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REAL ESTATE PRICE DETERMINANTS AND THE USE OF AGGRESSIVE LENDING INSTRUMENTS

by
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AN ABSTRACT OF THE PROJECT OF

Mohamad Nizar Abdel Kader for Master of Arts in Financial Economics
Major: Financial Economics

Title: Real Estate Price Determinants and the Use of Aggressive Lending Instruments

The real estate sector, especially the housing market knew an incomparable expansion around the world. This growth was particularly in the United States in which prices increased rapidly to peak in 2005. Thereafter, the market prices started to fall in 2006 and encountered to largest fall in 2008. This can be used as an evidence of what is called a "housing bubble".

The inflation in the real estate market matches with an increase of the private sector credit mainly through the use of aggressive lending instruments and the relaxation of credit constraints. Hence along with the fundamentals determinants of house prices, the expansion of housing loans can also play an important role in determining real estate prices and explain its cycle.

The project will mainly discus the basic determinants of real estate prices using both theoretical and empirical evidences. It will also stress on the effect of aggressive lending instruments on real estate mean prices.

This project will mainly include an introduction explaining an overview of the subject and presenting the problematic. Chapter I will discuss in its first section some literature reviews describing the relationship between macroeconomic variables such as income, interest rates, unemployment, etc… and prices in the housing market. The second section will present an analysis of real estate bubbles and their effect on the economy while the third section will elaborate some literature about the relationship between the real estate market and the stock market. Chapter II will present in its first section the data that will be used in the empirical work and thereafter describe the methodology we will be using to construct the model. Chapter III will demonstrate the constructed hypothesizes about the suspected relationship represented in the literature review. This demonstration will be based on empirical evidence from the U.S market trough an organized econometric model. Chapter IV will elaborate a relationship between the use of aggressive lending instruments or mortgages and the market's prices. The project will then ends-up by a conclusion presenting the outcome of the studies and its contribution.

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CHAPTER I

INTRODUCTION

The late 2007 were marked by a start of a financial and economic crisis in the United States of America that later was propagated to the rest of the world. This period was financial institution mainly linked to the real estate market in the United States of America lost around one trillion dollars in assets. This crisis was also marked by a wealth loss that can be illustrated by the sharp decrease in all U.S. stock indexes; in instance the S&P/500 for example decreased by around forty-five percent in one year: from late 2007 to November 2008. Similarly, future markets dropped by around twenty to thirty percent during the same period along with a decrease in investment and savings whose assets were marked by a loss of around 8.3 trillion dollars, and hence the combined households wealth losses can be estimated by nearly 14.1 trillion dollars which led the Federal Reserves (FED) to pump in around thirteen trillion dollars in the U.S. market to offset these losses. And therefore, this crisis was called many economists the 'Great Recession'.

This recession was identified by many to be caused by the collapse of the U.S housing bubble which was marked by a great expansion not only in the United States of America but also all around the globe to peak in 2005. The collapse of the housing bubble was the main reason behind the fall of security values linked to the real estate market (especially the housing market) and later deteriorate financial institutions; in this

instance the crisis was spread in the financial market and thereafter in the whole economy.

The housing market hence appear to a key factor leading to this worldwide recession that can be characterized by sharp decline in investment related to the damage in investor's confidence, consumption, world trade, and oil prices. It was also marked by a significant increase in unemployment rates that become a big concern and challenge for many governments.

Many economists blame the increase in credit default rates to trigger the crisis since a big portion of the defaulted credits were tightly linked to credit-financed properties. These default directly affected financial institutions and banks that as a consequence were mostly damaged on the liquidity channel which affected their rating and therefore the investor's confidence. This led to a negative effect on the stock market that was directly recuperated on the entire economy. As a result the housing property that were used as collateral, have seen their value decrease which in turn worsened the liquidity problem of the institutions; which could look like an endless circuit.

In instance it looks important and interesting to study the housing market and to find out how it operates since a housing bubble in the United States of America was a key factor leading to a worldwide recession. So we will try find in our paper the main causes that leads to shifts in the real estate market or in other words what are the main macroeconomic factors that are responsible of a change in real estate prices. We will also try to establish a relationship between the fluctuations in housing prices in the United States of America and the availability of aggressive lending instruments, meaning that we will try to investigate about the causality between the shifts in the U.S.

housing market and the capability of borrowing represented by mortgage rates. Therefore, the project will mainly discus the basic determinants of real estate prices using both theoretical and empirical evidences and will also stress on the relationship between aggressive lending instruments and real estate mean prices.

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CHAPTER II

LITERATURE REVIEW

A. Determinants of Housing Prices

Many theoretical models discussed the effect of macro foundations on the pricing of Real Estate and especially on price changes of housing. Authors separate between housing demand and supply of housing when modeling the change in housing prices. From the demand side, changes in housing prices (PH) can be considered as a function of household income (Y), real interest rate on housing loans (r), financial wealth (WE), demographic and labor factors (D), expected rate of return on housing (e) and a vector of other demand shifters (X). These shifters are mainly described by proxies concerning the state of the housing entity such as its age and location. Therefore, the demand for housing (D^H) can be modeled as follows:

$$D^H = F\ (PH, Y, r, WE, D, e, X)$$

According to the literature, there exists a negative relationship between the demand for housing and the change in housing prices, meaning that a positive change in housing prices i.e. an increase in the market price leads to a lower demand for housing. Moreover, demand for housing is positively affected by the household income. Same, economists notice a positive relationship between the demand for housing, the expected return on housing and the financial wealth. The relationship is considered to be negative when dealing with the real interest on housing loans. Demographic and labor market factors mainly including total population and/or total households and employment or

unemployment rates could have either a positive or a negative effect on housing demand.

The supply of housing is considered to be a positive function of the profitability of the construction business. Profitability is explained to be the quality and potentiality of profits and is mainly affected by the cash flow management. Hence one can say that profitability is a positive function of housing prices and a negative function of the real cost of construction (C); however, the latter includes price of land (P), material cost (M) and wages of constructors (W). As a result, the supply of housing can be represented by:

$$S^H = F (PH, C (P, W, M)$$

The intersection between the supply and demand leads the equilibrium price of housing. In other words this happens when $D^H = S^H$. Then, changes in housing prices can be illustrated as: $P^H = F (Y, r, WE, D, e, X, C (P, W, M)$. This equation could give the initiative to consider changes of housing prices as stable; however, the literature demonstrates that P^H is more volatile than its components. This means that the change is housing prices varies more than the determinants of the demand and supply can predict, (Balazs, T., & Mihaljek 2007).

Some economists developed studies concentrating on housing price changes rather than the level of prices (Mack, C, & Mayer, C.J. 2002). It is shown that appreciation of housing prices is more or less affected by both population and employment growth. From his side, Poterba (Poterba, & Weil, 1991) studied the consequences of income changes, construction costs and after-tax user costs (net cash outflow after deducting income tax) on the change of housing prices. The author demonstrated that income and construction costs are vital variables when explaining

housing prices. However he found no clue explaining the impact of demographic or after-tax user cost on price changes.

Another study on metropolitan areas (Englund, & Quigley, 1998) gathered data from 15 out of 25 OECD countries (Organization of Economic Cooperation and Development). The paper shows that a sudden demand shock caused by a tax reform leads to a decrease of housing rents in order to maintain equilibrium. In other words any unexpected demand shock will lead to a negative effect on housing prices.

An extension to Poterba's study evaluates the factors explaining real housing price changes. The author conducted a study on 130 metropolitan areas in the United States of America using a likelihood procedure in order to avoid heterskedasticiy and autocorrelation.

The literature distinguishes between the demand and supply of housing. It considers the demand to be function of housing prices ($P_{i,t}$), real income ($Y_{i,t}$), population ($pop_{i,t}$), real interest rate ($I_{i,t}$) and real wealth ($W_{i,t}$). The latter variable is calculated using the S&P 500 stock index deflated by the price index[1]. From its side, the supply is shown to be function of housing prices, real interest rate, real construction cost ($C_{i,t}$) and other cost factors ($M_{i,t}$),construction permits. At equilibrium real housing prices can modeled as a function of all the above variables plus a disturbance vector ($\varepsilon_{i,t}$). If one has to deal with real changes in housing price, he/she should consider the variable $\Delta P_{i,t} = \frac{Pi,t-Pi,t-1}{Pi,t-1}$.

The methodology used in Poterba's paper consists on regressing the change in housing prices $\Delta P_{i,t}$ on the changes of the above variables ($\Delta Y_{i,t}$, $\Delta pop_{i,t}$, $\Delta I_{i,t}$, $\Delta W_{i,t}$,

[1] Computed by the Bureau of Labor Statistics (BLS)

$\Delta C_{i,t}$, $\Delta M_{i,t}$, $\varepsilon_{i,t}$) using a likelihood estimator. The results demonstrate the significance of all the variables as well as a high R^2 meaning that the overall model is statically significant. It also shows a positive relationship between the change in housing prices and all the other variables, i.e an increase in any variable lead to higher housing prices.

Tsatsoronis and Zhu (2004) conducted a study in which they also distinguished between the demand and supply side. The two authors considered that income growth (for which they used GDP per capita as a proxy) and interest rates are the most important determinants of housing price changes. They also took into consideration important changes in demographic factors, employment and taxing system. The investigation was done on a cross sectional sample of 17 industrialized countries in order to separate between common features across the sample from unique or specific factors.

From the supply side, Tsatsoronis and Zhu argued that housing prices are mainly affected by registration fees, cost of land, cost of construction and cost of maintenance.[2]

The regression results made on the gathered data proved that income growth has a positive impact on housing price changes. In other words those regions encountering increases in household's income are more likely to have higher housing prices as the demand for housing would increase. From another perspective, when interest rates are higher, the cost of financing of new houses becomes greater, which lowers the purchase power of households leading to a decrease in the demand and hence in housing prices. Thus the authors noticed a negative relationship between interest rates and housing price changes. Same, unemployment is negatively related to housing prices. Demographic

[2] See also Case-Shiller (2003) and Cutts-Nothoft (2005)

factors positively affect housing prices as an increase in the number of households will increase the demand for housing and hence its prices. The supply side variables have a positive impact on these prices.

Karl Case and Robert Shiller constructed an index for median house prices in the United States of America by comparing repeat sales on same houses during the 1980's US housing boom. The model was based on a study across local US metropolitan areas. The two economists gathered data on the local level of employment, income, consumer price index, total population and number of households. They considered that the demand for housing at time t is function housing prices and income. The supply can be considered as a function of prices and vacancy. Moreover the demand and supply are function of two vectors of exogenous variables, respectively X and Y. The vector X[3] mainly includes the total population and/or the number of households along with the employment rate. Y[4] is a function construction permits and the start of new housing. The regression methodology showed significance of all variables meaning that that these variables are capable of explaining housing price trends.

