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EU Housing Markets: The Role of Institutional Factors

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Abstract

Using cluster analysis this study reveals significant heterogeneity in the institutional characteristics of European mortgage markets. Distinct clusters are formed which can be related to differences in the mortgage credit system, the relative importance of the owner-occupation and the property specific fiscal system. The paper then tests for multiple structural breaks. We find evidence that structural breaks in European housing markets often coincide with a changes in housing market policy.

Keywords: Housing Market; European Union; Structural Breaks; Institutional Factors

EU Housing Markets: The Role of Institutional Factors

1. Introduction

The turmoil in the world's financial system observed during the 2007-9 financial crisis has heightened interest in housing markets and their importance both financially and economically. Beyond the natural policy considerations that arose following the crisis, there has been a growing awareness in the importance of assessing the effects of changes in property prices on a variety of issues. These include consumption decisions, given the predominance of housing in overall household wealth (Campbell & Cocco, 2007; Muellbauer & Murphy, 2008) and also the impact on the broad banking and financial sector given the proportion of bank loan portfolios that residential mortgage loans comprise (Martins *et al.* 2014).

This paper builds upon the existing literature in considering how the institutional characteristics of national residential mortgage markets may affect house prices. A number of studies, including Tsatsaronis & Zhu (2004), Calza *et al.* (2007) and Miles & Pillonca (2008), all point to significant heterogeneity in the institutional characteristics of national mortgage market¹. Calza *et al.* (2007) report that “*this heterogeneity is particularly evident within the euro area, where mortgage lending remains a predominantly domestic business activity, largely reflecting natural traditions and cultural factors as well as the institutional settings of the local banking sector*”. The authors point out as examples of these diverging institutional features, the typical mortgage contract duration, the required level of down-payment, degree of innovation and development of the capital market and the type of interest-rate structure of mortgage contracts (variable or fixed interest rate). Maclennan *et al.* (1998) and ECB (2003), among others, point out the differences present in the rental market, mortgage credit system and in transaction costs as factors that aid in explaining the differences observed in the volatility of house prices across EU countries. Van den Noord (2003) extends that analysis by illustrating how house price volatility within the Eurozone appears to be related, at least in part, to differences in tax treatment of owner-occupied housing². The analysis contained in these papers primarily consists of surveys of institutional differences across countries, without either a corresponding detailed

examination of the effects on house prices dynamics (McCrone & Stephens, 1995; Maclennan *et al.*, 1998 and ECB, 2003) or the study of the how a restricted set of institutional characteristics may impact the market (Van den Noord, 2003; Tsatsaronis & Zhu, 2004). Whilst a large number of studies have compared the behaviour of housing markets in different countries (e.g. Holmans, 1994;, Englund & Ioannides, 1997; Iacoviello, 2000; Calza *et al.*, 2007; Miles & Pillonca, 2008; Adams & Fuss, 2010) only Calza *et al.* (2007) examines the role of a restricted set of institutional characteristics relating to the financial system and the corresponding effects of monetary policy on consumption and housing prices. Calza *et al.* (2007) analyses the effects of monetary policy shocks on consumption and housing prices, noting significant variation in both the timing and strength of those effects across different countries. In particular, the authors report that the size of the peak effect of a monetary policy shock on consumption and real house prices is positively related to indicators of development/flexibility in mortgage markets. Such indicators include the mortgages debt to GDP ratio; the loan-to-value (LTV) ratio and the existence of equity release products.

The contribution of this study is thus the identification of institutional differences that exist in the housing market and financial institutions across a variety of European countries. We base the methodological framework on cluster analysis, showing that there are marked differences at the level of institutional characteristics. We then consider how this heterogeneity in institutional characteristics can impact house prices dynamics through the testing for structural breaks. Whilst there are some papers to have considered the issue of structural breaks the literature is sparse, especially in the context of multiple structural breaks in Europe. The issue is of relevance and importance as institutional factors and policy changes may play an important role in any structural breaks observed. To test for multiple structural breaks we use the Bai & Perron (1998, 2001 and 2003) framework. We consider possible breaks in both real user cost and real price growth. The empirical results not only confirm the presence of structural breaks in the majority of cases, but also show that the breaks frequently coincide, or are close to, changes in housing policy. However, many of the changes in housing policy frequently cited in the literature do not necessarily result in structural breaks. It is argued that this may be due to policy changes not resulting in major

structural changes or that their impact may have been mitigated by other events or policies.

The paper is structured as follows. In the next section, we briefly characterise the European housing market, with a special emphasis on the rental and house ownership market, mortgage market and tax system. In section 3 we utilise cluster analysis to group the markets based upon their institutional characteristics. The fourth section of the paper contains the findings from the analysis of structural breaks. Finally, Section 5 provides concluding comments.

2. EU Housing Markets

2.1. EU Rental Markets

Across the EU-15 the proportion of total housing stock that is rented varies quite considerably. As displayed in Table 1 the percentage of rented stock ranges from 12% to 58%. A variety of factors potentially influence the relative importance of the rental sector, including the tax-subsidy system; regulation in the rental sector; the provision of *social* rental accommodation and the regulation and the structure of financial markets. In addition, preference for home ownership and expectations for capital gains from house price appreciation may also influence the degree of rented stock, specifically in a downward direction (ECB, 2003). The result of such factors, both supply and demand based, has been that the role of the rental market is relatively marginal in some European countries, such as Spain. Indeed, with the exception of Germany, across the entire EU-15 the highest proportion of housing stock that can be categorised as privately rented is 26% for Denmark and Luxembourg. The rental market can act as a regulating valve, attenuating extreme house price appreciation (DiPasquale & Wheaton, 1992). In contrast, countries such as Spain, Ireland, U.K. and Finland, with a higher percentage of home ownership and low levels of private rental housing, may experience heightened house price volatility.

Insert Table 1

EU governments have frequently acted in response to the reduction in the size, and quality of the market for rented dwellings. This response has often been in the

context of relaxation in rent regulations. There are three fundamental aspects in rent control systems (ECB 2003):

- (i) The existence of regulations governing how the initial rent in a multi-year rental contract will change in the future. In many countries the rent is indexed to CPI (Consumer Price Index). However, in countries such as Germany there is a mechanism that allows the adjustment of rents to recent housing market conditions.
- (ii) The existence of some type of control on the initial rent negotiated for a new rental contract between a landlord and a tenant. If rents in new contracts should reflect market conditions on the passage from the first to the “second generation”
- (iii) The existence of regulations governing contracts termination (eviction).

These elements are considered in the preparation of the index presented in Table 2 on the typology of property laws: pro-landlord, pro-tenant or neutral law³. The table shows that in most EU countries the law is strongly pro-tenant. The exceptions are the U.K. where the law is pro-landlord and Finland and Greece where property law is neutral, i.e. the index shows a value of zero.

2.2. EU Mortgage Markets

A wide number of papers including, Tsatsaronis & Zhu (2004), Calza *et al.* (2007) and Miles & Pillonca (2008), note the existence of significant differences in mortgage market institutional characteristics across EU-countries. Tsatsaronis & Zhu (2004) classify countries into three groups based on institutional characteristics and illustrate that the interaction between bank lending and house prices are affected by these features. Key factors that can be used to differentiate markets include:

- (i) *Interest-Rate Structure*: In particular whether fixed or variable rate mortgage products dominate. Variable rates may make housing prices more sensitive to changes in short-term rates and thus to monetary policy.
- (ii) *Mortgage Equity Withdrawal*: The ability of liquidity-constrained agents to take advantage of built up increased collateral value.

- (iii) *Valuation and Leverage Practices*: These elements aid in the evaluation of risk and indicate the degree of prudence maintained in mortgage lending. This in turn influences creditors' appetite for exposure to the market and the strength of the credit channel. Important parameters in this respect are the existence and level of prudential ceilings on the loan-to-value (LTV) ratios that determine the ability of banks to lend against real estate collateral, and the valuation methods of property used in conjunction with these ceilings. Methods that base lending decisions on current market value of property would tend to increase the sensitivity of credit availability to market conditions and could possibly help to create a positive momentum in market demand.
- (iv) *Depth of the Securitisation Market*: The availability of a securitised mortgage market facilitates the accompanying advantages and disadvantages.
- (v) *Transaction Costs*: Transaction costs (e.g. registration fees, agents' commissions, legal fees and sale/transfer taxes) also contribute to differences in house price volatility.

Insert Table 2

Papers such as MacLennan *et al.* (1998) argue countries with high transaction costs, low leverage ratios, low weight of house ownership and a high proportion of fixed-rate mortgages, tend to experience lower volatility, a lower effect of house prices on consumption and a reduced role of housing in the transmission mechanism of interest rate. MacLennan *et al.* (1998) also notes how the degree of housing finance integration in the capital markets is an important factor in obtaining funds by financial institutions. Warnock & Warnock (2008) highlight the importance of the mortgage market in generating demand for housing assets. Given the relative size of the asset it follows that factors that are associated with a well-functioning housing finance system are those that enable the provision of long-term finance. In a cross-sectional analysis for 62 countries between 2001 and 2005, the authors find that countries with stronger legal rights for borrowers and lenders (through collateral and bankruptcy laws), deeper credit information systems, and a more stable macroeconomic environment, have deeper housing financial systems. In their study Legal Rights⁴ and Credit Information⁵ variables are obtained from the "Getting Credit" reports of the World Bank⁶. The

importance of the legal environment and investor protection are also emphasized by Lieser & Groh (2010). The authors find that *Investor Protection and Legal Framework* is only second in importance, behind *Economic Activity*, in their composite index of real estate investment attractiveness⁷. Sorensen & Lichtenberger (2007) report that country-specific factors such as institutional differences that are difficult to measure over time play an important role in explaining the differences in mortgage interest rates. The authors emphasize the importance of the national legal framework procedure to enforce the collateral, the LTV ratios and fiscal factors, in explaining the differences in interest rates across EU countries. The expected cost of anticipated losses depends not only on the probability of default but also on the cost of the event itself. While the probability of default is influenced by many factors (e.g. position in the business cycle, income prospects, etc.), the cost of the event itself is also determined by the national legal framework and, in particular, by the cost and duration of the procedure to enforce the collateral. When some of these costs, such as time and resources, are borne by the creditor, banks may include them ex ante into their lending rates.

