Factors leading to the U.S. housing bubble: a structural equation modeling approach

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ABSTRACT

For the past decade, academics and practitioners have debated the existence of a housing bubble. Given the sharp declines in the housing market and the financial crisis, there is little doubt that a bubble occurred and then burst. Nevertheless, an important research question remains, what factors contributed to the creation of the bubble? This research addresses this issue by selecting well understood factors that traditionally drive the housing market and constructing a regression model to investigate the nature of the relationships. Because of the co-dependence of many of the factors, structural equation modeling (SEM) is used rather than traditional regression analysis. Using this technique addresses the difficulties presented by the high levels of multi-co-linearity present in many of the factors. Because all the variables used in our models are observable rather than latent, measurement model issues typical in most SEM analyses are not a concern.

Keyword: Mortgage markets, housing bubble, financial crisis, housing market, mortgage rates

INTRODUCTION

The housing market suffered a severe decline over the past two and one-half years. Further, there is no question that values dropped anywhere from a modest ten percent in sTable markets to fifty percent in markets that were overheated. With large numbers of home owners still experiencing economic distress, more homes will undoubtedly be liquidated at below purchase prices, putting further downward pressure on housing prices. With hindsight, it is easy to conclude that housing prices have generally plummeted from lofty values, and therefore, a housing bubble must have occurred. However, the problem is more complex than that. Questions still remain as what factors created the housing bubble. Further, the answers to these questions lend insight into dynamics of one the most important consumer sectors of our economy. The authors of this paper will attempt to shed some light on these issues, using empirical data and a sophisticated methodology.

Many factors have been suggested as contributing to the housing bubble, which began in approximately 1998, lasting until 2006. Consumer buying behavior was driven by forces, such as greed, the desire to live in a larger house, the need to build retirement assets, and desire to avoid "ineviTable" higher prices in the future. Market conditions also contributed to higher prices, because of pressure from increases in population, shifts in demographics, availability of easy credit, and the relaxation of lending standards. Economic factors of low inflation, rising salaries, and low interest rates also have been suggested as playing a significant role in driving up housing prices.

This research addresses these issues by selecting well understood factors that traditionally drive the housing market and constructing a regression model to investigate the nature of the relationships. Because of the co-dependence of many of the factors, structural equation modeling (SEM) is used rather than traditional regression analysis. This technique deals with the high levels of correlation among the many of the factors driving the housing market. Because all of the variables used in our models are observable, measurement model issues typical in most SEM analyses are not a concern.

REVIEW OF THE LITERATURE

Behavior of the housing market has been the subject of a substantial research stream over the past decade. Kindleberger (1987) provided a definition of a housing bubble based on buyer's expectation that many researchers have used as a starting point for their research. Some studies questioned the existence of the bubble, such as Himmelberg, Meyer, and Sinai (2005). Other studies, such as Mints (2007), Baker (2007), and Chambers, Carriga, and Schagenhauf (2008) and Chomsisengphet and Pennington-Cross (2006) focused on factors that drove the housing market. Case and Shiller (2003) studied what factors might cause a housing bubble and studied several diverse housing markets to validate their hypotheses. Mayer and Quigley (2003) added insights to the results of Case and Shiller (2003) and took issue with their over emphasis on the investment motive of buyers. For their research, Smith and Smith (2006) defined a bubble in financial terms rather than using Kindleberger's approach, which focused on buyer's expectations. A more extensive review of the literature can be found in Kohn and Bryant (2010).

As discussed in Kohn and Bryant (2010), there has been considerable debate concerning the definition of a bubble, methods of detection of the bubble, and root causes of the bubble, if, in fact, it did exist. Using standard regression analysis, the authors determine that a bubble did occur, with significant differences between two examined periods, pre-bubble, 1988 to 1996, and bubble, 1997 to 2007.

Also, there were important findings from this previous work. Using median asking prices as the dependant variable, seven independent variables were included in regression analysis. These variables were the consumer price index, housing inventory, 30-year conventional mortgage rates, personal income, population, vacancy rates, and median asking rents. Results show only two variables were retained in the pre-bubble model, personal income and vacancy rates. By comparison, the bubble-period analysis revealed only two of the seven were removed, the 30-year conventional mortgage rates and personal income. Both models exhibited high values of coefficients of determination.

The authors note, however, that co-linearity was very high among independent variables in the bubble model, but not significant in the pre-bubble model. Results were clear and useable in that the research reveals that a bubble did occur and variables were significant in their effects on the housing market. As the authors state, "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."[1] Kohn and Bryant go on to point out that more sophisticated research techniques should be used to reduce the effects of co-linearity on model results. The current research takes that next step and uses SEM to resolve problems caused by co-linearity and to be able to confirm earlier findings.

The current research takes a structural approach by modeling a set of commonly accepted factors that affect the housing market and attempt to determine what role, if any, they played in driving the housing market. By using SEM rather than traditional regression analysis, the complex nature of inter-dependencies of these variables can be more accurately analyzed. There are several indicators that can be used to reflect housing market behavior. The median asking price was used as a proxy for the house price boom, since it reflects the seller's subjective expectations of the home's value. In some sense, this variable also captures the element of greed that exists in all bubble situations, namely, sellers in any overheated market are driven by the prospect of substantial gains to demand even higher prices for their assets.

