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Housing Prices and Macroeconomic Factors: Prospects within the European Monetary Union

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This study analyses the dynamic effects of specific macroeconomic variables (i.e. housing loan rates, inflation and employment) on the price of new houses sold in Greece. An error correction vector autoregressive (ECVAR) model is used to model the impact of the macroeconomic variables on real housing prices. Variance decompositions show that the housing loan rate is the variable with the highest explanatory power over the variation of real housing prices, followed by inflation and employment.

Keywords

Housing prices; macroeconomic factors; ECVAR model; Greece

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Introduction

On January 1, 1999, the European Monetary Union (EMU) became a reality. On that date, the 15 members of the European Union (EU) decided to lock their currencies together. Thus, the euro has emerged as the only currency of transaction among EU members (The UK, Sweden and Denmark are still off the EMU procedure, although they have been constant members of the EU). As a result, the European Central Bank has emerged as the single monetary authority that can implement the European monetary policy, while the Growth and Stability Pact governs the evolution of government deficits and public debts. It is worth mentioning at this point that although a convergence of money supply rates, and therefore, interest rates, has been accomplished within the EMU bounds, such a convergence remains far from being established in terms of fiscal issues. The establishment of the monetary union is expected to lead to real convergence among EU members, since the welfare gains from the more efficient allocation of resources are expected to be positive (Worzala and Bernasek, 1995).

Housing markets in Europe, as well as in Greece, constitute a major part of a European investor's portfolio (Boydell and Clayton, 1993). According to McLennan, et al. (1998), the expenses on housing cover approximately a quarter of disposable income. Given the importance of the housing sector, interest rate sensitivity is expected to be high enough to influence consumption expenses, although the degree of intensity differs significantly among members due to the presence of different institutional factors (Muellbauer and Murphy, 1997). Particularly, in Greece during the period 1991-2000, the number of new houses increased by 11%, compared to a 9% increase over the period 1981-1990%. Sixty-one percent of the total number of houses in Greece are located in urban areas, and about 76% of these properties are privately owned, while only about 24% are rented. Fourteen percent of Greek households, the highest percentage among the EU countries, own a second house, indicating that Greek households consider real estate a viable investment option. As regards to the credit availability issue, the majority of mortgages, especially after 1990, have been at flexible rates for long durations, which implies a significant interest rate effect on housing prices.

Over the past few years, the world real estate industry has been undergoing drastic reforms due to the liberalization of financial markets, the drastic fall of interest rates, the obsolescence of the existing stock of housing, and a change in consumer norms on housing uses. In addition, the housing sector has been a target of government fiscal and monetary policy aimed at achieving low inflation, low unemployment, and balanced growth.

Real estate cycles (i.e. periods of excess building), followed by contraction in construction, are primarily affected by shocks in the form of fiscal and monetary policy. For example, a sudden increase in the money supply reduces interest rates, and with everything else being equal, the user costs of housing services fall, while the quantity demanded of housing services increases. The real prices of housing units increase as well, since housing services are linked one-to-one to housing units (Baffoe-Bonnie, 1998).

In addition to money supply, other economic variables, such as employment and mortgage interest rates, can affect both housing prices and the construction of new housing. With regard to the impact of inflation on the housing sector, different views have been held (Kearl, 1979; Hendershott, 1980; Feldstein, 1992; Poterba, 1992). In particular, Feldstein (1992) indicated that increasing inflation serves to reduce people's incentive to invest in real estate, which in turn lowers housing demand. On the other hand, Kearl (1979) argued that inflation causes nominal housing payments to rise, which implies a lower housing demand. Building activity is stimulated by higher employment growth (Smith and Tesarek, 1991; Sternlieb and Hughes, 1997), while Hartzel, et al. (1993) argued that certain regional employment characteristics play a significant role in investors' decisions, and thus, in the determination of housing prices. Finally, Giussani, et al. (1992) found a significant impact of GNP changes (and thus, of employment) on housing prices.

