Recent House Price Trends and Homeownership Affordability

U.S. Department of Housing and Urban Development
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House prices in the U.S. overall have increased by at least 6 percent annually for each of the past four years, according to most measures, more than twice the rate of inflation overall. Variation across markets has been substantial, and annual gains in many metropolitan areas have been well above 10 percent. The price hikes have been far in excess of income increases, and the house price to income ratio for the nation is the highest in at least twenty years.

Despite these price increases, home sales have remained strong. The number of existing homes sold in 2004 was up 10 percent from a year earlier, easily setting a new record. New home sales also have risen to record levels, and the demand that has pushed these sales has lifted new single-family construction to record levels as well. The homeownership rate–the proportion of households that own their home–is at its highest level ever, at 69 percent.

The sharp increases in house prices have spurred debate as to their causes, their implications, and the prospects for the future. Whether the increases can be fully explained by income growth and interest rates, given prevailing supply conditions, or whether prices have been boosted by speculation to "bubble" levels, has been hotly contested by analysts. The consequences of the increases in prices for household wealth and consumer spending and borrowing have been scrutinized by macroeconomists on Wall Street, the Federal Reserve, and in academia.

Finally, the outlook for house prices has been pondered not only by all these professionals but also by consumers wondering if now is the time to buy or to sell. Those anticipating that prices will drop or at least stop increasing note that house price increases have far exceeded both income growth and rent hikes for the past few years. They also point to the rising share of home sales that have been to investors, a fickle segment of the total demand base, rather than to owner-occupants. Those with a more sanguine outlook state that the record low mortgage interest rates of late are the factor reconciling the disparate facts and bring order to the assessment and stability to the outlook. They note that, as a share of household income, the cash flow costs of owning a house have not changed much.

The purpose of this report is to shed light on these questions by reviewing past research on house prices, by providing new evidence on recent trends in prices and ownership affordability, and by offering suggestions for next steps in house price research.

House Prices: Different Measures, Distinct Trends

Several measures of house prices are available, each with strengths and weaknesses. Median sales prices of both new and existing houses are available for a large number of places and are updated regularly, but they do not control for improvement in quality or fluctuations in sales volume. Hedonic indexes developed from statistical regression analysis carefully control for quality differences but require fairly detailed housing data that are available only for a limited number of places and time periods. Repeat-sales indexes cover a large cross-section of metropolitan areas and states but may not fully control for changes in housing quality. Hybrid approaches can improve on repeat-sales, largely by incorporating additional data and hedonic techniques, but obtaining those additional data on a regular basis is difficult.

Hedonic indexes estimated from the American Housing Survey (AHS) indicate that, controlling for changes in housing quality, real house prices increased 32 percent between 1985 and 2003. First-time home buyers faced price increases almost as large. By market segment, prices rose the most for the type of house typically occupied by higher income households. The price increases estimated from the AHS are somewhat less than those of the prominent Office of Federal Housing Enterprise Oversight (OFHEO) repeat sales index, perhaps because houses that are sold do not represent all houses.

Incomes, Interest Rates, and Affordability: Sharp Contrasts from House Price Trends

The recent house price increases are best assessed in comparison to consumers' ability to pay for them. There are many different ways to measure this ability to pay for housing, often labeled "affordability." The ratio of house price to income is the simplest, and indeed this ratio has risen over the past few years for both all homeowners and for first-time buyers, suggesting reduced affordability.

But the affordability story is quite different when measures of the ongoing cash flow costs of homeownership and the changes in house asset values are considered. Largely because of substantial declines in the cash costs of mortgage payments on constant quality houses, the ratio of cash costs to household income, did not increase appreciably between 2001 and 2003, despite the sharp rise in the ratio of house prices to incomes over this period. This pattern held among all owners and also among new home owners.

Housing demand has been fueled not only by the mortgage interest rate reductions but also by consumers' expectations of future capital gains from continued house price appreciation, according to findings of previous research. Illustrative calculations of our AHS data, under the assumption that future house price expectations are based on the experience of the past eight years, show that a simplified measure of "user costs" (mortgage payments less expected capital gains) of constant quality houses fell sharply between 1997 and 2003 in a diverse set of large metro housing markets nationwide.

The Long Run Determinants of House Prices

Of the theoretical approaches and models used by economists to study house prices, the most prominent is the traditional stock-flow model. The model assumes that the stock, or supply, of housing equals demand in equilibrium. The change in supply, or the flow, of housing during any period is new construction less depreciation of the existing stock. Housing demand in stock-flow models is typically taken to be a function of demographics, income, the price of housing, financing costs, and (for stock-flow models of owner-occupied housing) the price of the competing good, that is, rent. The volume of new construction in a period is taken to be a function of housing prices (what the new house can be sold for) and the costs of building that new house.

Research based on the stock-flow model has provided three basic conclusions. First, the housing market has a somewhat predictable cycle, with positive serial correlation in prices. Second, the housing market experiences significant episodes of sustained disequilibrium, because of delays in participants' realization of the disequilibrium and because of the time required for construction. Third, costs for the various factors of production do not seem closely related to the amount of construction, although poorly measured input prices may be part of the explanation.

The basic determinants of housing demand have been widely researched, and some more subtle demand factors also have received attention of late. The growth and composition of the population in a local housing market is perhaps the main demand driver in the long run, although income is obviously central to determining how much and what kind of housing is demanded. Regardless of current income, household wealth influences what consumers are willing and able to spend for housing as well as for other goods. The availability and price of mortgage financing, and the various tax provisions affecting homeowners have been shown to be strong determinants of housing demand. Among the less obvious demand factors, ownership's value to consumers has been found to depend on the risk of future rent increases they would otherwise face if they were not to buy.

The supply side of the housing market and supply effects on house prices have received less attention than has the demand side, in part because of the lack of data available to adequately understand and calibrate supply influences. In particular, little empirical evidence is available regarding the behavior of the decision makers on the supply side–developers, builders, and financiers–in contrast to the demand side of the market where decision-making consumers have been the subject of numerous surveys. Important adjustments to the housing stock and prices within segments of the market occur not only through new construction, but also through filtering of units up or down in the quality spectrum over time and also through renovations. The responsiveness of these sources of supply change, as well as new construction, to house price changes determines the overall supply elasticity of housing and the long-run effects of demand shifts on housing prices. A number of recent empirical studies have examined these components of supply change, or the overall supply elasticity, but our understanding of housing supply remains limited.

Government's Role in House Prices

Regulatory constraint on what can be built, and where, is another example of a widely acknowledged influence on house prices for which empirical evidence is inadequate due to data limitations. The paths by which zoning, building codes, environmental regulations, and property taxation and other

local fiscal policies can influence housing prices have been articulated in a number of conceptual papers, and indirect evidence has been assembled that hints at their empirical importance. But the number of direct empirical studies focused on quantifying the effects of regulation on house prices has to date been quite limited, although on balance these studies have found regulatory influences to be substantial.

House Price Dynamics: Expectations, Speculation, and Bubbles

In contrast to the fundamental demand and supply factors that determine the long-run prices of houses, in the short run prices can and do respond to changes in the expectations of market participants on both the demand and supply side. These expectations sometimes move far from the reality suggested by market fundamentals and, in some instances, cause house prices to reach unsustainable levels that some would characterize as "bubbles."

House price changes have been found to be serially correlated. A number of studies of this phenomenon suggest that this correlation is attributable at least in part to information lags. The extent of this serial correlation varies with market conditions and notably is negatively related to the local market's supply elasticity. Recent work has also examined the role of financing, and in particular the ability to "leverage up" by re-investing capital gains accrued in rising markets into even bigger houses.

The definition of house price "bubble" and its very existence have been topics of active research and occasionally heated debate. Similarly, when and why bubbles burst are questions on which there are views but no consensus. Research is increasingly turning toward behavioral finance for insights on how consumers form, and act upon, their expectations of housing market conditions. Consumers are being asked in surveys about their sources of information and their market knowledge, about the role of the media in their decision making, and on price setting in boom and bust markets.

House Price Research: What Is Needed?

Research on house prices to date has been more successful in answering some questions than others.

While better data and analytic techniques are always possible, house price research in the U.S. is in relatively good shape with regard to the key outcome measure – house prices. From the decennial Census, American Housing Survey, industry surveys, and other sources, many data are available on the sales prices of single-family homes and the market value of houses that do not transact. These data are available for a wide range of geographies and time periods. Hedonic indexes, repeat sales indexes, and other analytic tools have been developed to adjust house prices for differences in quality and location. Researchers, policy makers, the business community, and consumers are all able to compare house prices across markets and to track price changes over time.

Similarly, there are both data and understanding of some of the determinants of housing prices, notably the key tangible determinants of housing demand. How housing demand and house prices depend on income, demographics, interest rates, and tax laws have been the subjects of extensive theoretical work that has been tested in a large number of econometric studies over the past fifty years.

But research has been less successful in answering other questions about the determinants of house prices. Beginning with the demand side of the market, the intangible determinants of consumer choices are a fruitful field for future research. As described in this report, research on consumers' decision making process has been expanding lately, but more work is needed both on the theoretical/conceptual side and also regarding collection of data that will allow those theories to be tested. How consumers form their house price expectations and their assessments of the total costs of home ownership are not yet adequately understood. More generally, how consumers gather and process information about market conditions and determine the "right" time to buy or sell a house are key to understanding housing demand and short-run price dynamics.

The supply side of the housing market continues to be less researched and less well understood than the demand side, although there does seem to be growing recognition of the importance of supply conditions for house prices. Perhaps the biggest limitation has been the lack of data about supply conditions. Construction cost indexes are available, but these cover only labor and materials. Land costs are becoming a larger part of total development costs in many markets, and for the most part only anecdotal and case study information is available on the prices of buildable lots. More data on land costs, preferably comparable across markets and over time, are needed before major progress can be made on calibrating supply influences on house prices.

Government actions are major drivers of housing supply. Government regulation of land use and building design affects the cost of land, what can be built on it, and ultimately house prices. Some data are available and have been researched to estimate the effects of building codes on construction costs, but how land use regulation affects the supply and cost of housing remains a large question mark. Beyond the data sources on land use regulation described in this report, much more is needed to allow these land use controls and how they affect housing prices to be well understood. The data task is formidable, given the multidimensionality of land use controls and the importance not just of the regulations but also their enforcement, but these controls are unquestionably a major driver of housing supply, its elasticity, and house prices.