2.3. EU Tax Systems

The potential role that tax incentives can play, especially in the context of stimulating demand is well documented (e.g. Van den Noord, 2003). A tax system that contains generous incentives to house ownership may not only result in a higher steady-state level of house prices (and an associated misallocation of resources), but also in greater volatility of house prices. Poterba (1984, 1991) argues that house price volatility arises from the combination of the price-inelastic supply of newly built dwellings and the preferential tax treatment of owner-occupied housing. Based on the framework developed by Poterba, Van den Noord (2003) argues that the apparent divide between large and small countries in the Eurozone appears to be related in part to the differences in tax treatment in owner-occupied housing. Income tax systems in the smaller Eurozone countries tend to be more conducive to volatile house prices and this may have been interacting with the generally higher inflation rates (and hence lower real interest rates) observed in these countries since the advent of the common currency.

Wolswijk (2006) analyses the effects on mortgage debt growth in the EU of fiscal instruments. He argues that empirical research on mortgage debt has largely

ignored the role of fiscal instruments affecting housing markets and mortgage credit. In particular, fiscal measures may affect housing-related decisions via the taxation of imputed rents on own houses, the deductibility of mortgage interest payments from income tax, and capital gains taxes on the revenue of selling house⁸. Sorensen & Lichtenberger (2007) use the tax wedge computed by Van den Noord (2003) to measure the effects of fiscal factors on mortgage interest rates and find evidence that fiscal factors affect mortgage interest rates. Tax wedge values are presented in Table 3. The wedge measures the difference between after-tax and pre-tax mortgage interest rates, taking into account any deductibility of mortgage interest payments from taxable income, tax credits, and taxation of imputed income from owner-occupied housing. As can be seen from Table 3, in most countries a negative tax wedge is found, indicating that the tax system provides a subsidy.

Insert Table 3

3. Institutional Characteristics: Cluster Analysis

In this section of the paper we use cluster analysis to form groups of countries that are broadly homogeneous with respect to the institutional characteristics of their housing market, mortgage market and tax system. More specifically, we assign categorical numerical variables to each of those characteristics and use a statistical clustering algorithm, which determines the groups based on maximising the commonality of characteristics for countries within each group and maximising the differences between countries that belong to different groups. The selection of variables to be included in the analysis is crucial because poor results can derive from misleading or exclusion of important variables. The initial choice of variables determines the institutional characteristics that will be used to identify the groups of countries. Table 4 presents the variables included in the formation of groups.

Insert Table 4

Cluster analysis is a particularly appropriate procedure when there is a suspicion that the sample is not homogeneous. The estimations were obtained using the *Ward* method, based on the square of the Euclidean distance, to the indicated variables and for

the EU countries⁹. Figure 1 and Table 5 show the dendrogram obtained based on the Ward method and the partition of countries in different groups, respectively¹⁰. The analysis results in five groups of countries comprised as follows:

- Group / Cluster I: Germany and Austria;
- Group / Cluster II: Italy and Greece;
- Group / Cluster III: Belgium, France, Luxembourg, Netherlands and Portugal;
- Group / Cluster IV: Denmark, Finland and Sweden;
- Group / Cluster V: Spain, Ireland and U.K.

Insert Figure 1

Insert Tables 5 & 6

In order to consider whether these characteristics relate to the dynamics of the house prices in each market, Table 6 reports the average real rate of house price appreciation for each of the markets. In addition, Table 7 and Figure 2 detail the institutional characteristics across the different markets. The clusters formed by Greece and Italy and Germany and Austria have features of outliers insofar as always appear in single clusters. The cluster formed by Italy and Greece is characterized by the existence of important legal and institutional barriers to the use of housing as collateral. This is most evident in Italy, where possession proceedings by a mortgage lender to obtain the title to the property of a borrower in default can take up to 6 years¹¹. These legal difficulties appear to be associated with a general lack of competition and efficiency in the Italian legal system, and perhaps also with lack of rationalisation in the system of land title registration. This is corroborated by the legal rights index, which shows that it is in these two countries where lenders are protected the least. The Austria and Germany cluster is categorised not only by a low rate of owner-occupation but also in that mortgage equity extraction is extremely low, transaction costs are high and banks' lending practises (as measured by relatively low LTVs, use of fixed-rate mortgages and the use of historical property valuation) are more conservative than in the majority of

countries. In addition, securitisation in its purest form when transfer of ownership is involved is almost non-existent.

It can be seen from Table 6 that Austria and Germany are the only two countries to have had negative real house price over the 1997-2006 period. This is consistent with the premise that countries with large rental market, such as Austria and Germany, are less likely to have volatile house prices (e.g. MacLennan *et al.*, 1998). These findings are in stark contrast to those reported with respect to the fourth and fifth clusters. The fourth cluster is comprised of the Scandinavian countries (Denmark, Sweden and Finland), whilst the fifth contains Ireland, Spain and the U.K. Both of these clusters have a number of share characteristics including; ability to extract equity, greater development in securitisation, a generous tax system and lending practices that can be characterised as more “aggressive”. In addition, in both groups the market value method, high LTV ratios and floating-rate debt is most popular and the protection of legal rights of lenders and borrowers and the information system about credit risk of potential borrowers are well developed. The main attribute that distinguishes groups IV and V is the weight of house ownership and rental market¹². The adoption of less conservative lending practices by banks associated with a generous tax system, may lead to greater volatility in housing prices. For Spain, the U.K. and Ireland these factors, linked to a small rental market, may contribute to enhanced volatility in house prices. These institutional characteristics may aid in explaining why these three countries display the highest rate of real house price appreciation across the EU-15 over the decade from 1997 to 2006. The final grouping is the cluster formed by the Netherlands, Portugal and the francophone axis (France, Belgium and Luxembourg). In contrast to the previous group this group have more conservative bank lending practises. These markets also have both a higher proportion of home ownership and private rented accommodation than the EU-15 average. This offsetting effect, due to a smaller than average public rented sector, may explain why these countries have a lower rate of real house price appreciation in comparison to Clusters IV and V.

Insert Table 7

Insert Figure 2

4. Regime Changes in EU-15 Housing Markets

The second component of this paper is to test for the presence of structural breaks in the housing markets in the EU-15 and to consider whether any breaks identified can be linked with changes in policy. We consider possible breaks in both the rate of growth in real house prices (*iph*) and real user cost (*ruc*). To test for possible breaks we adopt the Bai & Perron (1998, 2001, 2003) framework to detect multiple structural breaks. Following the approach used in previous papers (e.g. Caporale & Grier, 2000; Bai & Perron, 2003; Rapach & Wohar, 2005) we regress each previous series on a constant and test for structural breaks in the constant. Consider such a regression model with m breaks ($m + 1$ regimes):

$$r_t = \beta_j + \varepsilon_t, t = T_{j-1}, \dots, T_j, \quad (1)$$

for $j = 1, \dots, m+1$, where r_t are *iph* and *ruc* series in period t and β_j ($j=1, \dots, m+1$) is the mean of *iph* and *ruc* in the j th regime. The m -partition, (T_1, \dots, T_m) , represents the breakpoints for the different regimes (by convention, $T_0=0$ and $T_{m+1}=T$). Bai & Perron (1998) explicitly treat these breakpoints as unknown, and estimates of the breakpoints are obtained using the least-squares method. Consider the estimation of Equation (1) via OLS. For each m -partition, (T_1, \dots, T_m) the least-squares estimates of β_j are obtained by minimizing the sum of squared residuals:

$$S_T(T_1, \dots, T_m) = \sum_{j=1}^{m+1} \sum_{t=T_{j-1}+1}^{T_j} (r_t - \beta_j)^2 \quad (2)$$

where, S_T represent the sum of squared residuals in m -partition. The regression coefficient estimates based on a given m -partition, (T_1, \dots, T_m) are denoted by $\hat{\beta}(\{T_1, \dots, T_m\})$, where $\beta = (\beta_1, \dots, \beta_{m+1})'$. Substituting these into Equation (2), the estimated breakpoints are given by:

$$(\hat{T}_1, \dots, \hat{T}_m) = \arg \min_{T_1, \dots, T_m} S_T(T_1, \dots, T_m), \quad (3)$$

The set of admissible m -partitions is subject to a set of restrictions. These restrictions will be discussed in depth shortly. It is clear from Equation (3) that the breakpoint estimators correspond to the global minimum of the sum of squared residuals objective function. After estimating the breakpoint, it is straightforward to compute the corresponding least-squares regression parameter estimates as $\hat{\beta} = \hat{\beta}(\{\widehat{T}_1, \dots, \widehat{T}_m\})$. Bai & Perron (2001) develop an efficient algorithm for the minimisation problem in Equation (3) based on the principle of dynamic programming.

