MODELLING THE HOUSING MARKET IN OECD COUNTRIES

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Abstract

The burst of housing bubbles in a number of developed countries motivates the study of the factors, which determine housing prices. Our analysis emphasise those variables that are related to monetary and fiscal policies. We also account for the impact of demographics and the external sector in order to generalise a nationwide housing price model. Following the construction of a theoretical model, we proceed to estimate it in the case of 18 OECD economies over the period 1970-2011, using cointegration and error-correction techniques. We also account for the short- and the long-run relationships through the error-correction formulation.

***Keywords**:* Housing market, OECD countries, cointegration, error correction, empirical modelling.

JEL Classification: C22, R31.

1. Introduction

The burst of the housing bubble in the US has produced the 'great recession' in the world economy. In this context, where the links between the housing market and the financial system have become stronger, the analysis of the determinants of the housing market behaviour is the key to our understanding of the evolution of housing prices. Moreover, there are some variables under the control of the fiscal and monetary authorities, which cannot be ignored in this analysis since they can be used to affect these prices. Another justification for our research is the fact that several years after the financial crisis of August 2007, the effects derived from the collapse of the housing markets are not homogeneous among the main economies (The Economist, 2012).

We begin with the determination of a housing price equation, sufficiently general, which captures traditional determinants like real disposable income, the real long-run interest rate, real residential investment, bank credit and demographic conditions. This is enhanced by taking on board several further indicators, which permits us to account for the openness of the considered economy and the role of the public sector in this particular market. Subsequently, this theoretical proposition is used to analyse the actual evolution of housing prices from 1970 to 2011 in 18 OECD countries by means of cointegration and error-correction techniques.

After this short introduction we formulate our theoretical housing price model in section 2. Section 3 presents the econometric methodology applied in the empirical analysis along with a description of the sources of data utilized. The econometric results obtained, along with a discussion of them, are displayed in section 4. Section 5 provides more general comments. Section 6 summarizes and concludes.

2. A Theoretical Model of Housing Prices

We develop a theoretical model where the dynamics of housing prices are driven by the evolution of its demand and its interaction with the supply of housing, which is fixed in the short run, but can adjust to demand in the long-run. Although our proposal accounts for its own fundamentals, which determine the long-run demand and supply relationships, we utilise the basic premise introduced by Poterba's (1984) asset market approach in order to explain the functioning of this market in the short-run. More specifically, Poterba (op. cit.) considers the quantity demanded for housing

services as a function of the real rent price of those services, and the stock of houses, which is given in the short run. As a result, the real rental price of the housing services in equilibrium is the one, which balances the desired quantity of housing services with the service flow, which exists in the market at that point. Muellbauer and Murphy (1997) also follow this approach and represent the dynamics in the housing market by means of an equation of demand for housing service, which depends mainly on average real income and real user cost of housing services, which captures housing prices; and a supply of housing services function, which rely on housing prices, population and housing stock. In this framework, the housing price equation can be considered as an inverted demand function. All these basic premises are still valid, and constitute the foundations of recent theoretical developments like, for example, Miles (2012).

Table 1 enhances these propositions to account for more determinants of housing prices and describes them as the result of the interaction between demand and supply of housing. Our proposal displays how an external shock in demographics, public sector involvement, i.e. variations in taxation or government expenditure, a change in monetary policy strategy, i.e. changes in interest rates or the conditions to obtain a loan, exert an effect on the demand for housing. This creates an imbalance between supply and demand in the short run, since supply for housing is given in this time horizon. As a result, there is a change in housing prices, which means an incentive for homeowners and property developers to modify the supply, i.e. there is a change in real residential investment. The adjustment of supply to demand does not happen immediately. On the contrary, the initial cycle has an impact on the size of the housing market, which fuels a housing price change. The attempt to achieve the equilibrium position also influences demographics (unemployment), which reinforces the imbalance between demand and supply and fuels the cycle. These effects modify the possibility to obtain a mortgage and its risk premium, which affect the final mortgage rate. Both factors exert an impact on demand and on the disequilibria in the market. Finally, this comes to an end, when the degree of indebtedness of households is so high that the banking sector reduces the credit facilities and increases interest rates for new mortgages.

TABLE 1 THE DYNAMICS OF HOUSING PRICES

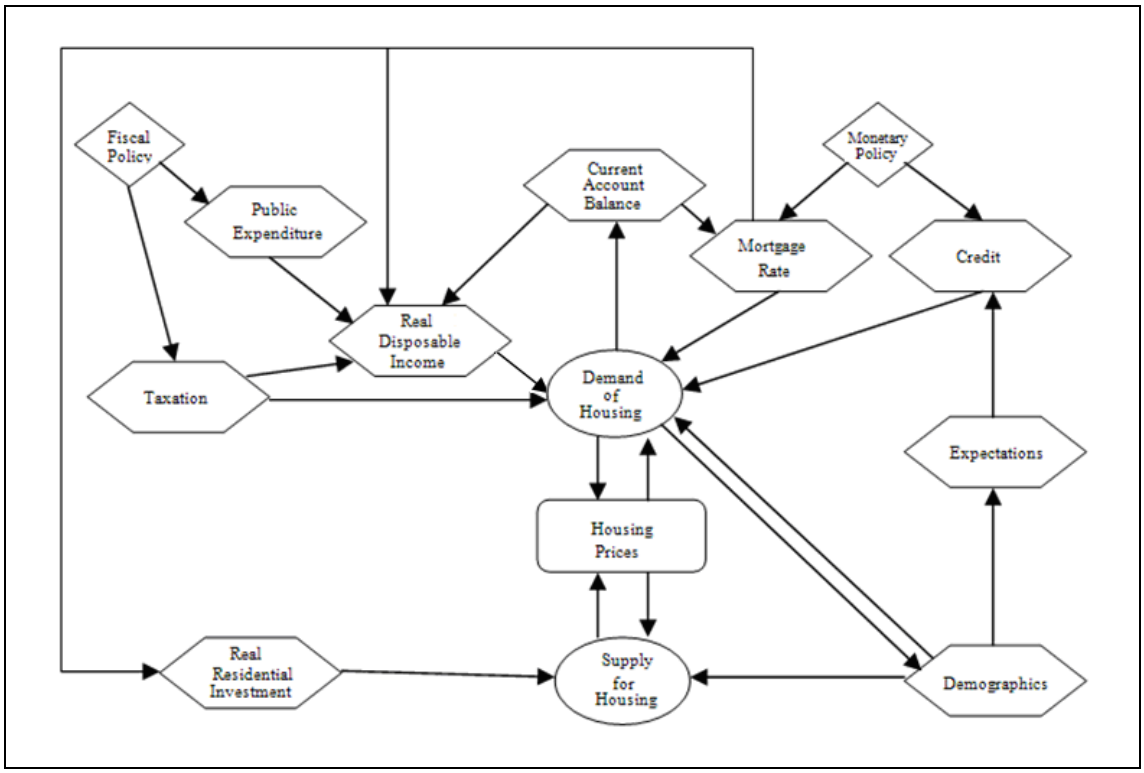

Table 1 permits us to summarise the dynamics of this market by means of a system of two equations (demand and supply of housing) where the variable to be determined is the real housing price. We define the determinants of the demand for housing at the steady state as in equation (1):

