

The Relationship between Housing Prices and Macroeconomic Factors in Spain

Garrett Fitzgerald¹

This paper examines the effects of certain macroeconomic variables (i.e mortgages, inflation, and employment) on the price of houses in Spain. An error correction vector autoregressive (ECVAR) model is used to model the impact of the macroeconomic variables on real housing prices. Variance decompositions will be analyzed to determine the extent to which these variables have an effect on housing prices in Spain.

JEL classification: E32; R20; G00; G11

Keywords: housing, spain, inflation, employment, mortgages

Bryant University, 1150 Douglas Pike, Smithfield, RI 02917. Phone (413) 586-2529, Email: gfitzger@bryant.edu

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1.0 INTRODUCTION

The aim of this paper is to take several macroeconomic variables (interest rates, employment, and inflation) and model the impact of these variables on real housing prices in Spain. The goal is to examine the relationship between these variables and analyze any interesting indications, to use empirical tests to support basic economy theory surrounding the relationships between the variables and provide policy implications.

This subject is important because the entire world is now in the throes of recession due to the burst of a global asset bubble. The paper is an analysis of the world's most extreme housing bubble, which is different in many regards from the United States housing bubble. In Spain, housing is the dominant and most widely held asset, and is a substantial portion of the country's GDP. Spanish housing data has been criticized for being unreliable and biased, so this analysis will discover whether the data can hold up to a series of tests and produce results that make sense. Readers will learn of the various events leading up to and after the bust of the Spanish property bubble and may be able to draw important implications from such analysis.

The remainder of the paper is organized as follows: Section 2 will present a review of literature, Section 3 presents the empirical analysis and results, and Section 4 will provide a conclusion and policy implications.

2.0 TREND

The Spanish economy has experienced robust growth since the mid-1990s, mainly attributed to the housing sector. From 1995 to 2008, Spanish housing prices have risen 190%, making the U.S housing market pale in comparison ¹. From 1999 to 2005, prices for apartments and houses accelerated at an annual rate of 15% in Spain. ² The housing market has been integral component of the Spanish economy. Housing related industries compose 20% of the economy in Spain, as opposed to 10% in the U.S. ³

Spain has one of the highest rates of homeownership in the world at approximately 80%, higher than the estimated 67.8% homeownership rate in the United States. ⁴ Adding to this, the Spanish tax and legal system favor homeownership. Eviction is often an expensive and slow process for owners.

Much of the lending done in Spain is related to the housing sector. According to Martinez (2008), 60 percent of the credit granted to the private sector residents is related to the activity in the real estate sector. Housing is the most important asset held by households, representing 66.1% of the total value of households' real assets and 58.9% of the total value of all their assets.

There are several unique characteristics of the Spanish housing bubble which are important to note. Robust housing price appreciation was coincidental with equally robust increases in housing supply; between 2000 and 2007, homes built averaged 600,000 annually, a number which exceeded the annual figures for Germany, France, the U.K and Italy combined. Also, adjustable (i.e, variable) rate mortgages (ARM) account for nearly all of the stock of mortgages (approximately 98%). This may be due to the expectations of low interest rates for the future due

¹ Lachman, Desmond. "The Housing Pain in Spain", published March 7 2008. New York Sun. Accessed 03/17/09. <http://www.nysun.com/opinion/housing-pain-in-spain/72501/>

² <http://www.wharton.universia.net/index.cfm?fa=viewfeature&id=1341&language=english>

³ "Real Estate Collapses, and Spain Trembles". <http://www.wharton.universia.net/index.cfm?fa=viewfeature&id=1341&language=english>

⁴ 2005 Spanish Survey of Housing Finances. <http://www.bde.es/informes/be/ocasional/do0810e.pdf>

to the stated objective of the European Central Bank to fight inflation. Also to note, home equity withdrawals are a rare occurrences in Spain. In contrast to the United States, Spain was relatively secure from the wake of the sub-prime crisis, as the regulation of securitized assets in Spain was conservative. As opposed to the situation in the United States, where securitization of mortgages was performed to transfer risk, in Spain securitization was related mainly to funding purposes.

