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THE RESPONSIVENESS OF HOUSE PRICES TO MACROECONOMIC FORCES: A CROSS-COUNTRY COMPARISON

Diana Kasparova and Michael White

ABSTRACT

This paper examines housing markets in selected European Union countries and investigates the degree of similarity in housing market responses to changes in underlying demand- and supply-side variables. This may help to suggest how EU housing markets may be affected by a single monetary policy and whether housing market integration across the countries may be expected as a result of EMU.

The choice of countries is explained followed by a description of the demand and supply characteristics of each country's housing markets. The paper then exploits a data set that has been constructed by combining data from each nation. Attention is paid to the statistical properties of variables used in estimations to construct accurate measurements to compare inter-country similarities/differences in housing market behaviour. The interaction of the housing market with the macroeconomy is then examined. The issue of monetary union and its impact on housing markets is discussed.

KEYWORDS

ERM, EMU, economic convergence, housing markets, Granger causality, cointegration, error correction mechanism

1. INTRODUCTION

This paper investigates the degree of similarity in housing market responses to changes in macroeconomic forces. From information on the behaviour of housing markets, it is possible to suggest how they might be affected by a single monetary policy. The importance of housing for the economy, the financial system, labour market and construction industry justifies this investigation. Issues related to the single currency are covered in literature on optimum currency areas (De Grauwe 1994; Eichengreen 1994; Kenen 1995; Kern 1998). There is also a substantial literature on comparative housing and mortgage systems across the EU (Hedman 1994; Barlow and Duncan 1994; Ball and Wood 1994; Doling 1999; Mabbett and Bolderson

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1999; Stephens 1998; Papa 1992). However, literature on the impact of a single currency on housing markets is limited. These issues were discussed in Hardt (1998), Kennedy (1995), Maclennan *et al.* (1998), Maclennan and Stephens (1995, 1998), Priemus *et al.* (1993) and Stephens (1999). Empirical studies on house price convergence across the countries have also been conducted by Ball and Grilli (1997) and Henley and Morley (1999).

A substantial literature exists on models of housing markets at an urban spatial scale. These models are often cross-sectional and use hedonic techniques (see Maclennan 1977). More recently, as the availability of time series has improved, macroeconomic analysis of national and regional housing markets has developed. A large body of literature now exists on the relationship between house prices and demand- and supply-side variables. For example, for studies on the UK house prices see Meen and Andrew (1998), Holly and Jones (1997) and Muellbauer and Murphy (1997). For studies on Swedish house prices see Englund (1994), Hort (1998, 2000) and Turner (1995, 1999). For Dutch house prices see Boelhouwer *et al.* (1996) and Boelhouwer (2000b). For reports on German house prices see Ulbrich (1998), and for articles on Spanish house prices see Pareja Eastaway and San Martin (1999) and Argentaria Real Estate (1998, 1999).

Alongside these developments has been a more rigorous statistical analysis of data. Explicit attention has been paid to issues of stationarity (Drake 1993; Ashworth and Parker 1997) and Johansen (1991) cointegration techniques have been applied to identify the number of cointegrating vectors. These issues are relevant since they provide a basis for constructing meaningful statistical relationships and identification of robust long-run models. Most of this work, however, has analysed particular countries and regions within countries. As far as we are aware, few authors have attempted to examine and compare housing market behaviour across countries. For examples see Holmans (1994), Englund and Ioannides (1997) and Iacoviello (2000). Yet this may be an important factor for macroeconomic stability when considering the behaviour of housing markets in the euro zone.

This paper presents an analysis of house price behaviour in a selection of European Union (EU) countries. It analyses the direction of causality between house prices and GDP for each country. A parsimonious reduced-form demand and supply model is constructed to examine house prices. Such models are common in analysing UK and European commercial property markets. This basic model is extended into an error correction framework and a panel (or pooled time-series cross-sectional) model where data from the various EU countries are combined with the countries being the cross-sections within the model.

The paper is structured as follows. The next section describes the implications of the EMU for monetary policy and the housing market. Section 3 describes which countries are chosen and why. Section 4 presents an overview of housing systems in each case study country. Section 5 reviews

the literature on the modelling approach and the data used. Section 6 presents an estimation method and results while the final, seventh, section provides a conclusion and discussion of the future direction of this research.

2. IMPLICATIONS OF THE EMU FOR MONETARY POLICY AND HOUSING MARKETS

EMU implies the existence of a single interest rate for participating countries, a fixed exchange rate between them, a floating rate with the rest of the world and, in theory, policies designed to maintain low inflation. Therefore, the countries that join the EMU sacrifice their national monetary policies as an instrument for adjustment to shocks. However, if convergence in the economic environment leads to convergence in economic behaviour, structural differences between the countries might be reduced, and housing market developments may become more similar. This was the case in Britain in 1994–95 when lower inflation rates encouraged an increase in take-up of fixed rate mortgages (Ball and Grilli 1997; Maclennan and Stephens 1995, 1998).

A low level of inflation should help decrease speculation in housing markets (e.g. in the UK and Spain) and reduce house price volatility. This is because capital gains under the low inflation may be lower than user costs of capital, especially if low inflation is sustained by high interest rates. Therefore, if EMU creates similar macroeconomic conditions for member states, it might bring some similarities to the housing market cycles of EU countries.

However, national housing markets may be affected asymmetrically by EMU. And as national economic policy might be harmful for some regional markets and supportive for others, so might the effect of EU-wide economic policy be on the national housing markets. The asymmetric reactions of housing markets may put economic convergence at risk. This follows from the late 1980s and early 1990s reactions of EU economies to a common shock – financial liberalization. The role of the housing market was crucial here. In the late 1980s, in Sweden and the UK, financial deregulation contributed to a housing boom and to equity withdrawal leading to a consumption boom and to general inflation. The following recession affected net disposable income and resulted in negative equity. These countries used devaluation and a decrease in interest rates for stabilization purposes. In Germany, the housing market was less volatile, equity withdrawal and the following consumption boom and negative equity did not occur, therefore the destabilizing effect on the economy was negligible (Maclennan and Stephens 1998; Maclennan *et al.* 1998; Priemus *et al.* 1993; Ball and Grilli 1997). Indeed, Ball and Grilli (1997) argue that the characteristics of the EU housing markets might hinder their economic convergence and make the goals of economic growth, efficiency and stability difficult to achieve. Additionally, they did not exclude the situation whereby social pressures

and housing market realities force some countries to diverge again after convergence has been reached.

One of the reasons for these differences in housing market reactions may be found in the unique national structures which determine demand–supply interactions on housing markets. For example, relatively high levels of owner-occupation, the role of housing as collateral, low transaction costs, easy availability of credit, high integration of capital and mortgage markets with most mortgages at variable rates, and tight housing supply make the UK housing market much more sensitive (via volatility of house price) to changes in interest rates compared to the German housing market, whose characteristics are almost the opposite to those of the UK (Maclennan *et al.* 1998). Therefore, the unique demand–supply interactions within the countries may have a greater influence on house prices than convergence in the macroeconomic environment.

Additionally, there is no homogeneous housing market at the national level. Nations consist of a set of regional markets, each with their own demand–supply interaction and house price cycles. It can be argued, therefore, that differences in house price movements across regions within countries are strong and that changes in monetary policy affecting an economy as a whole will have a different impact on the fluctuations of house prices across regions. As a result, analysis of the impact of EMU on house prices across countries may be incomplete without a cross-regional analysis. However, regional differences in house prices are smaller than differences between countries. This follows from the fact that international differences which determine national house price movements (such as macroeconomic policies, financial, institutional and legal structures, etc.) are greater than interregional differences affecting regional house prices (such as location, employment opportunities, etc.) (Giovannetti and Marimon 1998; Heidenheimer *et al.* 1990 as described in Doling 1997: 79).

