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The Credit Channel of Monetary Policy and Housing Markets: International Empirical Evidence

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The Credit Channel of Monetary Policy and Housing Markets: International Empirical Evidence

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Abstract

This paper tests for the presence of a credit channel (particularly a bank-lending sub-channel) for monetary policy in the housing market. We argue that the importance of this channel for investment in residential housing is highly dependent on the structural features, and particularly the efficiency and institutional organization, of housing finance. We employ a VAR methodology to analyse this issue with respect to the housing markets of four European countries (Finland, Germany, Norway and the United Kingdom), which differ greatly in terms of structural features. Our results are generally consistent with the existence of a broad credit channel, whereas the bank-lending channel seems to be operational only under certain conditions. More importantly, our results are consistent with previous analyses of housing market efficiency, which strongly suggests the existence of a clear relationship between the presence of a credit (bank lending) channel, the efficiency level of housing finance, and the type of institutions that are active in mortgage provision.

Key words: monetary transmission, bank lending channel, house prices, vector autoregressions

JEL Classification: E44, E51, E52, G21, C22

Rahapolitiikan luottokanava ja asuntomarkkinat: Kansainvälisiä empiirisiä tuloksia

Suomen Pankin keskustelualoitteita 14/2000

Matteo Iacoviello – Raoul Minetti
Tutkimusosasto

Tiivistelmä

Tutkimuksessa tarkastellaan empiirisesti kysymystä, toimiiko rahapolitiikan luottokanava (ja sen osana erityisesti pankkiluottokanava) asuntomarkkinoilla. Kanavan olemassaolo merkitsisi, että vallitsevan korkotason lisäksi myös luotontarjonnalla olisi itsenäistä merkitystä asuntomarkkinoilla. Hypoteesina on, että luottokanavan merkitys asuntoinvestointien määräytymisessä riippuu ratkaisevasti asuntorahoitusjärjestelmän rakenteesta, tehokkuudesta ja instituutioista. Tutkimusmenetelmänä käytetään vektoriautoregressiivisiä (VAR) malleja, joita sovitetaan Suomen, Ison-Britannian, Norjan ja Saksan aineistoon. Näiden maiden asuntomarkkinat poikkeavat rakenteeltaan merkittävästi toisistaan. Yleisesti ottaen tulokset viittaavat luottokananavan olemassaoloon, mutta pankkiluottokanava näyttää toimivan vain joissakin tapauksissa. Tulokset ovat samansuuntaisia aikaisemmista asuntomarkkinoiden tehokkuutta tarkastelleista tutkimuksista saatujen tulosten kanssa. Ne osoittavat, että (pankki)luottokananavan olemassaololla on selvä yhteys asuntorahoitusjärjestelmän tehokkuuteen ja asuntorahoitusta myöntävien instituutioiden tyyppeihin.

Asiasanat: rahapolitiikan välittyminen, pankkiluottokanava, asuntohinnat, vektoriautoregressio

JEL-luokitus: E44, E51, E52, G21, C22

Contents

1 Introduction

Since the work of Bernanke and Blinder (1988), the literature has shown a renewed interest in the analysis of the credit channel of propagation of monetary policy. According to this view, the presence of widespread imperfections in the credit market – such as asymmetries of information or imperfect enforceability of contracts – result for consumers and firms in a wedge between the opportunity cost of internal funds and the cost of external funds. On its turn, this *external finance premium* would not be independent of monetary policy. For instance tight monetary policy would not only raise markets rates of interests but also the external finance premium, thus discouraging investment and consumption. The explanations of this link are traditionally sorted into two sub-views: according to the *balance sheet* sub-view, the bridge between monetary policy and the external finance premium is represented by the financial position of borrowers. A contractionary monetary policy deteriorates the net worth of borrowers either reducing their current cash flows – by increasing their interest-on-debt burdens – or reducing the value of their pledgeable assets; this would feed back on the external finance premium required by external lenders. The *lending* sub-channel view, on the other hand, focuses on the financial status of lenders: an exogenous monetary policy tightening drains reserves and retail deposits on the liability side of banks' balance sheets. Faced with this drain of retail deposits, banks could react increasing their funding through managed liabilities – such as certificates of deposit – or shrinking also the asset side of their balance sheet (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 decide to reduce their holdings of assets. According to the lending view, the impact would be relatively stronger on loans than on securities. In fact loans and securities are only imperfect substitutes because loans are riskier and less liquid. Therefore the result of a monetary tightening would be a credit crunch (i.e. an inward shift of credit supply) that would especially affect borrowers with limited access to non-bank sources of external funding.

The credit channel literature has produced mixed results in the last decade (see for instance Bernanke and Gertler, 1995, and references therein). A strong focus has been placed on identifying contractions in credit aggregates resulting from inward shifts in the demand for funds – and therefore fully consistent with the traditional monetary transmission mechanism – from shifts in the supply resulting from the workings of a credit channel. A second crucial issue of this empirical literature has been to disentangle the bank-lending channel 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 for instance Gertler and Gilchrist, 1994).

The target of this work is proceeding to extend the analysis of the credit channel of transmission on the side of consumers' expenditure focusing on the housing market.

Why houses? First, housing markets feature puzzles in terms of quantity and of price dynamics difficult to reconcile with the traditional views of the monetary transmission mechanism. As observed by Bernanke and Gertler (1995), the impulse response of residential investment to innovations in short-term rates is

generally slow and sharp. These features do not match the dynamic response of long term rates (the ones that most closely drive residential expenditure) that traditionally under-react to innovations in short term rates and tend to revert fast to their initial steady state. Analysing the pressure on the housing markets from the price side leads generally to similar puzzles. Secondly, housing markets have been characterised in many regions (Scandinavia, UK, New England, Texas and Australia) by striking booms and busts in prices in the last decades. Monetary policy has generally been considered a secondary factor in this dynamics. However, the way monetary policy affects house prices is still unclear and, given the disproportionate share of the housing stock in households' portfolios, a key subject for understanding the dynamics of aggregate consumption.

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 systems, especially the institutional framework (2.2) and the *efficiency* of the housing finance systems (2.3) and, finally, providing a tentative classification of the analysed housing systems (2.4). Section 3 explains the empirical methodology (3.1 and 3.2) and presents the results of the empirical analysis (3.3). Section 4 concludes. The relevant data for the analysis of the housing systems and the technical details of the empirical analysis are described in the Appendix.

2 The credit channel and housing finance system

2.1 The credit channel sensitivity of housing

The two-fold target of this analysis is:

1) Assessing the presence of a credit channel of monetary policy in housing markets (disentangling when possible a bank-lending sub-channel from a balance sheet sub-channel);
2) Relating this presence, as far as possible, to the structural characteristics of the housing finance system, especially its institutional organisation and its level of efficiency.

The credit channel of monetary transmission is likely to operate in the housing market as in other sectors of the economy. If ever, both its two sub-channels can be expected to be relatively more effective in the housing market. Starting from the balance sheet sub-channel, changes in the net worth of borrowers can affect lending conditions on mortgages as those on other loans. However, if a relevant share in the volatility of net worth is explained by the volatility in the price of collateralisable assets (like houses), mortgages could be particularly exposed to the balance sheet mechanism. In fact, mortgages belong to the category of collateralisable loans (with the collateral being in general represented by the house itself) and their terms are strongly affected by the price of these assets. This could also explain the attitude of banks of investing an increasing share of their portfolios in the housing market in periods of increasing house prices.

The lending sub-channel can also be expected to be relatively strong both at the source (depository institutions) and at the destination (households). At the

source, because of the wide volatility of house prices, real estate loans are generally considered risky ones. If a negative monetary policy shock (and the following adverse impact on the economy) increases the risk aversion of the bank management, the shrink on the asset side could affect especially housing loans (resulting in a flight to quality from riskier to safer loans and to securities). The relative illiquidity of mortgages could also be relevant. If banks are concerned with keeping a buffer against liquidity shocks, they could be encouraged to shift from less liquid to more liquid loans.

At the destination, a crunch in housing loans is likely to affect the demand from households more than a crunch in the markets for non-durable goods. In fact the main beneficiaries of bank mortgages are small households with limited access to non-bank sources of funding. A reduction of bank-credit, in the absence of state funding or credit from alternative institutions, would probably result in the actual lack of funds for house purchases crunching the demand more in this sector than elsewhere.

2.2 Credit channel sensitivity and the institutions for real estate finance

The first major structural feature that can be expected to affect the relevance of the credit channel in the housing market is the institutional organisation of the housing finance system.

It is well known that housing finance systems are characterised by a huge heterogeneity across countries and defy therefore a clear categorisation. However, broadly speaking the systems of the countries that we are going to analyse (Finland, Germany, Norway and UK) can be polarised in three categories:

i. Bank oriented model (Finland, UK, in part Germany);
ii. Mortgage bond model (in part Germany);
iii. State model (Norway and in part Finland).

The bank-oriented model is characterised by a strong presence of depository institutions (banks and mortgage banks) in mortgage provision. At the beginning of the Nineties, Finnish banks were covering a share of approximately 80 % of housing funding (Nordic Council, 1992). In UK depository institutions have an approximate share of 90 % of the market. In Germany commercial and savings banks and credit cooperatives cover about 45 % of the market competing with mortgage banks and Bausparkassen (and other minor institutions) in the provision of mortgage finance. The banking system is by its own nature the strongest candidate for the presence of a bank-lending channel. Not only is the dependence of borrowers on depository institutions high by definition, but also the amount of loanable funds is probably strongly dependent on monetary policy actions, because of the general reliance of these institutions on short-term retail deposit funding. In particular, as stressed by Guiso et al. (1999), banking systems with a low degree of size concentration (i.e., with many small banks) are relatively more prone to the existence of a lending channel, given the traditional difficulty of small banks in accessing to wholesale markets.

The mortgage bond model is characterised by a strong role of specialist mortgage institutions (mortgage banks). The key difference with the banking system, however, is in the source of funding of these specialist intermediaries, generally represented by the wholesale market. Out of our sample, in Sweden lending by Mortgage Banks is funded mainly through issuance of long-term housing bonds (with adjustable bond rates) to institutional investors. German mortgage banks adopt a similar mechanism of financing, issuing mortgage and municipal bonds. Bausparkassen, instead, rely on savings generated from long term (6–18 years) housing linked contracts and on government subsidies. We argue that, because of this funding mechanism, the mortgage bond model is probably less likely to be characterised by a bank lending channel. If specialist mortgage lenders with easy access to the wholesale market (and hence shielded from fluctuations in retail deposits) are major players in the market and offer mortgage contracts highly substitutable with the ones of depository institutions, monetary policy is likely to have limited credit supply effects.

Finally, the state model is characterised by a relevant presence of the state (directly or indirectly trough public banks). In Finland, an average share of mortgage loans between 10 % and 20 % is provided by the State Housing Fund. In Norway, this percentage has averaged around 40 % in the Nineties. Mortgage loans by the State are generally restricted to social housing (Finland) or, in any case, to particular categories of beneficiaries (Norway).

It is important to stress, however, that the role of the institutional framework in determining the importance of a credit channel should not be overstated. Even in a system in which banks play a fundamental role a quantitatively small source of alternative finance could still represent a sufficiently flexible buffer against crunches in bank mortgage supply.

2.3 Credit channel sensitivity and the *efficiency* of the housing finance system

The second major structural feature that is likely to affect the importance of a credit channel is the "efficiency" of the housing finance system. In a comparative study of European housing finance systems, Diamond and Lea (1992) propose a number of qualitative indices for evaluating the efficiency of housing finance. In particular, among the ones they indicated, three are the aspects of efficiency that are likely to be relevant for the presence of a credit channel:

a) the depth of the funding system for housing finance institutions;
b) the presence of a diversified range of sources of mortgage lending;
c) the optimal sharing of credit risk.

