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Case-Shiller® Home Price Index Forecast Methodology

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House Price Model Methodology

September 2008

Introduction

Moody's Economy.com has developed an econometric model of the Fiserv Case-Shiller repeat purchase house price indices. The approach is based on a structural model of housing demand and supply that allows for serial correlation and mean reversion in metropolitan area housing markets. The model that Moody's Economy.com has developed is a tool for identifying the forces driving house prices and assessing to what degree house prices can be explained by fundamental, persistent forces, and to what degree they are explained by more temporal forces. Using the forecasts that are generated by Moody's Economy.com's regional and macroeconomic forecast models, the house price model can determine how well-balanced house prices are and how much overvalued metro area housing markets will ultimately adjust.

Moody's Economy.com and Fiserv Lending Solutions have partnered to create the most authoritative house price forecasts available. Fiserv provides the historical Case-Shiller repeat purchase house price indices (CSIs), and Moody's Economy.com forecasts the CSIs using economic and demographic drivers that are projected by its large-scale macroeconomic and regional forecast models. To the extent possible, the house price model relies on region-specific geographic drivers.

With 15 years of commercial experience in producing home price indices, Fiserv's CSIs are among the most trusted house price measures available. Their repeat purchase home price indices are designed to measure the market value of house prices in a geography, controlling for a constant quality level. The indices are based on all arm's-length sales transactions in a market, providing the most accurate description of price trends. Fiserv's indices cover nearly two-thirds of the housing market by value. For Moody's Economy.com and Fiserv's joint house price index service, Fiserv has created a database that covers all Census Divisions, states and metropolitan areas (MSA) in the U.S. For geographies or time periods where Fiserv is not able to obtain a sufficient number of sales pairs to create an accurate index, they supplement the database with repeat purchase house price indices reported by the Office of Federal Housing Oversight Enterprise. Fiserv's historical database also includes pure CSIs for a number of counties and zip codes, as well as house price tier and condo indices for selected MSAs and counties[1].

Moody's Economy.com has created econometric forecast models based on the historical data provided by Fiserv. Included in the house price forecast database are U.S., Census Division, state, MSA, and county house price indices. In addition, Moody's Economy.com forecasts the CSI house price tier and condo indices for the metro where Fiserv reports an index.

In order to maintain reasonable co-movements among the regional and house price tier forecasts, the metro area aggregate house price forecasts are modeled from first principals. Metro areas are chosen as the fundamental measure of house price to model because they provide the best combination of geographic granularity and data availability. There is a large cross-section of CSIs available, with over 100 metro areas reported.

The condo, tier, state and Census Division indices are modeled using the relevant metro area indices, modified by appropriate economic and demographic data. Moody's Economy.com also forecasts county aggregate house price indices in a similar fashion, modifying the relevant metro area or state price index using the relationship between county and MSA/state economic and demographic data. The U.S. CSI is forecasted using Moody's Economy.com's large-scale macroeconomic forecast model.

This article begins with a discussion of previous recent research regarding the determination of house prices and the identification and measurement of overvalued and speculative housing markets. The third section presents the theoretical basis for the model developed in this article. The fourth section outlines the estimation results, with a focus on the metro area model. Section five uses the estimated

[1] The regional coverage in the forecast database for the aggregate house price index is complete down to the metro area level. However approximately eight Census Regions, 27 states and 100 metro areas are true CSI indices. Indices for the remaining geographies are infilled by Fiserv using data from the Office of Federal Housing Enterprise Oversight. Fiserv also reports house price indices for some 350 counties.

Chart 1: House Prices and Household Income

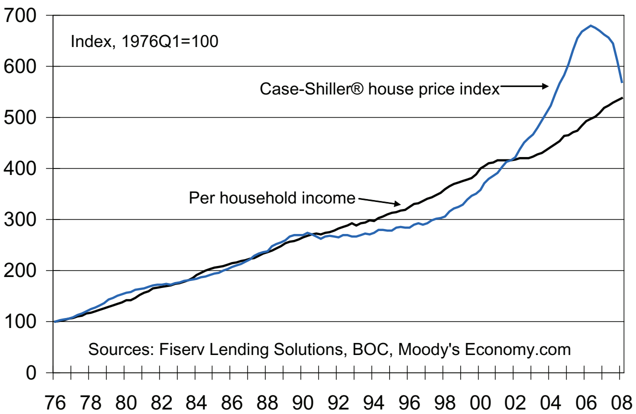
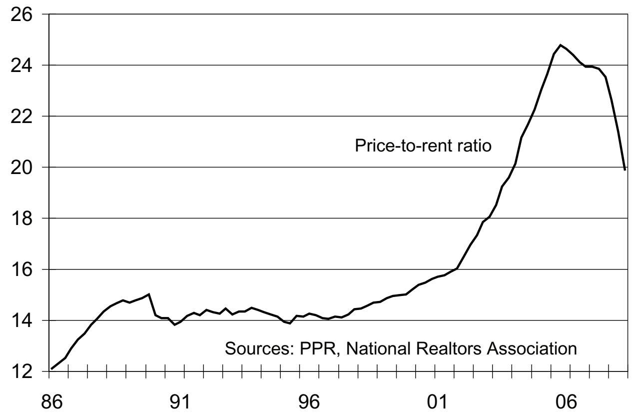


Chart 2: House Prices and Apartment Rents



model to identify metropolitan areas with overvalued housing markets, the degree of their overvaluation, and section six simulates the model to consider how these housing markets will adjust under different economic assumptions.

Previous research

There has been substantial recent research into the determination of house prices, and whether housing markets are overvalued and/or speculative. This research is briefly described in the discussion that follows.

A popular approach for identifying whether housing is appropriately valued is to compare house prices with household incomes.[2] Over long periods, house-price gains have closely mirrored household income gains nationally and across metropolitan areas (see Chart 1). The recent froth in house prices is evident in the large gap that developed between income and prices. As house prices have been falling, this gap has narrowed, although not completely.

That housing values and household incomes should be closely related is based on the special importance most households seemingly place on owning their own home. This importance is seemingly rooted in both household psychology and the significant tax advantages of homeownership. Households have historically purchased as much housing as their incomes will allow. The strong relationship between house prices and incomes can also be established through the cost of land and construction costs. The value of land is ultimately determined by its opportunity cost, which in turn equals the value of goods and services produced in the geography. Given a constant labor share of output, the growth in land values and incomes will thus be equivalent. The growth in construction costs also closely tracks incomes since these costs are predominantly labor costs.

When house prices and household incomes diverge substantially, this is only suggestive that a housing market is overvalued or speculative. House prices and incomes can diverge over extended periods when mortgage rates or other transaction costs are steadily rising or falling as they have done over the past quarter century, for example, or when non-labor construction costs, such as the cost of materials, are growing at a persistently strong or weak rate.

A second approach compares house prices with apartment rents.[3] Over long periods, house-price gains and the growth in apartment rents have tracked closely across the nation and metropolitan areas (see Chart 2). Similar to the price-to-income relationship, imbalances that developed during the housing boom are evident in the price-to-rent ratio. These imbalances are now slowly being redressed as the median house price declines. That housing values and rents are closely related is simply due to the fact that multifamily housing and single-family housing are close substitutes. If house prices deviate substantially from rents, then this suggests that

[2] See Case, Karl and Shiller, Robert, "Is There a Bubble in the Housing Market? An Analysis," in Brookings Papers, Fall 2003.