Another area of needed supply side research is on the decision making of developers, renovators, and their financiers. Even less is known here than about the decision making of consumers. What, for example, causes the time lags in suppliers' responses to changing demand and the common overshooting of supply when the response does come? Both of these features of the supply side, which have implications for house price dynamics, are observed in the aggregate but are the result of the decisions of many individuals working with imperfect information and varying incentives.

A last area of needed house price research investigates the interaction of demand and supply as it affects house prices. How do the peculiarities of housing as a durable heterogeneous good, trading infrequently in markets with imperfect information and often inelastic supply, affect house prices over time and across markets? What are the causes and consequences, especially those pertaining to house prices, of the transactions volume or turnover rate of housing in a local market? What are the unique features of extreme markets? For example, what triggers panic buying in rapidly inflating markets, and in softening markets what determines how firmly sellers hold on to their reference selling prices? One goal would be to understand the tipping point at which fear of large price increases, or decreases, converts an orderly market into a disorderly one.

I. Introduction

This is the Final Report for HUD Contract C-OPC-21895, Task Order CHI-T0007. The purpose of that contract is to study recent house price trends and homeownership affordability. The study includes a literature review, empirical analysis and recommendations for future research. A central concern is that recent house price increases may have undercut the affordability of homeownership. Given that promoting homeownership is an important part of HUD's mission, this study considers which pricing factors are making houses and homeownership less affordable. The focus of the literature review is on academic literature since 1990 along with some popular media references since 2000. The empirical results are based on a panel of American Housing Surveys from 1985 to 2003. The main finding is that house prices have increased substantially more than income or general inflation since the late 1990s. However, when viewed in terms of cost to the buyer, the drop in interest rates has resulted in mortgage payments that are largely unchanged as a share of income. Moreover, if expected capital gains are included, the user cost of home ownership has actually declined in most areas. The change in affordability depends on how much the affordability measure incorporates the expected future gains on sale of the house and expected increases in interest rates. If those future capital gains are heavily discounted because they are considered uncertain or because mortgage rates are expected to increase substantially, then the increase in house prices will undercut the homebuyer affordability.

The report starts with a description of recent developments in house prices and affordability (Chapter II) and presents various indexes used to track house prices and affordability (Chapter III). House prices have increased not only in nominal terms, but also after controlling for inflation and unit quality. Hedonic equations are estimated and a standard bundle of housing characteristics is priced for every survey year from 1985 to 2003. New owners or first time homebuyers are shown separately from all owners. New owners may be more sensitive to market changes as higher prices raise the threshold of homeownership. The analysis also subgroups owners by income, region and select CMSAs. House prices are divided by income to form an affordability index to show the relative gain in house prices (Chapter IV). Interest rate effects are measured by estimating mortgage payments for a fixed-rate mortgage. The drop in interest rates has lowered mortgage payments so that the share of income devoted to housing costs is essentially unchanged. When the analysis of user cost is extended to include expected capital gains, the house cost burden has actually decreased as current house price increases are projected into the future.

The report then examines the basic economic theory of a traditional stock-flow model along with more recent innovations (Chapter V). The model combines demand and supply factors, which are considered in detail (Chapters VI and VII). An important focus in the supply literature is that regulatory constraints limit the supply response and seem to increase house prices. Given the high prices in highly regulated markets in California and the Northeast, careful consideration is given to the theory and empirical evidence associated with regulatory constraints (Chapter VIII). The basic price models describe price levels, but a closely related set of models study the changes and dynamics of house prices. Chapter IX considers several models of house price dynamics including the financial accelerator model, which describes how small increases in prices can be compounded by existing owners trading up the property ladder. The difference between excess demand and a price bubble is the degree of speculation not supported by fundamental supply and demand. Although not a

widespread phenomenon, it is possible that house prices in some metropolitan areas are inflated with speculation. Chapter X considers the evidence on bubbles. Chapter XI delves into the behavioral finance explanations about how market participants form expectations. In short, house prices could be high because demand is strong, supply is weak or prices have become disconnected from either supply or demand. We consider each possibility for high prices as well as the possibility that prices could overshoot and collapse. The current evidence from AHS suggests that demand is strong because interest rates are low, allowing borrowers to buy higher priced houses, and past increases in house prices lead buyers to expect substantial capital gains on future sale.

It might help the reader to keep in mind the following list of research questions organized by chapter.

1. What are the basic facts about recent house price trends and affordability trends? (Chapter II)
2. What are the different types of house price indexes and what are their strengths and weaknesses? (III)
3. How are affordability indexes calculated and used? (IV)
4. What is the basic theory behind house price models? (V)
5. In more detail, what are the demand factors that affect house prices? (VI)
6. In more detail, what are the supply factors that affect the elasticity of supply and house prices? (VII)
7. What are the different types of regulatory constraints and how do they affect supply and demand? (VIII)
8. What is known about the pattern of house price dynamics and the financial accelerator? (IX)
9. How can we distinguish house price bubbles from ordinary price fluctuations? (X)
10. How do people form price expectations? (XI)

The Executive Summary provides a compressed version of the findings and a set of recommendations for future research.

II. House Price Trends

The future of the economy is, as always, uncertain. Long term interest rates, which had fallen to 40-year lows in 2003 and 2004, have maintained housing demand and especially refinancing. In 2005, mortgage rates have begun rising and most projections call for a gradual rise in interest rates with expansion in the economy. Housing has continued to support wealth through homeowner equity ($15 trillion and rising) even as stocks have stagnated ($10 trillion).[1] The homeownership rate slipped modestly in the recession,[2] but home sales set records in 2004 with 6.64 million existing home sales and 1.19 million new home sales.[3] No signs of a slowdown have yet emerged, as home sales in the first quarter of 2005 were up further from their levels of a year earlier.

The median existing home price is rose 8.3 percent in 2004 to $184,100 with a projected increase of 5.3 percent for 2005 according to the National Association of Realtors. New home prices are increasing even faster at 11.3 percent in 2004 to $215,300 but with some deceleration in early 2005. This rate of house price increase has been so great that David Lereah, NAR's chief economist, said: "A modest slowdown in home price appreciation will be healthy for the market, offering sellers a good return on their investment while keeping prices within reach for home buyers."[4] The rise in house prices is all the more remarkable because inflation remains low (2.7 percent in 2004, by the CPI) and inflation-adjusted disposable personal income increased 3.0 percent in 2004. As always, the experience of individual metro markets has varied widely, but in the aggregate the national story is one of strong increases in house prices.

Indeed, in recent years house price increases have outpaced income growth. For 2001-2003, nominal home prices by a repeat sales measure rose 7.7 percent annually, while per capita disposable income increased only 3.4 percent, according to a group of housing trade organizations.[5] The situation was quite different in the 1990s, with house prices rising only 3.7 percent annually, slightly less than the 4.0 percent pace of income gains. Over the longer period from 1975 through 2003, house price gains at 6.0 percent annually slightly outpaced the 5.7 percent rate of income growth. Again, these national aggregates mask the substantial variation in house price/income relationships across local markets.

Another change in the second half of the 1990s is that consumer debt payments as a percentage of disposable income has increased from 12 percent in 1993 to 14 percent in 2002.[6] Despite the

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1 Data from the Federal Reserve as reported by Mark Zandi, Economy.com, Inc. at a presentation on Nov. 15, 2002 on Housing and Home Price Outlook, sponsored by FDIC and NABE National Capital Chapter.

2 David W. Berson, VP and Chief Economist, Fannie Mae, "Perspectives on the U.S. Housing Market," presentation on Nov. 15, 2002.

3 National Association of Realtors, "Historically Strong Housing Market Expected in 2005," Washington, January 12, 2005 (www.realtor.org/PublicAffairsWeb.nsf/Pages/HistoricallyStrongHousingMarket05?Open Document)

4 Idem.

5 Homeownership Alliance, *America's Home Forecast: The Next Decade for Housing and Mortgage Finance*, 2004.

6 Statistics presented by David W. Berson, Fannie Mae, "Perspectives on the U.S. Housing Market," presentation on Nov. 15, 2002.

prevalence of low-down payment mortgages and cash-out refinances, mortgage debt has remained remarkably stable at 6 percent of disposable income. Apparently the increase in home equity for most owners has kept the debt burden level. However, for some borrowers the burden is too much. Default rates have increased modestly for conventional mortgage loans and more substantially for FHA, VA, and subprime loans. Most of the increase in delinquencies and defaults occurred during the recessionary period of 2000 and 2001, with some improvement in 2002. It is cause for concern that the number of mortgages in foreclosure is at an all-time high and any significant drop in prices could make the situation much worse. Despite the weak credit for some, interest rates have edged lower and house prices continue to increase. Freddie Mac projects house price appreciation of 3 to 5 percent over the long term.[7]

Homeownership Trends

Data from Census provides us a perspective on homeownership rates. As of the fourth quarter of 2004, the national homeownership rate was at a record high 69.2 percent, with the Midwest region leading at 73.7 percent and the West region trailing at 63.9 percent. Rates were up about a half a percentage point from those of the previous two years. One reason homeownership rates have risen strong despite the soft labor market of the past couple years is the aging of the baby boomers. Homeownership rates are higher for older age groups, and the aging of the very large baby boomer cohort is pulling up the rates overall.[8]

Dowell Myers of the University of Southern California has done an in-depth analysis of the 2000 Census for the Fannie Mae Foundation.[9] Most of the 2.0 percentage point gain in homeownership rates was due to aging cohorts (1.2 percentage points), with the remainder primarily due to higher homeownership rates among the elderly. In every state but Nebraska, there were gains in homeownership for people over 65 years old. Younger adults experience basically stable homeownership rates, but that was a strategic reversal from substantial declines during the 1980s. Some of the gains in homeownership can be attributed to declines in household formation, which often generates new renter households. Normally household formation and homeownership are negatively correlated. On the other hand, constant quality house prices and homeownership are positively correlated, particularly for young adults, in the cross-section statistics, perhaps attributable to price effects of strong ownership demand of this demographic group in some markets.

Geographically, homeownership rates increased most rapidly in the Mountain division, especially Nevada. During the 1990s, the number of new homeowners in the Mountain division was double the increase in owner-occupants during the 1980s.[10] Homeownership also increased by 1.5 percentage points among the 177 central cities with at least 100,000 residents after falling during the 1980s. In

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7 Frank E. Nothaft, Chief Economist, Freddie Mac, "Housing and Mortgage Market Outlook," presentation at Morgan Stanley conference, November 2, 2002.