This research will investigate the behavior of median asking prices to determine what factors did or did not play a significant role in explaining the behavior of housing prices. SEM models will also help determine if the substantial shift in the behavior of housing prices that occurred over the past two decades was reflective of a bubble. The collapse of the housing market and sharp declines in housing values may not necessarily be indicative of a housing bubble, since values of assets decline during deflationary periods.

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." Our definition of a housing bubble is based on a variation of Case and Shiller's definition. A bubble occurs when the market price of any asset rises substantially above traditionally accepted values, as determined by historical behavior. By modeling a pre-bubble period and comparing it to a bubble period, differences between the two models can be studied to determine if they are structurally different. The pre-bubble period should reflect a more sTable market in which traditional factors contribute to a rise or fall of median asking prices. During the bubble period in which housing prices have been rising substantially, a different set of factors should influence housing prices. This structural approach may shed more light on the behavior of the housing market, and hence, whether a bubble did occur.

HOUSING BUBBLE VARIABLES

The model chosen is the same as in Kohn and Bryant (2010), since the current analysis is being used to verify and extend results. Median Asking Prices (MAP) is the dependent variable, while both supply and demand factors are used as independent variables for housing consumption. Data from the Federal Reserve, Freddie Mac, and US Census were compiled from monthly series, and quarterly data were converted to monthly values through interpolation. The following is a list of the variables and a brief explanation of their meanings:

Independent variable:

Median Asking Price (MAP) reflects sellers' expectations of their homes' values, as opposed to using a measure of final settlement price that might reflect rational market forces.

Dependent variables:

1. Housing Inventory reflects the supply of housing in the market place.
2. Vacancy Rates captures unoccupied housing currently available, including new construction, which was obtained from US Census data.
3. Median Asking Rents (MAR) is used to reflect ownership as an alternative to renting.
4. On the demand side, population includes demographic effects on housing.
5. Consumer Price Index (CPI) is included as a demand variable to capture overall inflation effects.
6. Personal income (PI) is a measure of housing affordability.
7. The 30-year fixed mortgage rate is included as a variable on the demand side.

HOUSING BUBBLE STRUCTURAL MODEL AND HYPOTHESES

The research of Kohn and Bryant (2010) was based on the classical multiple regression model, namely one dependent variable driven by many independent variables. Typically, a central issue for this approach focuses on the correlation among the independent variables, giving rise to multi-co-linearity. In an application such as a study of the behavior of the housing market, these co-dependencies would be of paramount concern for accurately establishing the role played by each of the variables. It often becomes a central weakness of the analysis that can be partially overcome by a more thorough investigation of the correlations among independent variables.

Given the variables in this study, it is not surprising to find such high levels of multi-co-linearity, making traditional multiple regression analysis problematic. In fact, the very high levels of multi-co-linearity that were found in previous study of Kohn and Bryant (2010) severely limited the interpretation and implication of the regression coefficients. Problems arise from the fact that, while variables are classified as either independent or dependent, independent variables can be correlated. Further complications arise in more complex systems, because some variables play a dual role of simultaneously being dependent on one or more variables, while acting as independent variables in that they influence others.

In this analysis, rather than use the term dependent and independent, we use exogenous and endogenous to signify the roles that variables can play. An exogenous variable is one that is not dependent on any other variables (though it may be correlated with another variable) and acts as the typical independent variable in regression analysis. Endogenous variables, on the other hand, have the dual role described above, simultaneously influencing and being influenced by other variables. This approach lays the foundation for a more realistic and complex model of system behavior.

The variables that form the basis for our research fall into the categories of exogenous and endogenous, because they are highly correlated and interdependent. Using SEM allows us to more accurately represent the relationships among these variables. The robustness of this approach eliminates the issue of multi-co-linearity, because it incorporates this behavior into the structural model. Further, it allows for correlations between the variables to be represented. Thus, SEM addresses this particular weakness of multiple regression.

SEM also addresses whether variables are observable or latent. An observable variable is directly measurable using an accepTable scale. Latent variables are not directly measurable and require the construction of a measurement model. This model must be tested and validated using confirmatory factor analysis before it can be used in SEM analysis. When SEM uses latent variables, another layer of analysis is needed to ensure that a sound theoretical basis exists for overall SEM analysis. In this study, no variables are latent, meaning that all the variables are directly observable. The lack of latent variables means that measurement models are not needed, and hence, the traditional issues of validation of the measurement models upon which many structural models rest is not an issue in this study. Thus for many reasons, SEM is the logical alternative to regression in dealing with the complexity and interdependence of the variables in understanding the behavior of housing prices.

Another issue of primary importance in SEM analysis is the likelihood that the theory is validated by the empirical analysis. SEM is used as a confirmatory methodology for causal relationships. The use of the word "theory" in this context means a construct that has a wide acceptance as a correct explanation of the phenomenon. More specifically, causality has been demonstrated, and researchers wish to use empirical evidence as a demonstration of the theory. Much has been written about the philosophy of causality and the basis of causal models. The reader will find discussions of causality in Bolen (1989), Bullock, Harlow, and Mulaik (1994), and Hair, Anderson, Tatham, and Black (1984).

This is in stark contrast to the use of traditional statistical analysis as an exploratory tool in which many proposed hypotheses might explain a set of data. Here the word "hypothesis" implies that a possible explanation has been suggested, but by no means is accepted, as the correct explanation. Causality is not assumed, and caveats are presented disclaiming cause and effect implications. Empirical data is used in conjunction with a variety of statistical tests to explore the validity of the hypothesis. Usually alpha and beta error in hypothesis testing of correlation and coefficient of determination in regression are typical measures to lend support to the likelihood of the hypothesis. SEM, on the other hand, has a large number of goodness-of-fit measures or indices to establish causality. These include chi-square goodness-of-fit, goodness-of-fit index (GFI), adjusted goodness-of-fit (AGFI), normed fit index (NFI), and root mean square residual (RMSR) to name a few. Bolen (1989) and Hair, Anderson, Tatham, and Black (1984) have extensive discussions of these measures.

