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Macroeconomic Influences on Cyprus House Prices

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Macroeconomic Influences on Cyprus House Prices: 2006Q1- 2014Q2

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Abstract

This paper attempts to explain the determinants of intertemporal variations in housing prices in Cyprus over the period spanning from the first quarter of 2006 until the second quarter of 2014. The analysis focuses on explaining quarterly percentage changes in the House Price Index published by the Central Bank of Cyprus. After estimating several alternative specifications with different combinations of independent variables and different lags we were able to explain about 70% of the quarterly percentage changes in Cyprus house prices. Our findings indicate that nominal GDP per capita, and, alternatively, nominal GDP, have the largest impact on prices followed by construction costs and the number of households. Interest rates were found to have the smallest effect. The results of the study provide also indications of an asymmetric effect of GDP on demand and house prices before and after the Lehman Brothers collapse. We believe that the considerably stronger effect of rising GDP on house prices during the pre-crisis period is attributable to the abundance of both equity and debt capital that was available for house purchases.

Introduction

The housing market is a very important segment of national economies in the developed world, as it is a large part, if not the largest, of their property markets. Furthermore, in countries with high homeownership rate, like Cyprus, housing prices and their fluctuations have a significant effect on household wealth and consumption and therefore on the economy. In addition, fluctuations in housing prices have a significant effect on the financial system, as a large part of the loan portfolios held by banks are collateralized with residential property.

At the current stage, the Cyprus economy is struggling to recover from a deep recession, at the aftermath of the events of March 2013, when a bail in financed by the depositors of the country's largest banks, was implemented as a part of the requirements for providing the Cyprus government with funds that would prevent it from going bankrupt. Those events were followed by the closing of one of the two largest banks and significant restructuring of the largest one, several reforms in the public sector, including government spending cuts, and significant contraction of the business and property sectors. As a result of these developments, there was significant contraction of household wealth and income, a dramatic increase in the number of housing loans not being serviced, and severe lack of credit for real estate loans.

The Cyprus housing market was severely impacted by the global financial crisis as large part of the housing market activity represented sales of second homes and investment property to foreigners (predominantly British and Russian). With the freezing of international capital flows at the aftermath of the collapse of Lehman Brothers, property sales in Cyprus switched from a rapid growth to free fall in 2009 with the number of sales contracts dropping by 44%, according to the data provided by the Department of Lands and Surveys. With the exception of 2010, during which sales contracts increased by 5%, the free fall of property sales continued in 2011 and 2012 with the number of sales contracts registering declines of 18% and 11% respectively. We believe that these severe drops were the result of the severe reduction of both equity capital from international and domestic property investors and consumers, and debt capital from the local banking system due to increased restrictions on providing property loans, such as the decrease in the maximum loan-to-value ratio imposed by the Central Bank of Cyprus and increased cautiousness by the banks in a high-risk environment.

The collapse of the country’s two largest banks, with one being led to bankruptcy and the other one being saved by tapping on the deposits of its clients, dealt the final blow to the island’s property market leading to a severe reduction of the already quite low level of sales volumes. The number of sales contracts fell by 40% in 2013 to 3,767, which represented a mere 26% of the roughly 14,700 sales contracts that were recorded in 2008 by the Cyprus Department of Lands and Surveys. With the housing market still being in a deep recession as a result of the global financial crisis and the events of 2013, there are serious questions regarding the factors that will drive its recovery, when GDP growth turns positive in the next couple of years as predicted by the European Commission. Within this context, understanding and quantifying the impact of the macro economy on the housing market and housing prices becomes of critical importance in trying to form realistic expectations about the prospects of the recovery of the Cyprus housing market.

Macroeconomic Determinants of House Prices

Platis and Nerouppos (2005) examined empirically the effect of property characteristics on housing prices in Cyprus, while Pashardes and Savva (2009) examined the effect of both property characteristics and macroeconomic factors over the period 1988-2008.

In all studies of macroeconomic determinants of house prices the focus is on the major drivers of the demand for and the supply of housing. Some of the most commonly examined drivers from the demand side include income per capita (Quigley, 1999) or GDP/capita (Pashardes and Savva, 2009), interest/mortgage rates (Pashardes and Savva, 2009; Arestis and Gonzalez, 2013; Apergis and Rezitis,2003), the number of households or population size (Quigley, 1999; Pashardes and Savva, 2009; Arestis and Gonzalez, 2013) and inflation (Kearl, 1979; Poterba, 1992; Arestis and Rezitis, 2009).