As stressed in the introduction, the first two aspects are likely to be particularly important for the presence of a bank-lending channel. A deeper market for wholesale funding is likely to undermine *at the source* the effectiveness of a bank lending channel by reducing the dependence of housing finance institutions on retail deposits. Analogously a wide range of mortgage finance institutions is likely to weaken *at the destination* the bank-lending sub-channel reducing the dependence of households' house purchases on bank credit. The third aspect (the

sharing of credit risk), instead, is likely to determine mainly the strength of the balance-sheet sub-channel. In fact, risk sharing is reflected in the level of mortgage rates and of required down-payment ratios. On its turn the loan-to-value ratios determine the correlation between collateralisable-asset prices and borrowers' credit capacity.

The level of efficiency of a housing finance system, as measured by the three mentioned indices, is clearly the result both of the historical evolution of the system and of the type of constraints imposed by the regulator. In particular, in many European countries all the three mentioned levels of efficiency have been strongly enhanced by the process of financial liberalisation occurred during the Eighties and especially by three sets of measures:

Set 1: Abolition (relaxation) of ceilings on deposit rates and of portfolio restrictions on the market funding of lenders;
Set 2: Abolition (relaxation) of entry and product restrictions in the market for housing finance;
Set 3: Abolition (relaxation) of quantitative controls on mortgages and in particular of regulatory down-payment requirements and minimum income-to-payment ratios.

In the presence of a regulatory ceiling on deposit rates, banks can be unable, after a monetary tightening, to offset the drain in deposits by increasing the return offered to depositors. A similar argument applies for restrictions on market funding. In the past, in some countries depository institutions have been prevented from raising funds issuing bonds on the open market for capitals[1] and this has implied a strong link between the volume of retail deposits and the volume of assets. Entry restrictions are again likely to affect mainly the effectiveness of the lending channel allowing a smaller range of intermediaries alternative to depository institutions and hence resulting in stronger bank-dependence of households. For all these reasons, the lending channel is likely to have become weaker (if it exists at all) in liberalised environments without the restrictions in sets one and two. In particular the abolition of ceilings on interest rates and of portfolio and entry restrictions (disintermediation) would have respectively deepened the market for banks' liabilities and, at the destination, reduced the dependence of households on banks for mortgage funding.

The third set of restrictions can be instead mainly associated with the balance sheet channel. In particular loan to value ratios determine the way changes in the value of collateralisable assets affect the availability of loanable funds from bank and non-bank intermediaries. In this case, however, the impact of financial liberalisation (with relaxation of the restrictions in set 3, like higher loan to value ratios) on the balance-sheet sub-channel is less clear to define (Bernanke and Gertler, 1995). As a result, the impact of financial liberalisation on the two sub-channels can be expected to have been at least partially asymmetric, with a suspected tendency of liberalisation to weaken the bank-lending channel but an ambiguous effect on the balance-sheet sub-channel.

The level of efficiency, broken down in the three mentioned aspects, will represent the second entry in our tentative classification of the analysed housing systems.

[1] 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.

2.4 A tentative structural classification

On the basis of the mentioned structural features, we provide a classification of the countries under study by means of a multiple entry table (some figures are reported in Appendix 2). 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 recent analysis of the European Mortgage Federation on the funding of mortgage loans in the EU and in Norway (EMF, 2000). For brevity, we defer a more detailed analysis of each country to the discussion of the results. Needless to say, this classification is only meant as an approximate qualitative guide for the interpretation of the empirical results and should not be overstated.

The entries of our matrix are represented by the institutional framework and by the level of efficiency, in the three aspects previously indicated. Given the impossibility of distinguishing, even at a qualitative level, whether the presence of the state affects the effectiveness of the bank lending channel, (what we defined as) state and banking model are bundled together.

2.5 Non-structural aspects: credit (lending) channel sensitivity and the financial status of intermediaries

Besides the aforementioned structural features, the literature has recently given consideration to the financial conditions of depository institution in explaining the relevance in the short run of the lending sub-channel. The basic intuition is that the possibility for a bank of accessing to the wholesale market would be directly correlated to its financial health, as measured for instance by its level of capitalisation, its profitability or the share of non-performing loans in its portfolio (Kashyap and Stein, 1998). However, unlike the long-run structural features already analysed, the financial status of depository institutions is likely to change relatively frequently with the cycle and can be therefore of limited usefulness in accounting for the structural relevance of a lending channel in a medium-long term (the one emphasised in this paper).

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

	International framework	Funding Market*	Efficiency Mortgage market	Risk-bearing
Finland	Banking and state system	– Strong reliance of banks on retail overnight deposits and limited use of general wholesale funding (like bank bonds) – Limited use of mortgage bonds and no use of mortgage backed securities (EMF)	– Limited possibility of diversifying away from banks – State funding restricted to particular categories of mortgages/borrowers (BGMR)	Credit risk – Loan to value ratios around 70–80 %
UK	Banking system	Frictionless and 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 the issue of mortgage-backed securities (DL and EMF)	– Fully integrated and competitive system – No restrictions on contracts (DL)	Credit risk – Loan to value ratios up to 80 % (without insurance) and 100 % with insurance
Germany	– Banking and mortgage bond system (Bausparkassen and mortgage banks). – Low degree of concentration in the banking system	Segmented (DL) – In particular strong reliance of banks on retail deposits (mortgage backed securities issued at a very small rate) Sources of inefficiencies – 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)	Credit risk – Loan to value ratios> 80 % restricted only to repeat buyers – Regulator constraints LTV ratio below 80 % for mortgage bank and Bausparkassen mortgages
Norway	Banking and state system	– Good access of banks (both commercial and savings) to the wholesale market (in particular bank bonds and other general funding) (EMF)	– Strong and increasing competition in the market for residential mortgage loans (LWD)	Credit risk 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).

* Since what matters for the analysis of the bank-lending sub-channel are especially the funding opportunities of depository institutions, in the column "Funding Market" we focus mainly on them.

3 Empirical tests

3.1 Common empirical methodology

The countries in the sample are two Nordic countries (Finland and Norway), Germany and the United Kingdom. The choice reflects the need of sufficient heterogeneity in the structure of housing finance systems across countries. Appendix 1 provides a more detailed explanation along with figures that support this argument. Appendix 3 describes data sources and time periods used in the regression.

For each of the countries, we run three (plus one) separated structural Vector Autoregressions (explained in the next subsection) in order to assess the presence of a credit channel and, possibly, disentangle a balance sheet sub-channel from a lending sub-channel. The first three VARs are symmetric across countries even though in some cases some heterogeneity in the choice of the specific variables is needed in order to capture the institutional features of the country-specific housing finance systems. In addition, we also run for some countries a fourth VAR in levels, which is conditional on the results of the third specification. The variables used in each of the VARs and the identification scheme are summarised in Table 2. More detail on the VARs is given below while the identification scheme is described in subsection 3.2.

Table 2. **Overview of the econometric specifications**

VAR	Variables (regression)	Identification of	Identification scheme
1	Y, DP, R, HP, HL, TL (Loans regression)	MONETARY POLICY SHOCK	Combination of short and long run restrictions; the 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, RM, RL (Spread regression)		
3a	Y, DP, R, HP, MIX (Mix regression)		
3b	Y, DP, MIX, HP	MIX SHOCK	Recursive ordering. 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 all institutions), TL (total loans from all institutions), RM (mortgage rate), RL (long term safe rate), MIX (ratio of housing loans from "non-banks" to total housing loans).

1) The first VAR includes six variables: *output, consumer price inflation, a short term nominal interest rate,*[2] *real house prices, volume of housing (or, when not available, real estate) loans by banks and other depository institutions, and total loans by banks and other depository institutions.* The results from

[2] The nominal interest rate is used as a broad indicator of monetary policy conditions, although our identification scheme combines both short and long run restrictions in order to identify a proper measure of exogenous monetary actions.

this VAR are only used as a first guide as they are substantially uninformative for detecting even simply the presence of a broad credit channel. As widely agreed, since credit aggregates are endogenously determined by demand and supply conditions, a reduction in total (housing) loans after a negative shock could reflect a shrink in loan demand resulting from the contraction of the economy (housing demand), therefore being fully consistent with a traditional monetarist transmission mechanism. However detecting a negative response of house-mortgages to negative monetary policy shocks is at least a necessary condition, even though not a sufficient one, for the existence of a broad credit or bank lending channel.

2) The second VAR focuses on the price side and includes six variables: *output, consumer price inflation, the short term nominal interest rate, real house prices, a benchmark medium-long term interest rate and a mortgage interest rate on outstanding (or, when available, new) housing loans*. The spread between the mortgage rate and a safe rate of comparable maturity (e.g. a government bond yield) can be regarded as a *relatively* reliable indicator of a credit channel in the housing market. In fact, the increase in the external finance premium associated with the workings of a credit channel could be captured by the increase in this spread.[3] However, the use of this spread encounters three major problems, all of which can reduce its informative content in our study of the housing market. First, the price is only one of the terms of mortgage contracts. For instance an increase in the expected default probability of the borrower could result in higher required collateral rather than a higher mortgage rate. The second problem stems from the possible presence of quantity rationing in the credit market. If quantity rationing were pervasive, the spread would obviously fail to capture an increase in non-price rationing of mortgage demand. Finally, a third technical issue arises from the complex evolution of mortgage rates in the analysed countries. The 1980s have been characterised in some countries in the sample by a progressive shift from long-term fixed rate mortgage rates to variable, reviewable and renegotiable[4] mortgage rates. The spread between a long-term safe rate and a variable mortgage rate would reflect also a liquidity premium (possibly a time varying one) not associated with agency or monitoring costs. To avoid this problem we will adopt different benchmark safe rates in the analyses in order to match better the actual length of fixity of the rate.

   Along with the mentioned problems, the information content of the Spread is confined to capturing a broad credit channel but does not allow to disentangle a lending sub-channel from a balance sheet one. In fact, the unavailability of differentiated data on the mortgage rate applied by different lenders precludes from determining whether banks' mortgage supply shrinks more than that of other intermediaries (resulting in an increase in the spread on bank mortgages stronger than the one on mortgages of other institutions). The increase in our "general" finance premium could be therefore fully

[3] Gertler and Lown (1999) look at the spread between high-yield corporate bonds ("junk bonds") and a 10-year government bond in the United States, and argue that this spread is closely correlated with the premium on external funds that bank-dependent firms face.

[4] Reviewable rates are normally adjustable at discretion of the lender; renegotiable rates are not fixed over the entire term, but for more than one year.

associated with the reduced net worth of borrowers[5] and signal a homogeneous tightening in the contractual terms offered by *all* the institutions.

3a) The third (five variable) VAR includes: *output, consumer price inflation, a short term nominal interest rate, real house prices, and ratio of housing loans by all "non-depository" financial institutions and State to all housing loans* (including housing loans by banks and all other depository institutions – when relevant –). The analysis of the **external finance Mix** *(fraction of housing loans by "non-banks")* is probably the best way to disentangle the workings of *a lending sub-channel*. In fact a crunch in bank mortgage supply, resulting from a drain in deposits, would be generally associated with a *relative* increase in the Mix because households would try to compensate the reduction in bank mortgages increasing their demand for mortgages of other institutions. In the presence of imperfect substitutability between bank mortgages and other mortgages this compensation would only be partial, however, and the crunch in bank supply would still have an effect on total housing demand. Therefore the analysis of the Mix requires two steps: analysing whether monetary policy shocks affect the Mix (VAR 3a) and, conditional on finding that monetary policy affects the Mix, analysing whether changes in the Mix affect conditions in the housing market (VAR 3b).