This research uses SEM as an exploratory methodology, since we are interested in studying the behavior of the housing market rather than confirming a proposed theory of market behavior. As such, fit indices are not useful to us. Rather we are interested in which factors can be shown to play a significant, statistically and explanatory, role in housing market behavior. Using SEM to determine which linkages belong in our models and coefficients of determination are sufficient indicators to establish how the housing market has evolved over the past 20 years.

We based our structural model on commonly accepted relationships among the variables that influence housing prices. Generally it is accepted that Population drives Housing Inventories, Vacancy Rates, and the Median Asking Prices (MAP). The Consumer Price Index (CPI) drives Personal Income (PI), 30-Year Fixed Mortgage Rates, and MAP. Housing Inventory also drives Vacancy Rates, MAP, and Median Asking Rents (MAR). Finally, we propose that Vacancy Rates and MAR drive MAP. Population and CPI were treated as correlated variables.

Thus, many of the variables are driven by one or more variables, and, in turn, drive other variables. Hence Population and CPI are exogenous while PI, Mortgage Rates, Housing Inventory, Vacancy Rates and Median Asking Rents are endogenous variables. Median Asking Prices is also endogenous but is strictly a dependent variable. These relationships result in a structural model shown in Figure 1.

HYPOTHESES

Based on well understood relationships, the following null hypotheses are proposed:
H1a: CPI positively influences PI
H1b: CPI positively influences 30-Year Mortgage Rates
H1c: CPI positively influences MAP

H2a: Housing Inventory positively influences Vacancy Rates
H2b: Housing Inventory negatively influences MAP
H2c: Housing Inventory negatively influences MAR

H3: Mortgage Rates negatively influences MAP

H4: Personal Income positively influences MAP

H5a: Population positively influences Housing Inventory
H5b: Population negatively influences Vacancy Rates
H5c: Population positively influences MAP
H6a: Vacancy Rates negatively influences MAP
H6b: Vacancy Rates negatively influences Median Asking Rents

H7: Median Asking Rents positively influences MAP

We also theorize that significant structural differences exist between the pre-bubble and bubble period. In sTable markets, fewer variables would impact housing prices, while during the bubble period, more complex relationships would exist. Therefore, we hypothesize that evidence of a bubble in housing prices would result in substantially different models for the two periods.

H8: Structural model for pre-bubble period is different from the bubble period.

To more clearly identify and understand these hypotheses, the structural model in Figure 2 displays each hypothesis associated with its respective linkage.

ANALYSIS AND RESULTS

To investigate the behavior of the housing market, we split the entire data set into two sub-sets: 1/1/1988 to 12/1/1996 reflects a more sTable, pre-bubble period for housing prices, and 1/1/1997 to 12/1/2007, during which housing prices soared, perhaps reflecting the bubble effect. We also used the data from the entire period (1/1/1988 – 12/1/2007) for comparison purposes with the pre-bubble and bubble periods. Descriptive statistics for the 3 periods are presented in Table 1a, b, and c.

Using Amos 7.0, the structural model in Figure 1 was analyzed for each of the 3 periods. As in typical regression analysis, the linkages of the structural model were tested for significance. An iterative procedure was used to remove all non significant (>.05) links. Links were removed one at a time by selecting the link with the largest P value of the non significant linkages. The process was repeated until all links were significant. Under certain circumstances, removing a link between two variables also caused one of the variables to be removed. Thus if it were found that the link between Median Asking Rent and Median Asking Price was not significant, then Median Asking Rent could be removed from the model.

Using the methodology described above, the final models (all linkages significant at or below .05) for each of the periods are shown in Figures 3 – full, 4 – pre-bubble, and 5 - bubble. In each final model, the value of the standardized coefficient is shown on each link, and the coefficient of determination is shown for each variable. In addition, Tables for final models are also provided showing the un-standardized coefficients, standard errors, critical ratios, and P values for all linkages in Tables 1, 2, and 3. Significant values below .001 are indicated by ***. For each model, Table 4 presents the R^2's of the Median Asking Price for the final models.

HYPOTHESES RESULTS

As can be seen by inspecting Figures 4 and 5, the final models for pre-bubble and bubble periods are substantially different. Below are the conclusions that were reached based on the final models for each period.

During the pre-bubble period, many of the linkages were not significant and were removed from the model. This also resulted in removing 2 variables, 30-Year Mortgage Rates and Median Asking Rents. The pre-bubble coefficient of determination for the final model was .80.