On the supply side, Quigley (1999) used construction permits and the owner-occupied housing vacancy rate; Pashardes and Savva (2009) examined the effect of construction costs (cost of materials and cost of labor introduced separately in the estimated model); Arestis and Gonzalez (2013) examined the effect of residential investment; and Arestis and Rezitis (2009) examined the effect of money supply (M2).

The most relevant study of macroeconomic determinants of Cyprus house prices is the Pashardes and Savva (2009) study, which covers the period 1988-2008. This study found that population changes had the largest effect on Cyprus housing prices (1% increase in population triggered a 3.4% increase in prices over the period of the study) with construction and labor costs appearing to have the second and third largest effect. Per capita GDP was found to have also a statistically significant but smaller effect (ratio 0.6 to 1) while the effect of interest rate on loans was statistically insignificant. On the demand side, Pashardes and Savva (2009) have also included the Cyprus Stock Exchange Index and the sterling pound to euro exchange, which were found to have a statistically significant effect with the expected sign.

In the model that Apergis and Residis (2003) estimated for house prices in Greece they found that interest rates had a contemporaneous statistically significant and negative effect (demand side effect). They also found that CPI, employment and money supply had a statistically significant and positive (demand side) effect on Greek house prices.

Finally, in the results presented by Quigley (1999), examining the macroeconomic determinants of house prices in the US, income/household is statistically significant at the 10% level only when the number of households and the residential vacancy rate are not included in the regression. In the model that includes also the latter two variables, income/household and number of households do not appear to be statistically significant even at the 10% level. Also the coefficient of construction permits in the same model, although statistically significant, it has the wrong sign, as a positive effect is obtained. The owner-occupied vacancy rate was also statistically insignificant.

Modeling House Prices

In formulating the model for explaining intertemporal house price variations in Cyprus, we follow the classical demand-supply framework according to which prices at each point in time are determined by the interaction of supply and demand. Following Quigley (1999) demand and supply functions are represented as follows:

$$D_t = f (P_t, INC_t, X_t) \quad (1)$$

$$S_t = f (P_t, Y_t) \quad (2)$$

where:

D_t = demand for houses at time t
S_t = supply of houses at time t
P_t = house price at time t
INC_t = household, or per capita income or GDP, at time t
X_t = vector of other exogenous factors that drive the demand for houses
Y_t = vector of other exogenous factors that drive the supply of houses

Other exogenous demand variables that may be included in vector X_t are market size variables, such as the number of households (HHS), population (POP) or total employment, and availability and cost of capital variables, such as the availability of housing loans and interest rates (RATE). Obviously, a greater number of households, population or total employment, and greater availability of housing loans, as well as lower interest rates, should be associated with a larger demand for houses. Furthermore, from the demand side, there is a rationale for including the price of the previous period, as if it is lower than current prices it implies rising prices, which will in turn feed expectations for further increases in the future, motivating households and investors to move their purchases forward to avoid paying higher prices in the future.

On the supply side, the total housing stock at any given point in time represents the aggregate supply, however due to lack of a quarterly total stock series we are using different proxies for the short-term new supply, such as residential building permits (PRM) lagged by a number of quarters in order to account for the time between the permit issuance and the completion of the building, and total construction costs (CCOST) accounting for both the cost of materials and labor.

By equating demand with supply and solving for the price we get the following general form equation:

$$P_t = f\,(INC_t,\ X_t,\ Y_t) \qquad (3)$$

On the basis of this equation, we estimated alternative percentage change model specifications in which all variables are in percentage changes, as well as error correction models (ECM) and partial adjustment models (PAM).

In applying, the partial adjustment modeling approach, the logarithmic version of this model was estimated in order to capture non-linearities in the effect of the independent variables. In addition, this specification allows the direct estimation of short-term and long-term elasticities from the estimated coefficients of the independent variables (Cuddington and Dagher, 2015, Bernanke and Blinder, 1988). The particular specification is derived from the following partial adjustment equation, which is quite suitable in describing price movements in slowly adjusting markets, such as the housing market.

$$logP_t = logP_{t-1} + a\,(logP_t^* - \ logP_{t-1}) \tag{4}$$

In the above equation, α captures the per-period rate of partial adjustment while $logP_t^*$ represents the logarithm of the long-run equilibrium house price as described by equation (5) below (Zheng et al., 2010).

$$logP_t^* = b_0 + b_1 logINC_t + b_2 logX_t + b_3\ logY_t \tag{5}$$

Substituting (5) into (4) produces:

$$logP_t = ab_0 + ab_1 logINC_t + ab_2 logX_t + \alpha b_3\ logY_t + (1 - a)logP_{t-1} \tag{6}$$

Estimation of (6) allows quantification of the short-term effects of the independent variables, which are represented by their estimated coefficients, and the long-run effects, which are derived by dividing their estimated coefficients by α (Zheng et al., 2010). As it can be derived from (6), α can be estimated as $a = 1 - c$, where c is the OLS estimate of the coefficient of $logP_{t-1}$.