Since each of the EU countries constitutes a range of different economic and housing systems, the EU countries have to be grouped according to these dimensions in order to make conclusions on similarities and differences between the countries with regard to the impact of the EMU on housing markets. The grouping of countries not only makes comparison easier but it also allows conclusions which were made as a result of the analysis for only one country to be applied to all countries in the group associated with this country. The next section describes the way in which countries were grouped and explains the choice of the case study countries.

3. CHOICE OF CASE STUDIES

In comparative housing studies, two approaches of grouping the countries are adopted. The first is based on distinguishing the types and the second one is based on distinguishing the stages. In the first case, extreme ('ideal')

types describe the main features of housing systems and then each country is identified with one of these types. In the stages approach it is accepted that countries' housing systems move from one model (stage) to another with time, or that the models change themselves while countries stay within the same model (Doling 1997).

None of the national housing systems can fit exactly one group or another, be it grouping by stages or by models. The reason for this lies in the fact that 'countries may be defined as agglomerations of inter-correlated variables which cannot be separated out and matched with variables in other countries' (Doling 1997: 26). As a result, variability of even key variables between the countries of the same group is unavoidable. Therefore, in any research, a grouping of the countries provides only a broadly similar picture with countries in the same group sharing more or less equivalent characteristics under investigation. Consequently, the groupings of countries are broadly similar across the studies. This may be explained by the possibility of interpreting different stages as different types. Thus, since grouping by stages puts together countries with similar but not identical characteristics, the representatives of the groups could be seen as exemplars or types with which countries in the group can be associated, and, therefore, constitute a grouping by types.

Selection of the case study countries in this research should represent a great diversity of economic performance, monetary policy regime (i.e. participation in the ERM and EMU) and housing systems in the EU. Therefore, countries with extreme, 'ideal' types of housing systems, economic performance and monetary policy regimes have to be chosen so that other countries of the EU could approximately fit one of these types. Spatial dimension should be reflected by selection of the countries from the EU core and periphery. Temporal dimension is determined by the monetary policy regime criterion for selection of the countries. Hereby, participation in the ERM (since 1979 until its crisis in 1992/93) and later policies to meet convergence criteria are considered as a proxy for the EMU. This is because at those periods of time independent monetary policies were restricted as compared with the period preceding them. Therefore, it was decided that the time period should cover 1972–98 (/1999, where available), whereby 1972–79 is the period of independent monetary policy under a regime of capital control after the Bretton Woods system collapsed.[1]

Apart from participation in the ERM and EMU, the selection criteria include inflation records, short- and long-term interest rates and house price volatility. The inflation record is based upon the average level and volatility (mean and variance) of prices, as are the long- and short-term interest rates. The data on participation in the ERM and EMU, inflation, long- and short-term interest rates and house prices are given in Table 1. (Since data on house price volatility for all EU countries are available starting from 1986, data on economic indicators refer to the period from 1986, too.)

Table 1 Characteristics of the countries according to the chosen criteria

Country	*Inflation 1986–96 volatility/average level*	*Long-term government bonds 1986–98 volatility/average level*	*Three-month interest rates 1986–98 volatility/average level*	*House price volatility 1986–97 (st. dev.)*	*Participation in the ERM 1979–99 Number of realignments of ex. rate (revalue/ devalue)*
Germany*	1.3/2.2	1.3/6.5	2.1/4.7 1986–92	1.8	7 rev.
Belgium*	0.8/2.3	1.5/7.6	2.4/6.8	2.2	1 dev., 4 rev.
France*	0.7/2.6	2.7/7.0	1.5/8.4 1986–96	7.0	4 dev., 1 rev.
Netherlands*	1.3/1.9	1.3/6.7	1.0/5.5 1986–89	2.6	6 rev.
Austria*	0.9/2.6	1.2/7.0 1986–97	n.a.	1.7 1991–97	1995–99
Luxembourg*	1.3/2.2	n.a.	n.a.	2.0	As Belgium
UK	2.4/4.5	1.5/8.7	3.1/8.8	10.0	1990–92
Ireland*	0.8/2.8	n.a.	1.7/8.6	5.1	3 dev., 1 rev.
Finland*	2.0/3.4	2.1/8.6 1992–97	n.a.	15.0	Linked currency 1979–92; in the ERM 1995–99
Sweden	3.1/4.8	1.9/9.9 1988–97	2.8/9.4 1986–97	8.2	Linked currency 1979–92
Denmark	1.2/2.9	1.9/8.6	n.a.	6.6	3 dev., 3 rev.
Spain*	1.4/5.6	3.0/10.7	3.1/9.5	9.4	3 dev. 1989–99
Portugal*	3.5/8.7	4.1/11.7	4.3/12.1	3.5	3 dev. 1992–99
Greece*	4.6/15.0	0.8/16.6 1986–88	2.9/15.9	3.1 1986–93	1998–99
Italy*	0.9/5.2	3.0/10.2 1991–98	2.7/10.3	11.6	6 dev. 1979–92 1996–99

Note: * Denotes participation in the EMU.
Sources: Maclennan *et al.* (1998); Eurostat; Pitchford and Cox (1997).

The described developments of economies and housing markets allow the following grouping of countries. Germany, the Netherlands, France, Austria, Belgium and Luxembourg (core group countries) can be grouped together on the basis of chosen criteria. These countries attempted to keep inflation low and their exchange rates within the narrow bands, and they also have similar house price patterns. Germany is selected to represent this group because the DM was an anchor currency in the ERM. The Netherlands as a case study country is chosen because it is the only country which observed the regime of a fixed exchange rate with the DM since 1983.

Greece, Portugal and Italy could be associated with Spain, which is selected as a case study country representing southern Europe. These countries operated within a wider exchange rate band most of the time and the impact of a single monetary policy on their housing markets may be expected to be similar. Greece was not among the first-wave participants in EMU but was participating in the ERM II since the start of EMU and joined EMU in 2001 and, therefore, the effect of single monetary policy on it can be expected to be similar to that on Spain.

Choice of the UK as a case study country is determined by the fact that it is the only one of the four big economies in the EU which had a brief experience of participation in the ERM. It does not participate in EMU, and is very different from the core group economies regarding its inflation record, interest rate and house price volatility. Ireland and Finland may be associated with it in terms of inflation record, interest rate level and volatility, the effect that the ERM crisis of 1992 had on them and the relatively high volatility of house prices. Similar to Germany and the Netherlands, Ireland and the UK had strong trade relationships and linked currencies. Moreover, in the case of Ireland and the UK, labour mobility between them was high (Connolly 1995).

Sweden and Denmark are also included in this group because of the effect the ERM crisis had on them. Also their volatile house prices give them characteristics closer to those of the UK-led group of countries.[2] Similar to the UK, Sweden and Denmark do not participate in the EMU. However, they have a longer history of participation in the ERM, and Denmark, additionally, observes the ERM II band. It was decided to include both the UK and Sweden in the analysis because this should allow for examination of whether cross-country convergence of economies (i.e. inflation and interest rates) and housing markets (i.e. house price cycles), should it happen, happens across the countries regardless of EMU.