Results for Pre-Bubble Period – Final Model

H1a: CPI positively influences PI - Accepted
H1b: CPI positively influences 30-Year Mortgage Rates - Removed from model, no influence
H1c: CPI positively influences Median Asking Prices - Removed from model, no influence

H2a: Housing Inventory positively influences Vacancy Rates – Rejected, negative slope
H2b: Housing Inventory negatively influences MAP – Removed from model, no influence
H2c: Housing Inventory negatively influences Median Asking Rents - Removed from model, no influence

H3: Mortgage Rates negatively influences MAP – Removed from model, no influence

H4: Personal Income positively influences MAP - Accepted

H5a: Population positively influences Housing Inventory – Accepted
H5b: Population negatively influences Vacancy Rates – Removed from model, no influence
H5c: Population positively influences MAP – Removed from model, no influence

H6a: Vacancy Rates negatively influences MAP - Accepted
H6b: Vacancy Rates negatively influences Median Asking Rents – removed from model, no influence

H7: Median Asking Rents positively influences MAP – Removed from model, no influence

Results for Bubble Period – Final Model

During the bubble period, no variables were removed, and only one linkage was removed, namely Vacancy Rates → Median Asking Price. The coefficient of determination rose to .96.

H1a: CPI positively influences PI - Accepted
H1b: CPI positively influences 30-Year Mortgage Rates – rejected, negative slope
H1c: CPI positively influences MAP - Accepted

H2a: Housing Inventory positively influences Vacancy Rates - Accepted
H2b: Housing Inventory negatively influences MAP – Accepted
H2c: Housing Inventory negatively influences Median Asking Rents - Rejected, positive slope

H3: Mortgage Rates negatively influences MAP – Accepted

H4: Personal Income positively influences MAP - Accepted

H5a: Population positively influences Housing Inventory – Accepted
H5b: Population negatively influences Vacancy Rates – Accepted
H5c: Population positively influences MAP – Rejected, negative slope

H6a: Vacancy Rates negatively influences MAP - Rejected, positive slope
H6b: Vacancy Rates negatively influences Median Asking Rents – removed from model, no influence

H7: Median Asking Rents positively influences MAP – Accepted

During the full period, no linkages were removed. The coefficient of determination was .96

Hypothesis Results for Full Period – Final Model

H1a: CPI positively influences PI - Accepted

H1b: CPI positively influences 30-Year Mortgage Rates - Rejected, negative slope
H1c: CPI positively influences Median Asking Prices - Accepted

H2a: Housing Inventory positively influences Vacancy Rates - Accepted
H2b: Housing Inventory negatively influences MAP – Accepted
H2c: Housing Inventory negatively influences Median Asking Rents - Rejected, positive slope

H3: 30-Year Mortgage Rates negatively influences MAP – Accepted

H4: Personal Income positively influences MAP - Accepted

H5a: Population positively influences Housing Inventory – Accepted
H5b: Population negatively influences Vacancy Rates – Accepted
H5c: Population positively influences MAP – Rejected, negative slope

H6a: Vacancy Rates negatively influences MAP - Rejected, positive slope
H6b: Vacancy Rates negatively influences Median Asking Rents – Rejected, positive slope
H7: Median Asking Rents positively influences MAP – Accepted

DISCUSSION OF THE RESULTS

During the pre-bubble period, the structural model was substantially simpler. Removing many linkages resulted in removing two variables from the final model. All remaining relations behaved as expected, except for the Housing Inventory → Vacancy Rate link, which was significant in the final model but had an inverse influence. This is contrary to conventional thought.

During the bubble period, the model retained the complexity of the original model in that all variables remained in the model and only one link, Vacancy Rate → Median Asking Rent, was removed. Several significant linkages exhibited reverse slopes compared to expectations, and so their hypotheses were rejected (H1b, H2c, H6a), even though they remained in the model. All other hypotheses were accepted.

During the full period, all variables remained in the model and no linkages were removed. As in the bubble period, several of the relationships were contrary to expectations. H1b, H2c, H5c, H6a, and H6b were all rejected, although they remained in the model with slopes opposite to that proposed. R^2 for all models were quite high, with the bubble and full models rising to .96 from the .8 level of the pre-bubble model.

Inspection of the standardized coefficients of the various models (Figures 4 and 5) also lends insight into the behavior of housing prices. Of the variables that drive Median Asking Prices, CPI has the largest coefficient (1.03), while 30-Year Mortgage Rates has the smallest (-.07), during the bubble period. Furthermore, neither variable directly influenced housing prices during the pre-bubble period. Thus low interest rates seem to have almost no influence on house asking prices. Given that many assume the bubble was primarily driven by low mortgage rates, the reality, from what the data tells us, is that other factors, such as low inflation represented by the consumer price index, played a greater role than interest rates in driving housing prices.[4]

During the bubble period, Housing Inventory drove three other variables, namely Vacancy Rates, Median Asking Prices, and Median Asking Rents. Inspection of the final model shows that the availability of new housing played a different structural role in driving housing prices, when compared to the pre-bubble period. During the pre-bubble period, housing inventory only affected vacancy rates, whereas it played a more complex role during the bubble period.

Furthermore, both housing inventories and vacancy rates also exhibit strikingly different behaviors during the two periods. In the pre-bubble period, these variables exhibit negative slopes: Housing Inventory → Vacancy Rates, -.38; Vacancy rates → Median Asking Prices, -14. The Housing Inventory → Vacancy Rates linkage behaved opposite to expectation, and the coefficient of Vacancy Rates → Median Asking Prices indicates a relatively small role in driving asking prices. However, during the bubble period, the slopes of both linkages, 1.40 and .38, respectively, tripled and became positive. The increase in values implies a much greater role in determining housing prices for these variables during the bubble period.

During the bubble period, the positive slope for Vacancy rates → Median Asking Prices is contrary to accepted behavior for these variables. In addition, the coefficients for Housing Inventory → Median Asking Price (-.43) and Median Asking Rent → Median Asking price (.22), which did not exist in the pre-bubble model, behave as expected in the bubble model. However, Housing Inventory → Median Asking Rent (.92) behaves contrary to expectations. During the bubble period, the rapid increase of available housing may also have resulted in higher rents, as housing became less affordable.