The Data

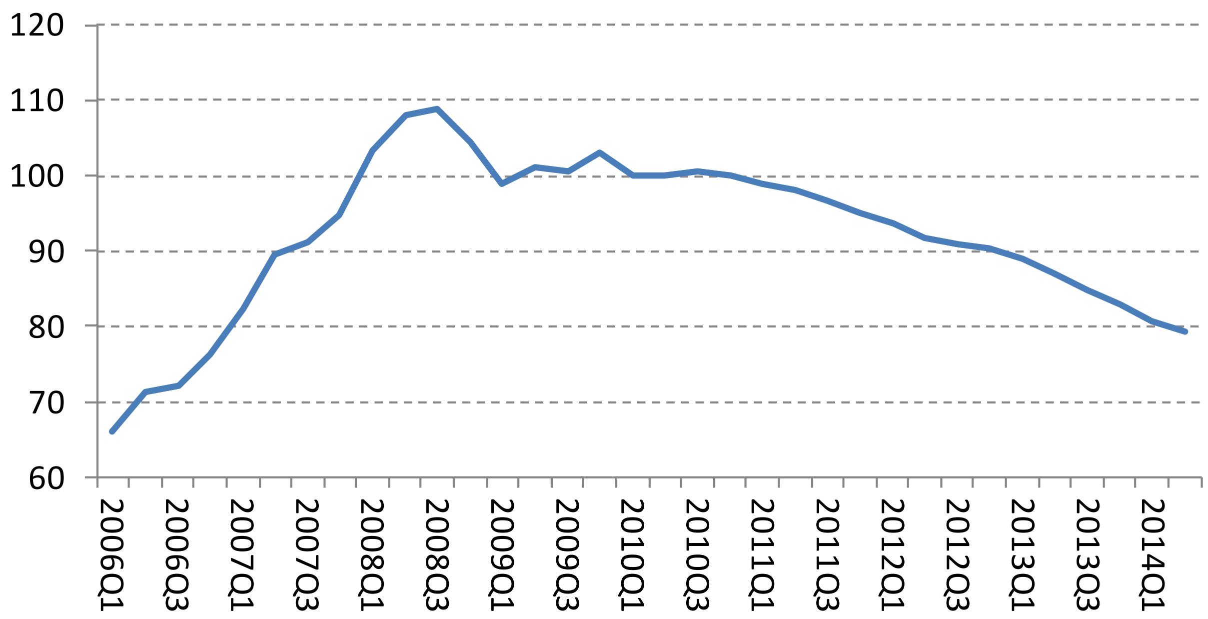
We are using the Cyprus Central Bank House Price Index, which is based on valuations of residential properties that were used by the banks as collaterals for providing housing loans. This index is estimated through a hedonic pricing model, which includes a multitude of property and location characteristics (Central Bank of Cyprus, 2010). Despite the widely discussed smoothing bias in appraised values (Geltner, 1991), we believe that the estimated index reflects to a significant extent intertemporal movements in transaction prices, although overall the latter are expected to have been more volatile than the former.

