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

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

Christos S. Savva

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.

CONTENTS

Επιπτώσεις στο Ρυθμό Αλλαγής του Δείκτη Τιμών Κατοικιών σε Αλλαγές Μακροοικονομικών μεταβλητών: Η περίπτωση της Κύπρου

Χρήστος Σ. Σάββα

ΠΕΡΙΛΗΨΗ

Στο άρθρο αυτό εφαρμόζουμε μεθοδολογία η οποία αναλύει τις επιπτώσεις των μακροοικονομικών μεταβολών στο ρυθμό αλλαγής του δείκτη τιμών των κατοικιών στην Κύπρο ανάλογα με τα στάδια που βρίσκεται η οικονομία («ανόδου» ή «κρίσης»), για την περίοδο 2001 μέχρι 2014. Τα αποτελέσματα εισηγούνται την ύπαρξη διαφορετικής συμπεριφοράς των τιμών των κατοικιών ανάλογα με το επίπεδο της οικονομίας.

1. INTRODUCTION

The housing market in most countries constitutes a popular topic of study. From the public sector perspective, it constitutes a big part of government revenue (through taxes on house ownership and stamp duties imposed on transaction in real estate market), while from households' perspective, it constitutes the biggest part of their wealth and the most common type of collateral for mortgage.

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

For instance, the majority of these papers identify interest rates as the most important explanatory variable (Abraham and Hendershott, 1992; for the US, Iacoviello and Minetti, 2003; for European countries including the UK, Himmelberg et al., 2005; Adams and Füss, 2010; Holly and Jones, 1997; McQuinn and O'Reilly, 2008; Bouchouicha and Ftiti, 2012; among others for various countries. Lastrapes (2002) suggested money supply as a possible factor that affect house prices while Brunnermeier and Julliard (2008) conclude that inflation plays important role. Beltratti and Morana (2009) suggest global macroeconomic shocks, Adams and Füss (2010) provide evidence that variables linked with economic activity (such as industrial production, the level of unemployment and money supply) influence house price.[1]

Nevertheless, the above studies do not account for structural breaks in the behaviour of macroeconomic series and housing prices, hence they do not depict the true picture of the relationship between macro-factors and growth in house

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

prices. Therefore, they may lead to wrong inferences regarding the effects of real economy on housing market.[2]

The purpose of this paper is to investigate how changes in key macroeconomic variables could influence the 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 real estate price changes in a two-regime-switching context, thus providing information on how selected economic factors influence price changes in the residential real estate 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 the fiscal consolidation measures and structural reforms in public sector, include the restructuring and downsizing of the banking sector, by resolving the second largest bank and the recapitalising the biggest 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 housing market and prices.

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

2. THE DATA

Based on the related literature and the work of Pashardes and Savva (2009)[3] we use quarterly data for the following series: For house market price index we use the index constructed by Economics Research Centre (University of Cyprus).

[2] Notable exception in is the study of Nneji et al. (2013).

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

Further, we employ Lending Rate, Final Consumption Expenditure of Households (to proxy for disposable income), unemployment rate, Cyprus Stock Exchange Index, Exchange Rate and Inflation Rate. All series were transformed to render stationarity. Specifically, as a dependent variable we use percentage change of house price index (ΔHP), while for independent variables we employ change in Lending Rate (ΔLR), percentage change of Consumption (ΔINC), percentage change of Stock Price Index (SR), and percentage change of Exchange Rate (XR). Unemployment Rate (UNEMP) is expressed in rates while inflation (INFL) is the percentage change of the consumer price index. The data spans from 2001Q1-2014Q4.

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

Table 1. Summary Statistics

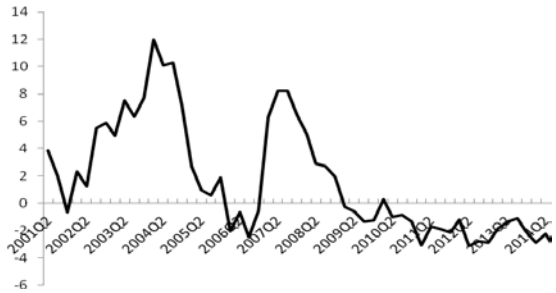
	ΔHP	ΔLR	ΔINC	UNEMP	SR	XR	INFL
Mean	1.595	-0.012	0.444	0.192	-5.904	0.717	0.506
Stdev	4.102	0.343	2.047	0.883	23.206	4.984	1.461
Minimum	-3.428	-1.000	-6.377	-2.541	-63.716	-9.726	-2.849
Maximum	11.992	1.000	4.649	2.204	40.277	13.400	3.126
Skewness	0.852	-0.711	-0.677	-0.660	-0.683	-0.028	-0.177
Kurtosis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