$$D_H = D_H(P_H, RDY, MR, C, PO, UN, TAX, CA) \qquad (1)$$

$$- \quad + \quad - \quad + \; + \quad - \quad - \quad -$$

which shows how the demand for housing, D_H, is negatively influenced by house prices, P_H; mortgage rate, *MR*; the rate of unemployment, *UN*; the ratio of taxation to property/house price, *TAX*; and the current account balance, *CA*. Moreover, the function shown in equation (1) is also related positively to further factors: real disposable income, *RDY*; the volume of banking credit, *C*; and the population, *PO*. The sign below a variable indicates the partial derivate of D_H with respect to that variable.

The explanatory determinants of housing supply are highlighted in equation (2):

$$S_H = S_H(P_H, RRI, UN) \qquad (2)$$

$$+ \quad + \quad +$$

where P_H and UN are as defined above in equation (1); S_H stands for the supply of housing, and *RRI* expresses the level of real residential investment.

At equilibrium, equations (1) and (2) can be set equal to each other, and solving the resulting equality for the housing price equation (3) emerges:

$$P_H = P_H(RDY, MR, RRI, C, PO, UN, TAX, CA) \qquad (3)$$

$$+ \quad - \quad - \quad + \quad + \quad - \quad - \quad -$$

where the variables are as in equations (1) and (2).[1]

An increase in real disposable income exerts a positive effect on housing demand, which finally drives up house prices. This process is understood by considering two factors: a) dwelling acquisitions imply that a relevant part of the total income that households earn during their life is used for repaying the required mortgage; and b) in the short-run the supply of housing is given because this good cannot be reproduced easily and rapidly. This influence is stronger when the analysis of the housing demand is focused on urban areas where there is no much available land to construct new properties.

The mortgage rate, which affects housing prices negatively, is also relevant in our equation. This suggests that accommodating monetary policy and low interest rates had had a significant effect in the development of the housing bubble, mainly in the US housing market prior to the 'great recession'. The mortgage rate reflects the evolution of the interest rate, which is the basic instrument used by central banks to control inflation. The lack of available data on the mortgage rate during the period under investigation for some of the countries included in our sample, forces to use a

[1] See also Milne (1997) and Arestis and Karakitsos (2010), which account for the supply side elements of the housing market.

proxy for this variable.[2] Specifically, we approximate the rate of interest of mortgages by the long-term interest rate (AMECO, 2011).

Another important variable is real residential investment, whose influence comes through the supply side of the housing market. This variable introduces the value of the flow of new dwellings and it could be considered as a proxy for the activity in the housing market. We can distinguish between a positive impact in the short run and a negative one in the long run. In the long run, the model reflects the incentive to homeowners and property developers to enhance the supply of houses for sale in order to obtain capital gains. As a result, this increase in the supply of housing means a decrease in the price *ceteris paribus*. However, in the short run there is a positive relationship between housing prices and real residential investment. A rise in real residential investment provokes an increase in housing prices, since the acquisition of new dwelling means an increase in the demand for housing; and with given short-run supply of housing, a hike in housing prices is inevitable. This incident takes place until individuals decide to sell their properties, and finally the negative long-run effect emerges.

In our model the volume of credit, *C*, is considered as a proxy of mortgage lending standards, since the volume of banking credit to the private sector moves procyclically with the credit standards. In particular, the credit standards are weakened during the expansionary stages of the business cycle due to the presence of positive expectations and low rates of defaults. As a result the share of borrowers that are considered as solvent, and the volume of credit in the economy expand. It is further approximated by the domestic credit to the private sector as percentage of GDP. The huge development of cheap credit in the pre-crisis period, with the extreme example of the US subprime loans, suggest a positive correlation between credit and housing price appreciation;[3] since the relaxation of the conditions to obtain a loan favours an increasing housing demand (Mian and Sufi, 2009; Adelino *et al*., 2012).[4] However, the impact of this variable cannot be restricted only to the boom in the

[2]The European Mortgage Association (2011) provides the representative interest rates on new mortgage loans for a sample of 33 economies. However, the availability of national time series largely varies across countries. In general terms they do not start before 1990.

[3]Dübel and Rothemund (2011) offer a comparison between the US and EU mortgage credit markets.

[4]Abel and Deitz (2010) suggest that the causation between housing prices and nonprime lending activities takes place in both directions: the development of nonprime loans permits an increase in housing prices, since this stimulates housing demand; at the same time, a rapid increase on housing prices favours risky loans (see also Goetzmann *et al*., 2009).

market, since after the bust the presence of liquidity constraints, the tightening of borrowing conditions and the quality of the existing mortgages could accelerate the fall of the housing prices (Benetrix *et al.*, 2011).[5] Specifically, there is a feedback between housing prices and the volume of credit through the 'collateral' channel.[6] For instance, Muellbauer and Cameron (2000) suggest that falls in the equity and housing market reduce the value of the collateral, and as a result, borrowers have to face rising costs of external finance and lower equity withdrawal, which curb demand for housing and slow down housing prices. If we explore this relationship in the other way around, rising housing prices, induce expectations about future house price appreciation and increase the value of the 'collateral', which weakens current conditions to obtain a mortgage. These events contribute to fuelling the increase in the price of this particular asset and boost the housing cycle again.[7] Moreover, credit standards also have an impact on the supply side, due to the presence of 'small' builders who require external finance in order to start their activities. Under these conditions, a relaxation of the credit conditions and a reduction in the spread that this particular kind of borrowers have to accept in order to obtain the funds, have a double positive effect. On the one hand, the production cost for housing is lower, and so, housing becomes more affordable. On the other hand, more builders are going to be able to execute their projects. As a result, an increase in the supply of housing emerges. This implies that supply is becoming more elastic and increases in demand have less of an impact on prices. These two incidents induce a decline in the housing price in the short run, but in the long run falling prices increase the demand for housing. The expected overall impact, then, is the one that arises from the demand side.

Our proposal also accounts for the influence of demographics, which permits the study of the role of the potential buyers in the evolution of housing prices through the demand side of the housing market. We include a relevant variable to capture

[5]Abel and Deitz (2010) examine the development of Upstate New York´s housing market and find a stable behaviour of housing prices in this area before and after the crisis, essentially due to the reduced volume of subprime mortgages in the area.