The methodology is to gather quarterly data from 1985 to 2002 giving a total of 3 621 observations. These were collected based on a cross sectional model of all the fifty-one US states. The two economists, thereafter, constructed the ratio of home price to annual income for fifteen states; eight having highly volatile prices and the other seven being less volatile. They found that for the least volatile states, ratios were stable and low (varying between 2.1 and 2.4). In contrast, for the other eight states, the ratios turned to be higher and volatile (varying between 4.5 and 7.8).

[3] Representing the size of the market
[4] Representing the construction activity

The results for the fifty-one states show that forty-three states out of the fifty-one have a standard deviation of 0.41, whereas the remaining eight (highly volatile states) have a standard deviation above 0.41[5]. Logically, this divides the states into two categories; the category contains states in which "prices of homes move in line with income" (Case-Shiller 2004). However in the other group, prices tend to be more volatile, for which the plot pattern cannot in anyway identified as a Random Walk.

The model hence showed that "income was able to explain almost completely the change in housing prices expect for eight states" (Case – Shiller 2004) where prices are more volatile and thus cannot only be explained by shifts in income.

The two authors then included other macroeconomic fundamentals to the model in order to study their effect on housing prices. These variables were mainly mortgages rates, housing starts, employment, and unemployment rates. They found that in the forty-one states where income is highly correlated to prices, the additional variables show little effect on the overall regression. On the contrary, for the other eight states the results showed that the additional variables were highly significant. Case and Shiller hence argue that income was able to explain shifts in prices in all the states expect for eight. For which other variables could add strong explanation of housing price changes. They later conclude that these changes can be explained by additional variables which the most important one can be expectations of potential buyers.

Other models concentrated only one a specific variable to study its effect on the housing price changes. Apergis (2004) examined the effect of household income on housing price changes. The author gathered data from 41 metropolitan areas in the

[5] Is there a bubble in the housing?(Case – Shiller 2004)

United States of Amercia and found that a 10% increase in household's income is associated with a 2% increase in housing prices. This shows a positive relationship between these two variables; however one can notice that changes in housing prices respond in a moderate way to an increase in household's income.

Other literatures proved that construction activity - measured by the number of construction permits and the number of new constructions – and housing prices are correlated, i.e there is a double causality between these two variables. In other words, construction activity is higher in regions where prices are high and vice versa. Furthermore, prices are lower in regions with higher vacancy rates. We also notice that prices tend to be higher in larger metropolitan areas. The size of these areas can be measured by the number of population or the number of households.

B. Short and Long Run Effects

Demand and supply factors affecting real estate prices are considered to have long swings (Jud and Winkler 2001). Hence one should distinguish between factors having long term influence on housing prices and those having a short term effects.

In order to evaluate short term drives, i.e. those who interact in a less than one year period, economists tend to consider the supply side as fixed. In other words they consider that the demand side factors are the only variables affecting price changes. These factors differ from one region to another; however the literature mainly considers real interest rates as a key short run variable. It is shown that higher interest rates will reduce the ability of households to afford new payments that comes along the increase in mortgages. This will quickly reduce the demand for existing housing and therefore

reduce the price. Other short run variables are transaction costs such as the level of VAT, stamp and registration fees and inheritance costs. Some economists also consider the provision of financing for the purchase of real estate when dealing with short term variables.

Intermediate and long term factors affecting real estate price changes can be viewed from both the demand and supply side; as the latter in no longer considered fixed over large horizons. When considering the demand's variable we consider growth in household disposable income. Another important factor is demographic shifts given that these trends play a major role in determining the type of real estate demand. These are mainly birth and death rates, household size, aging patterns, gender mix, migration patterns, ethnicity and national origin. Employment rate is one of the most important factors driving real estate markets. In fact, market with positive local employment trends encounter increases of real estate demand and therefore positive price change. Another long term pattern can be described as the permanent features of the tax system. An appropriate tax system can encourage ownership of real estate entities as opposed to other forms of wealth accumulation. This will lead to higher demand shifts and therefore to higher prices.

Long term supply factors are mainly cost of land, cost of construction and investment, availability of land, building permits and political use of land regulations. These variables form the regional supply constraints that could in many circumstances slow down the supply responses. The slower the response, the more inelastic the supply cure is and the more prices will increase in response to a change in demand. If for example, a local area is slow to approve new building permits an increase in the demand

might require several years before the new supply curve to line at the equilibrium. Meanwhile, prices will become higher than they would be in a less constrained market.

C. The So-called Real Estate Bubble:

The Real Estate Bubble is a kind of economic bubble that occurs more or less periodically. It is characterized by a sharp increase of real estate prices (phase 1). When these prices become unsustainable with the macroeconomic determinants, it starts declining (phase 2). These bubbles are for many schools not of a concern, especially for the neoclassical theory. However, economic bubbles and especially property ones are of big importance for other economists (Marxist, post-Keynesians, Austrians, etc…) as they consider it as fundamentals of financial crisis leading to economic crisis.

The economic explanation of real estate bubbles lies behind the fact that these bubbles are responsible of wealth accumulation and then of a wealth distribution. The first effect is characterized by a positive wealth effect when prices go up. In this instance, households consider themselves more wealthy and hence spend more on their consumption. Latter, when prices go down, there is a negative wealth effect leading to lower spending by households. These effects can be anticipated and then smoothed by appropriate monetary and fiscal policies. The wealth accumulation effect happens when households buy and sell their real estate properties at different prices.

Post-Keynesians and Austrians consider that real estate bubbles are mainly the result of excessive housing loans on the credit market mainly in the form of mortgages. Hence they associate property bubbles with credit bubbles that lead to credit crunches

and thereafter to financial and economic crisis. Therefore many economists argue the existence of double-causality between real estate bubbles and economic crisis.

Post-Keynesians evaluate bubbles in the real estate market using a demand point of view. They consider that during the rise real estate markets, households feel richer and therefore borrow money in counterpart of their property increased value. This money is often used for speculation purposes. In fact, households often borrow in order to purchase new properties whose values are expected to grow. When the bubble reverses leading to a sharp decrease in property prices, the level of debt however remains the same. The default of debt hence leads to a shrink in the aggregate demand and therefore to an economic crisis.

According to the Austrian school, the bubble effects are viewed from a supply side. It argues that during the first phase of the bubble (increasing prices phase) constructors urge to build more properties and hence use extra materials considered to be wasted in unneeded properties. This is what the mentioned school calls the "misallocation of resources". During the bubble second phase, constructors must therefore reorganize and hold these wasted tools. The transition between the two phases (characterized by the passage from non productive to productive uses of resources) leads to a supply side crisis and thereafter to an economic crisis.

Case and Shiller consider in their paper "Is there a bubble in the housing market" (2004) that a housing bubble occurs when buyers believe that the desired property is no longer expensive as it will generate greater returns in the future given that prices will increase. Hence they argue that this kind of bubble is generated by massive expectations of price increases and that these expectations will lead to a higher level of prices. They also show in their literature that first time buyers expecting future price

increases will be worried about the fact that they won't be able to purchase or afford the property in the future. These expectations are dual in the sense that households not only expect an increase in housing prices but also consider that these prices will not fall in the future. Thus an investment in housing properties in no longer considered risky. These combined expectations will lead to a boost in the housing demand and thus to a dramatic increase in prices.

Along with demand boost, property owners will save less and would prefer to spend their income on new properties that would do the savings for them as home prices will increase in the future. This logically leads to higher demand and therefore to higher prices.

This incredible increase in the demand associated with "the expectation of rapid and steady future price increase" (Case and Shiller 2004) will lead to unstable housing prices; however these prices cannot increase forever, and there is a time beyond which households recognize that their property prices will no longer raise leading to a decline in the demand. This marks the start of the bubble burst.

Case and Shiller's paper was established before the recent bubble burst in the late 2007. It was done during the market boom considered to be the first phase of a housing bubble. The two economists notice a rapid increase in housing median prices since the year 2000 in a wide range of developed countries. It is important to mention that some countries have known the highest level of prices since 1975 during this phase. However Case and Shiller argue that this increase in prices is not enough to prove the existence of a housing bubble given that the expectations of future price increase could be not sufficiently significant to generate a higher demand. Hence it is important to

evaluate the levels if macroeconomic fundamentals as these can be important instruments to prove the existence of a potential bubble.

Economists have also debated the possibility of identifying and preventing any future real estate bubble. Some theories argue (mainly neoclassical) that it is impossible to identify any potential property bubble that, as a result, cannot or should not be prevented. In contrast, Post-Keynesians and Austrians consider that bubbles can be identified using an analytical study of housing market indicators. These indicators are primarily economic indicators and financial ratios. It is used to evaluate properties value and compare it with a so called 'fair value'. This comparison could help in anticipating or identifying the property bubble. These are composed of two elements; valuation and debt. The first component measures the value of the property and thus identifies how expensive it is. The latter part, evaluates by how much households become indebted when purchasing the property.

The first element can be measured using several instruments and the most commonly used is the price to income ratio that evaluates the median property price to median income. This ratio is often used by commercial banks, when dealing with loans, to evaluate a client's profile. Another instrument is the Affordability Index that computes the ratio of monthly cost of mortgages to the personal income. This ratio gives a more realistic evaluation of the property's affordability than the previous one. Finally one can use the Median Multiple ratio that measures the median property price to the median annual household income and whose fair value is around three points.

The household's debt can be measured mostly using the housing debt to income ratio and the housing debt to income ratio. The first instrument evaluates the mortgage

fee to the disposable income. The other ratio computes of the debt (or mortgage) to the value of the property.

D. A Former Housing Bubble

The years 1980s showed a great increase in housing prices in many major cities around the world. These prices started declining sharply in the early 1990s. This boom in the 1980s followed by a burst in the 199s could look like a housing bubble.

Statistics show that the boom started in early 1984 where in Boston for example, housing prices increased up to 39% and later up to 140%. The analysis of the macroeconomic fundamentals such as income per capita, interest rates, employment growth and construction costs was able to explain or predict only a 15% increase in housing prices. Moreover, studies done on repeated sales in many metropolitan areas permitted to construct a "repeat-sales index" (Case and Shiller 2004), and showed a positive serial correlation in the changes of home prices. Hence, macroeconomic fundamentals were unable to explain alone the sharp increase in housing prices. This, along with the serial correlation of price changes was an evidence of the existence of a housing bubble in the 1990s. Later, the burst started in the late 1980s accompanied by a decline in the demand of properties that contributed in an important recession in the 1990s.

E. Real Estate and Stock market

In their paper entitled "More evidence on the relationship between the stock market and the Real Estate market" (2007), Nicholas Apergis and Lambros Lambrinidis try to study and evaluate any potential relationship between the stock market and the real estate market in both the United States of America and the United Kingdom using the co integration and Error correction model.

The two authors argue that in the majority if countries any trend or fluctuation in the real estate market leads to a considerable variation in the real economy. Hence for example, a crisis in the real estate market could have a negative impact on the whole economy and especially in terms of income, employment, and growth. Same important capital gains in the stock market will lead to higher consumption that will enhance higher employment and income and therefore demand. The increase in these variables is more likely to have a positive impact on the real estate market. These two interpretations; usually known as the "Wealth effect" (Apergis –Lambrinidis 2007) are used by the two authors to prove the relationship between the above two markets.