[3] See Gallin, J., 2004, "The Long-Run Relationship Between House Prices and Rents," *Finance and Economics Discussion Series*, Board of Governors of the Federal Reserve System, No. 2004-50

the cost of housing services provided via owning is substantially different from the cost of those services via renting. Households will eventually adjust, as will house prices and rents. The strong relationship between house prices and rents is also due to the fact that house prices should equal the present value of the future services provided by housing. Those services are equal to what it would cost the homeowner to rent her home back to herself, which in turn is equal to the rent on a comparable apartment.

When house prices and apartment rents diverge substantially, this is only suggestive of an overvalued or speculative housing market. House-price and rent growth can diverge over extended periods due to steadily rising or falling mortgage rates or other transaction costs, shifts in the availability of mortgage credit as lenders change their underwriting standards, and changes in the tax code that impact the cost of homeownership via renting.

A third approach is a type of accounting exercise in which the user cost of housing is calculated and compared to rents or the net present value of owning a home is calculated and compared to prevailing house prices.[4] If the user cost is measurably higher than rents or the net present value of owning a home is lower than house prices, then the housing market is deemed to be overvalued or speculative.

This approach is very sensitive to the measurement of housing costs, however, including things such as property taxes and maintenance costs. These costs are very difficult to measure accurately, particularly at a metro area level. Risk premiums and discount rates, things that can not be directly observed, must also be assumed to perform the calculations of the user cost and net present value. It is also worth noting that the results in some cases are hard to explain. In one of the studies, for example, it is found that Los Angeles house prices have always been undervalued to varying degrees.

Each of the previous efforts at determining the appropriate level of house prices thus has consequential limitations. Simply comparing household incomes and apartment rents to house prices ignores the possibility that they may diverge for extended periods of times. Accounting exercises are useful, but the results are severely impaired by the quality of the data used and the assumptions made. The model presented in the remainder of this paper provides an alternative approach to identifying and measuring overvalued housing markets that addresses, at least in part, each of these limitations.

[4] See Himmelberg, C.; Mayer, C.; and Sinai, T., 2005, "Assessing High House Prices: Bubbles, Fundamentals, and Misperceptions," Federal *Reserve Bank of New York Staff Reports*, no. 218, and Smith, G., and Smith, M., March 2006, "Bubble, Bubble, Where's the Bubble?, *Brookings Paper on Economic Activity*.

Theoretical Model

The structural econometric model of housing demand, supply and price allows for serial correlation and mean reversion in the housing market[5]. Mean reversion implies that in the long run, housing markets move toward equilibrium. In each metro area k and each period t, it is assumed that there is a long-run equilibrium value for the unit price of housing space that is determined by:

$$P^*_{tk} = f(x_{tk}) \quad (1)$$

Where P^* is the real equilibrium house value per quality adjusted square foot in the metro area, and x_{tk} is a vector of explanatory variables. Equation (1) can be thought of as the reduced form of a long-run housing supply and demand relationship.[6]

The explanatory variables in the equilibrium equation can include real household income, real household non-housing wealth, the age and ethnic composition of the population, regulatory conditions and permitting requirements, structural changes in lenders' underwriting standards, and the long-run risk-adjusted return to housing and other household assets.

The change in real house prices is determined by:

$$\Delta P_{tk} = a_k \Delta P_{t,k-1} + b_k(P^*_{t-1,k} - P_{t-1,k}) + c_k \Delta P^*_{tk} + D_{tk} \quad (2)$$

The first set of terms in equation (2) captures serial correlation, where a_k is the serial correlation coefficient, b_k is the rate of mean reversion, and c_k captures the immediate adjustment to changing fundamentals. The vector D_{tk} includes various business cycle factors, such as unemployment and user costs, that impact changes

[5] Capozza, Dennis R. ; Hendershott, Patric H. ; Mack, Charlotte, March 2004, "An Anatomy of Price Dynamics in Illiquid Markets: Analysis and Evidence from Local Housing Markets." *Real Estate Economics*.

[6] It can also be derived from urban theory. See Capozza, Dennis; Helsley, R., 1989, "The Fundamentals of Land Prices and Urban Growth," *Journal of Urban Economics*, 26, 295-306.

in house prices around its long-run equilibrium. These factors are also interacted with the adjustment terms *a*, *b*, and *c*. The degree of serial correlation and the rate of mean reversion are affected by where the economy is in its business cycle.

It is important to note that equation (2) can be written in difference equation form and its dynamic properties examined. The parameters a_k and b_k determine whether house prices exhibit oscillatory or damped behavior, and convergent or divergent behavior.[7]

The user cost of housing, which measures the after-tax cost of homeownership, is a key explanatory variable in the model, and is equal to:

$$U_{tk} = (1\text{-}Tax_{tk})(r_{tk} + Ptax_{tk}) - M_{tk} - P^e_{tk} \qquad (3)$$

Where U_{tk} is the user cost, Tax_{tk} is the effective marginal tax rate, r_{tk} is the effective mortgage rate, $Ptax_{tk}$ is the effective property tax rate, M_{tk} equals maintenance costs and obsolescence, and P^e_{tk} represents the homeowners' expected house-price growth over the horizon of their homeownership, and is estimated using long-run household income growth.

Empirical Results

The structural model estimated in this study is based on the Case-Shiller repeat purchase house price data for MSAs from Fiserv Lending Solutions.[8] The model also uses a plethora of other historical housing market, economic, and demographic data at the national, state, and metro area level that has been constructed by Moody's Economy.com. Historical data ranging from housing starts to household income are derived from various government sources and trade organizations, but are cleaned and adjusted to be on a consistent basis across metro areas and over time. A comprehensive list of the variables tested in the estimation is shown in Table 1.

Dummy variables are also interacted with some of the regressors in order to capture broad regional similarities in housing markets. These dummy variables effectively pool the data based on geography, with pool 1 including East Coast metro areas, pool 2 including Mountain West metro areas, pool 3 including Florida metro areas, pool 4 including metro areas in the interior of the country, and pool 5 including metro areas on the West Coast. The industrial and demographic makeup of the metro areas in each pool is similar, as is the supply side of their housing markets, including the degree of building constraints and the prevalence of restrictive regulatory requirements. For example, coastal metro areas, where land constraints can create temporary supply shortfalls, are subject to greater booms and busts in prices, while prices in interior metro areas are far more stable. Florida metro areas, which are unique due to the state's large second and vacation home market, are in their own group, as are the fast growing markets in the Mountain states. The categories of MSAs are listed in Table 2.

Equilibrium equation. The model is estimated in two stages. In stage 1, the equilibrium house price in Equation (1) is estimated. In stage 2, the adjustment house-price equation in Equation (2) is estimated using the fitted values for the equilibrium house price from stage 1. Both equations are estimated using pooled cross-sectional estimation with fixed effects.[9] In this technique, all the data for the metro areas are pooled together in one regression equation. The coefficient on a particular exogenous variable is constrained to be the same for each metro area.

An alternative would have been to perform regressions for each metro area. The panel data regression is preferable to the individual MSA regressions for several reasons. First, it allows correlation analysis of each individual MSA's economic and demographic conditions against house prices for that MSA. That is, price behavior is hypothesized to differ among MSAs because economic conditions among MSAs differ, not because the relationships between house prices and economic conditions differ. Second, the fixed effects method of panel

[7] Cappozza et al, 2004, calculate the dynamic properties of equation (2) under the simplifying assumption that P*tk = P*k, a constant.

[8] Moody's Economy.com has also estimated similar models for the OFHEO repeat purchase house price index and the National Association of Realtors median existing house price.

