Urban Real Estate Prices and Fair Value: The Case for U.S. Metropolitan Areas

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Changes in house prices in the long term, compensated for inflation, appear to follow the path of the real growth in the economy. Correlation coefficient for changes in real house prices and the real growth in the economy is 0.58 and that the real growth in the economy explains about 30 percent of the variance in changes in real house prices during 1992-2009. In particular, changes in house prices did not show any significant relationship to changes in stock prices. However, they are both significantly affected by changes in the real growth in the economy. It is further observed that market prices for real estate and common stock do not adjust for unexpected inflation.

INTRODUCTION

Housing has been among the top national policy initiatives in the United States as reflected in direct and indirect subsidies to home ownership. Most individuals further perceive their home as a safe, long term investment and expect it to appreciate in value. There is, however, a different story told by the macro data statistics. House prices have shown wild swings that persisted for an appreciable amount of time. In effect, an expected long term gain has, at times, turned into a loss of capital. The case for variance in values in real estate properties is not an isolated one. The past behavior of stock prices does not appear to support creation and maintenance of wealth in the long run either.

In addition, a puzzle is formed when investment in real estate shows similar behavior as an investment in common stock. The problem being that the return profile of an investment in common stock as a financial asset is expected to have a different pattern than value of a house as real asset. In particular, it is found that a tradable share of ownership of a certain pool of real estate properties known as Real Estate Investment Trust, REIT, often follows a similar path as financial assets such as shares of common stock of commercial banks. This is contrary to rational expectations since a share of REIT should reflect the value of its underlying real estate properties whereas a bank's profit depends on the difference between the rates they pay depositors and receive from the borrowers.

Gotham (2006) explains the sociological process that has evolved in transforming real estate into a "quasi liquid financial asset." These institutional structures appear to have helped the establishment of real estate investment trusts and government sponsored enterprises facilitating real estate transactions as well as providing capital resources to the real estate market. Real estate investment trusts provide a convenient way for investing in shopping centers, warehouses, office buildings, hotels, and apartments. Government sponsored agencies have further provided liquidity in the real estate market through loan guarantees.

These structural changes in the real estate industry have created an abnormal behavior during the past few decades. As for example, Mei and Saunders (1997) review the patterns in real estate investments of U. S. banks and insurance companies during 1970-1989, and find concentration of buying when prices are high and selling when prices are low. This irrational behavior has caused wild fluctuations in real estate prices, much different from their assessed fair value. Goetzmann, Peng and Yen (2009) use real estate data during 1987-2005 and find serial correlations in real estate prices that last for an appreciable period of time. In particular, serial correlations beyond 3 years are negative. These results imply that changes in prices in real estate properties are correlated over time for an appreciable amount of time with a reversion to the mean. The latter implies price reversions every 3 to 4 years.

Transaction Prices and Fair Value

Transactions prices show the agreed upon prices between willing buyers and willing sellers whereas the fair value or the appraisal price conveys information regarding a reasonable price at the time of transactions. The fair value of an asset is based on either expected future stream of benefits or reflects projection of historical pattern of income into the future. Market frictions such as taxes and transaction costs affect both the appraised value and market prices. For example, it is less costly to make a transaction in shares of real estate investment trusts than selling a building. Economic forces, such as inflation, tend to have a powerful impact on valuation of real estate. For example, it is rational to assume that real estate values should be higher when after tax cost of financing adjusted for inflation is zero or negative (see for example, Titman (1982)).

It is commonly assumed that the location, land, the cost of structure, the state of the economy, as well as the financial markets play important roles in the determination of real estate prices. Leinberger (2007) shows that real estate prices in urban centers have remained higher than elsewhere even though he cites references indicating that such urban centers are reproducible and thereby price divergences should not persist. In line with this, Davis and Heathcote (2006) show that land prices account for 47 percent and the structure for 53 percent of real estate values in 2006.

According to Shiller (2007), changes in house prices are not tied to rents or construction costs. In particular, there appear to be no relationship between real rent and the rise in house prices. Rosenthal (1999) using the current and past prices of real estate properties in Vancouver during 1979-1989, further shows that changes in prices cannot be explained by changes in the cost of its production and thereby, must be due to the changing values of the land.

Historical Performance of Real Estate

Goetzmann, Peng and Yen (2009) use real estate data from the Federal Housing Enterprise Oversight (OFHEO) containing quarterly transaction prices as well as appraised values together with the Case-Shiller real estate data that include transactions prices only. They find that the arithmetic annual return on real estate during 1987-2005 is 6.7% with an inflation (CPI) rate of 3.7%, resulting in 3% real return for real estate. They further find autocorrelations that last up to 25 months for the Case-Shiller data and up to 24 quarters for OFHEO data. In particular, the long term auto correlations beyond 3 years are negative. These results imply that short term changes in prices may help in prediction of short term trends in prices whereas longer term serial correlations in changes in prices may provide a signal for reversal in prices every 3 to 4 years.