3b) In the countries where monetary policy actions affect the Mix, we run therefore a fourth VAR in levels (with a linear trend) with *output, consumer price inflation, external finance Mix and real house prices*. We identify the **external finance shock** using a recursive identification scheme, ordering the Mix after output and consumer price inflation.[6] 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 would support the existence of an independent bank-lending channel.[7]

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 recently been used in the analysis of a lending channel in the automobile market (Ludvigson, 1998). As stressed by Oliner and Rudebusch (1996), the analysis of the Mix does not solve completely the endogeneity problems. If different types of borrowers address preferentially different institutions for mortgage finance, a change in the Mix could simply reflect a different change

[5] The Spread, in other words, could simply act as a proxy for the risk of default on mortgages, a risk that is related to the state of the economy.

[6] That is, we assume that movements in the Mix cannot contemporaneously affect consumer price inflation and output.

[7] Following Ludvigson (1998), we do not include the interest rate in this equation. In fact, if the interest rate indicates monetary policy, then including some interest rate measure 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 cause 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 (resulting from capital crunches or worsening financial conditions of the banks).

in the demand for mortgages by these groups. For instance, let us assume that on a certain housing market banks compete with the State in the provision of mortgage finance but public funding is restricted to social housing or to single family houses (this is the case of Finland). If, following tight money, the demand for social housing or for single family houses decreases less than other segments of the demand, the Mix bank funding/state funding could decrease; however, this would only capture a different behaviour of consumers on the demand side. As it will become clearer below, in our sample this endogeneity issue arose especially for Finland but lack of long time-series data undermined the possibility of running specific tests on the cyclical behaviour of particular segments of housing demand.

In principle, rather than estimating three separated VARs to assess the effects of monetary policy, another approach could be the following: (1) run a single benchmark VAR and extract from the residuals a monetary policy shock measure; (2) estimate separately the dynamic response of the variable(s) of interest by regressing it on current and lagged values of the estimated policy shocks.[8] We also tried this procedure: the results were qualitatively similar. In addition, we found that the correlations between the three monetary policy shocks obtained from the first three VARs were always positive and statistically significant. For this reason, and since our focus is mainly descriptive, we prefer to think of our econometric approach in terms of 3 separated VARs. Accordingly, we report for each of the regressions the response of the variables specific to that regression (such as total and housing loans in the first regression) and of the variables common to all of them (such as interest rate, GDP, inflation and house prices). Needless to say, different variables in the VAR will imply that the estimated effects of the shocks on these common variables will, in general, not be identical across specifications, although, as we will see, they will be qualitatively similar.[9]

In all the VARs we use house prices as an indicator of cyclical conditions in the housing market. In principle, another natural way to test for an association between the credit channel and the housing market would be to investigate whether housing investment (rather than real house prices) falls in response to tight money. Although we believe that the results of the paper would not be affected by this choice, there are some reasons to think that house prices are more suitable to our analysis. First of all, since observed quantities reflect equilibrium between an interest elastic demand and a rigid supply, prices could be more informative than quantities in capturing developments in the housing market. In fact, in the housing market prices respond faster to shifts in the demand while the adjustment of quantities is by far slower. Secondly, house prices can play a crucial role in a transmission of monetary policy working through credit supply shifts. In fact, on the one hand, house prices affect borrowers' wealth and credit capacity (see Kiyotaki and Moore, 1997, for a theoretical model); on the other, they also influence lenders' net worth and therefore the amount of credit they can extend.

[8] For instance, the estimated shocks of the first regression (the one with bank loans) could have been used to estimate the response of the Spread in the second regression, and of the external finance Mix in the third.

[9] In addition, in many cases we choose (depending on the specification) different time periods in the regressions in order to take into account the possibility of structural breaks such as financial liberalisation episodes occurred during the periods in question.

Specifying the VARs using quantities rather than prices would omit these crucial interactions, possibly resulting in serious mis-specification.

Along with the VAR evidence, we present in the Appendix 5 some formal descriptive statistics. We document that simple cross-correlations between our key variables already suggest a broad inverse relation between the Mix and the Spread on the one hand and output and real house prices on the other. Further, in some countries this relation appears particularly strong at negative lags, hinting that the former variables lead movements in the latter.

We also present summary statistics for two key variables in our econometric specification, the Spread and the Mix variable (plotted in Figure A1.1). Visual inspection of the behaviour of the money-market rate and of the Spread suggests a positive correlation between the variables in all the countries. Furthermore, the Spread is on average positive over the sample periods in all the countries, although its variance – if we focus for comparative purposes over the last ten years – is much higher in Norway and UK than in Germany and Finland. The low value of the Mix for the UK reflects the large predominance of banks and building societies in the mortgage market.

3.2 The identification scheme

This section describes more in detail the time-series properties of the data analysed and our econometric specification (a more detailed description of the methodology can be found in Warne, 1993).

The econometric methodology for the identification of the monetary shock in VARs 1, 2 and 3a relies on the common trends framework developed by King, Plosser, Stock and Watson (KPSW, 1991). The idea behind this approach is to use the cointegration properties of the data to achieve identification in a vector autoregression by using both short and long run restrictions. When a group of variables is found to be non-stationary but cointegrated, a useful specification for their dynamics is a vector-error-correction model (VECM). A VECM places non-linear, reduced rank restrictions on the matrix of long run impacts from a VAR. KPSW (1991) propose a distinction 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 across the series, and the number of these shocks is equal to the number of variables in the system less the number of cointegrating relationships between them. The remaining transitory innovations equal the number of cointegrating relationships (intuitively, a cointegrating vector identifies a linear combination of the variables that is stationary thus eliminating the trend, so that shocks to it do not eliminate the steady state in such a system).

What matters for our purposes is that the cointegrated VAR model needs not to be fully identified: partial identification of either the transitory or permanent shocks is possible. Furthermore, it is possible to separate the transitory shocks by adding some (untested) restriction on their impact effects. *In this vein, we identify – in the class of the transitory shocks – the monetary innovation as the one that does not affect contemporaneously output and consumer price inflation, but can have potential effects on all the other variables. In addition, the shock has also to satisfy long run neutrality, both by having zero long run effect on output (and the other real variables), and by keeping relative prices of houses and consumer*

goods constant.[10] Therefore, output, inflation, real house prices and other real variables will revert back to their initial steady state once the effects of the contraction die out.

Appendix 4 shows Augmented Dickey-Fuller unit root tests results on levels of the series. Overall, the evidence of the tests is that the variables are integrated of order 1. In Germany, it appears that the unit root null hypothesis for inflation, interest rates and real house prices is rejected. Note, however, that it is not necessary that each time series in a common trends model is non-stationary. Loosely speaking, a stationary variable is cointegrated with itself, and can therefore be nicely fitted in a common trends framework (Warne, 1993).

The results of Johansen's tests for cointegration (also shown in Appendix 4) hint at the possibility in all the specifications of more than one cointegrating relationship between the variables. The rank test statistics are not entirely conclusive as for the number of cointegrating relationships. It appears that, depending on the circumstances, two to four cointegrating vectors are plausible. We rely on commonly used plausibility arguments in order to solve the dilemma: a common rank of three, as we will see, yields to reasonable responses of interest rates, output and inflation to the monetary shock. It also allows us to identify the monetary shock in a neat way, by using zero impact restrictions only on GDP and CPI inflation.[11]

On the basis of this, we specify our first three VARs in the form of a VECM.[12] Overall, this combination of short and long run restrictions will turn out to be quite successful, as we will see that the (contractionary) monetary shock elicits upward pressure in the interest rate and a negative response of output and consumer prices,[13] all suggestive of a contractionary monetary policy stance.[14]

As anticipated in the previous section, in VAR 3b we use a more conventional identification scheme to capture the effects of a Mix shock on the real variables. In fact, while economic theory has a lot to say about short and long run effects of a monetary shock, it is quite silent about the permanent effects of a Mix innovation. Therefore, in order to identify the innovation in the Mix, we rely on the traditional recursive assumption, ordering the Mix after output and consumer price inflation and before real house prices.

[10] The monetary shock will not affect relative prices of the two goods in the long run. However, it can affect consumer and house price index (by the same amount), since we impose the zero long run restriction on consumer price changes, not on levels.

[11] We departed from this rule only for one of the regressions for Norway. See footnote 21.

[12] Each VECM is estimated with a lag length of 2 to 4, depending on which was sufficient to obtain serially uncorrelated residuals.

[13] In some cases, consumer prices are above the baseline for a few quarters after a contractionary monetary shock. There is a large literature on this finding, better known as the price puzzle. See, for instance, Sims (1992).

[14] We have also tried the more traditional recursive identification scheme by ordering the interest rate after output and CPI inflation in the VAR and not imposing the additional restriction of long run monetary neutrality. Overall the results of this specification are not very different from the one we adopted.

3.3 Impulse responses and country specific tests

A. Finland

The overall evidence provides *support for the existence of a credit channel also in the version of a bank-lending sub-channel*.

Figure A1.2 shows the impulse response of deflated housing and total loans to a monetary contraction, using quarterly data from 1978:3 to 1999:3, along with one standard-error (asymptotic) confidence bands.[15] Both housing loans and total loans decrease after tight money. Figure A1.2.b shows the impulse responses of the mortgage rate on new housing loans and of the 5-year government bond yield to a negative monetary innovation.[16] The chosen maturity of the benchmark rate reflects the fact that in Finland loans have in general adjustable rates with typical adjustment periods of 3–5 years (Kosonen, 1993).[17] The impulse response of the Spread (calculated as the difference between the impulse responses of mortgage and long term safe rate and shown in Figure A1.6) stays negative for 3 quarters after the contraction and in general does not show any conclusive pattern. This behaviour of the Spread would seem to hint the absence of a significant credit channel. However, further analysis of the Mix *strongly* supports the workings of a credit channel in the form of a bank-lending sub-channel.

In Finland the *Mix* is defined as the ratio of the sum of housing loans by the State plus other minor non-depository lenders to housing loans by all the institutions (including commercial, savings and cooperative banks). We analyse the behaviour of the Mix in two steps. In the first one, we run a five variable VAR (output, consumer price inflation, short-term rate, real house prices, Mix) using quarterly data from 1987:1 to 1999:3 (that is after the liberalisation of interest rates). The results in Figure A1.2c show that there is a significant increase in the fraction of total housing loans made by non-depository institutions following tight money (with the response staying significant until ten quarters after the shock). This result looks consistent with the structural characteristics of the Finnish market for housing finance (as reported in Table 1). According to the EMF (2000), Finnish banks still tend to rely strongly on retail overnight deposits and overall their access to wholesale funding through money markets occurs at a higher cost than mortgage credit institutions in other Nordic countries (Kosonen, 1993, Booth et al., 1994). This inherent difficulty of banks in addressing the wholesale market for mortgage funding and in offsetting a decrease in reservable retail deposits could be at the basis of a credit supply effect of monetary policy (and explain the response of the Mix). The result also suggests that financial liberalisation could have had a minor role in weakening a bank lending channel *at*

[15] Warne (1993) and Vlaar (1998) discuss how to compute the asymptotic distribution of the parameters of the moving average representation of structural VAR models with long run restrictions.

[16] In this case the sample includes quarterly data from 1988:1 to 1999:3. Therefore the sample extends entirely after the abolition of interest rate ceilings (occurred in 1987).

[17] Maclennan, Stephens and Muellbauer (1999) report a percentage of 90 % of mortgages with adjustable rates.

the source (i.e. increasing the substitutability between retail deposits and wholesale funding).[18]

In the second step, we analyse the impact of an orthogonal innovation to the Mix on house prices and GDP. Figure A1.2d plots the response of real GDP, inflation and real house prices to an innovation in the Mix (ordered after GDP and nominal rates), along with one standard error bootstrapped confidence intervals. Real house prices fall significantly after an increase in the Mix suggesting that the composition of mortgage finance can play an important role in affecting housing demand. This incremental explanatory power of the Mix (besides the conventional interest rate channel), combined with the first result of the relevance of monetary policy for the Mix, *supports therefore the existence of an independent bank-lending channel*. This second result appears consistent with the characteristics of the Finnish system too. The big bulk of mortgages originated from non-depository institutions come from the State (being channelled, from 1990, through the State Housing Fund). State mortgages can represent a buffer for shocks in bank funding only to a limited extent. In Finland, in fact, state funding is restricted to social housing (rental, cooperative and owner occupied) and to financing the construction of single family houses. Moreover all the households receiving state loans must pass the income test. As a result the substitutability between private-bank funding and alternative funding can be expected to be far from perfect, implying the relevance of mortgage distribution for households' housing investment decisions.

