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House Price Dynamics and the Reaction to Macroeconomic Changes: The Case of Cyprus

Christos S. Savva*

Department of Commerce, Finance and Shipping, Cyprus University of Technology

Abstract

This paper applies a two-regime Markov switching model to investigate the impact of the macro-economy on the dynamics of the housing market in Cyprus for the period from 2001 to 2014. The econometric methodology implemented in this study suggests that the behaviour of housing market in Cyprus is regime dependent and allows for a clearer understanding of the drivers of the housing market during "boom" and "crash" periods.

Keywords: Cyprus housing market, Macroeconomic determinants, Housing market.

1. Introduction

The housing market in most countries is a popular topic of study. From the public sector perspective, it constitutes a major part of government revenue (through taxes on home ownership and stamp duties imposed on transactions in the property market); from the households' perspective, it constitutes the greatest part of their wealth and is the most common type of collateral for mortgages.

In many countries around the globe (see for instance the cases of the US, UK, Spain Ireland and Japan, among others), housing markets have experienced large cyclical variations in prices and volumes, with these cycles being characterised by a surge in prices, followed by a fall or crash (Nneji et al, 2013). Hence, in combination with the importance of the housing market mentioned above, this cyclical nature of the housing market has been a major topic of research and discussion, with the directions of research focusing on which macroeconomic variables affect house price dynamics and how.

The majority of these papers identify interest rates as the most important explanatory variable, for example Abraham and Hendershott (1992) for the US, Iacoviello and Minetti (2003) for European countries, including the UK,

* Address: Cyprus University of Technology and Economics Research Centre. E-mail: christos.savva@cut.ac.cy

and Himmelberg et al (2005), Adams and Füss (2010), Holly and Jones (1997), McQuinn and O'Reilly (2008) and Bouchouicha and Ftiti (2012), among others, for various countries. Lastrapes (2002) suggests money supply as a possible factor that affects house prices, while Brunnermeier and Julliard (2008) conclude that inflation plays an important role and Beltratti and Morana (2009) posit global macroeconomic shocks. Adams and Füss (2010) provide evidence that variables linked to economic activity (such as industrial production, the level of unemployment and money supply) influence house prices.[1]

Nevertheless, the above studies do not account for structural breaks in the behaviour of macroeconomic series and housing prices and thus they do not depict the true picture of the relationship between macro factors and growth in house prices. Therefore, they may lead to incorrect inferences regarding the effects of the real economy on the housing market.[2]

The purpose of this paper is to investigate how changes in key macroeconomic variables could influence growth in house prices, depending on which part of the cycle the real estate market is in. This study examines the impact of macroeconomic drivers of property price changes in a two-regime switching context, thus providing information on how selected economic factors influence price changes in the residential property market depending on whether the housing market is a "boom" or "crash" regime.

This work further contributes to the existing literature by investigating the case of Cyprus. This case is of particular interest due to the unprecedented measures agreed with the European Stability Mechanism (ESM) and the International Monetary Fund (IMF) in April 2013 to save the country from the rapid worsening of its public finances and the severe conditions of banks' balance sheets. These measures, besides fiscal consolidation measures and structural reforms in the public sector, include the restructuring and downsizing of the banking sector, by resolving the second largest bank and recapitalising the largest bank via the contribution of bank creditors, including uninsured depositors (i.e. with deposits over €100,000). All of the above of course had an immediate impact on the housing market and prices.

The rest of the paper is organised as follows: Section 2 describes the data and Section 3 discusses the methodology. Section 4 presents the results and Section 5 indicates the policy implications of the main findings and concludes.

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[1] See also the work of Englund and Ioannides (1997), Tsatsaronis and Zhu (2004) and Glindro et al (2011) for similar suggestions.

[2] A notable exception is the study of Nneji et al (2013).