Titman (1982) shows the impact of inflation on real estate prices. Given that a rise in inflation can reduce the after tax cost of borrowing, it should lead to higher demand for real estate ownership and thereby, to higher property values. Hartzell, Hekman and Miles (1987) observe prices on commercial properties held by a commingled real estate fund during 1973-1983, and find strong support for their inflation hedging properties. Himmelberg, Mayer and Sinai (2005) find an average real growth in price of 0.5 percent during 1975-1995, and 3.6 percent during 1995-2004. In particular, they find that price to rent ratio does not appear to explain the rise in house prices.

Hoesli, Lizieri and MacGregor (2008) find that during 1977-2003 U. S. private real estate returns and common stocks reacted negatively to unexpected inflation, however responding positively to anticipated inflation. Meanwhile changes in real GDP shows a positive effect on private real estate prices. The results remain unchanged for unanticipated inflation when market based transaction prices are included, except that market based transaction real estate prices react negatively to expected inflation and world stocks in the shorter time horizons.

EMPIRICAL DESIGN

Empirical design consists of statistical regression and correlation studies that can be categorized in two sets as follows:

Regression Set One

$$y = \alpha + \beta x + e \quad (1)$$

Where

- y denotes the change in return on real estate adjusted for inflation,
- x denotes the change in growth of the economy adjusted for inflation, and
- e denotes a random noise.

This regression is designed for testing the hypothesis that investors appraise the value of real estate in accordance with the growth in the economy adjusted for inflation.

Regression Set Two

$$y = \alpha + \beta x + e \quad (2)$$

Where

- y denotes the change in return on real estate adjusted for inflation,
- x denotes the change in inflation-adjusted returns on financial assets such as common stock and bonds, and
- e denotes a random noise.

This regression is purported for finding the interactions between real estate and financial assets prices all adjusted for inflation.

Expectation from Regression One is that the change in real estate prices adjusted for inflation would reflect the real growth in the economy. Results from Regression Two are expected to show that changes in prices for real estate adjusted for inflation should differ from those of financial assets such as common stock and bonds. These empirical findings would either be a support for rational behavior or may reveal the existence of abnormal behavior in the real estate markets.

Data

The sources of data in this study are The Standard and Poor's / Case-Shiller real estate transaction prices consisting of twenty metropolitan areas, available since January 1987. Treasury inflation protection bonds (TIPS) are available since January 1997. These are securities that compensate investors for the realized inflation on a six-month basis. TIPS prices rise with observed inflation and its real return is expected to be an unbiased estimate of the real return, compensated for inflation, in the economy. This information is useful to explain the behavior of common stock and real estate prices. TIPS data as used here are taken from TIAA-CREF and are available since April 1997 on a daily basis. Stock data are also taken from TIAA-CREF databases. A popular gauge for inflation is the consumer price index (CPI) and the rate of growth in the economy is based on the growth in the gross domestic product or income (GDP).

TABLE 1
RELATIONSHIP BETWEEN HOUSE PRICES AND FINANCIAL ASSETS

Model	Constant (t-stat) (p – value)	Indep var (1) (t-stat) (p – value)	Indep var (2) (t-stat) (p – value)	F. Value (Significance)	R^2	Time Interval (Observations)
(1)	0.32 (4.88) (0)	0.54 (1.66) (0.10)	-	2.76 (0.10)	0.01	Jan 92-Sep 09 213 months
(1-1)	0.32 (4.87) (0)	0.54 (1.64) (0.10)	-	2.67 (0.10)	0.01	Jan 92-Sep 09 213 months
(1-2)	0.45 (4.84) (0)	0.73 (1.84) (0.07)	0.36 (0.33) (0.75)	1.78 (0.17)	0.01	Apr 97-Sep 09 150 months
(2)	0.46 (4.84) (0)	0.83 (0.69) (0.49)	-	0.48 (0.49)	0.0	Apr 97-Aug 09 149 months
(2-2)	0.47 (5.01) (0)	0.37 (0.34) (0.74)	-	0.11 (0.74)	0.0	Apr 97-Aug 09 149 months
(3)	0.45 (5.11) (0)	0.73 (1.91) (0.06)	-	3.65 (0.06)	0.02	Apr 97-Aug 09 149 months
(3-3)	-0.55 (-2.07) (.04)	-0.36 (-0.38) (0.70)	87.01 (4.38) (0)	10.84 (0.0)	0.30	Jan 98-Jun 09 46 quaters
(4)	-0.47 (-2.35) (0.02)	67.87 (4.64) (0)	-	21.48 (0.0)	0.23	Mar 92-Sep 09 70 quarters
(4-4)	-0.46 (-2.25) (0.03)	67.23 (4.24) (0)	0.09 (0.11) (0.91)	10.59 (0)	0.22	Jan 92-Sep 09 71 quarters
(5)	-0.05 (-1.84) (0.07)	7.02 (3.30) (0.002)	-	10.88 (0.0)	0.14	Jan 92-Sep 09 71 quarters

