Eurobank Global Markets Research
www.eurobank.gr/research
EurobankGlobalMarkets
Research@eurobank.gr

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Dr. Platon Monokroussos
Deputy General Manager
Head of Global Markets Research
pmonokrousos@eurobank.gr

Dimitris Thomakos
Professor, Dept. of Economics
University of Peloponnese
Quantitative Advisor
Global Advisory Division

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Explaining and forecasting residential house prices in Greece

A technical note

Preface

The present paper utilizes cointegration analysis and a vector error correction model (VECM) to explain and forecast residential house prices in Greece, based on quarterly data spanning the period Q1 1995 to Q4 2013. In line with a number of earlier empirical studies, we document the existence of a cointegration relationship, which links real house prices, real GDP, the real mortgage loan rate and inflation. Furthermore, our VECM estimates suggest that, in the long-run, housing prices are positively related to real GDP and negatively related to both real lending rates and inflation. Finally, an out-of-sample forecasting exercise based on the estimated VECM coefficients points to a further decline in nominal residential house prices by between 6 and 12 percent, with a bottoming out of the recession in the domestic residential property market expected by early 2015 under the assumed baseline scenario (and by early 2016, under an adverse scenario).

1. Introduction

The international literature identifies a number of important drivers of residential housing prices, which include, among other, aggregate household income and wealth, the unemployment rate, inflation, returns on other assets, availability and terms of mortgage financing, tax incentives and demographic factors. A number of recent theoretical and empirical studies have also placed particular emphasis on the relationship between monetary developments and house prices. In theory, one can think of various interdependences between money and the housing sector, with causality running in both directions. For instance, a surge in house prices may cause a rise in the demand for money as a result of an increase in household wealth or due to higher transaction volumes in the property market. Furthermore, higher house prices increase the collateral values of homes and improve households' access to bank loans, thereby boosting credit and money growth. Causality may also run the other way around as, ceteris paribus, an expansionary monetary policy reduces interest rates (and, by implication, compresses housing services user costs), leading to an increase in the demand for housing services and thus, to higher house prices.

Not surprisingly, the empirical literature documents a significant effect of the mortgage interest rate on consumer spending via housing wealth, especially for markets featuring a large percentage of floating interest rate loans. That is because in the absence of adequate own resources or intergenerational transfers, most property purchases are financed though borrowing by banks and other financial institutions, using the value of property as collateral, especially as the average home price is usually a multiple of the average annual household disposable income. Furthermore, credit rationing renders the level of initial assets, current income and the mortgage rate relatively more important in determining demand for residential housing than expected future income streams and capital gains.

As to the other potential drivers of housing market activity, a number of empirical studies document a significant impact of GDP changes and employment on housing prices, while diverging views exist regarding the impact of inflation. In particular, a number of studies argue that inflation causes a rise in nominal mortgage payments and thus, a decline in the demand for housing services. Moreover, higher current (and expected) inflation may trigger a hawkish policy response from the monetary authority, which may decrease money supply, boost nominal rates and thus, increase the user cost for housing services. On the other hand, a number of authors document a positive link between inflation and housing prices as households may consider real estate purchases as a hedge against increased economic uncertainty signified by higher inflation rates.

The present paper utilizes cointegration analysis and a vector error correction model (VECM) to explain and forecast residential house prices in Greece, based on quarterly data spanning the period Q1 1995 to Q4 2013. In line with a number of earlier empirical studies, we document the existence of a cointegration relationship, which links real house prices, real GDP, the real mortgage loan rate and inflation. Furthermore, our VECM estimates suggest that, in the long-run, housing prices are positively related to real GDP and negatively related to both real lending rates and inflation. Finally, an out-of-sample forecasting exercise based on our estimated VECM coefficients points to a further decline in nominal residential house prices by between 6 and 12 percent, with a bottoming out of the recession in the domestic residential property market expected by early 2015 under the assumed baseline scenario (or by early 2016, under an adverse scenario).

The rest of this document is structured as follows: Chapter 2 presents a brief literature review of the determinants of residential house prices; Chapter 3 highlights some important developments in the Greek residential housing market in the period before and after the global financial crisis; Chapter 4 presents the data and variables utilized in our empirical study; Chapter 5 presents our empirical methodology and results; and Chapter 6 concludes.

2. Literature review: determinants of residential house prices

Residential housing is a durable good producing service streams that satisfy the basic human need for shelter, while simultaneously serving as a store of purchasing power (Zhu, 2003; Barker, 2005). Households can choose to acquire the whole asset or to simply buy the service stream it yields by renting residential property. The theoretical literature identifies the main factors determining the demand for residential housing. In more detail, demand is positively related to life-cycle wealth, which includes initial assets, current income and discounted expected income (Muellbauer and Murphy, 1997; Iossifov et al., 2008) and negatively related to household user cost, which is the difference between the monetary costs (e.g. after-tax depreciation, repair costs, property taxes, mortgage interest payments) and the benefits stemming from owning residential property (e.g. capital gains); see Poterba, 1984. In equilibrium, the marginal utility of an additional unit of housing equals the marginal user cost. Furthermore, the household should be indifferent between owning and renting and between consuming the stream of services from an extra unit of housing, either bought or rented, and an extra unit of any other consumption good (Poterba, 1984; Iacoviello, 2005).