2. Data

Based on the related literature and the work of Pashardes and Savva (2009),[3] we use quarterly data for the following series: for the housing market price index, we use the index constructed by the Economics Research Centre (University of Cyprus); we also employ the lending rate, the final consumption expenditure of households (to proxy for disposable income), the unemployment rate, the Cyprus Stock Exchange Index, the exchange rate and the inflation rate. All series were transformed to render stationarity. Specifically, as the dependent variable we use the percentage change in the house price index (ΔHP) and for independent variables we employ the change in lending rate (ΔLR), percentage change in consumption (ΔINC), percentage change in the stock price index (SR) and percentage change in the exchange rate (XR). The unemployment rate (UNEMP) is expressed in rates, while inflation (INFL) is the percentage change in the consumer price index. The data spans the period 2001Q1–2014Q4.

In Table 1, we present the descriptive statistics of these variables and their time-varying behaviour is depicted in Figure 1.

TABLE 1

Summary Statistics

	ΔHP	ΔLR	ΔINC	UNEMP	SR	XR	INFL
Mean	1.595	-0.012	0.444	0.192	-5.904	0.717	0.506
Stdev	4.102	0.343	2.047	0.883	23.206	4.984	1.461
Minimum	-3.428	-1.000	-6.377	-2.541	-63.716	-9.726	-2.849
Maximum	11.992	1.000	4.649	2.204	40.277	13.400	3.126
Skewness	0.852	-0.711	-0.677	-0.660	-0.683	-0.028	-0.177
Kurtosis	-0.441	3.196	1.457	1.142	0.433	0.117	-0.922

Notes: This table presents summary statistics for variables of interest in this study

From Table 1, it can be seen that the average growth in house prices is quite high, 1.595% per quarter or 6.38% per annum. During boom years this figure has a value of 11.9925 per quarter, whereas during crashes the value drops to -3.428% per quarter. The distribution of returns in the housing market suggests a positive skewness (i.e. it has a longer right tail) while kurtosis is negative, implying that house price growth is platykurtic. The second column refers to the lending rate difference, which is close to

[3] See also Sitivanides (2015) for a more recent perspective.

zero, while the rest of the columns report positive results for the unemployment rate, consumption growth, change in exchange rate and inflation per quarter. The opposite holds for stock returns for which the value is negative and large in magnitude, mainly because of the stock market crash during the last decade.

Similar inferences to the descriptive statistics can be drawn from Figure 1, in which housing price growth is seen to be booming from 2002 to 2006 and 2007 to 2009 and declining for the rest of the period. Finally, another point of interest is the very volatile stock market returns. Nevertheless, these values and patterns may conceal substantial differences over time, which cannot be captured only at the descriptive level. Therefore a more advanced specification is needed to uncover possible differences over time. The next section discusses the econometric methodology we use to investigate this issue.

3. Methodology

Building on the work of Nneji et al (2013), in this paper we apply a two-regime univariate Markov switching (MS) model following Hamilton (1989, 1994). This methodology allows us to study the nonlinear relationship between the growth in house prices and changes in macroeconomic variables, estimated as follows:

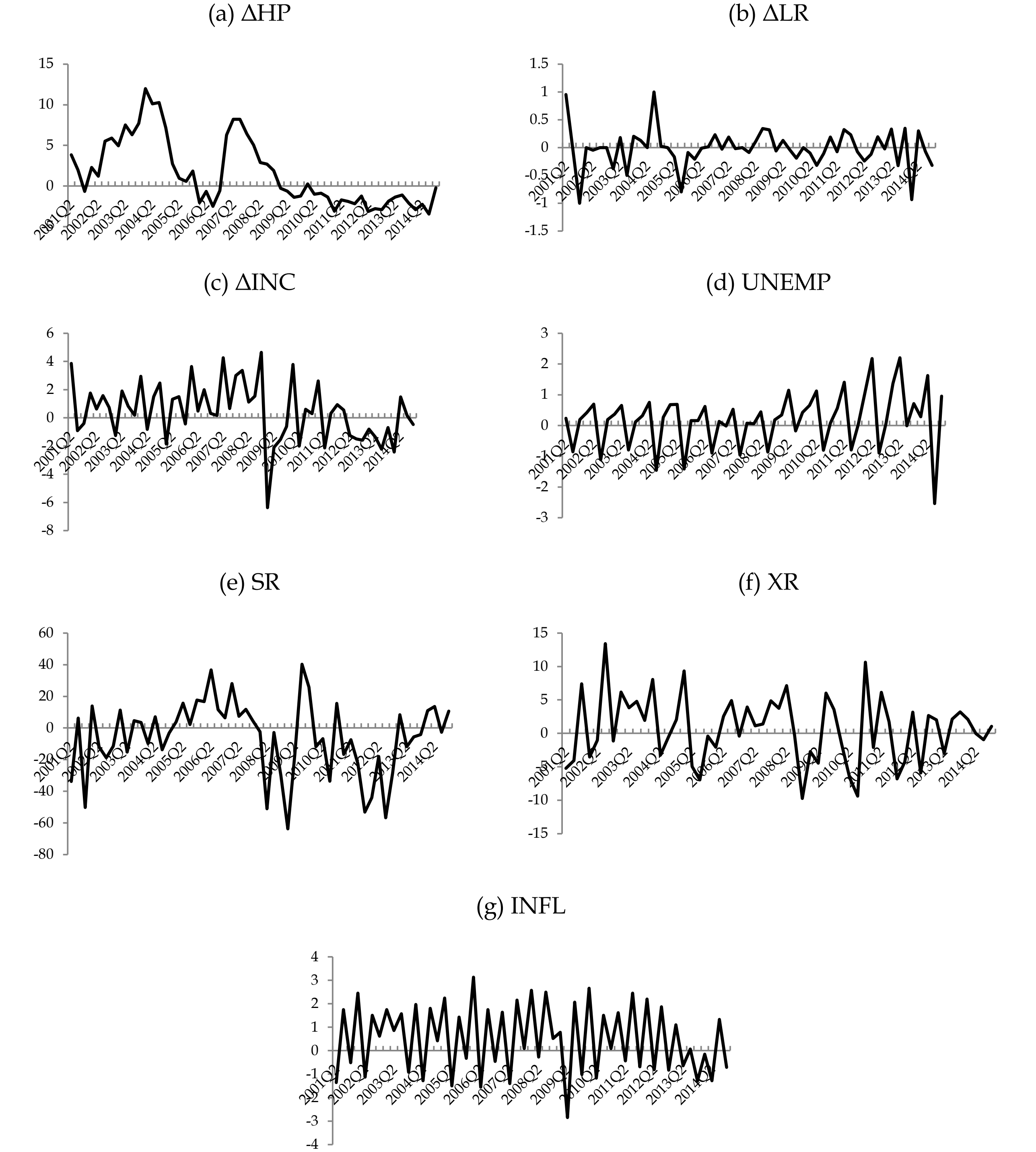
$$\begin{aligned}\Delta HP_t = \beta_{s_t,0} + \beta_{s_{t-1},1}\Delta LR_t + \beta_{s_{t-1},2}\Delta INC_t + \beta_{s_{t-1},3}UNEMP_t \\ + \beta_{s_{t-1},4}SR_t + \beta_{s_{t-1},5}XR_t + \beta_{s_{t-1},6}INFL_t + u_{s_t}\end{aligned} \tag{1}$$

where $u_{s_t,t} \sim N\left(0, \sigma_{s_t}^2\right)$ and $S_t = i$ for i=1, 2.

The estimated betas from model (1) can be interpreted as a measure of the sensitivity of house price growth to changes in the lending rate, consumption, stock returns, exchange rates, unemployment and inflation. Note that these explanatory variables are lagged and not contemporaneous to avoid concerns regarding a potential endogeneity problem if there is feedback from the housing market to the macroeconomy or if house price dynamics affect monetary policy. We assume the lag time to be one quarter.

FIGURE 1

Plots of the Variables



Our model is a two-regime MS model, where the term S_t is the latent state variable which can take the value of 1 or 2 depending on the state or regime in the housing market. In other words, the effect of each of the explanatory economic variables depends on the housing cycle, i.e. whether it is boom or bust.[4] This unobservable state variable is governed by a first-order Markov chain with a constant transition probability matrix (P):

$$P=\begin{bmatrix}\Pr\left(S_t=1\,|\,S_{t-1}=1\right) & \Pr\left(S_t=2\,|\,S_{t-1}=1\right)\\ \Pr\left(S_t=1\,|\,S_{t-1}=2\right) & \Pr\left(S_t=2\,|\,S_{t-1}=2\right)\end{bmatrix}=\begin{bmatrix}p_{11} & p_{12}\\ p_{21} & p_{22}\end{bmatrix} \tag{2}$$

where p_{ij} refers to the transition probabilities from state i to state j.