[9] A criticism of this approach is that it is assumed that there is a cointegrating relationship among the variables included in the equilibrium equation, when in fact there may not be. Standard unit root tests for cointegration based upon Dicky-Fuller or augmented Dicky-Fuller are not appropriate in a panel setting as used in this study. If the urban theory, which is used as the basis for the derivation of the equilibrium equation, is correct, however, then there is a cointegrating relationship among the variables. Nevertheless, the criticism applies.

Table 1: Variable Definitions and Sources

Variable	Sources
Case-Shiller House Price Index	Fiserv Lending Solutions
Consumer Price Index	BLS, Moody's Economy.com
Average Household Income	BEA, BOC, BLS, Moody's Economy.com
Median Household Income	BOC, Moody's Economy.com
Household Non-Housing Wealth	FRB, BOC, BLS, Equifax, Moody's Economy.com
Home Equity Lines Outstanding at Commercial Banks	FRB
Total Commercial Bank Assets	FRB
Construction Costs	BLS, R.S. Means
Effective Apartment Rent	Property Portfolio Research
Housing Stock	BOC, Moody's Economy.com
Households	BOC, Moody's Economy.com
Population by Age Cohort	BOC, Moody's Economy.com
Foreign Immigration	BOC, Moody's Economy.com
Unemployment Rate	BLS
S&P 500 Stock Index	S&P
Treasury Interest Rates	FRB
Effective Mortgage Rate	FHFB, Moody's Economy.com
Effective Personal Income Tax Rate	BEA
Property Tax Rate	BEA, BOC, Moody's Economy.com

Note: Most of these variables are available at a metropolitan area level from the source or are constructed by Moody's Economy.com.

Note:
BLS - Bureau of Labor Statistics
BOC - Bureau of Census
FRB - Federal Reserve Board
FHFB - Federal Housing Finance Board
OFHEO - Office of Federal Housing Enterprise Oversight

Table 2: Metro Area Classification

MSA	Regional Description	Region Number
Atlantic City, NJ	East Coast	1
Baltimore, MD	East Coast	1
Barnstable Town, MA	East Coast	1
Bethesda, MD [Metropolitan Division]	East Coast	1
Boston, MA [Metropolitan Division]	East Coast	1
Bridgeport, CT	East Coast	1
Burlington, VT	East Coast	1
Cambridge, MA [Metropolitan Division]	East Coast	1
Camden, NJ [Metropolitan Division]	East Coast	1
Edison, NJ [Metropolitan Division]	East Coast	1
Peabody, MA	East Coast	1
Rockingham County, NH [Metropolitan Division]	East Coast	1
Hartford, CT	East Coast	1
Manchester, NH	East Coast	1
Nassau, NY [Metropolitan Division]	East Coast	1
New Haven, CT	East Coast	1
New York, NY [Metropolitan Division]	East Coast	1
Newark, NJ [Metropolitan Division]	East Coast	1
Norwich, CT	East Coast	1
Ocean City, NJ	East Coast	1
Philadelphia, PA [Metropolitan Division]	East Coast	1
Pittsfield, MA	East Coast	1
Providence, RI	East Coast	1
Salisbury, MD	East Coast	1
Springfield, MA	East Coast	1
Trenton, NJ	East Coast	1
Washington, DC [Metropolitan Division]	East Coast	1
Wilmington, DE [Metropolitan Division]	East Coast	1
Worcester, MA	East Coast	1
Albuquerque, NM	Mountain State	2
Denver, CO	Mountain State	2
Flagstaff, AZ	Mountain State	2
Las Vegas, NV	Mountain State	2
Phoenix, AZ	Mountain State	2
Prescott, AZ	Mountain State	2
Tucson, AZ	Mountain State	2
Cape Coral, FL	Florida	3
Deltona, FL	Florida	3
Fort Lauderdale, FL [Metropolitan Division]	Florida	3
Fort Walton Beach, FL	Florida	3
Gainesville, FL	Florida	3
Lakeland, FL	Florida	3
Miami, FL [Metropolitan Division]	Florida	3
Naples, FL	Florida	3
Orlando, FL	Florida	3
Pensacola, FL	Florida	3
Port St. Lucie, FL	Florida	3
Punta Gorda, FL	Florida	3
Bradenton, FL	Florida	3
Tampa, FL	Florida	3
Sebastian, FL	Florida	3
West Palm Beach, FL [Metropolitan Division]	Florida	3

Table 2: Metro Area Classification (cont.)

MSA	Regional Description	Region Number
Akron, OH	Inland	4
Ann Arbor, MI	Inland	4
Atlanta, GA	Inland	4
Canton, OH	Inland	4
Chicago, IL [Metropolitan Division]	Inland	4
Cincinnati, OH	Inland	4
Clarksville, TN	Inland	4
Cleveland, OH	Inland	4
Columbus, OH	Inland	4
Dayton, OH	Inland	4
Detroit, MI [Metropolitan Division]	Inland	4
Johnson City, TN	Inland	4
Knoxville, TN	Inland	4
Lancaster, PA	Inland	4
Lansing, MI	Inland	4
Memphis, TN	Inland	4
Minneapolis, MN	Inland	4
Nashville, TN	Inland	4
Pittsburgh, PA	Inland	4
Springfield, OH	Inland	4
Toledo, OH	Inland	4
Warren, MI [Metropolitan Division]	Inland	4
Youngstown, OH	Inland	4
Bakersfield, CA	West Coast	5
Chico, CA	West Coast	5
Fresno, CA	West Coast	5
Hanford, CA	West Coast	5
Los Angeles, CA [Metropolitan Division]	West Coast	5
Merced, CA	West Coast	5
Modesto, CA	West Coast	5
Napa, CA	West Coast	5
Oakland, CA [Metropolitan Division]	West Coast	5
Santa Ana, CA [Metropolitan Division]	West Coast	5
Oxnard, CA	West Coast	5
Portland, OR	West Coast	5
Riverside, CA	West Coast	5
Sacramento, CA	West Coast	5
Salinas, CA	West Coast	5
San Diego, CA	West Coast	5
San Francisco, CA [Metropolitan Division]	West Coast	5
San Jose, CA	West Coast	5
San Luis Obispo, CA	West Coast	5
Santa Barbara, CA	West Coast	5
Santa Cruz, CA	West Coast	5
Santa Rosa, CA	West Coast	5
Seattle, WA [Metropolitan Division]	West Coast	5
Stockton, CA	West Coast	5
Tacoma, WA [Metropolitan Division]	West Coast	5
Vallejo, CA	West Coast	5
Visalia, CA	West Coast	5

analysis captures the non-economic differences among MSAs that remain stable across time. For example, demographic characteristics such as age distribution and income distribution affect the demand for housing, but will remain relatively constant over the short time span considered in this study.

The third benefit of panel analysis concerns the difficulties in drawing sound conclusions from limited data. Analysis based on only several years of data often results in inaccurate conclusions. Too many outliers, or unusual occurrences, may appear, thus skewing the results. Panel analysis reduces this problem by combining MSA data together in such a fashion that the effect of outliers are minimized, while each MSA's economic factors are correlated with its own account variables.

The pooling of over 11,000 sample points represents a considerable portion of total dollar balances for arm's length transactions. The most important explanatory variable in the equilibrium house-price equation, Equation (1), is real per capita income, particularly in the East and West coastal regions (see Table 3). A 1% increase in real per capita income in a metro area in these regions leads to an approximately six-tenths of a percentage point increase in real house prices. This means that households are buying 6% more housing when incomes rise 10%.