Causes for the Spanish Housing Bubble

In 1999, members of the European Union formally introduced the euro and subsequently the monetary policy of all members was under the control of the European Central Bank. Spain's membership in this monetary union implied a sharp reduction in real interest rates. The reduction in real interest rates substantially decreased the cost of capital for investment, and lowered the discount factor for any expected future payoffs which should increase asset prices as a result.⁵ The reduction in real interest rates bolstered borrowing and heightened expectations for nominal stability of interest rates which allowed for the lengthening of maturities for mortgage borrowing (from 10 to 28 years between 1990 and 2007).⁶

Demographic factors were also a significant factor. A generation of baby-boomers composed the majority of the population, who, with their accumulated savings, were able to take advantage of the ongoing housing bubble. Also, an explosion of immigration that took place in the last ten years provided an abundance of cheap, unskilled labor for the construction sector and an increased demand for housing. As of 2005, foreigners accounted for 7% of the population, a statistic which has by estimates reached approximately 10% as of 2008.⁷ Additionally, speculation was fueled by an extraordinary influx of foreign-investors (those seeking to speculate, purchase vacation or second homes, or both).

⁵ Ayuso, J. and Blanco, R. and Restoy, F. (2006), "House prices and real interest rates in Spain", *Banco de Espana Ocasional Papers*, 0608.

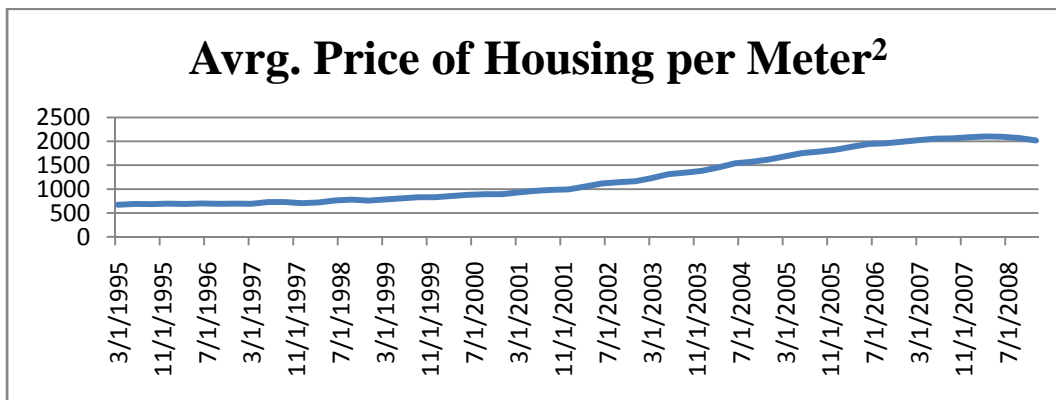
⁶ The Housing Boom and Bust in Spain: Impact of the Securitization Model and Dynamic Provisioning, published September 1st, 2008. Housing Finance International. Accessed 04/16/2008. <http://www.allbusiness.com/economy-economic-indicators/economic-policy/11760429-1.html>

⁷ 4.7% resident population growth from 2002-2005. 2005 Survey of Housing Finances. Bank of Spain. <http://www.bde.es/estadis/eff/eff-be1207e.pdf>

Credit expansion among households increased substantially in time with declines in the household saving ratio. In 2005 the household saving ratio was around four percentage points lower than the average over the first half of the previous decade, net financial saving (Δ in financial assets minus Δ in financial liabilities) has fallen dramatically, and private, non-financial sector debt had risen to 160% of GDP, more than twice the 1995 ratio.⁸

As Exhibit 1 shows below, average house prices have risen higher than historical norms in the past 10 years, and have only just begun to decline. The author would like to point out it has been widely assumed that official figures from the Ministry of Housing underestimate the true extent of the current Spanish housing correction. The data used by this paper, published by the Ministry of Housing (MiV), is provided by the Association of Official Appraisal Agencies in Spain (ATASA). The fact that estimates are based on home appraisals presents a serious bias in the data; appraisal agencies are pressured to overvalue homes when banks wish to lend out more money, and pressured to undervalue homes during economic hard times. Adding to this problem, a Bloomberg article investigated the fact that many banks have ownership equity stakes in home-valuation agencies.⁹ Thus, it is highly likely that the housing data may not be the best representation of housing price evolution, though it does capture the trend.