Bai and Perron (1998) consider testing procedures aimed at identifying the number of structural breaks (m) in Equation (1). The authors begin by describing a statistic to test the null hypothesis of no structural breaks against the alternative hypothesis that there are $m=b$ breaks. Let (T_1, \dots, T_b) be a partition such that $T_i = [T\lambda_i]$ ($i=1, \dots, b$). Also, define R such that $(R\beta)' = (\beta_1 - \beta_2, \dots, \beta_b - \beta_{b+1})$. Bai & Perron (1998) specify the following statistic test:

$$F_T(\lambda_1, \dots, \lambda_b) = \frac{1}{T} \left(\frac{T-(b+1)^2}{2b} \right) \hat{\beta}' R' [R\hat{V}(\hat{\beta})R']^{-1} R\hat{\beta}, \quad (4)$$

where $\hat{\beta} = (\widehat{\beta}_1, \dots, \widehat{\beta}_{b+1})'$ is a vector of regression coefficient estimates, and $\hat{V}(\hat{\beta})$ is a heteroskedastic and autocorrelation consistent estimate of the variance-covariance matrix for $\hat{\beta}$. Bai & Perron (1998) next consider a type of maximum F -statistic corresponding to Equation (4):

$$SupF_T(b) = F_T(\widehat{\lambda}_1, \dots, \widehat{\lambda}_b), \quad (5)$$

where $\widehat{\lambda}_1, \dots, \widehat{\lambda}_b$ minimize the global sum of squared residuals, $S_T(T\lambda_1, \dots, T\lambda_b)$, under the restriction that $(\widehat{\lambda}_1, \dots, \widehat{\lambda}_b) \in \Lambda\xi$, where $\Lambda\xi = \{(\lambda_1, \dots, \lambda_b); |\lambda_{i+1} - \lambda_i| \geq \xi, \lambda_1 \geq \xi, \lambda_b \leq 1 - \xi\}$ for some arbitrary positive number, ξ (the trimming parameter). Bai & Perron (1998) develop two statistics, what they call the “*double maximum*” statistics, to test the null hypothesis of no structural breaks against the alternative

hypothesis of an unknown number of breaks given an upper bound, M . The first “*double maximum*” statistic is given by:

$$UD_{max} = \max_{1 \leq m \leq M} SupF_T(m). \quad (6)$$

The second “*double maximum*” statistic, WD_{Max} , applies different weights to the individual $SupF_T(m)$ statistics so that the marginal *p-values* are equal across values of m (see Bai & Perron, 1998, page 59 for details). Finally Bai & Perron (1998) specify what they label the $SupF_T(l+1|l)$ statistic to test the null hypothesis of l breaks against the alternative hypothesis of $l+1$ breaks. The procedure begins with the global minimized sum of squared residuals for a model with l breaks. Each of the intervals defined by the l breaks is then analyzed for an additional break. From all of the intervals, the partition allowing for an additional break that results in the largest reduction in the sum of squared residuals is treated as the model with $l+1$ breaks. The $SupF_T(l+1|l)$ statistic is used to test whether the additional break leads to a significant reduction in the sum of squared residuals. Bai & Perron (1998, 2003) derive asymptotic distributions for the “*double maximum*” and $SupF_T(l+1|l)$ statistics and provide critical values for various values of ζ and M . Although the framework can be adapted to explicitly incorporate specific circumstances such as heteroscedasticity and autocorrelation in the residuals (Rapach & Wohar, 2005) we adopt the most general specifications that allows for all of these features.

Bai & Perron (1998) discuss a sequential application of the $SupF_T(l+1|l)$ statistics –a specific-to-general modeling strategy- as a way to determine the number of structural breaks. While Bai & Perron (2001) find that this procedure performs well in some settings, on the basis of Monte Carlo simulations, they recommend the following strategy to identify the number of breaks. First, examine the “*double maximum*” statistics to determine if any structural break is present. If the “*double maximum*” statistics are significant, then examine the sequence of $SupF_T(l+1|l)$ statistics to decide on the number of breaks. Bai & Perron (2001) recommend using a trimming parameter of least 0.15 (corresponding to $M=5$) when allowing for heteroskedasticity and serial correlation, and we follow this recommendation for our application.

The aforementioned tests are examined using both the growth rate in real house prices (*iph*) and real user cost (*ruc*). The choice of these two variables is due to the depth and availability of information, the degree of housing market representativeness and the fact that they tend to capture the impacts of policy changes on the housing market. The rationale behind considering the real user cost is that it allows for the possibility that mortgage interest payments are tax deductible¹³. Hort (1998) calculates the real user cost based on the following formula:

$$[(1-t_i)*i-\pi^e+t_h+\delta] \quad (7)$$

where t_i is the marginal rate of income tax, in each country, i is the interest rate on the interbank money market, π^e is the expected inflation rate, approximated by the arithmetic mean of the current inflation rate and the previous year inflation rate, t_h is the effective property tax rate and δ the property depreciation rate. The depreciation rate is estimated as suggested by Ott (2006) as:

$$\sigma_t = [GFCF_t - (NCS_t - NCS_{t-1})] / NCS_{t-1} \quad (8)$$

where *GFCF* and *NCS* refer to *Gross Fixed Capital Formation* and *Net Fixed Capital Stock* respectively. The sample is not balanced and the depth of each individual series depends on the information availability. The house price data was obtained from the Bank of International Settlements. For the remaining variables used, *inflation* is based on the respective *Consumer Price Index*, the *marginal rate of income tax* and *property tax* details are obtained from the OECD and the *GFCF* and *NCS* series were obtained from EUROSTAT and the European Mortgage Federation. For the interest rate series we use the appropriate 3 month interbank rate as obtained from the ECB. Hofmann (2001) for the Eurozone and Hofmann & Mizen (2004) for the U.K. show that interbank rates are good proxies of loan rates¹⁴.

Tables 8 and 9 present the results of structural breaks for each of the EU-15 countries. In the case of Germany, Denmark, Italy and Luxembourg “*double maximum*” statistics are not significant at conventional levels. For Spain, the Netherlands, Portugal

and Sweden there is only evidence of structural changes in one of the series. The $F(2|1)$ statistic shows statistical significance for the *iph* series' of Austria and Spain and the *ruc* series of both Finland and the Netherlands, whilst the $F(3|2)$ statistic is statistically insignificant. This therefore indicates that two structural breaks (three regimes) are present in the series of the countries mentioned. For Belgium, Greece, Ireland and U.K., the $F(1|0)$ statistic is statistical significant for both series, while the $F(2|1)$ statistic shows statistically insignificant. These results indicate the existence of one structural break (two regimes) for these countries. The same conclusion is obtained for the *ruc* series of Austria, Sweden and *iph* series of Finland and Portugal.

Insert Tables 8 & 9

Maclennan *et al.* (1998), ECB (2003) and Hilbers *et al.* (2008), among others, illustrate how policy changes may affect the housing market. Figure 3 illustrates some of the different channels (e.g. fiscal, prudential, monetary and structural policies) through which these effects may flow. Based on the policy changes identified in ECB (2003) and Wolswijk (2006), Table 10 presents a list of reforms that have taken place in the EU-15 since the mid-eighties. In turn, Table 11 presents the dates of the structural breaks in the two series and the 95% confidence intervals. Based on policy changes identified in ECB (2003) and Wolswijk (2006) a number of the structural break dates are relatively close to points in time when there were changes in policy in housing, mortgage financing or tax. As can be seen from Table 11 a majority of the policy changes identified can be associated structural regime changes in the housing market. The Bai & Perron (1998, 2001 and 2003) methodology, which is based on “a purely data-driven procedure” in the selection of structural breaks dates, seems to confirm the existence of a linkage between policy changes and structural changes on housing market series.

Insert Figure 3

Insert Tables 10 & 11

It should however be noted that not all policy changes have resulted in structural breaks on housing market series. As is clear from Figure 3, the housing prices developments is the result of a number of factors, and the effects of a particular policy does not produce always the desired effects by the authorities because some of them are

mitigated by adverse effects caused by other policies. The reasons why reform measures may not have caused a structural break can be attributed to a combination of factors: (1) a lack of coverage in the series analysed during the emergence of these reforms, (2) some of these reform measures may result in a lagged effect, in temporal terms, (3) the possible existence of a mismatch between the objectives of the legislator/regulator and the practical results of implemented policy, which can lead that final objectives pursued by the reform measure be far short of the intended¹⁵ and (4) the authorities desired effects may arise mitigated by adverse effects caused by other policies.

5. Conclusion

This study contributes to the housing literature in two ways: firstly, by studying the importance of institutional characteristics associated to rental and home ownership market, financial mortgage market and tax system in house prices behaviour and secondly, through the endogenous determination of structural breaks in the housing market across the EU countries. We develop an analysis of clusters which reveals significant differences in terms of institutional characteristics across the EU-15 countries. Five clusters emerge. The cluster formed by Spain, Ireland and the United Kingdom, with a less conservative mortgage credit system, a sparse rental market and a generous fiscal system. This is not particularly surprising given the high house price appreciation observed prior to 2007 in these countries. On the other extreme, a second cluster characterized by conservative mortgage credit system, a large rental market and a less generous fiscal system is formed by Germany and Austria. In contrast to the aforementioned cluster these countries have negative house prices growth.

The second key aim of this study is the determination of endogenous structural breaks for two series relating to the EU-15 housing markets. The fact that many of the structural breaks dates are quite close to finance mortgage market, tax system and/or rental and house ownership market policy changes suggests that the breaks have a policy change cause and that countries have changed policies concurrently. The results also show that not all policy changes have resulted in structural breaks. This situation can be explained by the fact that not all policy reforms have been structural for housing market or have been mitigated by adverse effects caused by other policies. In this way

further studies on house prices determinants should take account the institutional characteristics differences across EU countries and the regime changes in housing markets, for there is not the risk of obtaining biased results.

References

- [1] Adams, Zeno e Füss, Roland, 2010, “Macroeconomic Determinants of International Housing Markets”, *Journal of Housing Economics*, 19: 38-50.
- [2] Bai, Jushan and Perron, Pierre, 1998, “Estimating and Testing Linear Models with Multiple Structural Changes”, *Econometrica*, 66 (1): 47-68.
- [3] Bai, Jushan and Perron, Pierre, 2001, “Multiple Structural Change Models: A Simulation Analysis”, *Econometric Theory and Practice: Frontiers of Analysis and Applied Research*, 212-237.
- [4] Bai, Jushan and Perron, Pierre, 2003, “Computation and Analysis of Multiple Structural Change Models”, *Journal of Applied Econometrics*, 18: 1-22.
- [5] Calza, Alessandro, Monacelli, Tommaso and Stracca, Livio, 2007, “Mortgage Markets, Collateral Constraints, and Monetary Policy: Do Institutional Factors Matter?”, *CEPR Discussion Paper n.º DP6231*, April.
- [6] Campbell, John and Cocco, João, 2007, “How Do Home Prices Affect Consumption? Evidence From Micro Data”, *Journal of Monetary Economics*, 54 (3): 591-621.
- [7] Caporale, Tony and Grier, Kevin, 2000, “Political Regime Change and the Real Interest Rate”, *Journal of Money, Credit and Banking*, 32 (3): 320-334.
- [8] DiPasquale, Denise e Wheaton, William, 1992, “The Markets for Real Estate Assets and Space: a Conceptual Framework”, *American Real Estate and Urban Association Journal*, 20 (1): 161-180.
- [9] Englund, Peter e Ioannides, Yannis, 1997, “House Price Dynamics: An International Empirical Perspective”, *Journal of Housing Economics*, 6: 119-136.
- [10] European Central Bank, 2003, “Structural Factors in the EU Housing Markets”, *ECB*, March, 2003 (<http://www.ecb.int/pub/pdf/other/euhousingmarketsen.pdf>).
- [11] Giuliodori, Massimo, 2005, “The Role of House Prices in the Monetary Transmission Mechanism Across European Countries”, *Scottish Journal of Political Economy*, 52 (4): 519-543.
- [12] Guiso, Luigi, Jappelli, Tullio and Terlizzese, Daniele, 1992, “Saving and Capital Market Imperfections: The Italian Experience”, *Scandinavian Journal of Economics*, 94 (2): 197-213.