On the supply side, the volume of housing construction is determined by the real prices of inputs (e.g. land and construction costs). In equilibrium (and under perfect competition), the price of an extra unit of housing sold should be equal to the price it commands (Himmelberg, Mayer, and Sinai, 2005; Iossifov et al., 2008). Various supply-side rigidities in the residential housing market (e.g. scarcity of land and zoning restrictions) give rise to supply-demand imbalances, rendering real estate prices primary demand-driven in the short-term. These imbalances can be aggravated further by elevated expectations of future capital gains on owner-occupied housing, giving rise to pronounced price deviations from fundamentals and, potentially, to housing market bubbles (Stiglitz, 1990; Hilberts, Lei, Zacho 2001).

Regarding the determinants of housing prices, the empirical literature identifies a number of important drivers, which include, among other, aggregate household income and wealth, the unemployment rate, inflation, returns on other assets, availability and terms of mortgage financing, tax incentives and demographic factors (see e.g. Muellbauer and Murphy, 1997; Hilbers, Lei and Zacho, 2001; Davis and Zhu, 2004; Egebo and Lienert, 1988). A number of recent theoretical and empirical studies have also placed particular emphasis on the relationship between monetary developments and house prices (see e.g. Greiber and Setzer, 2007). In theory, one can think of multiple interdependences between money and the housing sector, with causality running in both directions. For instance, a surge in house prices may cause a rise in the demand for money as a result of an increase in household wealth or due to higher transaction volumes in housing and construction markets. Furthermore, higher house prices increase the collateral values of homes and improve households' access to bank loans, thereby boosting credit and money growth. Causality may also run the other way around as, ceteris paribus, an expansionary monetary policy reduces interest rates (and compresses housing services user costs), leading to an increase in the demand for housing services and thus, to higher house prices.

Interestingly, the empirical literature documents a significant effect of the mortgage interest rate on consumer spending via housing wealth, especially for markets featuring a large percentage of floating interest rate loans and for systems characterized by the importance of the collateral role of houses (Muellbauer, 1992; Muellbauer and Murphy, 1997; Maclennan et al., 1998; Apergis 2003). That is because in the absence of adequate own resources or intergenerational transfers, most property purchases are financed through borrowing by banks and other financial institutions, using the value of property as collateral, especially as the average home price is usually a multiple of the average annual household disposable income. Furthermore, credit rationing renders the level of initial assets, current income and the mortgage rate relatively more important in determining demand for residential housing than expected future income streams and capital gains (Iossifov et al., 2008). As to the other potential drivers of housing market activity, a number of empirical studies document a significant impact of GDP changes and employment on housing prices, while diverging views exist regarding the impact of inflation. In particular, a number of studies (see e.g. Kearl, 1979) argue that inflation causes a rise in nominal mortgage payments and thus, a decline in the demand for housing services. Moreover, higher current (and expected) inflation may trigger a hawkish policy response from the monetary authority, which may decrease money supply, boost nominal rates and thus, increase the user cost for housing services. On the other hand, a number of authors document a positive link between inflation and housing prices as households may consider real estate purchases as a hedge in periods of increased economic uncertainty signified by higher inflation rates.

3. Greek housing market developments in the period before and after the global financial crisis

Available data for Greece, spanning the period 1995-2013, shows a strong co-movement between real housing prices and real mortgage loans in the pre-crisis period along with a much steeper decline in real prices after the outbreak of the 2008/2009 global financial upheaval (Graph 1.1 - Annex). To a large extent, the latter disconnect can be attributed to massive Eurosystem liquidity support provided to Greek banks post the eruption of the sovereign debt crisis. This prevented a more pronounced drawdown of domestic credit, which could exacerbate further an already severe recession.[1] Note that from early 2010 to late 2013 the total outstanding stock of bank mortgage loans to domestic households recorded a cumulative decline of ca 12.5%, which compares with a parallel drop of more than 30% in domestic bank deposits. For comparison, the (new) house price index compiled by the Bank of Greece (BoG)[2] has declined by a cumulative 29.7% since early 2010 and by ca 33.6% over the period Q3 2008 to Q4 2013.

Between Q1 1997 and Q4 2013, BoG's nominal housing price index recorded a cumulative increase of ca 171%, implying average annual growth in the prices of dwellings of slightly over 10% (Graphs 1.2 & 1.3 – Annex). Over the same period, the harmonized consumer price index for Greece grew by a cumulative 47% or by an average annual rate of 2.8%. Meanwhile, bank housing loans in Greece recorded robust growth in the decade leading to the global financial crisis, with the respective ratio to GDP rising from 4.1% in Q4 2005 to 33.2% in Q4 2008 and reaching 38.9% at the end of last year. Note that the increase in the housing loans-to-GDP ratio over the latter period can be exclusively attributed to the steep decline in nominal GDP.