Exhibit 1: The Average Price of Housing per Meter Squared, 1995-2008



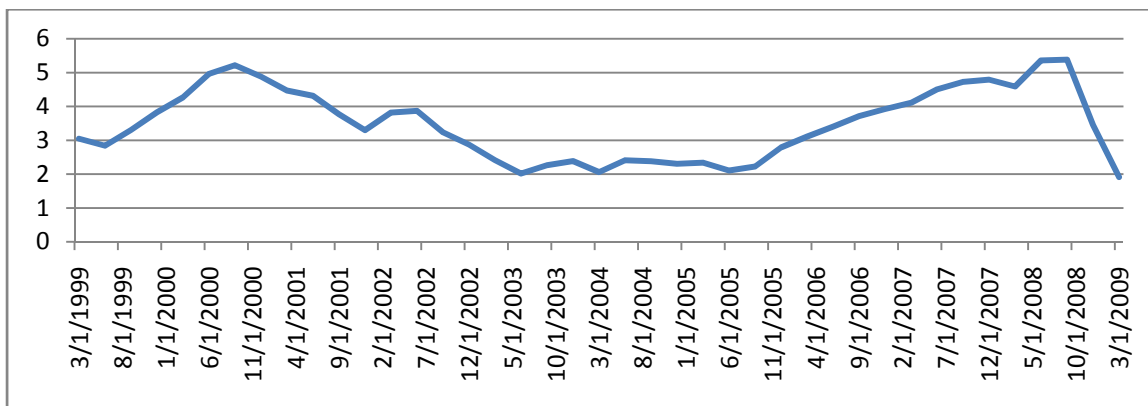
Source: Ministerio De Vivienda

⁸ Ayuso, J. and Blanco, R. and Restoy, F. (2006), "House prices and real interest rates in Spain", *Banco de Espana Occasional Papers*, 0608.

⁹ Sills, Ben and Duarte, Esteban, (2008), "Spain's Inflated Home Values Infect Mortgage Bonds", *Bloomberg.com* <<http://www.bloomberg.com/apps/news?pid=20601170&refer=home&sid=avLtlLCD0wcQ>>

Martinez (2008) argues that over the past two years the rise in interest rates was a major cause of the bursting of the housing bubble, along with the over-valuation of house prices, the excess housing supply and the growing debt levels of Spanish families. The EURIBOR interest rate, which is commonly used for as the base interest rate for mortgage lending, remained very low during the 2003-2005 period. The ensuing housing price appreciation, along with a rise in stock markets, bolstered household and corporate net wealth. At the onset of the financial crisis, the EURIBOR is shown to begin a sharp downward trajectory as the European Central Bank responded to the financial turmoil. The graph of the EURIBOR, which provides the base rate for mortgage rates, implies a negative correlation with the price of housing.

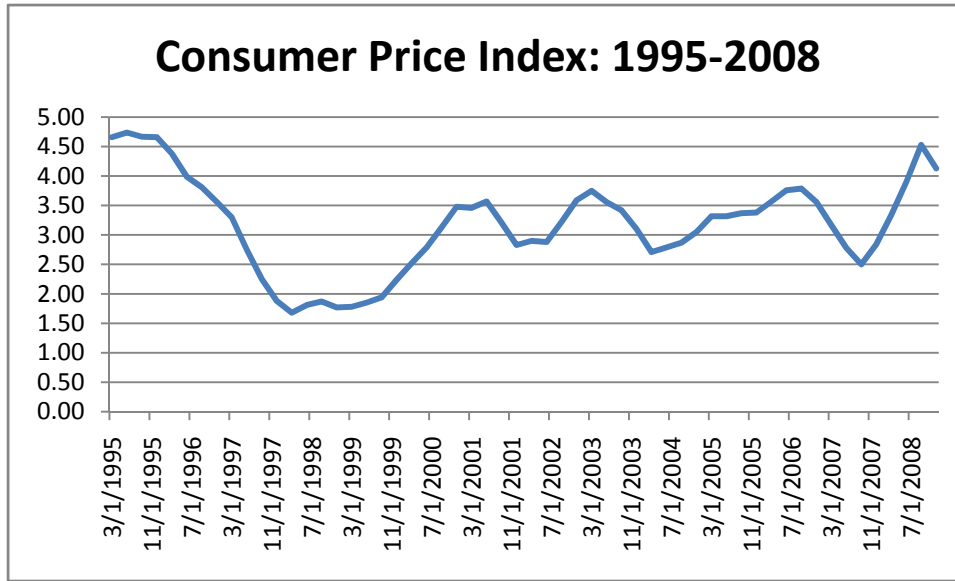
Exhibit 3: EURIBOR 12-month Interest Rate: 1999-2009



