Modeling the U.S. housing bubble: an econometric analysis

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Abstract

The US economy experienced excessive demand for housing for over a decade, causing a housing boom. Consumers went on a spending spree driven by higher and higher, real and perceived home equity values, as well as equity market increases. In the US market, "bigger is better" or "as much as one can afford" became the mentality of home buyers. In addition, consumers were driven to buy houses now to avoid future higher prices. Interest rates were generally held to historic lows from 1990 to about 2007. For a long time, the Federal Reserve was praised for helping the financial markets sustain their roles in the housing markets. Since the housing market crash, beginning about 2006, the Federal Reserve has been blamed for the housing crisis. This research will examine the housing market boom to determine what factors led to this economic situation.

Keywords: housing bubble, housing crash, housing boom, greed, modeling housing prices

INTRODUCTION

Over the past six decades, housing markets in the United States have periodically gone through boom and bust cycles. Following World War II, housing boomed to accommodate returning troops and their "baby boom" families. In the 1960s and 1970s, the baby boomers entered their household formation years, which caused the housing markets to expand rapidly. Inflationary effects of the late 1970s spurred this trend, as people responded to inflationary pressures with a "buy now before prices go up" attitude.

This latest housing boom cycle began in approximately 1998, lasting until 2006. There has been widespread belief that central bank influences on short-term interest rates helped to spur the booms.[1] Mortgage interest rates were at or near historical lows, ranging mostly between five and six percent.

During the eight-year span, households experienced wealth increases from both equity market increases and home price appreciation of unparalleled proportions. (Business Week, February 11, 2008.) Perhaps most damaging were expectations that this boom cycle would continue. As a result, consumers went on spending sprees, based on higher and higher real and perceived home equity values, as well as equity market increases. The prevailing attitudes of "bigger is better," or "as much as one can afford," or "buy now avoid future higher prices" became the driving forces for home buyers. Finally, purchasing a home became part of planning for retirement. Owning a home became a way to save for retirement and simultaneously enjoy the investment. Thus, many consumers viewed the appreciation in their homes as a future source of retirement funds. Even the sharp downturn in equity markets from their lofty heights in about 2001 did not deter the housing market.

Important as well, home mortgage interest was tax deductible, unlike other debt interest payments. Since the interest on the additional borrowing would generate a tax deduction, the reduction in the effective mortgage rate as an added bonus and incentive. Consumers tapped equity in their homes to purchase second homes, pay off credit cards, buy cars, take vacations, and purchase many other items. The pervasive attitude that housing prices would continue to increase often led home owners to repeatedly refinance the accumulating equity.

In addition to consumer ebullience, mortgage lenders were doing their part to keep this cycle from ending. Lending standards were relaxed, bringing in a new class of borrowers, who traditionally could not afford to own their own homes. Home buyers could receive 100 percent loan-to-value loans, with little if any credit or income checking. Variable rate mortgages were widely used that would adjust upwards eventually. Interest-only loans added to speculative pressures by allowing borrowers to obtain the maximum amount of financing without regard to repaying the principle, at least for a set number of years. The stage was set for a housing decline, since, if interest rates rose, these mortgages would adjust to create payment levels beyond the borrowers' capacity to pay. Thus, money was easy, while credit checking was lax.

Using median asking price as a proxy for the house price boom, this research will investigate the housing market boom to determine what factors led to this economic situation. Preliminary results show that mortgage interest rates in the US, while significant, are only one of several factors that influenced the boom.

REVIEW OF THE LITERATURE

Popular press has called the period between 1998 and 2006 a "housing bubble". We see again and again references to this phenomenon. However, there is academic literature that questions and denies the occurrence of a housing bubble (Himmelberg, Meyer, and Sinai (2005) and (Smith 2005). Others accept the existence of a housing bubble and attempt to explain causes of the bubble through mortgage rates (Mints 2007) and economic indicators (Baker, 2007). Still others do not discuss a house price bubble explicitly, but they do demonstrate that demographic data (Kim 2007), homeownership rates (Chambers, Garriga, and Schlagenhauf 2008), and new mortgage products (Chomsisengphet and Pennington-Cross 2006) have supported a larger pool of potential buyers in recent years than in prior years.