- [13] Hilbers, Paul, Hoffmaister, Alexander, Banerji, Angana and Shi, Haiyan, 2008, "House Price Developments in Europe: A Comparison", *International Monetary Fund*, *wp/08/211*:1-64.
- [14] Hofmann, Boris, 2001, "The Pass-Through of Money Market Rates to Loans Rates in the Euro-Area", *ZEI, University of Bonn*, *mimeo*.
- [15] Hofmann, Boris and Mizen, Paul, 2004, "Interest Rate Pass-Through and Monetary Transmission: Evidence From Individual Financial Institutions' Retail Rates", *Economica*, 71 (281): 99-123.
- [16] Holmans, Alan, 1994, "House Prices, Land Prices, the Housing Market and House Purchase Debt in the U.K. and Other Countries", *Economic Modelling*, 11(2): 157–99.
- [17] Hort, Katinka, 1998, "The Determinants of Urban House Price Fluctuations in Sweden 1968-1994", *Journal of Housing Economics*, 7: 93-120.
- [18] Iacoviello, Matteo, 2000. "House Prices and the Macroeconomy in Europe: Results from a Structural VAR Analysis", *European Central Bank (ECB)*, *working paper n°. 18*, April.
- [19] Lieser, Karsten and Groh, Alexander, 2010, "The Attractiveness of 66 Countries for Institutional Real Estate Investments: A Composite Index Approach", *working paper*, July 10, 2010 (http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1638286)
- [20] Maclennan, Duncan, Muellbauer, John and Stephens, Mark, 1998, "Asymmetries in Housing and Financial Market Institutions and EMU", *Oxford Review of Economic Policy*, 14 (3): 54-80.
- [21] Martins, António, Serra, Ana, Martins, Francisco and Stevenson, Simon, 2014, "Residential Property Loans and Bank Performance during Property Price Booms: Evidence from Europe", *working paper*, *School of Real Estate & Planning, University of Reading*.
- [22] McCrone, Gavin and Stephens, Mark, 1995, *Housing Policy in Britain and Europe*, London, UCL Press.
- [23] Miles, David and Pillonca, Vladimir, 2008, "Financial Innovation and European Housing and Mortgage Markets", *Oxford Review of Economic Policy*, 24 (1): 145-175.
- [24] Muellbauer, John and Murphy, Anthony, 2008, "Housing Markets and the Economy: the Assessment", *Oxford Review of Economic Policy*, 24 (1): 1-33.

- [25] Ott, Hervé, 2007, “Are Euro Area House Prices Overvalued? An Asset Pricing Approach”, *In Three Empirical Essays on House Prices in the Euro Area* (Doctoral dissertation at University of Munich) and available at (http://edoc.ub.uni-muenchen.de/6800/1/Ott_Herve.pdf).
- [26] Poterba, James, 1984, “Tax Subsidies to Owner-Occupied Housing: An Asset-Market Approach”, *Quarterly Journal of Economics*, 99 (4): 729-752.
- [27] Poterba, James, 1991, “House Price Dynamics: The Role of Tax Policy and Demography”, *Brooking Papers on Economic Activity*, 1/1991: 143-203.
- [28] Rapach, David and Wohar, Mark, 2005, “Regime Changes in International Real Interest Rates: Are They a Monetary Phenomenon?”, *Journal of Money, Credit and Banking*, 37 (5): 887-906.
- [29] Sorensen, Christoffer and Lichtenberger, Jung-Duk, 2007, “Mortgage Interest Rate Dispersion in the Euro Area”, *European Central Bank, working paper n.º 733*, February.
- [30] Tsatsaronis, Kostas and Zhu, Haibin, 2004, “What Drives Housing Price Dynamics: Cross Country Evidence” *BIS Quarterly Review*, March.
- [31] Van den Noord, Paul, 2003, “Tax Incentives and House Price Volatility in the Euro Area: Theory and Evidence”, *OECD Economics Department, working paper n.º 356*.
- [32] Warnock, Veronica and Warnock, Francis, 2008, “Markets and Housing Finance”, *Journal of Housing Economics*, 17 (3): 239-251.
- [33] Wolswijk, Guido, 2006, “Determinants of Mortgage Debt Growth in EU Countries”, *European Journal of Housing Policy*, 6, (2): 131-149.

Table 1: EU-15 Rental Market and House Ownership

The table shows the weight of house ownership, social rented market and private rented market and other types of accommodation, as a percentage of the total dwelling stock, for the EU-15 countries. The values refer to 2007 and were obtained from Global Property website (www.globalpropertyguide.com) and European Mortgage Federation (*Hypostat 2008 - A Review of Europe's Mortgage and Housing Markets, November*). In the last column comes the legal rights index of landlords and tenants. This index gives the amount of control the landlord has over his property, measured on a five-point rating scale: strongly pro-landlord = 2; pro-landlord = 1; neutral = 0; pro-tenant = -1 and strongly pro-tenant = -2. This index is available on the website of Global Property (*Global Property Guide's Landlord and Tenant Rating System*).

Country	Owner Occupied (%)	Social Rented (%)	Private Rented (%)	Other (%)	Landlord and Tenant Rating System
Austria	54	20	18	7	-1
Belgium	68	7	23	2	-1
Denmark	52	20	26	2	-2
Finland	57	17	16	10	0
France	54	21	17	8	-2
Germany	42	10	48	0	-1
Greece	81	0	16	3	0
Ireland	77	9	9	5	-1
Italy	68	6	18	8	-1
Luxembourg	70	0	26	4	-2
Netherlands	54	35	11	0	-1
Portugal	76	3	21	0	-1
Spain	82	2	10	6	-2
Sweden	39	22	22	17	-2
United Kingdom	67	23	10	0	1
EU – 15	62.8	13.0	19.4	4.8	-

Table 2: Characteristics of Mortgage Markets in EU-15

The table shows five different characteristics of mortgage market: the interest rate prevailing in the mortgage market (fixed or variable), the possibility of equity extraction (*mortgage equity withdrawal*), the maximum loan-to-value (LTV) ratio, the property valuation method and the depth of the securitization market, respectively. The values were obtained from the European Mortgage Federation.

¹F = Fixed mortgage rates (fixed mortgage rate for more than 5 years or at the end of maturity); V = Variable mortgage rates (after one year, the mortgage rate is renegotiable) or mixed (fixed rate for more than one year to 5 years). The classification is based on the majority of mortgage loans. ²ML = Mortgage Lending Value; OM = Open Market Value. ³Y = Yes and N = No. ⁴Securitisation was introduced at certain stage but remained very limited. ⁵N = Nonexistence of a legal limit on the LTV ratio. ⁶The maximum LTV is 80%, but tends to be reduced the loans leverage. Guiso *et al.* (1992) report for example, that in Italy possession proceedings by a mortgage lender to obtain the title to the property of a borrower in default can take up to 6 years, for what the banks tend to provide customers with a lower leverage, which translates into reduced LTV ratios.

Country	Interest Rate Adjustment ¹	Mortgage Equity Withdrawal ³	Maximum LTV ratio (%) ⁵	Valuation Method ²	Securitization (Mortgage-baked)
Austria	F	N	80-100	ML	N ⁴
Belgium	F	N	N	OM	N ⁴
Denmark	F	Y	80	ML	N
Finland	V	Y	N	OM	N ⁴
France	F	N	80	OM	N ⁴
Germany	F	N	80	ML	N ⁴
Greece	V	Y	N	OM	N ⁴
Ireland	V	Y	N	OM	Y
Italy	F	N	80-100 ⁶	OM	Y
Luxembourg	V	N	N	OM	N ⁴
Netherlands	F	Y	N	OM	Y
Portugal	V	N	N	OM	Y
Spain	V	Y	80	OM	Y
Sweden	V	Y	N	OM	N ⁴
United Kingdom	V	Y	N	OM	Y

Table 3: Others Institutional Characteristics of Housing Market

The table presents the “typical” duration of enforcement procedure (in months); the usual length of mortgage contracts (in years); the estimated average value of loan-to-value (LTV) ratio and the value of the Tax Wedge (difference between after-tax and pre-tax mortgage interest rates, taking into account deductibility of mortgage interest payments from taxable income, tax credits, and taxation of imputed income from owner-occupied housing), respectively for the EU-15. The values were obtained from the European Mortgage Federation, except the Tax Wedge, whose values were calculated by the authors based on the study of Van den Noord (2003) and information collected from the International Bureau of Fiscal Documentation (2008).

¹ “Typical Duration (in months) of a forced sale procedure (without incident)” - European Mortgage Federation (2007).

Country	Typical Duration of a forced sale procedure ¹ (months)	Usual Length of Mortgage Contracts (years)	Estimated Average Value of LTV ratio (%)	Tax Wedge
Austria	6	25	60	-0.56
Belgium	18	20	80-85	0
Denmark	6	30	80	-0.69
Finland	2-3	15-20	75-80	-0.90
France	8-18	15-20	78	0
Germany	6-12	20-30	67	0
Greece	3-24	15	55	1.58
Ireland	18-24	20	80	-0.94
Italy	60-84	5-20	55	-0.53
Luxembourg	5	20-25	80	-0.96
Netherlands	4-6	30	87	-2.03
Portugal	18-30	25-30	83	-0.23
Spain	7-9	15-20	70	-0.93
Sweden	4-6	30-45	80-95	-1.26
United Kingdom	8-12	25	69	0

Table 4: List of Institutional Characteristics Used in the Formation of Clusters

The following table shows the list of institutional characteristics used in the formation of clusters, divided by three areas of analysis: the rental and house ownership market, financial mortgage market and tax system. For each different institutional feature we present the variable definition, a summary of papers highlighting its importance and its source. ¹Use of dummy variables in the formation of cluster.