Reflecting a catching up process with the standards of living prevailing in other Eurozone states as well as a host of country-specific factors, the outstanding amount of housing loans in Greece grew faster than in many other euro area economies in the decade leading to the global crisis. Yet, the outbreak of the crisis found the country featuring a private-sector credit to GDP ratio not far from the respective euro area average (Graph 1.4 – Annex). In more detail, some of the drivers explaining the aforementioned development include a relatively late (i.e., in 1994) deregulation of the domestic lending market, the collapse of domestic interest rates upon euro adoption (Graph 1.5 - Annex), the gradual reduction by BoG of bank reserve requirements (in accordance with Eurosystem rules) as well as the abolition of an earlier requirement for banks to hold government bonds, which encouraged them to rebalance their portfolios in favor of private-sector debt.

Another important factor that explains the rapid growth of mortgage credit in Greece in the pre-crisis period is the country's relatively high home ownership rate (currently estimated at slightly below 80%; see Graph 1.6 - Annex). As noted in Brissimis and Vlassopoulos (2007), home ownership has traditionally been important in Greece for cultural reasons. It may also reflect the fact

[1] Cumulative real GDP losses in Greece amounted to 25.8ppts over the period 2008-2013.
[2] Index of prices of apartments (new series).

that property was the only available investment to insulate household savings from inflation in a period when financial regulation was intense and capital controls were in place.

On the back of the aforementioned developments, housing loans increasingly became an important part of Greek bank portfolios, as the share of mortgage loans in total bank loans more than doubled between 1995 (14%) and 2005 (29%).

A comprehensive overview of developments in Greece's residential housing market in the period following the outbreak of the global crisis can be found in Bank of Greece's website (http://www.bankofgreece.gr/BoGDocuments/BoG%20-%20RED%20Oct%202013.pdf) and for brevity we turn next to the empirical part of our paper.

4. Data

Our empirical analysis was carried out using quarterly data spanning the period Q1 1995 to Q4 2013. The variables used in our analysis include:

i. Bank of Greece's Index of Prices of Dwellings Historical Series (***hp***). This is a weighted index according to the stock of houses in Athens and in other urban areas and it is based on data collected by credit institutions. Up to 2005, the index includes all dwellings and from 2006 onwards it includes apartments only.

ii. Real interest rate on total housing loans with over 5-year maturity (***real_r***). In our analysis, we use the harmonized CPI index for Greece to deflate the respective nominal interest rate.

iii. Real GDP in 2005 prices (***rgdp***).

iv. Harmonized consumer price index for Greece with 2005 = 100 (***inf***).

All of the series above (except of the real interest rate) enter our study in seasonally adjustment terms and as logarithmic values (the X-12 ARIMA methodology was used to seasonally adjust our data).

5. Empirical methodology and results

To empirically test the relationship between residential house prices in Greece and the rest of our macro indicators we estimate a vector error correction model (VECM), after establishing (by using the appropriate unit root rests) that all variables considered in our study are non-stationary *I(1)* processes. A vector error correction is a restricted vector autoregressive (VAR) model designed for use with non-stationary time series that are known to be cointegrated, i.e. that possibly have a long(er)-term equilibrium relationship. The VECM has cointegrating relations built into the specification so that it restricts the long-run behavior of the endogenous variables to converge to their equilibrium while allowing for short-term adjustment dynamics.

__Unit root and cointegration tests__

We start the analysis by testing for the non-stationarity of our variables, utilizing the Augmented Dickey Fuller (ADF) unit root test.[3] The corresponding results for the variables entering our baseline VECM specification are shown in Table 2 (Annex). Overall, the applied ADF tests cannot reject (at the 1% significance level) the null hypothesis that the variables ***hp***, ***rgdp***, ***real_r*** and ***inf*** contain a unit root. Furthermore, unit root non-stationarity was strongly rejected for all of the aforementioned variables when taken in first differences, indicating that all of them constitute *I(1)* processes.

As a second step, we estimate a vector autoregression (VAR) model in levels for the variables ***hp***, ***rgdp***, ***real_r*** and ***inf***. Note that the VAR approach sidesteps the need for structural modeling by treating every endogenous variable as a function of the lagged values of all of the endogenous variables in the system. The lag order selected for our VAR specification was 2, based on the Akaike and

[3] See Dickey Fuller, 1981.

Schwarz information criteria. Furthermore, the application of a range of appropriate diagnostic tests (e.g. for serial correlation and normality) confirm that the estimated residuals are white noise. In more detail, estimated residuals are uncorrelated with their own lagged values and with all of the right-hand side variables (relevant results are available upon request).

We then proceed to determine the existence of cointegration relationships among the main variables of interest, using the testing procedure developed by Johansen (1988, 1991, 1995). Two or more non-stationary time series are said to be cointegrated if a linear combination of them exists that is stationary. Table 3 (Annex) depicts the results of our cointegration tests, which indicate the existence of one cointegration relationship among the variables ***hp***, ***rgdp***, ***real_r*** and ***inf***.