Mints (2007) studied the impact of several factors, including mortgage rates, on the Russian housing market and concluded that the housing bubble had occurred. This conclusion was based on the existence of a large disparity between mortgage rates and the rate of return of risk-equivalent financial investments. However, he did not study the U.S market but observed similar disparities in our housing market. He drew similar conclusions as to the existence of a U.S. housing bubble without any substantiating analysis.

Himmelberg, Meyer, and Sinai (2005) discount the use of standard house pricing models, such as using growth rates in house prices, the price-to-rent ratio, and the price-to-income ratio. They imply that if these measures were "reliable indicators of a rising cost of obtaining housing, then these recent trends would indeed provide reasons to suspect overvaluation in many housing markets. However, these measures are inadequate to assess whether the housing market is (in) the grip of a speculative bubble."[2] Instead they favor using a comparison of the user cost of housing, or the equivalent cost to rent the property for a year with the opportunity cost of investing for that year. This comparison should include tax benefits of home ownership, property taxes, maintenance expenses, and expected capital gains. They go on to state that a bubble occurs when unreasonable expected capital gains outweigh user costs.

Case and Shiller (2003) suggest that a bubble "referred to a situation in which excessive public expectations of future price increases cause prices to be temporarily elevated."[3] Further, they assert that it is the buyer's view of housing as an investment that is one of the essential characteristics of a housing bubble. Case and Shiller explain that it is the expectations of future price increases that drive the home buyer rather than the joy of home ownership. As such, they base their analysis of a bubble on expectations of home buyers and factors that affect expectations. In the bubble environment, a home that normally would be considered too expensive by the home buyer is now acceptable because of expected future price rises. Following a similar line of thinking, first time buyers are motivated to purchase a house at elevated prices, because of the fear of being priced out of the market due to continued escalation of housing prices. Excessive expectations are also likely to help buyers rationalize the high prices because they consider the risk of falling prices to be small. These factors tend to spur the demand for housing by reinforcing the bubble mentality. Case and Shiller suggest that rapid price increases are not sufficient evidence of the existence of a bubble. Rather, expectations are more likely to have led to higher prices and thus are a predictor of future behavior of the housing market.

To that end, they analyzed U.S. state-level data, including such factors as home prices, personal per capita income, population, unemployment rate, mortgage rates and housing starts. From their analysis of U.S. data they concluded that in all but 8 states personal income alone explains home price rises since 1985. In those 8 states (CA, CN, HA, MA, NH, NJ, NY, and RI),

other factors (change in population, change in employment rates, interest rates, etc) added explanatory power. However, even with the inclusion of those factors, Case and Shiller were not able to reject the hypothesis of an existence of a bubble in the 8 states.

To gain further insight to the existence of a housing bubble, Case and Shiller repeated their 1988 survey in their 2003 paper. They collected data on expectations, perceived risk, and word of mouth behavior of home buyers that, in turn, impacted buyer's theories of speculative price movements. These themes were analyzed to determine their impact on housing price movements and financial markets. The in 1988 survey, data from 4 markets (Los Angeles, San Francisco, Boston, and Milwaukee) showed strong evidence of a housing bubble. Based on future investment values, strong expectations, and little perceived risk, home buyers in these markets aggressively drove housing prices up. They also were able to document that home prices are sticky in a downward market. This effect causes only slight price declines even when there is an excessive supply. Based on the reluctance to accept the fact that, like all commodities, housing prices can fall, homeowners resist price reductions.

Their analysis of survey data from 2003 generally lent support for the existence of a bubble in the 4 markets driven by investment motive, expectations of price increases, and word of mouth influences. Prophetically, they concluded "that most people did not perceive themselves in the midst of a bubble, despite all the media attentions to the possibility."[4] Moreover, they stated "although these indicators do not suggest such strong evidence of a bubble as was observed in 1988, it is reasonable to suppose that, in the near future, price increases will stall and that prices will even decline in some cities."[5]

M. Smith and G. Smith (2006) also have done extensive investigation into the possibility of a housing bubble. They begin by stating the definition of a housing bubble according to Kindleberger (1987 p 281): "A sharp rise in price of an asset or a range of assets in a continuous process, with the initial rise generating expectations of further rises and attracting new buyers – generally speculators interested in profits from trading in the asset rather than its use or earning capacity. The rise is usually followed by a reversal of expectations and a sharp decline in price often resulting in financial crisis."[6]

Smith & Smith define a housing bubble on a strict financial basis rather than expectations as Case and Shiller postulated. They state "a bubble is a situation in which the market prices of certain assets (such as stocks or real estate) rise far above the present value of the anticipated cash flow from the asset. . . ."[7]. Their research is based on a financial model that involves determination of the investment value of a home from rental data. The net present investment value of a home is determined using a series of fundamentals that affect cash flow, such as transaction costs, insurance, down payment, property taxes, tax savings, mortgage payments and capital gains on the sale of the house. These values can then be used to determine if premiums exist for selling prices with respect to their fundamental values.

