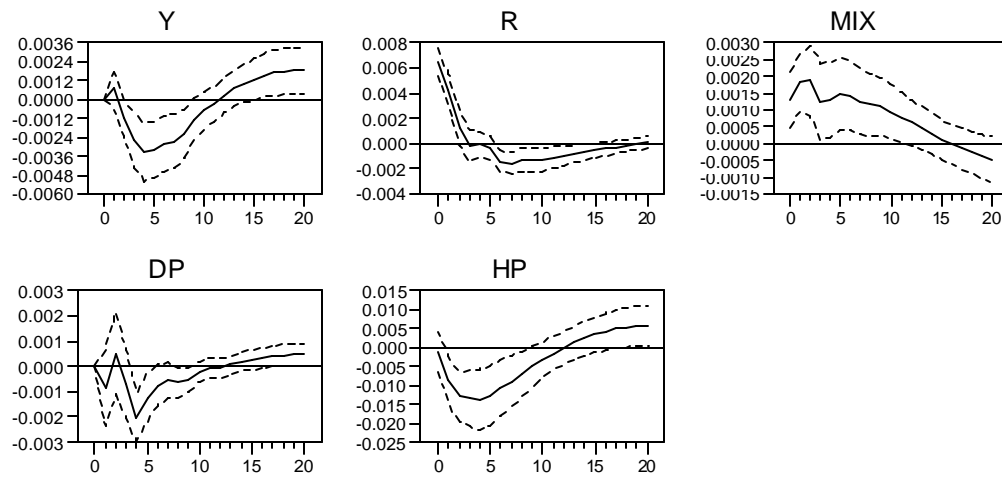
Figure 2.D: FINLAND: RESPONSES +1 S.E. BANDS TO A SH OCK IN THE MIX VARIABLE
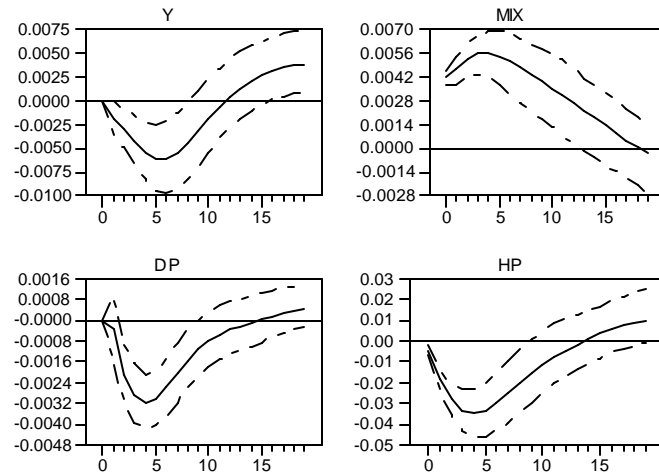
Figure 3.A: GERMANY: RESPONSE ±1S.E. BANDS TO A MONETARY SHOCK, LOANS REGR.
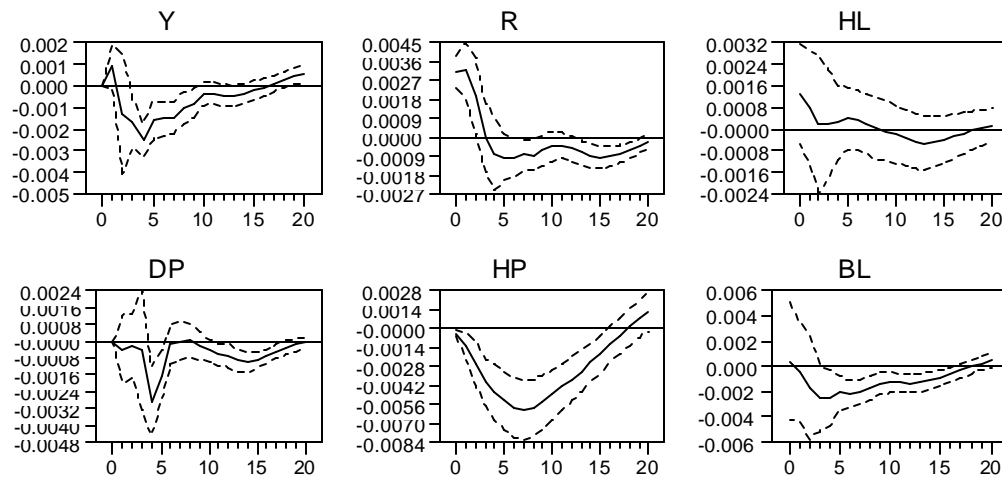