Vector error correction model

Having established the existence of one cointegration relationship among the above variables, we proceed to estimate our vector error correction model, VECM(2), conditional on this. Identification of the cointegration relationship can then be obtained by imposing a normalization restriction. In our case we normalize on the ***hp*** variable, with our empirical analysis yielding the following results (see also Table 4 – Annex):

$$\Delta(hp) = -0.019\,\Delta(hp(-1)) + 0.219\,\Delta(hp(-2)) - 0.040\,\Delta(rgdp(-1)) - 0.102\,\Delta(rgdp(-2)) - 0.001\,\Delta(real\_r(-1)) + 0.002\,\Delta(real\_r(-2)) - 0.875\,\Delta(inf(-1)) - 0.638\,\Delta(inf(-2)) - 0.230\,EC(-1) + 0.014$$

(R-squared = 0.39)

where the notation above is as follows:

Δ(hp) is the log difference of the index of prices of dwellings, with hp(-1) and hp(-2) denoting the 1st and 2nd lags of the hp variable;

Δ(rgdp) is the log difference of GDP (in 2005 prices);

Δ(real_r) is the first difference of the real rate on housing loans with maturity over 5 years;

Δ(inf) is the log difference of Greece's harmonized consumer price index; and

EC is the error-correction term, with the respective estimated coefficient (= -0.230 and strongly significant with a t-statistic value of -4.617) denoting the system's speed of adjustment to deviations from the long-term equilibrium.

As shown in Table 4 (Annex), the estimated EC term (i.e., the long-term equilibrium relationship among the four variables of interest) is as follows:

Long-term equilibrium relationship

$$hp = 1.326\,rgdp - 0.022\,real\_r - 0.94\,inf + 9.128$$

(-8.31)*   (2.64)*   (4.49)*

Where the values inside the parentheses above denote the corresponding t-statistics and the single asterisk (*) indicates significance at the 1% confidence level.

All long-term coefficients reported in Table 4 (Annex) are statistically significant and carry the expected signs. In more detail,

Housing prices are positively related to real GDP with an elasticity of 1.326. This compares with an estimated income elasticity of 0.997 found in Brissimis and Vlassopoulos, 2007, though they use a different VECM specification than that estimated in our study and a different time span.

Housing prices are negatively related to real lending rates, with the estimated response coefficient found to be strongly significant and broadly comparable in size with that estimated in Brissimis and Vlassopoulos, 2007 (-0.039). In an earlier study using quarterly housing price data for Greece spanning the period 1981 to 1999, Apergis (2003) finds an interest rate coefficient of -0.008, with the respective interest rate variable being proxied by the average rate of housing loans maturing in 15 years.

Housing prices are negatively related to inflation, with an estimated response coefficient of -0.94.

Finally, the loading factor for housing prices (-0.230) is both negative and statistically significant, implying relative fast adjustment of prices to market disequilibria. On the other hand, the estimated loading factors for real GDP, the real lending interest and inflation are insignificant, suggesting that the latter 3 variables can be considered as weakly exogenous in our model specification.

Out-of-sample forecasts

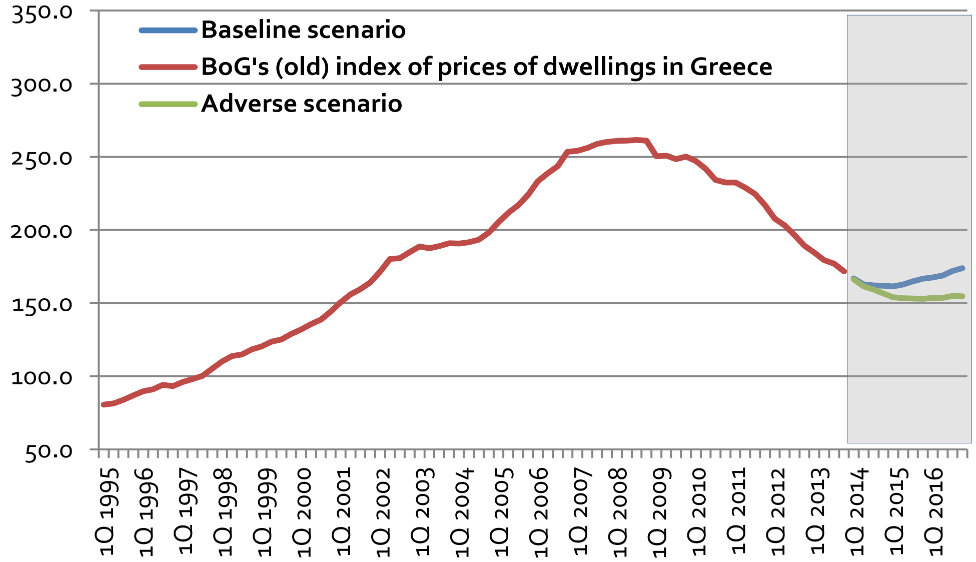
As a final step to our empirical analysis, we perform an out-of-sample forecasting exercise for residential housing prices in Greece (***hp***), based on our VECM estimates and assuming two discrete scenarios for the evolution of the remaining variables of interest i.e., real GDP (***rgdp***), the real rate on housing loans with maturity over 5 years (***real_r***) and inflation (***inf***). The assumed paths of our real GDP variable are constructed so as to broadly coincide with the baseline and the adverse scenarios agreed with the EC/ECB/IMF troika of official lenders and used in the latest stress-tests conducted by the Bank of Greece to estimate the capital needs of the domestic banking system (results publically announced on March 6, 2014). The assumed paths of the other two variables (i.e., inflation and the real interest rate on housing loans) under the baseline and the adverse scenario are based on the troika's latest forecasts (when available) and authors' respective projections (available data upon request). Graph A, below provides a diagrammatic depiction of the historical and forecasted evolution of residential housing prices in Greece, under the assumed baseline and adverse scenarios, while Table-A shows the respective figures.