The changes in house prices of each case study country are displayed in the Figures 1–5 below**.** These show the changes in real house price indices. Within the 1970–98 time period, the data cover different time periods for the countries reflecting their availability. Data for the Netherlands show a notable cycle in the late 1970s followed by a steady increase in house prices. The UK displays three significant and one smaller (i.e. currently increasing

house prices) cycle. Swedish house prices are similarly volatile, with the second cycle in the late 1980s being most notable. House prices in Germany are relatively stable compared to the other countries presented. There is no distinct upward or downward movement in real house prices over the period covered. The amplitude of fluctuation around this long-run path is also relatively small in comparison with the other countries (e.g. the changes in real house prices did not exceed 10 per cent in the late 1980s as compared to higher than 30 per cent in the Netherlands in the late 1970s and higher than 20 per cent in the UK in the late 1980s). In order to explain such variability, demand- and supply-side factors of housing markets in these countries are considered.

4. AN OVERVIEW OF HOUSING SYSTEMS IN THE CASE STUDY COUNTRIES[3]

a. The UK

Since 1970, house prices in the UK have experienced four cycles (Figure 1). The first cycle was caused by the Barber boom in the early 1970s. The second cycle, at the end of the 1970s, was caused by general inflation which followed the 1979 oil shock. High inflation made housing an attractive investment but with housebuilding being very low, this resulted in house price inflation. The government responded to the inflationary environment provoked by the oil crisis by rising interest rates and allowing sterling

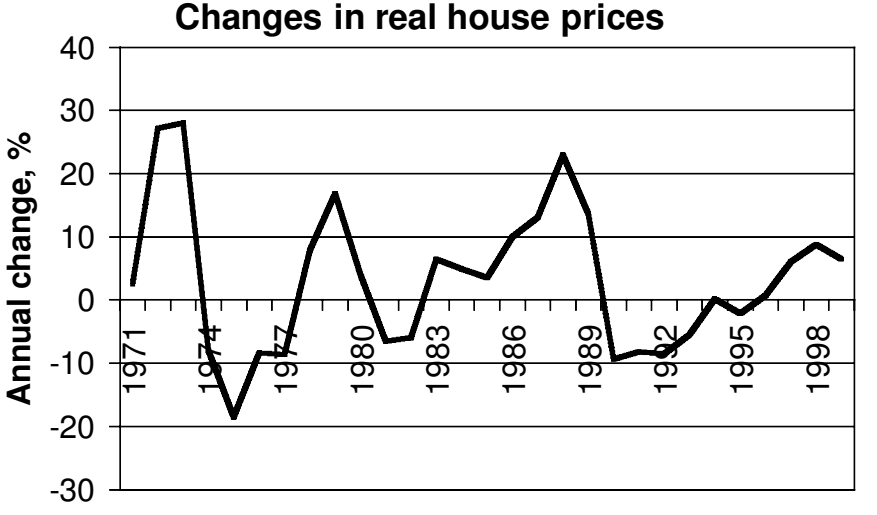

Figure 1 The UK: real house prices
Source: Council of Mortgage Lenders.

to appreciate against the US dollar. In combination with rapidly rising unemployment, high interest rates caused a house price slump.

The main contributors to the late 1980s boom were the growing economy and the increase in the volume of credit, which was due to deregulation of the financial market. Financial deregulation made mortgage rates more dependent on interest rates and the reliance on variable rate mortgages made the housing market very sensitive to macroeconomic variables via fluctuations in debt and consumption. The volume and share of mortgage debt in GDP increased rapidly in the 1980s and, in 1990, the share of mortgage debt in GDP reached 53 per cent (Wilcox 1999). However, consequent increases in housing and mortgage costs made housing less affordable again, especially for those low-income households who entered owner-occupation in the upturn of the market. The early 1990s slump in the market followed. The fourth cycle (increasing house prices) can be explained by the growing economy, low unemployment and low mortgage rates.

The supply side of the housing market is connected with the land market and the planning system. In the UK, almost all land comes to the market via individuals or private agencies. Housebuilding companies are usually specialized in land banking and trading. There is a high risk in buying land and land price cycles are very volatile. This speculative nature of the industry contributes to house price volatility (Ball 1996). A backlog in maintenance leads to the inadequacy of the stock in terms of its condition and an increase in inelasticity of supply.

A high share of owner-occupied housing, i.e. 67.3 per cent of the stock in 1997 (Wilcox 1999), contributes to the volatility of the housing market. One of the reasons for the above-mentioned increase in mortgage debt in the 1980s was an increase in the share of owner-occupation during that time period. Although private rents were deregulated in 1989, taxation favoured owner-occupation and the share of the rented sector did not increase much.

b. Germany

Real house prices in Germany have been relatively stable during the last twenty years. Figure 2 shows changes in real house prices in Germany. According to the data on detached housing, in 1990, the changes in house prices were almost the same as in 1979–80. Hereby, house prices were decreasing until 1988 and have been increasing since then. After the 1992 peak, real house prices decreased in 1993 and then increased slightly until 1994 when they fell in real terms until 1998 since when they have started to increase. The 1988–92 increase can be explained by a number of factors: namely, by the housing shortage that appeared in West Germany before reunification, the reunification itself, migration from East to West Germany and the tax reform of 1987.[4]

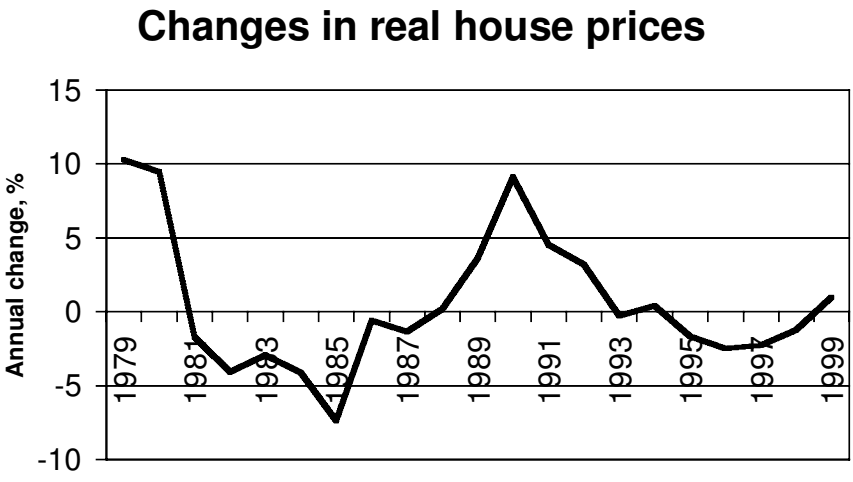

Figure 2 Germany: real house prices
Source: Ring Deutscher Makler (RDM).

Taxation affects tenure structure, too. It favours investment in social rented housing (i.e. a sector that is built with public assistance and is let at a lower price to households who meet certain criteria) and, thus, encourages building of this sector. After a certain time period these social rented dwellings change their status into commercial rented sector dwellings. The size of the rented sector, i.e. 58 per cent in 1995 (EC 1998), the rent regulation and the security of tenure make the rented sector a buffer to inflationary distortions in times of house price increases and an alternative to owner-occupation in times of recessions, thus contributing to the stability of the housing market.

The housing finance system also contributes to the relative stability of the housing market in Germany. Regarding mortgage products, five-year fixed rate mortgages dominate on the market. The biggest part of the loan (i.e. up to 60 per cent) usually comes either from the specialized mortgage banks, or from the public saving banks or from the commercial banks. Bausparkassen provide the next 20 per cent, and the last 20 per cent comes from the borrowers' own resources or from saving, commercial and cooperative banks but at a higher rate. The share of mortgage debt in GDP fluctuated from 45.6 per cent in 1983 to 51.2 per cent in 1997 (LBS 1998). These characteristics of the mortgage system effectively cushion house prices from volatility should it arise in the financial market. At the same time, low volatility of mortgage debt protects the economy from fluctuations in the housing market.