Source: Banco de Espana

Exhibit 4 shows the movements of the Spanish Consumer Price Index from 1995 to 2008. In the beginning of the series, we see the decline of inflation. At that time, Spain had its own central bank, and was implementing monetary policies in order to begin the transition into a European Monetary Union. Upon formation of the EMU in 1999, inflation begins an upward trajectory and stays within the range of 3.50%-2.50%, until peaking at 4.50% in early 2008. The movements of inflation show a modest correlation with the upward trending housing data, though it is expected the initial downward trend of CPI may prove to be a source of problems in our results.

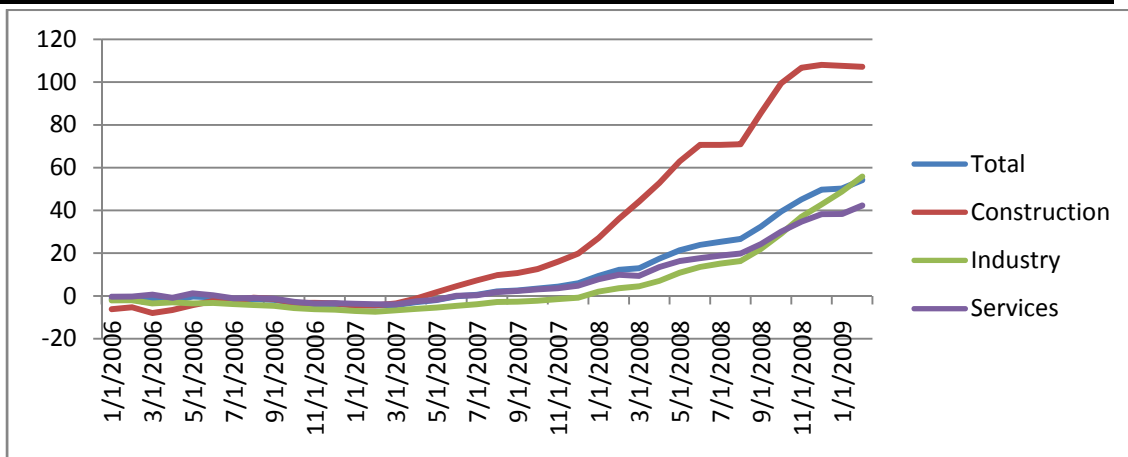
Exhibit 4: Consumer Price Index from 1995-2008



Source: Banco de Espana

Exhibit 2 shows the registered number of unemployed, in millions, by branch of activity from 2006 to the current quarter. Despite a large increase in the labor supply which stemmed from significant flows of immigration and an increase in female participation rates, unemployment decreased from 22.9% in 1995 to a low of 8.26% in 2007, before climbing to 9.50% in 2008. Recent estimates of the national average unemployment rate are approximately 15%.¹⁰

Exhibit 2: Registered # of Unemployed (in millions) by Branch of Activity, 2006-2009



Source: Banco de Espana

¹⁰ Index Mundi. http://www.indexmundi.com/spain/unemployment_rate.html Accessed 04/16/2009.