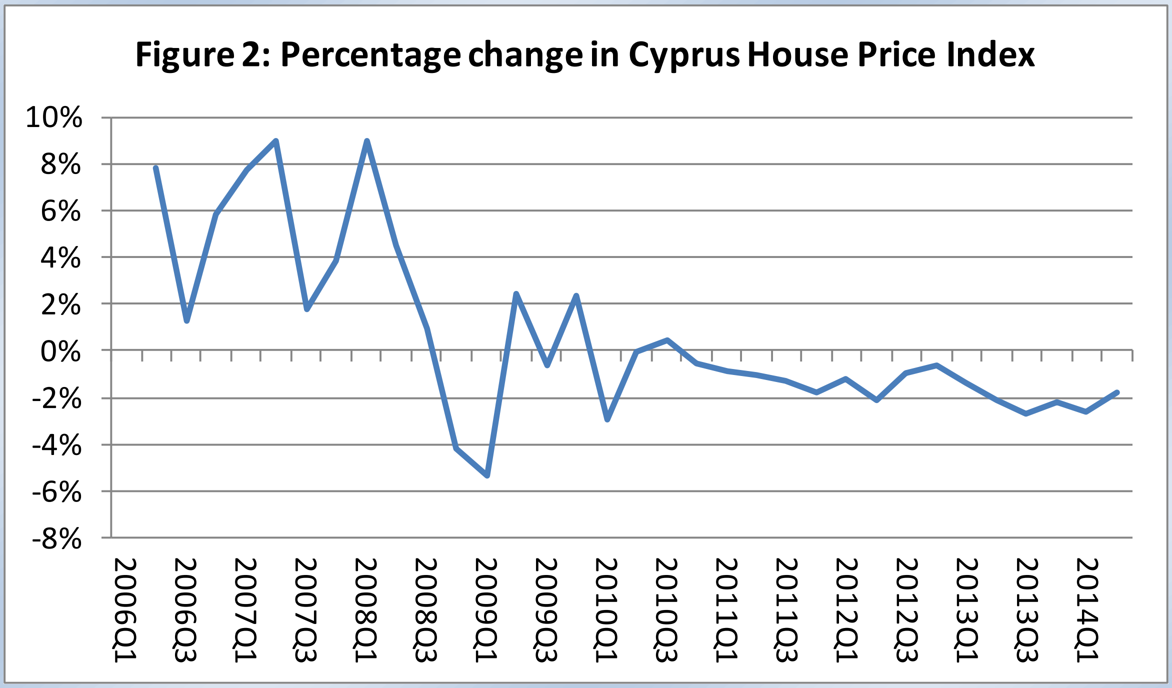
The data spans from the first quarter of 2006 to the second quarter of 2014. Quarterly data on housing permits, construction costs, number of households, total population, total employment, consumer price index, and real and nominal GDP were obtained from the Cyprus Statistical Service. The data on interest rates on deposits with up to one year maturity was the only consistent quarterly interest rate series that we were able to find for Cyprus over the period of analysis in the ECB interest rate database, and this is the variable that was used in our estimates as a proxy for intertermporal variations in mortgage rates over the period of analysis. Due to the entrance of Cyprus in the Eurozone in 2008, there is no consistent quarterly mortgage rate series over the period of our analysis that spans from the first quarter of 2006 until the second quarter of 2014. In order to capture the significantly reduced availability of credit for house purchases after the global financial crisis begun and especially after the events of March 2013, we used the outstanding balance of housing loans to households and total deposits of non-monetary financial institutions held with monetary financial institutions (MFIs).

Figure 1 presents the quarterly data on the Cyprus House Price Index over the period of analysis (the data refers to houses only and does not include flats). As the graph shows, the index was steadily rising until the third quarter of 2008 when it reached its peak. After the third quarter of 2008, which was marked by the collapse of Lehman Brothers and the beginning of the global financial crisis, house prices registered two subsequent drops but did not embark in a consistent downward path until the fourth quarter of 2010. This downward path has continued uninterrupted until the latest point in our data series, that is, the second quarter of 2014.

As Figure 2 shows, the quarterly percentage increases over the period 2005-2008 ranged mostly between 2% and 8%, while quarterly price declines over the period 2009-2014 ranged mostly between 1% and 3%. From the first quarter of 2006 until the third quarter of 2008 Cyprus house prices increased by 65%, while they fell by only 27% over the period spanning from the fourth quarter of 2008 until the second quarter of 2014. In what follows, we will try to identify the major macroeconomic influences that caused these movements and quantify their effects on house prices.

Figure 1: Cyprus House Price Index





Econometric Analysis

Before proceeding with the estimation of the aforementioned time-series models for identifying and quantifying the effect of major macroeconomic variables on Cyprus house prices, we carried out stationarity tests for the dependent and independent variables. These are necessary in order to avoid the spurious regression problem, which results in misleading OLS estimates and t-statistics that may indicate that an independent variable has as statistically significant effect on the dependent variable when in reality it does not. In order to test the variables that were used in the best fitting model for stationarity we use the Phillips-Peron test, which corrects for any serial correlation and heteroskedasticity in the errors of the test regression. The results of these tests are presented in Table 1. As indicated in this table, all variables tested are non-stationary in terms of their levels and their logarithms. On the contrary, their first differences and percentage changes are all stationary, with the null hypothesis of unit root rejected for all variables at very high levels of confidence (at 94.4% in the case of nominal GDP per capita and at higher than 95% for all other variables).

Given that all percentage change variables are stationary, we estimated several alternative specifications of equation (3) using different demand and supply variables, as well as different lags (no higher than the fourth lag due to the relatively small sample size). In particular, for income per capita we used alternatively nominal GDP per capita, nominal GDP per household and nominal GDP per employee; for demand size we used alternatively, total population, total number of households and total employment; for credit availability we used alternatively the outstanding balance of housing loans and total bank deposits; and for housing supply we used alternatively the number of units in housing permits and construction costs.