B. Germany

Results for Germany show *some evidence for the presence of a broad credit channel in the housing market but no evidence for a bank-lending sub-channel*.

Figure A1.3a shows impulse responses of real total loans and housing loans by banks, using data from 1974:2 to 1998:3.[19] A monetary contraction leads to a significant fall in real total loans from banks, whereas housing loans decline, but quite insignificantly. The overall sluggishness in the contraction of loans could derive from the widespread presence of long-term relationships between bank and customers that induces banks to insulate initially their loan portfolios from monetary disturbances.

The spread between the mortgage rate and the long term government bond yield widens after a monetary contraction and stays positive for about eight quarters hinting at the possible presence of a broad credit channel (Figure A1.3b). Mortgage rates increase only by half a fraction of the increase in the short-term interest rate. This is consistent with the practice of fixed mortgage rates in use amongst Bausparkassen, but could also reflect stickiness of lending rates due to persisting collusive behaviour of banks (Shigemi, 1995).

[18] Financial liberalisation in the second half of the Eighties 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.

[19] 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.

The last two Figures (A1.3c and A1.3d) report the analysis of the finance Mix, using data from 1974:2 to 1998:3. The presence of a number of differentiated institutions in the German housing finance system makes the definition of the Mix *complex*. In defining it we consolidated all the institutions traditionally relying on reservable, short-term retail deposits. The Mix is defined therefore as the ratio of sum of housing loans from Bausparkassen and Mortgage Banks to total housing loans from all the financial institutions.[20] The results for the effect of monetary policy on the composition of external finance look quite clear-cut. A monetary contraction leads to an increase in the Mix, which displays a hump-shaped response over the adjustment period, peaking after nine quarters and returning to the baseline after approximately four years. This result for the Mix appears fully consistent with the characteristics of the German market for funding. According to Diamond and Lea (1992), German funding markets are probably strongly segmented. The first type of inefficiency that affects them is the relative *sluggishness of average market deposit rates*. However the most relevant inefficiency is probably the *segmentation of the bond market*. In particular, commercial and savings banks can issue unsecured debt but cannot issue mortgage bonds (unlike mortgage banks) and are also strongly discouraged by the regulator from issuing derivative securities; as a result banks tend still to rely mainly on retail general funding and especially on savings deposits (EMF, 2000). At the regulatory level, Diamond and Lea (1992) also highlight *"a close scrutiny of all the institutions by government regulators"*. An additional explanation for the observed behaviour of the Mix could come from the degree of concentration of the banking system. Actually the system consists of a network of small banks with difficult access to the wholesale market and, more 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 amongst these banks (Butterworth, 1990) but the vast majority of them is relatively small and operates on a regional basis with close community ties (being controlled by local authorities that also guarantee their operations).

The second stage of the analysis (Figure A1.3d) contains the analysis of the impact of the Mix innovation. As anticipated, also for Germany the Mix does not appear to affect the relative price of houses significantly, indicating a good degree of substitutability of depository institution mortgages with mortgages originated from other institutions. Also this result is not entirely surprising. The mortgage market in Germany appears well diversified with a strong competition among institutions (Diamond and Lea, 1992). Although the contracts offered by depository and non-depository institutions are not entirely homogeneous, especially in the length of the mortgage term and in the type of mortgage rate offered (fixed or renegotiable), these differences do not seem to justify a serious problem of non-substitutability.

Overall the results suggest therefore the substantial weakness of the bank lending channel hypothesis. However, the behaviour of the spread leaves room for the presence of a broad credit channel.

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

C. Norway

The results for Norway exhibit *very weak evidence of a credit channel and, if ever, in the form of a balance sheet sub-channel*.

Figure A1.4a shows the response of total and housing loans by depository banks[21] to a monetary policy shock, using data from 1989:1 to 1999:4. Total and housing loans significantly fall after a monetary contraction, as well as real house prices and GDP.

The behaviour of the spread between the mortgage rate[22] and the 5-year government bond yield provides very weak evidence for the presence of a credit channel. Although the regression is run over a relatively short period (1988:3–1999:4), some interesting results emerge. The spread (Figure A1.4b) widens after a monetary tightening but this response does not appear quantitatively striking. Further analysis shows that this behaviour of the spread could be more consistent with a worsening financial status of borrowers than with the workings of a bank-lending sub-channel. Important evidence comes in this sense from the behaviour of the Mix (Figure 1, bottom row). Over the last 15 years, an important fraction of housing finance has been provided by Government Lending Institutions. Only in recent years, commercial and savings banks have increased their share in the market, which is about 75 % at present. Finally, a minor share of the market is covered by finance and credit companies that (like in other systems) gather most of their funds from the wholesale market. In defining the Mix, therefore, we took the ratio of the sum of loans from state and non-depository financial institutions to the overall total housing loans.[23] Figure A1.4c shows the impulse response of the Mix to a negative monetary policy shock (over the period 1989–1999). The response appears overall insignificantly different from zero. This result probably reflects the progressive 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 in the last ten to fifteen years, reducing the overall dependence of banks on retail deposits (even though deposits still represent the main source of funding covering an approximate share of 60 % of banks total liabilities). The analysis by the EMF (2000) shows 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).[24] Quite interestingly instead, arguments related to the average size of Norwegian depository institutions would not be much of help. In fact, the degree of concentration in the Norwegian banking system is overall quite low with the strong presence of a myriad of small savings banks and a few not particularly big commercial banks.

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[21] This specification included four cointegrating vectors. However, the identification restrictions imposed on the monetary shock are similar as in all other cases (no impact effect on GDP and consumer – and house – prices) and long run neutrality.

[22] Interest rates on mortgage loans from banks were available for Norway only starting in 1995. Before that date, we used the interest rate on long and medium term loans.

[23] 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 eighties to a current value of little more than 15 %.

[24] The EMF reports also 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..."*.

D. United Kingdom

The results for UK display *weak evidence of a broad credit channel and do not support the presence of a bank-lending sub-channel*.

The first VAR uses quarterly data on output, consumer price inflation, treasury bill rate, loans for house purchases from banks and building societies, total loans from banks and building societies from 1963:2 to 1999:3. A monetary contraction results in the contraction of both real loans and mortgages of depository institutions, which bottom out approximately seven-eight quarters after the shock, as shown in Figure A1.5a.

Evidence from the response of the spread between the mortgage rate and the long government bond yield (Figure A1.5b) supports the presence of a broad credit channel.[25] A normalised monetary policy innovation corresponding to an increase in the T-bill rate of 50 basis points is associated with an impact rise of 10 basis points in the Spread (Figure A1.6). The Spread stays above the baseline for nine quarters before turning below its initial value when the monetary authority reacts anticiclically to moderate the initial fall in the GDP. Real house prices react with the expected negative sign but, more interestingly, the timing of the response closely matches the one of mortgage loans (bottoming approximately seven quarters after the shock).

Figure A1.5c provides the analysis of the *Mix*. The *Mix* is defined as the ratio between housing loans of non-depository financial institutions and insurance companies (in practice excluding banks and building societies) and the total of housing loans by all financial institutions.[26] After the abolition of the Corset in 1980 – but especially starting from the second half of the Eighties – the UK housing finance system has featured the strong competition brought about by real estate agents and centralised mortgage lenders to building societies (and banks). These non-depository institutions keep nowadays a marginal but robust position in the housing finance system with slightly less than a 10 % share of the market (see Figure A1.1). The bulk of funds of these institutions (and of insurance companies) come from the wholesale money market, in practice shielding them from fluctuations in retail deposits.[27]

As for the other countries, we analyse the behaviour of the Mix in two steps. In the first one, we consider the impact on the Mix of a negative monetary innovation; we run a five variable VAR (output, consumer price inflation, treasury bill rate, real house prices, Mix) using quarterly data from 1986:1 to 1999:3. The Mix increases consistently after a shock (Figure A1.5c) showing evidence of a crunch in bank and building societies mortgage supply stronger than the crunch in the mortgage supply of non-depository institutions (the response stays positive for eight quarters and is strongly significant). In the second step, we run a four-variable VAR in levels including output, consumer price inflation, Mix and real house prices. A positive innovation in the Mix, while affecting output negatively,

[25] In this case the VAR includes quarterly data from 1986:1 to 1999:3 (that is a period that extends entirely after the bunch of reforms of the UK housing finance system realised in the early eighties including the 1986 Building Societies Act).

[26] Therefore the Mix excludes funding by the state. However, funding by the state has progressively shrunk from the second half of the Eighties.

[27] Insurance corporations mainly fund their mortgage lending activity through insurance premiums.

reduces real house prices only after four quarters and at a negligible significance level (Figure A1.5d), overall suggesting good substitutability between mortgages by depository institutions and mortgages by alternative institutions. On the ground of the latter result, the hypothesis of the presence of a *lending channel* in the UK housing market *appears rejected*. In fact, on one side, the observed causality running from monetary actions to the Mix shows that the stance of monetary policy can affect the supply side of the housing finance market. On the other hand, the low marginal explanatory power of the Mix casts doubts on the relevance for households' decision of changes in the composition of the external finance.

Comparing these results with the Diamond and Lea (1992) analysis, the most surprising finding is certainly the relevance of monetary policy for the Mix. As reported in Table 1, the UK funding market stands for one *"of the most fully integrated and developed funding markets, almost as far as the United States"* (Diamond and Lea, 1992). Banks have an easy access to the wholesale market and the limit imposed on wholesale funding by Building Societies is not binding. The only major inefficiency reported by Diamond and Lea is the limit imposed to the issuance of unsecured debt by Building Societies. In such a fluid and liberalised context it would have probably been more consistent to find a weak link between monetary policy and the composition of finance.

The weak link between the Mix and house prices appears instead in line with "reasonable" expectations. Considering that the phenomenon of disintermediation in the UK housing market has led to a substantial homogeneity in the type of products offered by different institutions, this finding appears easy to justify. In such a strongly liberalised environment, it would have probably been puzzling to find a strong dependence of households' housing purchases on a specific source of finance[28] (let it be the most important one).[29]

The evidence found, however, is not entirely conclusive to discard the presence of a balance-sheet sub-channel. The weak increase in the finance premium shown by the results on the interest rate spread could capture at least in part the impact of a worsening financial status of the borrowers.

4 Conclusions

In this paper we have analysed and tested the presence of a bank lending channel, and more in general of a broad credit channel, in four European housing markets featuring different institutional frameworks and levels of efficiency in the funding and mortgage systems. Overall the results appear consistent with the analyses by Diamond and Lea (1992), Booth et al. (1994), Lea, Welter and Dubel (1997) and by the European Mortgage federation (2000) suggesting that, despite the process of integration, residual heterogeneity characterises European housing markets and, eventually, the transmission mechanism of monetary policy.

[28] Moreover, unlike in the Finnish system, the homogeneity in the products offered is also associated with substantial homogeneity in the range of beneficiaries of mortgage loans across institutions. This implies that the change in the Mix cannot be explained by changes in the composition of demand.

[29] Focusing on financial liberalisation, it would seem therefore that the flexibility of the UK system has resulted more from an increased freedom of entry in the market for housing finance (set 2 of features) than from relaxation of funding restrictions and liberalisation of market rates (set 1 of features).

Table 3 provides a summary of the empirical evidence presented. For each country, we report the response of total bank loans and housing loans, Spread and Mix variable to a monetary contraction, and the response of output and real house prices to a positive innovation in the Mix variable.