Variable	Authors	Definition/Importance	Source
Rental and House Ownership Market			
Landlord and Tenant Rating System	ECB (2003) Maclennan <i>et al.</i> (1998) Lieser and Groh (2010)	This index gives the amount of control the landlord has over his property, measured on a five-point rating scale: strongly pro-landlord = 2; pro-landlord = 1; neutral = 0; pro-tenant = -1 and strongly pro-tenant = -2.	Global Property (<i>Global Property Guide's Landlord and Rating System</i>)
Weight of Rental Market	ECB (2003) Maclennan <i>et al.</i> (1998)	Weight of Rental Market, as a percentage of the total dwelling stock.	European Mortgage Federation (<i>Hypostat Series</i>)
Weight of House Ownership Market	ECB (2003) Maclennan <i>et al.</i> (1998)	Weight of House Ownership Market, as a percentage of the total dwelling stock.	European Mortgage Federation (<i>Hypostat Series</i>)
Transaction Costs	ECB (2003) Maclennan <i>et al.</i> (1998) Lieser and Groh (2010)	Average value of house transaction costs (as a percentage of house value), including registration costs, real estate agents' commissions, legal fees and sale and transfer taxes.	European Mortgage Federation (<i>Study on Cost of Housing in Europe – Hypostat Series</i>)
Financial Mortgage Market			
Interest Rate Adjustment ¹	Tsatsaronis and Zhu (2004) Maclennan <i>et al.</i> (1998) Calza <i>et al.</i> (2007)	The interest rate prevailing in the mortgage market: 1 = Fixed mortgage rates (fixed mortgage rate for more than 5 years or at the end of maturity); 0 = Variable mortgage rates (after one year, the mortgage rate is renegotiable) or mixed (fixed rate for more than one year to 5 years). The classification is based on the majority of mortgage loans.	European Mortgage Federation (<i>Study on Interest Rate Variability in Europe– Hypostat Series</i>)
Securitization ¹	Tsatsaronis and Zhu (2004) Calza <i>et al.</i> (2007)	Existence and depth of the securitization market. 1 = Nonexistence of securitization or proves to be very limited, 0 = otherwise.	European Mortgage Federation (<i>Study on the Efficiency of the Mortgage Collateral in the European Union– Hypostat Series</i>)
Mortgage Equity Withdrawal ¹	Tsatsaronis and Zhu (2004) Calza <i>et al.</i> (2007)	Possibility of Equity Extraction ("Mortgage Equity withdrawal"). If liquidity-constrained agents could adjust their net borrowing positions or to refinance the terms of their existing mortgages according to the changed conditions. 0 = nonused or reduced use. 1 = used.	European Mortgage Federation (<i>The Valuation of Property for Lending Purposes– Hypostat Series</i>)
Property Valuation Method ¹	Tsatsaronis and Zhu (2004)	Usual Property Valuation Method: Mortgage Lending Value or Open Market Value. 0 = open market value; 1 = mortgage lending value.	European Mortgage Federation (<i>The Valuation of Property for Lending Purposes– Hypostat Series</i>)
Weight of Real Estate Investment Funds	Warnock and Warnock (2008)	Weight of Real Estate Investment Funds in Investment Funds Sector.	EFAMA (Trends in European Investment Funds)

Table 4: List of Institutional Characteristics Used in the Formation of Clusters (continuation)

Variable	Authors	Definition/Importance	Source
Financial Mortgage Market			
LTV Ratio	Tsatsaronis and Zhu (2004) Sorensen and Lichtenberger (2007) Calza <i>et al.</i> (2007)	Estimated average value of loan-to-value (LTV) ratio.	European Mortgage Federation (<i>Study on Cost of Housing in Europe – Hypostat Series</i>)
Credit Info Index	Warnock and Warnock (2008) Lieser and Groh (2010)	Credit Info index measures the depth of credit information about potential borrowers that lenders access from standardized and informative sources of credit information. The index ranges from 0 to 6, with higher values indicating the availability of more credit information.	World Bank (<i>Doing Business Database</i>)
Legal Rights for Borrowers and Lenders Index	Warnock and Warnock (2008) Lieser and Groh (2010)	Legal Rights for Borrowers and Lenders Index measures the strength of legal rights for borrowers and lenders. The index is composed of ten categories, seven of which pertain to collateral law and three pertain to bankruptcy law. A score 1 is assigned if each feature is present in the country, so that the <i>Legal Rights</i> index ranges from 0 to 10 with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit.	World Bank (<i>Doing Business Database</i>)
Typical Duration of Enforcement Procedure	Sorensen and Lichtenberger (2007) Lieser and Groh (2010)	Usual duration of the procedure to enforce the collateral by the lender, in the case of borrower default.	European Mortgage Federation (<i>Typical Duration of a forced sale procedure (without incident)</i>)
Tax System			
<i>Tax Wedge</i>	Van den Noord (2003)	<i>Tax wedge</i> measures the difference between after-tax and pre-tax mortgage interest rates, taking into account deductibility of mortgage interest payments from taxable income, tax credits, and taxation of imputed income from owner-occupied housing. The existence of a negative tax wedge indicates that the tax system provides a subsidy.	International Bureau of Fiscal Documentation (2008)
Tax on Imputed Rent	Maclennan <i>et al.</i> (1998) Wolswijk (2006)	Existence on tax system of Tax on Imputed Rent. (1 = No; 0 = Yes)	International Bureau of Fiscal Documentation (2008)
Deductibility of Mortgage Interest Payments [†]	Maclennan <i>et al.</i> (1998) Wolswijk (2006)	Possibility of deductibility of mortgage interest payments from taxable income. (1 = No; 0 = Yes)	International Bureau of Fiscal Documentation (2008)
Tax on Capital Gains	Maclennan <i>et al.</i> (1998) Wolswijk (2006)	Effective tax rate on capital gains, assuming the validity of the assumptions listed in note 14 of Table 7.	International Bureau of Fiscal Documentation (2008)

Table 5: Clusters

This table shows the clusters formed by the methods of the *farthest neighbour* and *Ward* based on 17 variables listed in Table 4, relating to the rental and house ownership market, financial mortgage market and tax system. Based on the dendrogram obtained we classify EU-15 countries into five groups on the basis of these characteristics. # denotes the number of countries groups/clusters.

	“Farthest Neighbour” Method				Ward Method			
	# Clusters				# Clusters			
	3	4	5	6	3	4	5	6
Germany	1	1	1	1	1	1	1	1
Austria	1	1	1	1	1	1	1	1
Belgium	2	2	2	2	2	2	2	2
Denmark	1	3	3	3	3	3	3	3
Spain	2	3	5	3	3	3	5	4
Finland	1	3	3	3	3	3	3	3
France	2	2	2	2	2	2	2	2
Greece	3	4	4	6	2	4	4	5
Netherlands	2	2	2	4	2	2	2	6
Ireland	2	3	5	3	3	3	5	4
Italy	3	4	4	6	2	4	4	5
Luxembourg	2	2	2	2	2	2	2	2
Portugal	2	2	2	4	2	2	2	6
United Kingdom	1	3	5	5	3	3	5	4
Sweden	1	3	3	3	3	3	3	3

Table 6: Real House Price Growth Rate (%)

This table shows the real house prices growth rate across EU-15 countries, for three different time periods: 1997 to 2001, 2002 to 2006 and from 1997 to 2006.

Country	Real House Price Growth Rate (%)		
	1997-2001	2002-2006	1997-2006
Austria	-18.14%	13.37%	-7.20%
Belgium	27.40%	55.47%	98.07%
Denmark	23.82%	56.03%	93.20%
Finland	19.00%	46.25%	74.04%
France	28.56%	63.57%	110.29%
Germany	-5.32%	-6.68%	-10.63%
Greece	28.33%	35.13%	73.40%
Ireland	65.41%	49.37%	147.07%
Italy	21.50%	32.02%	60.57%
Luxembourg	24.36%	39.57%	72.53%
Netherlands	58.89%	16.25%	84.71%
Portugal	15.32%	-7.06%	7.18%
Spain	27.25%	70.45%	116.90%
Sweden	38.76%	45.10%	101.33%
United Kingdom	51.62%	57.09%	138.19%
EU-15 (mean)	27.12%	37.73%	73.31

Source: Authors' construction using data from the Bank for International Settlements (BIS).

Table 7: Clusters: Average Values of Variables

This table presents the average values of the 17 variables listed in Table 5, relating to the rental and house ownership market, financial mortgage market and tax system, for each cluster formed. **Cluster I:** Germany and Austria. **Cluster II:** Italy and Greece. **Cluster III:** France, Belgium, Luxembourg, Netherlands and Portugal. **Cluster IV:** Sweden, Denmark and Finland. **Cluster V:** Ireland, United Kingdom and Spain.