Table 1: Phillips-Peron (PP) Unit Root Tests

Series	PP statistic	PP statistic Levels in logarithms	Optimal lag[1]
Levels			
House price Index (HPI)	-2.21	-2.83	4
Nominal GDP (NGDP)	0.97	0.80	4
Nominal per capita GDP (NGDPPC)	0.02	0.07	3
Number of Households (HHS)	-3.38	-3.50	1
Construction Costs (CCOST)	-1.57	2.01	0
Interest rate (RATE)	-2.09	-1.62	2
First Differences			
DHPI	-4.12*	-4.28*	1
DNGDP	-3.70*	-3.69*	2
DNGDPPC	-3.45	-3.49	2
DHHS	-6.38**	-6.33**	4
DCCOST	-3.85*	-4.10*	1
DRATE	-4.38**	-4.32**	1
Percentage Changes			
PCHPI	-4.30**		1
PCNGDP	-3.70*		2
PCNGDPPC	-3.49		2
PCHHS	-6.10**		4
PCCCOST	-4.12*		1
PCRATE	-4.17*		1
PCRGDP	-3.93*		1

[1]Due to the small number of observations all tests are performed with maximum lag of four quarters. The optimal lag is the lag for which we obtained the lowest PP statistic

* Denotes significance at the 5% level; ** Denotes significance at the 1% level

It should be noted that we also experimented with real GDP per capita and inflation as an alternative to nominal GDP per capita. In all alternative specifications the latter worked better than the former. Furthermore, we experimented with several alternative specifications that included different lags of the dependent variable (house price change) as a proxy for buyer expectations for future prices but the results did not verify any statistical significance of such variables.

In order to isolate the effect of GDP on house prices we estimated two alternative versions of the percentage change model, Models A and B. Model A uses nominal GDP per capita while model B uses only nominal GDP. Furthermore, we estimated two alternative versions of each of these models. Version 1 does not account for any structural breaks while Versions 2 and 3 do.[1] In particular, Version 2 tests for a change in the intercept of the regression line while Version 2 tests for a change in the slope of the effect of nominal GDP per capita in Model A and nominal GDP in model B. Due to the limited number of observations, we did not test for a change in the effect of the other independent variables. One could make the case for as second structural break after the first quarter of 2013, which marked the beginning of the implementation of the rescue plan that was agreed between the Cyprus government and the Troika, but this is not feasible technically since this period is represented in our data by a very small number of observations.

As indicated in Table 2, the best fitting models include as independent variables the nominal GDP per capita or alternatively nominal GDP, the number of households, the total construction cost index and the interest rate on deposits with maturity of up to one year. As we consider that equity and debt financing is a very important driver of realized housing demand and, therefore, house prices, it is crucial to try and understand why the alternative credit availability proxies that we discussed earlier, were not found to have a statistically significant effect (and that is why they are not included in the best-fitting models). In our view, the explanation is that none of the two main proxies we used - outstanding balance of housing loans and bank deposits held by monetary financial institutions - captures the drastic switch in the availability of *both equity and debt financing* from abundance to severe scarcity immediately after the collapse of Lehman Brothers. We believe that the dramatically heightened risk of the global economy immediately after that event reduced drastically the availability of equity capital, which was in our opinion the main reason for the collapse of property sales in Cyprus by 44% in 2009. In the next few years, this collapse in equity capital continued and along with the rapidly deteriorating conditions in the housing market and heightened cautiousness on the part of financial institutions contributed to the drastic reduction of the availability of debt capital as well, with the latter reaching levels of extreme scarcity after the events of March 2013. Within this context, we believe that the abundance of equity and debt capital for house purchases before the beginning of the global financial crisis and its dramatic reduction immediately after is captured by a binary variable separating the two periods, such as the structural break variable introduced in Versions 2 and 3 of the models presented in Table 2.

[1] The structural break is tested by using a dummy variable that takes the value of 0 for the period up to the third quarter of 2008 and the value of 1 thereafter. We test for the change in the effect of the nominal GDP per capita and alternatively of nominal GDP by adding in the respective models an interactive term of each of these two variables with this dummy variable.