With the necessary caution the four housing markets appear *weakly ordered in a scale according to the relevance of the credit channel*. The two poles are represented by the Finnish case, featuring quite robust evidence of a bank-lending channel, and the Norwegian case, with very weak (or lack of) evidence of a broad credit channel.

Table 3. **Summary of the empirical findings**

Country	Response to a negative monetary shock			Response to a Mix shock	Credit channel?
	Bank loans and housing loans	Spread between mortgage rate and long rate	Mix (Housing loans non bank / Total Housing loans)	Real House Prices	
Finland	BL HL	SPREAD ⇔	MIX ⇑	HP	Yes (bank lending)
Germany	BL HL⇔	SPREAD ⇑	MIX ⇑	HP ⇔	Yes, broad
Norway	BL HL	SPREAD ⇔⇑	MIX ⇔		Very weak, broad
UK	BL HL	SPREAD ⇑	MIX ⇑	HP ⇔	Weak, broad

As stressed by Booth et al. (1994), despite financial liberalisation, the Finnish real estate finance system appears still affected by frictions, in a context in which banks preserve a predominant and sometimes exclusive role in funding house purchases. On the other side, the Norwegian system appears to have undergone and to be still undergoing a process of clear improvement in the funding mechanisms of housing finance institutions and increasing competition among mortgage-financiers (EMF, 2000). Moreover, this system has traditionally featured a quite well diversified range of alternative sources of mortgage finance at least if compared with the Finnish system.

In our tentative scale, close to the Finnish case but in a less extreme position, we could include the German finance system, where we find some evidence of a broad credit channel even if not of a bank lending channel. The relative rigidity of the German markets, only marginally affected by the process of deregulation, could easily explain this result, while the lack of evidence of a bank-lending channel could stem from the historical richness of institutions alternative to banks in the German system of mortgage provision.

Finally, the results for UK are also at least in part expected, showing weak evidence of a credit channel. The UK housing finance system has switched from a strongly regulated environment, prevailing until the early Eighties and centred on an oligopolistic cartel of Building Societies, to a much more fluid framework. Nowadays, strong competition among alternative institutions, liquid funding and mortgage markets and substantial lack of impediments from the regulator characterise its system of mortgage-provision (Diamond and Lea, 1992).

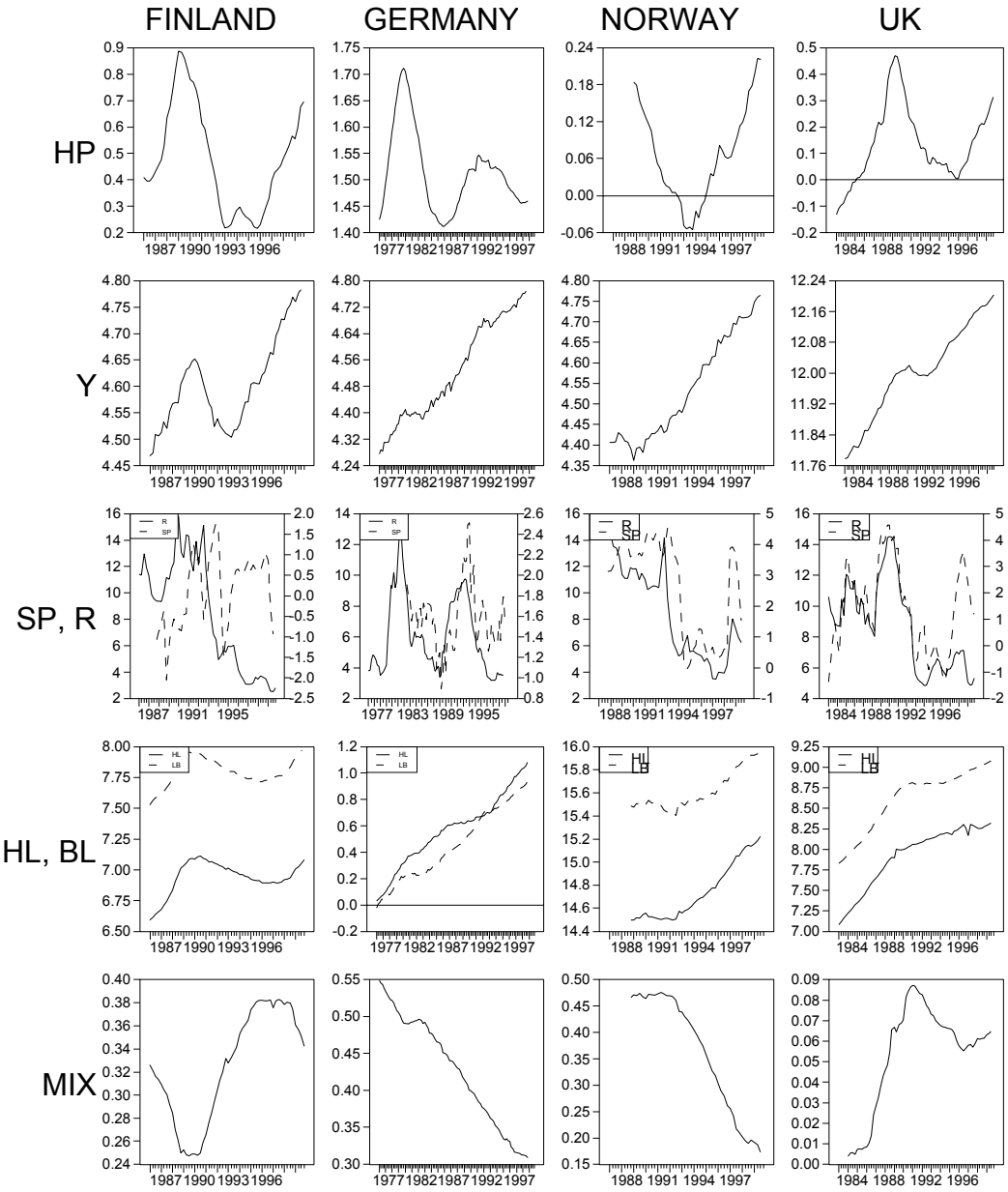
It should be observed that throughout the paper we have avoided to stretch the results to compare quantitatively the impulse responses across countries, limiting the analysis to *qualitative differences* in the sign of the responses. We think that, especially for addressing complicated issues such as the transmission of monetary policy, this approach is relatively safe and robust even though the conclusions we draw should still be interpreted with caution.

The normative implications of the analysis for the conduct of monetary policy are relevant. Housing markets can play an important role in the business cycle not only because housing investment is a very volatile component of aggregate demand but also because changes in house prices can have important wealth effects on consumption and investment choices. In a framework with a single monetary policy (which is the case for Germany and Finland and in perspective for UK and Norway), the choice of the appropriate intermediate targets can encounter relevant difficulties in the presence of strongly asymmetric transmission channels. The question then becomes whether the process of integration and the phenomena associated with it (like the diffusion of mortgage securitisation) will progressively sweep away these asymmetries.

The second conclusion we can infer from the analysis is a more methodological one. Recent studies (Maclennan, Muellbauer and Stephens, 1998) have strongly questioned the usefulness of VAR studies for analysing asymmetries in the housing finance systems. The substantial consistency of our results with the descriptive evidence by Diamond and Lea (1992) and other mentioned analyses suggests that, at least if we limit ourselves to qualitative inference, VARs can still represent a useful technique.

Appendix 1

Figure A1.1 **Time series data**



The data used. HP and Y indicate (log of) real house prices and GDP. The third row shows the money market rate (R, left scale) and the spread (SP) between mortgage rate and a safe rate of same maturity (both variables are expressed in basis points). The fourth row shows log of real loans from banks for housing (HL) and all other purposes (BL). The fifth row shows the MIX variables, constructed as the ratio between housing loans from non-depository institutions versus total housing loans.

Impulse responses of the VAR in the countries analysed. 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 A1.2a **Finland: responses ±1 S.E. bands to a monetary shock, loans regression**

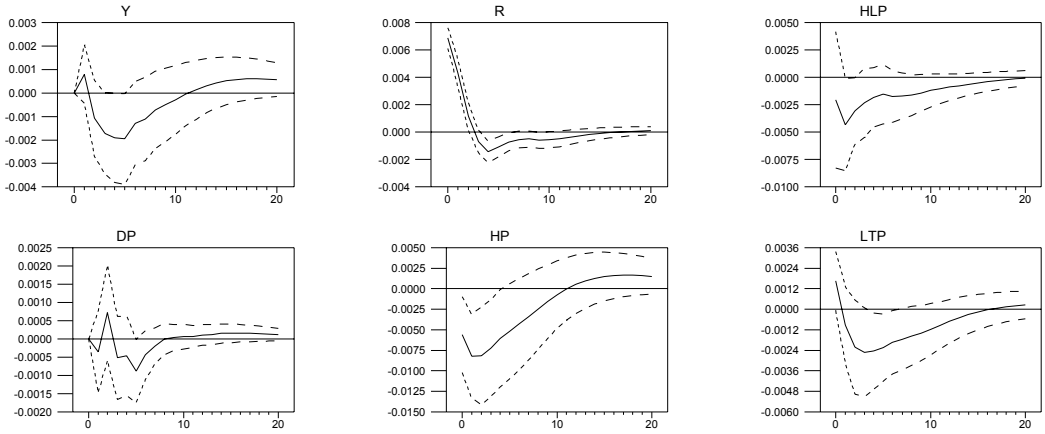


Figure A1.2b **Finland: responses ±1 S.E. bands to a monetary shock, spread regression**

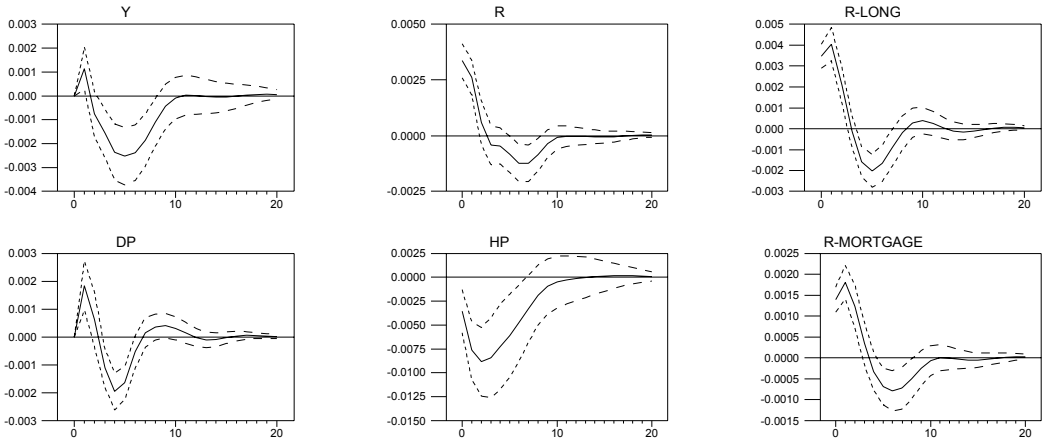


Figure A1.2c **Finland: responses ±1 S.E. bands to a monetary shock, Mix regression**