Figure 3.B: GERMANY: RESPONSE +1S.E. BANDS TO A MONETARY SHOCK, SPREAD REGR.
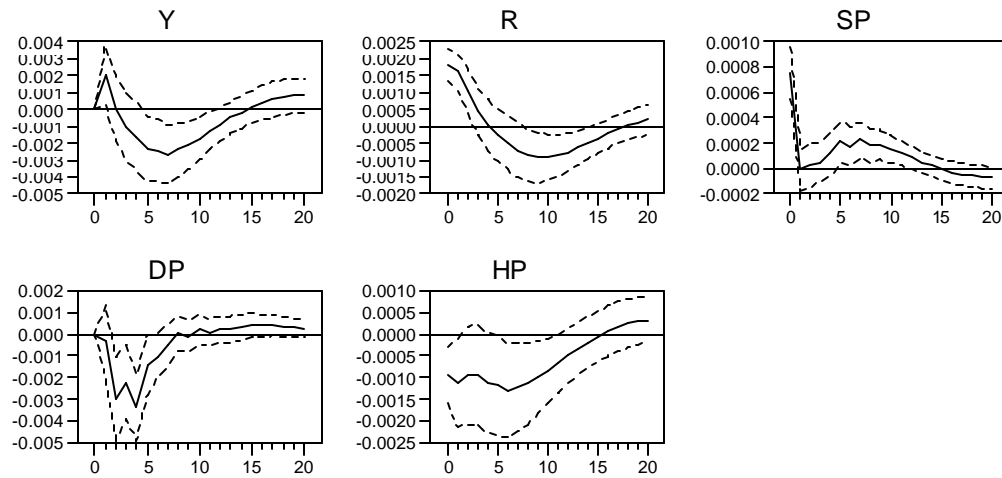
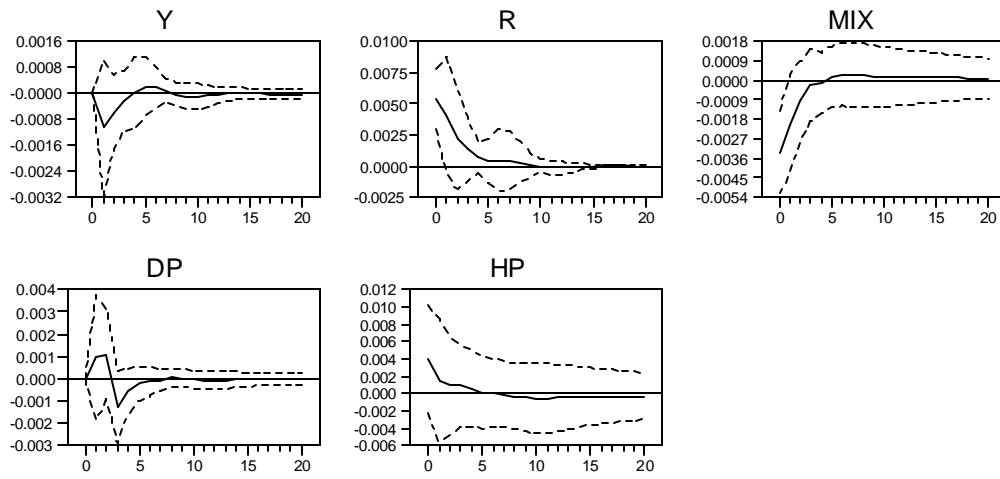**Figure 3.C**: GERMANY: RESPONSE ±1S.E. BANDS TO A MONETARY SHOCK, MIX REGRESS.
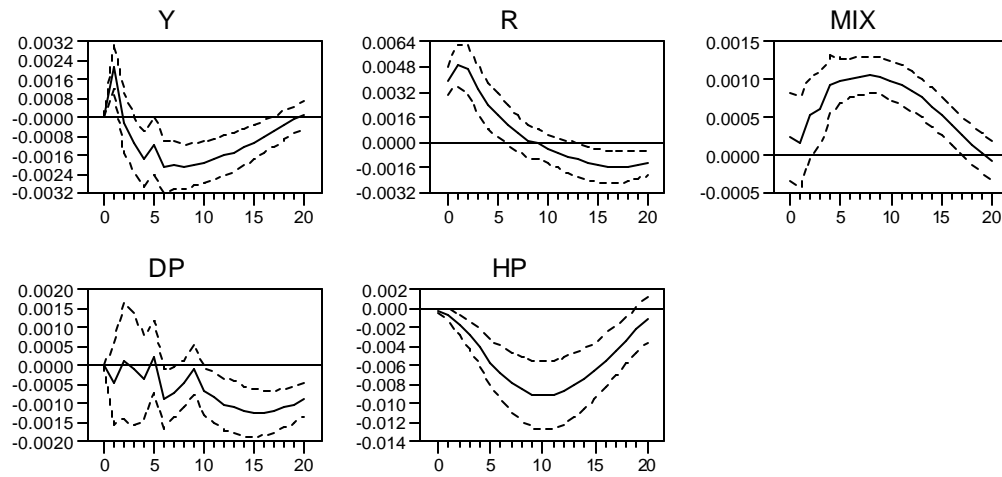