3.0 LITERATURE REVIEW

The workings of this paper will take example and guidance from several others. The paper, *Housing Prices and Macroeconomic Factors: Prospects within the European Monetary Union*, by Apergis (2003) provides this paper with a blueprint for empirical analysis. The paper analyzes the dynamic effects of macroeconomic variables on the price of new houses sold in Greece. The empirical methodology utilizes unit root tests, cointegration analysis, an error correction model, variance decompositions, and impulse responses which will all be utilized later.

A paper titled *House prices and real interest rates in Spain*, by Ayuso, Blanco, and Restoy (2006) provides supplemental information and analysis of housing price trends. The paper analyzes the contribution of interest rates to the recent course of housing prices in Spain. Ayuso, Blanco and Retory create a refined asset pricing model that shows that changes in the discount factor cannot fully explain the trend of house prices in Spain, providing support for the inclusion of other macroeconomic variables.

In the paper *Inflation, Mortgages, and Housing*, Kearl (1979) examines the influences of inflation on housing, mortgages and construction by constructing a model. Though this model cannot quantify unspecified uncertainties in economic conditions, the model supports evidence that inflation distortions have significant effect on the housing prices and thus the demand for housing.

4.0 EMPIRICAL RESULTS AND ANALYSIS

The empirical analysis was carried out using quarterly data from 1995 to 2008. The variables used in the empirical analysis are housing price (HP) obtained from the Ministry of Housing in Spain, the mortgage interest rate (calculated as the weighted average of 3-year mortgage loans) obtained from the Bank of Spain website (INT), prices measured by the consumer price index from the National Institute of Statistics (CPI), and unemployment measured in percentage change obtained from the Bank of Spain (UEMP). The housing price data is the average price per meter squared of appraised housing in Spain, deflated by dividing it by CPI. The empirical analysis was performed using Eviews 6.0.

Cointegration Analysis

The variables were tested for unit root non-stationarity by using unit root tests proposed by Phillips and Perron (1987). If a time series has a unit root, then the time series is said to be non-stationary. Stationarity is a stochastic (in other words, random) process whose characteristics such as mean and variance do not change over time or position. A unit-root would imply that the variance of a time series would increase to infinity over time. The Philips-Perron test was chosen because the test is nonparametric with respect to nuisance parameters, allowing for a wider class of time series models in which there is a unit root. The method also has advantages when there are moving average components in the time series. The results are reported in Table 1. When first differences were used, unit root non-stationary could be rejected at the 5% significance level, suggesting that the variables HP, INT, UEMP and CPI are $I(1)$ variables, or integrated in the first order, which means that it takes one first difference of the series to make it stationary.

Table 1: Unit-Roots (Philips- Perron)

| Variable | Without trend | | With Trend | |
|----------|---------------|-------------------|------------|-------------------|
| | Levels | First Differences | Levels | First Differences |
| HP | -0.33 | -3.37** | -1.94 | -3.33** |
| INT | -2.60* | -3.11** | -1.11 | -3.82** |
| UEMP | -2.04 | -3.18** | 1.61 | -4.12** |
| CPI | -2.18 | -3.40** | -2.12 | -3.65** |

Figures in under first differences denote t-statistics.

Note: *, **, *** depict each variable as a 10%, 5%, and 1% confidence level.

Cointegration Analysis

The possibility of cointegration among these variables was also examined. Cointegration is property of time series variables; if two or more series are non-stationary, but a linear combination of them is stationary, the series are said to be cointegrated. We can test that there is a statistically significant connection between all the macroeconomic variables by testing for a cointegrating vector. The results are presented in Table 3. Allowing for linear deterministic trend in the data, and an intercept and trend in the cointegrating equation, the trace eigenvalue test statistic indicates the presence of two cointegrating vectors, while the max eigenvalue test statistic indicates the presence of one cointegrating vectors. The following is the vector autoregression estimate.