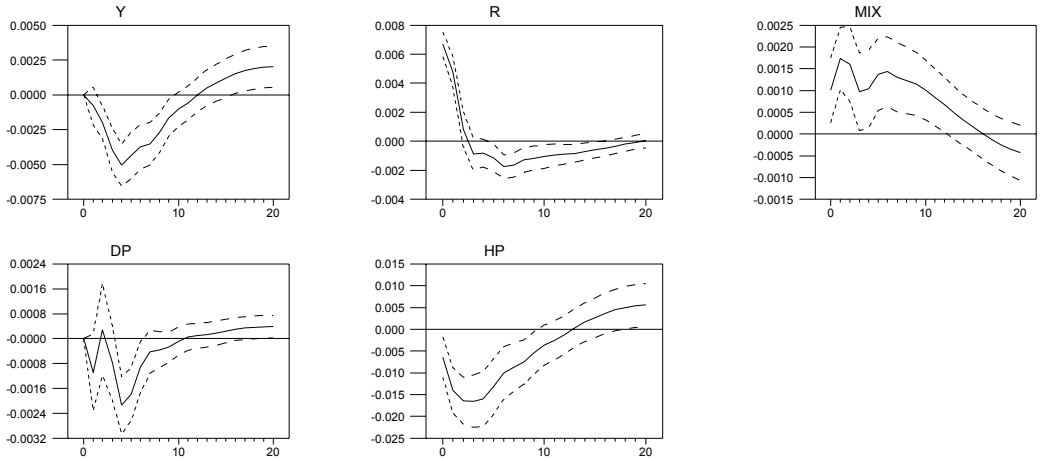


Figure A1.2d **Finland: responses ±1 S.E. bands to a shock in the Mix variable**

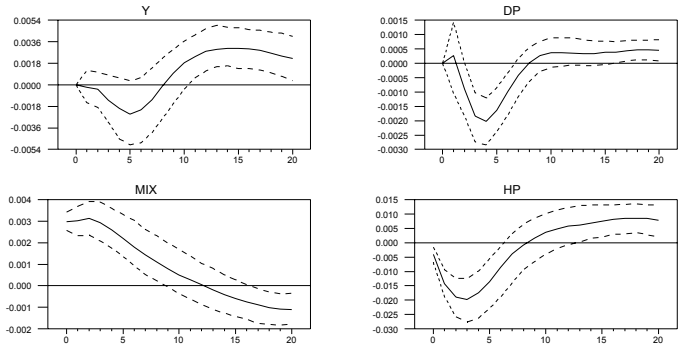


Figure A1.3a **Germany: response ±1 S.E. bands to a monetary shock, loans regression**

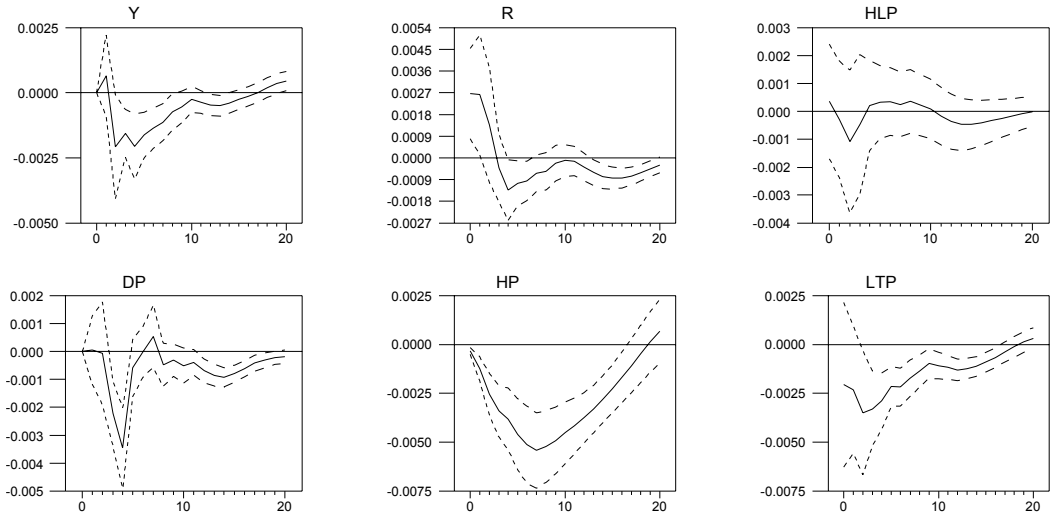


Figure A1.3b **Germany: response ±1 S.E. bands to a monetary shock, spread regression**

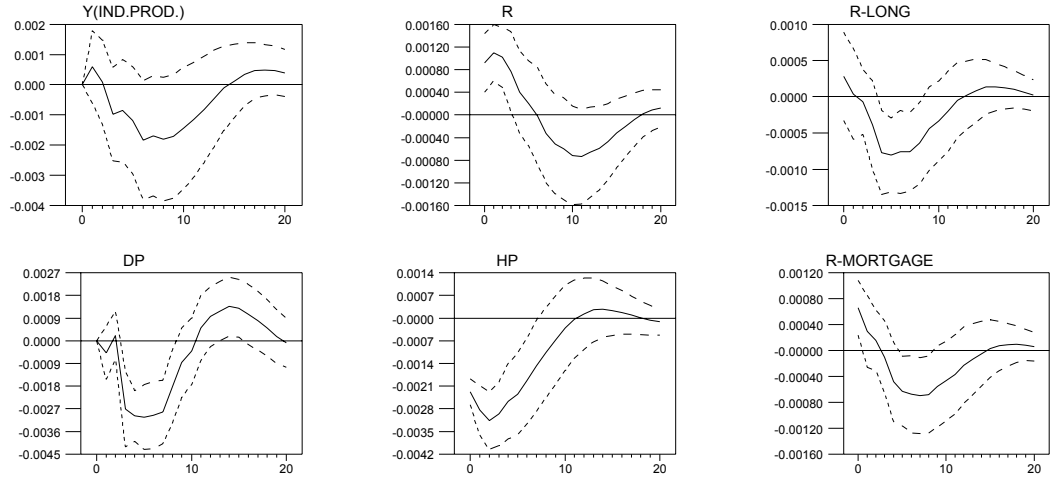


Figure A1.3c **Germany: response ±1 S.E. bands to a monetary shock, Mix regression**

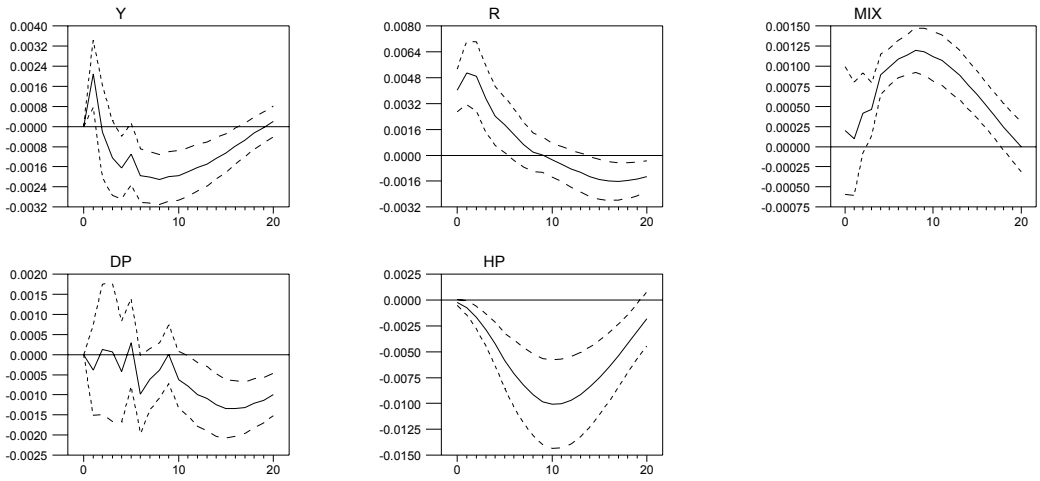


Figure A1.3d **Germany: impulse responses ±1 S.E. bands to shock, Mix variable**

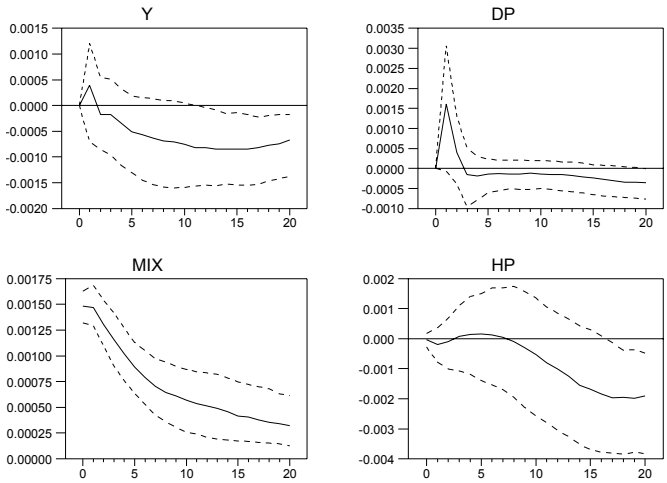


Figure A1.4a **Norway: response ±1 S.E. bands to a monetary shock, loans regression**

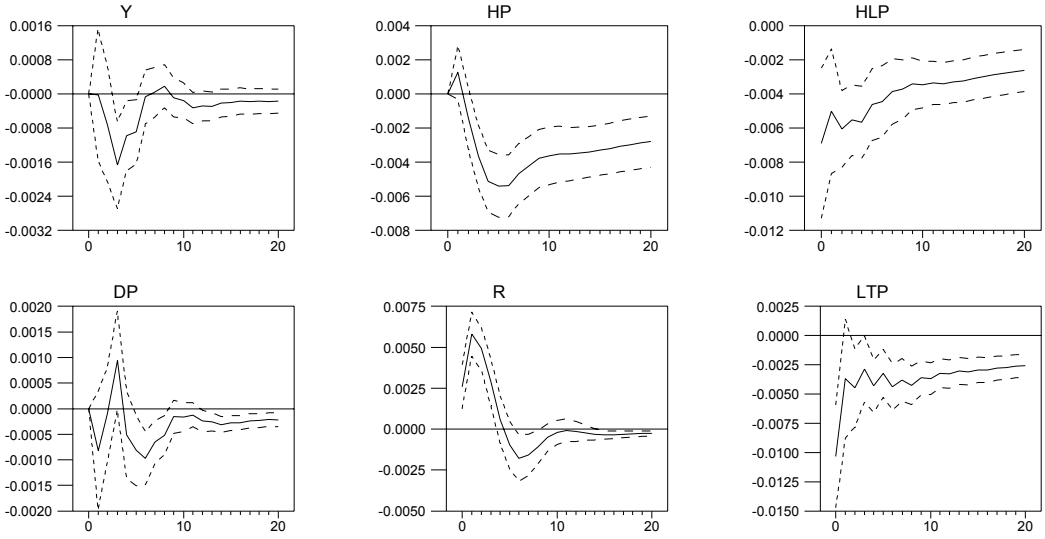


Figure A1.4b **Norway: response ±1 S.E. bands to a monetary shock, spread regression**

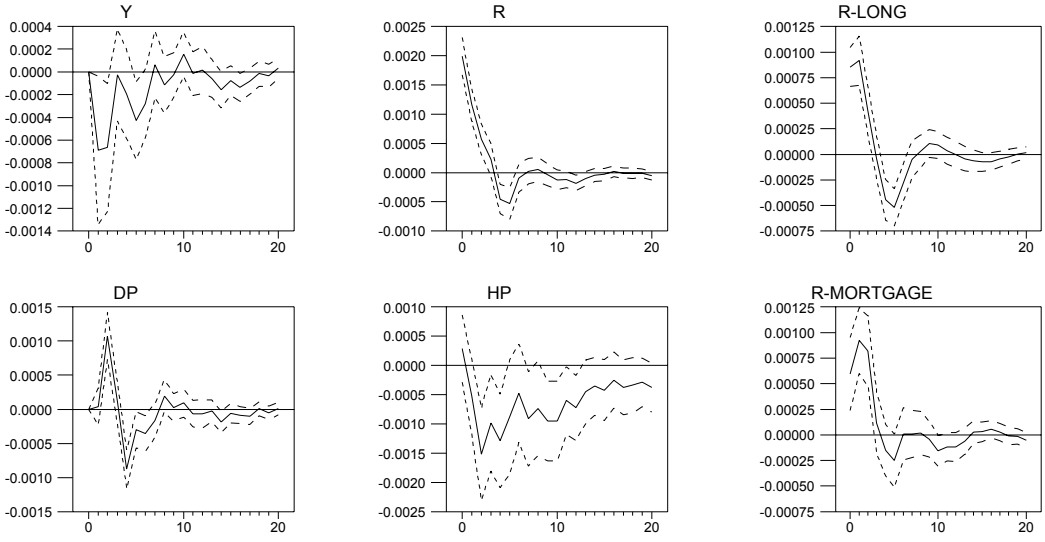


Figure A1.4c **Norway: responses ±1 S.E. bands to a monetary shock, Mix regression**