The mortgage interest rate is a very important variable that influences the decisions of individuals on whether or not to buy a house. When the mortgage rate increases, people are prevented from buying houses; therefore, the demand for housing decreases. It has been argued that significant interest rate effects on consumer expenditure are expected through housing wealth, especially in systems characterized by the importance of the collateral role of houses (Muellbauer, 1992; Muellbauer and Murphy, 1997; Maclennan, et al., 1998). Earlier studies, which analysed the effect of macroeconomic aggregates on the housing sector (i.e. Kearl, 1979; Follain, 1981; Schwab, 1983; Manchester, 1987; Harris, 1989), have not allowed for the fact that these macroeconomic variables are themselves influenced by demand and supply shocks in the housing sector. Among recent relevant studies, Baffoe-Bonnie (1998) developed a vector autoregressive (VAR) model, which takes into account the full interaction of the housing sector with the rest of the economy.

The goal of this paper is to empirically investigate the effects of specific macroeconomic variables on real housing prices of new houses sold in Greece. In modelling the impact of macroeconomic variables on real housing prices, an error correction vector autoregressive (ECVAR) model is used to capture the full interaction of the housing sector with the rest of the economy. The remainder of the paper is organized as follows: Section 2

presents the empirical analysis and the empirical results, while Section 3 provides some concluding remarks and policy implications.

Empirical Analysis

Data

The empirical analysis was carried out using quarterly data from 1981 to 1999. The variables used in the empirical analysis are the housing price index (HP) based on construction prices, the mortgage interest rate proxied by the average rate of housing loans maturing in 15 years (INTR), prices measured by the consumer price index (P), and employment measured by the employment index (EMPL). The housing price index was deflated by dividing it by P (RHP). Macroeconomic data on employment and consumer prices were obtained from the OECD Main Economic Indicators CD-Rom. Housing mortgage rates were kindly provided by the Research Department of the Commercial Bank of Greece, while housing prices were obtained from the National Statistical Service of Greece. Finally, the RATS software assisted in the empirical analysis.

Integration Analysis

The variables were tested for unit root non-stationarity by using unit root tests proposed by Dickey and Fuller (1981). The results with and without trend are reported in Table 1. The hypothesis that the variables RHP, INTR, P, and EMPL contain a unit root could not be rejected at the 1% significance level. When first differences were used, unit root non-stationarity was rejected at the 1% significance level, suggesting that the variables RHP, INTR, P, and EMPL were I(1) variables.

Table 1: Unit-Root Tests

	Without trend		**With trend**	
Variables	**Levels**	**First differences**	**Levels**	**First differences**
RHP	-2.57(6)	-3.59(3)*	-0.34(5)	-4.08(4)*
INTR	-0.93(4)	-3.25(3)*	-0.61(6)	-4.13(4)*
EMPL	-2.45(5)	-5.08(4)*	-0.74(5)	-7.09(3)*
P	-1.47(4)	-7.11(3)*	-2.25(5)	-5.26(4)*

Figures in parentheses denote the number of lags in the augmented term that ensures white noise residuals

*Reject the null hypothesis of non-stationarity at the 1% significance level.

Cointegration Analysis

Once having identified that these variables are integrated of the same order, the possibility of cointegration among these variables was also examined. Thus, a vector autoregression (VAR) model was postulated to obtain a long-run relationship. The Johansen and Juselius (1990) methodology revealed evidence in favour of cointegration. The results are presented in Table 2. Both the maximum eigenvalue (λmax) test statistic and the trace (λtrace) test statistic indicate the presence of three cointegrating vectors. However, only one can be accepted – the one that obeys the stationarity of residuals (Johansen and Juselius, 1990). In other words, a single cointegration vector is accepted. After normalization, this vector on RHP yielded the following results:

RHP = -0.332 - 0.008 INTR + 0.82 P + 0.524 EMPL
$x^2(1)$ = 3.98[0.03] 7.12[0.00] 11.8[0.0] 4.37[0.03]
Augmented Dickey-Fuller (ADF) test = -5.63*

where chi-square numbers indicate the significance of coefficients in the cointegrating vector and those in brackets indicate p-values. Finally, ADF indicates the unit root test on the residuals from the cointegrating vector estimated above. The figure implies the rejection of the null hypothesis of non-stationarity. There appears to be evidence in favour of the existence of one common cointegrating vector among the variables under study.

Table 2: Maximum Likelihood Cointegration Tests

Null hypothesis	Alternative hypothesis	λ_{trace}	95%	λ_{max}	95%
R=0	r=1	115.66	75.98	43.58	34.40
r≤1	r=2	72.07	53.48	30.34	28.27
r≤2	r=3	41.74	34.87	23.20	22.04
r≤3	r=4	6.78	9.16	6.78	9.16

*Reject the null hypothesis of no cointegration at the 1% significance level.