Moreover, population growth strongly (.95 beta coefficient) drove the demand for housing. Thus, the rapid construction of large numbers of homes in conjunction with expanding numbers of buyers, who generally prefer new homes to old, also were major contributing factors to the upward surge in housing prices. In some sense, purchasing a house underwent a similar transformation that occurred in the automobile market. The large inventories of cars and the many ways of reducing the cost of financing a car led to drivers to purchase cars more frequently and at higher price levels. Similarly, home buyers were able to easily shed their old houses and replace them with new ones. Cheaper used cars were overlooked, because financing deals such as leasing options, made new cars equally or more attractive to car buyers. Likewise, adjusTable rate mortgages, interest-only mortgages, and lax lending requirements encouraged home buyers to trade up.

Finally, an inspection of the coefficient of determination for the models, R^2 of .96 for the bubble model and an R^2 of .8 for the pre-bubble model, indicate that the variables remaining in all of the models explain much of the behavior of housing prices, especially during the bubble period. These results are also indicative of more complex behavior of housing prices during the bubble period. Asking prices rose at an accelerated pace for many reasons, some of which have been captured in these comparisons.

CONCLUSIONS

Clearly other factors not represented in this study also contributed to housing price behavior. SEM analysis was used in this research to study the role and behavior of a select group of variables rather than to validate a theory of housing market behavior. This study demonstrates that during the bubble period, a more complex structural model was found, and the variables making up the model behaved in more complex ways when compared to the pre-bubble period.

Results of this study reaffirm conclusions found in the earlier study by Kohn and Bryant (2010), while eliminating issues with multi-co-linearity in the models. There is evidence that a bubble did occur, and there were several major factors that were instrumental in significant house price increases, including the minor impact of the 30-year mortgage interest rate. This finding was contrary to the original study, where the 30-year mortgage rate dropped from the analysis. Still, it was only one of several factors, indicating that interest rate policy was not a major driving force of housing policy.

Further research might include substituting the one- or three-year adjusTable-rate mortgage (ARM) interest rate for the 30-year fixed rate to see what affects the lower ARMS had on the housing market. In addition, other surrogates for housing market behavior, such as the housing price index, could be used in place of the median asking price. On a broader level, questions remain as to what roles lax lending practices, greed driven behaviors, and sub-prime mortgages played in both the rise and collapse of the housing market. These factors are much harder to measure and incorporate in structural models. Yet ultimately, they may reveal the true driving forces that led to the housing debacle and its ripple effects through the world's economy.

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Figure 1
Structural Equation Model
All Relationships