[6]This 'collateral' channel is a variant of the 'financial accelerator' (Corrado, 2007). Bernanke *et al.* (1998) developed this notion, which considers that in a situation with imperfect capital markets (asymmetric information and agency problems) investors prefer the cost of the external finance in comparison to the cost of internal resources. This preference depends on the investors' cash-flow and assets balance. Moreover, this preference moves pro-cyclical and enhances the variations of investment and production through the credit market.

[7]See Feroli *et al.* (2012) for a description of the transmission mechanism of monetary policy in the New Keynesian models.

population, *PO*. Our proposal suggests a positive impact of the growth of population on housing prices, since this means an increase in the demand for this particular asset.[8] The higher population density, the stronger the impact of an increasing trend in the population growth, since in this case there is an additional effect coming from the supply side of the housing market, which exacerbates the increase in housing prices, i.e. the scarcity of new residential land (see also Miles, 2012). Moreover, our equation accounts for the evolution of unemployment, *UN*, whose impact goes in the opposite direction to that of *PO*. At first sight, an increase in the rate of unemployment reduces the share of potential buyers who can afford the acquisition of a new residence, which implies a decrease in demand, and a reduction in housing prices.[9] We also point to additional effects of this element.[10] In particular, an increase in unemployment is understood by lenders as a negative signal to the development of the economy and to the possibility of repayment of mortgages. As a result, these pessimistic expectations about the future contribute to harden the conditions to obtain a mortgage, what slows down demand and curbs housing price appreciation. There is also another effect, which comes from the supply side of the market, since increasing long-term unemployment modifies the behaviour of some home owners that are obliged to sell their properties due to the fact that they cannot afford their repayments. This increase in the supply of housing induces a fall in the equilibrium price of the market. Moreover, there is a feedback between demand for housing and unemployment, since the construction sector has very important 'pulling' effects on the economy.[11]

Furthermore, taxation over property is considered in order to account for the influence of fiscal policy on the housing market. Public sector exerts an effect on housing demand by means of levies, subsidies and deductibility of some specific costs, as for example a fraction of the mortgage interest payments. Our proposal is focused on the impact of taxation in order to analyse if a high level of taxes on properties could modify the path of dwelling ownership; in other words, could a high

[8] See the United Nations databank for information about past and future trends of population. Available at:
http://esa.un.org/wpp/Excel-Data/population.htm

[9] See also Iossifov *et al.* (2008) and Klyuev (2008).

[10] Cameron and Muellbauer (2001) examine how the evolution of housing prices conditions the persistence of unemployment in those areas with higher rates of ownership. They also analyse the interactions between the housing prices and the migrations flows in the UK.

[11] During 1996-2006 real estate activities and the construction sector represent more than a third of the increase in employment, which was created during that period in Spain, which meant more than 1.500.000 direct jobs (ILO, 2011).

level of taxation influence the behaviour of homebuyers in the sense that they prefer renting a property rather than buying it?[12] The role of the taxation system has been emphasised by previous contributions (Muellbauer, 2003), which considers taxation a much more useful instrument in order to stabilise the market than reforms in the land-use planning system. Our testable hypothesis suggests that an increase in property taxation could modify individuals´ preferences, thereby implying that some potential homebuyers would abandon the housing market. This means a slowdown in demand, and a reduction in housing prices would take place. Specifically, our model proxies taxation by the ratio of tax revenues over housing prices, *TAX*.[13]

Finally, the impact of the external sector is included. It is the case that those countries, which have been experiencing the highest increase in housing prices, display at the same time large external deficits (Adam *et al.*, 2011).[14] The general view points to a positive relationship between housing prices and net foreign inflows.[15] The relevant assumption is that net foreign inflows increase housing prices since they can provoke falls in real interest rates. However, there are two views on this proposition. On the one hand, there is the suggestion that capital inflows induce falls in interest rates, and low interest rates promote housing price increases (Taylor, 2009). On the other hand, there is the view that a strong and high domestic demand provokes movements in housing prices and capital inflows in the same direction (Laibson and Mollerstrom, 2010; Ferrero, 2011).[16] Our testable hypothesis relates to the latter view.[17] In our approach the situation characterised by the presence of a high effective demand, along with strong preferences for housing and positive expectations about the evolution of housing prices, could induce individuals to go for higher

[12]See Muellbauer and Cameron (1998) as an example of a study of the effects of taxation in the housing market and a discussion of how the taxation system can stabilise the market in the UK.

[13]Hilbers *et al.* (2008) provide a detailed description of housing-related taxation in Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Switzerland, Sweden and the United Kingdom. Their analysis shows huge taxation disparities among these countries, which makes it difficult to make comparisons. To deal with this problem they approximate the tax burden on housing by means of the ratio of tax revenues to housing prices. We also adopt this approach in our analysis.

[14]However, Favilukis *et al.* (2012) do not find a significant impact of capital flows on housing prices from 2002 to 2010 in a sample of several countries.

[15]Benetrix *et al.* (2011) analyse empirically the impact of current account on housing prices by means of two exercises. First, they consider the complete cycle, and, second, they focus on this relationship during the slumps. This analysis does not find a significant impact over the cycle, but when prices are slumping current account surpluses are related with falling prices.

[16]Favilukis *et al.* (2012) discuss these alternative views.

[17]Gete (2010) also suggests that an increase in preferences for housing, provoke a relocation of productive inputs toward housing production, which means increasing imports of non-housing goods.

consumption. As a result, deterioration in the current account balance may take place, due to the possibility that this increase in demand may be satisfied by imported final consumption goods, indirectly by imports of commodities to produce final consumption goods. This development of external trade could also affect the evolution of production and income growth in the economy. This situation becomes more evident in those countries that show a high propensity to consume, as for example in Spain (Rebollo, 2001). In a second stage, there is an additional impact that emanates from the current account deficits. If the external deficit is maintained or grows through time, an increase in interest rates will be necessary to attract capital flows to finance the external indebtedness. This implies a negative effect on demand, as argued above. Although the causation of the relationship between housing prices and current account deficits is controversial, our proposal is focused on the impact of current account balance on housing prices. Our model considers that the effect of this factor emanates mainly in the long run. This assumption is justified in view of the fact that financial markets penalise those economies, which are excessively and continuously indebted for a long period. In particular, an economy that exhibits an active housing market, which is growing fast, will display current account deficits due to rising imports of construction inputs and other durable goods whose consumption is related to the acquisition of a dwelling; although the impact, which arises from the durable goods imports is relatively small since its consumption is not a high fraction of the total consumption (Benito et al., 2006). If this situation prevails through time the economy will be forced to face rising interest rates in order to obtain the funds, which are required to repay its external debt. This means of course rising interest rates, and rising user cost of the dwellings.

3. Econometric Analysis

3.1 Preliminary Observations

We assume a linear specification of equation (3) for housing prices and employ the standard cointegration technique (Engle and Granger, 1987). Firstly, the long-run cointegrated relationship is estimated by means of Ordinary Least Squares (OLS). Then the residuals of the long-run relationship are checked to ensure that they are I(0) series, which is the condition required for the variables to be cointegrated in the long-

run, which they are.[18] Secondly, a dynamic model that captures the relationship among the variables in the short run, is estimated by including an error-correction term, which is built as the lagged residual of the corresponding long-run model.