The MS model is estimated using a maximum likelihood procedure. Under the assumption that the error term (u_t) is normally distributed, the density of y_t conditional on the regime (i) is represented as:

$$\eta_{i,t}=f\left(y_t\,|\,S_t=i,X_t,\Omega_{t-1};\theta\right)=\frac{1}{\sqrt{2\pi\sigma_i^2}}\exp\left\{-\frac{\left(y_t^{'}-X_{t-1}^{'}\beta_i\right)^2}{2\sigma_i^2}\right\} \tag{3}$$

where, Ω_{t-1} represents all the past information to time t-1, θ is the vector of parameters to be estimated, y_t is the dependent variable and X_t the vector of independent variables. The conditional density of the observation at time t is obtained from the joint density of y_t and S_t:

$$f\left(y_t\,|\,\Omega_{t-1};\theta\right)=f\left(y_t,S_t=1\,|\,\Omega_{t-1};\theta\right)+f\left(y_t,S_t=2\,|\,\Omega_{t-1};\theta\right) \tag{4}$$

which is equivalent to:

$$\sum_{i=1}^{2} f\left(y_t,S_t=i\,|\,\Omega_{t-1};\theta\right)P\left(S_t=i\,|\,\Omega_{t-1};\theta\right) \tag{5}$$

As it is impossible to know for certain what regime the housing market is in, inference about the regime is made by observing the growth rate of house prices. The inference comes in the form of filtered probabilities (ξ_{jt}), which are computed recursively using historical information, Ω_{t-1}:

[4] From preliminary specification tests, this model proved to be the most adequate over the linear, three-stage and four-stage Markov switching specifications.

$$\xi_{jt} = \Pr\left(S_t = j \mid \Omega_t; \theta\right) = \frac{\sum_{i=1}^{2} p_{ij} \xi_{j,t-1} \eta_{jt}}{f\left(y_t \mid \Omega_{t-1}; \theta\right)} \tag{6}$$

These filtered probabilities depend on real-time updated information up to time *t*. It is also interesting to compute the probabilities of what state/regime the housing market was in at a previous date *t* using all the observations and information obtained through a later date T. These are known as smoothed probabilities ($\xi_{jt|T}$=Pr($S_{t=i}$| Ω_T;θ)) and they are computed using an algorithm developed by Kim (1994). Estimation of the parameters θ in the MS model is done by maximising the following log-likelihood function:

$$l\left(\theta\right) = \sum_{t=1}^{T} f\left(y_t \mid \Omega_{t-1}; \theta\right) \tag{7}$$

4. Empirical Findings

As a first step, we estimate the restricted version of equation (1) in which only a single state is assumed. The results are presented in Table 2.

TABLE 2

Summary Statistics

	Interc.	ΔLR	ΔINC	UNEM	SR	XR	INFL
β	0.248	-0.809***	1.560*	0.188	-0.055	0.011	0.066
	(0.315)	(0.070)	(0.837)	(0.145)	(0.311)	(0.012)	(0.057)

Notes: This table presents ols output from time series analysis on the whole sample between 2000 until 2014. The dependent variable is the quarterly change in house prices and the independent variables are changes in lending rate, changes in disposable income, unemployment rate, stock returns, changes in exchange rate and inflation. *, ** and *** denote significance at 10%, 5% and 1% respectively. Standard errors in brackets.

In this linear model, only two of the variables are significant, at least at 10% level (changes in lending rate and consumption growth). The sign of the change in lending is negative, suggesting that an increase in this rate would have a negative effect on house prices. In contrast, an increase in consumption growth would lead to a positive effect on house prices.

Nevertheless, these results raise questions, such as whether the rest of the variables have no effect on house prices and also whether it is the case that the sensitivity of the housing prices to changes in macroeconomic variables remains constant in the various phases of the economy. Therefore, we proceed with the implementation of the Markov regime-switching specification.