Applying this model to ten markets, the value of a home was compared to its sales price. From their analysis of the selected urban areas, Smith and Smith conclude that the sharp rise in housing prices and buyer's expectations through 2005 reflect the attractive investment opportunities of home ownership, rather than the existence of a bubble in housing prices.

The problem exists in reconciling the results of Smith and Smith with Case and Shiller in light of the downturn in the current housing market. There have been sharp declines in housing values in 2007 and 2008 in many overheated markets. Clearly the sticky nature of housing prices described by Case and Shiller, coupled with an avalanche effect as reality sets in, have led to a complete reversal of the housing market. Mayer and Quigley (2003), in their review of Case and

Shiller, generally agree with many of their conclusions. However, while Mayer found confirmation of his previous research (1997, 2001) concerning sticky housing prices, he still observed that demand can fall considerably in slowing markets. Quigley took issue with the over emphasis of the investment motive for home ownership (and expectations of future values) that Case and Shiller presented as evidence of a housing bubble.

As seen in the literature, the definition of a bubble is not a generally accepted term. From our perspective, a bubble occurs when many factors come together to drive the price of an asset up beyond what typical behavior of the asset has exhibited in the past. In the case of housing, factors such as greed, easy availability of credit, and supply of housing might play a more significant role in driving housing prices in a bubble period than in a normal period.

In addition to the factors mentioned above, none of the research cited here used interest rates as a major factor in the housing bubble. Yet interest rates are often considered the primary force responsible for the housing bubble. Thus there are many issues related to the recent volatile nature of the housing market that have not been sufficiently studied. It is our intention to use widely available data to investigate the housing market to determine consumer behavior in the housing market and factors that influenced the housing bubble. With hindsight, perhaps we should rephrase the question from "was there a housing bubble" to "when and why did it occur"?

VARIABLES AND HYPOTHESES

We selected 7 independent variables that would directly influence housing prices. The model chosen uses Median Asking Prices (MAP) as the dependent variable, and both supply and demand factors as independent variables for housing consumption. Supply factors include inventory of housing inventory and vacancy rates. Demand factors include population, personal income, Consumer Price Index (CPI), median asking rents, and the 30-year, fixed-rate conventional mortgage interest rates.[8] Data were compiled from the Federal Reserve, US Census, US Department of Labor, and the US Department of Commerce. Monthly series were used and quarterly data was converted to monthly values through interpolation.

Median Asking Price was chosen as the dependent variable, because it reflects sellers' expectations of their homes' values, as opposed to using a measure of final settlement price that might reflect buyers' expectations. Year-over-year asking prices increased by 28 percent between 2004 and 2005 and by 16 percent between 2005 and 2006. However, from 2006 to 2007, median asking prices were down by 4 percent. By way of comparison, US home sales prices rose 6.2 percent in 2006, according to the Freddie Mac Conventional Mortgage Home Price Index Classic Series. To the dismay and disappointment of sellers, house prices fell, at an annualized rate of 1.6 percent and 0.5 percent, in the third and fourth quarters of 2007, respectively, and appreciated for the whole year at only 0.3 percent.[9] These numbers did vary by region and city.

Housing Inventory was chosen to reflect the supply of housing in the market place. As the housing boom progressed in the US, inventory of homes for sale was in short supply. Building could not keep up with demand. Sellers in some markets experienced multiple offers on their homes that often sold within a few days at premium prices.

Vacancy Rates captures unoccupied housing currently available, including new construction, from US Census data.

Median Asking Rents (MAR) have a significant impact on housing markets. Generally, housing prices are influenced by rents, reflecting ownership as an alternative to renting. As rents

rise, ownership becomes a more attractive alternative to renting, placing additional upward pressure on housing prices.

On the demand side, population was chosen to include demographic effects on housing. Since baby boomers have begun to reach retirement age, they have been in peak income earning years. Many in this age bracket have either moved to larger homes and/or bought second homes as retirement assets. With accelerating house price inflation, returns on investments have been higher on housing than returns on comparable risk investments in financial markets. In addition, housing is seen as a real asset that can be lived in and may feel like a safer investment than financial assets.