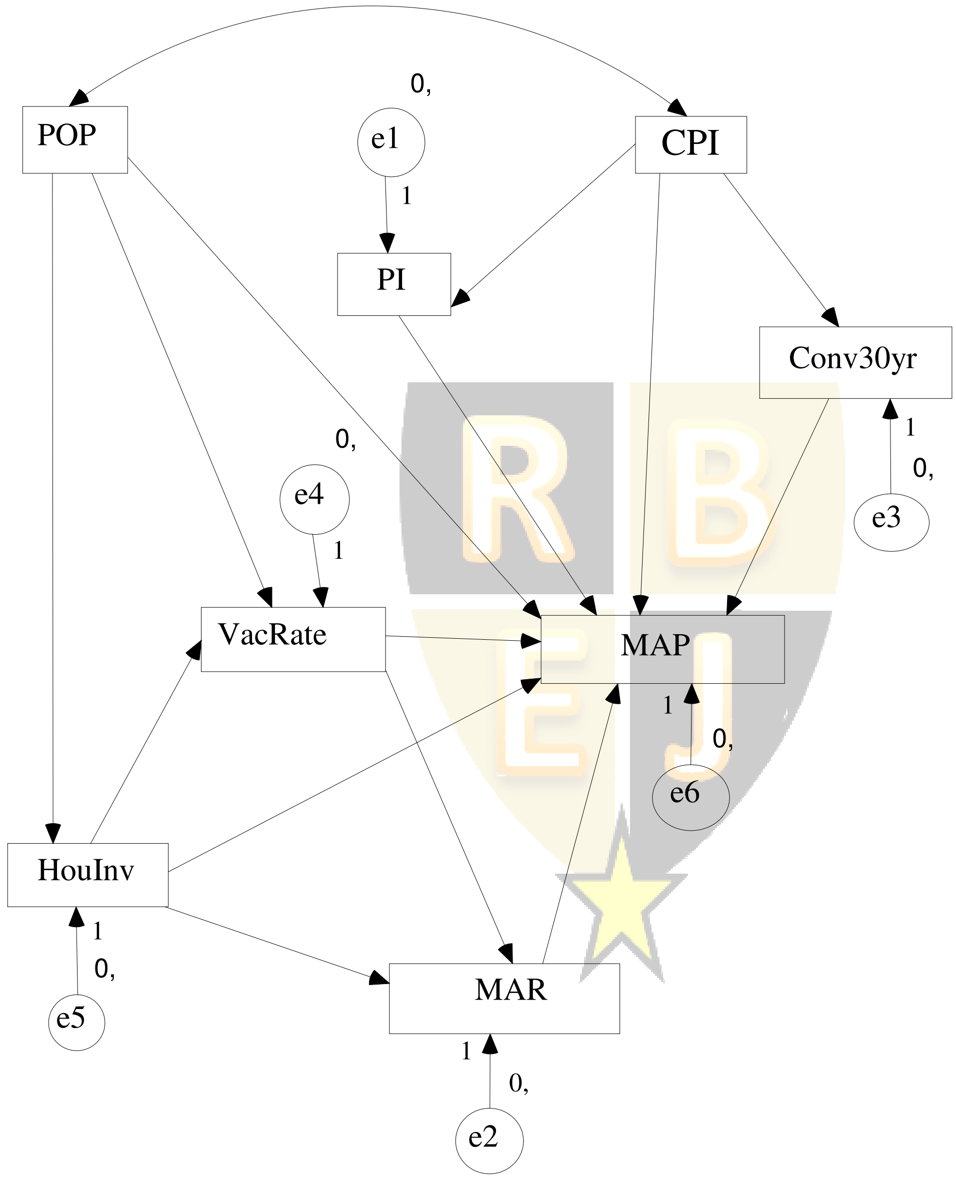

Figure 2
Generic Structural Model for
Housing Bubble Relationships
and Hypotheses

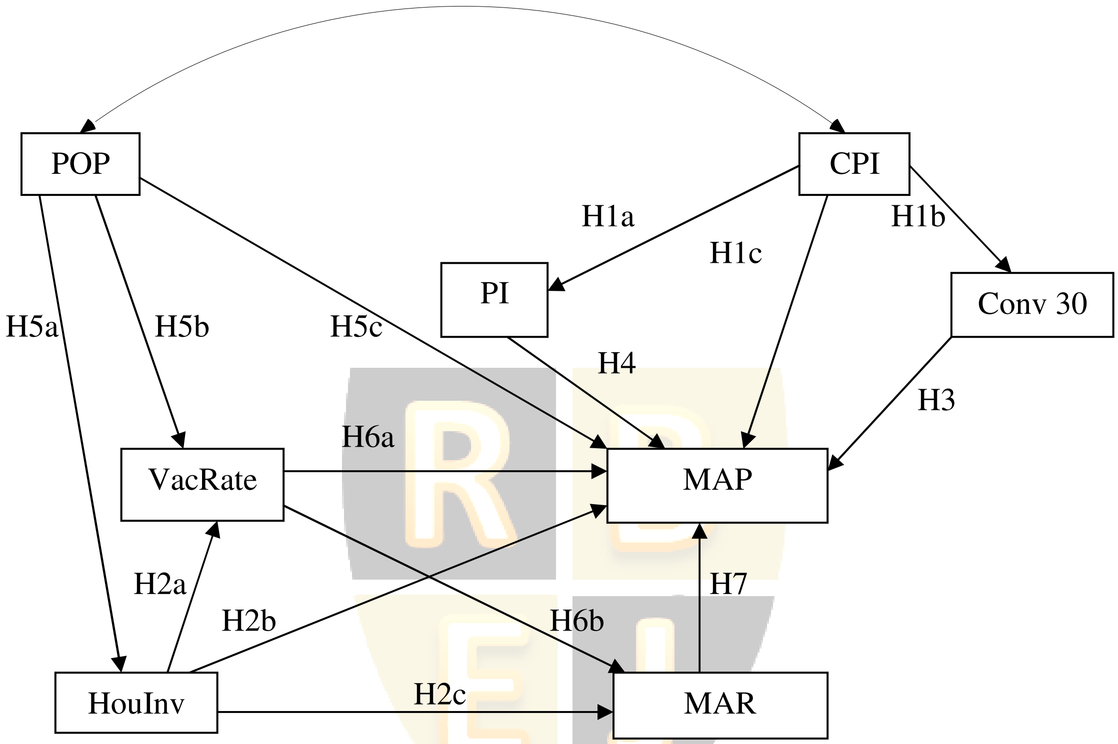

Figure 3
Full Model 88 - 07
Final Results
All paths significant
No changes in structure