An Error Correction Model

As cointegration is confirmed, we proceed to estimate an error correction VAR (ECVAR) model. In our case, the ECVAR model involves four variables (i.e. real housing prices, loan interest rates, inflation, and employment). In the estimations of the ECVAR model, a dummy variable capturing the deregulation of the monetary sector in 1988 was also included. Such deregulation actions that are closely relevant to our study involved the facilitation of credit expansion and the sharp dropping of mortgage loan rates. Moreover, deregulation activities in the monetary sector are expected to lead to a higher sensitivity of housing prices (and any other asset prices) to

interest rate changes. The ECVAR model involves the variables included in the cointegrated vector with a distributed lag. Moreover, the choice of the lag specification is based on the minimum final-prediction-error (FPE), or Akaike criterion. The criterion suggested a 2-lag ECVAR system. The ECVAR estimations provided the following results:

$$\Delta RHP = \underset{(3.51)^*}{0.172}\,\Delta RHP\text{-}1 + \underset{(4.29)^*}{0.084}\,\Delta RHP\text{-}2 - \underset{(-3.97)^*}{0.125}\,\Delta INTR\text{-}1 - \underset{(-4.41)^*}{0.104}\,\Delta INTR\text{-}2$$
$$+\underset{(3.57)^*}{0.212}\,\Delta P\text{-}1 + \underset{(3.03)^*}{0.128}\,\Delta P\text{-}2 + \underset{(4.01)^*}{0.117}\,EMPL\text{-}1 + \underset{(3.46)^*}{0.048}\,EMPL\text{-}2 - \underset{(-4.23)^*}{0.013}\,EC\text{-}1$$
$$+ \underset{(3.73)^*}{0.237}dum88$$

$R^2 = 0.64$ LM = 4.38[0.33] RESET = 2.29[0.42] HE = 1.38[0.24]
ARCH(degrees of freedom=1) = 6.72[0.74]

with LM being a serial correlation test, RESET a misspecification test, HE a heteroskedasticity test, and ARCH an ARCH test. EC is the error correction term associated with the residuals from the cointegrating vector, while dum88 is a dummy variable with 0 values up to 1987:4, and 1 thereafter. Figures in parentheses denote t-statistics, while those in brackets are p-values. Finally, an asterisk indicates statistical significance at 1%.

The variable of interest rates was shown to exert a negative effect on housing prices, while those of inflation and employment were shown to exert a positive. The negative and statistically significant coefficient of the EC term implies a significant adjustment to disequilibrium deviations of housing prices from their optimal level determined by the long-run (cointegrated) housing prices equation. The ECVAR equation incorporates a dummy variable, dum88, to control for the impact of the deregulation that occurred in the monetary sector in 1988. The estimations revealed that the dummy variable is positively associated with housing prices, indicating that the deregulation occurring in the monetary sector led to higher prices due to lower restrictions on mortgage credit. Variance decompositions and impulse responses can be carried out based on the above estimated model.

Variance Decompositions

This section determines quantitatively the degree of importance of the various macroeconomic aggregates, which influence real housing prices beyond the sample period. It is possible to decompose the total variance of real housing prices in each of the future periods and determine how much of this variance each macroeconomic variable explains. Therefore, the response of real housing prices to a one-standard deviation innovation in each macroeconomic variable is obtained at horizons up to 20 quarters.

Different Choleski ordering provided support for the robustness of our results.

Table 3 Variance Decompositions of Real Housing Prices

Proportion of variance explained by shocks to real housing prices (ΔRHP)				
Quarters	ΔRHP	ΔINTR	ΔEMPL	ΔP
1	48.4	31.7	18.4	1.5
	(10.9)	(11.4)	(3.5)	(0.9)
4	43.8	25.8	16.7	13.7
	(11.8)	(10.7)	(4.8)	(2.7)
12	1.8	49.7	15.1	33.4
	(1.7)	(11.7)	(6.8)	(4.7)
20	1.6	47.5	15.4	35.5
	(0.7)	(12.9)	(2.7)	(4.2)

Figures in parentheses denote standard error of the estimates. They were estimated through Monte Carlo techniques based on 500 replications.