Apergis and Lambrinidis (2007) also used the "credit price effect" to demonstrate the relationship between the real estate market and the stock market. They argue that "changes in the price of real estate leads to changes in corporate profitability and, thus to the stock price of these corporations" (Apergis – Lambrinidis 2007). They explain this causality using the fact that an increase in the real estate price leads to higher credit capacity since the corresponding real estate property becomes a more trusted form of collateral. The increase in this credit capacity will logically be

transformed into a boost in investment and therefore to a higher stock value of the firm showing the relationship between the stock market and the real estate market.

The relationship between the real estate market and the stock market can also be identified by studying the performance on both markets. The following two graphs (figure 1 and figure 2) represent the historical trends on the specific markets.

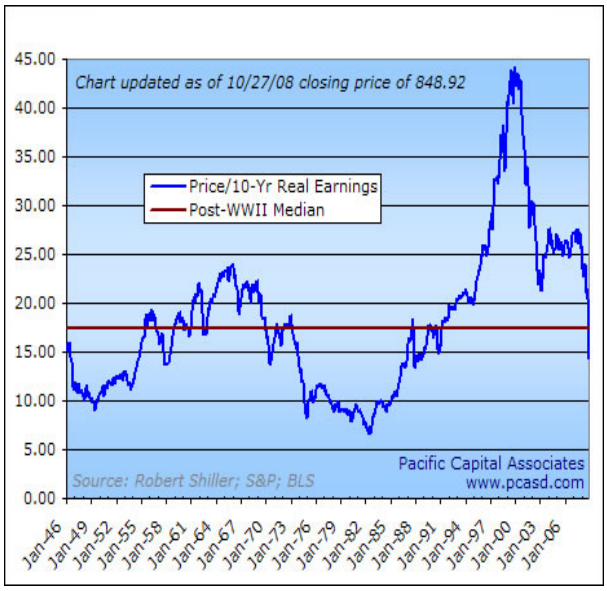


Fig 1. S&P 500 Price to 10-Year Real Earnings Ratio

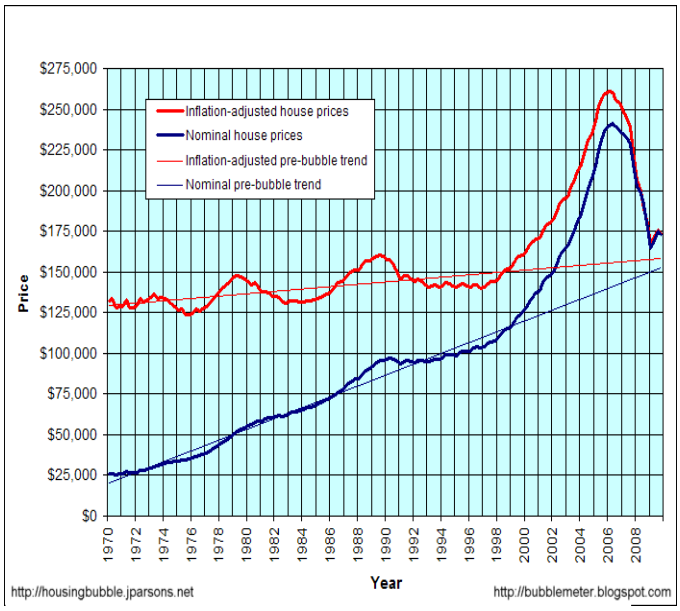


Fig 2. United States House prices trend

It is shown from the above graphs that there is a type of analogy in the movement of the two markets that could suggest a certain relationship between the real estate market and the stock market (represented by the S&P 500 index). It is obvious that every peak or sharp decline in the real estate market is followed by respectively a peak or sharp decline in the stock market. This is true for the 1990's peak in the real estate market and for the 2000's crash. However one can notice that not every peak or crash in the stock market is followed by a respective one in the real estate market.

Daniel Quan and Sheridan Titman studied the relationship between the real estate market and the stock market from an international perspective by gathering data from 177 different countries including both large industrialized and developing countries.

The two authors argue that real interest rates and the cost of labor measuring employment have a direct impact on real estate and stock markets. They consider that these factors could participate in the initiation of a positive economic activity that catalyzes an increase in real estate and stock prices. In this instance the two markets are considered to be moving together in similar trends.

However, one can show that these variables could cause a negative relationship between the real estate market and the stock market. In fact, an increase in real interest rates as a result of higher investment opportunities will be accompanied by higher stock prices from one side, and lower value of real estate properties from another side; suggesting a negative correlation between the two markets. Similarly, a decrease in labor cost caused for example by a foreign competition will tend to lower domestic wages that will directly have a negative impact on the housing market given that construction costs will be lower and therefore real estate value will decrease. Simultaneously, the decrease in labor cost will be accompanied with an increase in corporate profits and therefore in stock prices. This suggests a negative relationship between the stock market and the real estate market.

The two authors thereafter differentiate between the effect of these variables on developed countries from one side and developing countries from the other side. They argue that the negative relationship is more likely to be present in industrialized

countries and that factors leading to the positive correlation are less likely in these countries. However, in developing countries (mainly Asians) the factors leading to the negative relationship are minors. This is basically due to the fact that "stock market fluctuations in these countries seem to be more demand side effects that cost side effects" (Quan – Titman 1996). Therefore, the two economists suggest that the positive relationship between the real estate market and the stock market is more important in developing countries that in industrialized ones.

Table 1. Time Series Regression Results - With Lagged Real Estate and Stocks

Country	R^2	Intercept	Stock	Rent(-1)	Stock(-1)	F-Statistic	Period
Australia	.3962	3.3521 (1.1155)	.0143 (1.2608)	.4548 (.9466)	.0055 (.3572)	0.806	86-94
Belgium	.2807	1.0816 (.2570)	.0017 (.0220)	.4872 (1.5951)	.0848 (1.0507)	0.552	82-94
Canada	.4571	3.7826 (.8308)	.0241 (.7066)	.4222 (.6954)	.0538 (1.5849)	1.563	87-94
France	.4897	-1.2995 (-.2842)	-.0075 (-.0767)	.6426 (2.4837)	.1375 (1.4563)	1.177	82-94
Germany	.4791	-1.0093 (-.2857)	.0295 (.5885)	.7694 (2.8050)	.0509 (1.0355)	0.588	82-94
Hong Kong	.1931	7.0231 (.3433)	.3477 (1.0775)	.3126 (.7776)	.0022 (.0064)	0.666	85-94
Italy	.8152	-5.8085 (-1.9013)	.0591 (1.1501)	.9899 (4.7182)	.0853 (1.6674)	2.019	85-94
Indonesia	.6808	-9.6700 (-.9241)	.1142 (1.3978)	.3849 (1.3861)	.2120 (2.8449)	4.652	86-94
Japan	.9400	-4.2237 (-1.9713)	-.3254 (-3.6510)	.7477 (6.5436)	.6713 (7.5709)	28.853	85-94
Malaysia	.4306	-2.1687	.1435	.5495	.3304	0.651	82-94

The above table represents (part of) the results of the regression made by Quan and Titman that studies the relationship between the stock market and the real estate market in 17 countries. The results thus show s significant positive relationship between the two markets; however this positive relationship is more important in developing

countries (Malaysia, Japan, Hong Kong, etc…) than in developed countries where the positive relationship remains rather weak.

F. Market Efficiency

Usually one can describe a market to be efficient when there is no asymmetry of information i.e. when prices include the historical information; however economists distinguish between three types of market efficiencies: weak-form efficiency, semi-strong efficiency, and strong-form efficiency. The available literature tested for weak form efficiency for housing markets, i.e. they tested if the historical information is incorporated in the housing prices. When the market is weak-form efficient it means that investors cannot generate extra-profits using historical information. In this case we say that if the housing market is weak-form efficient it means that investors cannot make extra-profits using historical prices. The most relevant literature proving the weak-form efficiency of the housing market is a study done by Rosenthal entitled "Residential buildings and the cost of construction: new evidence on the efficiency of the housing market" (1999)

In contrast, the market is said to be inefficient if households are able to generate abnormal profits using trading rules. Case and Shiller in their paper entitled "The efficiency of the market for single-family homes" (1988) studied the efficiency of the housing market by gathering panel data on different metropolitan areas in the United States of America from 1970 to 1986. They used their traditional repeated sales to compute the basic "Case-Shiller housing price Index". In order to study the effect of historical information on today's price they regressed the price index on lagged price for

which they found no significance meaning that the information is not included in the price and proving that the market was weak-form inefficient. However Case and Shiller argue that investors cannot generate abnormal profits in the housing market since it is characterized by high transaction cost.

CHAPTER III

DATA AND METHODOLOGY

A. Data

1. S&P/Case Shiller Area Home Price Indices

a. A General Approach

The S&P/Case Shiller Area Home Price Indices were first initiated by the two economists Karl Case and Robert Shiller. These indices are nowadays known to be the most consistent and trusted measure of housing price changes. The indices are constituted of two composite indices, the first one include ten metropolitan areas within the United States of America and called composite 10. The second one consists of twenty metropolitan areas (also within the United States of America) and is called composite 20. These two indices are based on monthly data providing benchmarks of the residential real estate market. These were also combined to create the S&P/Case Shiller U.S national Home Price Index and constituting of quarterly data on U.S home prices. The indices are designed to determine increases and decreases in the value of housing properties in the designated metropolitan areas and all over the United States of America.

These indices have some eligibility criteria which means that there are some specific conditions that lead to the inclusion or exclusion of a certain residential real estate in the calculation of the indices. Hence when computing the index the two

economists include data on single-family housing, they also specify that the residential property should be an existing one and have been sold twice on the market. It is also important to specify that the indices are based on changes on housing prices holding everything else constant. As a result when establishing the indices, the two economists exclude prices for multi-family buildings, condominiums, and co-ops/apartments. These are mainly excluded since their property are jointly owned by shareholders making it difficult to differentiate between the real value of the building and the value of the individual house. Furthermore Case and Shiller do not take into consideration any under construction housing nor residential properties that are not sold twice on the market. The indices also exclude transactions associated to property transfers given that these transactions do not reflect the market value of the residential property. Finally the two economists specify – as stated above – that the computation of the indices is done holding everything else constant, meaning housing properties undergoing improvements and reconstructions are excluded from the data.

b. Index construction and calculations

As stated above, the S&P/Case Shiller Metro Area Home Price Indices are intended to measure any increase or decrease in housing properties in the U.S market and relies on observation of house price changes. Composite 10 and Composite 20 are computed every month (reflecting monthly changes in housing prices) for which home sales are gathered by pairs and calculated using a three-months moving average algorithm, for which a repeated sales methodology is applied.