CPI is included as a demand variable to capture overall inflation effects and personal income is a measure of housing affordability. The last variable included on the demand side is the 30-year fixed mortgage rate.

Based on well understood relationships, the following hypotheses are proposed:

H1: CPI positively influences MAP
H2: Housing Inventory negatively influences MAP
H3: Mortgage Rates negatively influences MAP
H4: Personal Income positively influences MAP
H5: Population positively influences MAP
H6: Vacancy Rates negatively influences MAP
H7: Median Asking Rents positively influences MAP

We also theorize that during the pre-bubble era, in more stable markets, fewer variables would impact housing prices. During the bubble era, however, more complex forces would be at work and therefore more factors would influence housing prices. Therefore, we hypothesize that if a bubble in housing prices had taken place, then the models would be substantially different between the two periods,

H8: Model of pre-bubble relationships is different from the model of bubble relationships.

DATA COLLECTION

Data for analysis was obtained from the following sources:

1. CPI: U.S. Department of Labor: Bureau of Labor Statistics
2. Housing Inventory: Bureau of the Census
3. 30-year conventional mortgages: Federal Reserve Board
4. Personal Income (PI): U.S. Department of Commerce, Bureau of Economic Analysis
5. Population U.S. Department of Commerce: Bureau of Economic Analysis
6. Vacancy Rates: Bureau of the Census
7. Median Asking Prices: Bureau of the Census
8. Median Asking Rents: Bureau of the Census

Data was collected for the period between 1/1/1988 to 12/31/2007 for all variables.

RESEARCH METHODS

To investigate the possibility of a housing bubble, we split the entire data set into two sub-sets: 1/1988 to 12/1996 to reflect a more stable period for housing prices (pre-bubble) and 1/1997 to 12/2007 during which housing prices soared, reflecting the bubble effect. We also used

the data from the entire period (1/1988 – 12/2007) for comparison purposes with the pre-bubble and bubble periods.

A multiple linear regression model was proposed using our 7 independent variables, with Median Asking Prices as the dependent variable.

MAP= F(CPI, Housing Inventory, Mortgage rates, PI, Population, Vacancy Rates, MAR) (1)

Using SPSS, the 3 models were tested using stepwise regression analysis:

1. Pre-Bubble Model – Period: 1/1988-12/1996
2. Bubble Model - Period: 1/1997-12/2007
3. Full Model – Period: 1/1988 to 12/2007

For both the pre-bubble and bubble periods models, descriptive statistics, measures of strength of the relationship, and regression coefficients, along with their associated statistics, were calculated and presented below. The results for the full model were quite similar to the bubble period model. The main difference was that all variables remained significant in the final full model (6 out of 7 were significant at <= .003, mortgage rates were significant at .038) and for the sake of brevity, not included here.

PRE- BUBBLE MODEL - 1/1988 to 12/1996

For the pre-bubble period, step-wise regression began with model 1 consisting of a full complement of independent variables. As can be seen by inspecting Table 2, none of the variables are significant at the .01 level. After 5 additional iterations, model 6 was achieved, retaining Personal Income and Vacancy Rates. Both independent variables are highly significant and have very low measures of co-linearity. In addition, the coefficient of determination changed by only .001 between model 1 (R^2 =.802) and model 6 (R^2 = .801), as the 5 non-significant variables were removed.

Descriptive Statistics (Insert table 1 here)
Coefficients(a) (Insert table 2 here)
Model Summary (Insert table 3 here)

BUBBLE MODEL PERIOD: 1/1997 to 12/2007

When the bubble period model was run, 5 independent variables were retained in the model after two iterations. This is in sharp contrast to the results of the pre-bubble period. The coefficient of determination rose to 96%, and very strong measures of co-linearity were recorded.