Table 3 reports the variance of the forecast error of real housing prices and its decomposition into proportions attributable to random innovation shocks to each macroeconomic variable, including its own. In addition, Table 3 provides standard errors of variance decompositions calculated through Monte Carlo techniques based on 500 replications. The results in Table 3 suggest that, up to 4 quarters, shocks to the housing mortgage rate account for more variation in real housing prices than variation produced by shocks to employment or inflation. In contrast, over a longer period, up to 20 quarters, shocks to both the housing mortgage rate and inflation account for more variation in real housing prices. Note, also, that the variable with the highest explanatory power over the variation of real housing prices is the housing mortgage rate, which explains about 25.8% of the variation, up to four quarters, and about 47.5% of the variation, up to 20 quarters. The variable following the housing mortgage rate in explaining the variation of real housing prices is employment, which explains 16.7% of the variation up to the 4th quarter. For a longer period (i.e. 20 quarters), it is inflation that accounts for 35.5% of the variation in real housing prices.

Impulse Responses

The impulse response functions show the dynamic behaviour of a variable due to random shocks in other variables. Figures 1 through 3 show the impulse response functions along with confidence intervals corresponding to ±2 times the standard deviation of the shock, and are based on 500 Monte Carlo replications for real housing prices in response to changes in the loan rate, inflation, and employment, respectively. Since the innovations are not necessarily uncorrelated, the residual terms were orthogonalized using a Choleski form in order to isolate the effects of each macroeconomic variable

on real housing prices. Although the impulse responses are sensitive to the ordering of the variables, different ordering provided support to the robustness of our results.

Figure 1: Impulse response of real housing prices to a positive shock in the housing loan rate

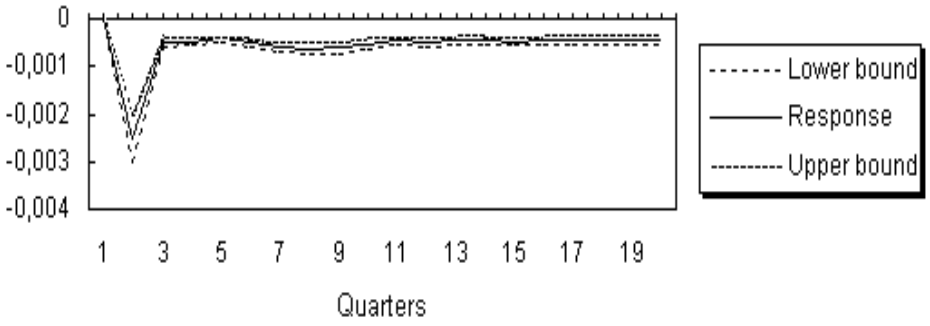
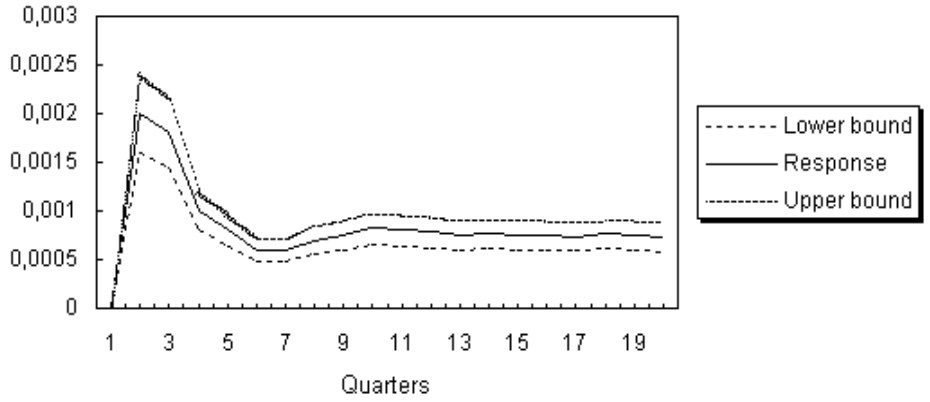