Turning to the supply side, the elasticity of housing supply is quite high. Land supply plays a crucial role here. Land suitable for new construction of social housing is owned mainly by housing associations. Among the other

owners of land are private persons (farmers, etc.), companies, institutions, developers and the church. At the peak of housing demand local authorities supply more land and building permits, which also prevents housing market bubbles.

c. The Netherlands

Real house prices in the Netherlands increased sharply in the period 1973–79 but by 1983 they returned to their 1972 level (Figure 3). The reasons for such an increase were growing incomes and expectations of its growth, low and declining mortgage rates, the 1972 financial deregulation (which increased competition on the market and removed the ceiling on the loan-to-value (LTV) ratio, thus allowing it to reach sometimes 125 per cent) and the 1973 expansion of mortgage guarantees provided by the state. The 1979 oil crisis reversed the situation: income growth stagnated, mortgage rates increased and conditions to obtain mortgages and government guarantees were tightened (Boelhouwer 2000).

From 1986 house prices started to increase again, and at present, growing incomes, low mortgage rates, accounting for the income of another earner in mortgage lending, unrestricted mortgage interest tax relief, government promotion of owner-occupation and a shortage of up-market housing has resulted in booming house prices, especially at the top end of the market. Mortgage debt, at 65 per cent of GDP in 1998, grew as a result of equity withdrawal, increases in the number of mortgages and in average loan size

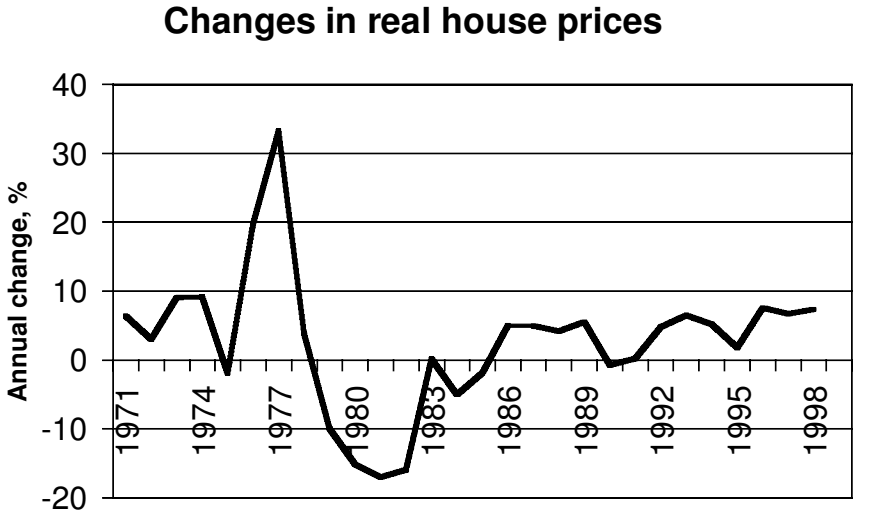

Figure 3 The Netherlands: real house prices
Source: The Netherlands Association of Realtors (NVM).

(Boelhouwer 2000). Since the mid-1990s, risk in the market has also increased because the dominant type of product has been an investment mortgage based on shares.[5]

Land planning is very restrictive. At present, different municipalities within the provinces are given figures on how many and what types of new houses should be constructed on how big an area (thus determining the size of a dwelling) and in what time period. They are also given a tenure structure for the to-be-built stock and price and rent range. The little land that is available for the construction of residential property and the mismatch between demand and supply make supply very inflexible. The factors that smooth the house price increase include the dominance of fixed for five- to thirty-year mortgage rates and the still high share of rented sectors at 49 per cent of the stock in 1999 (Boelhouwer 2000). Also, since 1999, the restrictions on an opportunity to withdraw equity and, since 2000, on the mortgages eligible for the state guarantees have been imposed.

d. Sweden

Movements of house prices in Sweden are closely connected with the development of the financial market. Until 1985 the financial market was regulated and mortgages had to be granted by special mortgage banks for a household to get interest subsidies. With financial deregulation, lending increased and became more risky (e.g. the LTV ratio increased from 75 per cent on average to 100 per cent). Financial deregulation coincided with an increase in GDP, a decrease in real interest rates and in unemployment and an increase in tax deductions and interest rate subsidies (which have been the main instrument of government intervention in the housing market). As a result, house prices that have been falling since 1979 started to increase in 1986 (Figure 4).

Between 1990 and 1993 house prices fell again. All the fundamentals reversed in 1990. Changes in taxation led to an increase in interest payments. Banks became more cautious and reduced the LTV ratio to 60–75 per cent; along with the formal assessment they also introduced their own assessment of the property. House prices stabilized in 1994 and since 1996 real house prices have been rising again. The reasons for the last increase are steady growth of the economy, low inflation and decreasing interest rates. House price volatility is potentially increasing. This is because 61 per cent of housing stock is already in owner-occupation and in the cooperative ownership, and rent regulation discourages building of rented dwellings.[6] Factors that reduce house price volatility are the necessity of a downpayment of up to 10 per cent of the loan value and five-year fixed mortgage rates.

Supply of housing is tight, especially in the big cities. The detailed housebuilding plans and the size of a house have to be approved by the municipality before it can issue a building permit. Land is mainly owned

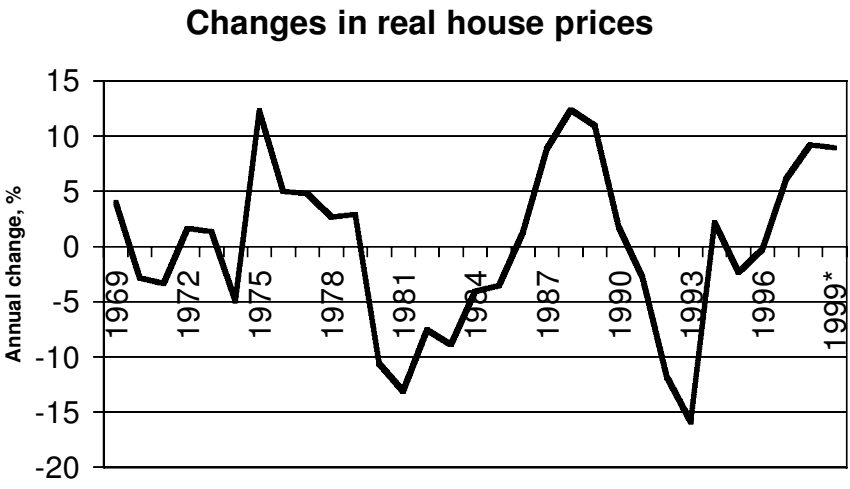

Figure 4 Sweden: real house prices
*1999 – estimated.
Source: Statistics Sweden.

by private persons. The necessity to decrease public spending in the beginning of the 1990s forced municipalities to sell the land, and they priced it very highly. At present, these high land prices make housebuilders reluctant to invest in housing because house prices cannot yet cover the costs. Thus, sometimes they find it more profitable to trade land only without building houses on it. The municipalities used to control land prices via eligibility to subsidies but this role is now diminished with the removal of interest rate subsidies. These factors also potentially increase house price volatility.

e. Spain

In the last twenty years, the Spanish housing market witnessed the 1986–91 house price boom and bust (Figure 5). The main factor behind the house price increase in Spain was financial deregulation that started in 1973. By 1987 the mortgage market was deregulated, the mortgage credit became easily available, and in 1991 as a result of the increased housing demand house prices reached their peak. House price inflation contributed to general inflation, other factors behind its increase being the turbulence of exchange rates following the German reunification and the removal of capital controls. In response to this situation, the government devalued the currency and introduced public sector pay restraints.