8 Ludmilla Salvacion and Rebecca Wood (2003) "Analysis for the Housing Market", The Meyers Group.

9 Dowell Myers (2001) "Advances in Homeownership Across the States and Generations: Continued Gains for the Elderly and Stagnation Among the Young," Fannie Mae Foundation Census Note 08 (October 2001).

10 Patrick A. Simmons (2001) "A Coast-to-Coast Expansion: Geographic Patterns of U.S. Homeownership Gains During the 1990s," Fannie Mae Foundation Census Note 05 (June).

36 of the large industrial cities that suffered population loss during previous decades, the number of homeowners increased by 90,000 in the 1980s and by 163,000 in the 1990s.

Considering just the bottom 20 percent of the owner income distribution, Goodman's analysis of the American Housing Survey data shows that homeownership rates increased from 42.5 percent in 1985 to 48.5 percent in 1999.[11] This gain was larger than for any other income quintile and nearly twice as much as the increase in homeownership overall.

Affordability Trends

One reason for the improvement in homeownership between the 1980s and the 1990s is the substantial improvement in affordability. "Affordability" refers to various measures of homeownership costs relative to incomes. Not just house prices, but also mortgage interest rates and sometimes the other components of the cash costs of owning a house, are included in these calculations.

Starting at an index value of about 150 in 1971, the NAR Home Affordability Index fell more or less steadily until 1982 and then began climbing up to the 130-to-140 range, where it has been since 1993. The index shows that the typical household had about 140 percent of the income needed to purchase a home at the median existing-home price, $161,600 in the fourth quarter of 2002 and $183,100 in 2004. An index of 100 means the median-income family had enough income to buy the median-price existing home (assuming a 20 percent down payment). Undoubtedly the NAR Affordability Index is sensitive to interest rates. Exhibit 1 shows the historical relation from 1971 to 2002 between the Freddie Mac conventional mortgage rate series and the NAR Home Affordability Index (divided by 10 to make the scale comparable). The correlation is –0.94.

Another type of affordability index is presented in *The State of the Nation's Housing* by the Joint Center for Housing Studies of Harvard University.[12] Exhibit 2 shows a comparison of the after-tax mortgage payment as a percentage of owners' income and the median contract rent as a percentage of median renters' income. The main point is that housing costs decreased for owners on average between the 1980s and the 1990s. Real home prices increased by 32 percent while owner real income increased by 25 percent from 1975 to 2001. During that same period, contract rents increased 9 percent and renter real income increased only 6 percent. Overall, house prices and mortgage payments have been more volatile than rents, in large part due to interest rate fluctuations.

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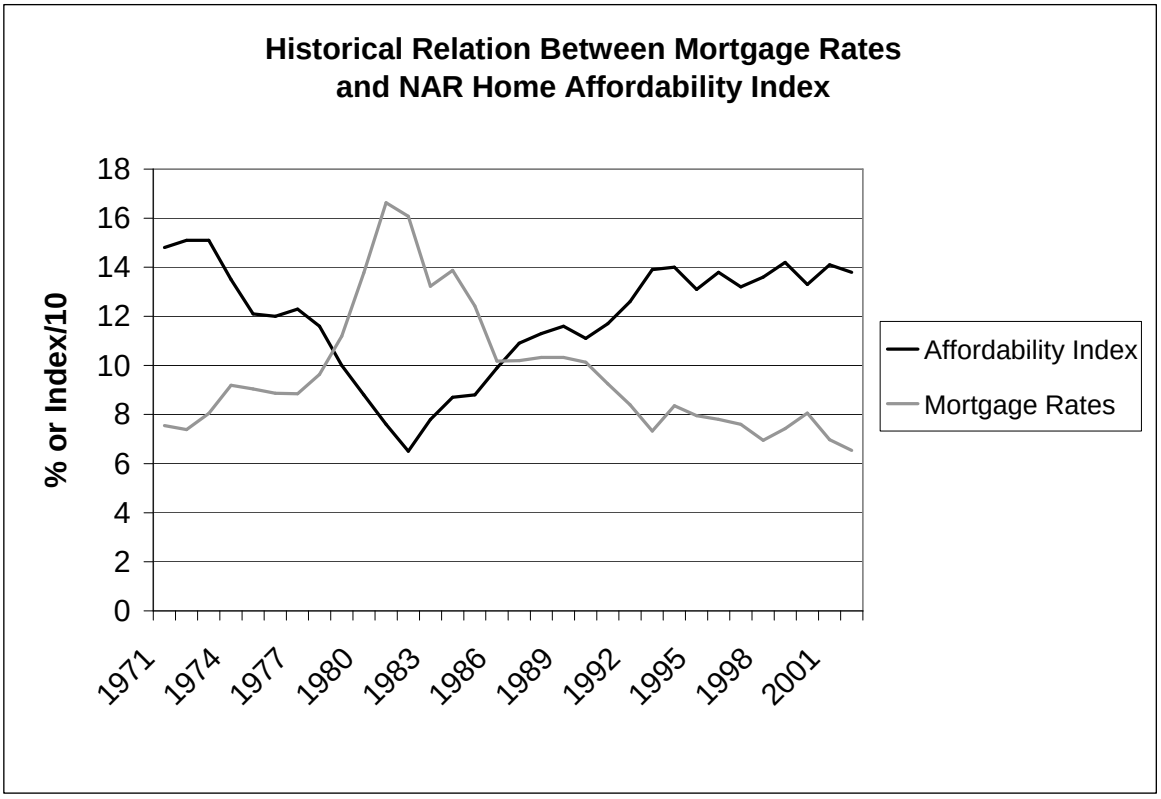
[11] Jack Goodman (2001) "Housing Affordability in the United States: Trends, Interpretations, and Outlook," a report prepared for the Millienial Housing Commission, Nov. 21, 2001.

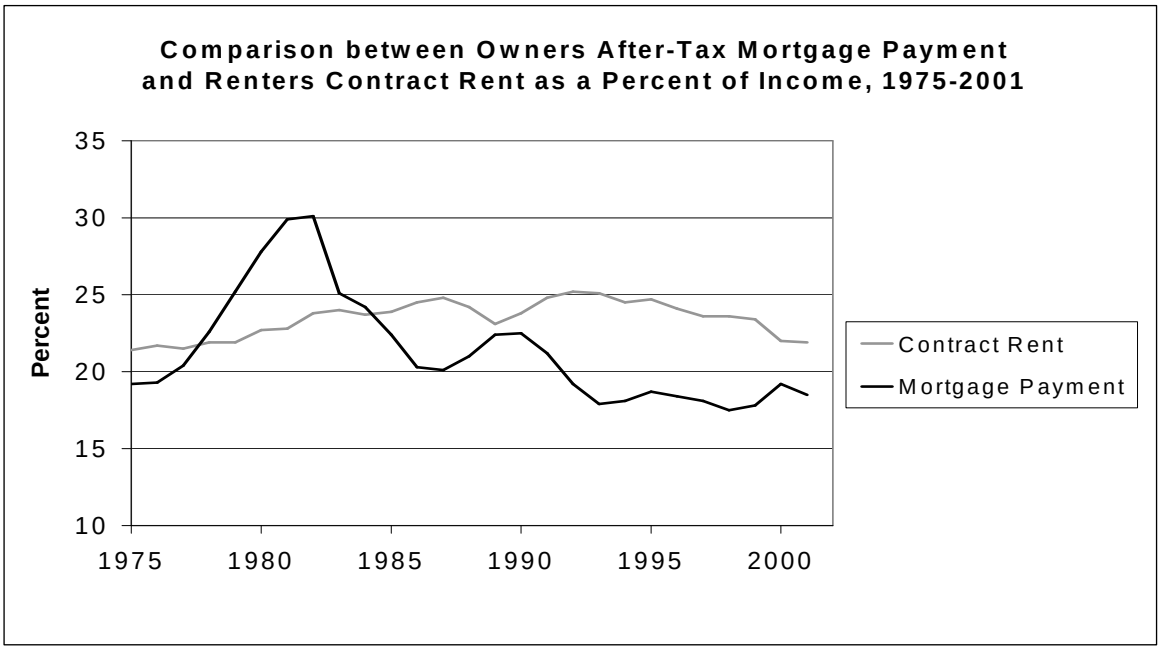
[12] Joint Center for Housing Studies of Harvard University (2002) *The State of the Nation's Housing*, Table A-3, p. 32.

Exhibit 1



Source: National Association of Realtors and Freddie Mac 30-year Conventional Mortgage Rates.

Exhibit 2



Source: The State of the Nation's Housing, 2002.

Despite the generally favorable picture of homeownership affordability at the national level, it is important to recognize that some areas and some income groups are struggling with high house prices and low incomes. Based on data from the American Housing Survey, between 1997 and 2001 the number of low- to moderate-income working families (owners and renters) who spent more than half of their income on housing or lived in physically deficient units (critical housing needs) increased from 3 million to 4.8 million.[13] These low to moderate-income working families are defined as those who work the equivalent of a full-time job and earn between the minimum wage and 120 percent of the area median income. Almost 41 million households in the United States are low- or moderate-income working families. If we expand the group to include poor households, there are 14.4 million families who face critical housing needs in 2001. Clearly, incomes have not risen sufficiently to make housing affordable for these families.

In summary, house price trends have continued strong from 1995 through 2004 with increases in most MSAs. Prices have been gradually increasing relative to income. Interest rates are rising but remain near a 40-year low, keeping monthly payments affordable for most, but also helping to lift house prices. Homeownership gains to 68 percent reflect the generally favorable conditions as well as aging of the baby boomers and efforts by lenders to serve low-income and minority households. The strong house price growth poses the largest challenge to prospective homebuyers saving for a down payment.

[13] Barbara J. Lipman (2002) "America's Working Families and the Housing Landscape, 1997-2001," Center for Housing Policy/National Housing Conference, November 2002.

III. House Price Indexes

Given that so much of the literature uses the results of house price indexes, it is useful to describe the different types of house price indexes. One important distinction between indexes is how they control for quality differences. Another feature is how representative they are of the stock in general or just sales transactions. No house price index is perfect, but the repeat-sales indexes are available for a large cross-section of MSAs and years and are widely accepted for research. See Green and Malpezzi (2003) for an excellent review (pp. 32-60).