Descriptive Statistics (Insert table 4 here)
Coefficients(a) (Insert table 5 here)
Model Summary (Insert table 6 here)

ANALYSIS OF RESULTS

For the Pre-Bubble period, step wise analysis removed all but two of the independent variables. Personal Income and Vacancy Rates remained in the model. This model has a coefficient of determination, R^2 of 80%, which essentially remained unchanged from the value

for the initial model using all 7 independent variables. Co-linearity measures such as tolerance and VIF show little multi-co-linearity effects between Personal Income and Vacancy Rates and their impact on Median Asking Prices. Inspecting the direction of influence for Personal Income and Vacancy rates, hypotheses 4 and 6 are supported. The standardized coefficients for Personal Income (.83) and Vacancy Rates (-.14) indicate that Personal Income plays a far greater role in driving Median Asking Prices than does Vacancy Rates, in the pre-bubble period. These results reflect a housing market behaving in a traditional manner in which income and supply of housing represent the major driving forces behind housing prices. Hypotheses 1 through 3, 5, and 7 were rejected, since these variables did not appear in the final model.

When the model was tested using the Bubble period data, striking differences were found. Only 2 variables, the 30-year conventional fixed rate mortgages and personal income, were removed. The coefficient of determination rose to 96%. It is interesting to note that the two variables removed are usually considered to be among the most important factors driving the housing market. Yet the availability of easy credit seems to have negated the impact of these variables. Thus hypotheses 3 and 4 are not supported, since they play no role in the final model for the bubble period.

Another major difference was the very high levels of co-linearity among the independent variables, in sharp contrast to the pre- bubble model. This is to be expected given the inter-relationships among the remaining independent variables. For research with a forecasting orientation, the strong co-linearity effects would be problematic. Since we are primarily interested in identifying indications of a housing bubble, the issue of co-linearity is not a consideration.

The fact that the co-linearity effect was not observed during the pre-bubble period as opposed to the overwhelming effect during the bubble period lends further support for a housing bubble effect. In addition, using more sophisticated statistical techniques such as structural equation modeling would allow the effects of multi-co-linearity to be handled appropriately. In a structural model, the independent variables become exogenous and endogenous variables based on the relationships among the original independent variables.

Inspection of the coefficients indicates that hypotheses 1, 2, and 7 are supported. However, hypotheses 5 and 6 are not supported. During the bubble period, Population had a negative influence on Median Asking Prices, while Vacancy Rates had a positive influence. Both results are contrary to expectations. Interestingly, the magnitude of standardized coefficient of Population (|-.432|) is the second largest and comparable to other coefficients (values from .406 to .267), indicating the strong nature of this contrary effect.

Normally higher vacancy rates would depress housing prices. However, this was not observed during the bubble period. One explanation for this unexpected effect during the bubble period may be that, in speculative periods, buyers' and sellers' expectations continue to drive prices up. Greed kicks in and demand for housing is driven by the desire to take advantage of ever increasing profits. Rising housing prices also may lead to new construction, which adds to an already existing supply.[10] It is often observed that home buyers generally prefer new construction to old, even when there is a substantial inventory of pre-existing housing. This effect has driven the Florida housing market for the last 30 years. However, with such high levels of co-linearity present, interpretations of the beta coefficients should be limited.

Likewise, the contrary effect of population on housing prices reflects the more complex dynamics during the housing bubble period. Usually, increasing population drives prices up, as reflected in the increasing demand for houses. However, during the bubble period, the higher

populations had the reverse effect. It could be that other variables' interactions with population produced this effect. Without further research, any explanation of this influence is purely speculative. Because of many unexpected differences between pre-bubble and bubble models, hypothesis 8 is accepted. These differences reflect the fact that significant forces were at work during the bubble period that did not exist during the pre-bubble period.

Below are summaries of the conclusions for the pre-bubble and bubble hypotheses:

Pre-Bubble Hypotheses: 1/1988 – 12/1996

H1: CPI positively influences MAP: Reject
H2: Housing Inventory negatively influences MAP: Reject
H3: Mortgage Rates negatively influences MAP: Reject
H4: Personal Income positively influences MAP: Accept
H5: Population positively influences MAP: Reject
H6: Vacancy Rates negatively influences MAP: Accept
H7: Median Asking Rents positively influences MAP: Reject

Bubble Hypotheses: 1/1997-12/2007

H1: CPI positively influences MAP: Accept
H2: Housing Inventory negatively influences MAP: Accept
H3: Mortgage Rates negatively influences MAP: Reject
H4: Personal Income positively influences MAP: Reject
H5: Population positively influences MAP: Reject**
H6: Vacancy Rates negatively influences MAP: Reject**
H7: Median Asking Rents positively influences MAP: Accept
H8: Model Relationships for pre-bubble and bubble periods are different: Accept

(**significant but reverse direction)

When the data from the entire period (1/1988 to 12/2007) was used, the following results (not presented here) were found: all variables remained in the model, the coefficient of determination remained at 97%, extremely high levels of co-linearity existed, hypotheses 1, 2, 3, 4, and 7 were accepted while 5 and 6 were not supported because of the reversal of relationships, as occurred in the bubble model. Inspection of standardized coefficients showed that Population (-.72) has almost as much influence as Personal Income (.75) on Median Asking Prices. It bears repeating that given the high levels of multi-co-linearity too much interpretation of beta coefficients is problematic.