We check the stationarity of the data by applying the augmented Dickey-Fuller (Dickey and Fuller; 1979, 1981) tests, the Phillips-Perron (Phillips and Perron, 1988) test and the GLS-based Dickey-Fuller (Nelson and Plosser, 1982) test, whose null hypotheses are the presence of a unit root. The Kwiatkowski-Phillips-Schmidt-Shin (Kwiatkowski *et al*., 1992) test, which checks for stationarity is also used. We apply unit root/stationarity tests to assure that the series are I(1), since under some circumstances as the presence of structural changes the results of the unit root/stationarity tests could be conflicting and suggest the presence of unit roots instead of stationarity with structural changes. The results of these tests confirm that the time series employed are I(1) ones, which leads us to estimate the model by using cointegration analysis.[19]

The validity of the estimated relationships, as in the section that follows, is checked by using: a) the Breusch-Godfrey Serial Correlation LM (Breusch, 1979; Godfrey, 1978) statistic, which tests for the lack of autocorrelation of first-, second- and third-order; b) the White (White, 1980) test with and without cross terms, which checks for the absence of heteroskedasticity; c) the ARCH (Engle, 1988) test, which tests for the presence of ARCH effects of first- and second-order; and d) the Jarque-Bera (Jarque and Bera; 1980, 1981) test to examine the skewness and kurtosis of the residuals.

Moreover, the R-squared, the DW statistic, the Akaike Information Criterion (AIC), the Schwartz Information Criterion (SIC) and the F-statistic are reported.[20]

3.2. Data

We test our model by using a sample of 18 OECD economies from 1970 to 2011. We consider the following countries: Australia, Belgium, Canada, Denmark, Finland,

[18]We apply the augmented Dickey-Fuller (Dickey and Fuller; 1979, 1981) test and the Kwiatkowski-Phillips-Schmidt-Shin (Kwiatkowski *et al*., 1992) test. These results, which confirm the stationarity of the residuals of the cointegrating relationships, can be obtained from the authors upon request.
[19]The results of these unit root/stationarity tests are available from the authors upon request.
[20]Gujarati (1997) discusses these diagnostics/statistics.

France, Germany, Italy, Ireland, Japan, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, the United Kingdom and the United States. The length of our panel is determined by the availability of annual data about Real House Prices Index published by the Bank of International Settlements.[21] The size of the sample is large enough to examine the main global and European economies and permit us to account for the analysis of economies with different characteristics in terms of economic development, demographics, structure of the public sector and financial systems.

The main data provider is the *AMECO* databank published by the European Commission´s Directorate General for Economic and Financial Affairs.[22] We use the following annual series: a) Balance on Current Transactions with the Rest of the World (% of GDP); b) Total Population (National accounts);[23] c) Unemployment Rate; d) Gross Fixed Capital Formation by type of Goods at Current Prices (Dwelling);[24] e) Gross National Disposable Income per Head of Population; f) Real Long-term Interest Rate;[25] and g) Gross Domestic Product Price Deflactor.

Moreover, other data sources are utilised.[26] The World Bank database, which publishes the information utilised as a proxy for the supply of credit, Domestic Credit to Private Sector (% of GDP); and the *OECD* databank which provides the Taxation over immovable property (% of GDP) time series.[27]

EViews 5.0 is the econometric package used to estimate the relationships and calculate the relevant statistics/diagnostics.

[21]The website of this databank is available at: http://www.bis.org/

[22]All the variables are available at:
http://ec.europa.eu/economy_finance/db_indicators/ameco/index_en.htm

[23]The population time series for Germany during the period 1970-1991 comes from the OECD databank Population Statistics.

[24]In the case of this particular variable the data for Switzerland and Norway during the period of investigation is published by the OECD databank Gross fixed capital formation, housing.

[25]Missing data forces us to utilise the long-term interest rate data published by the OECD for Switzerland, New Zealand, Australia, Norway and Canada.

[26]These additional data are published in:
http://stats.oecd.org/index.aspx; http://data.worldbank.org/

[27]These time series are also annual.

4. Econometric Results

4.1 Long-run Relationships

Table 2A summarises the econometric relationships, which are estimated on the long-run basis.[28] All the models include a constant, which is significant except in the Danish market. Table 2B reports the diagnostis/statistics conducted to validate these relationships.[29] The parameters can be interpreted as in a standard semi-loglinear model, which is a functional form well known and commonly utilised in the housing literature (Rogers, 2006).

Table 2A shows how real disposable income is the key variable in our model, since its impact is present in all the countries except Switzerland. However, its positive influence among the analysed markets is quite different. The strongest effects are observed in the case of the Netherlands (2.413), Spain (2.100) and Sweden (1.497), while the lowest incidence arises in Germany (0.160).

TABLE 2A HOUSING PRICE LONG-RUN RELATIONSHIP (1970-2011)

Long-run relationship									
	Constant	L_RDY	L_RRI	L_C	MR	L_TAX	L_UN	L_PO	CA
Australia	3.533***	0.322* (0)		0.583*** (0)		-0.877*** (0)			-1.241* (0)
Belgium	-204.368***	0.775*** (0)				-0.244*** (0)	-0.121*** (0)	12.780*** (0)	-2.533*** (0)
Canada	-19.554***	0.531** (0)			-1.535** (0)		-0.270*** (0)	1.266*** (0)	-4.593*** (0)
Denmark	0.929	0.648*** (0)		0.175*** (0)		-0.547*** (0)	-0.068*** (0)		
Finland	1.591***	0.811*** (0)		0.312*** (0)			-0.242*** (0)		
France	-67.310***	0.595* (0)			-1.396*** (0)		-0.269*** (0)	3.883*** (0)	-5.525*** (0)
Germany	4.036***	0.160*** (0)		0.281*** (0)		-0.303*** (0)			-1.354*** (0)
Ireland	2.115***	0.707*** (0)		0.237*** (0)			-0.088*** (0)		-1.858*** (0)
Italy	-81.141***	0.428** (0)					-0.257*** (0)	4.701*** (0)	
Japan	-73.915***	0.589*** (0)		0.439*** (0)		-0.705*** (0)		3.929*** (0)	
Netherlands	-3.118***	2.413*** (0)				-0.331*** (0)			-2.983*** (0)

[28] In order to ensure the validity of the long-run equilibrium models and avoid spurious regressions, the Cointegrating Regression Durbin Watson test (Sargan and Bhargava, 1983; Engle and Granger, 1987) is applied. The null hypothesis of this test is the lack of cointegration of the variables included in the regression. At 5% significance level, the critical value is equal to 0.386, which implies the rejection of the null hypothesis, i.e. the acceptance of cointegration among the variables included in the long-run relationship in those cases where the DW statistic is greater than 0.386 (Gujarati, 1997). All the cointegrating relationships, which are displayed in our contribution exhibit DW statistics higher than this critical value, i.e. there is cointegration among the relevant variables.