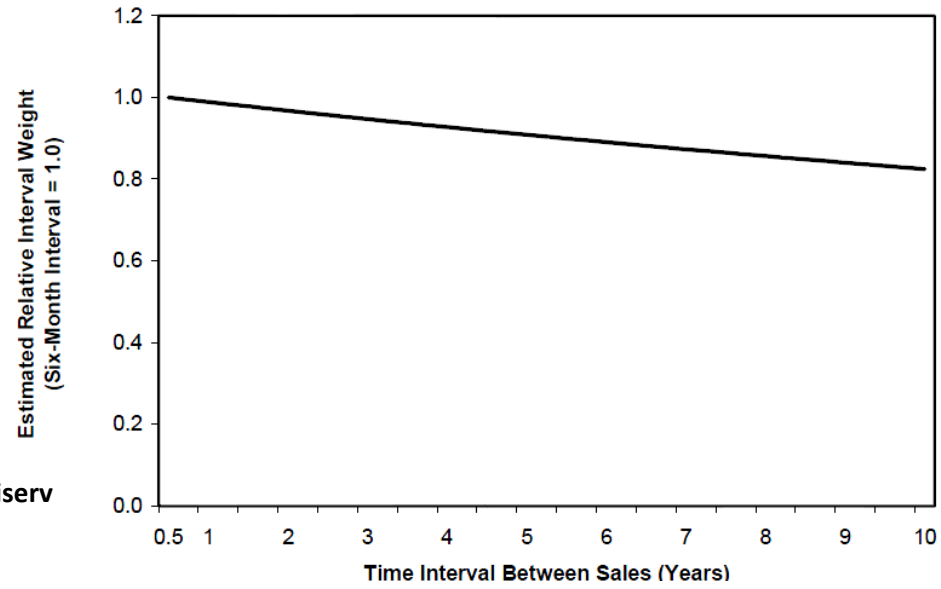
The repeated sales technique is the most trusted method to measure changes in the housing market and is also used by many home price index publishers such as the office of Federal Housing Enterprises Oversight (OFHEO).

The index construction consists of gathering data from the selected month on all housing properties that meet the inclusion criteria. The data is composed of the sale price, the sale data and the type of property and is gathered using a market research in which information is collected for every single-family house regarding any previous sale. If the housing property is sold twice on the market, the current transaction and the previous one are matched as a pair and are considered to be a "repeat sale". The price difference in the two transactions therefore reveals any appreciation or depreciation in the residential property price holding the quality and the size constant (in order to meet the inclusion criteria).

Later, the repeat sale variable or the sales pair is aggregated with all other "repeated sales" variables in the same Metropolitan Statistical Area (MSA) to create the MSA-level index. Then to create the Composite 10 and Composite 20, the MSA-level indices are combined respectively for the ten and twenty chosen metropolitan areas. This combination is done using an appropriate market-weighted average which main goal is to evaluate the price changes in the overall real estate market of the chosen area rather than measuring changes in prices of individual homes; hence it becomes important to weight the sales pairs.

These weights can be used to adjust the sales interval, which is the time between the first and the second sale. When the time interval for a residential property is long, economists consider that the house could have experienced physical changes and in this

case low weights are 0assigned to the related pair. The following graph shows how these weights are assigned for different time interval.



Source: Fiserv

Fig 3. Estimated weights for transactions time interval

From another perspective small weights are given for pairs having high turnover frequency since in this case it is very likely that a physical change may have been followed or preceded by a transaction or in some cases this transaction can be a fraudulent. Finally, weights are used to correct any price anomaly that occurs when the change in the price of the pair sales is inconsistent with the statistical distribution of the price changes in the area. This mainly happens because of physical changes, error in the gathered data, and some other exogenous factors not related to the market. Hence, in order to measure correctly the price changes in the market smaller weights are assigned for these sale pairs.

When aggregating all the MAS-level indices a composite index is formed. Composite 10 is created by gathering ten MAS-level indices from the ten chosen areas;

and Composite 20 by gathering twenty MAS-level indices from the twenty selected metropolitan regions. Selected regions are represented in the following table:

Table 2. Metro Areas for Composite 10 and Composite 20 Indices

Composite 10 MSA	**Additional MSA for Composite 20**
Boston	Atlanta
Chicago	Charlotte
Denver	Cleveland
Las Vegas	Dallas
Los Angeles	Minneapolis
Miami	Portland (Oregon)
New York	Seattle
San Diego	Tampa
San Francisco	Detroit
Washington DC	Phoenix

The construction of the housing price index is created as follows:

$$Index_{ct} = [\sum_i (Index_{it} / Index_{io}) / V_{io}] / Divisor.$$

Where $Index_{ct}$ represents the composite at time t

$Index_{it}$ represents at time t the home price index for the metropolitan area i

$Index_{io}$ represents at base time 0 the home price index for the metropolitan area i

V_{io} represents at base time 0 the value of housing stock in metropolitan area i[6]

[6] S&P/Case-Shiller Index Methodology (2008)

In the course of the project we will use Composite 10 index in order to evaluate the change (increase or decrease) in housing price over the period of study. The following graph shows the evolution of Composite 10 and Composite 20 Indices.

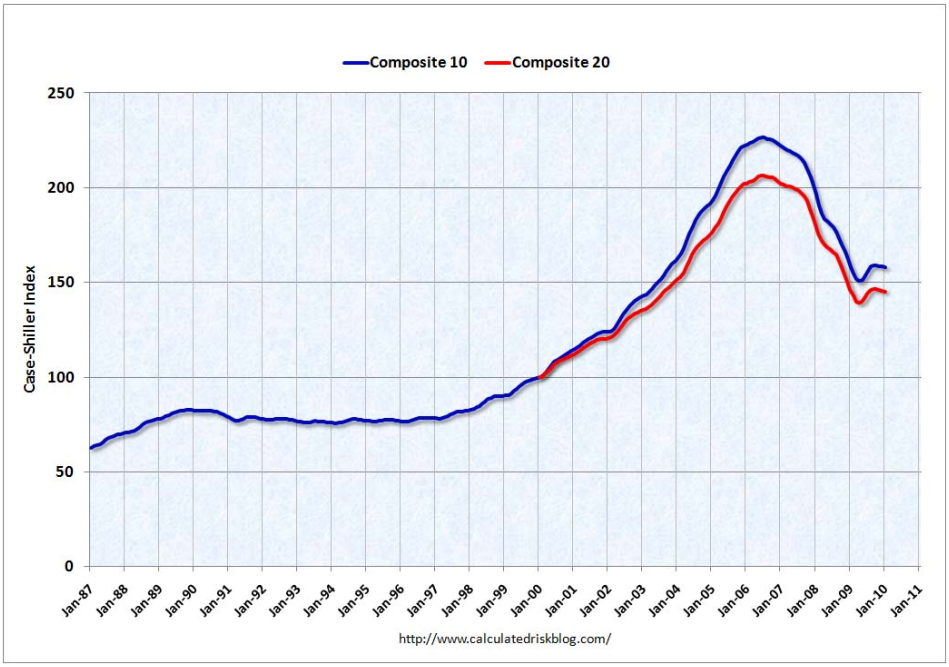


Fig 4. Case Shiller Composite Indices NSA(nominal)

We notice from the above chart a moderate increase in the Composite 10 index from a level of around 60 in 1987 to a level of 80 in 1998. The index thereafter started a sharp increase trend going from 85 in 1999 to peak at more than 230 in mid-2006; after which it started declining to reach less than 140 in 2010.

Since the aim of the project is to study the determinants of real estate prices or in other words the variables affecting prices in the real estate market, we will explain in the following paragraphs the economic definition and analysis of the list of independent variables the model will be based on.

2. Per Capita Income

The per capita income is the average income each household receives yearly. It can be computed for any geographic location, from local cities to the entire nation. In our study we will be using the national per capita income in the United States of America, computed by the U.S Bureau of Economic Analysis (BEA).

The per capita income includes wages, interest, dividends and government transfers. It is the yearly amount of money each household receives, or in other words the amount of money each individual receives if the national income is equally divided. Moreover, the per capita income is considered to be a measure of a population's wealth and mainly used to compare nations with different levels of per capita income.

However, the measurements of per capita income has many limitations and is firstly manifested by the fact that the calculations do not take into account the informal economy or activity that could largely be significant in many countries. The per capita income is also computed using exchange rates that are considered to be highly volatile and could fluctuates considerably.

The following graph represents the evolution of U.S per capita income from 1967 to 2007:

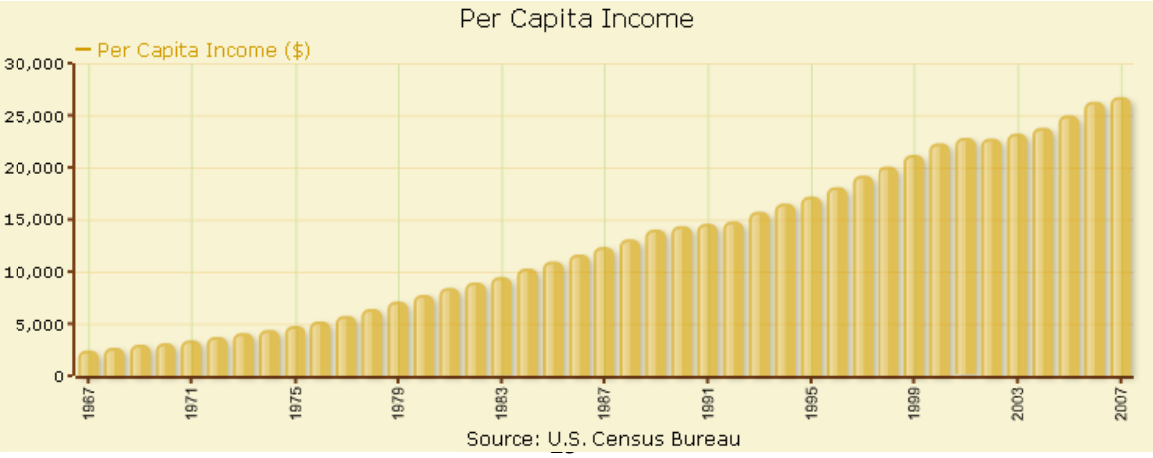


Fig 5. U.S per Capita Income

The above figure shows quarterly changes in U.S per capita income in a time period of around forty years for which we notice a considerable growth that can be represented as a linear increase.

3. Bank loan prime rate

Bank loan prime rate is the base rate or "reference rate" used by commercial banks to set the interest rate for standard loans or in other words to set the price of a commercial loan. The prime rate is very close to the federal funds rate, it is principally equal to the federal funds rate (interest rate banks charge each other for loans and determined by the Federal Open Market Committee) plus a certain base points. In the United States of America for example, the prime rate operates at 300 basis points or three percent points above the federal funds rate.

The bank prime loan rate is considered to be a short-run interest rate that is more or less uniform across all banks, contrary to deposit rates that differs from one bank to another. However, one bank can change its prime rate according to market's fluctuations and conditions even though the prime rate remains very closely related to the market interest rates

From another perspective, bank prime loan rates differ considerably depending on the loan maturity, bank size, and type of the loan (collaterally secured or not). For these reasons, banks price their loans with an interest rate equal to the prime rate plus a certain premium or basis point, this operation is called "pricing off of the prime rate".