Table A - Real GDP growth and residential house prices: realizations and forecasts

	Real GDP (%, YoY)		Residential house price index (%, YoY)	
	Baseline	*Adverse*	*Baseline*	*Adverse*
2008	-0.2	-0.2	0.3	0.3
2009	-3.1	-3.1	-4.2	-4.2
2010	-4.9	-4.9	-7.0	-7.0
2011	-7.1	-7.1	-6.7	-6.7
2012	-6.4	-6.4	-12.8	-12.8
2013	-3.7	-3.7	-9.3	-9.3
2014f	0.6	-2.9	-5.9	-9.0
2015f	2.9	-0.3	1.0	-3.9
2016f	3.7	1.0	2.9	0.9

Source: BoG, Eurobank Global Markets Research

Graph A – Evolution of residential house prices in Greece and VECM forecasts



Source: BoG, Eurobank Global Markets Research

6. Concluding remark

The present paper utilizes cointegration analysis and a vector error correction model (VECM) to explain and forecast residential house prices in Greece, based on quarterly data spanning the period Q1 1995 to Q4 2013. In line with a number of earlier empirical studies, we document the existence of a cointegration relationship, which links real house prices, real GDP, the real mortgage loan rate and inflation. Furthermore, our VECM estimates suggest that, in the long-run, housing prices are positively related to real GDP and negatively related to both real lending rates and inflation. Finally, an out-of-sample forecasting exercise based on our estimated VECM coefficients points to a further decline in nominal residential house prices of between 6 and 12 percent, with a bottoming out of the recession in the domestic residential property market expected by early 2015 under the assumed baseline scenario (or by early 2016, under an adverse scenario).

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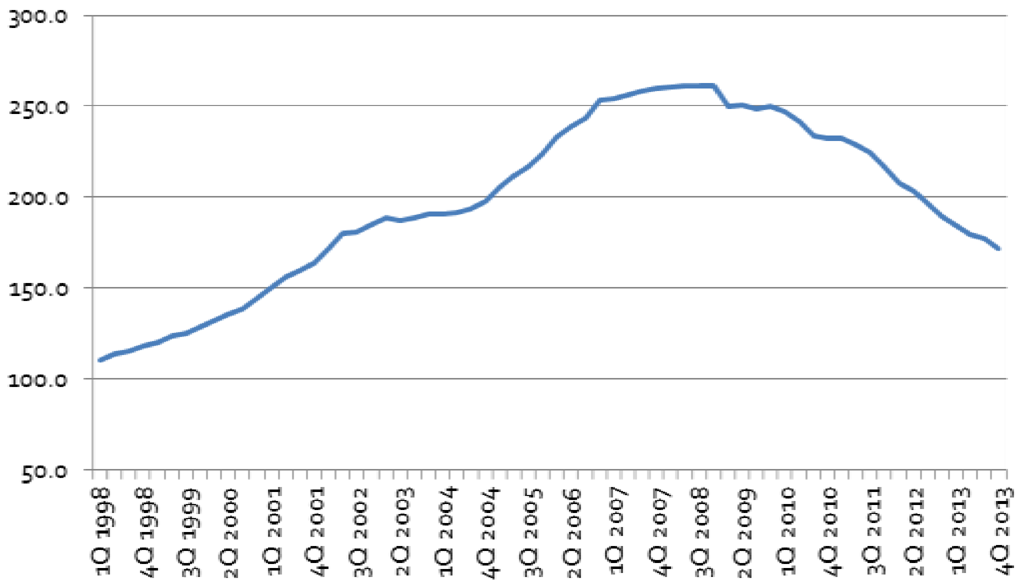
Annex