Income is not significant in the Florida pool. This is likely due to the large number of migrants and wealthier second and vacation homebuyers from outside the state who purchase homes in the state. Florida house prices are closely related to national income trends, including the ongoing skewing of the income distribution. To capture this, the ratio of national average household income to median income was included in the equilibrium equation for the Florida pool. As this ratio rises, suggesting that higher income households nationally are doing relatively well, so to does Florida equilibrium house prices.

The income elasticity of equilibrium house prices on the East and West Coasts was affected by 9/11, hence the income terms are interacted with a proxy for the impact of 9/11. After the terrorist attack, households traveled much less and thus stayed at home more. This prompted a substantial increase in housing demand and thus equilibrium prices in these regions. This nesting effect was not evident in the rest of the country, at least not statistically. This impact, while significant in the immediate wake of 9/11, has faded and accordingly the proxy variable for this effect has been allowed to return to a pre-9/11 average.

Equilibrium house prices have also been affected by a significant shift in mortgage lending underwriting standards in recent years. The run-up in house prices during the earlier part of the decade was a direct result of the explosion of subprime, alt-A mortgages, IO and option ARMs that expanded the availability of mortgage credit to households who did not previously have access to any type of credit. The subsequent financial meltdown and the collapse of mortgage credit has been a significant weight on housing demand and hence house prices. These trends are difficult to measure and forecast, however, the ratio of total commercial bank assets in home equity lines of credit serves as a good proxy. The explosive growth of HELOCs is symptomatic of the democratization of mortgage credit earlier in the decade and the more recent rapid decline in this share represents the sharp reversal of credit availability. Empirically, the impact of the change in underwriting standards is most important in the more heated and expensive markets. On average, a 100-basis-point increase in the HELOC share of bank assets generates a 400-basis-point increase in equilibrium house prices.

The collapse in stock prices and the plunge in short-term interest rates early in this decade also elevated housing as an attractive alternative investment for households. Households were incited to engage in seemingly rational portfolio shifting by the high risk-adjusted returns to housing compared to the risk-adjusted returns on stocks and cash. This is measured in the equilibrium house-price equation by the difference between the risk-adjusted returns on stocks and cash, weighted according to their share of assets in the average household balance sheet, and the risk-adjusted return on housing. The risk-adjusted return is in turn measured by a Sharpe ratio, proxied by the ratio of a five-year moving average of returns to the standard deviation of those returns.[10] A 100-basis-point increase in the risk-adjusted returns to stock and cash results in a 28-basis-point decline in equilibrium house prices. This impact is uniformly evident across all metro areas.

The age composition of the population also affects equilibrium house prices. Those between the ages

[10] Alternative moving averages were tested. A five-year moving average provides the best statistical results.

Table 3: Equilibrium House-Price Equation (Equation 1)

Dependent variable: Log of Real House Price				
Method: GLS (Cross Section Weights)				
Sample: 1980:1 2006:4				
Included observations: 108 (102 after adjustments)				
Number of cross-sections used: 102				
Total panel (balanced) observations: 11,016				
R-squared	0.943			
Adjusted R-squared	0.942			
S.E. of regression	0.127			
F-statistic	1,545			
Independent Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Beta Weight**
Constant	2.57	4.4E-2		-
Market Portfolio Versus Housing Returns	-2.8E-3	2.9E-2	16.8	-0.5%
9/11 Dummy Interacted with Real Per Capita Income, Region 1	0.52	2.6E-2	12.5	8.3%
9/11 Dummy Interacted with Real Per Capita Income, Region 5	1.01	3.8E-3	137.4	15.0%
9/11 Dummy Interacted with HELOC Share of Bank Assets	3.5E-2	0.10	2.9	1.1%
Vacation Home Share of Stock Interacted with Population Share 50-64, Region 1	9.8E-4	3.6E-2	8.2	1.4%
Vacation Home Share of Stock Interacted with Population Share 50-64, Region 2	4.9E-3	2.7E-2	16.6	1.9%
Vacation Home Share of Stock Interacted with Population Share 50-64, Region 3	9.7E-3	3.8E-3	14.5	8.8%
Vacation Home Share of Stock Interacted with Population Share 50-64, Region 4	2.2E-2	4.3E-3	21.5	2.1%
Vacation Home Share of Stock Interacted with Population Share 50-64, Region 5	3.9E-3	2.0E-3	36.5	1.0%
Ratio of Average to Median Household Income, Region 3	1.01	6.4E-5	-34.2	4.8%
9/11 Dummy Interacted with 5-year Population Growth, Region 3	3.55	0.51	7.0	2.2%
Real Per Capita Income, Region 1	0.65	3.7E-4	16.2	20.9%
Real Per Capita Income, Region 2	0.41	1.9E-4	42.6	7.0%
Real Per Capita Income, Region 4	0.25	2.8E-4	16.3	7.2%
Real Per Capita Income, Region 5	0.62	4.0E-4	10.3	18.8%
Fixed Effects				
Akron, OH	1.00			
Albuquerque, NM	0.93			
Ann Arbor, MI	1.30			
Atlanta, GA	1.27			
Atlantic City, NJ	-0.82			
Bakersfield, CA	-0.83			
Baltimore, MD	-0.68			
Barnstable Town, MA	-0.78			
Bethesda, MD [Metropolitan Division]	-0.35			
Boston, MA [Metropolitan Division]	-0.24			
Bradenton, FL	0.34			
Bridgeport, CT	-0.32			
Burlington, VT	-0.78			
Cambridge, MA [Metropolitan Division]	-0.22			
Camden, NJ [Metropolitan Division]	-0.68			
Canton, OH	0.86			
Cape Coral, FL	-0.48			
Chicago, IL [Metropolitan Division]	1.52			
Chico, CA	-0.55			
Cincinnati, OH	1.21			
Clarksville, TN	0.81			

Table 3: Equilibrium House-Price Equation (Equation 1) (cont.)

Cleveland, OH	1.19
Columbus, OH	1.28
Dayton, OH	1.08
Deltona, FL	0.41
Denver, CO	1.02
Detroit, MI [Metropolitan Division]	1.00
Edison, NJ [Metropolitan Division]	-0.49
Flagstaff, AZ	0.28
Fort Lauderdale, FL [Metropolitan Division]	1.07
Fort Walton Beach, FL	0.92
Fresno, CA	-0.76
Gainesville, FL	1.32
Hanford, CA	-1.06
Hartford, CT	-0.51
Johnson City, TN	0.99
Knoxville, TN	1.04
Lakeland, FL	0.28
Lancaster, PA	1.20
Lansing, MI	1.12
Las Vegas, NV	1.00
Los Angeles, CA [Metropolitan Division]	-0.80
Manchester, NH	-0.83
Memphis, TN	1.30
Merced, CA	-0.74
Miami, FL [Metropolitan Division]	1.25
Minneapolis, MN	1.27
Modesto, CA	-1.07
Napa, CA	-1.14
Naples, FL	-0.86
Nashville, TN	1.27
Nassau, NY [Metropolitan Division]	-0.42
New Haven, CT	-0.49
New York, NY [Metropolitan Division]	-0.16
Newark, NJ [Metropolitan Division]	-0.26
Norwich, CT	-0.55
Oakland, CA [Metropolitan Division]	-0.60
Ocean City, NJ	-1.39
Orlando, FL	1.04
Oxnard, CA	-0.78
Peabody, MA	-0.32
Pensacola, FL	1.08
Philadelphia, PA [Metropolitan Division]	-0.84
Phoenix, AZ	0.75
Pittsburgh, PA	0.86
Pittsfield, MA	-0.69
Port St. Lucie, FL	0.13
Portland, OR	-1.25
Prescott, AZ	0.53
Providence, RI	-0.43
Punta Gorda, FL	-0.45
Riverside, CA	-0.99
Rockingham County, NH [Metropolitan Division]	-0.62

Table 3: Equilibrium House-Price Equation (Equation 1) (cont.)