Indexes Based on Median Sales Price

The simplest form of house price index is the median sales price.[14] The National Association of Realtors (NAR) provides a commonly used median sales price.[15] To construct the index, the NAR collects sales prices for all the houses sold in a geographic area during a month or quarter and then selects the median value. Selecting the median value helps protect the index from sales of extremely high- or low-valued properties. This approach assumes that a good measure of house prices is captured by the broadest distribution of sales prices (compared to repeat-sales or a select sample). A big advantage is that the data elements required are minimal: only sales price, location and date. These minimal data requirements make it possible to form house price indexes even for small geographic areas. Another advantage is that the index can be used for house price levels or changes. The change in nominal dollars can be deflated by an inflation index to convert the nominal index into a real index. However, a potential drawback to median sales indexes is that there is no correction for changes in house quality.

Indexes Based on Hedonic Regression

The basic challenge in measuring house prices is that houses vary so widely in attributes. At any point in time, only a small fraction of the stock of houses is sold on the market, and they are not necessarily a representative sample of the entire stock. Over time, house prices can appear to increase if the quality of homes being sold increases, even though the value of the stock is the same. Therefore, a good house price index measures the change in house prices for a constant quality unit.

One particularly important attribute for housing is location. The value of location is capitalized into the land, but the land is rarely sold separately from the building. In effect, the value of location, neighborhood, and associated externalities get bundled into the value of the land. The building features are then added to the land, and the entire bundle is priced as one sales value. Rosen (1974) originated and Triplett (1983) refined the idea of using hedonic regression to break down the sales value by property attributes. In the regression, the sales price is the dependent variable, the attributes

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[14] Michael Collins (1998) "How to Build a Neighborhood Price Index," http://pages.prodigy.net/michael_collins/Indices.pdf.

[15] NAR website for existing home sale data is: http://www.realtor.org/Research.nsf/Pages/EHSdata. NAR also provides median house price series for metropolitan areas.

are the independent variables and the estimated coefficients are the values associated with a unit of each attribute. Once the attribute values are estimated, then they can be used to price a standard bundle to determine how constant quality prices vary by time and place.

Although hedonic regression technique is fairly simple to do, there are a number of drawbacks. One technical issue is that the index varies depending on whether the standard bundle comes from the beginning or end of a time sequence. The Fisher ideal price index deals with this problem by taking the geometric average of the Paasche (terminal period attribute weights) and Laspeyres (initial period attribute weights).[16] Another technical issue is that the functional form for the regression is not determined by theory. This has led to great deal of experimentation with different functional forms, but no clear winner.

A more fundamental problem with hedonic regression is that the appropriate set of house characteristics to include in the regression is unknown. The practical solution is to include whatever attributes are available in the data set, up to the point where multicollinearity becomes a problem. For some data sets, such as the American Housing Survey, there are many combinations of attributes that explain the variation in sale prices equally well. The choice is arbitrary and can have an impact (although a modest one) on the resulting house price index.

The more serious data problem is an omitted variable problem, because important attributes are not available. Consistent estimation of the hedonic coefficients is based on the strong assumption that all omitted variables are orthogonal, meaning the included variables are independent of the excluded variables. If the omitted variables do represent new aspects not captured by the included variables, the explanatory power of the model can be impaired without them. Good examples, which we will return to later, are neighborhood characteristics and regulatory constraints. The sales price of a home definitely is affected by the neighborhood, and regulatory constraints play an important role in developing the nature of a neighborhood. But, there are countless public and private decisions that are responsible for the character of a neighborhood, and they are hard to capture with a few variables in a regression. The reliability of house price indexes built with the hedonic-regression approach depends on the included variables being a representative set of all those attributes that most affect house price. Few data sets can provide such a complete set of information.

A widely-used hedonic index is Census's Constant Quality C-27 Series (now part of C-25).[17] House prices are adjusted for 10 characteristics: floor area, land area, number of stories, number of bathrooms, air conditioning, presence of a fireplace, type of parking, type of foundation, geographic location, and proximity to a metropolitan area.

The American Housing Survey (AHS) has frequently been used for hedonic house price indexes because it provides a rich source of variables for attributes, including some neighborhood variables. Thomas Thibodeau has estimated house price indexes at both the national and metropolitan levels,

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[16] Richard A. Meese and Nancy E. Wallace (1997) "The Construction of Residential Housing Price Indices: A Comparison of Repeat-Sales, Hedonic-Regression, and Hybrid Approaches," Journal of Real Estate Finance and Economics, 14(1/2): 51-73.

[17] U.S. Bureau of the Census (1991) *Price Index of New One Family Homes Sold. Current Construction Reports* Series C-27.

along with a rental services index at the national level.[18] There are also separate indexes for new housing, existing standard-quality housing, and substandard housing.

The house value reported in the AHS is the owner's memory of the sales price, if the house was purchased within the previous 12 months, or the owner's estimate of the house value. Goodman and Ittner (1992) found there was no significant bias from owner estimated house values. DiPasquale and Somerville (1995) calculated that owners consistently overestimated their house value, but the time series patterns between AHS-based and NAR indexes are similar, except near market turning points. More recently, Kiel and Zabel (1999) found that recent homebuyers report house values 8.4 percent above the sales price, while longer tenure owners overvalue by only 3.3 percent. Overall, owners overvalue by 5.1 percent.

Indexes Based on Repeat-Sales Methodology

House price indexes are most often used to track changes in house prices over time. Transaction data can be linked, so that we can compare the sales price for the same house at different times. The difference in those sales prices shows how much prices have increased for a particular bundle of attributes. We do not need to know the attributes to determine how much the price has changed. By taking the average increase in prices, the repeat-sales house price index can determine average house price appreciation rates without having to measure all the attribute characteristics of the properties sold. Bailey, Muth and Nourse (1963) proposed this approach, but its popularity stems from work by Case and Shiller (1987, 1989), in which they refined the methodology to control for heteroscedastic errors. The problem is that the size of the errors is related to the time in between sales, and this violates the assumption of equal error variances in least squares regression. Case and Shiller proposed an auxiliary equation of the squared residuals regressed on a constant and a measure of time between sales. The fitted values from the auxiliary regression are then used to create weights for a second stage weighted least-squares regression that provides coefficient estimates corrected for time-dependent error variances.

Although the repeat-sales indexes avoid the onerous amount of data required for a hedonic index, there are a number of potential drawbacks and strong assumptions. One problem is that the sample of house sales is much smaller when only houses sold two or more times are included. Not only does this decrease sample size, but there also is a real concern that the included sales may not be representative of all sales and the entire stock. Starter homes or homes with undesirable qualities might be expected to turn over more frequently, as liquidity-constrained families use those houses as stepping stones to better houses. A related issue is that many houses go through renovation or extension between sales. If there is a way to identify such changes, those properties can be dropped from the sample, but otherwise the value gains may mistakenly distort the index. Another assumption implicit in the repeat-sales method is that attribute prices remain constant between sales so that the attribute prices cancel out in the construction of the house price index. Meese and Wallace (1997) tested the assumptions of representative sample selection and constancy of pricing parameters on data

[18] Thomas G. Thibodeau (1995) "House Price Indices from the 1984-1992 MSA American Housing Surveys," *Journal of Housing Research*, 6(3):439-481.

from Oakland and Fremont, California. They found the repeat-sales method fails both tests in this particular case.[19]

Nevertheless, the repeat-sales approach has become practically the industry standard. Fannie Mae and Freddie Mac have combined their transaction data, and OFHEO publishes the resulting house price indexes at the national, regional, state and large metropolitan levels on a quarterly basis.[20] The indexes also provide diffusion parameters that allow researchers to estimate the rate of increased variance in the house price distribution over time since last sale. Even if the OFHEO index or the closely-related Freddie Mac index do not perfectly control for quality changes, the fact that they are updated every quarter for such a wide range of geographies (and are free) has made them the house price indexes of choice in research.

Indexes Based on Hybrid Approaches

A number of hybrid approaches have been developed over the years that attempt to take the best of both worlds between hedonic and repeat-sales indexes. The main obstacle to widespread acceptance is usually lack of data, but for customized purposes these innovations can be useful. Gatzlaff and Ling (1994) tested an assessed-value technique. The idea is to broaden the repeat-sales sample to include single-sale properties by using an assessed-value in place of a second sales value. The assessed-value comes from property tax records, and the underlying assumption is that those assessments are not biased.

Furthermore, assessment data often provides some information on property attributes that can be used for quality controls. According to Pollakowski (1995), assessment data can include specific location, structural characteristics, and information on zoning and land use. The location information can be used to geocode the properties and merge in information on neighborhood characteristics as well as control for spatial autocorrelation (Can, 1992; Can and Megbolugbe, 1997). Another potentially valuable use for the neighborhood characteristics is to control for sample selection bias, so that high turnover properties do not distort the house price index (Pollakowski, 1995). One drawback of assessment data is that assessments are usually performed on a cycle of 3 to 5 years, and not all quality adjustments are captured in the data. Even though there may be doubts about the reliability of the assessed value, especially in high growth areas, the other information from assessment records can be used to improve house prices.

Kiel and Zabel (1997) tested hedonic, repeat-sales and hybrid house price indexes using the confidential version of the AHS data from 1975-1991. The confidential version at Census allowed them to supplement the public use AHS data with census-tract-level neighborhood information and correct for categorical coding of house values. They found that omitting neighborhood characteristics led to improvements in neighborhood quality appearing as increases in the price index (supposedly

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[19] Gatzlaff and Haurin (1997) use a sequential censored sample estimation procedure to evaluate the repeat-sales methodology and found that the subsample of repeat-sales homes gives biased house prices which are highly correlated with the percentage change in employment. Dombrow, Knight and Sirmans (1997) also found instability of parameters over time, which could bias repeat-sales indexes and virtually any house price index.

[20] The OFHEO indexes are available on the web at: http://www.ofheo.gov/house/. The Freddie Mac index is found at: http://www.freddiemac.com/finance/cmhpi/faq.htm.

for a constant quality house and neighborhood). However, Kiel and Zabel also concluded that transaction data are not representative of the entire housing stock.

In summary, median house prices are available for a large number of places and updated regularly, but they do not control for the gradual improvement in quality or fluctuations in sales volume. Hedonic indexes carefully control for quality differences, but rely on data like the AHS, which is only available for the largest MSAs on a rotating basis. Repeat-sales indexes cover a large cross-section of MSAs and states on a quarterly basis with some controls for quality changes, but not for sales volume. Hybrid approaches can improve on repeat-sales, largely by incorporating additional data and hedonic techniques, but obtaining that additional data on a regular basis is difficult. Overall in spite of flaws, repeat-sales indexes are the most common for research purposes.