Graph 1.1 - Greece: real housing loans and housing prices

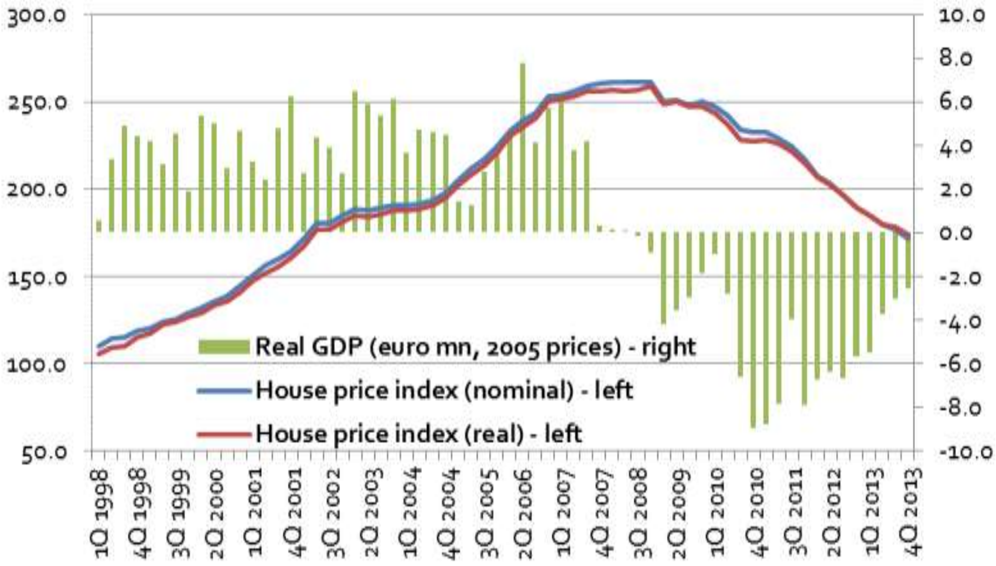
Source: BoG, Eurobank Global Markets Research

Graph 1.2 - Greece: Index of prices of dwellings (1997=100; historical series)



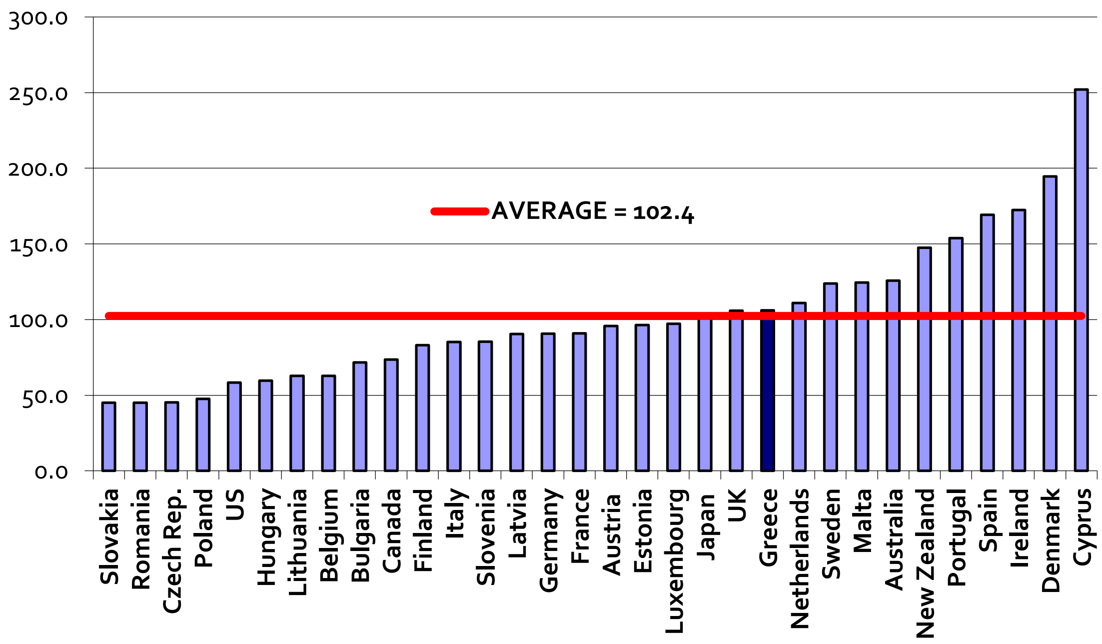
Source: BoG, Eurobank Global Markets Research

Graph 1.3 - Greece: residential property prices and real GDP YoY growth



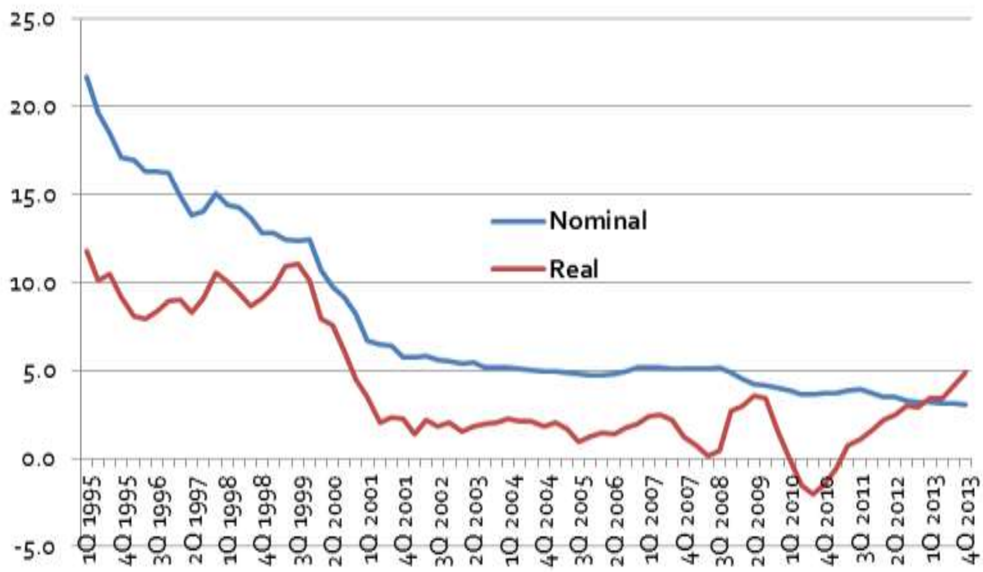
Source: BoG, Eurobank Global Markets Research