Sacramento, CA	-1.13
Salinas, CA	-0.64
Salisbury, MD	-0.56
San Diego, CA	-0.66
San Francisco, CA [Metropolitan Division]	-0.75
San Jose, CA	-0.63
San Luis Obispo, CA	-0.95
Santa Ana, CA [Metropolitan Division]	-0.60
Santa Barbara, CA	-0.74
Santa Cruz, CA	-0.58
Santa Rosa, CA	-0.66
Seattle, WA [Metropolitan Division]	-1.13
Sebastian, FL	0.33
Springfield, MA	-0.54
Springfield, OH	0.85
Stockton, CA	-0.66
Tacoma, WA [Metropolitan Division]	-1.16
Tampa, FL	0.88
Toledo, OH	0.43
Trenton, NJ	-0.78
Tucson, AZ	0.87
Vallejo, CA	-0.60
Visalia, CA	-0.71
Warren, MI [Metropolitan Division]	1.26
Washington, DC [Metropolitan Division]	-0.42
West Palm Beach, FL [Metropolitan Division]	0.70
Wilmington, DE [Metropolitan Division]	-0.53
Worcester, MA	-0.37
Youngstown, OH	0.75

Note: A similar model is available for the OFHEO house price indexes and this model is used where metro area CSI data are unavailable.

of 50 and 64 tend to have strong demand for second and vacation homes. As the large baby boom generation has moved into this cohort, second and vacation home demand has significantly increased, lifting housing demand and prices. This is most prevalent in parts of the country where the housing stock is dominated by such homes. This effect is captured in the equilibrium house-price equation by the share of stock in second and vacation homes interacted with the share of the population between the ages of 50 and 64. As would be expected, the elasticity of equilibrium house prices to this variable is much higher in the Florida and Mountain West pools, to which retiree migration is strongest, and measurably lower in the inland and East Coast markets. In Florida, for example, a 100-basis-point increase in the share of the population between 50 and 64 lifts equilibrium house prices by nearly 97 basis points.

The final variable included in the equilibrium equation is included only for the Florida pool, and is designed to capture the uniquely strong migration flows, both domestic and international, into the state. Builders in the state have been unable to meet the significant acceleration in population growth with enough new construction in recent years, resulting in tighter housing markets and higher prices. Migration and population are likely to accelerate further in coming years with continued strong foreign immigration, and more importantly increased retiree migration by the aging baby boom generation.

The equilibrium equation is estimated with metro area fixed effects in order to capture any systematic differences in the average quality of housing across areas. The fixed effects also capture the impact of those land supply constraints that do not vary over time.[11]

[11] F-tests of the metro area effects reject that these effects are zero at the 0.001 confidence level. Similar tests for time effects were not found to be significant.

Variables that change substantially over the course of the business cycle were not included in the equilibrium equation. Most notable would include construction costs and the user cost of housing. These variables were tested in the adjustment equation, which is described in the discussion that follows. The residuals from the equilibrium equation thus provide an estimate of the overvaluation or undervaluation of metro area house prices relative to their long-run equilibrium. Overvaluation and undervaluation can be due to temporary business cycle forces and/or speculation.

Adjustment equation. The adjustment house-price equation determines how house prices that deviate from their long-run equilibrium ultimately return to that equilibrium.

The fitted values from the long-run equilibrium house-price equation in Equation (1) are thus an important explanatory variable in the adjustment house-price equation in Equation (2) (see Table 4). The contemporaneous change in house prices to changes in the long-run equilibrium price ranges from 10% to 20%. This response is measurably smaller than that found in other studies and may reflect the unique housing market conditions of recent years. The response is strongest for the Mountain West, inland metro areas and the East Coast. Florida and West Coast metro areas respond more weakly, suggesting that factors other than long-term drivers have been at play in driving house-price changes.

Serial correlation terms, house prices lagged one, two and three quarters, are also included in the adjustment equation, reflecting the persistence of house-price changes. House-price persistence is strongest in the Mountain West, Florida and West Coast metro areas, and weakest in the inland markets. This suggests that speculative pressures are least likely to develop in the inland markets. These results are consistent with those found in other studies.

Reversion of house prices back to their equilibrium price is most pronounced in the West Coast markets and weakest in the inland markets. The mean reversion is calculated as the equilibrium price less the market price. Thus, for example, if this term is positive, that is, prices are below equilibrium, then price growth will be faster. West Coast metro areas have historically experienced the most volatile house prices, with large price gains eventually followed by sharp price declines. House prices in the inland markets, in contrast, tend not to deviate far from their equilibrium, which in turn dampens any reversion back to equilibrium.

There are two business cycle variables in the adjustment equation, including the unemployment rate and the user cost. These variables come in with the correct signs and are significant; that is, the higher the unemployment rate and user cost, the slower real price growth. The direct impact of these factors on the adjustment to equilibrium, however, is small relative to the impact of serial correlation and mean reversion, contributing less than one basis point for a 100-basis-point increase.

A wide range of interaction terms was also tested in the adjustment equation in an effort to capture the impact of information costs and business cycle effects on serial correlation and mean reversion. The interaction of mean reversion and user cost was found to be negative and significant in the West Coast, Florida and the Mountain West. This implies that the adjustment down to equilibrium in an overpriced market will be quicker the higher the user cost. However, similar to the business cycle effects, the impact of this interaction term is small.

Valuation

Equation (1) can be used to determine the degree to which metro area housing markets are overvalued or undervalued. That is the difference between current actual house prices and the price expected based on long-run fundamental economic and demographic factors are determined by Equation (1).

After more than one year of house price declines, many of the markets that were most overheated during the boom are no longer overvalued (see Table 5). For example, metro areas in southern California and the Central Valley of California are no longer overpriced, after sustaining price declines on the order of 40% or more since the peak of the market in 2006. Similarly, Bradenton FL, another region where house prices soared, is now a balanced market.

Even with the recent house declines, several markets still stand out as being overvalued, including Miami FL, Prescott AZ, Naples FL and Atlantic City NJ. In these metro areas, house price depreciation has not been enough to bring the market back into balance. To a lesser extent, the New York City and Washington DC areas also remain slightly overvalued.

Forecast Simulation

Equations (1) and (2) can be further used to produce forecasts of house prices at a metro area level.

Table 4: Adjustment House-Price Equation (Equation 2)

Dependent variable: Log of the Change in Real House Price
Method: GLS (Cross Section Weights)
Sample: 1978:1 2006:4
Included observations: 116
Number of cross-sections used: 102
Total panel (unbalanced) observations: 11,832
All independent variables are differences in logs or logs
The mean reversion variable represents the difference between equilibrium and actual house prices.