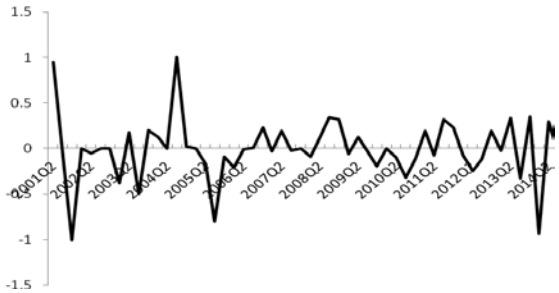
From the table the average growth in house prices is quite high, 1.595% per quarter or 6.38% per annum. During boom years this figure has a value of 11.9925 per quarter while during crashes the value drops to -3.428% per quarter. the distribution of returns in the housing market suggest a positive skewness (i.e. it has a longer right tail) while kurtosis is negative implying that house price growth is platykurtic. The second column refers to lending rate difference which is close to zero, while the rest of the columns report positive unemployment rate, consumption growth, change in exchange rate, and inflation per quarter. The opposite holds for stock returns where the value is negative and big in magnitude mainly because of the stock market crash during the last decade.

Figure 1. Plots of the Variables

(a) ΔHP

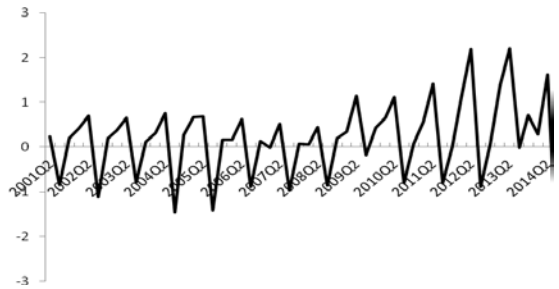


(b) ΔLR



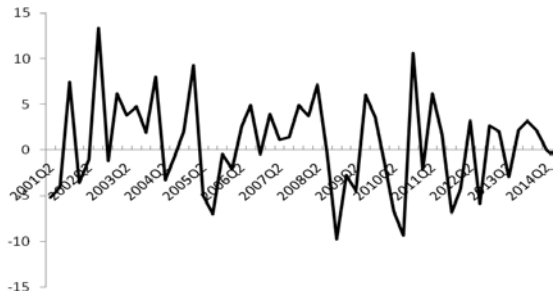
(c) ΔINC

(d) UNEMP

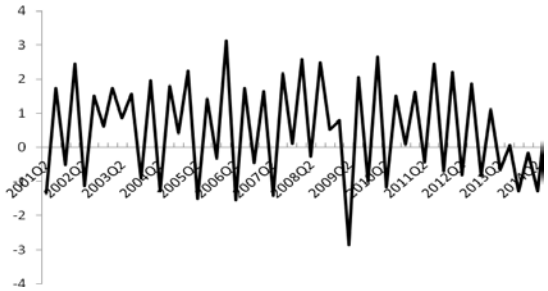


(e) SR

(f) XR



(g) INFL



Similar inferences to the descriptive statistics can be drawn from Figure 1, where housing prices growth are booming during 2002 to 2006 and 2007 to 2009 and decline 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 are not able to be captured only at the descriptive level and therefore a more advanced specification is needed to uncover possible differences over time. The next section discusses the econometric methodology we use in order 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 due to Hamilton (1989, 1994). this methodology allows us to study the nonlinear relationship between the growth in house prices and changes to macroeconomic variables:

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

where $u_{s_t,t} \sim N\left(0, \sigma^2_{s_t}\right)$ 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. Notice that these explanatory variables are lagged and not contemporaneous to avoid the possible concern that there may potentially be an endogeneity problem if there are feedbacks from the housing market to the macroeconomy or if house price dynamics affect monetary policy. We assume the lag time to be one quarter.

Our model is a two-regime MS model, where the term S_t is the latent state variable which could 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 there is a boom or

bust.[4] This unobservable state variable is governed by a first order Markov chain with a constant transition probability matrix (P):

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

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:

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

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:

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

which is equivalent to:

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

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}:

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

[4] From a preliminary specification tests this model proved to be the most adequate over the linear, 3 stages and 4 stages Markov switching specifications.