Variable	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V
Financial Mortgage Market					
Average Loan-to-Value Ratio (%)	63.50	55.00	82.10	81.66	73.00
<i>Credit Information</i> ¹	6.00	4.50	3.40	4.33	5.66
<i>Legal Rights</i> ²	6.50	3.00	5.60	6.67	8.00
Interest Rate ³	1.00	0.50	0.60	0.33	0.00
<i>Mortgage Equity Withdrawal</i> ⁴	0.00	0.50	0.20	1.00	1.00
Securitization ⁵	1.00	0.50	0.60	1.00	0.00
Weight of Real Estate Investment Funds ⁶	4.18	3.07	10.12	0.00	1.83
Valuation Method ⁷	1.00	0.00	0.00	0.33	0.00
Enforcement Procedure ⁸	7.50	42.75	13.00	4.50	13.00
Rental and House Ownership Market					
Private Rent (%) ⁹	33.00	17.00	19.60	21.33	9.66
House Ownership (%) ⁹	48.00	74.50	64.40	49.33	75.33
Landlord and Tenant Rating System ¹⁰	-1.00	-0.50	-1.40	-1.33	-0.66
Transaction Costs (%) ¹¹	11.64	16.24	14.90	7.91	8.05
Fiscal System					
<i>Tax Wedge</i> ¹²	-0.28	0.53	-0.64	-0.95	-0.62
Deductibility of Mortgage Interest Payments From Taxable Income ¹³	0.50	0.00	0.20	0.00	0.33
Tax on Capital Gains ¹⁴	0.00	0.00	4.84	29.47	26.52
Tax on Imputed Rent ¹⁵	1.00	0.50	0.40	1.00	1.00

Table 8 – Bai and Perron (1998, 2003) Test Results: Real House Prices Growth Rate

The table presents the Bai and Perron (1998, 2003) statistics of multiple structural breaks in the mean of the real house prices growth rate (*iph*), across EU-15 countries. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. ^a One-sided (upper-tail) test of the null hypothesis of 0 breaks against the alternative hypothesis of an unknown number of the breaks given an upper bound of 5. ^b One-sided (upper-tail) test of the null hypothesis of 0 breaks against the alternative hypothesis of an unknown number of the breaks given an upper bound of 5. ^c One-sided (upper-tail) test of the null hypothesis of *l* breaks against the alternative hypothesis of *l+1* breaks; F(1\0), *l*=0; F(2\1), *l*=1; F(3\2), *l*=2. – indicates that there was no more place to insert an additional break given the minimal length requirement.

Country	UD _{max} ^a	WD _{max} (5%) ^b	F(1\0) ^c	F(2\1) ^c	F(3\2) ^c
Austria	17.18*	19.74**	17.18*	13.47**	4.36
Belgium	7.56***	11.79**	7.33***	2.37	--
Denmark	7.02	9.60	7.02	--	--
Finland	36.01*	51.83**	13.59*	6.24	--
France	5.53	9.23	5.53	--	--
Germany	6.28	9.46	6.28	--	--
Greece	9.14**	18.52**	8.80**	3.014	--
Ireland	24.62*	45.06**	8.11***	4.23	--
Italy	5.75	7.67	5.75	--	--
Luxembourg	5.50	7.41	5.50	--	--
Netherlands	6.68	9.40	6.68	--	--
Portugal	19.17*	30.36**	10.44**	7.02	--
Spain	22.90*	40.98**	22.90*	13.48**	7.20
Sweden	5.20	7.32	5.20	--	--
United Kingdom	16.65*	24.11**	16.65*	4.54	--

Table 9 – Bai and Perron (1998, 2003) Test Results: Real House User Cost Rate

The table presents the Bai and Perron (1998, 2003) statistics of multiple structural breaks in the mean of the real house user cost rate (*ruc*), across EU-15 countries. *, ** and *** indicate significance at the 10%, 5% and 1% levels, respectively. ^a One-sided (upper-tail) test of the null hypothesis of 0 breaks against the alternative hypothesis of an unknown number of the breaks given an upper bound of 5. ^b One-sided (upper-tail) test of the null hypothesis of 0 breaks against the alternative hypothesis of an unknown number of the breaks given an upper bound of 5. ^c One-sided (upper-tail) test of the null hypothesis of *l* breaks against the alternative hypothesis of *l+1* breaks; F(1\0), *l*=0; F(2\1), *l*=1; F(3\2), *l*=2. – indicates that there was no more place to insert an additional break given the minimal length requirement.

Country	UD _{max} ^a	WD _{max} (5%) ^b	F(1\0) ^c	F(2\1) ^c	F(3\2) ^c
Austria	38.14*	83.68**	7.66***	4.50	-
Belgium	30.28*	63.61**	7.99***	2.73	-
Denmark	4.16	7.66	4.16	-	-
Finland	18.71*	21.86**	18.71*	9.58***	9.57
France	3.09	4.22	4.22	-	-
Germany	4.62	9.55	4.62	-	-
Greece	24.40*	44.16**	15.03*	2.29	-
Ireland	34.55*	58.5**	21.73*	6.46	-
Italy	7.00	9.72	7.00	-	-
Luxembourg	3.76	5.86	3.76	-	-
Netherlands	36.99*	63.92**	15.33*	8.60***	8.60
Portugal	4.32	8.25	4.32	-	-
Spain	6.51	8.51	6.51	-	-
Sweden	168.62*	370.00**	20.30*	3.72	-
United Kingdom	31.68*	37.65**	16.13*	2.26	-

Table 10 – Major Reforms in the EU-15 Housing Markets

The table presents major housing tax and subsidies reforms in the house ownership and rental market and major financial deregulation measures in EU-15, starting in the 70's, which have not resulted in a break of the series analyzed . The list of these reforms is based ECB (2003) and Wolswijk (2006).

Country/Start of Series	Reform Measures
Germany (1975 Q4)	Interest rate deregulation in the 1970s. 1983: Introduction of upper limit of 30% in a three-year period on rent increases for sitting tenants; rent escalation clauses and rent contracts linked to a price index permitted. 1987: Abolishment of tax on imputed rent, end of interest deductibility, introduction of tax credit for redemption. 1996: Replacement of fiscal subsidies by non-fiscal subsidy. 2001: Upper limit on rent increases in a three-year period reduced to 20%. Period of giving notice for tenants reduced to three months.
Austria (1986 Q3)	1980: Liberalization of interest rates. 1981: Abolition of credit controls. 1994: "Indicative value rent system" introduced.
Belgium (1981 Q1)	1984: Rent increases linked to CPI. 1985-1987: Indexation temporarily suspended. 1987: Abandoning of interest setting for deposits. 1991: Freely negotiated new rental fixed term contracts introduced. 1992: Law permitting an introduction of variable interest rate loans ("referenced loans") and reducing the maximum early repayment fee. 1990s: Wave of mergers and privatizations in the banking sector.
Denmark (1972 Q1)	1982: Liberalization of mortgage contracts and interest rate setting. Early 1990s: Liberalization of mortgage contract terms and free access to withdrawal of net equity in house and flats. 1997: Adjustable rate loans introduced. 1998/99: Standard instead of marginal tax rate for interest deductibility. Imputed rent substituted by a property tax.
Spain (1987 Q1)	Early 1980s: Abolition of differences in the activities permitted for different types of banks. 1985: Freely negotiated rents in new agreements. 1992: Securitization of mortgage loans introduced. 1995: Minimum lease of five years (at tenant's option); CPI indexation. One-off updating of existing contracts (to be implemented over ten years).
Finland (1978 Q1)	1993: Substantial reduction of mortgage interest relief tax rate.
France (1980 Q2)	1984: Bank specialization requirements reduced. 1987: Elimination of credit controls. 1997: New contracts liberalised. 1997/98: Abolishment of mortgage interest tax relief. 1999: Reform of securitization of mortgage loans. 1999: Reduced limits on early repayment fees.

Table 10 – Major Reforms in the EU-15 Housing Markets (continuation)

Country/Start of Series	Reform Measures
Greece (1994 Q1)	1985-1992: Gradual liberalization of quantitative constraints, interest rates and other terms and conditions on housing loans. 1997: Freely negotiated rents in new contracts. Minimum duration of contracts of three years.
Netherlands (1976 Q4)	1980: Interest rate deregulation.
Ireland (1975 Q1 and 1978 Q1)	1984: Formal guidelines for bank lending to private sector ended. 1985: Interest rate deregulation. 1986: Elimination of credit controls. 1991-1999: Reductions in the primary liquidity ratio from 8% to 2%.
Italy (1988 Q2)	1983: Interest rate deregulation. 1983: Credit ceilings eliminated (and temporarily re-imposed in 1986 and 1987). 1990: Abolition of administrative controls on branching. 1992: Freely negotiated rents in new agreements. 1993: Introduction of municipal property tax. 1994: Separation of long-term and short-term credit institutions abolished. 1995: Increase of legally maximum LTV from 75% to 80% (can be raised to 100% if other guarantees are posted). 1998: Two types of “free” contracts: freely negotiated at the individual level at the start and contracts where yearly rent increases are collectively negotiated by landlords and tenants.
Luxembourg (1975 Q1)	1987: Increases in the rents of dwellings built before 10 September 1944 and clarification of the meaning of invested capital for those built after this date. 1990s: Increase in the amount of mortgage interest deductible from income taxes; Registration tax regime made more favourable.
Portugal (1988 Q1)	1981: Freely negotiated rent contracts for new tenancies introduced (but no indexation allowed in these contracts). 1983: Easing of entry restrictions in the banking and insurance sector. 1985: Mechanism of updating all rents with CPI; one-off updating of old contracts (but still remaining very distant to rents in new contracts). 1990: Possibility of setting a limit on the duration of rental contracts. 2006: New Urban Lease Act.
United Kingdom (1968 Q2 and 1973 Q1)	1980: Removal of credit controls. Banks permitted to lend mortgages. 1986: Building societies allowed expanding their lending business. 1987: Securitization introduced. 1988: Assured tenancy – eviction easier and initial rent and indexation negotiated.
Sweden (1986 Q1)	1983: Mortgage institutions freer to issue bonds for refinancing of old dwellings. 1985: Loan ceilings for banks abolished. 1986: Portfolio regulations on insurance companies dropped. 1991: Introduction of analytical income tax, reduction of tax rate for interest deduction, abolishment of tax on imputed rent, introduction of a property tax.

Table 11 – EU-15 Housing Market Structural Breaks and Policies Measures

Table 11 shows the number and dates of structural breaks for the mean of real house prices growth rate (*iph*) and real house user cost rate (*ruc*), across EU-15 countries. In the determination of regime changes is adopted the Bai and Perron (1998 and 2003) methodology. Based on this procedure are estimated the periods of breaks in house market series and their confidence intervals for a confidence level of 95%. The institutional factors (policies measures) that explain regime changes are obtained on the website www.globalpropertyguide.com, ECB (2003) and Wolswijk (2006). (+) And (-) indicates if on average house prices or interest rate increased (decreased) during the regime period.