CONCLUSIONS AND FUTURE DIRECTIONS FOR RESEARCH

The US economy experienced excessive demand for housing for over a decade, causing a housing boom. From the literature, we, as others, believe that a housing bubble did exist, at least regionally. This research compares two time periods in the US housing market between 1988 and 2007 to determine if there were a significant difference in housing price behavior between the periods prior to January, 1997 (pre-bubble period) and post January, 1997 (bubble period).

During the pre-bubble period, we found that only two variables impacted median housing prices, whereas in the bubble period, 5 out of the 7 original independent variables were present in the final model. In all models, very high coefficients of determinations were observed, lending support to the strengths of the models for all 3 periods studied. However, more sophisticated research techniques are needed to resolve the impact of co-linearity effects. The fact that the

models for the pre bubble and bubble periods were different reflecting different factors at work during these two periods is, for us, indicative of a bubble.

Interestingly, the fact that mortgage rates were not retained in the final model for the bubble period further supports the contention that other factors were responsible for creating the housing bubble. Many researchers used mortgage rates either directly or indirectly to study behavior of housing prices. We also suspected that mortgage rates would play a substantial role in explaining the volatility observed in the housing market. Based on this preliminary research, we think that greed and inflated expectations exhibited by purchasers, through asking prices, and mortgage lenders, through lax lending standards, played a more significant role in formation of the bubble. Further research into the role of greed is needed to more fully understand the behavior of the United States housing market.

The availability of easy credit is another factor that may have contributed to the rapid rise of housing prices. Low interest rates do not necessarily guarantee that a homeowner will qualify for a loan. On the other hand, lowered underwriting standards and creative lending practices allowed unqualified borrowers to obtain mortgages. Though a variety of methods including interest only loans, ARMs with low teaser rates, and borrowing the down payment for the property, home buyers were encouraged to purchase houses regardless of their financial wellbeing. Easy credit resulting from complex financial structures allowed lenders to sell their mortgages, relieving them of the risk associated with making unsound loans.

Finally, too much interpretation of unsupported hypotheses or counter intuitive results is not productive because of the high levels of co-linearity and the limitations of multiple regression analysis. Future research using structural equation modeling (SEM) would be particularly useful in resolving problems created by multi-co-linearity effects. Since all the variables in the model are directly observable, critical issues in SEM concerning adequate theoretical models, appropriate latent variables, and reliable and valid measurement models would not be a concern. Finally, issues of confirmatory versus exploratory analysis would also be less problematic using SEM for verification of the bubble effect. In addition, if latent variables such as greed and expectations were part of a structural model, then SEM would be a suitable analytical technique. Although not reported here, preliminary results using structural models also confirm the effects of a bubble, when the pre-bubble and bubble periods were compared.

The point of this research is to identify clear cut differences between the pre-bubble and bubble periods. Because of many unexpected differences between pre-bubble and bubble models, we conclude there is ample evidence that a bubble did exist. These differences reflect the fact that significant forces were at work during the bubble period that did not exist during the pre-bubble period.

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4. Ibid, p. 341.

5. Ibid, p. 341.

6. Kindleberger, Charles (1987), "Bubbles." In the new Palgrave: A Dictionary of Economics. Edited by John Eatwell, Murray Milgate, and Peter Newman. New York: Stockton Press. P. 281

7. Smith, Margaret H., and Gary Smith (2006), "Bubble, Bubble, Where's the Housing Bubble," *Brookings Papers on Economic Activity*, Vol. 2006, No. 1, pp. 1-50. Published by: The Brookings Institution. p. 2.

8. The 30-year fixed mortgage rate was chosen instead of any adjustable rate mortgage (ARM) interest rates, because of its stability and not needing to calculate changes in rates over time. One area for further study could be to use ARMs to determine the effects of teaser rates.