Analysis of American Housing Survey, 1985-2003

This section presents an analysis of house price trends using the American Housing Survey (AHS) data from 1985-2003. The American Housing Survey is a national housing unit survey conducted every other year by the Census for the U.S. Department of Housing and Urban Development. The survey is well suited for hedonic analysis because it collects detailed information about unit and neighborhood characteristics as well as returning to the same units each survey even if the households have changed. The methodology is to estimate a hedonic regression to value characteristics of owner-occupied housing units (mostly single-family detached houses, but also some townhouses and condominium units in multifamily structures) for each survey year and then use the hedonic coefficients to value a standard bundle over time. Dollar values have been converted into constant 2003 dollars using the Consumer Price Index less shelter.[21] The resulting trend in house prices of the standard bundle shows the change in house prices controlling for unit quality and inflation.

The specification for the hedonics regression follows Thibodeau (1995) for the independent variables and uses log of house price as the dependent variable.[22] The regression coefficients for each survey year are presented in Appendix A1.[23] The number of observations ranges from 21,000 to 29,000 per year and the goodness-of-fit measured by R^2 ranges from 0.35 to 0.45.[24] The standard bundle of housing characteristics is based on average characteristics from owner-occupied units across all years.

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[21] Consumer Price Index less shelter means the housing component of the index has been removed. It is the housing component that records the increase in house prices. If the CPI with shelter is used, the house price series is being partially deflated by itself. In this case, it is preferable to show the real change in house prices relative to general inflation excluding house prices.

[22] Following Thibodeau and other analysts, the independent variables include demographic characteristics of the occupants, including race and household size. These are intended to proxy for unobserved housing and neighborhood conditions and conditions that might affect the rental contract terms.

[23] The estimated coefficients and standard errors for square footage in each of the hedonic regressions are 0.000 due to the scaling of this variable. In fact, square footage has a significant positive effect on house prices in each period, as indicated by the t ratio values for the estimated coefficients.

[24] These R^2 values are somewhat lower than those reported by Thibodeau. The likely explanation is that the hedonics here are estimated on national data, whereas Thibodeau and other analysts typically estimate the equation for individual metro areas. Because house prices vary so much from market to market (even controlling for physical features) and our specification does not include locational dummies, this cross-market variation goes uncaptured by our equations.

Exhibit 3 presents the weighted descriptive statistics of the average bundle for all owners and Exhibit 4 does the same for new owners. The houses of new owners tend to be lower value, smaller in size, younger in building age, and more likely to be a mobile or manufactured house.

Exhibit 3. Average Bundle for All Owners in 1985-2003

Variable	Name	Obs	Mean	Std. Dev.	Min	Max
House Value (dependent variable)	value	282575	120927.2	114175.9	0	681012
Suburb	suburb	282575	0.514	0.500	0	1
Non-Metro	nonmet	282575	0.250	0.433	0	1
One full bath	baths10	282575	0.502	0.500	0	1
Zero Bedrooms (studio/efficiency)	bdrms0	282573	0.001	0.028	0	1
One bedroom	bdrms1	282573	0.028	0.164	0	1
Two Bedrooms	bdrms2	282573	0.229	0.420	0	1
Four or more bedrooms	bdrms4p	282573	0.224	0.417	0	1
Single family attached	attached	282575	0.046	0.210	0	1
Two to four units	twoto4	282575	0.027	0.161	0	1
Five to nine units	fiveto9	282575	0.007	0.082	0	1
Ten to nineteen units	tento19	282575	0.006	0.074	0	1
Twenty or more units	twentyp	282575	0.014	0.117	0	1
Mobile home	mobile	282575	0.077	0.266	0	1
Age of Unit	unitage	282575	35.701	23.049	0	94
Steam or hot water	hsys2	282575	0.116	0.320	0	1
Electric heat pump	hsys3	282575	0.095	0.293	0	1
Baseboard or electric coils or pipeless	hsys4	282575	0.077	0.267	0	1
Vented/unvented room heaters	hsys5	282575	0.035	0.183	0	1
Other heating	hsys6	282575	0.055	0.228	0	1
At least one room air-conditioner	acsys2	282575	0.252	0.434	0	1
Central Air	acsys3	282575	0.525	0.499	0	1
Sewer	sewer	282575	0.701	0.458	0	1
Unit is adequate	adequate	281476	0.952	0.214	0	1
Age of the household Head	agehead	282575	51.982	16.239	14	93
Neighborhood is good (4-8)	goodnbhd	274379	0.472	0.499	0	1
Neighborhood is fair/poor (1-3)	fairpoor	274379	0.020	0.140	0	1
Head of household is Black non-hispanic	black	282575	0.080	0.272	0	1
Head of household is Hispanic	hispanic	282575	0.051	0.221	0	1
Persons per room (excludes bathrooms)	crowds	281476	0.445	0.235	0.047619	6
Square footage	sqft	255357	1941.209	1185.468	99	10421
Years in the unit	yearsin	279683	14.835	13.142	1	89

Exhibit 4. Average Bundle for New Owners in 1985-2003

Variable	Name	Obs	Mean	Std. Dev.	Min	Max
House Value (dependent variable)	value	12850	98457	90414.19	0	681012
Suburb	suburb	12850	0.517	0.500	0	1
Non-Metro	nonmet	12850	0.200	0.400	0	1
One full bath	baths10	12850	0.543	0.498	0	1
Zero Bedrooms (studio/efficiency)	bdrms0	12850	0.002	0.042	0	1
One bedroom	bdrms1	12850	0.042	0.201	0	1
Two Bedrooms	bdrms2	12850	0.292	0.455	0	1
Four or more bedrooms	bdrms4p	12850	0.139	0.346	0	1
Single family attached	attached	12850	0.080	0.271	0	1
Two to four units	twoto4	12850	0.037	0.190	0	1
Five to nine units	fiveto9	12850	0.013	0.115	0	1
Ten to nineteen units	tento19	12850	0.012	0.110	0	1
Twenty or more units	twentyp	12850	0.021	0.142	0	1
Mobile home	mobile	12850	0.126	0.332	0	1
Age of Unit	unitage	12850	31.407	25.021	1	85
Steam or hot water	hsys2	12850	0.093	0.290	0	1
Electric heat pump	hsys3	12850	0.108	0.310	0	1
Baseboard or electric coils or pipeless	hsys4	12850	0.085	0.278	0	1
Vented/unvented room heaters	hsys5	12850	0.027	0.161	0	1
Other heating	hsys6	12850	0.041	0.198	0	1
At least one room air-conditioner	acsys2	12850	0.235	0.424	0	1
Central Air	acsys3	12850	0.526	0.499	0	1
Sewer	sewer	12850	0.786	0.410	0	1
Unit is adequate	adequate	12781	0.948	0.222	0	1
Age of the household Head	agehead	12850	33.053	9.693	14	93
Neighborhood is good (4-8)	goodnbhd	12664	0.519	0.500	0	1
Neighborhood is fair/poor (1-3)	fairpoor	12664	0.021	0.143	0	1
Head of household is Black non-hispanic	black	12850	0.106	0.308	0	1
Head of household is Hispanic	hispanic	12850	0.096	0.295	0	1
Persons per room (excludes bathrooms)	crowds	12781	0.496	0.266	0.0625	3.5
Square footage	sqft	11290	1614.222	940.718	99	10421
Years in the unit	yearsin	12850	1.572	0.495	1	2

The trend in quality-controlled, constant dollar, house prices for all owners and new owners is shown in Exhibit 5. The patterns over time are very similar, with the price for all owners about 16 percent higher than for new owners. The 95 percent confidence intervals around each path show that they are significantly different and precisely estimated. Although house prices have been increasing since 1993, they did not surpass the previous high from 1989 until 1999. Since then, however, the increases have been substantial (10 percent in 2001 and 7 percent in 2003 for all owners).

As a means of reference, Exhibit 6 shows the OFHEO house price index deflated by CPI less shelter compared with quality-controlled, AHS house price indexes for all owners and new owners. All three indexes are normalized to 100 in 1985. The indexes are similar though OFHEO increases faster than the AHS indexes, especially between 2001 and 2003. The logical explanation is that OFHEO does not control for quality changes, such as remodeling, as well as the AHS does. Another possibility is that AHS represents the full stock of owner-occupied housing, whereas OFHEO represents the units with repeat sales. It may be that units with rapid appreciation are more likely to be repeat sales or more likely to be in growth markets. For example, second homes were 36 percent of the houses sold in 2004.[25] Demand for these investment properties is strong and may be pushing up the OFHEO

[25] National Mortgage News (3/3/2005) reported on research by National Association of Realtors. Seconds include both rentals as investment properties and vacation homes. They estimate that there are 43.8 million second homes in the United States compared with 72.1 million owner-occupied units.

index but excluded from the AHS index of owner-occupied properties. A third possibility is that AHS has a higher representation of manufactured housing units.