Export revenue increased as a result of devaluation and stimulated economic growth but this extra tax revenue was used to cut the budget

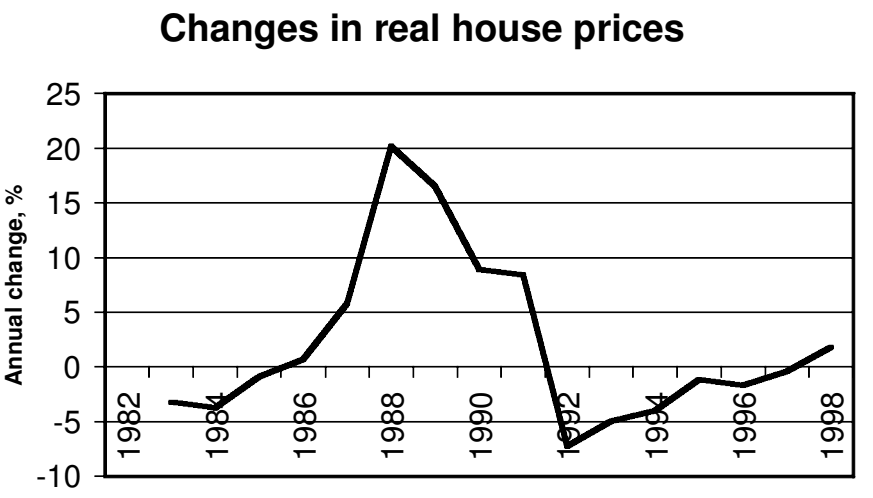

Figure 5 Spain: real house prices
Source: Ministerio de Fomento (Ministry of Promotion).

deficits and domestic demand was curtailed (Eichengreen 1998: 25–6). Additionally, the central bank of Spain put a ceiling on the value of mortgages that banks could lend. These measures together with high interest rates made housing less affordable and led to a decrease in house prices. Since 1998, Spain's economy has been expanding, employment has been increasing, and low interest rates have been discouraging saving. Declining mortgage rates, easy availability of mortgages, and unmet demand have been pushing house prices up. At present, increased affordability has led to an increase in acquisitions of second houses.[7]

With regard to the financial market, variable mortgage rates dominate the market. The 'Subrogation Law' adopted in 1994 allowed households to transfer the loan from one bank to another at almost no cost (Argentaria Real Estate 1994). This law contributed to an increase in competition on the market and to a decrease in mortgage rates. The low level of mortgage rates together with the high LTV ratio[8] increases affordability of housing and contributes to house price volatility because those with greater income uncertainty can enter owner-occupation.

Inelasticity of land supply is another factor behind house price volatility. Land with developed infrastructure is owned mainly by private individuals and that without (the main source of land for new construction) by the municipalities. Although municipalities are obliged to leave 5 per cent of land for building social housing, the majority of them sell all land on the private market in order to raise funds.

In the case of buying land from private owners, there is no restriction on

the sale price, no tax on free land and the municipality cannot force the landowner to sell the land. This means that it takes a very long time for the land to come to the market especially during the expansion of the market. Consequently, speculative land trading has become a main source of profit for housebuilders. These land speculations make land and house prices volatile.

A high level of owner-occupation (about 81 per cent of the stock in 1995) is also a reason for house price volatility. Although rent regulation has been eased since 1964, according to the 1994 legislation, the duration of a rent contract with the new tenant should be not less than five years and during this time period rent should not increase faster than inflation. Higher house price inflation as compared to general inflation, therefore, discourages property letting. Finally, with regard to subsidies, there is little the government can do to influence house price movements at present. The bulk of subsidies have been granted in a form of reduced mortgage interest rates on the loans to eligible households. However, with historically low interest rates set by the ECB, these subsidies lose their importance.

5. METHODOLOGY

In the modelling of house prices, explicit attention is paid to the time-series properties of underlying variables and to whether these variables can be combined to form a meaningful model. Thus, unit root and cointegration tests are performed.

Since the work by Engle and Granger (1987) such tests have become standard in the literature. Stationarity or unit root tests examine whether a series has a mean value that is either constant or changes over time. They measure the number of times a series has to be differenced to become stationary. The next stage of testing the model can now be conducted and this latter can be tested for cointegration. This is important because the rejection of cointegration implies that the model does not provide an accurate statistical relationship and cannot be used to measure the significance of variables.

Various approaches exist to modelling house prices over time. Factors affecting demand and supply have been examined in the literature. This type of approach has been adopted by McAvinchey and Maclennan (1982) and by Nellis and Longbottom (1981), among others. Although, from a theoretical perspective, separate demand and supply equations are specified in this type of approach, it is the case in this paper, and others, that given limits on data availability, a reduced-form model is constructed.

Modelling house prices can also be approached by examining utility maximization. Individuals maximize utility over time subject to an income or credit constraint. Such credit constraints can then be examined in light of financial deregulation (Campbell and Mankiw 1990). This approach of

constrained utility maximization leads to the 'user cost' equation (see Meen 2000).

Drake (1993) uses cointegration analysis in examining UK house prices and develops an error correction model where both a long-run 'equilibrium' relationship and short-run relationship are modelled. In the short-run model, the change in the house price index is regressed on lagged changes in housing starts, a dummy variable to reflect the 1988 fiscal changes in the tax treatment of mortgages, and lagged residuals from the long-run regression. The dummy variable has the expected positive sign and the error correction (ECM) term, that is the lagged residual, is negative, again reflecting *a priori* expectations.

The housing starts variables, capturing supply, all have positive signs. This differs from the (long-run) relationship estimated by Ashworth and Parker (1997) where housing starts have a significantly negative impact on house price.

Generally, demand for and supply of houses can be written as follows:

$$D_h = f(P^h,\ Y,\ r,\ pop) \tag{1}$$

$$S_h = f(P^h,\ h^s_{t-1}) \tag{2}$$

where (1) represents a general demand specification, P^h is house price, Y is real income, r is the mortgage interest rate and pop is population. Equation (2) is the supply function and h^s_{t-1} is the previous period's housing stock (see Meen and Andrew (1998) for more details on alternative model specifications). The reduced-form house price equation is then:

$$p^h_t = a_0 + a_1 Y_t + a_2 r_t + a_3 pop + a_4 h^s_{t-1} \tag{3}$$

In the model presented below, data are very restricted when attempting to examine different countries simultaneously. As a result of this, the reduced-form demand and supply model used takes the following form with only two demand- and one supply-side variable;

$$p^h_t = a_0 + a_1 Y_t + a_2 r_t + a_3 s_t + u_t \tag{4}$$

where the demand variable Y is real GDP, r is the real mortgage rate[9] and s is housing starts. All variables are in real terms and are logged. This model can be set within an error correction mechanism framework and estimated by using a pooled time-series cross-sectional (or panel) approach. The residual from this long-run relationship is then the difference between the observed and actual long-run values. If the model in (4) is a cointegrating relationship, the error will be stationary in levels and can be used in the short-run dynamic model as an adjustment process. The short-run model takes the following form:

$$\Delta p^h_t = b_0 + b_1 \Delta Y_t + b_2 \Delta r_t + b_3 \Delta s_t + b_4 u_{t-1} + b_5 \Delta p^h_{t-1} \tag{5}$$

This suggests that house prices adjust to short-run changes in the independent variables and also to lagged market disequilibria, estimated in equation (4). Signs on the coefficients are expected to be $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 < 0$, $\beta_4 < 0$. If $\beta_4 = 0$, then there is no adjustment to market disequilibria. If $0 < \beta_4 < -1$ then there is partial adjustment, while is $\beta_4 = -1$ there is full adjustment and if $\beta_4 < -1$ then there is over-adjustment. The model is estimated for four countries in a pooled time-series cross-sectional model for which there is sufficient information. The parsimonious model estimated partly reflects lack of time to collect other data but also reflects a preference for model simplicity.