The following figure illustrates the fluctuations in the bank prime loan and federal funds rates and from 2000 to 2010:

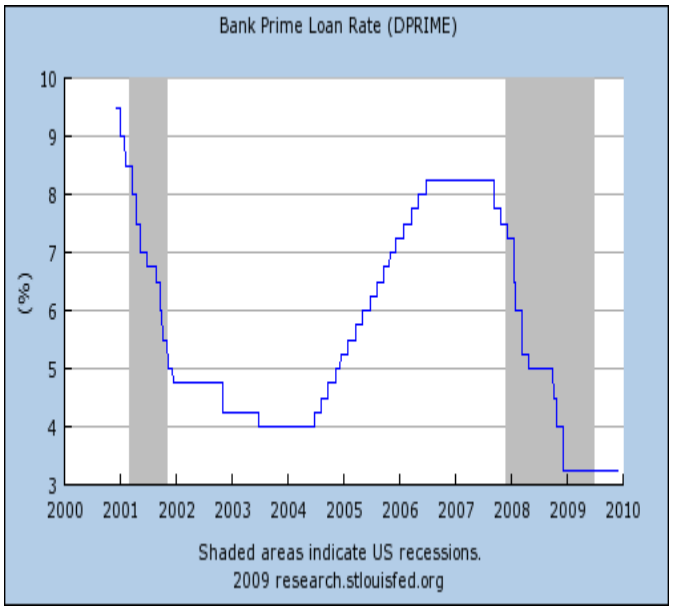


Fig 6. U.S bank Prime Loan rate (DPRIME)

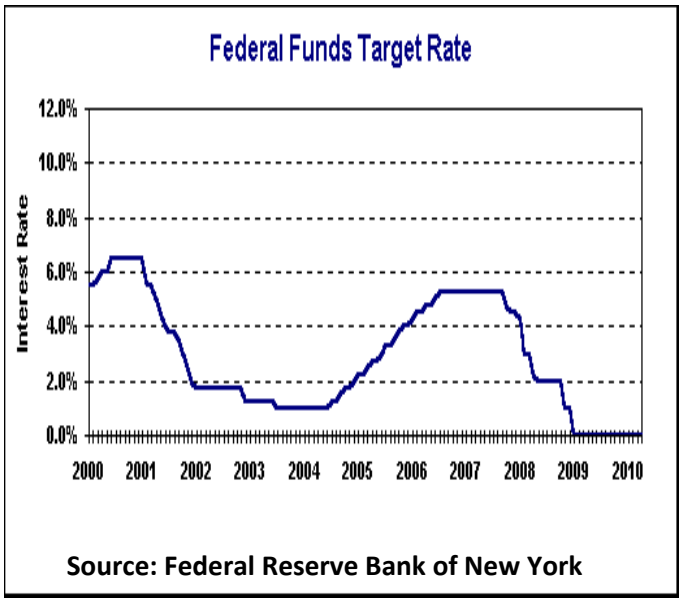


Fig 7. U.S Federal Funds rate

As shown in the above two graphs we notice large fluctuation is U.S bank prime lo rate that mainly adjusts according to market conditions and chocks and considerably moves in line with the U.S Federal Funds rate.

4. Unemployment rate

Unemployment rate measures the percentage of the labor force that is currently unemployed. It is meant by unemployment the number of households willing and able to work but are without work. Computed by the Bureau of Labor Statistics, the unemployment rate is used by many economists to evaluate the macroeconomic traits in the economy.

There exists different types of unemployment which are sub-categories if voluntary (related to the person's decision) and involuntary unemployment (mainly because of socio-economic problems). As for the types of unemployment we first

mention the classical unemployment which occurs when the market wages are set above the market-clearing wages leading to higher labor supply exceeding the number of vacancies. Second we can mention frictional unemployment which occurs when the employee shifts from one job to another and hence the time period between the job reallocation is called frictional unemployment. This kind of unemployment is always present in the economy and is considered to be a productive aspect. There is also the cyclical unemployment, also called the Keynesian unemployment which occurs mainly because of a demand side crisis or in other words when the aggregate demand in the economy is low. It is called cyclical as it mainly moves in line with the business cycle.

As stated above, the unemployment rate is computed by the Bureau of Labor Statistics and/or the United States Census Bureau using two types of surveys that collects employment and unemployment statistics. These are the current population survey (CPS) and the current employer survey (CES). The first one conducts an investigation on a sample of 60 000 households while the later is based in a statistic gathered on 400 000 employers.

The following figure shows the actual unemployment rates in the United States of America from January 2000 to January 2010:

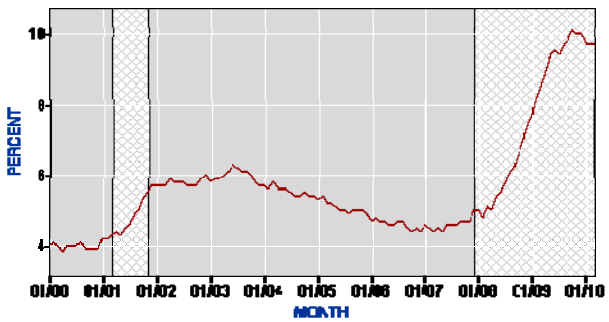


Fig 8. Unemployment rate (seasonally adjusted)

As it is shown in the above chart, unemployment rates are closely related to the state of the economy i.e. to business cycles. We notice high increase in unemployment rates during recession or crises while during market rises these rates follow a steady trend.

5. Construction Permits

The construction permit, also called building permit is a legal license used for new constructions, renovations, and adding into new pre-existing structures. The number of construction permits represents the number of new buildings/construction projects authorized for construction and is considered to be an indicator for the housing market development or growth as it represents the first step in the construction process. Changes in housing permits indicators can be considered as a change signal for the whole economy as new constructions affect many productive sectors in the economy.

6. Housing Starts

Housing starts is the number of privately owned new houses (technically housing units) on which construction has been started in a given period. This data is divided into three types: single-family houses, townhouses or small condos, and apartment buildings with five or more units. In the course of our project we will use single-family houses starts to be compatible with the S&P/Case-Shiller Composite inclusion criteria.

B. Methodology:

The aim of this project is to determine the variables explaining changes in housing prices or in other words to evaluate the macroeconomic determinants of residential property prices. Thus we will be estimating the effect of the variables stated in the above section (per capita income, bank loan prime rate, unemployment rate, housing starts, and construction permits) on the dependent variable 'housing prices' that will be modeled using the S&P/Case-Shiller Composite 10. Hence the dependent variable will be regressed on the set of independent variable according to the following equation:

$$Price = \alpha + \beta_1 income + \beta_2 int\_rate + \beta_3 unemply + \beta_4 housing\_starts + \beta_5 permits + u_t$$

Where price represent the dependent variable S&P/Case-Shiller Composite 10, income represents the per capita income, int_rate represents the bank loan prime rate, unemply corresponds to the unemployment rate, housing_starts is the number of new housing starts variable and finally permits corresponds to the number of construction permits. Moreover, α represents the intercept and β_i corresponds the slope coefficient of the above dependent variables.

Before estimating the above equation, several tests and procedures should be established in order to obtain the best and most significant estimates (results). The first step that we will undertake in our model will consist on for unit roots, hence we will differentiate between non stationary and stationary variables or in other words between the variables having a unit root and the variables that do not contain a unit root. Stationary variables (with no unit root) are variables in which chocks will be eliminated

over time when the variable reverts to its long run mean; in this case we say that these chocks are temporary. A series written as an AR(1) model (Autoregressive model): $\gamma_t = \square\ \gamma_{t-1} + u_t$

This series is said to be stationary if and only if $|\square| < 1$. In this case the above series can be represented as follows:

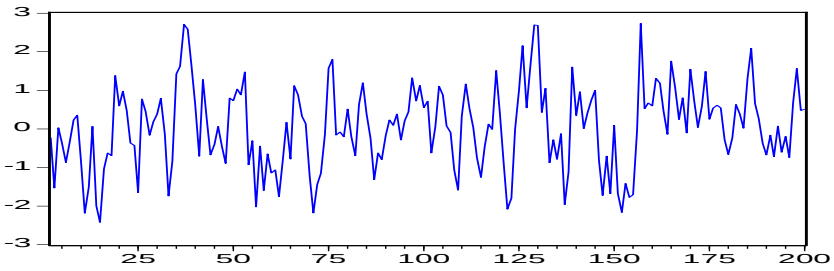


Fig 9. Stationary series Plot

On the other hand, we say that the above AR(1) process is non-stationary if $|\square| \geq 1$. In instance, a non-stationary series is said to have a mean and a variance dependent on time to which the series will convert. A non-stationary variable in this case is called integrated of order i (represented by I(i)) and hence should be differenced I time for it to become stationary

The problem of non-stationary variables is critical when we construct our model given that regressing non-stationary variables on each other will lead to a spurious regression, meaning that the error term from the regression is very likely to be non-stationary and hence this will violate the basic assumptions of the OLS model.

Hence as stated above, the first procedure that we will follow in our methodology is to test for unit root, or to find out non-stationary variables to avoid the spurious

regression problem. To do that we will use the Augmented Dickey-Fuller test for unit roots (ADF test) in which the two econometricians Dickey and Fuller test for the value of □ in the general model they estimate: $\Delta Y_t = a_0 + \phi Y_{t-1} + a_2 t + \Sigma \beta_i \Delta Y_{t-1} + u_t$

The procedure consists on testing if □ = 0 from the most general model (shown above) to the most specific one. In other words we test if □ = 0 (meaning that the series has a unit root) from the most general model, containing an intercept and a trend to the most specific model containing no intercept and no trend. It means that when we find that □ = 0 we hence tests for the presence of the trend i.e. check for its significance and later check for the presence of the intercept.

One method to resolve the unit root problem is to difference the time series until stationarity is obtained. For example an integrated variable of order one I(1) is differenced once for it to become stationary, and in this case the usual OLS procedure can be applied in order to estimate the model since the spurious regression problem was eliminated trough the differencing procedure.

However, this technique may present undesirable properties since by differencing the variables we are differencing the error term and hence producing a non-invertible moving average error and eliminating the long-run relationship. Econometricians have shown that the error term can be represented as a combination of the cumulated error processes of the non-stationary variables and is itself a non-stationary process. Nonetheless, when dealing with economic structure models it is very likely that the non-stationary variables used in the model are related and move together and thus eliminate the non-stationarity from the error term. In this case we say that the variables are cointegrated and that the differencing procedure can no longer per applied.

Econometricians in this instance use an Error Correction Model (ECM) to estimate the variables.

It is said that two variables are cointegrated if the long-run relationship between them increase over time and later become trended or constant. When cointegration is proven, the next step is to construct the Error Correction Model, but when dealing with more than two variables more than one cointegration relationship can exist. In fact for n variables we can have up to (n – 1) cointegration relationships, and in this case we refer to the Vector Error Correction Model.