Figure 3.D: GERMANY: IMPULSE RESPONSES ±1 S.E. BANDS TO SHOCK, MIX VARIABLE
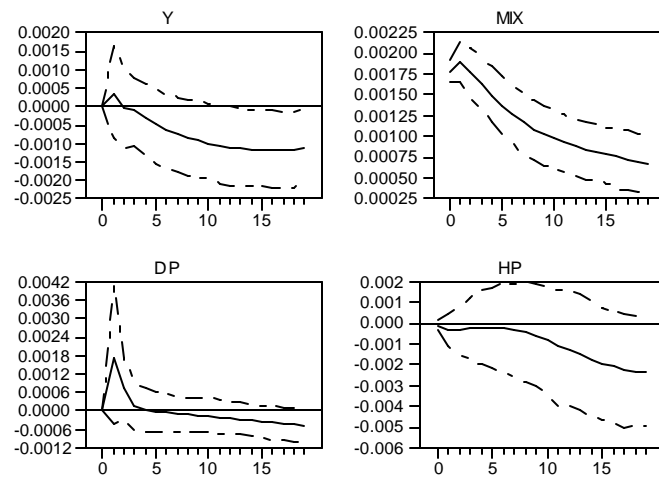
Figure 4.A: NORWAY: RESPONSE ±1S.E. BANDS TO A MONETARY SHOCK, LOANS REGRES.
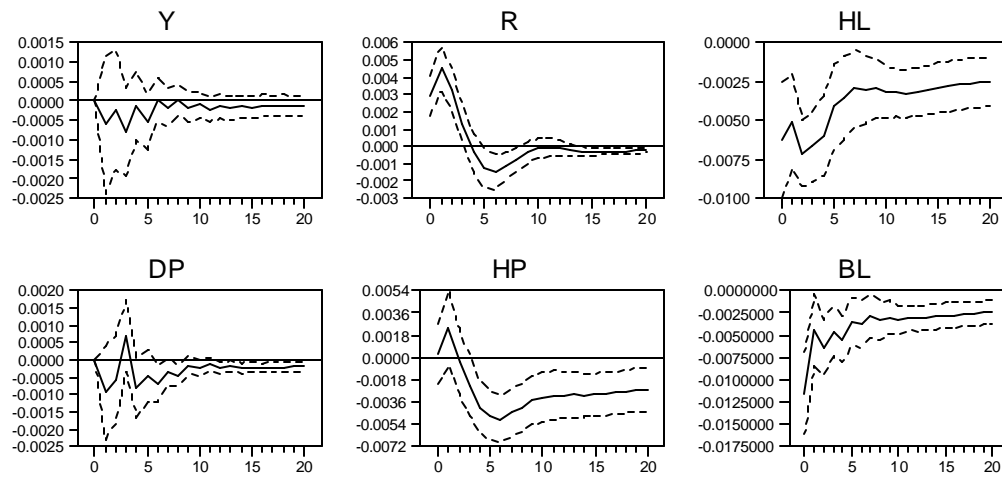
Figure 4.B: NORWAY: RESPONSE ±1 S.E. BANDS TO A MONETARY SHOCK, SPREAD REGR.