To derive the best model, we examine specifications with two, three and four regimes. The two-regime model identifies “boom” and “bust” states. The three-regime model covers “boom”, “steady-state” and “bust” periods. Finally, the four-regime model signals “crash”, “boom”, “slow growth” and “recovery” periods (Guidolin & Timmermann, 2008; Ryden et al, 1998). Based on Hannan–Quinn, Schwarz and Akaike information criteria, we conclude that two regimes are optimal to describe the case of Cyprus.

Prior to discussing the regime-dependent estimates, it is important to refer to the estimated smoothed probabilities of the housing prices being in any of these growth regimes. These probabilities allow us to make statistical inferences about the regime in which the market is situated at each point in time by observing the complete dataset. Recall, the smoothed probabilities are dependent on the estimated transition probability matrix, which provides information on the probability of a switch from one state at time *t*–*1* to another at time t as given by Eq. (2). The estimated transition probability matrix is shown in Eq. (8):

$$P = \begin{bmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{bmatrix} = \begin{bmatrix} 0.941 & 0.066 \\ 0.059 & 0.934 \end{bmatrix} \tag{8}$$

where 1=boom and 2=bust regime.

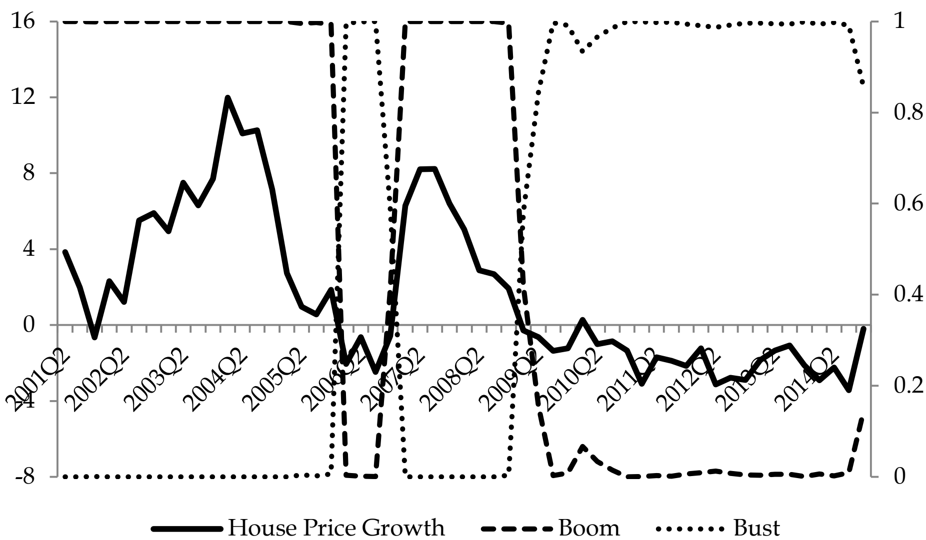
The probability of remaining in the high regime given that the growth in housing prices was in the boom regime in the previous period is 94%. There is a 6% chance of switching from the boom regime to the low regime. The low regime has the least persistence in that there is a 93.5% probability of remaining in the bust period if there was a recession the last quarter. With these transition probabilities, it is also possible to compute the expected duration (ED) of being in each of the regimes. This is calculated using the following formula:

$$ED = \frac{1}{\left(1 - p_{ii}\right)} \tag{9}$$

Therefore, the expected durations of the boom and crash regimes are roughly 17 and 15 quarters respectively. This means that we would expect the recession period in the housing market to last four years and a housing boom to last just over four years. A graphical representation of the smoothed probabilities is given in Fig. 2.

FIGURE 2

House Price Dynamics and Regimes



From Fig. 2, we note that the dominant state for the period under investigation is boom, although the market switches to recession from 2009 onwards. Various incidents, such as the worldwide financial crises, but more importantly the unprecedented measures agreed with the ESM and the IMF in April 2013 to save the country from its severe financial problems are probably responsible for this situation. Table 3 provides the estimated parameters of the MS model, which aims to provide a detailed insight into how changes in macroeconomic variables influence the growth in house prices in the two regimes.