Lower significance levels and P-values, preferably less than 5 percent, are desired.
Adjusted R^2 values are recorded for regressions containing more than one independent variable.

The Statistical Regression Results

Regression models are as follows.

Model (1) shows data analysis for testing a hypothesis stating that return on the real estate market has a similar path as the return in the stock market.

$$\%\ Change\ in\ Price_{house} = a + b * \%\ Change\ in\ Price_{stock} + e \quad (1)$$

Where

a denotes the constant value,
b denotes the beta coefficient or the degree of association of the house and stock prices, and
e denotes the random error in estimation.

Equation (1) shows the relationship between changes in prices in common stock and house prices. The results for model (1) are shown in Table 1. As shown in Table 1, changes in common stock prices weakly explain changes in house prices during 1992-2009. The regression coefficients are significant only at the 10 percent level and R^2 is quite low of one percent implying that only one percent of the changes in house prices are explained by the changes in common stock prices.

The relationship between changes in common stock and house prices in real terms, compensated for inflation, is shown in Model (1-1).

$$\% \text{ Change in Price}_{house} - \% \text{ Change in CPI} = a + b * \{\% \text{ change in Price}_{stock} - \% \text{ Change in CPI}\} + e \quad (1\text{-}1)$$

Where

- a denotes the constant value,
- b denotes the beta coefficient or the degree of association of the house and stock prices, adjusted for inflation,
- e denotes the random error in estimation and
- *CPI* denotes Consumer Price Index.

Equation (1-1) shows the relationship between changes in common stock and house prices when both are fully compensated for inflation. The results for model (1-1) are shown in Table 1. As shown in Table 1, only one percent of changes in house prices when adjusted for CPI, are explained by changes in real common stock prices during 1992-2009. The regression coefficients are significant only at the 10 percent level.

Model (1-2) takes into account the impact of changes in common stock and inflation protection bonds on changes in house prices.

$$\% \text{ Change in Price}_{house} = a + b_1 * \% \text{ Change in Price}_{stock} + b_2 * \% \text{ Change in Price}_{Tips} + e \quad (1\text{-}2)$$

Where

- a denotes the constant value,
- b_1 denotes the beta coefficient or the degree of association of the house and stock prices,
- b_2 denotes the beta coefficient or the degree of association of the house and U.S. Treasury Inflation Protection Bonds (TIPS), and
- e denotes the random error in estimation.

Equation (1-2) shows the relationship between changes in house prices with both common stock and U.S. Treasury Inflation Protection Bonds (TIPS). The results for model (1-2) are shown in Table 1. As shown in Table 1, changes in common stock prices together with changes in TIPS explain only about one percent of changes in house prices during 1997-2009. The regression does not appear to be a good fit as the coefficients are not highly significant and the F value shows a case of omitted variables.

Model (2) shows data analysis for testing a hypothesis stating that return on the real estate market has a similar path as the return in the Treasury Inflation Protected Bonds (TIPS).

$$\% \text{ Change in Price}_{house} = a + b * \% \text{ Change in Price}_{Tips} + e \quad (2)$$

Where

- a denotes the constant value,
- b denotes the beta coefficient or the degree of association of the house and TIPS prices, and
- e denotes the random error in estimation.

Equation (2) examines the degree to which house prices are adjusted for inflation. The results for model (2) are shown in Table 1. As shown in Table 1, changes in TIPS prices do not explain changes in house prices during 1997-2009 and regression coefficients are not statistically significant.

Model (2-2) shows the relationship between changes in return on TIPS and the real return on real estate prices.

$$\% \text{ Change in Price}_{house} - \% \text{ Change in CPI} = a + b * \{\% \text{ Change in TIPS} - \% \text{ Change in CPI}\} + e \quad (2\text{-}2)$$

Where

- a denotes the constant value,
- b denotes the beta coefficient or the degree of association between the real returns in housing and inflation protection bonds (TIPS), and
- e denotes the random error in estimation.