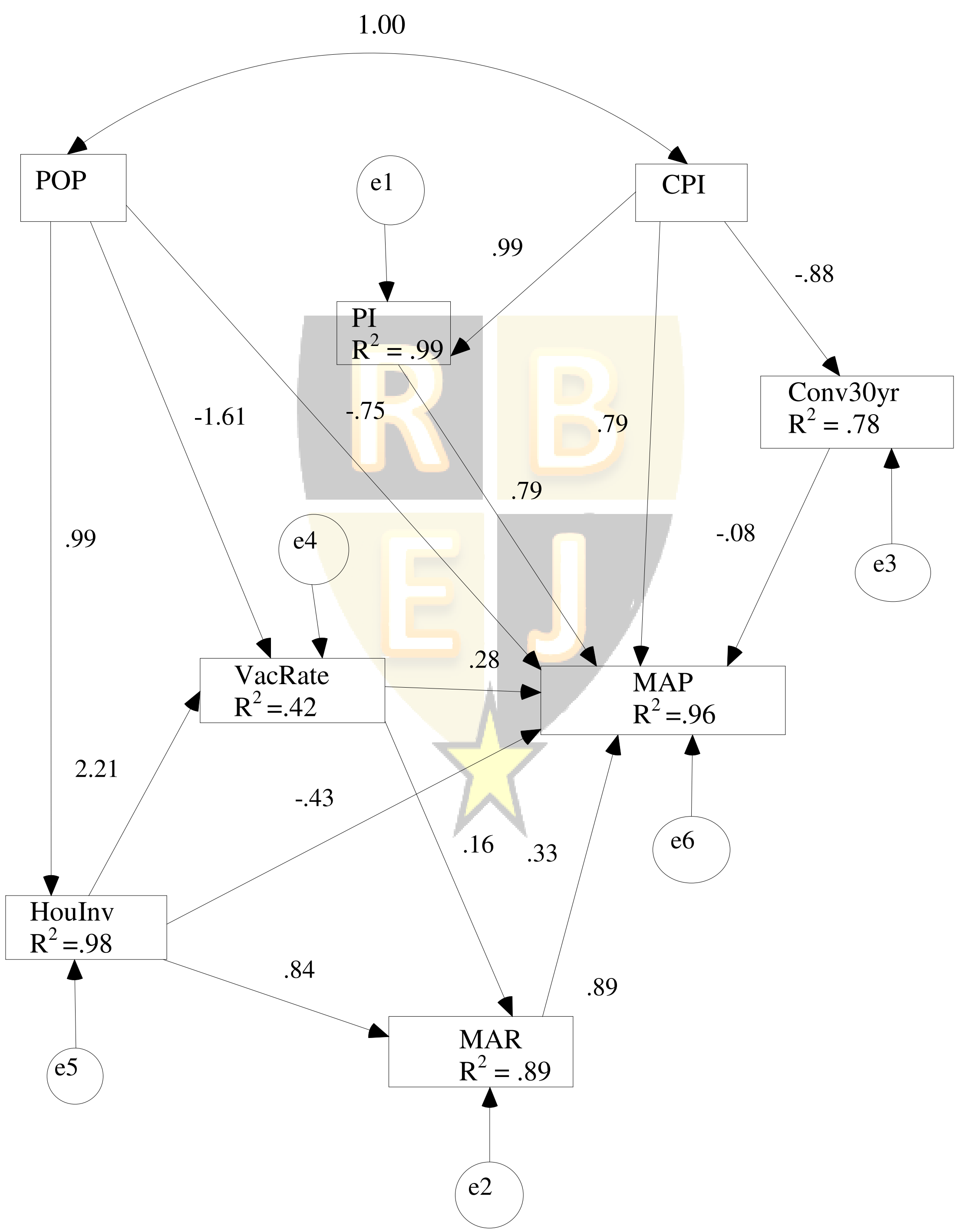

Figure 4

Pre-Bubble 88 - 97

Final Results

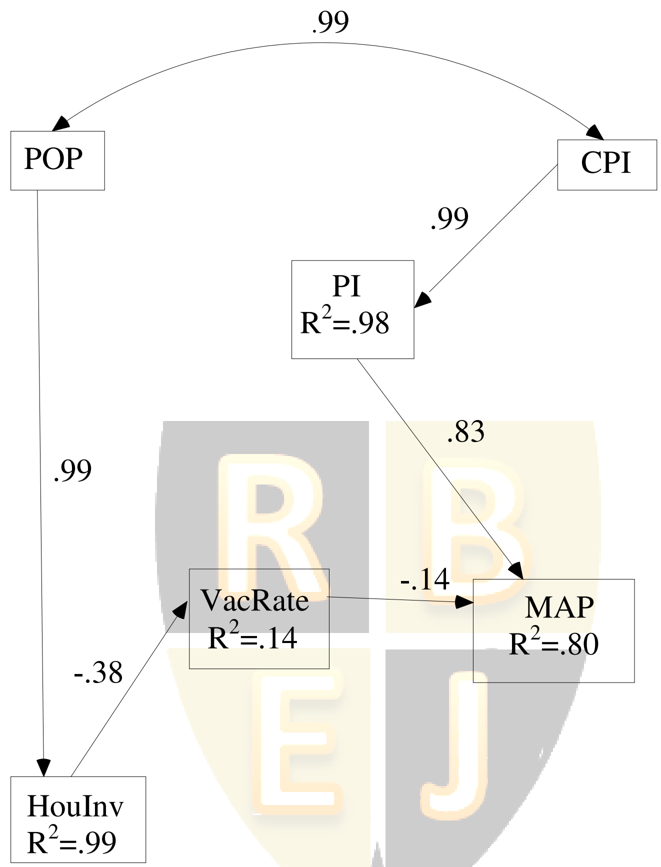

Figure 5

Bubble Period 96 - 07
Final Results

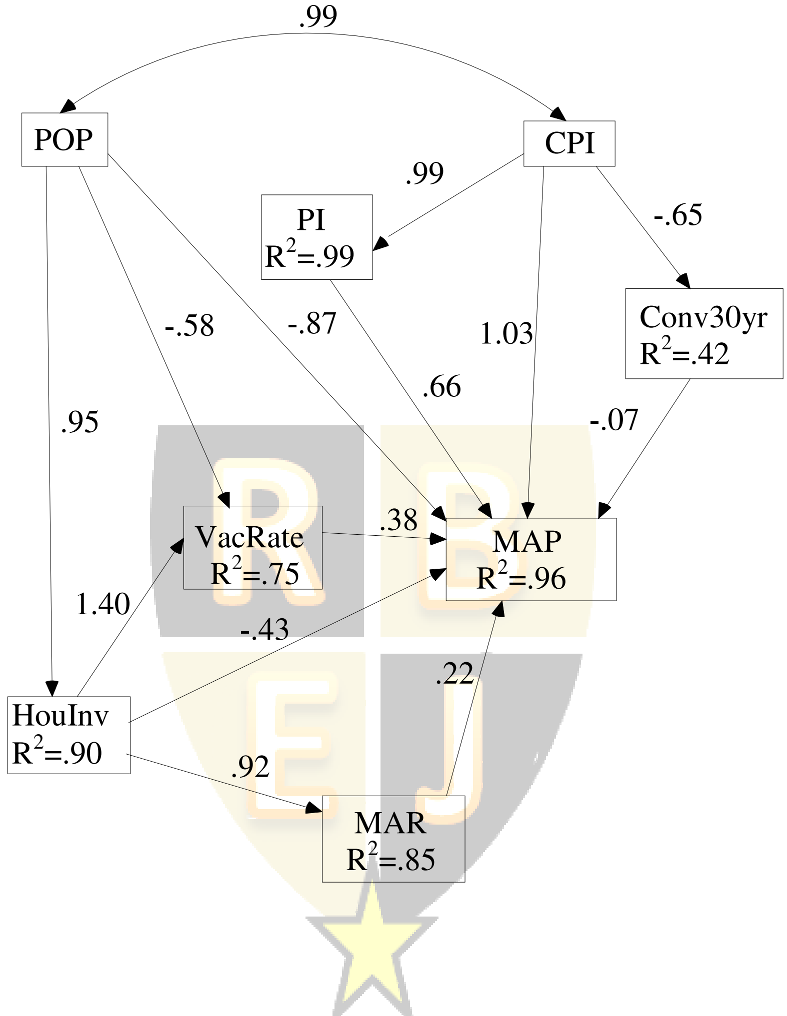

Table 1a
Descriptive Statistics - Full Model 1988 – 2007

	N	Mean	Std. Deviation
Median Asking Price	240	95.87	35.75
Consumer Price Index	240	162.38	25.30
Personal Income	240	7410.87	2190.95
Population	240	273992.30	17710.53
Housing Inventory	240	115668.82	7141.77
Vacancy Rate	240	1.75	.32
30 year conventional FR	240	7.69	1.46
Median Asking Rent	240	455.25	78.68

Table 1b
Descriptive Statistics – Pre Bubble Model 1988 – 1996

	N	Mean	Std. Deviation
Median Asking Price	108	68.55	8.94
Consumer Price Index	108	139.03	12.38
Personal Income	108	5356.33	708.15
Population	108	257013.35	8251.63
Housing Inventory	108	108771.57	3343.90
Vacancy Rate	108	1.60	.13
30 Year Conventional FR	108	8.88	1.18
Median Asking Rent	108	391.79	35.91

Table 1c
Descriptive Statistics – Bubble Model 1997 – 2007

	N	Mean	Std. Deviation
Median Asking Price	132	118.23	33.86
Consumer Price Index	132	181.48	15.02
Personal Income	132	9091.85	1421.56
Population	132	287884.17	9193.12
Housing Inventory	132	121312.02	3551.50
Vacancy Rate	132	1.87	.37
30 year conventional FR	132	6.71	.78
Median Asking Rent	132	507.19	64.79

Table 2: Regression Weights: Full Model, 1988 – 2007 Final Results

Linkages			Un-standardized Estimate	S.E.	C.R.	P