[29] These long-run relationships were also estimated by means of the OLS White-Heteroskedasticity Consistent technique (White, 1980) and the Generalised Method of Moments (Arellano and Bover, 1995). These two alternative methods permit us to check the robustness of the results and deal with thee problems related to the presence of heteroskedasticity, simultaneity and autocorrelation which could bias our results. The estimations of these alternative methods are not reported since the results are similar in terms of the estimated coefficients and their significance. These results suggest acceptance of the validity of the parameters of the cointegrating relationships as displayed in Table 2A.

New Zealand	-13.614***	0.856*** (0)				-0.696*** (0)		1.012*** (0)	-1.468*** (0)
Norway	2.616***	0.400*** (0)		0.631*** (0)		-0.396*** (0)			
Spain	-19.769**	2.100*** (0)	-0.474** (0)			-0.106*** (0)		1.175** (0)	-3.109*** (0)
Sweden	-3.984***	1.497*** (0)		0.114** (0)	-1.152** (0)	-0.074*** (0)	-0.163*** (0)		
Switzerland	4.132***			0.556*** (0)		-0.222*** (0)	-0.072*** (0)		
UK	-102.600***	0.514*** (0)				-0.232*** (0)		5.909*** (0)	-4.524*** (0)
US	-11.272**	0.534** (0)		0.216** (0)	-1.612*** (0)	-0.442*** (0)		0.715*** (0)	-1.719*** (0)

Note: *, ** and *** indicate statistical significance and rejection of the null at the 10, 5 and 1 percent significance levels, respectively. Numbers in parentheses, in the case of the variables, show the lag(s) of the relevant variable.

TABLE 2B HOUSING PRICE LONG-RUN RELATIONSHIPS: DIAGNOSTICS/STATISTICS

Diagnostic/Statistics Long-run Relationships						
	R-squared	DW	AIC	SIC	F-statistics	Jarque-Bera
Australia	0.985901	1.038534	-2.832231	-2.618954	594.3913 (0.0000)	3.663394 (0.160142)
Belgium	0.967581	0.817681	-1.991956	-1.741189	208.9252 (0.0000)	6.220228 (0.044596)
Canada	0.949475	0.929957	-2.552453	-2.301686	131.5442 (0.0000)	2.248694 (0.324864)
Denmark	0.913787	0.654112	-2.027806	-1.818834	95.39315 (0.0000)	1.909364 (0.384934)
Finland	0.941986	1.000613	-2.622403	-2.455226	200.2607 (0.0000)	1.467591 (0.480083)
France	0.954118	0.886646	-2.530451	-2.279684	145.5643 (0.0000)	1.000449 (0.606394)
Germany	0.940215	0.917485	-4.537345	-4.328373	141.5387 (0.0000)	3.614961 (0.164067)
Ireland	0.987945	1.130828	-2.955245	-2.746273	737.6041 (0.0000)	2.174456 (0.337150)
Italy	0.79371	0.509235	-1.440898	-1.275406	48.73558 (0.0000)	1.0999652 (0.577050)
Japan	0.972013	0.881974	-3.964817	-3.755845	312.5777 (0.0000)	1.831850 (0.400146)
Netherlands	0.963346	0.737503	-2.076933	-1.908045	315.3897 (0.0000)	1.697077 (0.428040)
New Zealand	0.969048	0.806066	-2.70219	-2.486718	258.2888 (0.0000)	5.792835 (0.057762)
Norway	0.970469	1.138326	-3.377046	-3.202892	361.486 (0.0000)	5.133177 (0.076797)
Spain	0.958288	0.649963	-1.639866	-1.389099	160.8183 (0.0000)	0.953403 (0.620828)
Sweden	0.957433	1.221089	-2.896436	-2.640504	148.4486 (0.0000)	0.723558 (0.696436)
Switzerland	0.819921	0.597715	-2.800482	-2.624536	48.5666 (0.0000)	1.684553 (0.430729)
UK	0.958012	0.42364	-1.772867	-1.563895	205.3471 (0.0000)	2.360246 (0.307241)
US	0.976877	0.795917	-3.852367	-3.559806	239.3991 (0.0000)	1.095062 (0.578376)

Note: In the last column numbers in parentheses indicates the p-value of each test.

Surprisingly, real residential investment is only significant in the Spanish model. As our theory suggests, its influence in the long run is negative (-0.474). Regarding the financial variables, the mortgage rate is only significant in Canada (-1.535), France (-1.396), Sweden (-1.152) and the United States (-1.612). In all these cases, the impact is negative and the size of the relevant coefficients is similar. However, the influence of credit is more homogeneous. Specifically, the volume of credit affects significantly housing prices in Australia (0.583), Denmark (0.175), Finland (0.312), Germany (0.281), Ireland (0.237), Japan (0.439), Norway (0.631), Sweden (0.114), Switzerland (0.556) and the Unites States (0.216). Taxation over property plays a role in all the economies included in our sample, except in Finland, France, Ireland and Italy. The highest depressing effects appears in Australia (-0.877)

and Japan (-0.705). However, the lowest impacts are observed in Spain (-0.106) and Sweden (-0.074).

Demographics (unemployment rate and population) are significant in Belgium (-0.121 and 12.780), Canada (-0.270 and 1.266), France (-0.269 and 3.883) and Germany (-0.257 and 4.701). Moreover, unemployment affects negatively housing prices in markets like Denmark (-0.068), Finland (-0.242), Ireland (-0.088), Sweden (-0.163) and Switzerland (-0.072). Population growth is also important in Japan (3.929), New Zealand (1.012), Spain (1.175), the United Kingdom (5.909) and the United States (0.715). The current account produces a negative effect in eleven of the market considered. The strongest impact emerges in Canada (-4.593), France (-5.525) and the United Kingdom (-4.524). However, the lowest effect is present in Australia (-1.241) and Germany (-1.354).

These results are validated by means of several statistics, which are displayed in Table 2B. The first column shows the percentage of the housing prices explained in the long run, which is captured by the model. In all the cases more than the 90% of the fluctuations of housing prices are explained; however, this percentage is lower in Italy and Switzerland (80%). The second column displays the Durbin Watson statistic, whose value is far from 2 due to the existence of unit roots in the data (Gujarati, 1997).[30] The use of this statistic permits one to analyse the presence of autocorrelation just in the short-run relationship. The third and fourth columns display the AIC and the SIC, which present negative values. The models, which appear in Table 2A, have been selected amongst several specifications by choosing the one with the lowest absolute value in each case.[31] We report the F-statistic, which confirms the joint significance of the regressors, since the p-value is 0. We also include the Jarque-Bera statistic, which checks for the normality of the residuals. We accept the null hypothesis of normality when the p-value is above 0.05. Only in the Japanese model

[30]The values of this statistic in our models are along the lines or even higher than the values found by other studies that employ the same technique (see, for example, Esteban and Altuzarra, 2008). These low values of the Durbin Watson statistic for the long-run equations are not a problem, since according to this cointegration procedure the lack of autocorrelation and a high value (close to 2) of the Durbin Watson have to be satisfied in the case of the short-run model, as explained in the text.