These filtered probabilities depend on real-time updated information up to time *t*. It is also interesting to compute 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 ($\xi_{j|T}=Pr(S_{t=i}|\ \Omega_T;\theta)$), 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:

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

4. EMPIRICAL FINDINGS

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

Table 2. Simple Regression output

	Intercept	ΔLR	ΔINC	UNEMP	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 among the various phases of the economy. Therefore, we proceed with the implementation of regime Markov switching specification.

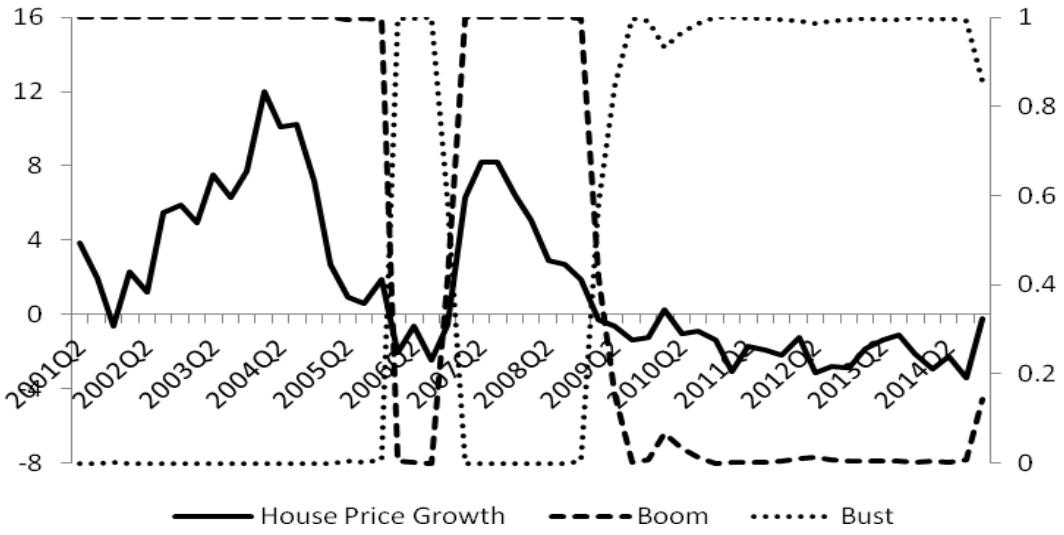
To end up with the best model, we examine specifications with two, three and four regimes. The two-regime model identifies “boom” and “bust” states while a three-regime models “boom”, “steady-state” and “bust” periods. Finally, four-regime model would signify a “crash”, “boom”, “slow growth” and “recovery” (Guidolin and Timmermann, 2008 and 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 estimated 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 resides 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.

Figure 2. House Price Dynamics and Regimes



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:

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

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

From Fig. 2, we note that the dominant state for the period under investigation is the boom although the booming of the market is switched to recession in 2009 onwards. Various incidents such as the worldwide financial crises but more importantly the unprecedented measures agreed with the European Stability Mechanism (ESM) and the International Monetary Fund (IMF) in April 2013 to save the country from its severe financial conditions 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

	Intercept	ΔLR	ΔINC	UNEMP	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 significances and sizes but also in the signs of the estimated betas depending on the regime. For example, changes in the macroeconomy influence the housing market in the boom regime only. Focusing on the effects of each variable, it is clear that an increase in 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, the lending has no effect in house prices 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 bigger in size and highly significant. Moreover, in high regime (unlike the linear model) an increase in unemployment rate has adverse and significant effect. Stock returns cause a decrease in housing prices growth, perhaps because investors find it more profitable to invest in stock market. In addition, in contrast to the linear specification which suggest 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 to Lending Rate, Consumption, Stock returns, change of 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 that spans from the first quarter of 2001 until the fourth quarter of 2014 are regime dependent with the boom regime being the one where 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 the economy. In addition, as long as the growth continues to be negative the collapsing of house prices remains a likely scenario.

Hence, if the policy makers want their policies to have effect on housing market they should seek for 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 collaterals. With lower interest rates a considerable large number of loans will be repayable by their debtors.
- Introduce policies that reduce unemployment.
- Generally, improve macro economic conditions (create stable economic climate of low inflation and positive economic growth).

From a different angle, the implementation of policies that reduce transaction cost in housing sales along with the reduction of taxes on house ownership and stamp duties is expected to increase the activity in housing market.

Nevertheless, although modeling the impact of the macro-economy 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 note of caution since there are no indications that the findings are robust for different periods or time spans.

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