$$\begin{aligned}
 \Delta HP = & \quad 1.23\Delta HP(-1) & - 0.266\Delta HP(-2) & - 13.84\Delta INT(-1) & + 3.38\Delta INT(-2) & + 6.08\Delta UEMP(-1) \\
 & [8.44146] & [-1.84167] & [-1.39870] & [0.32424] & [1.14570] \\
 & & & & & \\
 & - 6.97\Delta UEMP(-2) & - 12.55\Delta CPI(-1) & + 26.12\Delta CPI(-2) & & \\
 & [-1.33489] & [-1.07672] & [2.12119] & &
 \end{aligned}$$

Table 3: Unrestricted Cointegration Rank Test

| Hypothesized No. of CE(s) | Trace Statistic | 0.05 Critical Value | Max-Eigen Statistic | 0.05 Critical Value |
|------------------------------|--------------------|---------------------------|------------------------|---------------------------|
| None | 62.40516 * | 47.85613 | 31.58740 * | 27.58434 |
| At most 1 | 30.81777 * | 29.79707 | 16.58365 | 21.13162 |
| At most 2 | 14.23411 | 15.49471 | 10.97582 | 14.26460 |
| At most 3 | 3.258296 | 3.841466 | 3.258296 | 3.841466 |

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

There appears to be evidence in favour of the existence of a common cointegrating vector among the variables under examination.

An Error Correction Model

As cointegration is confirmed, we go ahead and estimate an error correction vector autoregressive (ECVAR) model. A vector error correction model is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. The model is specified so that it restricts the long-run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term, known as the *error correction (EC)* term, gradually corrects deviation from the long-run equilibrium through a series of partial short-run adjustments. Our ECVAR model will involve four variables (real housing prices, mortgage interest rates, CPI, and change in unemployment) along with a 2-lag specification. The ECVAR estimations provided the following results:

$$\begin{aligned}
\Delta\text{HP} = & \quad 0.303\Delta\text{HP}(-1) & - 0.467\Delta\text{HP}(-2) & - 14.44\Delta\text{INT}(-1) & + 23.45\Delta\text{INT}(-2) & + 1.25\Delta\text{UEMP}(-1) \\
& [2.09488] & [-3.25047] & [-1.30356] & [2.15111] & [0.24683] \\
& + 1.25\Delta\text{UEMP}(-2) & - 13.79\Delta\text{CPI}(-1) & - 41.37\Delta\text{CPI}(-2) & - 0.019\Delta\text{EC} \\
& [0.24683] & [-1.00835] & [-2.53513] & [-5.41167] \\
\text{R-squared} & & 0.654476 & & &
\end{aligned}$$

EC is the error correction term. Figures in brackets denote t-statistics.

The results of the estimation are disappointing, but may still be analyzed. The variable of interest rates, when lagged once, is shown to be inversely related to housing prices, as basic economy theory suggests. Interestingly, when INT is lagged twice, it is shown to have a positive effect to housing prices, going against basic economy theory. The variable of employment has the expected sign at both first and second lags, supporting economic theory that suggests when employment increases so too should the demand and thus the price of housing. The variable of inflation does not have the expected sign, as basic economy theory suggests that inflation should be positively correlated with housing price. 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 price equation.

Variance Decompositions

A variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR. Each column gives the percentage of the forecast variance due to each innovation, with each row adding up to 100.