Figure 4.C: NORWAY: RESPONSES ±1 S.E. BANDS TO A MONETARY SHOCK, MIX REGRESS.

Figure 5.A: UK: RESPONSE ±1S.E. BANDS TO A MONETARY SHOCK, LOANS REGRESSION

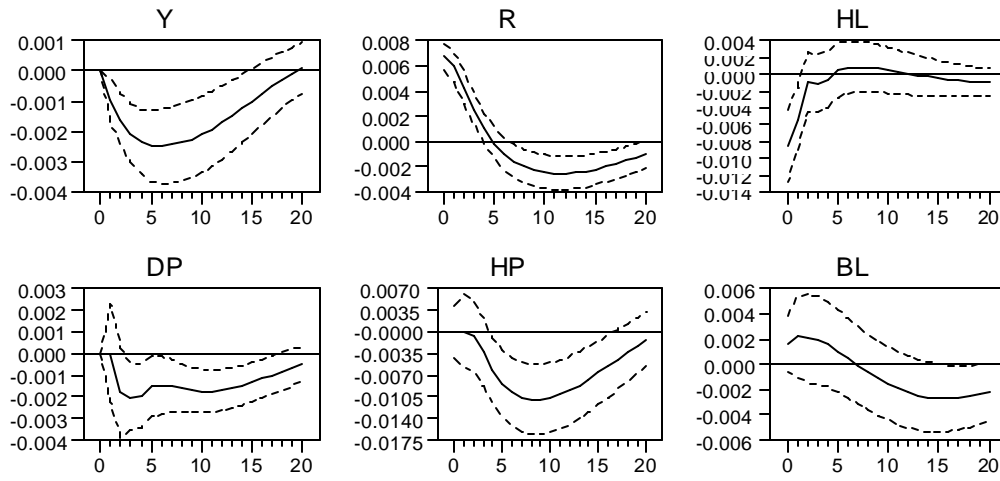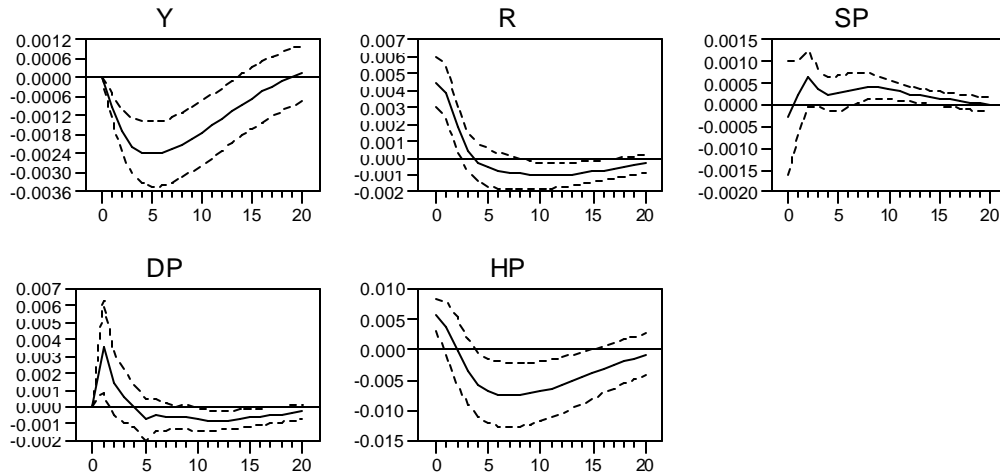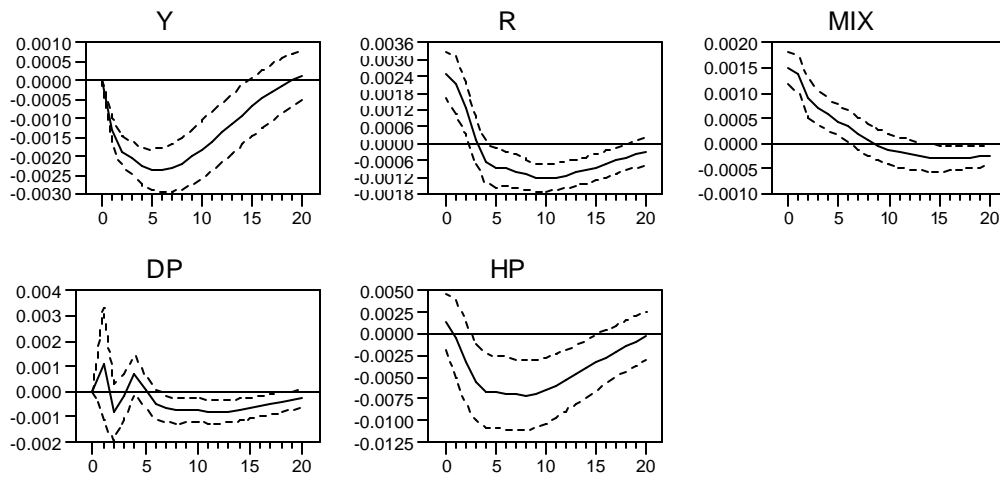**Figure 5.B:** UK: RESPONSE +1S.E. BANDS TO A MONETARY SHOCK, SPREAD REGRESSION

Figure 5.C: UK: RESPONSE ±1S.E. BANDS TO A MONETARY SHOCK, MIX REGRESSION

Y

R

MIX

DP

HP

Figure 5.D: UK: IMPULSE RESPONSES ±1 S.E. BANDS TO A SHOCK IN THE MIX

Y

MIX

DP

HP