Graph 1.4 – Private sector credit (% GDP) in a number of advanced and emerging market economies in 2008



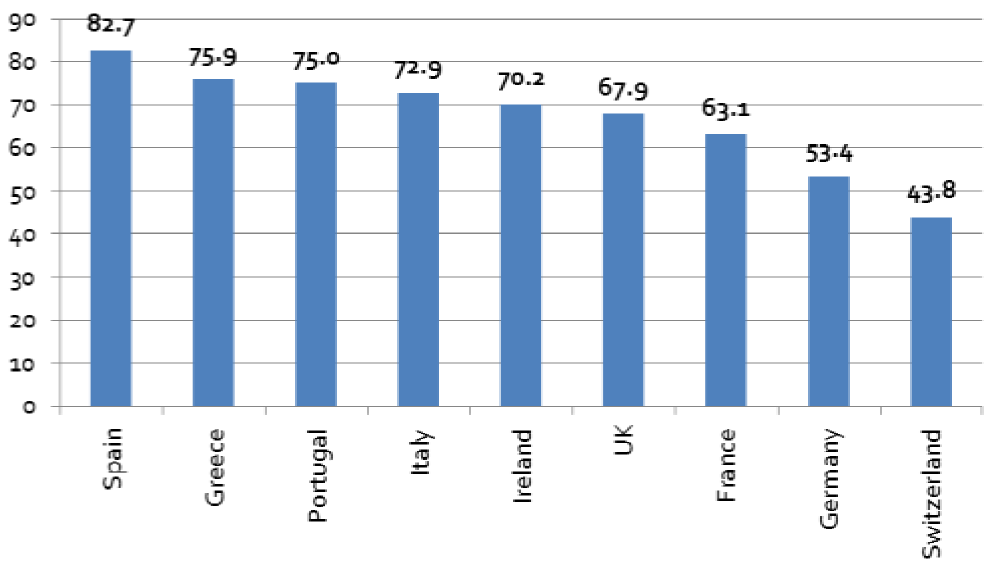
Source: IMF, WB, Eurobank Global Markets Research

Graph 1.5 - Greece: evolution of nominal and real interest rates on housing loans with (maturity over 5 years



Source: BoG, Eurobank Global Markets Research

Graph 1.6- Home owner rates in selected EU countries in 2011



Source: Statista, Eurobank Global Markets Research

Table 1 – Data & sources

Indicator	Acronym	Frequency	time span	Source
Index of prices of dwellings	***hp***	quarterly	1997-2013	BoG
Real interest rate on housing loans (> 5yr maturity)	***r***	quarterly	1995-2013	BoG
Real housing loans	***l***	quarterly	1995-2013	BoG
Real GDP (2005 prices)	***rgdp***	quarterly	1995-2013	Eurostat
Harmonized consumer price index	***cpi***	quarterly	1995-2013	Eurostat

Table 2 - Unit-Root Tests (Augmented Dickey-Fuller)

Table 1 - Unit-Root Tests (Augmented Dickey-Fuller)				
	With a constant		With a constant and a linear trend	
Variables	Levels	First differences	Levels	First differences
ph	-1.50	-3.14**	0.71	-5.23***
rgdp	-1.73	-10.46***	-0.02	-11.08***
real_r	-1.47	-4.86***	-0.69	-5.05***
inf			-1.25	-7.06***
Rejection of the null hypothesis of non-stationarity is denoted by *** (1% significance level), ** (5% significance level) and * (10% significance level)				
Appropriate number of lags selected in the augmented term so as to ensure white-noice regression residuals				

Table 3 – Cointegration tests (Johansen 1991, 1995)

Sample (adjusted): 1995Q4 2013Q4
Included observations: 73 after adjustments
Series: HP RGDP REAL_R INF
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.295508	55.06238	47.85613	0.0091
At most 1	0.225584	29.49205	29.79707	0.0542
At most 2	0.127909	10.82990	15.49471	0.2222
At most 3	0.011428	0.839046	3.841466	0.3597

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.295508	25.57033	27.58434	0.0885
At most 1	0.225584	18.66215	21.13162	0.1070
At most 2	0.127909	9.990851	14.26460	0.2125
At most 3	0.011428	0.839046	3.841466	0.3597