[31]The AIC and SIC diagnostics are useful to select models when there are several specifications for the same function. Specifically, these diagnostics suggest choosing the model that displays the lowest possible value. The lower the value for these diagnostics is the better the adjustment of the model. Moreover, the model whose value is the lowest is the one whose specification fits better to the structure of the data under consideration (Gujarati, 1997).

is this statistic slightly inferior to 0.05, but we can accept the null hypothesis at the 1% level of significance.

There are some similarities among the countries. For example, housing prices in France and Canada are determined by disposable income, mortgage rate, unemployment rate, population and the current account balance. A similar structure is found in other countries. For instance, in Belgium although the financial element is not exerting an effect, or in the United Kingdom, where the impact of unemployment is not significant. Moreover, those explanatory elements, which are important in the British market are also significant in the case of Spain, which also includes real residential investment, and the United States, which widens the model by including the mortgage rate and credit. The Japanese housing market, where an important house bubble emerged, shows how housing prices are determined by the same variables except for the volume of credit and the current account.

Some similarities also appear in Ireland, Finland, Denmark, Sweden, Germany and Norway. Specifically, the housing price in Germany and Norway is determined by disposable income, credit and taxation over property. The relationship in the case of Germany includes in addition the current account. The specification for the Irish economy is similar to the previous ones, although this model includes the effect of unemployment. The function estimated in the case of Finland, whose determinants are disposable income, credit and unemployment, is not dissimilar to the Danish one, where in addition taxation over property is significant. This last relationship is also relevant in the case of Sweden, where the mortgage rate is also significant.

4.2. Short-Run Dynamics

Table 3A reports the dynamics of housing prices in the short run. These models are validated by means of the diagnostics/statistics, which are reported in Table 3B and 3C. These relationships are estimated by applying the ‘general to specific’ modelling strategy of Hendry and Richard (1983).

TABLE 3A HOUSING PRICE SHORT-RUN RELATIONSHIPS (1970-2011)

Short-run Relationship											
	Constant	ΔL_RDY	ΔL_RRI	ΔL_C	ΔMR	ΔL_TAX	ΔL_UN	ΔL_PO	ΔCA	ΔL_RHP	EL_RHP
Australia	0.030***					-0.846*** (0)				0.132*** (1)	-0.288***
Belgium	-0.002	0.905*** (0)								0.657*** (0)	-0.229***
Canada	0.015*		0.134* (2)				-0.261*** (0)		-2.498*** (0)	0.198*(1)	-0.292**
Denmark	-0.030**	0.601* (0)				-0.448*** (0)	-0.074*** (0)	9.199** (1)			-0.183**
		0.922*** (2)									
Finland	0.003		0.521*** (0)	0.219* (0)			-0.169*** (0)				-0.525***
France	0.005		0.574*** (0)						-1.819*** (0)	0.402*** (1)	-0.311***
Germany	-0.006*	0.382*** (0)			-0.594*** (1)				-0.621*** (1)	0.482*** (1)	-0.339**
Ireland	-0.002	0.379** (0)		0.117* (0)		-0.162*** (0)	-0.085* (0)			0.358*** (1)	-0.211*
Italy	-0.014	1.041** (1)							-2.016*** (1)	0.556*** (2)	-0.395***
Japan	0.001	0.565*** (0)		0.201** (0)		-0.516*** (0)		2.317** (0)	-0.829* (0)	0.196*** (0)	-0.331**
Netherlands	-0.001	1.284*** (0)	0.438*** (0)						-1.266** (0)	0.410*** (1)	-0.447***
		-0.617* (1)									
New Zealand	0.016**		0.118** (0)			-0.469*** (0)			-0.729*** (0)	0.258** (1)	-0.257**
Norway	0.002	0.373** (1)		0.604*** (0)		-0.232*** (0)	-0.094** (0)		-0.413** (2)		-0.590***
Spain	-0.051**	2.202*** (0)			-0.914** (1)			3.565* (2)		0.349*** (1)	-0.257**
Sweden	-0.071***	1.654*** (0)						8.404*** (0)	-0.859** (0)	0.321*** (1)	-0.361***
Switzerland	-0.003	0.597** (0)	0.183** (0)						-0.421* (0)	0.405*** (1)	-0.280***
UK	-0.009		0.514*** (0)	0.160** (0)		-0.316*** (0)			-1.565* (0)		-0.254***
US	0.010***	0.603*** (0)			-0.846** (0)	-0.273*** (0)				0.560*** (1)	-0.310***
		-0.312* (2)								-0.263** (2)	

Note: *, ** and *** indicate statistical significance and rejection of the null at the 10, 5 and 1 percent significance levels, respectively. Numbers in parentheses, in the case of the variables, show the lag(s) of the relevant variable.

TABLE 3B HOUSING PRICE SHORT-RUN RELATIONSHIPS: DIAGNOSTICS/STATISTICS I

Diagnostic/Statistics Short-run Relationships						
	R-squared	DW	AIC	SIC	F-statistics	Jarque-Bera
Australia	0.940502	1.523497	-4.570575	-4.398197	179.15 (0.0000)	2.887359 (0.236058)
Belgium	0.616683	1.716407	-3.625183	-3.456295	19.30571 (0.0000)	0.039594 (0.980398)
Canada	0.626512	1.843424	-3.378264	-3.122331	11.07127 (0.0000)	4.835438 (0.089125)
Denmark	0.854149	1.522012	-3.700704	-3.399043	30.25752 (0.0000)	3.540377 (0.170301)
Finland	0.814128	1.916716	-3.445146	-3.234036	38.32545 (0.0000)	1.583871 (0.452967)
France	0.737833	1.855448	-4.22906	-4.01795	24.626 (0.0000)	0.029943(0.985140)
Germany	0.545038	2.136733	-4.888589	-4.632657	7.906712 (0.0001)	1.088519 (0.580271)
Ireland	0.875852	1.944338	-3.993454	-3.694866	37.62605 (0.0000)	0.704155 (0.703226)
Italy	0.587481	2.173025	-2.61856	-2.405283	12.1051 (0.0000)	0.350045 (0.839438)
Japan	0.897662	1.664228	-4.719302	-4.378059	38.84558 (0.0000)	0.935640 (0.626366)
Netherlands	0.79844	1.747442	-3.383329	-3.084741	21.12695 (0.0000)	1.224301 (0.542184)
New Zealand	0.814284	1.587376	-3.644206	-3.38564	28.0612 (0.0000)	0.806098 (0.668279)
Norway	0.821489	1.705544	-3.796575	-3.482325	20.7086 (0.0000)	0.373909 (0.829482)
Spain	0.736396	2.03244	-2.954578	-2.696012	17.87882 (0.0000)	0.224664 (0.893748)
Sweden	0.843416	1.86874	-3.926122	-3.624461	27.8295 (0.0000)	1.340262 (0.511642)
Switzerland	0.753608	1.491762	-4.378606	-4.111975	17.73969 (0.0000)	1.544331 (0.462011)
UK	0.80797	2.162349	-3.213935	-2.918381	23.14137 (0.0000)	0.968584 (0.616133)
US	0.901153	1.609104	-5.251309	-4.906554	39.07153 (0.0000)	1.864080 (0.393750)

Note: In the last two columns numbers in parentheses indicates the p-value of each test.