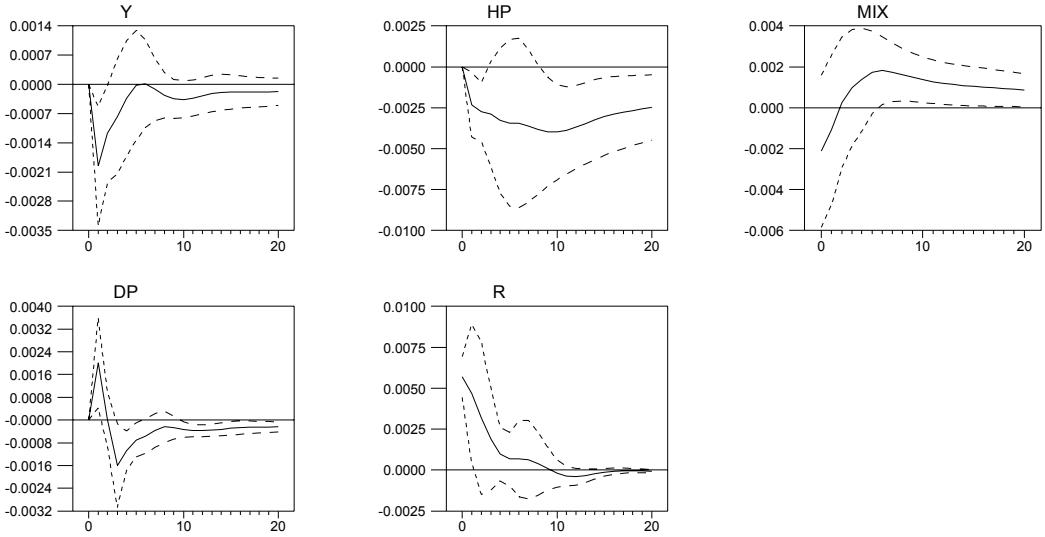


Figure A1.5a **UK: response ±1 S.E. bands to a monetary shock, loans regression**

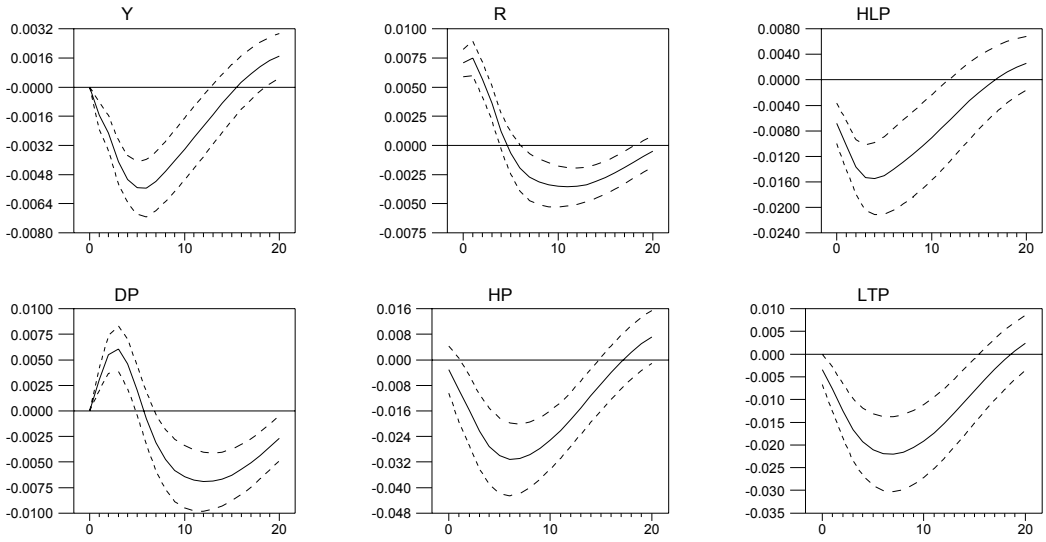


Figure A1.5b **UK: response ±1 S.E. bands to a monetary shock, spread regression**

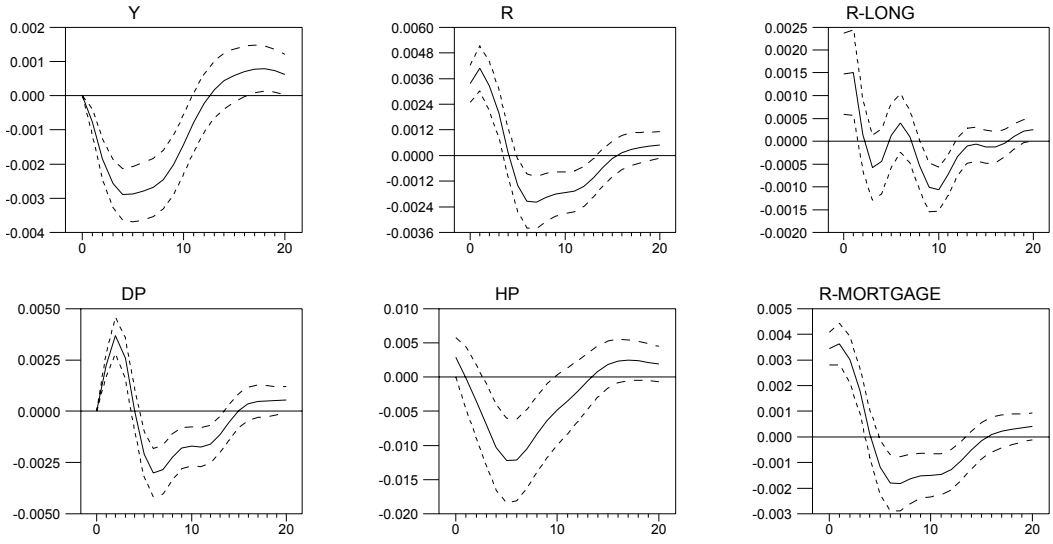


Figure A1.5c **UK: response ±1 S.E. bands to a monetary shock, Mix regression**

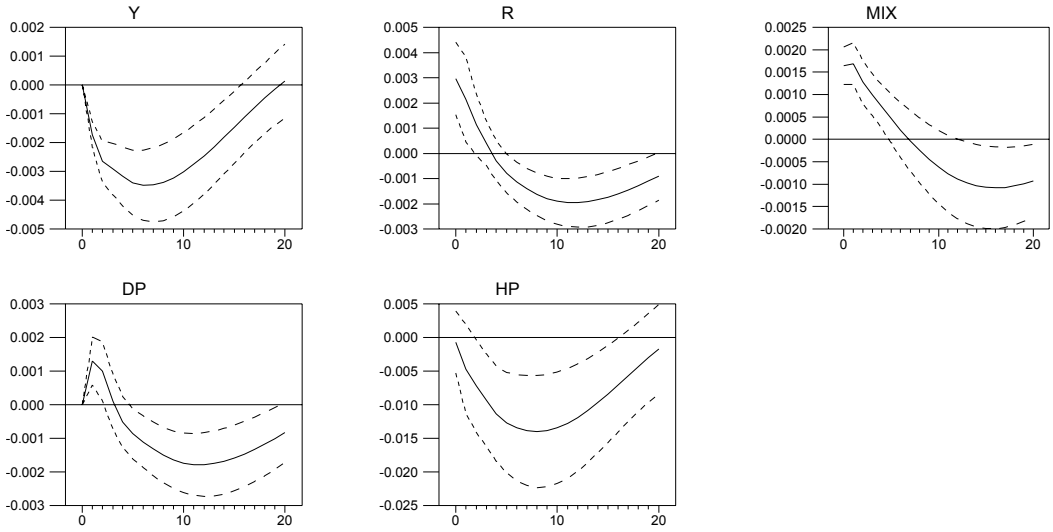


Figure A1.5d **UK: impulse responses ±1 S.E. bands to a shock in the Mix**

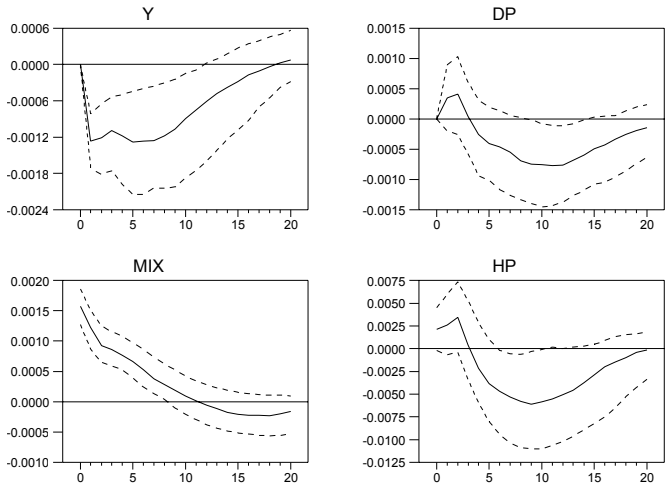
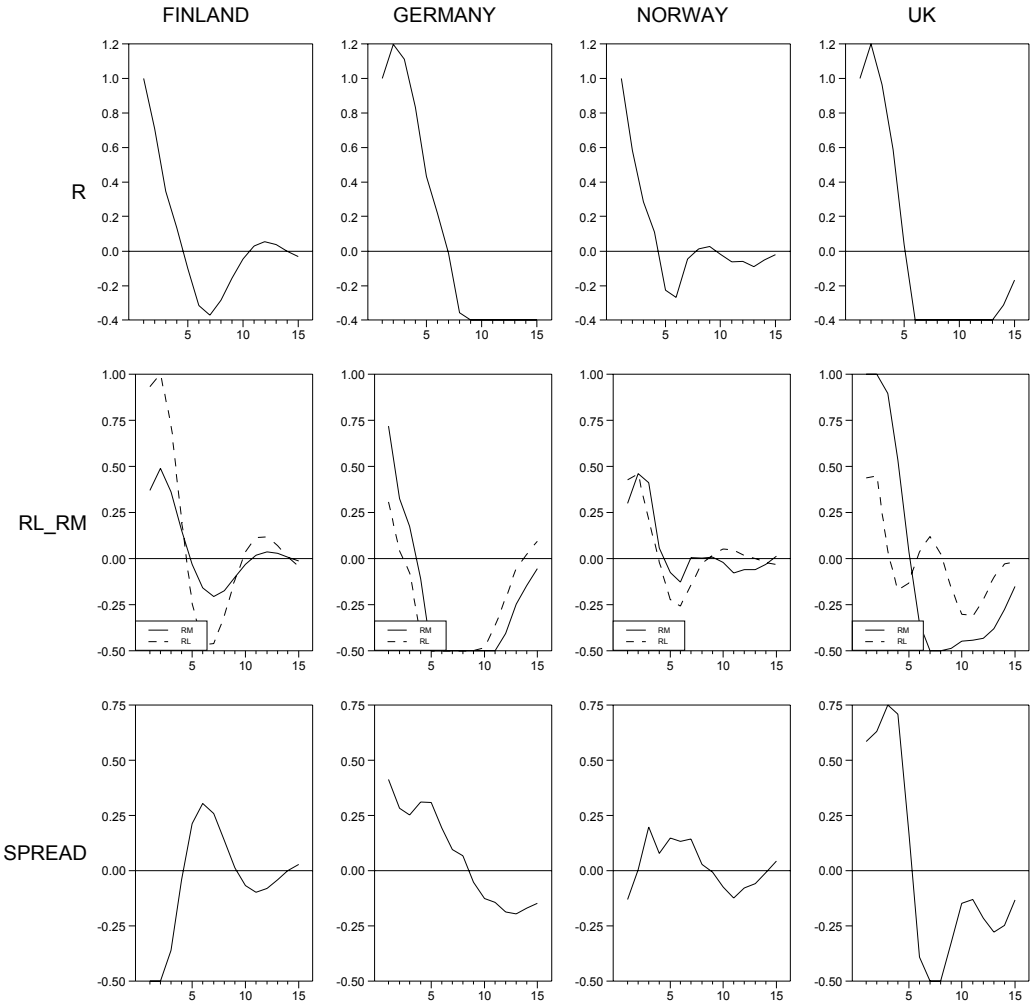


Figure A1.6 **Response of spread to monetary shock, normalised shocks**



Impulse responses of the SPREAD (3 quarters moving average) to a monetary shock (NORMALISED to be a 100 basis points increase in the short-term interest rate) in the countries analysed. The impact responses of mortgage rate and long rate can be interpreted as short run elasticities, whereas in the long run it is assumed that all variables revert to the baseline.