TABLE 3

Markov-Switching model output

	Interc.	ΔLR	ΔINC	UNEM	SR	XR	INFL	σ
Boom	1.709***	-0.569***	2.590***	-0.309***	-0.286***	0.041**	0.177***	2.896***
	(0.693)	(0.101)	(0.941)	(0.096)	(0.091)	(0.022)	(0.072)	(0.782)
Bust	-1.501***	-0.134	0.193	-0.066	0.215	0.012	-0.068	0.753***
	(0.365)	(0.205)	(0.729)	(0.134)	(0.176)	(0.011)	(0.053)	(0.214)
E(Duration regime 1): 16.816								
E(Duration regime 2): 15.123								
Adj R^2: 0.825								

Notes: This table presents MS model output from time series analysis on the whole sample between 2000 until 2014. The dependent variable is the quarterly change in house prices and the explanatory variables are changes in lending rate, changes in disposable income, unemployment rate, stock returns, changes in exchange rate and inflation. *, ** and *** denote significance at 10%, 5% and 1% respectively. Standard errors in brackets.

From Table 3, there are clear differences mainly in the significance and size of the estimated betas, but also in their signs, depending on the regime. For example, changes in the macroeconomy influence the housing market only in the boom regime. Focusing on the effects of each variable, it is clear that an increase in the lending rate is expected to cause a fall in the growth rate of house prices, perhaps as a result of investors' expectations of future increases in the cost of borrowing. In the crash regime, lending has no effect on house price dynamics, probably because of the very low expectations of the investors.

Furthermore, in line with the linear model, which shows that disposable income enhances house price growth, we find that for the boom regime the effect is even greater in size and highly significant. Moreover, in a high regime (unlike the linear model) an increase in the unemployment rate has an adverse and significant effect. Stock returns cause a decrease in housing price growth, perhaps because investors find it more profitable to invest in the stock market. In addition, in contrast to the linear specification, which suggests that the rate of inflation is statistically insignificant, we find that inflation does in fact have a positive effect on the growth of house prices in the boom regime. Finally, the associated uncertainty in each regime (parameter σ) is almost four times higher during the boom regime compare to the bust regime.

5. Discussion and Conclusions

In this study, we employ a two-state Markov switching nonlinear econometric model to examine the relationship between the housing market and macroeconomic variables in Cyprus. We investigate how changes in the lending rate, consumption, stock returns, exchange rate, unemployment rate and inflation affect housing prices, depending on the state of economy.

The main findings suggest that house prices in Cyprus over the period spanning from the first quarter of 2001 to the fourth quarter of 2014 are regime dependent, with the boom regime being the one under which changes in macroeconomic variables affect the prices. For the low regime (recession periods) the effect is not statistically significant, a fact that connects the housing market with the economic crisis and fears that the vicious cycle phenomena ignited by falling house prices are hitting back at the economy. In addition, as long as the growth continues to be negative, the collapse of house prices remains a likely scenario.

Hence, if policy makers want their policies to have an effect on the housing market, they should seek to undertake the following:

- Increase the growth rate of the economy, which will lead to an increase in household income and consumption.
- Proceed with innovations in mortgage markets starting with the reduction of lending rates. Of course all these reductions should be coupled with appropriate regulatory oversight and prudent banking regulations to avoid incidents similar to the last few years. A side effect of this policy is the reduction in the numbers of non-performing loans that used houses as collateral. With lower interest rates, a considerable number of loans would be repayable by their debtors.
- Introduce policies that reduce unemployment.
- Generally improve macroeconomic conditions (create a stable economic climate of low inflation and positive economic growth).

From a different angle, the implementation of policies that reduce transaction costs in housing sales, together with the reduction of taxes on house ownership and stamp duty, can be expected to increase the activity in the housing market.

However, although modelling the impact of the macroeconomy on the dynamics of the housing market in Cyprus under the Markov switching specification seems to give results in the right direction, these should be interpreted with a degree of caution as there are no indications that the findings are robust for different periods or time spans.

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