HouInv	<---	POP	.400	.003	121.791	***
VacRat	<---	POP	.000	.000	-4.115	***
VacRat	<---	HouInv	.000	.000	5.651	***
MAR	<---	HouInv	.009	.000	30.938	***
MAR	<---	VacRat	40.637	6.736	6.033	***
Conv30yr	<---	CPI	-.051	.002	-28.966	***
PI	<---	CPI	85.809	.754	113.735	***
MAP	<---	VacRat	30.107	1.862	16.167	***
MAP	<---	POP	-.001	.000	-4.709	***
MAP	<---	PI	.012	.001	8.659	***
MAP	<---	Conv30yr	-1.880	.611	-3.078	.002
MAP	<---	MAR	.146	.016	9.002	***
MAP	<---	HouInv	-.002	.001	-3.969	***
MAP	<---	CPI	1.067	.211	5.049	***

Table 3: Regression Weights: Pre Bubble - Final Results

Linkages			Un-standardized Estimates	S.E.	C.R.	P
POP	→	HouInv	.403	.004	89.498	***
HouInv	→	VacRate	.000	.000	-4.233	***
CPI	→	PI	56.599	.804	70.410	***
VacRate	→	MAP	-9.867	3.226	-3.058	***
PI	→	MAP	.010	.001	17.879	***

Table 4: Regression Weights: Bubble Period - Final Results

Linkages			Un-standardized Estimates	S.E.	C.R.	P
POP	→	HouInv	.367	.011	34.590	***
POP	→	VacRate	.000	.000	-4.253	***
HouInv	→	MAR	.017	.001	27.191	***
HouInv	→	VacRate	.000	.000	10.291	***
CPI	→	Conv30yr	-.034	.003	-9.729	***
CPI	→	PI	94.075	.903	104.224	***
VacRate	→	MAP	33.782	3.225	10.474	***
POP	→	MAP	-.003	.000	-6.277	***
PI	→	MAP	.015	.004	4.085	***
Conv30yr	→	MAP	-2.986	.978	-3.053	.002
MAR	→	MAP	.113	.023	4.913	***
HouInv	→	MAP	-.004	.001	-4.933	***
CPI	→	MAP	2.237	.448	4.992	***

Table 5

Final Models	R^2 - Median Asking Price
Full Model	.96
Pre-Bubble	.80
Bubble	.96