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Note: Tests conducted assuming an intercept (no trend) in the cointegrating equation and test VAR

Table 4 – VECM (2) estimates

Sample (adjusted): 1995Q4 2013Q4
Included observations: 73 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1			
HP(-1)	1.000000			
RGDP(-1)	-1.325522 (0.15945) [-8.31296]			
REAL_R(-1)	0.021629 (0.00819) [2.64036]			
INF(-1)	0.942230 (0.20993) [4.48820]			
C	9.127664			
Error Correction:	D(HP)	D(RGDP)	D(REAL_R)	D(INF)
CointEq1	-0.230342 (0.04989) [-4.61708]	0.075933 (0.06637) [1.14412]	-0.831379 (1.40853) [-0.59025]	-0.017533 (0.01054) [-1.66419]
D(HP(-1))	-0.019440 (0.10828) [-0.17953]	-0.044088 (0.14405) [-0.30606]	-1.351370 (3.05719) [-0.44203]	0.039291 (0.02287) [1.71827]
D(HP(-2))	0.219111 (0.10685) [2.05071]	0.298029 (0.14214) [2.09677]	1.471961 (3.01662) [0.48795]	0.019438 (0.02256) [0.86149]
D(RGDP(-1))	-0.040084 (0.10700) [-0.37461]	-0.095169 (0.14234) [-0.66859]	-1.850211 (3.02097) [-0.61246]	-0.039482 (0.02260) [-1.74733]
D(RGDP(-2))	-0.101691 (0.10182) [-0.99870]	0.155996 (0.13546) [1.15164]	-2.856945 (2.87481) [-0.99379]	0.002031 (0.02150) [0.09443]
D(REAL_R(-1))	-0.000907 (0.00486) [-0.18670]	-0.001931 (0.00646) [-0.29886]	0.442328 (0.13711) [3.22605]	-0.001275 (0.00103) [-1.24371]
D(REAL_R(-2))	0.001512 (0.00492) [0.30762]	-0.002773 (0.00654) [-0.42405]	-0.002928 (0.13880) [-0.02110]	0.001033 (0.00104) [0.99502]
D(INF(-1))	-0.875076	1.600978	-8.421276	0.082498

Table 4 - VECM (2) estimates continued

D(INF(-2))	-0.638255	-0.616271	-7.176044	0.286870
	(0.62153)	(0.82682)	(17.5478)	(0.13125)
	[-1.02691]	[-0.74535]	[-0.40894]	[2.18567]
C	0.014006	-0.006078	0.099615	0.004714
	(0.00703)	(0.00935)	(0.19839)	(0.00148)
	[1.99331]	[-0.65023]	[0.50212]	[3.17662]
R-squared	0.387635	0.193639	0.228251	0.337299
Adj. R-squared	0.300154	0.078444	0.118002	0.242627
Sum sq. resids	0.045315	0.080194	36.12164	0.002021
S.E. equation	0.026820	0.035678	0.757205	0.005664
F-statistic	4.431085	1.680970	2.070312	3.562830
Log likelihood	165.9542	145.1198	-77.90230	279.4751
Akaike AIC	-4.272718	-3.701913	2.408282	-7.382879
Schwarz SC	-3.958957	-3.388151	2.722044	-7.069118
Mean dependent	0.001393	0.002740	-0.078082	0.007808
S.D. dependent	0.032059	0.037166	0.806268	0.006508

Determinant resid covariance (dof adj.)	1.32E-11
Determinant resid covariance	7.30E-12
Log likelihood	521.6271
Akaike information criterion	-13.08567
Schwarz criterion	-11.70512

Eurobank Global Markets Research

Global Markets Research Team

Dr. Platon Monokroussos: *Head of Global Markets Research*
pmonokrousos@eurobank.gr, + 30 210 37 18 903

Paraskevi Petropoulou: *G10 Markets Analyst*
ppetropoulou@eurobank.gr, + 30 210 37 18 991

Galatia Phoka: *Emerging Markets Analyst*
gphoka@eurobank.gr, + 30 210 37 18 922

Global Markets Sales

Nikos Laios: *Head of Treasury Sales*
nlaios@eurobank.gr, + 30 210 37 18 910

Alexandra Papathanasiou: *Head of Institutional Sales*
apapathanasiou@eurobank.gr, +30 210 37 18 996

John Seimenis: *Head of Corporate Sales*
yseimenis@eurobank.gr, +30 210 37 18 909

Achilleas Stogioglou: *Head of Private Banking Sales*
astogioglou@eurobank.gr, +30 210 37 18 904

Vassilis Gioulbaxiotis: Head of International Sales
VGioulbaxiotis@eurobank.gr, +30 210 3718995

George Petrogiannis: *Head of Shipping Sales*
gpetrogiannis@eurobank.gr, +30 210 37 18 915

Eurobank Ergasias S.A, 8 Othonos Str, 105 57 Athens, tel: +30 210 33 37 000, fax: +30 210 33 37 190, email: EurobankGlobalMarketsResearch@eurobank.gr

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