Exhibit 5. House Price for Average Bundle for All Owners and New Owners

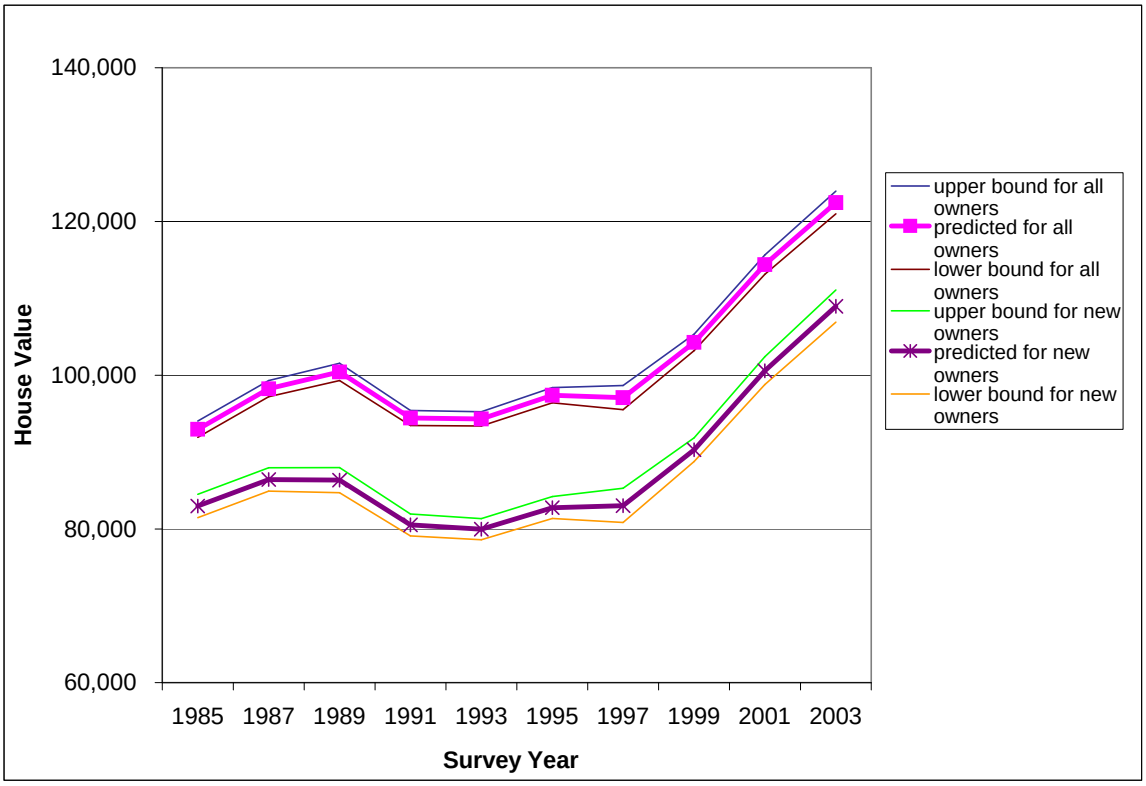
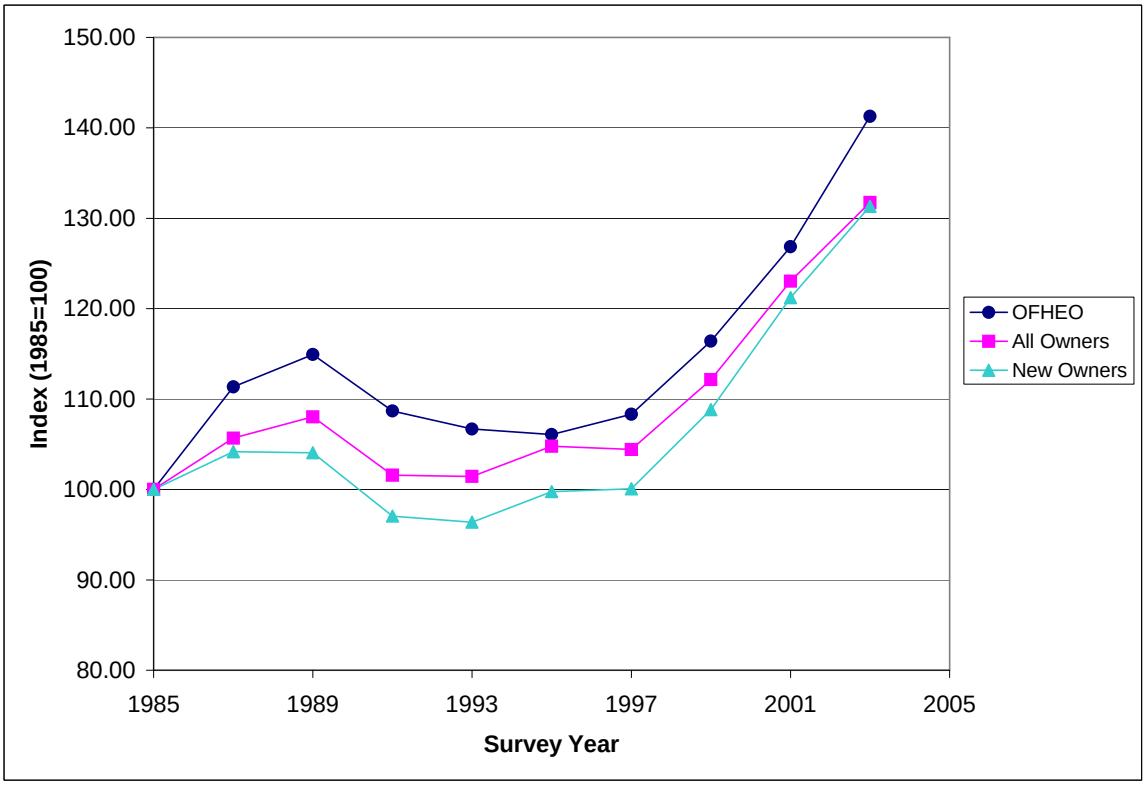


Exhibit 6. OFHEO and AHS House Price Indexes



Manufactured Housing Share

The average bundle includes manufactured houses (MH), which have lower value than site-built houses. A major increase in the share of single family units that are MH could account for some of the difference between quality-controlled and non-quality-controlled house price increases. According to AHS, the share of MH relative to all owner-occupied units has increased fairly steadily from 7.0 percent in 1985 to 8.3 percent in 2001 before dropping back to 7.6 percent in 2003. New owners are more likely to purchase MH units, which are less expensive than site-built housing, but the trend in MH shares for new owners has been decreasing. If site-built housing was becoming relatively more expensive, we would expect new owners to substitute MH housing. In fact, 14.1 percent of new owners bought MH in 1985, which declined to 12.5 percent in 2001 before dropping to 6.6 percent in 2003. The drop from 2001 to 2003 is suspiciously large and may sampling error or other data problems, but the overall trend has been for smaller shares of new owners buying MH. The pattern for low-income, new owners is less clear. The share of MH is higher for the low-income groups, but the pattern over time bounces around indicating a small sample effect. The overall trend by new owners to reduce the share of MH may be because buyers expect site built houses to appreciate more than MH and thus provide a more secure investment. Alternatively, zoning regulations constraining the growth of MH parks may be forcing some new owners to buy the more expensive site-built houses. Either way, the reduction in MH share gives a partial explanation why quality-controlled housing price increases are somewhat lower than the increases in median house prices reported by NAR.

By Income Group

Although new homebuyers tend to buy less expensive homes, they have above average incomes, at least when current income rather than permanent income is used. This section evenly divides owners into high, medium and low income groups (separately for all owners and new owners) according to the income distribution in 1995.[26] Again, hedonic regressions are estimated for each survey year and then applied to the average housing characteristics for each income group. The goal here is to determine whether house prices are increasing at a different rate for low-income vs. high-income owners.

Exhibit 7a shows the house price paths for each income group with all owners being the higher of each pair and new owners being the lower. There is very little difference between all owners and new owners for the medium income group, but much wider spreads for high and low income groups. In fact, the low-income new owners have the lowest house price increases of all. The percentage gains in house prices are larger for the high-income owners (32 percent) than for medium-income owners (29 percent) or low-income owners (26 percent). Exhibit 7b displays the same information by income group, but it is normalized so that 1985 equals 100. This view accentuates the relative changes with house prices for high income households rising more than for low income households, but all have increased sharply since 1997.

[26] For all owner, the high income group are those with 1995 household income above $67,611 and the low income group are those below $31,392. For new owners, the high income group are those above $62,323 and the low income are those below $38,636.

Exhibit 7a. Constant Quality House Prices for All Owners and New Owners, by Income Group

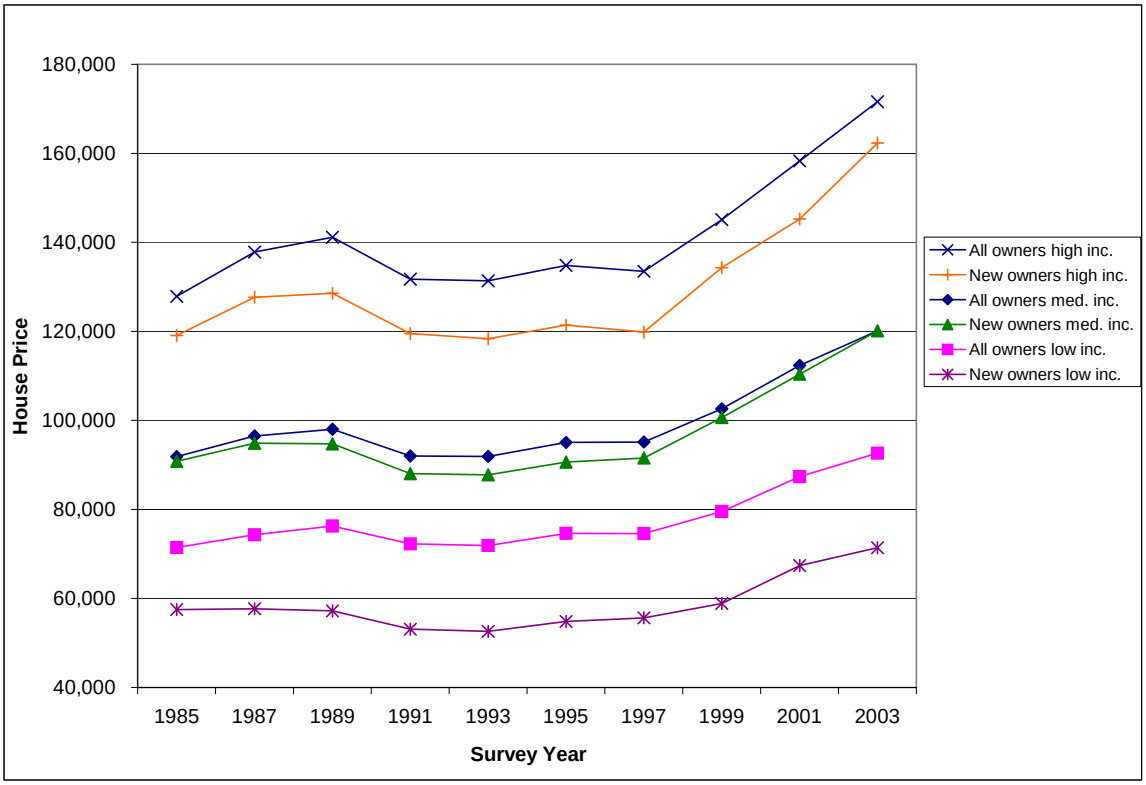
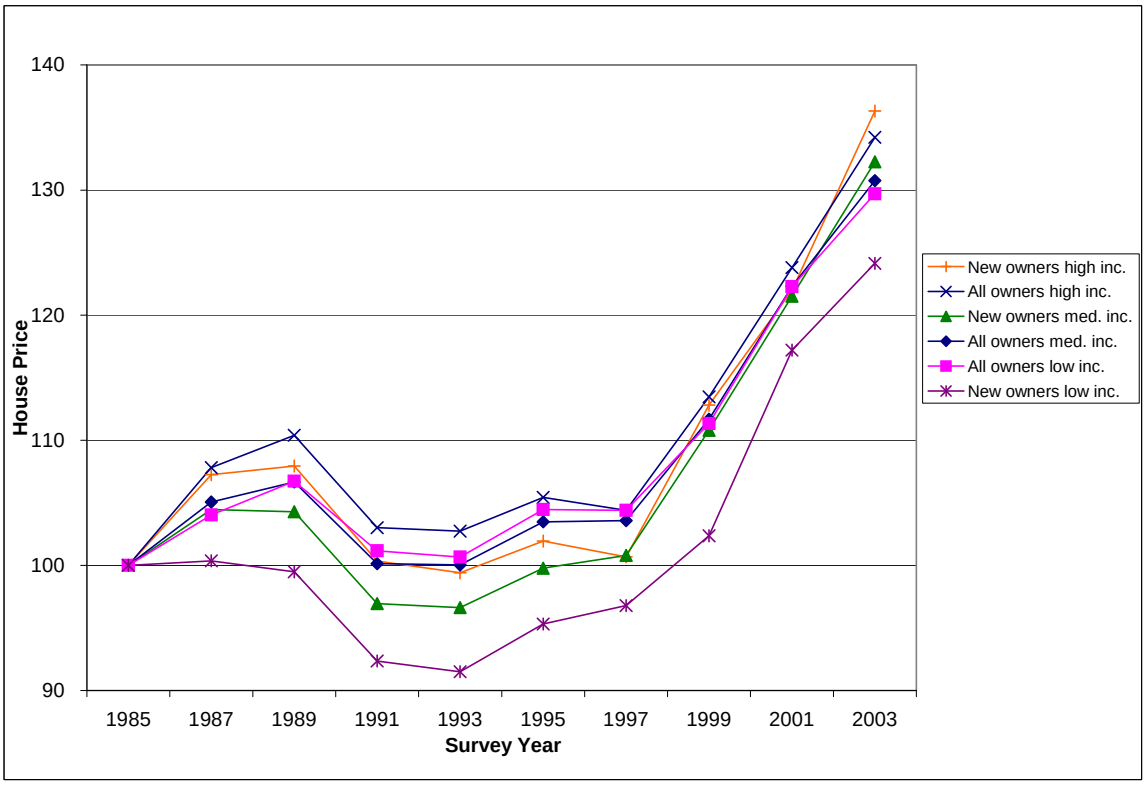