Equation (2-2) compares the real returns provided by investments in real estate and inflation protection bonds. The results for model (2-2) are shown in Table 1. As shown in Table 1, change in real return in the market as reflected in TIPS prices do not explain changes in real house prices adjusted for CPI during 1997-2009 and the regression coefficients are not statistically significant.

TABLE 2
CORRELATIONS BETWEEN HOUSE PRICES, ECONOMIC AND FINANCIAL ASSETS

Model (1)	Corr (chg in House, chg. in Stock) = 0.12
Model (1-1)	Corr (chg in real House, chg. in real Stock) = 0.11
Model (1-2)	Corr (chg in House, chg. in Stock) = 0.15 Corr (chg in House, chg. in TIPS) = 0.03 Corr (chg in Stock, chg. in TIPS) = 0.05
Model (2)	Corr (chg in House, chg. in TIPS) = 0.06
Model (2-2)	Corr (chg in real House, chg. in real TIPS) = 0.03
Model (3)	Corr (chg in real House, chg. in real Stock) = 0.16
Model (3-3)	Corr (chg in real House, chg. in real Stock) = 0.20 Corr (chg in real House, chg. in real GDP) = 0.58 Corr (chg in real Stock, chg. in real GDP) = 0.42
Model (4)	Corr (chg in real House, chg. in real GDP) = 0.49
Model (4-4)	Corr (chg in real House, chg. in real GDP) = 0.49 Corr (chg in real House, chg. in real Stock) = 0.19 Corr (chg in real GDP, chg. in real Stock) = 0.37
Model (5)	Corr (chg in real stock, chg in real GDP) = 0.37

Model 3 shows data analysis for testing a hypothesis stating that real return on the real estate market has a similar path as the real return in the stock market. Real return shows discount for inflation. The variables used in this model are expected to compensate investors for inflation.

$$\%\ Change\ in\ Price_{house} - \%\ Change\ in\ Price_{Tips} = a + b * \{\%\ Change\ in\ Price_{stock} - \%\ Change\ in\ Price_{Tips}\} + e \qquad (3)$$

Where

a denotes the constant value,

b denotes the beta coefficient or the degree of association of real returns in real estate and the stock market, and

e denotes the random error in estimation.

Equation (3) compares the real returns provided by investments in real estate and common stock prices when both are adjusted for the return obtained from inflation protection bonds. The results for model (3) are shown in Table 1. As shown in Table 1, differential returns in common stock prices and TIPS explain about two percent of differential returns in house prices and TIPS during 1997-2009. Regression coefficients are significant at the 6 percent level.

Model (3-3) shows data analysis for testing a hypothesis stating that real return on the real estate market has a similar path as the real return in the stock market. Real return shows discount for inflation as measured by TIPS. The impact of the real growth in the economy is also taken into account.

$$\%\ Change\ in\ Price_{house} - \%\ Change\ in\ Price_{Tips} = a + b_1 * \{\%\ Change\ in\ Price_{stock} - \%\ Change\ in\ Price_{Tips}\} + b_2 * \{\%\ Change\ in\ Real\ GDP\} + e \qquad (3\text{-}3)$$

Where

a denotes the constant value

b_1 denotes the beta coefficient of the differential changes in prices of common stock and TIPS,

b_2 denotes the beta coefficient of changes in real GDP, and

e denotes the random error in estimation.

Equation (3-3) compares the real return provided by investments in real estate with the real return on common stock prices when both are adjusted for the return obtained from inflation protection bonds. Furthermore, the impact of real economic growth in housing is analyzed. The results for model (3-3) are shown in Table 1. As shown in Table 1, changes in real GDP are significantly tied to changes in real house prices during 1998-2009. Adjustment for inflation is provided by TIPS returns. Changes in real stock prices, however, do not show a statistical significance. R^2 value of 0.30 indicates that model (3-3) explains 30 percent of variance in changes in real house prices.

Model 4 shows data analysis for testing a hypothesis stating that real return on the real estate market follows the path of the real growth in the economy.

$$\%\ Change\ in\ Price_{house} - \%\ Change\ in\ CPI = a + b * \%\ Change\ in\ Real\ GDP + e \qquad (4)$$

Where

a denotes the constant value,

b denotes the beta coefficient of changes in real GDP, and

e denotes the random error in estimation.

Equation (4) compares the real return provided by investments in real estate, adjusted for inflation as measured by CPI, with the real growth in the economy. The results for model (4) are shown in Table 1. As shown in Table 1, changes in real GDP explain 23 percent of changes in real house prices during 1992-2009. Regression coefficients are all very highly significant. Adjustment for inflation is made by CPI.