Table 2: Estimation results: Percentage Change Models

Variable	Lag	Model A.1 Coefficient	Model A.2 Coefficient	Model A.3 Coefficient	Model B.1 Coefficient	Model B.2 Coefficient	Model B.3 Coefficient
Constant		-0.003 (-0.64)	0.02 (1.18)	-0.01 (-1.78)	-0.01 (-1.94)	0.02 (1.52)	-0.01 (-3.2)
Structural Break			-0.02 (-1.48)			-0.03 (-2.56)	
Nominal GDP per Capita (NGDPP	0	1.96 (7.38)	1.37 (2.87)	3.01 (5.41)			
Structural Break x NGDPPC				-2.11 (-2.11)			
Nominal GDP (NGDP)	0				1.87 (6.96)	1.18 (3.27)	3.03 (8.07)
Structural Break x NGDP							-2.40 (-3.80)
Number of Households (HHS)	4	0.68 (2.19)	0.55 (1.71)	0.37 (1.12)	0.72 (2.20)	0.54 (1.78)	0.26 (0.88)
Construction Costs (CCOST)	4	0.88 (2.99)	0.57 (1.59)	0.29 (0.74)	0.84 (2.75)	0.43 (1.32)	0.05 (0.16)
Interest Rate (RATE)	1	-0.08 (-1.91)	-0.08 (-1.91)	-0.05 (-1.78)	-0.10 (-2.18)	-0.09 (-2.08)	-0.05 (-1.34)
R^2		0.72	0.75	0.76	0.70	0.76	0.81
Adjusted R^2		0.68	0.69	0.72	0.65	0.71	0.77
Durbin-Watson		2.15	2.21	2.29	1.91	2.25	2.34

Note: t-statistics in parenthesis below each coefficient.

Returning to the estimates presented in Table 2, it can be seen that different lags worked better for the different variables. First of all, despite our expectation of some lag of the effect of nominal GDP per capita and nominal GDP on house prices, the econometric results confirm overwhelmingly a contemporaneous effect. It is worth noting that the use of a one-quarter lag as opposed to the contemporaneous variable, results in a drop of the adjusted R-squared by more than 50% (from 0.68 to 0.31). Theoretically, income and GDP growth should affect the decision to buy, which should precede the transaction price by at least six months to allow for a reasonable time for search for a suitable house that meets the buyer’s preferences in terms of house attributes and micro-location within the urban area. The verification of a contemporaneous effect by the results leads us to conclude that the overall economic environment and its effect on per capita income affects strongly house prices through its effect on affordability and income expectations at the time of the finalization of the price of the transaction, which can be conceived to occur within the same quarter of the closing of the transaction.

Another factor that may contribute to the contemporaneous effect of GDP on prices is the fact that a rising proportion of house purchases during the early period of analysis and up to the end of 2008, represent investor rather than user purchases. In particular, many foreigners were buying houses in Cyprus during that period either purely as buy-to-let properties or mainly as investment properties that they could also use as second homes, given the islands beautiful climate and tourist resources. Investor expectations are significantly affected by the strength of the economy and GDP growth and that would have also contributed to a strong GDP effect on the final transaction price that an investor would be willing to accept.

In terms of the demand and supply variables included in the model, and particularly the number of households and construction costs, the four-quarter lag worked best. The lag of the effect of the number of households is justified by the long time that it takes to find a suitable house and close a real estate transaction, while the lag in the effect of construction costs is consistent with the time that is required to construct a house.

Finally, the interest rate enters the best-fitting model with one quarter lag. This short lag clearly represents a demand side effect, and it is reasonable, as the financing for the transaction is arranged once the particular house to be purchased is identified and it precedes the signing of the sale contract and the closing of the transaction. This explanation is also supported by the negative sign of the coefficient of the interest rate variable, which confirms the effect on the demand side of the market. The effect of the interest rate on supply should be taking place even before the start of the construction, which should precede the entry of a unit in the market by at least three to four quarters. We estimated alternative models with these lags but we obtained not only statistically insignificant coefficients but also the wrong sign in some cases.

In terms of the magnitude of the effect, nominal GDP per capita or, alternatively nominal GDP, have consistently the largest effect across all estimated models. In particular, the effect of the former ranges from 1.37 in Model A.2, where we have a structural-break effect on the intercept of the relationship after the third quarter of 2008, to 1.96 in Model A.1 that assumes no structural break after the third quarter of 2008. Model A.3 confirms the asymmetric effect of the nominal GDP per capita at very high levels of confidence. In particular, our results suggest that during the growth period of 2006-2008, 1% increase in nominal GDP per capita induced a 3% increase in Cyprus house prices while after the beginning of the global financial crisis this effect fell significantly to 0.90%. This would suggest the house prices would tend to rise at a faster pace when GDP per capita is growing and fall at a considerably slower pace when GDP per capita is falling.