This paper also attempts to test for Granger causality at an aggregated level between house prices and GDP. A vector autoregressive (VAR) model is constructed and causality tests are performed. The general form of the model is:

$$\begin{bmatrix} Y_t \\ P_t^h \end{bmatrix} = \begin{bmatrix} \gamma_0 + \gamma_1 Y_{t-1} + \gamma_2 Y_{t-2} + \gamma_3 P_{t-1}^h + \gamma_4 P_{t-2}^h \\ \varphi_0 + \varphi_1 P_{t-1}^h + \varphi_2 P_{t-2}^h + \varphi_3 Y_{t-1} + \varphi_4 Y_{t-2} \end{bmatrix} \tag{6}$$

Only two lags of data were used due to the limited time series and annual data frequency.

A preliminary step in this study is an analysis of the time-series properties of the variables used. Hence unit root tests were uniformly performed on all of the variables. The standard regression for this technique is:

$$\Delta x_t = \alpha + \beta_1 x_{t-1} + \sum_{i=1}^{\rho-1} \delta_i \Delta x_{t-1} + \mu_t \tag{7}$$

where the chosen value for ρ is such that μ_t will be a white noise error term. The coefficient of interest is β_1. Its *t*-statistic is compared with the critical values found in Fuller (1976). When only the lagged value of x is present, the test is referred to as a Dickey–Fuller (DF) test. When lagged difference terms are added, the resulting test is an augmented Dickey–Fuller (ADF) test. An alternative approach to adding lagged values of the dependent variable has been suggested by Phillips (1987) and extended by Perron (1988) and Phillips and Perron (1988). They suggest adding a non-parametric correction to the *t*-test statistic. This accounts for autocorrelation that may be present.

A necessary requirement for a valid error correction mechanism is cointegration in the long-run relationship. Research by Pedroni (1995) suggests that the usual applications of DF and PP tests are inappropriate in order to test for cointegration in a panel setting. Consequently, panel cointegration tests are reported based on this research. The Johansen (1991) approach is also employed, in the process of testing for Granger causality (see Granger (1969) on causality).

6. THE DATA

The data used in the analysis are annual. In the case of individual regressions when undertaking Granger causality testing, the number of observations is still relatively small and hence some caution should be taken in interpreting the results. We also had available some quarterly data but this was only for the UK and partly for Spain. Since we wanted to have a broader European analysis we use annual data and combine these observations for the different countries in the pooled analysis.

The data were provided by various national sources[10] and the main variables are real house price indices, real GDP, real mortgage interest rates and, representing the supply variable, housing starts.[11] House price data are available from 1978 in Germany, 1982 in Spain, and 1970 in other countries.

Initial data analysis is presented in Table 2.[12] This shows the unit root tests, both Dickey–Fuller and Phillips and Perron test results are reported. Most variables are stationary in first differences. House prices in Germany are found to be stationary in levels, they have no significant upward or downward trend over time. Interest rates in the UK are $I(1)$ compared with Sweden where they are $I(0)$. Results for Germany and the Netherlands are mixed with DF and PP tests giving different results.[13]

Cointegration test results are presented in Table 3 between house prices and GDP only.[14] These results suggest that there is one cointegrating vector in each country. This may perhaps be somewhat surprising in the case of Germany since house prices are $I(0)$ and GDP is $I(1)$. However, given the supply characteristics of the German housing system, it may not be too surprising that house prices are stationary in levels.

Table 2 Unit root tests on annual data, 1970–98

	Germany		*Netherlands*	
	A/DF	*PP*	*A/DF*	*PP*
House price	−4.281 ($I(0)$)	−3.114 ($I(0)$)	−4.636 ($I(2)$)	−4.981 ($I(2)$)
GDP	−3.017	−2.830	−2.662	−3.867 ($I(2)$)
Starts	−3.326	−3.016	−3.746	−4.296
	Sweden		*United Kingdom*	
	A/DF	*PP*	*A/DF*	*PP*
House price	−3.579	−5.087 ($I(2)$)	−5.449	−2.727 ($I(2)$)
GDP	−3.618	−3.485	−3.965	−3.514
Starts	−3.129	−4.412	−3.263	−3.561

Note: All variables are I(1) unless otherwise stated. Data for the Netherlands begin in 1977.

Table 3 Johansen Cointegration tests (between house prices and GDP)

Eigenvalue	*Likelihood ratio*	*5% critical value*	*1% critical value*	*Number of CEs*
Germany				
0.497	24.886	19.96	24.60	
0.326	9.084	9.24	12.97	1
Netherlands				
0.569	29.606	25.32	30.45	
0.512	13.627	12.25	13.26	2
Sweden				
0.564	28.572	19.96	24.60	
0.203	6.111	9.24	12.97	1
United Kingdom				
0.446	26.577	19.96	24.60	
0.325	10.605	9.24	12.97	2

Note: Results based on no deterministic trend in data except for the Netherlands.

7. RESULTS

Two sets of results are presented in this section. First, the results from Granger causality tests and, second, from the ECM. In the case of testing for causality between GDP and house prices and vice versa, the results are presented in Table 4. In all countries except Germany, the null of no causality is rejected. Thus we almost always reject the idea that changes in GDP and house prices are independent of each other. Hence house prices Granger-cause GDP and GDP also Granger-causes house prices. In Germany, the direction of causality is one way, from house prices to GDP. Again this may be related to the responsiveness of the housing construction industry in Germany. These results are relevant in the context of house price volatility. In the UK, GDP growth traditionally feeds into house prices and there is ample evidence from the late 1980s boom that house prices fed back into GDP (see Attanasio and Weber 1994; Muellbauer and Murphy, 1997; and Carruth and Henley, 1992). The dual direction of causality means that macroeconomic cycles are reinforced by the behaviour of the housing market in the Netherlands, Sweden and the UK. Given that causality is one-way in Germany, then volatility to the extent seen in other countries should not be expected.

The second set of results appears in Table 5. The top half of this table presents results for the long-run model. The demand variable, GDP, has the correct sign and is significant. The supply variable, housing starts, is also correctly signed and is significant. The interest rate variable was dropped from the analysis since it was not significant. The only variation between the countries is in the fixed effects where there are significant differences.

Table 4 Granger causality tests

Null hypothesis	*F-Statistic*	*Probability*
Germany		
House prices do not Granger-cause GDP	6.477	0.008
GDP does not Granger-cause house prices	0.915	0.418
Netherlands		
House prices do not Granger-cause GDP	6.686	0.009
GDP does not Granger-cause house prices	5.307	0.019
Sweden		
House prices do not Granger-cause GDP	4.572	0.012
GDP does not Granger-cause house prices	2.538	0.081
United Kingdom		
House prices do not Granger-cause GDP	3.141	0.063
GDP does not Granger-cause house prices	4.663	0.021

Table 5 Panel model

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
GDP	0.344	0.066	5.178
Housing starts	−0.424	0.039	−10.917
Fixed effects			
Germany	2.299	1.090	2.109
Netherlands	6.434	0.466	13.809
Sweden	7.325	0.439	16.689
UK	5.255	0.831	6.318
Adjusted R^2	0.985		
Log likelihood	97.059	*F*-statistic	1,432.551
DW	0.361	Prob. (*F*-stat.)	0.000
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	−0.014	0.011	−1.220
ΔGDP	0.773	0.414	1.867
ΔHousing starts	−0.156	0.053	−2.933
Error correction term	−0.209	0.042	−4.982
ΔHouse price (−1)	0.491	0.074	6.604
Adjusted R^2	0.539		
Log likelihood	179.792	*F*-statistic	28.818
DW	1.627	Prob. (*F*-stat.)	0.000

Taking the error from this long-run relationship, the short-run model is then estimated. Here again the variables have the anticipated signs and the error correction term is negatively significant. Given that the coefficient (on the ECM term) is quite small in absolute terms, adjustment to long-run equilibrium is relatively slow.