In this model, the set of cointegrated variables is represented by a vector Z_t that can be written as follows:

$$\mathbf{Z_t = A_1\, Z_{t-1} + A_2\, Z_{t-2} + \ldots + A_k\, Z_{t-k} + u_t}$$

This can be transformed into a Vector Error Correction model (VECM) as follows:

$$\mathbf{\Delta\, Z_t = \Gamma_1\, \Delta\, Z_{t-1} + \Gamma_2\, \Delta\, Z_{t-2} + \ldots + \Gamma_k\, \Delta\, Z_{t-k} + \Pi\, Z_{t-1} + u_t}$$

Where $\Gamma_i = (I - A_1 - A_2 - \ldots - A_k)$ and $\Pi = -(I - A_1 - A_2 - \ldots - A_k)$ and where I is the identity matrix. Π is considered to be an n x n matrix assuming n variables in the model and contains information about the long-run relationships which are the speed of adjustment to equilibrium (α) and the long-run matrix of coefficients (β'). Hence Π can be written as $\Pi = \alpha\beta'$.

The mentioned methodology for creating a Vector Error Correction Model is called the Johansen approach and is constituted of six steps. The first step consists of determining the order of integration of the variables included in the model using the ADF unit root test. The second step is to determine the appropriate lag length of the

model using a VAR representation and choosing the correct number of lags using the Akaike info criterion (AIC) or the Schwarz Besian criterion (SBC). Then the third step consists of determining the correct model concerning the appropriate set of deterministic components. In fact, Johansen presents five different models that differ based on the inclusion or not of intercept and/or trend in the long-run and short run model. Then we determine the rank of Π matrix in the forth step using a likelihood ratio. This will determine the number of cointegration relationships in the model. The fifth step is to test for weak exogeneity using an F-test. This will look for exogenous variables that should be eliminated from the model. Finaly the procedure requires to test for linear restrictions in the cointegration vector (α and β).

In our methodology we will start by testing for unit root in the set of variables used in our model and then test for cointegration. If no cointegration was found, we will proceed to the differencing process and thereafter use the usual OLS technique. However, if sings of cointegration were found in the model, we will set up the steps stated above in order to construct a Vector Error Correction Model (VECM) and estimate a correct model.

CHAPTER III

EMPIRICAL RESULTS

As stated in the previous chapter, the first step in our methodology is to test for stationarity for all variables using the Augmented Dickey-Fuller unit root test. In this procedure we start by testing the most general model including a trend and an intercept. These two components are then tested for significance and removed from the model once significance was not proven. In our model the trend and intercept were eliminated from the Dickey-Fuller estimated equation (for the majority of the variables) and hence the tests were based on the most specific model including no trend and no intercept. The ADF unit root test results are shown in the below table:

Table3. ADF unit root test results

Variable	**ADF test statistic**	**Intercept t-statistic**	**Trend t-statistic**
Price	-2.4427 *0.1325*	2.3271 *0.0218**	0.7125 *0.4777*
Income	4.1314 *1.0000*	1.0606 *0.2912*	0.7602 *0.4488*
Int_rate	-1.7011 *0.0841*	1.4139 *0.1603*	-0.0359 *0.9714*
Unemply	1.0156 *0.9179*	1.6444 *0.1030*	1.2850 *0.2016*

Housing_starts	-1.1963 *0.9061*	1.6686 *0.0981*	-2.5927 *0.0109**
Permits	-0.7657 *0.3825*	1.7164 *0.0801*	-1.6294 *0.1062*

* Indicate significant components at 5% level of significance
Italic numbers show p-values

The results in the above table show that all the variables included in our model have a unit root or in other words are integrated. We also notice that all variables were tested based on the most specific model except for S&P/Case-Shiller Composite 10 Index (price) and the number of housing starts (housing_starts) variables for which we included an intercept and a trend respectively.

The next step is to determine the level of integration of every variable or in other words to determine after how many differencing procedures the variable becomes stationary. The Dickey-Fuller unit root test is able to determine the level of integration by running the model by level i.e. by differencing the variables.

The results of the ADF unit root test by level are shown in the below table:

Table 4. First and Second difference ADF unit root test

Variable	ADF test statistic	p-value
Price	-3.3172	0.0011
Income	-3.5625	0.0080
Int_rate	-6.4075	0.0000*
Unemply	-2.0223	0.0418
Starts	-4.7038	0.0012

Permits	-5.0322	0.0000*

* Shows p-value for second differencing level

As shown from the table above the ADF test statistics and p-values allow us to reject to null hypothesis stating that the variable has a unit root at the 5% significance level for all the variables. However, this rejection differs from one variable to another regarding the level for which the test was performed. The variable price, income, unemply and starts are shown to be stationary after one differencing meaning that the &P/Case-Shiller Composite 10 Index, the per capita income, the unemployment rate and the number of housing starts are integrated of order one I(1) since they become stationary after one differencing process.

Nevertheless, for the variables int_rate and permits we were unable to reject the null hypothesis at the first differencing level since the respective p-values were greater than 5% level of significance. The corresponding two variables turned to be stationary after two level of significance and hence we can say that the bank loan prime rate and the number of building permits variables are integrated of order two I(2) since they become stationary after two differencing procedures.

After having found non-stationarity in our model's variables, the next step is to check for cointergration between the variables or in other words to check for the long run relationship between them. This will help us decide what procedure we should follow in order to solve the unit root problem and avoid any trouble related to the spurious regression. In this instance if cointegration was found, one should proceed to the Vector Error Correction Model and use the differencing procedure otherwise.

After having tested for unit root the Vector Error Correction method suggests to check for the correct lag structure of the model, this to have a standard normal error term. To do so we start by estimating a VAR model by including a large number of lags then choose the appropriate lag length using the Schwarz Besian criterion (SBC). The appropriate model (lag length) will be the one that minimizes the value of the SBC. This is done by estimating a VAR model for the six variables of the model then using the lag structure test we identify the correct number of lags. The results of the lag length test using the Schwarz Besian criterion (SBC) are presented in the following table:

Table 5. VAR lag order selection criteria

Lag	AIC
none	76.88089
1	56.04982
2	55.46569*
3	56.98153
4	57.97624
5	58.77124
6	59.53700
7	60.6484

*. Indicates the lag order chosen by the BSC

The above table shows that the optimal lag length is equal to two meaning that the appropriate VAR model to use contains two lags of the chosen variables.

Thereafter, Johansen suggests choosing the appropriate model concerning the deterministic components in the system or in other words the procedure recommends determining whether or not we should include an intercept and/or trend in the short-run and/or the long-run models. A general Vector Error Correction Model containing all the possible cases can be written as follows:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k} + \alpha \begin{pmatrix} \beta \\ \mu_1 \\ \delta \end{pmatrix} (Z_{t-1} \quad 1 \quad t) + \mu_2 + \theta t + u_t$$

This shows that the most general Vector Error Correction model can contain a constant with a coefficient μ_1 and a trend with coefficient δ in the long run model or in the cointegration equation plus a constant with a coefficient μ_2 and trend with a coefficient θ in the short run model called VAR model. Thus we need in this step to determine the appropriate model out of the five possible cases stated in the previous section. To do this we test for cointergration in each model and apply the Pantula principle that consists of determining the first time the trace value allows the rejection the null hypothesis. In other words we determine for which level of cointergration and for each model the first time the trace statistic value is smaller than the 5% t-statistic critical value; the model verifying this criterion will be considered as the most appropriate for the determined level of cointegration.

In our methodology we will be testing for models two, three and four given that models one and five are not likely to happen. The comparison of the three cases suggests that model three is the most appropriate one with up to three cointegrating equations. It means that the model we will be applying in our project is the one that is consisted of three cointergration equations and has a intercept in both the cointergation equation and VAR without any trend, hence we assume that the intercept in the

cointegration equation is cancelled out by the intercept in the VAR, leaving just on intercept in the short run model. The following table summarizes the results of the models two, three and four estimates:

Table 6. Pantula Principle Cointegration Test

Number of CE	**Model 2**		**Model 3***		**Model 4**	
	Trace value	**Critical Value**	**Trace value**	**Critical Value**	**Trace value**	**Critical Value**
None	163.1043	103.8473	129.0799	95.75366	163.6446	117.7082
1	113.6395	76.97277	85.91758	69.81859	113.7278	88.80380
2	72.77243	54.07904	51.80052	47.85613	77.65535	63.87610
3*	44.03922	35.19275	24.98661	29.79707	45.77230	42.91525
4	22.62690	20.26184	10.19373	15.49471	20.70796	25.87211
5	7.863788	9.164546	2.069740	3.841466	8.119333	12.51789

* The appropriate chosen model

In this instance step four of the Johansen procedure that consists of determining the rank of the Π matrix is achieved and hence we were able to determine the number of cointergationg vectors. The Π matrix is an k x k matrix of rank r and one way to determine its rank r, or the number of cointegrating relationships is to use a likelihood method based on the trace value (as we did above). The procedure suggests that the model linking the housing price represented by the S&P/Case-Shiller Composite 10 Index to the other set of variables is a Vector Error Correction model with up to three cointergrating relationships.

The next step is to construct the Vector Error Correction Model that gives us the estimates of the six variables we have chosen for our study. As shown from the above results our methodology will be based on the second case of Vector Error Correction Model presented by Johansen, i.e. the one that has an intercept in both the VAR equation (or short run equation) and in the Cointergating equation (or long run equation) and no trend. The equation will also be based on two lags of the variables and of their differences and will contain three cointegrating equations. However given that we are only interested by the effect of the chosen independent variables on the S&P/Case-Shiller Composite 10 Index we will only present in our project the cointegrating equation that models the price index on the left hand side of the equation.

The results of this estimation will be divided into short run and long run outputs. These are represented in the below tables:

Table 7. Vector Error Correction Model Short run estimates

Variable	**Coefficient**
d(price_index(-1))	0.107811
d(price_index(-2))	0.171023
d(unemply(-1))	-2.860243
d(unemply(-2))	-71.27967
d(permits(-1))	-0.000857
d(permits(-2))	-0.000960
d(income(-1))	-0.002168
d(income(-2))	-0.006582
d(int_rate(-1))	-31.72772

d(int_rate(-2))	0.621628
d(housing_starts(-1))	0.064079
d(housing_starts(-2))	0.077140
C	-10.86675

The Cointegration equation results can be represented as follows:

Table 8. Vector Error Correction Model long run estimates

Price_index(-1)	1.000000
Unemply(-1)	0.000000
Permits(-1)	0.000000
Income(-1)	0059184
Int_rate(-1)	28.92365
Housing_starts(-1)	0.411325
C	-4066.565
CointEq	0.022702

Therefore based on these results the model can be illustrated as follows:

Price_index = -10.86675 + 0.107811 d(price_index(-1)) – 0.171023 d(price_index(-2)) – 2.860243 d(unemply(-1)) – 71.27967 d(unemply(-2)) – 0.000857 d(permits(-1))

– 0.000960 d(permits(-2)) – 0.002168 d(income(-1)) – 0.006582 d(income(-2)) – 31.72772 d(int_rate(-1)) + 0.621628 d(int_rate(-2)) + 0.064079 d(housing_starts(-1)) + 0.077140 d(housing_starts(-2)) + 0.022702 [-4066.565 + 0.059184 income(-1) + 28.93265 int_rate(-1) = 0.411325 housing_starts(-1)]

The coefficients shown in this equation illustrate the change in housing prices for every one point change in each variable on both the long-run and short-run terms. For example, a one point increase in unemployment rates in the short run would lead to almost 2.86 points decrease in the S&P/Case-Shiller Composite 10 Index. Similarly on the long-run, this index would increase by 0.05918 points after an increase of per capita income by one point.