Table 5: Variance Decompositions

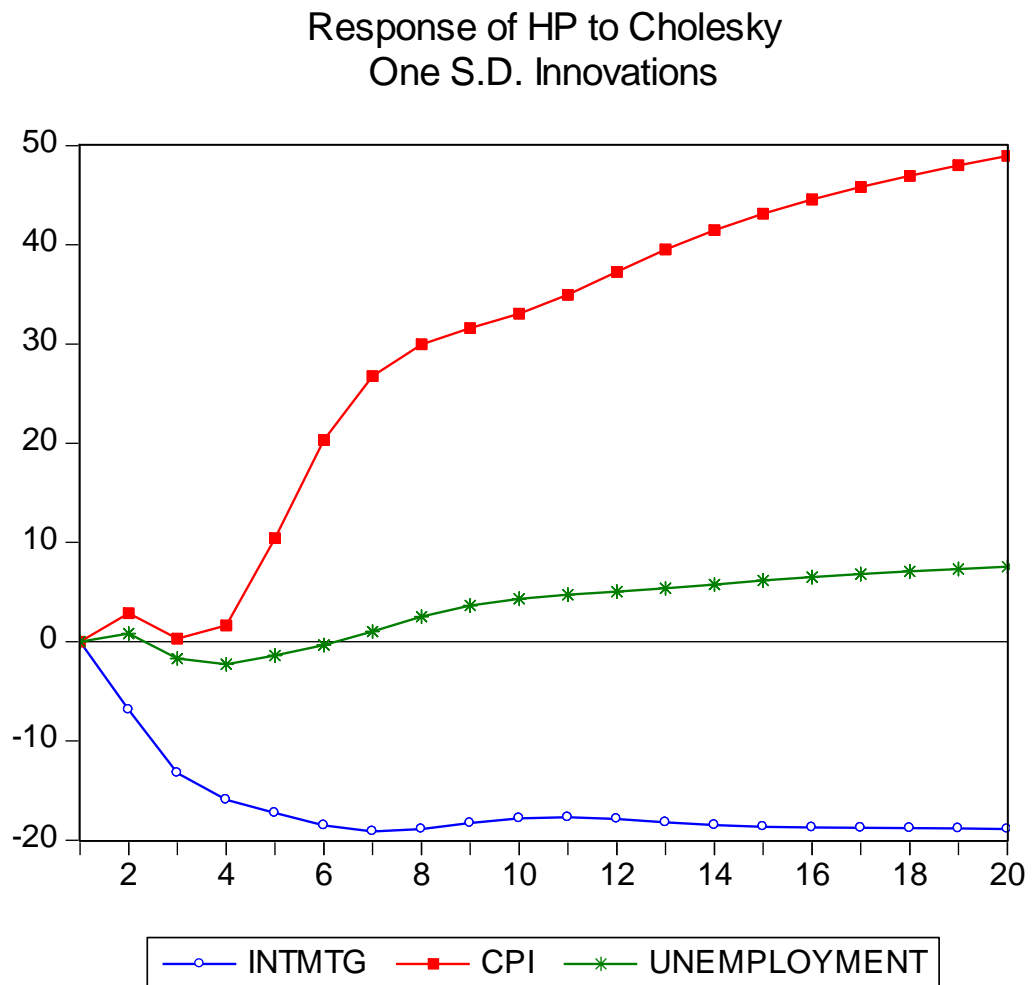
| Variance Decomposition of HP: | | | | |
|-------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Quarters | HP | INT | UEMP | CPI |
| 1 | 100.0000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) | 0.000000 (0.00000) |
| 4 | 82.22755 (10.4647) | 7.943156 (7.91734) | 8.469554 (8.58927) | 1.359737 (2.88653) |
| 8 | 50.70565 (15.3915) | 19.92647 (14.2167) | 9.658733 (15.2667) | 19.70915 (12.2341) |
| 12 | 35.21712 (15.3737) | 28.39678 (15.9498) | 5.165260 (19.4367) | 31.22084 (15.4223) |
| 16 | 24.86138 (14.6420) | 33.56340 (15.9738) | 7.945478 (23.1841) | 33.62974 (16.1045) |
| 20 | 17.08134 (13.7477) | 31.87512 (15.6998) | 20.76667 (25.5659) | 30.27688 (16.1336) |

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

The results from Table 5 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. 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. The variable with the highest explanatory power over the variation in real housing prices is the housing mortgage rate, the second being inflation, and third being employment.

Impulse Responses

Exhibit 6: Impulse Responses in Graph Format



An impulse response traces the effect of a one-time shock to one of the innovations (variables) on the current and future values of the endogenous variables. In other words, it shows the dynamic behavior of a variable due to random shocks in other variables. Table 6 shows the response of housing prices to shocks in the mortgage interest rate, CPI, and unemployment. The impulse response functions are based on 500 Monte Carlo replications. These impulse responses

are sensitive to the ordering of the variables, so different ordering might be in order to provide support, if any, to the results.