Panel cointegration tests are conducted based on work by Pedroni (1997, 1999) who computes critical values for cointegration tests when pooled time-series cross-sectional data are used. Specifically, seven diagnostic tests are constructed. These are: the panel v-statistic, the panel $_t$ -statistic and the panel t-statistics, equivalent to the PP and ADF tests for single time series. Also constructed are the group $_t$ -statistic and group t-statistics, again equivalent to the PP and ADF statistics. The panel statistics pool the autoregressive coefficient across panel members while the group statistics are based on estimators that average the individually estimated coefficients for each member.

The panel cointegration tests were estimated using the 'RATS' (regression analysis of time series) package and the procedure was set up in such a way that the program would report a normalized statistic that is distributed as $N \sim (0, 1)$ under the null hypothesis of no cointegration. The results are reported in Table 5a. These results suggest that panel cointegration cannot be rejected for the cross-country house price model.

Table 5, however, assumes that the response to GDP is the same in each country, which may not be the case. Table 6 allows GDP to vary across the countries while keeping supply the same. The results suggest that, in the long run, GDP is important in Germany and the UK but not in the Netherlands and Sweden. In the short run, only changes in GDP have a significant change in price for the UK.

Table 7 holds GDP responsiveness to be the same across countries and allows supply to vary. In the long-run model, for both Sweden and Germany supply is negatively significant, for the other countries it is insignificant. In the short-run ECM, changes in supply cause changes in house price in Sweden and the UK.

Hence it may be inappropriate to bring all the countries together in one model. In the long-run models, GDP is significant in the UK and Germany, while supply is important in Germany and Sweden. In the short-run models, GDP remains significant for the UK while supply is important in the UK and Sweden. Neither GDP nor supply are found to be significant determinants of house price in the Netherlands in the long or short run.

Table 5a Panel cointegration diagnostic statistics

	House price model
Panel v-statistic	2.776
Panel ρ-statistic	−0.901
Panel t-statistic (non-parametric)	−1.653
Panel t-statistic (parametric)	−1.922
Group ρ-statistic	0.321
Group t-statistic (non-parametric)	−1.749
Group t-statistic (parametric)	−1.998

Table 6 Panel model

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
GDP			
Germany	0.357	0.059	5.959
Netherlands	0.602	0.571	1.055
Sweden	−0.172	0.111	−1.564
UK	1.358	0.114	11.901
Housing starts	−0.152	0.017	−8.703
Fixed effects			
Germany	−2.053	1.103	−1.861
Netherlands	0.0076	4.357	0.017
Sweden	5.969	0.746	8.001
UK	−15.255	1.649	−9.249
Adjusted R^2	0.992		
Log likelihood	119.786	*F*-statistic	1,585.354
DW	0.524	Prob. (*F*-stat.)	0.000
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	0.002	0.008	0.284
ΔGDP			
Germany	−0.043	0.426	−0.102
Netherlands	−0.071	0.561	−0.127
Sweden	0.062	0.396	0.157
UK	0.822	0.284	2.894
ΔHousing starts	−0.099	0.015	−6.606
Error correction term	−0.281	0.045	−6.299
ΔHouse price (−1)	0.537	0.047	11.417
Adjusted R^2	0.683		
Log likelihood	195.430	*F*-statistic	30.342
DW	1.788	Prob. (*F*-stat.)	0.000

However, these results should be treated with caution because comparability of the data is questionable. This is because data on mortgage rates and house prices come from different (national) data sources and differ in the time period which they cover, the meaning attached to an indicator and methods of calculations. For example, house price data represent small villas in Sweden, and a mix of flats and detached housing in other countries. In the case of Germany, the data cover house price developments in cities and towns of West Germany. Different methods of calculation mean that data on house prices are represented by a mix-adjusted index in the UK, by a simple average in the Netherlands and Sweden and by the price of one square metre in Germany. With regard to mortgage rates, the data refer to the dominant product in each country and, therefore, represent variable mortgage rates for the UK and fixed for five-year rates for other countries.

Table 7 Panel model

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
GDP	0.549	0.092	5.985
Housing starts			
Germany	−5.587	1.684	−3.318
Netherlands	0.476	0.699	0.681
Sweden	1.112	0.618	1.800
UK	−3.571	1.322	−2.700
Fixed effects			
Germany	−0.224	0.032	−7.048
Netherlands	−0.042	0.309	−0.136
Sweden	−0.295	0.027	−11.068
UK	0.005	0.44	0.115
Adjusted R^2	0.989		
Log likelihood	107.382	*F*-statistic	1,247.316
DW	0.461	Prob. (*F*-stat.)	0.000
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	−0.005	0.009	−0.503
ΔGDP	0.495	0.367	1.346
ΔHousing starts			
Germany	−0.081	0.084	−0.962
Netherlands	−0.103	0.158	−0.651
Sweden	−0.068	0.035	−1.950
UK	−0.106	0.027	−3.873
Error correction term	−0.204	0.039	−5.196
ΔHouse price (−1)	0.597	0.076	7.815
Adjusted R^2	0.603		
Log likelihood	186.731	*F*-statistic	21.629
DW	1.778	Prob. (*F*-stat.)	0.000

Given these significant differences between the countries, individual regressions for long- and short-run relationships were estimated for each country. The results are reported in Tables 8 to 11.

The main difference between the individual country models and the panel model is that for some countries, the interest rate variable is now significant.[15] For Germany (Table 8) the interest rate is negatively significant in the long-run model. Higher interest rates reduce prices. Both GDP and housing starts are significant with the expected signs. In the short-run model, all variables have the expected signs with GDP being significant at the 10 per cent level. The coefficient on the error correction term suggests that approximately 70 per cent of house price deviations from the long-run value are corrected within one year.

Table 8 Germany

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
Constant	−1.263	1.108	−1.139
GDP	0.314	0.059	5.281
Interest rates	−0.027	0.006	−4.388
Housing starts	−0.156	0.028	−5.631
Adjusted R^2	0.639		
Log likelihood	31.2881	*F*-statistic	12.789
DW	1.469	Prob. (*F*-stat.)	0.000
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	−0.054	0.036	−1.509
ΔGDP	1.964	1.076	1.825
ΔInterest rates	−0.023	0.009	−2.361
ΔHousing starts	−0.101	0.064	1.561
Error correction term	−0.703	0.235	−2.988
Adjusted R^2	0.366		
Log likelihood	31.519	*F*-statistic	3.7476
DW	1.723	Prob. (*F*-stat.)	0.026

For the Netherlands (Table 9), only the interest rate is significant in the long-run model, but with the wrong sign *a priori*. In the short-run model GDP and the ECM term are correctly signed and significant while the interest rate remains wrongly signed. This contrasts with the panel model where demand and supply variables were never significant.

In Sweden, (Table 10), interest rates are insignificant while GDP and housing starts have the correct signs and are significant in the long-run model. In the short-run model, housing starts and the ECM term are negatively significant but the demand-side variables are insignificant.

Results for the UK are reported in Table 11. All variables are highly significant in the long-run model. In the short-run model the demand variables become insignificant while the supply variable is negatively significant. A lagged dependent variable is also added to reduce the amount of autocorrelation which is a particular problem in the UK short-run model.