Model (4-4) shows data analysis for testing a hypothesis stating that real return on the real estate market has a similar path as the real return in the stock market. Real return shows discount for inflation as measured by CPI. The impact of the real growth in the economy is also taken into account.

$$\%\ Change\ in\ Price_{house} - \%\ Change\ in\ CPI = a + b_1 * \%\ Change\ in\ Real\ GDP + b_2 * \{\%\ Change\ in\ Price_{stock} - \%\ Change\ in\ CPI\} + e \qquad (4\text{-}4)$$

Where

a denotes the constant value,

b_1 denotes the beta coefficient or the degree of association of the real return in house and the real growth in the economy,

b_2 denotes the beta coefficient or the degree of association of the return on house and stock prices, both adjusted for CPI,

CPI denotes consumer price index as a gauge for inflation,
GDP denotes gross domestic product or income in the U.S. economy, and
e denotes the random error in estimation.

Equation (4-4) compares the real return provided by investments in real estate with the real return on common stock prices when both are adjusted for CPI. Furthermore, the impact of real economic growth in housing is analyzed. The results for model (4-4) are shown in Table 1. As shown in Table 1, changes in real GDP together with changes in real common stock prices explain about 22 percent of changes in real house prices during 1992-2009. While the coefficients for changes in real GDP are highly statistically significant, those for changes in real common stock prices are not. Adjustment for inflation is made by CPI.

Model (5) shows data analysis for testing a hypothesis stating that real return on common stock prices has a similar path as the real growth in the economy. Real return on common stock is measured by adjusting for CPI.

$$\%\ Change\ in\ Price_{stock} - \%\ Change\ in\ CPI = a + b * \%\ Change\ in\ Real\ GDP + e \qquad (5)$$

Where

a denotes the constant value,
b denotes the beta coefficient or the degree of association of the real return in common stock and the real growth in the economy,
CPI denotes consumer price index as a gauge for inflation,
GDP denotes gross domestic product or income in the U.S. economy, and
e denotes the random error in estimation.

Equation (5) compares the real return provided by investments in common stock with the real growth in the economy. The results for model (5) are shown in Table 1. As shown in Table 1, changes in real GDP explain about 14 percent of changes in real stock prices during 1992-2009. The regression coefficients are highly statistically significant.

CONCLUSIONS

Information conveyed by Table 1 shows that changes in real estate prices in real terms adjusted for inflation are significantly tied to the changes in the real growth in the economy. These are shown by regression model (3-3), model (4) and model (4-4). Correlation coefficient for changes in real house prices and the real growth in the economy is 0.58 as shown in Table 2. In particular, changes in house prices did not show any significant behavioral relationship with changes in common stock prices during 1992-2009. However, they are both significantly affected by changes in the real growth in the economy. Market prices for real estate and common stock do not appear to adjust for unexpected inflation as shown by model (2) and model (2-2). This is in line, for example, with the results obtained by Hoesli, Lizieri and McGregor (2008). It is to be noted that the returns on Treasury Inflation Protection Bonds as used in this paper's models, are adjusted for both expected and unexpected inflation.

This research shows one way of explanation for the price behavior of real estate in major U.S. metropolitan areas. Using regression and correlation studies, it is found that changes in the real return as well as economic growth explain up to 30 percent of variance in house prices during the past two decades. The performance of real estate however, did not show a statistically significant relationship with the stock market in the long run. As the extensive literature in this field reveals, real estate prices have shown wild swings over the short term that have lasted up to 4-6 years. The mean reversion property of real estate prices appears to provide a predictable pattern for changes in real estate prices in line with other financial variables in the short term. The long term trend in real estate prices however, is perhaps best explained by changes in the real rate of interest and the real growth in the economy.

The statistical tests performed in this paper are purported for evaluating the likely impacts of real growth in the economy, the real rate of interest, inflation as well as changes in common stock prices. This study is, in part, in line with Fama (1981), for inclusion of "real activity" and "monetary shocks" as well as inflation in empirical tests of real estate studies. As is shown in this empirical study, changes in the real growth in the economy appear to have an economically important and statistically significant effect on both the changes in real estate and common stock prices.

There is a theoretical preference for the use of transactions prices in assessing performance of real estate as used in this research. Numerous prior studies in real estate are based on appraisal values and opinions of the owners. Surveys of opinions and appraisal values could be smooth and correlated over shorter time spans and might not reveal the true variance in prices. This would result in reduced variance and not revealing the true amount of risk. Analysis of the actual transactions prices as used in this paper appears to be a good alternative to augment or complement the survey results.

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