R-squared	0.486
Adjusted R-squared	0.480
S.E. of regression	0.018
F-statistic	81

Independent Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Beta Weight**
Constant	1.0E-2	8.9E-4	11.2	-
Equilibrium House Price, Region 1	0.15	1.3E-2	11.3	2.3%
Equilibrium House Price, Region 2	0.19	2.7E-2	6.9	1.1%
Equilibrium House Price, Region 3	0.13	1.9E-2	7.1	1.3%
Equilibrium House Price, Region 4	0.20	1.6E-2	12.9	1.8%
Equilibrium House Price, Region 5	0.12	1.1E-2	10.6	2.0%
House Price Lagged 1 Quarter, Region 1	0.26	1.6E-2	16.3	4.3%
House Price Lagged 1 Quarter, Region 2	0.35	3.5E-2	10.1	2.7%
House Price Lagged 1 Quarter, Region 3	0.31	2.2E-2	14.0	3.5%
House Price Lagged 1 Quarter, Region 4	3.0E-2	1.9E-2	1.6	0.3%
House Price Lagged 1 Quarter, Region 5	0.32	1.8E-2	18.3	5.4%
House Price Lagged 2 Quarters, Region 1	0.27	1.6E-2	16.8	4.5%
House Price Lagged 2 Quarters, Region 2	0.26	3.4E-2	7.7	2.1%
House Price Lagged 2 Quarters, Region 3	0.26	2.2E-2	11.6	2.9%
House Price Lagged 2 Quarters, Region 4	0.13	1.9E-2	7.2	1.3%
House Price Lagged 2 Quarters, Region 5	0.19	1.7E-2	11.3	3.3%
House Price Lagged 3 Quarters	6.6E-2	8.9E-3	7.4	1.9%
Mean Reversion, Region 1	4.5E-2	1.1E-2	4.2	3.6%
Mean Reversion, Region 2	6.4E-2	2.2E-2	3.0	2.1%
Mean Reversion, Region 3	0.12	1.6E-2	7.6	6.0%
Mean Reversion, Region 4	3.3E-2	1.6E-2	2.1	1.5%
Mean Reversion, Region 5	0.15	1.2E-2	11.9	10.0%
User Cost, Regions 1 and 5	-3.5E-4	1.8E-4	-1.9	1.0%
User Cost, Region 2	-1.5E-3	4.8E-4	-3.2	2.1%
User Cost, Region 3	-1.9E-3	3.3E-4	-5.7	3.8%
User Cost, Region 4	-1.2E-4	2.1E-4	-0.6	0.3%
Unemployment Rate, Region 1	-9.0E-4	2.0E-4	-4.6	2.9%
Unemployment Rate, Region 2	-6.7E-4	4.0E-4	-1.7	1.2%
Unemployment Rate, Region 3	-6.3E-4	2.5E-4	-2.6	1.7%
Unemployment Rate, Region 4	-1.2E-3	1.4E-4	-8.9	4.3%
Unemployment Rate, Region 5	-8.8E-4	1.9E-4	-4.6	4.1%
Mean Reversion Interaction with User Cost, Region 1	-6.3E-4	2.2E-3	-0.3	0.3%
Mean Reversion Interaction with User Cost, Region 2	-1.1E-2	5.0E-3	-2.3	1.7%
Mean Reversion Interaction with User Cost, Region 3	-2.0E-2	3.3E-3	-6.0	4.8%
Mean Reversion Interaction with User Cost, Region 4	-2.9E-3	3.2E-3	-0.9	0.6%
Mean Reversion Interaction with User Cost, Region 5	-2.4E-2	2.7E-3	-8.9	7.2%

Table 4: Adjustment House-Price Equation (Equation 2) (cont.)

Fixed Effects	
Akron, OH	-8.2E-4
Albuquerque, NM	5.5E-4
Ann Arbor, MI	-2.1E-3
Atlanta, GA	-1.8E-3
Atlantic City, NJ	-1.2E-4
Bakersfield, CA	-5.4E-4
Baltimore, MD	-1.4E-3
Barnstable Town, MA	-1.7E-5
Bethesda, MD [Metropolitan Division]	-3.8E-3
Boston, MA [Metropolitan Division]	-8.3E-4
Bradenton, FL	2.0E-3
Bridgeport, CT	-2.6E-3
Burlington, VT	-2.9E-3
Cambridge, MA [Metropolitan Division]	-1.9E-3
Camden, NJ [Metropolitan Division]	-1.5E-3
Canton, OH	-4.5E-4
Cape Coral, FL	2.5E-3
Chicago, IL [Metropolitan Division]	3.0E-3
Chico, CA	-8.3E-4
Cincinnati, OH	-1.3E-3
Clarksville, TN	-5.7E-4
Cleveland, OH	-5.4E-4
Columbus, OH	-2.2E-3
Dayton, OH	-1.4E-3
Deltona, FL	2.6E-3
Denver, CO	-4.5E-4
Detroit, MI [Metropolitan Division]	4.7E-3
Edison, NJ [Metropolitan Division]	-1.7E-3
Flagstaff, AZ	2.3E-3
Fort Lauderdale, FL [Metropolitan Division]	3.6E-3
Fort Walton Beach, FL	3.3E-4
Fresno, CA	1.0E-3
Gainesville, FL	7.6E-4
Hanford, CA	4.3E-3
Hartford, CT	-2.6E-3
Johnson City, TN	-5.5E-4
Knoxville, TN	-7.3E-4
Lakeland, FL	2.6E-3
Lancaster, PA	-2.0E-3
Lansing, MI	-8.7E-4
Las Vegas, NV	1.5E-3
Los Angeles, CA [Metropolitan Division]	7.6E-4
Manchester, NH	-3.1E-3
Memphis, TN	-2.5E-3
Merced, CA	3.9E-3
Miami, FL [Metropolitan Division]	5.8E-3
Minneapolis, MN	-1.2E-3
Modesto, CA	3.7E-3
Napa, CA	-1.2E-5
Naples, FL	5.7E-3
Nashville, TN	-1.9E-3
Nassau, NY [Metropolitan Division]	-9.1E-4
New Haven, CT	-1.9E-3

Table 4: Adjustment House-Price Equation (Equation 2) (cont.)

New York, NY [Metropolitan Division]	9.3E-4
Newark, NJ [Metropolitan Division]	-7.8E-4
Norwich, CT	-2.4E-3
Oakland, CA [Metropolitan Division]	-9.8E-4
Ocean City, NJ	3.8E-3
Orlando, FL	1.6E-3
Oxnard, CA	-6.8E-4
Peabody, MA	-8.5E-4
Pensacola, FL	1.2E-3
Philadelphia, PA [Metropolitan Division]	-1.8E-3
Phoenix, AZ	4.8E-4
Pittsburgh, PA	-8.4E-4
Pittsfield, MA	-1.0E-3
Port St. Lucie, FL	5.0E-3
Portland, OR	-2.6E-3
Prescott, AZ	2.1E-3
Providence, RI	-8.9E-4
Punta Gorda, FL	3.8E-3
Riverside, CA	-1.4E-3
Rockingham County, NH [Metropolitan Division]	-2.5E-3
Sacramento, CA	-2.3E-3
Salinas, CA	3.8E-3
Salisbury, MD	-5.5E-4
San Diego, CA	-2.2E-3
San Francisco, CA [Metropolitan Division]	-1.0E-3
San Jose, CA	-2.3E-5
San Luis Obispo, CA	-2.4E-3
Santa Ana, CA [Metropolitan Division]	-2.9E-3
Santa Barbara, CA	-9.8E-5
Santa Cruz, CA	1.3E-3
Santa Rosa, CA	-1.7E-3
Seattle, WA [Metropolitan Division]	-2.1E-3
Sebastian, FL	5.3E-3
Springfield, MA	-1.3E-3
Springfield, OH	-4.8E-4
Stockton, CA	3.1E-3
Tacoma, WA [Metropolitan Division]	-1.3E-3
Tampa, FL	1.5E-3
Toledo, OH	-1.1E-3
Trenton, NJ	-1.8E-3
Tucson, AZ	4.1E-4
Vallejo, CA	-1.3E-3
Visalia, CA	1.9E-4
Warren, MI [Metropolitan Division]	2.1E-3
Washington, DC [Metropolitan Division]	-3.2E-3
West Palm Beach, FL [Metropolitan Division]	4.1E-3
Wilmington, DE [Metropolitan Division]	-1.7E-3
Worcester, MA	-1.6E-3
Youngstown, OH	1.7E-3

Note: A similar model is available for the OFHEO house price indexes and this model is used where metro area CSI data are unavailable.