However, before performing the analysis of this equation we should mention that the obtained R^2 from this regression was around 27% which could be considered as an acceptable level. Furthermore the Vector Error Correction Model analysis presents along with the coefficient results, their respective t-statistics that allows us to check for the significance of each variable. The examination of t-statistic values lets us conclude the following:

On the short run level, the differenced lags of the price index (first and second lag) are both insignificant since they their t-statistic is less than the critical value which confirm that we fail to reject the null hypothesis that these variables are insignificant. The differenced unemployment rate is shown to be insignificant for the first lag and significant for the second one; this result is similar for the differenced lags of the construction permits. Income is also shown to be insignificant in the short for both lags, and this is logical since any shift in income needs some time to be influence and affects

the behavior of households. Finally interest rates are shown to be significant for the first lagged variable and insignificant for the second lag. These results are more or less explained by the literature which explains that in the short run the most important factor affecting housing prices is the interest rate that is quickly understood by households as change in the market conditions. The literature also shown that factors in relation with transaction and construction cost are considered as short run variables. In our model these could be housing permits that have a wide relationship with these costs, and this confirm their significance on the short run to intermediate level as they prove significance for the second lag. Finally, for the short-run level equation, unemployment rates appear to be significant for its second lagged value that can be considered as an intermediate level and this is also consistent with the literature that describes employment and unemployment rates as key factors in determining housing prices on the intermediate and long run levels.

Hence as a summary changes in housing prices seem to be affected on the short run by unemployment rates, permits, and interest rate. As a result, every one point increase in unemployment rate would lead to a decrease of 0.713 points in housing prices. This negative relationship seems to be logical since an increase in unemployment means that less households are able and willing to purchase new residential properties leading to a decline in housing demand and therefore in prices. Similarly, interest rates appear to have the same negative effect on housing prices and this can be explained by the fact that an increase in these rates would lead to higher financing constraints and hence households will have less ability to purchase housing properties leading to a decrease in the demand and therefore in prices. Finally, we can confirm that a one point increase in the number of building permits leads to a 0.001

decrease in housing prices and this could be explained that the higher building permits are delivered the supply of new housing entities and hence the lower the prices.

From a long-run point of view the Vector Error Correction Model analysis show that in the cointergating equation per capita income and housing starts appear to be significant factors explaining changes in housing prices. Both variables are shown to have a positive impact on housing prices. Income, as proved in the literature, could be a key variable in the long-run channel since an increase in income would lead to higher capability to purchase new housing and hence would lead to a rise in the housing demand leading to higher prices. The results represented in the above table prove that a one point increase in the level if income in the long run will lead to a 0.05 increase in residential property prices. Similarly a one point increase in housing starts would push prices up by 0.4 points. However this result is contradictory with the literature since normally a raise in new housing starts should in general causes an increase in the supply and therefore a decline in prices. One should also consider that the empirical results we got from our modeling could be affected by other market factors and hence could tightly affect our outcome. We should mention that those results could have been affected by many circumstances that occurred during this period in the United States of America such as the internet bubble, the 9/11 incidents and finally the housing bubble that occurred during this period. Hence one can believe that household's expectations and anticipations could have played a major role in shifting housing prices.

CHAPTER IV

REAL ESTATE MARKET AND THE AVAILABILITY AGGRESSIVE LENDING INSTRUMENTS

In this chapter we will be explaining the relationship between the availability of aggressive lending instruments or mortgages and the real estate market, or in other words how these instruments affect price changes in the housing market using both theoretical and empirical evidence.

We will start by presenting some literature review explaining the relationship between the use of mortgages and housing price fluctuations, and thereafter present empirical evidence using an appropriate econometric model.

A. Theoretical Evidence

Andrey Pavlov and Suzan Wachter, their paper entitled "subprime lending and real estate prices" (2009), try to show the existence of a correlation between aggressive lending instruments and real estate prices. They base their model on a rent-buy decision meaning that households and investors make a trade-off between renting and buying the residential property based on the market conditions.

Based on the statistics gathered by the two economists, numbers have shown that aggressive lending instruments consist of almost two-third of all U.S loans. These instruments were first originated in the 1990's mainly with the development of securitization and trough deregulation and financial innovation. These allowed financial

institutions to issue aggressive instruments without accounting for recourse. With these innovations the two authors argue that the demand for instruments increase since loans becomes more affordable and hence create additional financing means for households who shift from renting to buying leading to an increase in housing demand and therefore in market prices.

The two authors show that when loans are mispriced or in other words underpriced households consider that the borrowing constraint is relaxed and hence decide to buy the real estate property rather than rent it. Pavlov and Wachter construct a model based on a competitive market containing "both aggressive and traditional lending instruments" (Pavlov-Wachter 2009) and consider that the investor is free to purchase or rent the housing property in order to maximize his/her expected utility:

$$U(W_T) = \frac{W_T^{1-\gamma}}{1-\gamma}, \ \gamma > 1$$

Where W_T is the terminal wealth used to represent the lending state of the investor, i.e. if the terminal wealth is less or equal to zero, the investor defaults on his/her loan.

γ is the risk aversion parameter (greater than one)

And T is the final period.

Investors maximize this utility subject to:

1. Future probability of default
2. Negative consequences of default
3. Necessity to improve the credit score

The two economists consider a base credit score equal to 500 under which the investor is considered to default. They also construct an aggregated constraint combining the above three constraints called “the credit score constraint”. They prove that the use of aggressive lending instruments tightens the credit score constraint and thus a new group of investors – whose credit score is below the original credit score requirement – will have a credit score meeting the new constraint and will be able to use these lending instruments to finance their “buy decision” leading to higher demand and therefore to an increase in housing prices. They hence conclude by stating a positive relationship between the availability of aggressive lending instruments and real estate prices meaning that the more available mortgages are in the credit market the higher housing prices are.

Sophocles Brissimis and Thomas Valassopoulos in their paper entitled “The interaction between mortgages financing and housing prices in Greece” (2008) argue that although the relationship between mortgages financing and housing prices is well defined, the direction of the causality between these two variables remains questionable. In other words the two authors consider that the idea of which variable causes the other is not totally clear and is still debatable.

They first show that the higher the availability of credits is the more consumption will increase leading to higher economic activity and thus to higher growth expectations. On the other hand, the availability o lending instruments will increase the demand for housing properties. These two combined factors explain the causality mortgages have on the housing market since they will lead to higher property valuations and hence to an increase in housing prices.

On the other side, the increase in housing prices will lead to wealth accumulation and distribution and hence to higher consumption and investment levels. These high levels of consumption and investment will simultaneously stimulate the demand for mortgages and credits. Moreover, the increasing value of the residential property can be used as an important mean of collateral that enhances the borrowing capacity and therefore increases the demand for mortgages. These two phenomena prove the effect of housing prices on the lending market.

To empirically determine the direction of the causality between housing loans and housing prices, Brissimis and Valassopoulos have gathered quarterly data concerning the Greek market from 1993 to 2005. Their model was based on four variables: Gross Domestic Product (GDP), housing loans, housing prices, and mortgages rates. These variables were shown to be integrated of order one (I[1]) or non stationary having one cointegration relationship, and hence the two economists used a Vector Error Correction Model (VECM) to perform the corresponding modeling.

The regression results based on the VECM estimates show significance of all the variables and therefore prove that property prices are positively related to housing mortgages suggesting that the short-run and long-run causality goes from housing loans to housing prices, i.e. that housing loans positively affect or explain housing prices on the both short and long run terms.

Other literature reviews stress on the same idea discussed above concerning the direction of the causality between housing prices and mortgages. This was discussed by Santiago Valverde and Francisco Fernandez in their paper entitled “the relationship between mortgage markets and housing prices: Does financial stability make the

difference?" (2008) in which they argue that the mortgage market or the availability of lending instruments has no big influence on the housing market; but in contrast the housing market plays an important role in the credit market.

They try to prove this causality using an econometric model based on quarterly data gathered from Spain for the period of 1987 to 2008. The method followed by the two economists was to estimate an Error Correction model (ECM). They noticed that housing prices were not explained by mortgages a rate, meaning that in Spain the boost in housing prices was not a result of an interaction with the mortgage market.

The empirical results however showed that the increase in housing prices was able to explain the evolution in the mortgage market or in other words that the change in the residential property market causes an evolution in the credit market, i.e. that mortgage lending adapt to the change in the housing market.

B. The Causality Between Housing Prices And Mortgages Rates - An Empirical Evidence

In this section we will try to study the relationship between the housing market and the credit market or in other words the causality between housing price changes and mortgages rate using an econometric model. Data are gathered from the U.S market on a monthly base from April 1971 to March 2010 for a total of 119 observations.