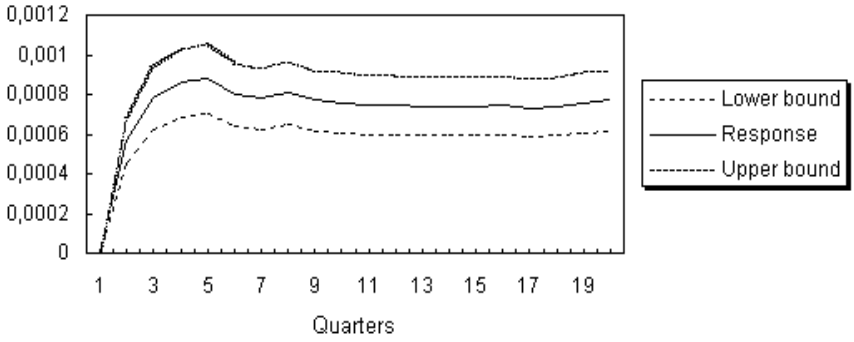
Figure 2: Impulse response of real housing prices to a positive shock in inflation



In Figure 1, a positive (higher) shock to the housing loan rate indicates that as the cost of financing a house purchase increases, the demand for housing falls. As a result, real housing prices decrease. Note that a shock to the housing loan rate generates a sharp cycle in real housing prices, with prices reaching their steady state within four quarters from the occurrence of the shock. An inspection of Figure 2 showed that a positive (increase) shock to inflation leads to higher housing prices, and eventually they reach their steady-state level after about 7-8 quarters from the occurrence of the shock.

These results seem to agree with their counterparts in Kearl (1979), according to whom inflation definitely leads to higher housing prices, thereby eventually reducing housing demand. Finally, an inspection of Figure 3 revealed that a positive (increase) shock to employment leads to higher real housing prices, which eventually reach their steady state level after about five quarters from the occurrence of the shock.

Figure 3: Impulse response of real housing prices to a positive shock in employment



Concluding Remarks and Policy Implications

The main objective of this paper was to analyse the dynamic effects of certain macroeconomic variables (i.e. the mortgage interest rate, inflation, and employment) on real housing prices of new houses sold in Greece. The results suggested that real housing prices do respond to specific economic variables. More specifically, variance decompositions show that the housing mortgage rate is the variable with the highest explanatory power over the variation in real housing prices, followed by inflation. In addition, impulse response functions show that a positive (higher) shock in the housing loan rate decreases real housing prices, and will eventually strengthen housing demand, while a positive (increase) shock in inflation and employment increases real housing prices and will eventually lead to lower housing demand.

After combining the results of variance decompositions and impulse response functions, certain policy implications should be indicated. Once mortgage rates are shown to be the most influential determinants for real housing prices, the future course of real housing prices within the environment of the EMU could be assessed. Within such an environment, housing finance systems will be closely integrated with capital markets, and therefore, mortgage rates are expected to be rationed by the general course of

common monetary policy. More specifically, Greek mortgage rates will follow a downward course in such a way that lower loan (mortgage) rates will lead to higher real housing prices, while lower inflation will lead to lower real housing prices. As a matter of fact, mortgage interest rates and inflation have followed a downward course, which is mainly attributed to the increased competition among banking institutions (i.e. a reduction in saving market segmentation), as well as among industries and firms within the environment of the EMU.

Furthermore, higher capital mobility implied by the EMU has contributed to lower financing costs in all sectors of the economy (including the banking sector), thereby lowering inflation rates. In addition, employment is expected to increase within the EMU, which is an environment characterized by the minimization (if not elimination) of certain uncertainties (e.g. exchange rate uncertainty). In this manner, developments in the employment sector are also expected to exert a substantial influence on real housing prices (i.e. higher employment is expected to lead to higher real housing prices).

Overall, the positive macroeconomic environment that will prevail within the EMU is expected to lead to more attractive investments for potential investors in the Greek real estate market, and more attractive opportunities for potential users of real estate credit. At the same time, increased competition in the banking sector, which will generate attractive mortgage interest rates, is expected to enhance the customer base among the banking institutions, and will very likely, under prudent credit policies, increase their expected profits.

Although nominal (and later real) convergence has been achieved to a large extent on the macroeconomic level, the fact that large differences regarding the institutional framework and certain other characteristics, such as transaction costs, remain in European real estate markets cannot be ignored in the process of affecting housing prices. In addition, this paper has not taken into consideration (mainly due to the lack of reliable fiscal data) the role of fiscal policies (i.e. direct and indirect taxes associated with real estate) in housing prices. Finally, an interesting point for research would be the impact of external economic factors, such as the economic conditions in the remaining EMU members and the competition emanating from foreign-owned banking institutions. These issues, however, will be addressed by future research efforts.

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