Appendix 2

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: exact figures not available

Loan to value ratios

Finland 70 % (source: Maclennan, Muellbauer and Stephens, 1998)

UK 95 % (source: Maclennan, Muellbauer and Stephens, 1998)

Norway 80 % (source: Maclennan, Muellbauer and Stephens, 1998)

Germany 65 % (source: European Mortgage federation, 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 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 3

Data description

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

Loans regressions

Country	Years	Variables
Finland	78:4–99:3	HP = Residential Property Prices *(source: BIS)*
		R = Money Market Rate *(Primark Datastream)*
		HL = Banks' Outstanding Housing Loans *(Statistics Finland)*
		TL = Banks' Lending Outstanding *(Statistics Finland)*
Germany	74:2–98:3	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))*
		R = 3months Money Market Rate *(Datastream)*
		HL = Private Commercial Banks Housing Loans *(Datastream)*
		TL = Private Commercial Banks Total Loans *(Datastream)*
Norway	88:3–99:4	HP = New Detached Houses, Price Index *(Datastream)*
		R = 3months Forward Rate *(Datastream)*
		HL = Housing Loans Commercial Bank + Savings Banks *(Statistics Norway)*
		TL = Total Loans Commercial Bank + Savings Banks *(Statistics Norway)*
UK	63:2–99:3	HP = Nationwide East Anglia House Price Index *(Datastream)*
		R = Treasury Bill Rate *(Datastream)*
		HL = Building Societies Loans For House Purchase + Bank Lending Secured On Dwellings *(Datastream)*
		TL = Total Loans, Banks And Building Societies *(Datastream)*

Spread regressions

Country	Years	Variables
Finland	88:1–99:3	RM = Interest Rate On Banks New Housing Loans *(Bank of Finland)*
		RL = Long Benchmarking Interest Rate, 3 Years *(Bank of Finland)*
Germany	82:4–98:3	*Industrial Production And Producer Price Inflation were used for Y And DP*
		RM = Mortgage Rate, 5yr Fixed Average *(Datastream)*
		RL = Government Long Term Bond Yield *(Datastream)*
Norway	88:3–98:4	RM = Interest Rate On Long Term And Medium Term Loans Until 95:4; Interest Rate On Mortgage Loans From Banks From 96:1 *(Statistics Norway)*
		RL = Interest Rate On 5 Year Bonds *(Statistics Norway)*
UK	86:1–98:3	RM = Interest Rate On New Mortgages to Owners From Building Societies *(Datastream)*
		RL = Long Term Government Bond Yield *(Datastream)*

Mix regressions

Country	Years	Variables
Finland	87:1–99:3	MIX = Housing Loans from all other lenders / (Housing loans from all other lenders + Housing Loans from Depository Banks and Central Bank)
Germany	74:2–98:3	MIX = Housing loans from Bausparkassen and Mortgage Banks / Total housing loans from all the financial institutions
Norway	88:3–99:4	MIX = Housing loans from state and non-depository fin. institutions / Total housing loans
UK	86:1–99:3	MIX = Other Financial Institutions Loans Secured On Dwellings / (Other Financial Institutions Lending secured on Dwellings + Building Societies Loans For House Purchase + Bank Lending Secured On Dwellings)

Appendix 4

Unit root and cointegration tests

Countries	Variables	Unit root test statistic	Sample period	Countries	Variables	Unit root test statistics	Sample period
Finland	Y	–0.84	78:4–99:3	Norway	Y	0.579	88:3–99:4
	DP	–2.14	78:4–99:3		DP	–4.248**	88:3–99:4
	R	–1.84	78:4–99:3		R	–1.88	88:3–99:4
	HP	–1.58	78:4–99:3		HP	–0.12	88:3–99:4
	HL	–2.40	78:4–99:3		HL	2.66	88:3–99:4
	TL	–1.36	78:4–99:3		TL	1.306	88:3–99:4
	RM	0.48	88:1–99:3		RM	–1.42	88:3–99:4
	RL	–0.91	88:1–99:3		RL	–2.14	88:3–99:4
	MIX	–0.33	87:1–99:3		MIX	2.43	88:3–99:4
Germany	Y	–0.45	74:2–98:3	United	Y	–0.94	63:2–99:3
	DP	–4.94**	74:2–98:3	Kingdom	DP	–2.24	63:2–99:3
	R	–3.17*	72:2–98:3		R	–2.846	63:2–99:3
	HP	–4.74**	72:2–98:3		HP	–1.486	63:2–99:3
	HL	–0.84	74:2–98:3		HL	–0.29	63:2–99:3
	TL	–0.30	74:2–98:3		TL	–0.287	63:2–99:3
	RM	–1.72	82:4–98:3		RM	–0.834	86:1–99:3
	RL	–1.71	82:4–98:3		RL	–0.665	86:1–99:3
	MIX	–0.84	74:2–98:3		MIX	–2.98*	86:1–99:3

Note: */** indicates rejection of the unit root null hypothesis at 5/1 % significance level.

Cointegration tests (sample periods as in the Appendix 1)

Countries	Model with	Suggested Cointegration rank (at 90 % confidence level)*	
		Lambda-max	Trace
Finland	Y, DP, R, HP, HL, TL	3	3
	Y, DP, R, HP, RM, RL	3	3
	Y, DP, R, HP, MIX	2	2
Germany	Y, DP, R, HP, HL, TL	3	3
	Y, DP, R, HP, RM, RL	4	3
	Y, DP, R, HP, MIX	3	2
Norway	Y, DP, R, HP, HL, TL	4	3
	Y, DP, R, HP, RM, RL	4	3
	Y, DP, R, HP, MIX	4	4
United Kingdom	Y, DP, R, HP, HL, TL	3	2
	Y, DP, R, HP, RM, RL	4	2
	Y, DP, R, HP, MIX	3	3

* To save space, the corresponding test statistics are not included. They are available from the authors upon request.

Appendix 5

Some summary statistics and cross-correlations

Series	Mean	Std Error	Minimum	Maximum
SPREAD-FIN	0.32 %	0.80	–1.50 %	1.77 %
SPREAD-GER	1.65 %	0.33	1.26 %	2.51 %
SPREAD-NOR	2.44 %	1.67	–0.03 %	4.55 %
SPREAD-UK	1.32 %	1.80	–1.35 %	4.58 %

Summary statistics for the Spread variable over the period 1989–1999

Series	Mean	Std Error	Minimum	Maximum
MIX-FIN	34 %	5	25 %	38 %
MIX-GER	35 %	3	31 %	41 %
MIX-NOR	35 %	11	17 %	48 %
MIX-UK	7 %	1	6 %	9 %

Summary statistics for the Mix variable over the period 1989–1999

The two tables above present some key summary statistics for the two key variables of the econometric model, the Spread the mortgage rate and long term safe rate and the housing loans Mix.

Figures A1 and A2 plot the cross-correlations between MIX and Spread and real house prices on the other.[30] Values below zero at negative entries in the graphs correspond to MIX and Spread being leading indicator of house prices (with the expected negative sign, i.e., high Spread or MIX today correspond to lower house prices in the next period).

Even this deceptively simple evidence is in line with the more structural results of our VARs (same results, not reported here, hold for the correlation between Mix and Spread and the GDP). As far as the Spread is concerned, at a lag of, say, 4 quarters there is overall evidence of a negative correlation between Spread and house prices, with the exception of UK. The negative correlation could capture financial factors at work during the business cycle. Same results hold for the link between Spread and GDP.

Analogous findings hold for the MIX variable too. Although the simple correlations could capture factors over and above the link between monetary policy, housing markets and movements in the output, the MIX variable leads movements in house prices by 1–2 years, again with the exception of the United Kingdom.

[30] All series were detrended using a band-pass filter that isolates frequencies between 6 and 32 quarters, thus removing seasonality and long-run trends.

Figure A5.1 **Cross-correlations between MIX and HOUSE PRICES**

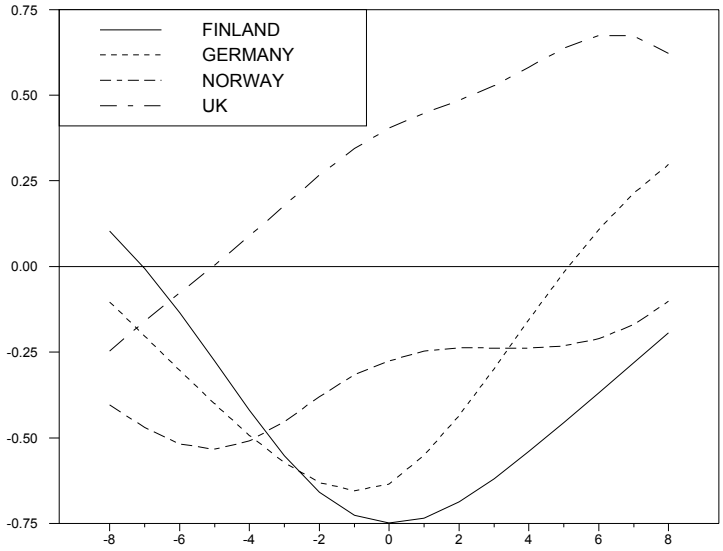
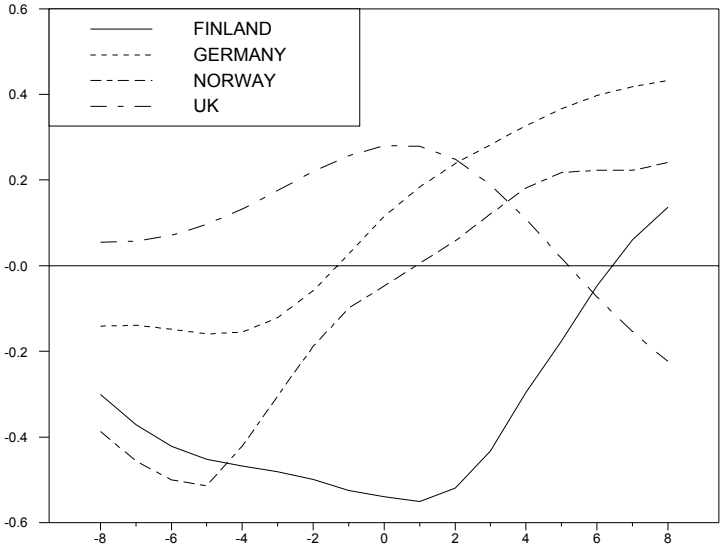


Figure A5.2 **Cross-correlations between Spread and HOUSE PRICES**



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