The housing price index, as described in Chapter III corresponds to the S&P/Case-Shiller Composite 10 Index and mortgages rates correspond to the monthly 30-years

mortgage. The two series are taken as log in order to improve their normality which could present better results adequacy. The following two figures show the representation of the two mentioned series which show a high degree of normality:

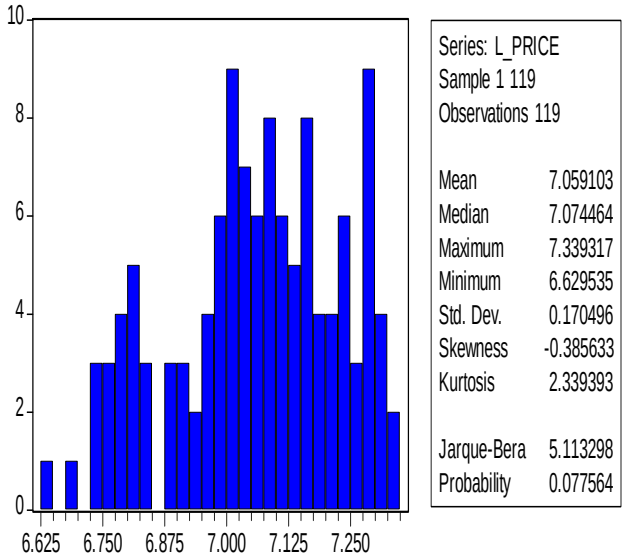


Fig 10. Log(price) descriptive graph

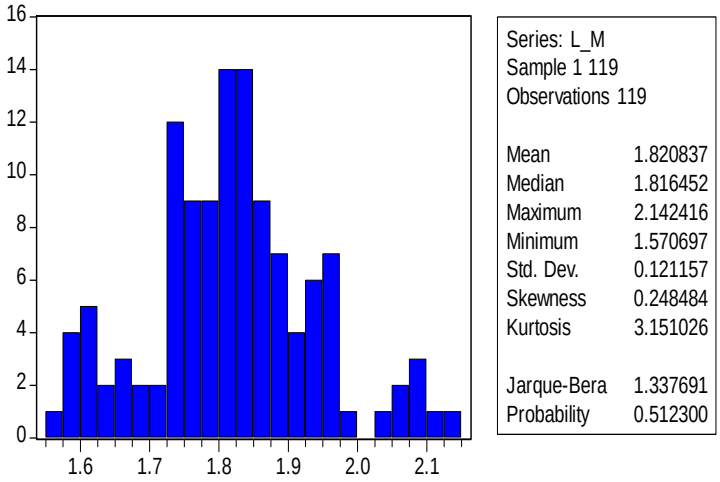


Fig 11. Log(mortgages) descriptive graph

The two series are thereafter tested for stationary or in other words, we will examine if the two series have a unit root or not using the Augmented Dickey Fuller Unit Root Test. The ADF unit root test for both series show that they are non-stationary and this can be confirmed using the ADF p-value that is greater than the 5% critical value in both cases that allow us to accept the null hypothesis stating that the series has a unit root. The following table represents a summary of the ADF test results:

Table 9. Log(prices) and Log(mortgages) ADF unit root test

Series	P-value	P-value after one difference
Log(prices)	0.2858	0.000
Log(mortgages)	0.1027	0.000

We notice from the above table that the two variables are non-stationary or have a unit root and this can be confirmed by looking at the ADF unit root test p-value (which is greater than the 5% critical value) and that they become stationary after one differencing meaning that one differencing operation leads to stationary series. This means that the two variables becomes integrated of order zero after the first differencing operation and hence are considered to be integrated of order one I(1). The next step is to evaluate any cointegration between the two series using the Engle-Granger cointegration test. The test consists on running the cointegration regression or estimating the equation relating the two series suspected to be cointegrated. Then the residuals from this regression are saved and tested for unit root using the ADF unit root test. If the residuals are found to be integrated or non stationary the variables are said to be not cointegrated, and are said to be cointegrated otherwise. The results of the ADF unit root test for the residuals we get from regressing log(prices) on Log(mortgages) and a constant are as follows:

Table 10. Residuals ADF unit root test

Series	**t-statistic**	**Engle-Granger Critical Value**
Resid	-2.6509	3.93

The above table show that the t-statistic obtained from the ADF unit root test is less that the Engle-Granger critical value (in this case traditional t-statistic critical values cannot be used and are hence replace by Engle-Granger critical values for adequacy) meaning

that we fail to reject the ADF unit root test null hypothesis stating that the series has a unit root, and therefore we confirm that the residuals from the regression of log(prices) on log(mortgages) and a constant are non stationary and hence the two series (log(prices) and log(mortgages)) are not cointegrated. In this case the two series can be differenced once and hence used in the estimated model with no fear of spurious regression given that no cointegration was found.

The process can now easily be carried on using the OLS procedure after performing all the needed test to make sure that all the assumptions of the Classical Linear Regression Model (CLRM) are satisfied (heteroskedasticity, serial correlation, normality, etc…). However our interest is beyond this operation as we are not interested by estimating an equation relating the price index to the mortgage rate but instead by the causality between the two variables. In other words we will be testing which variable explains the other or causes the other, hence we will check if the trend followed by housing prices in the United States of America was mainly explained by a fluctuation of the mortgage rates or vice-versa.

To do that we will apply the Granger causality test that allows us to determine which variable predicts or explains the other, i.e. the direction of the causality. It is a test created by Granger in 1939 which specifies that a variable is said the Granger-cause another if it is able to predict the other variable using its own previous values. The procedure consists of estimating a VAR using the chosen variables in which each variable is a dependant variable in one equation and an independent variable in another equation. Then check for the significance of the variable's coefficients and decide which variable can be excluded in order to determine the direction of the causality.

The below table represents the results of the Granger Causality test:

Table 11. Granger Causality Test Results

Null Hypothesis	Observations	F-Statistic	p-value
Mortgage does not Granger cause Price	116	1.27294	0.28406
Price does not Granger cause Mortgage	116	10.8217	0.0005

Based on the results we notice that the mortgage rate does not Granger cause housing prices since we were unable to reject the null hypothesis. On the other side, we note that housing prices Granger cause mortgage rates since the low p-value (less than 5% level of significance) allows us to reject the null hypothesis. Hence we can say that the direction of the causality goes from housing prices to mortgage rates, meaning that changes in housing prices in the United States of America were able to explain the fluctuation in the mortgage rates. Hence for example, any increase in housing prices would lead to higher availability of mortgages in the credit market and hence to a decline in the mortgage rates.

These results are conform to Santiago Valverde and Francisco Fernandez findings, who argue housing market plays an important role in the credit market and are able to explain changes is mortgage rates but in contrast mortgages play a minor role in the housing market. Therefore we can confirm based on the empirical results that the housing market caused the evolution of credit market in the United States of America or in other words that mortgage rates were able to adapt to the fluctuations in the residential property market. This can be explained by the fact that any increase in

housing prices will from one side lead to a wealth effect in which households consider themselves more wealthy and hence are willing to consume and invest more which will lead to a higher demand for mortgages. From the other side the increasing value of the housing property will permits to the household to use this property as trusted collateral and hence will be able to reach higher borrowing capabilities, and hence the housing market can explain the evolution on the credit market through two channels; the wealth accumulation channel and the trusted collateral channel.

CHAPTER V

CONCLUSION

The third quarter of 2007 gave some hints about a potential crisis that principally started in 2008 leading to a major deterioration on financial, commercial, and economic lines. The United States of America are blamed to have caused a worldwide crisis since the recession started to appear in the U.S economy and was later spread all over the globe. The U.S economy was severely damaged by this crisis which led to a decline in investors' confidence leading to a sharp deterioration in stock markets that were marked by a decline of forty-five in S&P 500 index. Future markets were also affected and felled down by around thirty percent. Simultaneously, the United States and the world experienced a decline in commerce, oil prices, investments, exchange rate problems or crisis…

The global recession in this period was preceded by a burst in the U.S housing bubble that peaked in 2006 and is hence considered to be caused by this collapse in the housing market. The deterioration in the real estate market is principally linked to an increase in defaulting creditors whose main collaterals were directly related to residential properties. Therefore the collapse of the housing market simultaneously with the increase in credit defaults led to liquidity problems within the financial institutions and as a result to deterioration in the stock market and hence in the whole economy.

The real estate market was once again, as a result of this crisis, back to the front lines and became of big interest for many economists who tried to link the housing market to the overall economic performance. The literature tried to establish a

relationship between macroeconomic fundamentals and housing prices and to find a link between shifts in economic variables and changes in housing prices. The literature was much diversified; studies were made on several countries and were based on both times series and cross-sectional analysis. These theories differentiated between the demand for housing and the supply of housing properties and established equilibrium prices by matching the two functions. Demand and supply side effects can be divided in short-run and long-run analysis. In the short run, the supply side is kept constant and studies have shown that the main factors leading to shift in housing prices were interest rates, transaction and construction costs. These three are argued to have a negative impact on housing prices meaning that any increase in these variables would lead to a decline in housing prices. For example, an increase in interest rates will cause financing solutions more expensive and hence households would have less financing capabilities leading to a decline in the housing demand and then in prices. In the long run channel, the theory suggests an effect of income, employment/unemployment, new housing starts, and population size on housing prices. Each variable could lead to a shift in housing prices in a different way, for example income has a positive impact on housing prices while unemployment could present a negative one. The literature also explains that housing bubbles are mainly formed because of households expectations about the increase in housing properties and hence in their respective wealth. These expectations also play an important role in the housing market and are used by many economists to prove causalities in the market. The literature also stressed on the relationship between housing prices and the availability of aggressive lending instruments. It tried to establish a link between these two by determining the direction of the causality between housing prices and mortgages. Economists diverged on this point, some argue that the causality

goes from mortgages to housing prices meaning that the availability of these mortgages would affect housing prices, while other consider that the causality is from housing prices to mortgages or in other words that shifts in residential prices leads to fluctuations in the credit market and hence in mortgage rates.

The goal of the project is to establish the relationship between macroeconomic fundamentals and housing prices as well as identifying the causality between these prices and mortgage rates. To do so, we gathered monthly data from the U.S market from year 2000 to 2010. The selected macroeconomic variables were per capita income, bank loan prime rates, unemployment rates, number of construction permits, and number of new housing starts; while housing prices were represented by the S&P/Case-Shiller Composite 10 Index. The methodology first suggested to test these variables for unit root and were all found to be non-stationary (with different levels of integration). Hence we were forced in this case to test for cointegration between these variables using the Johansen procedure. Using the later, cointegration was found between these variables and more specifically three cointegration relationships were proven. In instance, the model cannot be determined using simple OLS in order to avoid the spurious regression problem. As a result the modeling was based on a Vector Error Correction Model based on two lags of the chosen variables and on three cointegartiong relationship. The outcome proved a negative relationship between interest rates and housing permits on the short-run. It also proved the same for housing starts as well as for unemployment rates. On the long run, as expected, per capita income was shown to be significant and to have a positive effect on housing prices. Moreover, the number of new housing starts has shown positive effect on housing prices, which is incoherent with the literature that suggests a negative relationship between these two variables.

However we can suggest that an increase in new housing starts can be viewed by investors and households as a sign of positive economic performance on which they will build their expectations for future increase in housing starts leading to positive shift in the housing market.

On another side, mortgage rates were gathered for the same period and were also tested for unit root that showed non-stationarity. The cointergation test using the Engle-Granger procedure proved no cointergation between housing prices and mortgage rates. As a result the difference of the two variables was used to check for causality. The Granger-causality test suggested that the causality goes from housing prices to mortgage rates meaning that shift in mortgage rates are explained by shift in the housing market. This can be explained by the fact that an increase in housing prices leads to a wealth accumulation effect leading to higher consumption and investment levels and therefore to higher financing needs. This has a positive effect on the credit market. Simultaneously, the increasing value of the residential properties could be used as a collateral leading to a rise in credit demands. These two combined factors hence lead to an increase in mortgages rates.

To sum-up, the project was able to determine the main macroeconomic factors that affect prices in the real estate market. The Vector Error Correction Model helped us distinguish between short-run and long-run effect. On the short run, interest rates, unemployment, and construction permits seem to be the main determinants of housing prices; while income and the number of housing starts appear to be key factors in the long-run. Moreover, the project was able to determine the direction of the causality between housing prices and mortgages in the United States of America; the Granger-causality test showed that the causality goes from housing prices to mortgage rates.

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