The asymmetric effect of GDP per capita on house prices highlighted by the results of the econometric analysis is consistent with the findings of other studies pointing to asymmetric behavior and downward price rigidity of housing markets (Gao,et al., 2009; Guirguis and Vogel, 2006). Such downward price rigidity is justified in the literature as the result of the investment and consumption characteristics of housing, which allows existing housing owners during downturns to choose to live in the house or rent it as opposed to selling it in order to avoid losses. Downward price rigidity in the Cyprus housing market might have been also the result of market inefficiencies that were highlighted in the Memorandum of Understanding that was signed between the Cyprus government and Troika. These inefficiencies include lack of transparency and data on sales transactions, the backlog in the issuance of title deeds for completed transactions, and the existing legislation that provides for a very lengthy process for carrying out forced sales of mortgaged property.

Model B verifies also the strong effect of nominal GDP in aggregate terms (as opposed to nominal GDP per capita). In particular, the results suggest that for every percentage point increase in nominal GDP house prices rise by 1.87%. As was the case for nominal GDP per capita, the results verify the asymmetric effect of nominal GDP at very high levels of confidence. In particular, during the pre-crisis period, one percent increase in nominal GDP was associated with a 3% increase in house prices, while after the beginning of the crisis this effect was reduced by 80% to 0.60%. This, again, supports the conclusion that when the Cyprus economy expands house prices rise at a rate considerably faster than the rate they fall when GDP is contracting.

Turning to the effect of the other variables, and particularly the number of households, the four of the six models in which this variable is statistically significant at least at the 10% level, suggest that house prices rise by 0.6-0.7% for every percentage point increase in the number of households. Similarly, the two of the six models in which the effect of construction costs is statistically significant, suggest that house prices rise by 0.8-0.9% for every percentage point increase in construction costs. The interest rate variable is statistically significant (at the 10% or lower significance level) in five of the six models and all results suggest a small negative effect of 0.05-0.1% for 1% increase in interest rates.

Table 3 presents the estimation results of the best-fitting partial adjustment models, and particularly the corresponding partial adjustment specifications of Model A presented in Table 2. As it can be seen in this table, the model includes the same independent variables (except the number of households for which we obtained a very low t-statistic when it was included in the model) as well as one or more lags of the dependent variable, per the partial adjustment specification described by equation 6. Model C.1 includes two lags of the dependent variable, as the Durbin h statistic for the model with only one lag of the dependent variable verified the presence of serial correlation in the error term. The introduction of the second lag of the dependent variable eliminated this problem, as the estimated Breusch-Godfrey F-statistic is not high enough to allow us to reject the null hypothesis of no autocorrelation in the error term. Similarly, in Models C.2 and C.3 that include one lag of the dependent variable Durbin h is not high enough to allow us to reject the null hypothesis of no autocorrelation. It should be noted that the residuals of all models were tested for stationarity with the Phillips-Peron test, and in all cases the hypothesis of a unit root was rejected at the 5% or lower significance level.

Table 3: Estimation results: Partial Adjustment Models

Variable (logarithms)	Model C.1 Coefficient	Model C.2 Coefficient	Model C.3 Coefficient
Constant	-8.19	-6.17	-6.14
	(-3.55)	(-2.42)	(-2.56)
Nominal GDP per Capita (NGDPPC)	0.92	0.77	0.76
	(2.69)	(2.24)	(2.22)
Structural Break x NGDPPC		-0.004	
		(-2.05)	
Intercept Effect			-0.030
			(-2.05)
Construction Costs (CCOST)	0.52	0.23	0.22
	(1.46)	(0.60)	(0.60)
Interest Rate (RATE)	-0.07	-0.06	-0.06
	(-2.16)	(-1.85)	(-1.86)
First Lag of House Price Index	0.67	0.64	0.64
	(3.00)	(4.37)	(4.35)
Second Lag of House Price Index	-0.20		
	(-1.40)		
R^2	0.96	0.97	0.97
Adjusted R^2	0.95	0.96	0.96
Breusch-Godfrey F-Statistic	2.46		
Durbin-h		0.86	0.86

Note: t-statistics in parenthesis below each coefficient

As indicated earlier, the estimated coefficients in the partial adjustment models represent the short-term effects of the independent variables, while the ratio of each coefficient over the remainder of the subtraction of the coefficient of the lagged dependent from 1 provides the long-term effect of the corresponding variable. Given that both the dependent and independent variables are expressed in logarithms, the coefficients represent the percentage change in house prices for every percentage change in the independent variables. According to the estimates of Model C.1, the short-term effect of nominal GDP per capita is 0.92, indicating that for every percentage point increase (decrease) in this variable house prices rise (fall) by 0.92% per period. The long-term effect of GDP per capita though is considerably larger and particularly 1.74, which is very close to the one estimated by the percentage change model without any structural breaks. [2] Similarly the short and long-term effects of construction costs are 0.52 and 0.98, respectively, while the short and long-term effects of the interest rate are -0.07 and -0.13, respectively.