9. http://www.freddiemac.com/news/archives/rates/2008/4qhpio7.html

10. However, post bubble, as soon as the sub-prime effect was felt in the housing market, attitudes completely changed, and the overhang of unsold homes (higher vacancy rates) once again began to depress prices.

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Descriptive Statistics (table 1)

	Mean	Std. Deviation	N
Median Asking Price	68.55	8.943	108
Consumer Price Index	139.03	12.38	108
Personal Income	5356.33	708.15	108
Population	257013.35	8251.63	108
Housing Inventory	108771.57	3343.90	108
Vacancy Rate	1.60	.13	108
30 Year Conventional FR	8.88	1.18	108
Median Asking Rent	391.76	35.91	108

Coefficients(a) (table 2)

Model	Un-standardized Coefficients		Standardized Coefficients			Co-linearity Statistics	
	B	Std. Error	Beta	t	Sig.	Tol.	VIF
1 (Constant)	-61.97	162.3		-.38	.70		
Consumer Price Index	.11	.268	.152	.41	.68	.014	71.08
Personal Income	.007	.009	.559	.78	.44	.004	265.6
Population	.001	.001	.898	.94	.35	.002	476.6
Housing Inventory	-.001	.002	-.443	-.64	.52	.004	245.1
Vacancy Rate	-11.55	5.3	-.166	-2.18	.03	.333	3.01
30 Year Conventional FR	.53	.884	.069	.59	.55	.142	7.06
Median Asking Rent	-.08	.047	-.308	-1.63	.11	.054	18.57
6 (Constant)	28.19	7.161		3.94	.00		
Personal Income	.010	.001	.830	17.5	.00	.846	1.2**
Vacancy Rate	-9.867	3.291	-.142	-3.0	.003	.846	1.2**

a. Dependent Variable: Median Asking Price
**Low impact of Co-linearity effect

Model Summary (table 3)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.895	.802	.790	4.10
6	.895	.801	.797	4.03

Model 1: Predictors: (Constant), 30-year Conventional Fixed Rates, Vacancy Rate, Housing Inventory, Consumer Price Index, Personal Income, Population, MAR
Model 6: Predictors: (Constant), Vacancy Rate, Personal Income

Descriptive Statistics (table 4)

	Mean	Std. Deviation	N
Median Asking Price	118.23	33.86	132
Consumer Price Index	181.48	15.02	132
Personal Income	9091.85	1421.56	132
Population	287884.17	9193.12	132
Housing Inventory	121312.02	3551.5	132
Vacancy Rate	1.87	.37	132
30 Year Conventional FR	6.71	.78	132
Median Asking Rent	507.19	64.79	132

Coefficients(a) (table 5)

	Un-standardized Coefficients		Standardized Coefficients			Co-linearity Statistics	
Model	B	Std. Error	Beta	t	Sig.	Tol.	VIF
1 (Constant)	846	258.3		3.28	.001		
Consumer Price Index	2.24	.480	.992	4.66	.000	.007	146.48
Personal Income	.015	.007	.640	2.04	.044	.003	319.44
Population	-.003	.001	-.844	-3.45	.001	.005	193.43
Housing Inventory	-.004	.001	-.413	-3.77	.000	.026	38.92
Vacancy Rate	33.8	4.22	.366	8.01	.000	.149	6.73
30 Year Conventional FR	-2.99	1.60	-.069	-1.87	.065	.229	4.37
Median Asking Rent	.113	.037	.217	3.07	.003	.062	16.15
3 (Constant)	343.8	114.3		3.01	.003		
Consumer Price Index	2.43	.447	1.076	5.43	.000	.008	124.1*
Population	-.002	.001	-.432	-2.69	.008	.012	81.39*
Housing Inventory	-.003	.001	-.302	-3.79	.000	.050	19.99*
Vacancy Rate	37.5	3.91	.406	9.61	.000	.177	5.64*
Median Asking Rent	.139	.035	.267	4.01	.000	.072	13.99*

a. Dependent Variable: Median Asking Price * Strong effects of multi-co-linearity.

Model Summary (table 6)

Model(a)	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.981(a)	.962	.959	6.816
3	.980(a)	.960	.959	6.895

Model 1: Predictors: (Constant), 30-year Conventional Fixed Rates, Vacancy Rate, Housing Inventory, Consumer Price Index, Personal Income, Population, MAR

Model 3: Predictors: (Constant), Vacancy Rate, Housing Inventory, Consumer Price Index, Population, MAR