Forecasts of real per capita income, unemployment mortgage rates, the age composition of the population, and a number of other variables are determined via Moody's Economy.com metro area structural econometric models. These forecasts are taken exogenously in Equations (1) and (2) to produce forecasts of house prices. Broadly, these forecasts are based on the expectation that metro area economies remain are weak in the near term, but ultimately settle down to their long-run potential growth. Interest rates are also expected to rise modestly and stabilize near their neutral rate.

The house price model is calling for a substantial degree of overshooting, with prices in metro areas that are currently considered balanced, or even underpriced, expected to continue declining well into next year (see Table 5). Not only does the persistence term in the adjustment equation suggest the continued decline in house prices, but a weak economic outlook also weighs on the ability of house prices to rebound. The metro areas that are expected to be hardest hit before the housing correction fully plays out are also the areas that enjoyed the strongest froth, largely in the form of subprime lending: California, Florida, Arizona and Nevada. While on average, the national CSI is expected to hit bottom by mid-2009 and lose about 25% of its value from peak-to-trough, it will be as long as the second half of 2010 before prices in these regions stabilize, at prices half the value of their peak.

Conclusions

Given the importance of the housing market to the economy's performance, it is important to determine the ultimate depth and breadth of the house price correction. The model specified and estimated by Moody's Economy.com and described in this article is an important tool for understanding both the forces that drove house prices up during boom and how the reversal of these forces are now affecting outlook for house prices. It can be used to determine how much speculation affected metro area housing markets during the boom, and whether prices have fallen enough during the downturn to wring out these excesses, or whether further adjustments in metro area markets are necessary.

Table 5: Forecast Results

Metro Area	Price Balance*	% Overpriced	Peak in Prices	Trough in Prices	% Peak to 2008Q1 Decline	% Peak to Trough Decline	5 Year Forecast % AGR
Merced, CA	balanced	-17.8	2006Q1	2009Q2	-47.5	-59.9	5.0
Stockton, CA	balanced	-18.6	2006Q1	2009Q4	-44.0	-57.7	1.4
Punta Gorda, FL	overpriced	9.6	2006Q1	2009Q4	-37.9	-56.6	1.1
Las Vegas, NV	overpriced	8.0	2006Q1	2010Q1	-27.5	-55.9	-1.6
Modesto, CA	balanced	-16.4	2006Q1	2009Q4	-41.8	-55.5	0.8
Naples, FL	overpriced	21.2	2006Q1	2010Q1	-32.5	-55.2	-1.4
Riverside, CA	balanced	-14.8	2006Q2	2009Q4	-36.8	-53.6	1.8
Cape Coral, FL	balanced	-19.9	2006Q1	2009Q4	-38.2	-53.2	0.9
Miami, FL [Metro. Div.]	highly overpriced	46.0	2007Q1	2010Q1	-21.9	-52.3	-4.0
Salinas, CA	balanced	-12.2	2006Q1	2009Q4	-37.4	-51.3	1.5
Fort Lauderdale, FL [Metro. Div.]	overpriced	17.6	2006Q2	2010Q1	-24.7	-51.3	-3.3
Sebastian, FL	balanced	-0.9	2005Q4	2009Q4	-24.8	-49.6	-1.5
Visalia, CA	balanced	-17.4	2006Q1	2009Q4	-29.7	-48.9	0.6
Bakersfield, CA	balanced	-16.1	2006Q2	2009Q2	-35.4	-48.9	2.6
West Palm Beach, FL [Metro. Div.]	overpriced	2.4	2006Q1	2009Q4	-29.6	-48.7	0.4
Vallejo, CA	underpriced	-20.6	2006Q1	2009Q4	-35.1	-48.2	0.9
Phoenix, AZ	overpriced	13.0	2006Q2	2010Q3	-25.6	-47.8	-4.2
Santa Barbara, CA	balanced	-15.4	2005Q3	2009Q4	-34.9	-47.8	0.7
Port St. Lucie, FL	balanced	-14.3	2006Q1	2009Q4	-32.7	-47.5	1.5
Bradenton, FL	balanced	-11.0	2006Q1	2009Q4	-31.8	-47.1	0.5
Orlando, FL	overpriced	8.6	2006Q2	2010Q4	-20.4	-45.4	-4.8
Sacramento, CA	underpriced	-25.3	2005Q4	2009Q2	-35.2	-44.8	1.7
Tampa, FL	overpriced	-2.2	2006Q2	2010Q1	-23.1	-43.7	-2.6
Fresno, CA	balanced	-9.7	2006Q1	2009Q4	-28.9	-43.6	1.6
Fort Walton Beach, FL	overpriced	5.7	2005Q4	2010Q1	-23.4	-43.0	-2.5
Los Angeles, CA [Metro. Div.]	overpriced	1.1	2006Q2	2009Q4	-23.2	-42.5	1.1
Oakland, CA [Metro. Div.]	balanced	-17.0	2006Q1	2009Q2	-28.0	-42.1	4.6
Deltona, FL	overpriced	0.3	2006Q2	2009Q4	-22.5	-40.7	-1.0
Atlantic City, NJ	highly overpriced	19.4	2006Q2	2010Q3	-11.8	-40.3	-4.1
Santa Ana, CA [Metro. Div.]	balanced	-5.1	2006Q1	2009Q4	-23.3	-39.9	0.9
Santa Rosa, CA	underpriced	-20.1	2005Q4	2009Q2	-27.4	-39.2	1.5
Oxnard, CA	balanced	-11.2	2006Q2	2009Q2	-25.6	-38.7	2.7
Ocean City, NJ	overpriced	17.1	2005Q4	2010Q2	-12.9	-38.2	-1.9
Tucson, AZ	highly overpriced	13.3	2006Q2	2010Q1	-15.2	-38.0	-2.1
Napa, CA	balanced	-8.0	2006Q1	2009Q2	-22.5	-36.6	2.5
San Diego, CA	underpriced	-17.6	2006Q1	2009Q2	-25.4	-36.2	2.4

Table 5: Forecast Results (cont.)