In general, demand- and supply-side variables have the correct signs in Germany, Sweden and the UK, although interest rates are not significant in Sweden in determining house prices. In the Netherlands, interest rates have the wrong sign and GDP is only significant in the short-run model. Institutional factors in the form of the planning system in the Netherlands may explain the poor performance of the econometric model.

Table 9 Netherlands

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
Constant	9.616	6.179	1.556
GDP	−0.666	0.817	−0.815
Interest rates	0.131	0.016	8.375
Housing starts	0.894	0.525	1.703
Adjusted R^2	0.660		
Log likelihood	17.9094	*F*-statistic	13.302
DW	1.271	Prob. (*F*-stat.)	0.000
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	−0.048	0.026	−1.844
ΔGDP	2.277	1.028	2.216
ΔInterest rates	0.043	0.011	3.946
ΔHousing starts	0.006	0.252	0.024
Error correction term	−0.459	0.109	−4.183
Adjusted R^2	0.589		
Log likelihood	31.787	*F*-statistic	7.468
DW	1.498	Prob. (*F*-stat.)	0.002

Table 10 Sweden

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
Constant	0.422	1.989	0.212
GDP	0.636	0.290	2.192
Interest rates	0.004	0.006	0.649
Housing starts	−0.174	0.037	−4.669
Adjusted R^2	0.527		
Log likelihood	24.194	*F*-statistic	7.304
DW	0.648	Prob. (*F*-stat.)	0.003
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	−0.001	0.015	−0.063
ΔGDP	0.278	0.766	0.363
ΔInterest rates	0.003	0.003	0.889
ΔHousing starts	−0.158	0.041	−3.856
Error correction term	−0.489	0.169	−2.902
Adjusted R^2	0.506		
Log likelihood	29.264	*F*-statistic	5.091
DW	0.986	Prob. (*F*-stat.)	0.012

Table 11 United Kingdom

Variable	*Coefficient*	*Standard error*	*t-Statistic*
Long-run relationship			
Constant	−16.595	2.229	−7.444
GDP	1.451	0.154	9.392
Interest rates	−0.031	0.012	−2.492
Housing starts	−0.148	0.038	−3.864
Adjusted R^2	0.757		
Log likelihood	26.475	*F*-statistic	30.055
DW	0.619	Prob. (*F*-stat.)	0.000
Variable	*Coefficient*	*Standard error*	*t-Statistic*
Short-run relationship			
Constant	0.003	0.018	0.177
ΔGDP	0.740	0.469	1.578
ΔInterest rates	−0.012	0.010	−1.172
ΔHousing starts	−0.118	0.036	−3.248
Error correction term	−0.293	0.093	−3.141
ΔHouse price (−1)	0.549	0.087	6.291
Adjusted R^2	0.773		
Log likelihood	46.687	*F*-statistic	18.709
DW	1.453	Prob. (*F*-stat.)	0.000

8. CONCLUSIONS

This paper has attempted to analyse the responsiveness of house prices to changes in demand- and supply-side variables across European countries. On the basis of this analysis it sought to suggest how EU housing markets may be affected by a single monetary policy and whether housing market integration may be expected as a result of EMU. Thus, housing markets in the UK, Germany, the Netherlands, Sweden and Spain, representing diversity within the EU, were examined. The selection of these countries as case studies was conducted on the basis of the chosen criteria, which included inflation records, long- and short-term interest rates, volatility of house prices and participation in the ERM and EMU.

First, an overview of housing systems in the countries was given in order to identify national demand- and supply-side factors that have been affecting house prices in the countries for the last thirty years. It was shown that the combination of demand- and supply-side factors in each case study explained differences in the degree of variability of national house prices and determined the macroeconomic context within which changes in monetary policy fed through to changes in mortgage rates (demand-side factor) and affected movements of house prices. As a result of these differences in the transmission mechanism, the UK and Sweden seemed to show higher

susceptibility of house prices to changes in monetary policy than Germany and the Netherlands. This suggests that a single monetary policy may have an asymmetric impact on house prices in the EU (the conclusion supported by Maclennan *et al.* 1998) and, therefore, the integration of the housing markets may not be expected as a result of the EMU.

Modelling of house prices over time followed. The results suggest that it is not appropriate to pool all these countries together. Although some are very different with respect to trend and amplitude in house price movements, it is perhaps interesting to compare the core EU countries of Germany and the Netherlands. Their responsiveness to both the demand and supply variables is distinctively different in the long-run relationships although some degree of similarity exists in terms of short-run supply responsiveness, but this has still to be tested statistically. They also differ with respect to the Granger causality tests.

It may still be too early to fully capture the impact of EMU on economies and housing markets. However, given the difference between Germany and the Netherlands, it may be reasonable to expect EMU to have little impact on housing market behaviour because even these countries with similar macroeconomic characteristics (including monetary policies) showed little sign of similarities in the responses of their housing markets to changes in macroeconomic variables. This can be explained by different national characteristics relating to housing markets. So long as these aspects remain different, the integration of housing markets across the EMU countries may not be expected.

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APPENDIX 1. DATA SOURCES

Germany

House prices from the Bank for International Settlements. Other data from Eurostat.

Netherlands

All data from Eurostat and OECD except for: house price from NVM; mortgage rates from the Netherlands Central Bank; and housing starts from the Central Bureau of Statistics.

Sweden

Data from OECD and Statistics Sweden.

United Kingdom

Data from the Office for National Statistics (ONS), OECD, and the Council of Mortgage Lenders. Housing stock from the Department for the Environment, Transport and the Regions (DETR).

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NOTES

[1] However, the 'snake' was observed by Germany, the Netherlands, Belgium and Luxembourg during this time. This means that for Belgium, the Netherlands and Luxembourg, monetary policy was restricted for all three periods: 1972–79, 1979–92/93, and 1992/93–98.

[2] Spencer (1999) also put the UK in the same groups as all other Nordic countries. However, he did it on the basis of common high levels of owner-occupation and mortgage debt and dominance of (as he expects in the future in the UK) fixed rate mortgages (Spencer 1999).

[3] If not stated otherwise, this overview is based on the information obtained from the interviews with the relevant key actors conducted for a related research.

[4] High income tax and the fact that tax payments start from the very low income level make tax concessions connected with housing very effective. Thus, the 1987 tax reform encouraged owner-occupation and led to an increase in house prices at a time when mortgage rates were high.

[5] This type of product is similar to endowment mortgages, the difference being that repayment of the principal is deposited in an investment fund.

[6] For example, during the crisis of the 1990s, when house prices decreased and rents were stuck, it was cheaper to buy a villa than to rent a flat. Absence of cross-subsidization between rich and poor municipal companies forced some of them to sell or demolish their stock to prevent a decrease in the rents.

[7] The housebuilding industry benefits from this situation. In fact, the growth of the Spanish economy always coincides with the growth of housing investment. This is because house purchase is a means to tie black money (i.e. money coming from the shadow economy). Since a vacant property is not taxed, in order to hide this investment, an acquired second house is not usually let. Another reason for properties being left vacant will be considered below.

[8] Although legislation does not allow a loan from all sources to exceed 80 per cent of the value of the house, it is possible to get around this restriction and LTV may reach 100 per cent and even more.

[9] For the UK, r is the real long-term bond rate.
[10] Appendix 1 contains more detail on data sources. The authors are available to provide comparable data upon request.
[11] These are completions in the case of Germany.
[12] All results in this paper were generated using 'Eviews' econometric software with the exception of the panel cointegration tests.
[13] Owing to data limitations, it was not possible to estimate a model of the Spanish housing market.
[14] This is relevant for the Granger causality tests.
[15] This variable has been orthogonalized thus removing correlations with GDP.

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