Exhibit 7b. Constant Quality House Price Index for All Owners and New Owners, by Income Group, Normalized (1985=100)



By Census Region and CMSA

Following the same procedure used for income groups, we estimated separate hedonic regressions for the four Census regions, pricing the typical housing bundle found in that region. Exhibits 8a & 8b show the house prices for all owners by region. The patterns are the same for new owners except new owners are 12 percent lower than all owners. The West has the highest level and most rapid house price increases, no doubt driven by the California market. The Northeast did not surpass its 1989 high by 2003 though its increases since 1999 have been parallel to the West. The Midwest shows consistent, but more modest, increases since 1993, while the South has had the smallest increases. The normalized version in Exhibit 8b (1985=100) highlights the long term, steady gain in the Midwest.

The AHS provides identification for 13 metropolitan areas by the broad CMSA definition. We also produced hedonic price indexes for the typical housing bundle found in each of these metro areas. For visual clarity, the house price paths are shown on two graphs, Exhibits 9 and 10. As expected from the regional paths, Los Angeles, Boston and New York have the highest levels and the fastest growth. However, two other Northeastern cities, Buffalo and Pittsburgh, are among the lowest in house price level and in price growth since 1985. Abstracting from the levels, the normalized versions, Exhibits 9b and 10b, feature the relative changes since 1985. Providence experienced the largest percentage gain and Dallas suffered a loss.

Exhibit 8a. Constant Quality House Prices for All Owners, by Region

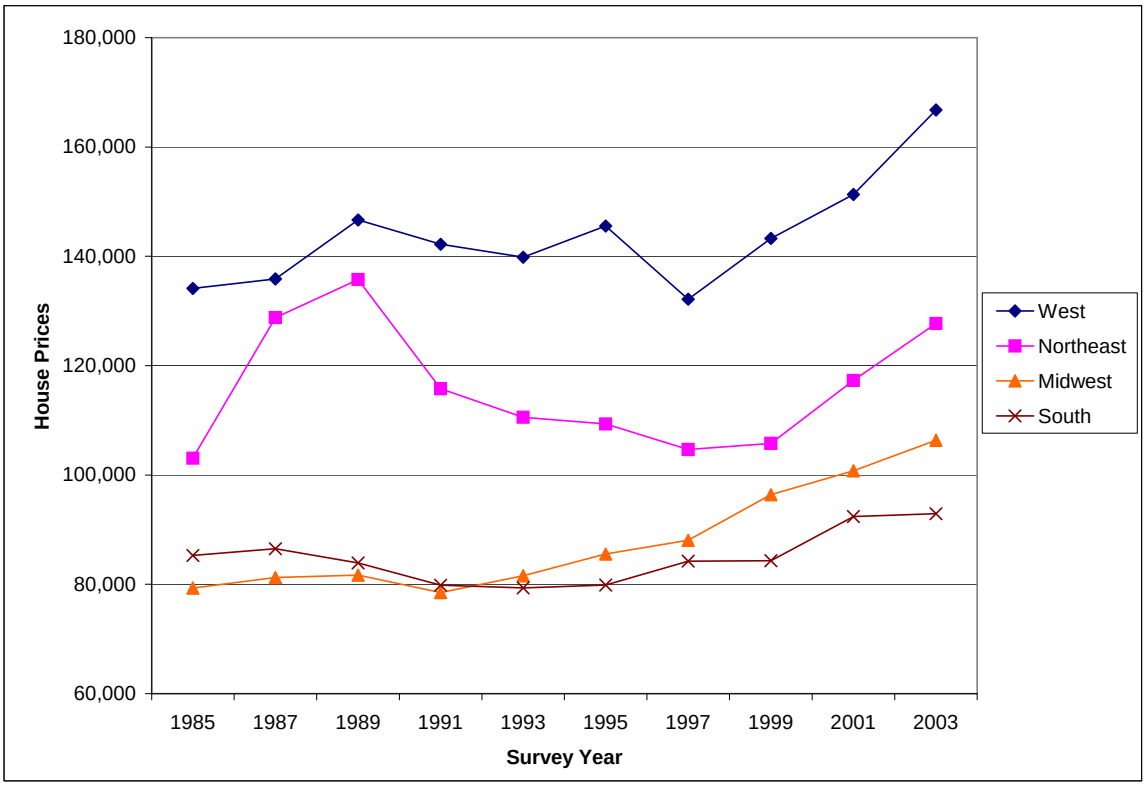


Exhibit 8b. Constant Quality House Price Index for All Owners, by Region, Normalized (1985=100)

Exhibit 9a. Constant Quality House Prices for All Owners, by CMSA

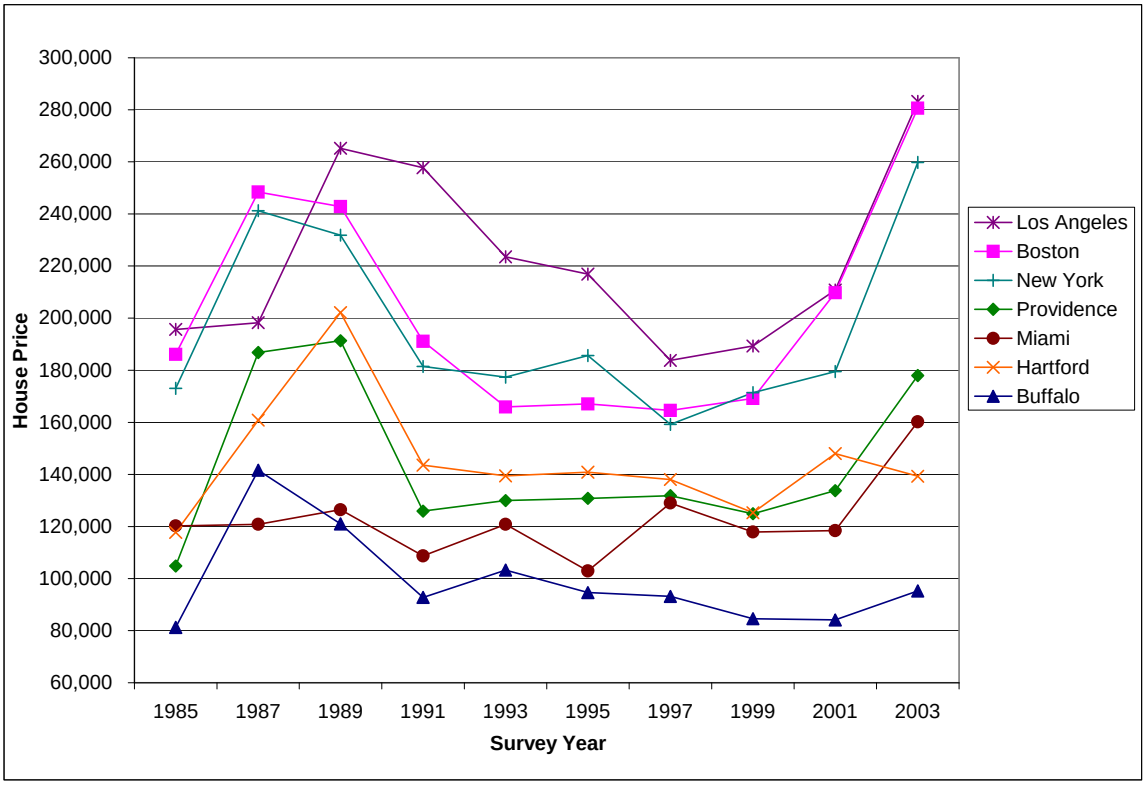


Exhibit 9b. Constant Quality House Price Index for All Owners, by CMSA, Normalized (1985=100)