Metro Area	Price Balance*	% Overpriced	Peak in Prices	Trough in Prices	% Peak to 2008Q1 Decline	% Peak to Trough Decline	5 Year Forecast % AGR
Washington, DC [Metro. Div.]	balanced	-0.9	2006Q1	2010Q1	-21.0	-35.6	-1.6
Lakeland, FL	underpriced	-15.8	2006Q2	2009Q4	-21.3	-35.3	0.0
Prescott, AZ	highly overpriced	31.1	2006Q2	2010Q4	-12.1	-34.9	-4.6
Pensacola, FL	balanced	0.8	2006Q2	2010Q1	-16.4	-34.3	-2.2
Hanford, CA	balanced	-1.7	2006Q2	2009Q4	-18.7	-33.2	0.8
Gainesville, FL	overpriced	11.4	2007Q1	2010Q2	-9.8	-33.0	-4.0
Detroit, MI [Metro. Div.]	balanced	-6.7	2006Q1	2009Q3	-22.0	-32.3	0.4
Newark, NJ [Metro. Div.]	balanced	0.8	2006Q2	2010Q1	-10.0	-32.3	-0.4
Edison, NJ [Metro. Div.]	overpriced	8.0	2006Q2	2010Q2	-8.1	-32.1	-1.6
San Luis Obispo, CA	underpriced	-14.7	2006Q1	2009Q4	-21.2	-30.7	0.9
Camden, NJ [Metro. Div.]	balanced	0.2	2006Q3	2010Q1	-5.6	-28.6	-1.2
Warren, MI [Metro. Div.]	underpriced	-14.0	2005Q3	2009Q2	-20.9	-28.0	1.8
San Jose, CA	balanced	-5.6	2007Q1	2009Q3	-12.8	-28.0	1.8
Flagstaff, AZ	balanced	-3.7	2006Q2	2009Q4	-10.8	-27.9	0.8
Nassau, NY [Metro. Div.]	overpriced	12.7	2006Q2	2010Q1	-10.6	-26.9	-2.1
Bethesda, MD [Metro. Div.]	overpriced	7.8	2006Q2	2010Q1	-11.3	-26.2	-1.3
Chico, CA	balanced	-8.4	2005Q4	2009Q4	-15.5	-25.5	1.2
New Haven, CT	balanced	-2.4	2006Q2	2010Q1	-6.3	-25.0	-0.0
San Francisco, CA [Metro. Div.]	balanced	-7.9	2007Q3	2009Q2	-9.0	-23.8	2.0
Santa Cruz, CA	highly underpriced	-20.0	2005Q4	2009Q1	-17.3	-23.7	4.5
Lansing, MI	underpriced	-11.7	2006Q1	2009Q3	-16.2	-23.7	0.6
Ann Arbor, MI	underpriced	-10.9	2005Q4	2009Q2	-18.6	-23.1	1.1
Providence, RI	balanced	1.1	2005Q4	2010Q1	-10.3	-23.1	-0.4
Rockingham County, NH [Metro. Div.]	balanced	-7.3	2006Q1	2009Q4	-11.9	-23.0	0.3
New York, NY [Metro. Div.]	overpriced	13.7	2006Q2	2009Q4	-8.2	-22.6	-0.8
Portland, OR	overpriced	7.3	2007Q2	2010Q1	-3.3	-22.2	-2.5
Worcester, MA	underpriced	-11.8	2005Q4	2009Q4	-13.4	-22.0	1.2
Bridgeport, CT	balanced	-4.4	2006Q1	2009Q4	-4.6	-21.6	0.7
Norwich, CT	balanced	-4.0	2006Q2	2010Q1	-4.2	-21.6	0.0
Denver, CO	balanced	4.5	2006Q2	2009Q4	-6.9	-20.4	-1.2
Minneapolis, MN	overpriced	6.2	2006Q1	2009Q3	-13.3	-20.3	1.5
Peabody, MA	balanced	-6.4	2005Q3	2009Q4	-11.4	-20.2	1.2
Boston, MA [Metro. Div.]	balanced	-1.5	2005Q3	2009Q4	-9.9	-19.9	0.9
Chicago, IL [Metro. Div.]	overpriced	17.7	2007Q1	2009Q3	-10.8	-19.5	0.2
Barnstable Town, MA	balanced	-0.5	2005Q4	2009Q4	-9.5	-19.1	-0.3

Table 5: Forecast Results (cont.)

Metro Area	Price Balance*	% Overpriced	Peak in Prices	Trough in Prices	% Peak to 2008Q1 Decline	% Peak to Trough Decline	5 Year Forecast % AGR
Baltimore, MD	overpriced	7.9	2007Q1	2010Q1	-5.4	-19.0	-0.6
Trenton, NJ	balanced	0.2	2006Q2	2010Q1	-7.6	-19.0	0.7
Manchester, NH	balanced	-1.9	2005Q4	2009Q4	-8.4	-18.7	1.1
Hartford, CT	balanced	-11.5	2007Q1	2009Q4	-4.0	-18.5	1.3
Tacoma, WA [Metro. Div.]	balanced	-3.7	2007Q1	2009Q4	-6.2	-18.0	2.3
Cambridge, MA [Metro. Div.]	balanced	-7.3	2005Q2	2009Q4	-9.0	-17.7	1.3
Cleveland, OH	highly underpriced	-12.1	2005Q4	2009Q4	-12.0	-16.7	1.2
Seattle, WA [Metro. Div.]	balanced	-1.6	2007Q3	2009Q4	-4.1	-16.2	1.1
Toledo, OH	highly underpriced	-27.8	2006Q1	2009Q2	-10.9	-15.5	1.1
Wilmington, DE [Metro. Div.]	balanced	-0.5	2007Q1	2009Q4	-3.4	-15.4	0.2
Salisbury, MD	balanced	0.4	2007Q3	2010Q1	-3.6	-15.3	-0.6
Youngstown, OH	underpriced	-12.2	2006Q3	2009Q2	-10.2	-13.2	1.9
Springfield, MA	balanced	-5.9	2007Q1	2009Q4	-4.1	-13.1	0.9
Columbus, OH	highly underpriced	-8.5	2006Q2	2009Q4	-7.5	-12.2	0.9
Akron, OH	highly underpriced	-10.5	2006Q1	2009Q4	-7.7	-11.9	1.2
Albuquerque, NM	overpriced	7.8	2007Q3	2010Q1	1.5	-10.7	-0.7
Cincinnati, OH	underpriced	-7.3	2006Q1	2009Q4	-5.8	-10.4	1.0
Pittsfield, MA	underpriced	-13.4	2006Q2	2009Q4	-4.4	-10.3	2.2
Philadelphia, PA [Metro. Div.]	balanced	3.1	2007Q2	2009Q4	1.0	-10.3	-0.1
Memphis, TN	underpriced	-21.2	2006Q3	2009Q1	-8.3	-10.3	1.7
Atlanta, GA	balanced	-2.3	2007Q1	2009Q4	-6.3	-10.1	0.6
Canton, OH	highly underpriced	-10.4	2006Q1	2009Q4	-5.1	-8.9	1.1
Burlington, VT	balanced	3.7	2007Q3	2009Q4	2.5	-8.6	-0.9
Dayton, OH	highly underpriced	-7.7	2006Q1	2009Q4	-3.2	-8.1	0.5
Springfield, OH	underpriced	-3.2	2005Q4	2007Q4	-1.6	-6.9	0.7
Knoxville, TN	highly overpriced	11.5	2007Q2	2009Q4	0.2	-5.4	-0.1
Nashville, TN	overpriced	8.6	2007Q2	2009Q4	-1.2	-4.6	0.6
Lancaster, PA	highly overpriced	18.8	2007Q3	2010Q1	2.5	-4.2	-0.8
Johnson City, TN	balanced	0.5	2007Q3	2009Q4	-1.9	-3.9	1.0
Clarksville, TN	underpriced	-9.1	2007Q3	2009Q2	0.1	-0.8	1.5
Pittsburgh, PA	underpriced	-2.6	2007Q3	2009Q2	0.4	-0.6	1.5

**Note:* Because the percent overpriced measure can be highly volatile, the price balance measure is based on a standardized version of the % overpriced.*

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