TABLE 3C HOUSING PRICE SHORT-RUN RELATIONSHIPS: DIAGNOSTICS/STATISTICS II

Diagnostic/Statistics Short-run Relationships							
	LM (1)	LM (2)	LM (3)	White	White X	ARCH (1)	ARCH (2)
Australia	1.967811 (0.170019)	1.716501 (0.195827)	2.400461 (0.086688)	0.507001 (0.798255)	1.800868 (0.112754)	0.051180 (0.822338)	0.215884 (0.806958)
Belgium	0.907267 (0.347373)	1.641111 (0.208743)	2.846262 (0.052510)	0.780852 (0.590939)	0.59645 (0.789602)	1.071307 (0.307368)	0.6939 (0.506366)
Canada	0.154995 (0.696418)	0.389248 (0.680831)	0.279501 (0.839742)	0.441165 (0.912912)	0.475447 (0.944930)	0.002064 (0.964012)	0.360607 (0.699887)
Denmark	1.292316 (0.264621)	0.727813 (0.491577)	1.808807 (0.168463)	0.35123 (0.969120)	0.845377 (0.655743)	0.002428 (0.960983)	0.029638 (0.970822)
Finland	0.107163 (0.745404)	0.091139 (0.913120)	0.162784 (0.920617)	0.878845 (0.544814)	0.598253 (0.841144)	0.080597 (0.778073)	0.598253 (0.841144)
France	0.104738 (0.748199)	1.100504 (0.344604)	0.777014 (0.515487)	1.541691 (0.183417)	1.364926 (0.240915)	2.459871 (0.125302)	1.065011 (0.355631)
Germany	1.920509 (0.175383)	1.165969 (0.324913)	0.871182 (0.466890)	1.5527 (0.173104)	2.072495 (0.129955)	0.087949 (0.768505)	0.09563 (0.909044)
Ireland	0.016502 (0.898613)	2.691939 (0.084089)	2.107995 (0.120895)	0.772906 (0.671851)	0.421493 (0.966913)	0.598952 (0.444031)	1.143943 (0.330517)
Italy	0.750855 (0.392463)	0.547497 (0.583718)	0.356932 (0.784460)	1.2763 (0.292492)	1.667778 (0.131033)	1.83387 (0.184111)	0.462653 (0.633516)
Japan	1.810744 (0.188502)	0.924055 (0.408279)	0.981223 (0.415687)	1.287876 (0.283658)	2.310009 (0.269235)	0.270908 (0.605910)	0.218227 (0.805060)
Netherlands	0.578858 (0.452509)	1.46842 (0.246371)	1.745538 (0.179674)	1.804643 (0.124384)	9.140942 (0.088966)	0.303547 (0.585070)	0.184058 (0.832711)
New Zealand	0.226265 (0.637642)	1.012402 (0.375424)	0.679618 (0.571644)	1.526765 (0.183799)	1.686472 (0.140319)	1.362929 (0.250923)	1.02684 (0.369297)
Norway	0.331074 (0.569974)	0.222426 (0.802142)	0.95324 (0.430698)	1.886681 (0.097844)	1.419627 (0.351344)	0.309325 (0.582087)	0.170833 (0.843805)
Spain	0.068742 (0.794912)	1.270842 (0.295269)	1.236757 (0.314316)	1.239652 (0.311538)	3.690626 (0.056708)	0.212002 (0.648051)	0.089746 (0.914385)
Sweden	0.139156 (0.711744)	1.840695 (0.176772)	1.231949 (0.316646)	1.302442 (0.277390)	1.505704 (0.253305)	1.659991 (0.206057)	1.392697 (0.262624)
Switzerland	2.572465 (0.119960)	1.60617 (0.219241)	1.232358 (0.317991)	0.630832 (0.773217)	0.580454 (0.870246)	0.162761 (0.689310)	1.613569 (0.215986)
UK	0.789144 (0.380988)	0.973482 (0.389016)	0.955638 (0.426350)	2.126163 (0.076945)	1.489961 (0.228034)	0.472538 (0.496109)	0.61152 (0.548220)
US	1.902827 (0.178308)	0.983257 (0.386639)	0.661065 (0.583178)	0.915024 (0.556793)	26.56021 (0.337674)	0.038478 (0.845621)	0.017229 (0.982927)

Note: Numbers in parentheses indicates the p-value of each test.

In the short run, the variable whose influence is more persistent among the countries, is the real disposable income, as in the long run. This impact is relevant in all the countries except in Australia, Canada, Finland, France, New Zealand and the United Kingdom. Specifically, this incidence is quite strong in Spain (2.202), although in countries like Italy (1.041), the Netherlands (1.284) and Sweden is also remarkable. However, the lowest effect is observed in Germany (0.382) and Norway (0.373).

The second determinant, real residential investment, is much more important in the short run. Actually, we can distinguish two groups. Canada (0.134), New Zealand (0.118) and Switzerland (0.183) where this particular effect is lower; and Finland (0.521), France (0.574), the Netherlands (0.438) and the United Kingdom (0.514), where the coefficients exhibit a higher value.

Our results show how credit affects housing prices in the case of Finland (0.219), Ireland (0.117), Japan (0.201), Norway (0.604) and the United Kingdom (0.160). Except for the last market, this element is a significant explanatory element in the short run as well as in the long run. In general terms, these estimated coefficients show a similar value, although for the Norwegian market where the effect is three times higher than in the other cases.

The mortgage rate is relevant in the United States market (-0.846) independently of the time horizon. Its impact is higher in Spain (-0.914) and it is also significant in Germany (-0.594), where this variable is significant only at the time of buying the house since the majority of the German mortgages have a fixed interest rate.

The impact of taxation is relevant in eight of the housing markets considered. Norway (-0.232), the United Kingdom (-0.316) and the United States (-0.273) exhibit similar values for this parameter. The lowest incidence emerges in Ireland (-0.162), while the highest one is observed in Australia (-0.846), which is almost twice the effect in Denmark (-0.448), Japan (-0.516) and New Zealand (-0.469). This variable is also present in the long-run relationship of these markets except in Ireland.