In contrast to the results of the percentage change model that point to a quite asymmetric effect of nominal GDP per capita before and after the third quarter of 2008, the results of Model C.2, which tests for the change in the effect of this variable over the same periods suggest a statistically significant but very small reduction of its effect (by 0.004) during the period after the collapse of Lehman Brothers. However, the results of Model C.3, which tests for a structural change in the intercept of the regression, are similar to the results of the corresponding percentage change model pointing to a reduction in the average quarterly change in house prices by three percentage points. The statistical significance of construction costs is reduced considerably in Models C.2 and C.3, but the interest rate effect remains statistically significant at the 10% level with short and long-term effects of 0.06 and 0.11, respectively.

It should be noted that although we estimated various versions of alternative error correction models we are not presenting any estimates as we were not able to get any results that verify the error correction mechanism.[3] The most likely explanation of this result is that the time series used in our analysis is not long enough to allow for the validation of such mechanism. This is supported to some degree by the relatively weak results of the partial adjustment models (which also describe a long-term term equilibrating mechanism) in terms of the effects of demand and supply variables, such as the number of households and construction costs.

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[2] This was estimated as the ratio of 0.92 over the sum of the coefficients of the two lags of the dependent variable (0.67-0.20)

[3] In all estimated models the error correction term was either statistically insignificant or both statistically insignificant and had the wrong sign.

Conclusion and Policy Implications

Our analysis has verified through estimates of several alternative models the strong effect of nominal GDP on Cyprus house prices over the period that spans from the first quarter of 2006 until the second quarter of 2014. Our results point also to a considerable asymmetry of the effect of nominal GDP per capita and nominal GDP before and after the beginning of the global financial crisis. We believe that the considerably higher effect of GDP on house prices in the growth period was fuelled primarily by the abundance of both equity and debt capital, reflected in the structural break variable, which captures the regime switch from abundance to extreme scarcity during those two periods. Our results point also to statistically significant but smaller effects from market size variables, particularly the number of households, and supply side effects, particularly construction costs. We also confirmed a statistically significant but quite smaller demand-side negative effect on prices from interest rates.

These findings are consistent with the findings of the Pashardes and Savva (2009) study in terms of the statistically significant effect of these macroeconomic influences on house prices. However, our results suggest that GDP had the largest effect over the period 2006-2014, while in the Pashardes and Savva (2009) study, which covered the period 1988-2008, population had the largest effect. The differences in the magnitude of the effects may be due to the idiosyncratic nature of the period examined in our analysis, as the period 2006-2008 represents one of the periods during which Cyprus house prices have been rising at a very fast pace, while the period 2009-2014 represents one of the worst periods of the Cyprus housing market.

Our findings have clear policy implications as they suggest that effective economic growth policies that will boost GDP growth and per capita income will have a beneficial effect on the Cyprus housing market. However, it should be pointed out that the effect of GDP growth on demand and house prices in the medium term is very unlikely to be anywhere close to the effect suggested by the results of our study. Although the effect of availability of credit/loans on demand and house prices has not been validated directly, we believe that the combined effect of the availability of both equity and debt capital on housing demand and prices has been validated in our study by the statistical significance of the effect of the structural break variable both on the constant of the estimated models and the effect of GDP on house prices. Given that the availability of credit for house purchases currently is dramatically reduced compared to the levels that were available before the global financial crisis, and are not expected to return anywhere close to those levels any time soon, we should expect a considerably subdued response of housing demand to growth in GDP or GDP per capita.

Any positive effect of GDP on demand and housing prices in the next 2-3 years is likely to be also reduced by the widely anticipated foreclosures of many properties that are associated with many housing loans that are in default. The Troika has been adamant in demanding from the

Cyprus government the introduction of new legislation that will allow for speedy forced sales of real estate assets that serve as security for non-performing loans. Although there have been significant delays in the approval of such legislation by the Cyprus Parliament, it is expected that eventually such legislation will be approved, and in all likelihood it will have an adverse effect on Cyprus house prices. The magnitude of this effect will depend on the rate at which the repossessed residential assets will be liquidated by the banks.

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