Country	Series	Series Start	Breaks	Confidence Interval	Policies Measures
Germany	iph	1975 Q4	No		
	ruc	1975 Q4	No		
Austria	iph	1986 Q3	1992 Q2 (+)	[1987 Q1; 1994 Q4]	Prices in Vienna increased nearly 150% during this period, due to positive developments in Eastern Europe, increased immigration and the expansion of home ownership. Prudential reforms, capital requirements tightened and end of interest rate cartel. Beginning of privatization of state-owned banks. Partial liberalization of new tenancies.
			2001 Q4 (-)	[1999 Q3; 2003 Q3]	End of the immigration flow, reducing the optimism of economic agents and an over-supply in housing market.
	ruc	1986 Q3	1998 Q3 (-)	[1998 Q1; 2005 Q4]	Eurozone process adhesion.
Belgium	iph	1981 Q1	2003 Q1 (+)	[2001 Q1; 2007 Q2]	High Growth of Housing Market caused by increased competition among banks and by interest rate reduction.
	ruc	1981 Q1	2003 Q1 (-)	[2000 Q1; 2008 Q2]	Eurozone process adhesion.
Denmark	iph	1971 Q1	No		
	ruc	1972 Q1	No		
Spain	iph	1987 Q1	1988 Q1 (+)	[1987 Q1; 1989 Q4]	Interest rate liberalization. Savings banks allowed opening branches outside their home regions.
			1997 Q4 (+)	[1995 Q1; 2001 Q2]	Eurozone process adhesion, high economic growth and boom in demand for second homes in coastal areas.
	ruc	1987 Q1	No		
Finland	iph	1978 Q1	1988 Q4 (+)	[1985 Q3; 1990 Q2]	Abolition of interest rate controls and government withdrew guidelines on mortgage lending.
	ruc	1978 Q1	1988 Q4 (-) 1996 Q2 (-)	[1985 Q3; 1990 Q2] [1995 Q4; 2006 Q4]	Abolition of interest rate controls and government withdrew guidelines on mortgage lending. Eurozone process adhesion and gradual liberalization of rent controls (rents are practically free from public control).

Table 11 – EU-15 Housing Market Structural Breaks and Policies Measures (continuation)

Country	Series	Series Start	Breaks	Confidence Interval	Policies Measures
France	iph	1980 Q2	No		
	ruc	1980 Q2	No		
Greece	iph	1994 Q1	1999 Q1 (+)	[1998 Q4; 2002 Q4]	Eurozone process adhesion, liberalization of mortgage refinancing and expansion of non-specialized commercial banks into mortgage lending.
	ruc	1994 Q1	1999 Q1 (-)	[1998 Q4; 2002 Q4]	Eurozone process adhesion, liberalization of mortgage refinancing and expansion of non-specialized commercial banks into mortgage lending.
Netherlands	iph	1976 Q1	No		
	ruc	1976 Q4	1994 Q4 (-) 2002 Q1 (+)	[1993 Q4; 1999 Q2] [2001 Q4; 2003 Q4]	In this period there was an increase of 78% of real house price. This is partly due to the liberalization of the mortgage market with relaxation of the lending criteria, increasing competition of the banks, liberalization of more expensive segment of rental market and full deductibility of mortgages interest payments from taxable income. The proportion of loans with LTV ratios greater than 100% increased from 15% in 1990 to a value exceeding 70% in 2001. Fiscal Change: Reduced tax relief for interest payments and restricted it to principal dwelling and expansion of the tax rate on capital gains.
Ireland	iph	1975 Q1	1994 Q3 (+)	[1991 Q2; 2006 Q4]	During this period the house prices increased 179% in real terms. The liberalization of the mortgage market with interest rate deregulation, the end of controls/regulations on rent contracts and tax changes (favoring home ownership against the rents) help explain prices growth in the period.
	ruc	1978 Q1	1998 Q4 (-)	[1997 Q1; 2000 Q3]	Eurozone process adhesion and tax changes: abolished property tax and halved capital gains tax.

Table 11 – EU-15 Housing Market Structural Breaks and Policies Measures (continuation)

Country	Series	Series Start	Breaks	Confidence Interval	Policies Measures
Italy	iph	1988 Q2	No		
	ruc	1988 Q2	No		
Luxembourg	iph	1975 Q1	No		
	ruc	1975 Q1	No		
Portugal	iph	1988 Q1	1992 Q1 (-)	[1989 Q3; 1996 Q4]	Wolswijk (2006) refers the process of privatization as one of the policies measures that explain this break that results in the liberalization of interest rates, abolition of credit controls and credit guidelines, liberalization of investment service and legislation of entry, branching, specialization and segmentation restrictions.
	ruc	1988 Q1	No		
United Kingdom	iph	1968 Q2	1992 Q4 (-)	[1990 Q4; 1994 Q3]	Crisis of Exchange Rate Mechanism (ERM). Financial Crisis.
	ruc	1973 Q1	1992 Q3 (-)	[1992 Q1; 1997 Q1]	Crisis of Exchange Rate Mechanism (ERM). Financial Crisis.
Sweden	iph	1986 Q1	No		
	ruc	1986 Q1	1996 Q1 (-)	[1992 Q4; 1998 Q2]	Measures to increase competition among mortgage finance institutions, banks and other credit institutions in the 80's have resulted in banking crisis of 1991-93 with negative consequences on house prices.

Figure 1: Dendrogram: Ward Method

Figure 1 shows the dendrogram obtained from hierarchical cluster analysis for all institutional features variables. The dendrograms obtained using the "farthest neighbour" and Ward agglomeration methods, suggest groups partition very similar, so we only present one of the agglomeration methods, the Ward method.

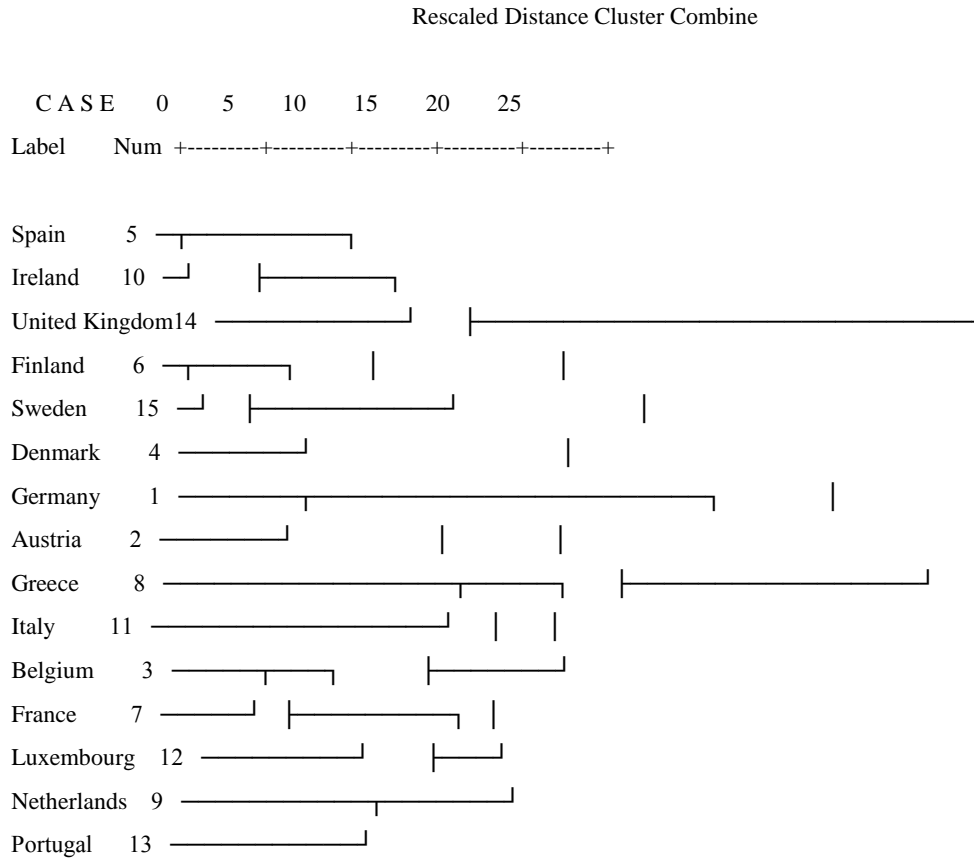
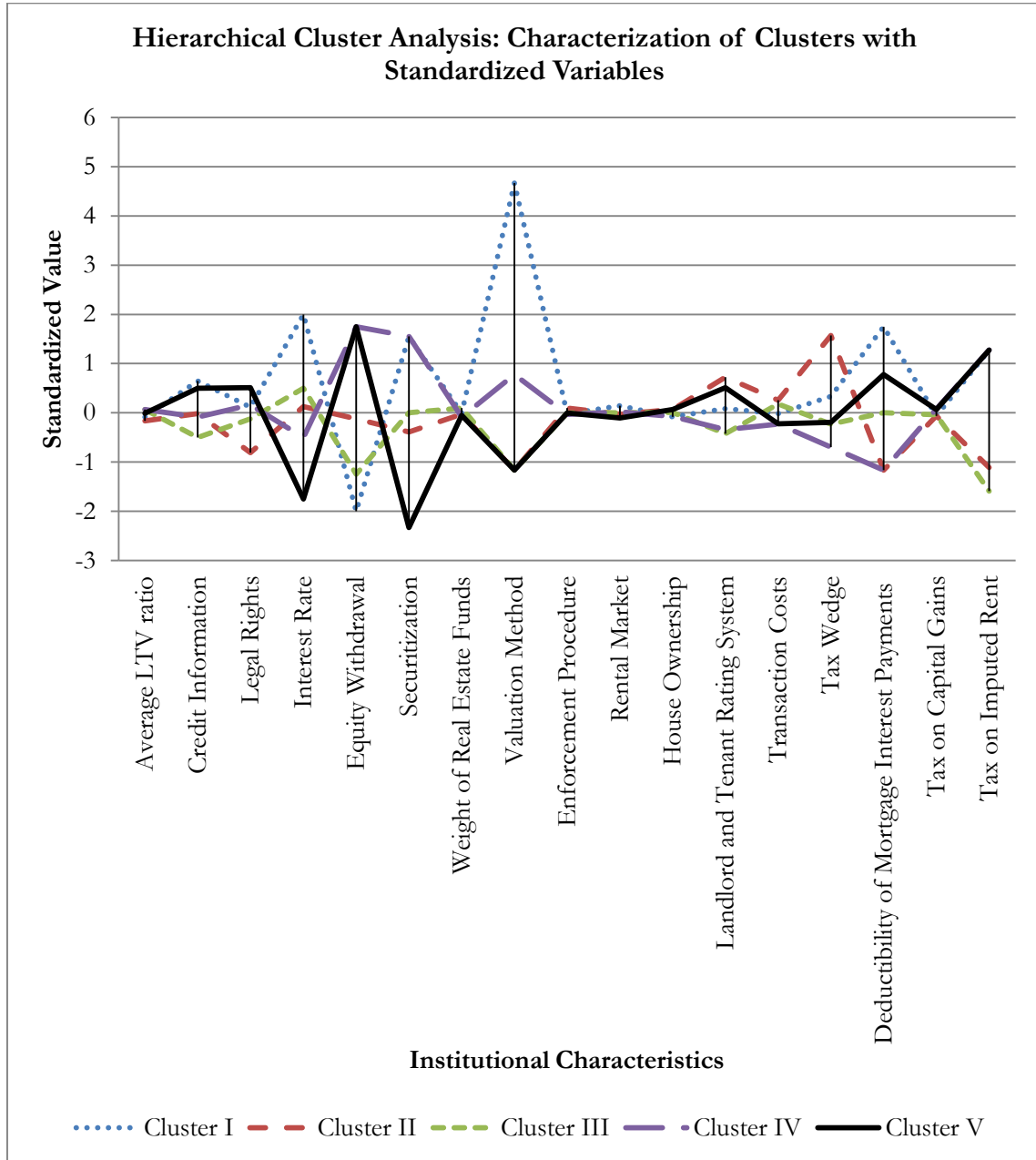