Furthermore, unemployment reduces housing prices in Canada and Finland (-0.261 and -0.169). A lower impact of this variable is found in Denmark (-0.074), Ireland (-0.085) and Norway (-0.094). As our proposal suggests, the growth of population increases the demand for housing in Denmark (9.199) and Sweden (8.404). In Spain (3.565) and Japan (2.317) this variable is also significant but much lower than in the Nordic cases. Both elements are more significant in the long run rather than in the short run.

The impact of the external sector exerts its higher negative incidence in Canada (-2.498), Italy (-2.016) and France (-1.819), while the lowest one appears in Norway (-0.413) and Switzerland (-0.421). Higher effects are observed in Japan (-0.829), New Zealand (-0.729), Sweden (-0.859) and Germany (-0.621) and even more intense impacts arise in the United Kingdom (-1.565) and the Netherlands (-1.266).

The study of housing prices in the short run also accounts for the development of housing prices as another explanatory variable. Lagged house prices are significant in all the relationships except in the case of the United Kingdom and the Nordic markets. The lowest impact arises in Australia (0.132), while the highest influence appears in Belgium (0.657), Germany (0.482), Italy (0.556) and the United States (0.560). This effect has the same intensity in the case of Canada (0.198) and Japan (0.196). A similar impact emerges in France (0.402), the Netherlands (0.410), Ireland (0.358) and Switzerland (0.405). Moreover, New Zealand, Spain and Sweden exhibit similar coefficients (0.258, 0.349 and 0.321), although they are lower than in the previous group of countries.

We examine next the error-correction term which explains the percentage of the disequilibria between the short-run dynamics and the long-run relationship that is

eliminated in each period. In the majority of the markets under consideration around 30% of the difference between the short-run models and the long-run equilibrium are reduced each year. In the case of Denmark, Ireland and Belgium this percentage falls to 20%. Other housing markets are more dynamic and the adjustment process is faster. For instance, this percentage is around 40% in Sweden, Italy and the Netherlands. Although the most dynamic markets are in Finland and Norway, where around a 50% and 60% of the disequilibria are annually reduced.

Finally, we discuss the diagnostics/statistics of Tables 3B and 3C, respectively, beginning with the R-squared. The less powerful model is the German one, where the R-squared is around 55%. However, the adjustment is high in the case of Australia (94%), the United States and Japan (90%). The Durbin Watson statistic (second column) is always higher than 1.5 and close to 2, since the models do not exhibit autocorrelation. This table also reports the AIC and the SIC, which show negative and low values in all the relationships. Finally, Table 3B displays the F-statistics, which clearly imply acceptance of the joint significance of the explanatory variables, and the Jarque-Bera test, which indicate that the residuals are normally distributed. The first three columns in Table 3C confirm the lack of autocorrelation of first-, second- and third-order in all the relationships. The results of White tests (fourth and fifth columns) indicate the homocedasticity of the models. Finally, the last two columns state the absence of ARCH effects of first- and second-order.

5. Overall Discussion of the Empirical Findings

In all the cases, the sign of the coefficients are consistent with our testable hypothesis. The element whose impact is strongest is real disposable income, which exerts a considerable positive effect in all the countries except in Switzerland. Its impact is not only direct, but it is also indirect since incomes are relevant when borrowers try to obtain their loans. Regarding the volume of credit, our estimations confirm that credit facilities and ‘subprime’ mortgages were contributing to the development of bubbles in the housing market, especially in the US. Our results also display a very significant effect which arises from the evolution of population. Specifically, our estimations show how a rise of population, namely, increasing flows of immigrants in the short run and the natural growth of population in the long run, exert a positive and strong effect on housing prices. The role of residential investment is much more evident in

the short run rather than in the long run. There is a positive impact in the short run, while the sign is the opposite in the long run, as our theoretical frame suggest.

Our study also confirms that monetary policy is an important tool to control housing prices through two channels: credit and mortgage rate. The interest rate on housing loans, whose impact in the United States is remarkable, slows down the evolution of housing prices. Our findings regarding this variable and the stronger effect of the volume of credit are consistent with our hypothesis and suggest a more powerful impact on housing prices. The latter emerges from the existence of credit facilities and a relevant contributory factor to the development of housing bubbles, namely the lack of proper regulation in the financial markets.

Furthermore, our research suggests other factors, which can exert an inverse effect on housing prices. First, the impact of fiscal policy cannot be ignored since taxation over property exerts a negative effect on housing prices due to the fact that it can modify the behaviour of households and reduces the demand for housing. Moreover, the public sector can influence real disposable income through changes in taxation and public expenditure. Second, current account deterioration provokes an increase in interest rates in order to attract capital flows. This enables the financing of the external debt, since a rise in the mortgage rate takes place, which curbs hikes in housing prices. As our theoretical framework suggests and our empirics confirm, the negative effect which emerges from the presence of external deficits is more relevant in the long run than in the short run. Finally, rising unemployment creates negative expectations for the banking sector, which harden credit standards; and its presence alters the acquisition of dwellings, since households modify their behaviour, i.e. they are more reluctant to purchase and some of them are compelled to sell their properties.

6. Summary and Conclusions

This contribution develops a theoretical explanation of housing prices, which accounts for traditional elements like disposable income, residential investment and mortgages rates. Moreover, the volume of credit, the impact of demographics, the taxation system and the current account are included in our model. The latter shows different channels to act through regulation.

Our theoretical proposition is tested in a sample of 18 OECD countries during the period 1970-2011 by applying cointegration and error-correction analysis.

This contribution also attempts to examine the extent to which fiscal and monetary authorities could avoid the creation of real estate bubbles. On the one hand, fiscal policy, which can be considered as a more useful element than regulation in the supply of housing, should be used more intensively. For instance, new taxes should be introduced in this market to levy those transactions, which involve the same property and take place in a short time period, since is aim is merely speculative. Regarding monetary policy, manipulation of interest rates in order to curb demand for housing is not the main tool that monetary regulators should utilise since the financial sector has to provide the financial resources, which are required to permit the normal functioning of the real economy. In particular, they should play a role in terms of prudential policy in order to constraint potential demand for mortgages just to those participants, which are solvent. This increase in regulation also has to affect credit conditions, for example, the amount of equity withdrawal should not be close to 100% of the value estimated for this mentioned asset in a 'healthy' banking system. Another line of reforms would have to be based on the lessons learnt from the past, for example, the effects of the Japanese 'third generation mortgages', which suggests a reduction in the maturity of mortgages. Finally, monetary policy should consider housing prices appreciation in order to fight against inflation, since during the booms in the housing market increasing housing prices are the key element in the evolution of agents' expectations concerning the development of this market and the economy as a whole.

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