In Table 6, as basic economic theory would suggest, a positive (higher) shock to the mortgage interest rate indicates that as the cost of financing a house purchase increases, the demand, and thus the price for housing falls. In response to a shock in mortgage interest rates, housing prices reach their steady state level at around 6 quarters. A positive (increase) shock to inflation leads to higher housing prices; the impulse response does not show housing prices reaching their steady state level within 20 quarters. Finally, a positive shock in unemployment initially shows a decrease in housing prices (and thus demand for homes), while by 7 or 8 quarters housing prices continue to rise.

5.0 CONCLUSION AND POLICY IMPLICATIONS

The main objective of this paper was to analyze the dynamic effects of certain macroeconomic variables (the mortgage interest rate, inflation and employment) on real housing prices. The results suggest that real housing prices do respond to specific economic variables. Variance decompositions show that the mortgage interest rate is the variable with the highest explanatory power over the variation in real housing prices, followed by inflation, then employment. Impulse responses show that a positive shock in the mortgage interest rate depresses real housing prices and will eventually lead to higher housing demand, while a positive shock in inflation and employment will increase real housing prices and will lead to lower housing demand.

After analyzing the results of our empirical tests, it is apparent that the most important factor for determining policies relating to housing are mortgage interest rates. It has been argued that low inflation environments will cause people to overvalue long-duration assets, i.e, a money “illusion” (Brunnermeir and Julliard, 2007), which would tend to lead to asset bubbles and busts. Due to the focus of the European Central Bank on maintaining a low inflation environment, such an argument might imply that Spain must find a solution to the natural tendency to overvalue long-duration assets.

Economists have discussed the susceptibility of the Spanish economy to economic cycles. The integration of Spain into the European Monetary Union (EMU) and the ensuing reduction in real interest rates and increased expectations for monetary stability can be cited as one significant source of the housing bubble. The Bank of Spain, with its monetary defenses taken away, had no defense against the easing of interest rates by the EMU.

It may important to note the conflicts of interest faced by political officeholders that may have resulted in failures to recognize or act against the housing bubble. The fact that housing is the biggest asset of the voting base, and that the construction sector produces a large amount of employment will be on the mind of any political incumbent when making policy decisions, or running for a second term.

Policy Implications

Policy implications would have to take into consideration that Spain no longer has control over interest rates. Without the control over interest rates, Spain could concentrate on collecting more reliable data on housing, tax incentives, and increased regulation.

Spain could improve the integrity of their data. One of the problems encountered during the creation of this paper was accessing even marginally reliable data on housing prices. An official Spanish Housing Price Index that is derived from actual housing transaction prices is published by the Institute for National Statistics only has data from 2007. Spain needs to provide adequate, reliable data in order to better understand and prevent housing bubbles.

Spain could remove tax incentives which promoted house ownership, such as, the income tax deduction for owning a house. The tax deduction makes housing more valuable in

comparison to other investment decisions, and to renting. This tax incentive without question aided in the creating one of the highest home ownership rates in the world (approximately 81.0% in 2005).

Spain must increase regulatory oversight over immigration and abuse of illegal labor. The existence of cheap, illegal immigrant labor had aided in overdevelopment of real estate projects, has expanded the black market, and has cut legal residents out of work.

Spain must clamp down on the current state of appraisals/valuations. As mentioned earlier, there is an unmistakable conflict of interest, as banks have been known to own ownership stakes in the home-valuation agencies they use. It is only recently, in December 2007, that a law was instituted that limited the amount of business appraisers can take from clients with ownership stakes (such as banks).

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Spain Real Estate Index, [source for housing price data]

< <http://www.spainrei.com/Spain-Property-Prices.shtml> >

Things we need to do on paper:

What if emp doesn't have a significant PP value

How do we end the trend section

Consolidate ecvar analysis

Do ecvar, then variance decomp, then impulse response to see if it is different

What citations do we use? How do we cite footnotes?

Problem: unemployment is positively correlated with HP

Inflation is negatively correlated with HP

This could be because.. unemployment is increasing while HP increases.. ? why unemployment figures are we using? Percentage change may be unusable

Cpi.. check data.. inflation was increasing from 95-2008 along with HP