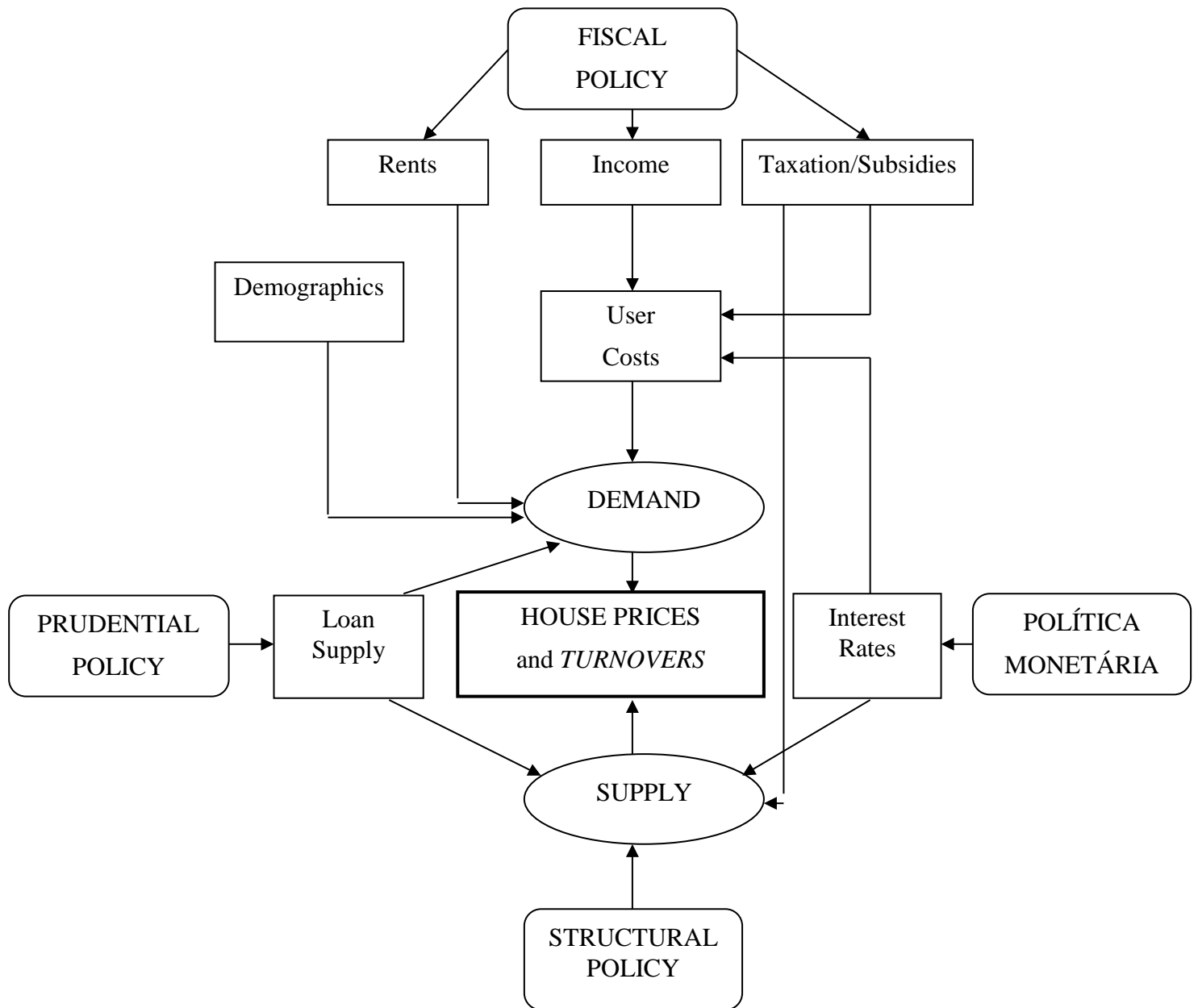
Figure 2: Hierarchical Cluster Analysis: Characterization of Clusters with Standardized Variables

Figure 2 presents a plot with standardized values of institutional variables used on hierarchical cluster analysis, for the five groups of countries formed. The definition of each variable appears in Table 5.



Note: **Cluster I:** Germany and Austria. **Cluster II:** Italy and Greece. **Cluster III:** France, Belgium, Luxembourg, Netherlands and Portugal. **Cluster IV:** Sweden, Denmark and Finland. **Cluster V:** Ireland, United Kingdom and Spain.

Figure 3 – Key Policy Relationship in Housing Market



Source: Hilbers *et al.* (2008)

Endnotes:

¹ Those characteristics are related to several aspects such as the prevailing interest rate in the mortgage market; the possibility of Equity withdrawal; the level of LTV (Loan-to-Value) ratios; accepted property valuation methods and the availability of asset securitization.

² McCrone & Stephens (1995) emphasise the importance of legal and institutional barriers in the use of housing as collateral, arguing that despite convergence pressures, differences in housing and financial market institutions across EU countries remained substantial.

³ The index is available from www.globalpropertyguide.com and takes into consideration the following elements: (1) If rents can be freely agreed between landlord and tenant, (2) whether the landlord collect security and rental deposits, and are the amounts limited, (3) the duration of the contracts is freely chosen by the parties and can either the landlord or tenant terminate early, and what are the penalties for early termination and finally does the tenant have a right to extend, (4) whether the court system works well and how long can it take to evict a tenant for non-payment of rent. This index gives the amount of control the landlord has over his property, measured on a five-point rating scale: strongly pro-landlord = 2; pro-landlord = 1; neutral = 0; pro-tenant = -1 and strongly pro-tenant = -2.

⁴ *Legal Rights* for borrowers and lenders is composed of ten categories, seven of which pertain to collateral law and three pertain to bankruptcy law. A score 1 is assigned if each feature is present in the country, so that the *Legal Rights* index ranges from 0 to 10 with higher scores indicating that collateral and bankruptcy laws are better designed to expand access to credit.

⁵ *Credit Info* index measures the depth of credit information about potential borrowers that lenders access from standardized and informative sources of credit information. The index ranges from 0 to 6, with higher values indicating the availability of more credit information.

⁶ Available at www.doingbusiness.org. A complete description of the indexes and their components is available in www.doingbusiness.org/MethodologySurveys/GettingCredit.aspx.

⁷ *Global Real Estate Investment Attractiveness Index (Global REIA Index)*.

⁸ Lieser & Groh (2010) also note the importance of capital gains taxation and the deductibility of mortgage interest on income tax in the context of their index of *Real Estate Investments Attractiveness*.

⁹ The variables included in the analysis are standardised. When cluster analysis would have been applied without a prior standardization, any distance measure would reflect the weight of the variables that have higher values and greater dispersion.

¹⁰ As a robustness test we also estimated the clusters using the *farthest neighbour* method. The results are do not differ from those from the *Ward* approach and are available from the authors on request.

¹¹ Guiso *et al.* (1992) argue that these long standing restrictions are a major reason why LTV ratios in Italy have historically been less than 50% and why the ratio of mortgage-debt-to-GDP is so low.

¹² Denmark is a slight outlier in some respects. Despite its high average LTVs, it shows a preference for fixed-rate mortgages whilst historical valuations are used for collateral purposes and there is a low weight of securitization.

¹³ As mentioned by Wolswijk (2006) “*after-tax mortgage interest rates have an effect on mortgage debt growth, indicating a potential role of interest deductibility as a policy instrument to influence mortgage developments. All countries, apart from France, Germany and the U.K., in 2003 allowed income tax deductibility of mortgage interest payment, with relevant marginal tax rates ranging from 29 percent (Finland) to 52 per cent (the Netherlands)*”.

¹⁴ As our analysis stops prior to the financial crisis the disconnect that emerged with the interbank market does not come into play.

¹⁵ The New Urban Lease Act (Novo Regime de Arrendamento Urbano –“NRAU”) in Portugal is an example of a legislative reform where the results fell far short of the desired effect.