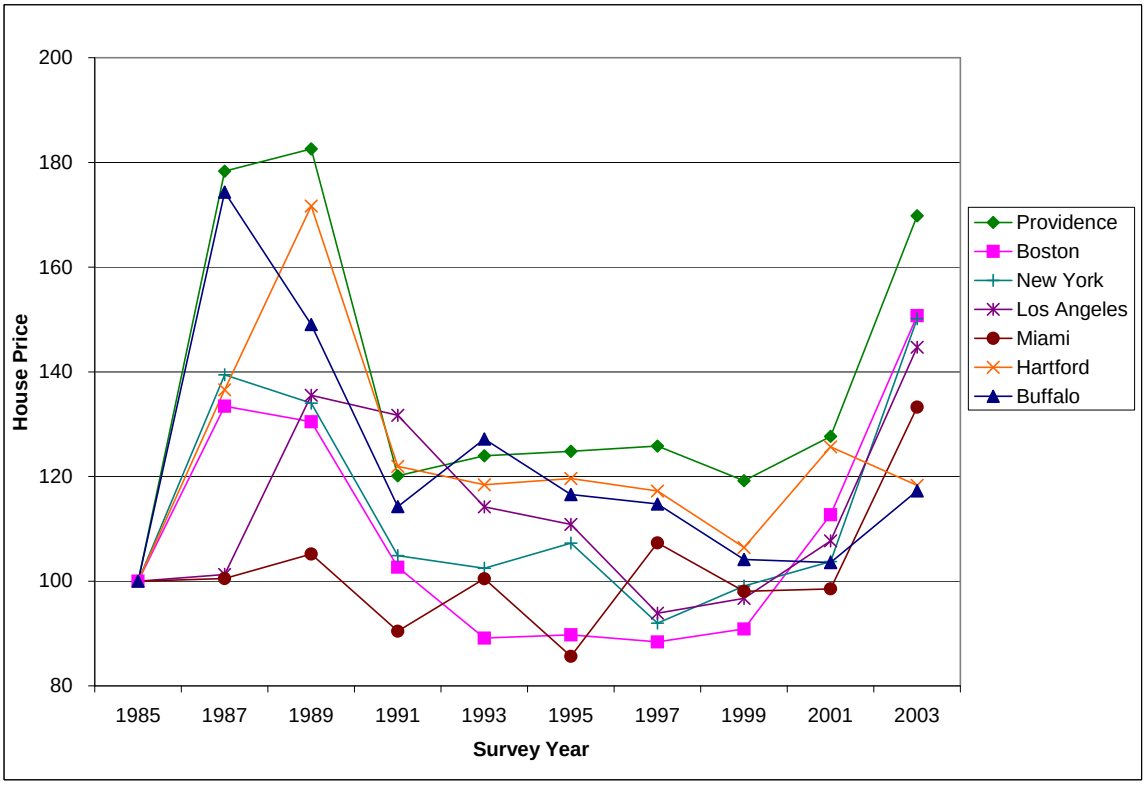


Exhibit 10a. Constant Quality House Prices for All Owners, for More CMSAs

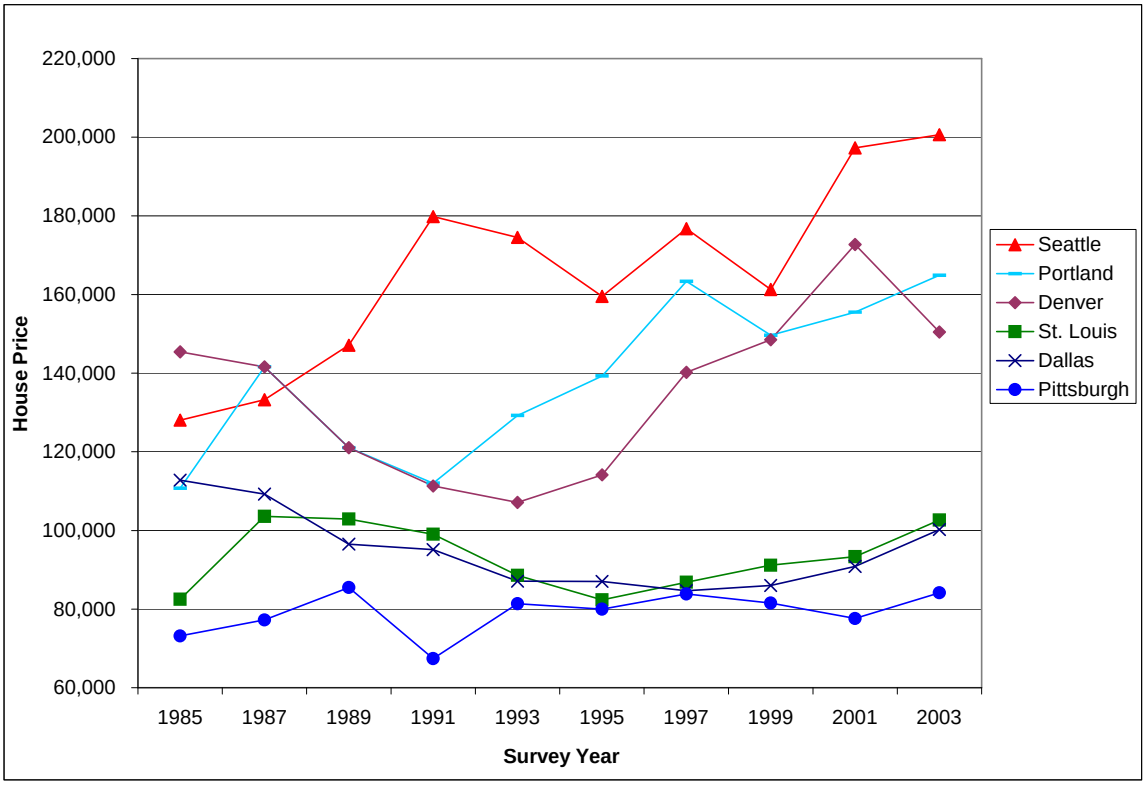
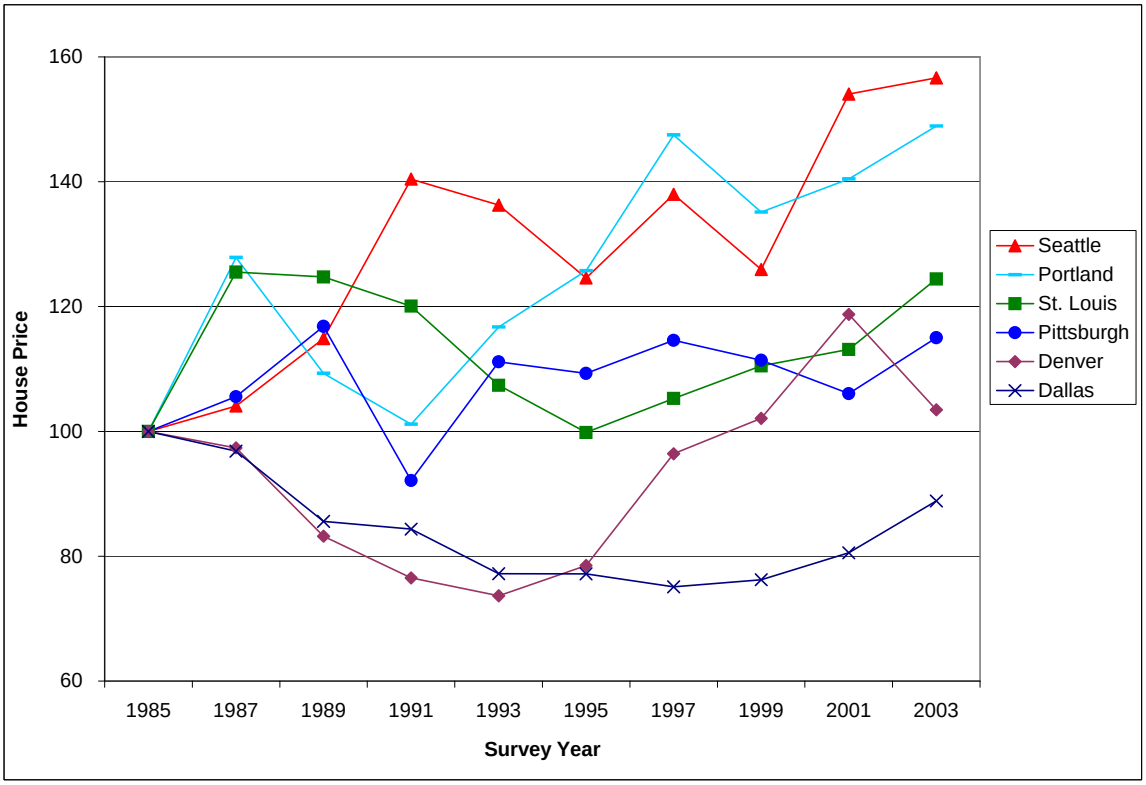


Exhibit 10b. Constant Quality House Price Index for All Owners, for More CMSAs, Normalized (1985=100)



IV. Affordability Indexes

Whether house prices are high or low, or rising rapidly or slowly, is properly assessed only by comparing price developments to other relevant variables, particularly household income, the most common summary measure of purchasing power. High growth in house prices relative to incomes for an extended period would cause affordability problems. This chapter describes the various kinds of affordability indexes along with their findings for select MSAs.

The essence of an affordability index is a comparison between the cost of housing and the income of a household. As investors, owners benefit from tax-free capital gains on their house, but face the risk of capital losses. Owners can also deduct their property taxes and mortgage interest payments from their income on their federal taxes. Owners get to live in their investment rent-free, though they have to pay for the mortgage, maintenance, and insurance, and for the sizable transactions costs of becoming a homeowner. Owners can be subdivided by type (first-time buyers, recent buyers or long term owners) and by metropolitan housing market. Houses can be subdivided into new or existing structures. Given these complexities, it is little wonder that there are many ways to measure housing costs for owners and just as many versions of affordability indexes.

However, we can order the indexes. Simple indexes do not adjust for taxes, capital gains, or inflation. These indexes implicitly assume that owners do not make decisions based on all available information. In effect, the assumption is that information is costly to collect and process, so potential homebuyers rely on the most readily available real estate news. Though denigrated by traditional economists as "irrational," behavioral finance research by Shiller (1990, 2002b) provides support for this view.

There is another motivation for keeping the affordability index simple. Transparency promotes credibility. Simple indexes usually require less information to calculate, so they can be applied to many places and many years. A consistent time series over the full housing cycle can reveal the broader context for the current index level. More sophisticated calculations, especially in proprietary or "black box" indexes, can be sensitive to the choice of parameters that are not fully explained to the reader. The reader should beware that affordability indexes used selectively by advocates can exaggerate either the loss of affordability or that "now is the best time to buy." Simple indexes are less amenable to manipulation.

A simple way to represent affordability is to divide house prices by annual income. No adjustment is made for user costs or even quality of housing. Goodman (2001) reports from AHS data that, for all homeowners, the ratio of house price to household income increased from 2.08 in 1985 to 2.17 in 1999. For recent buyers, the ratio increased from 1.89 in 1985 to 2.15 in 1999. This suggests house prices are getting less affordable relative to incomes. Subdividing the owners by income quintile shows the affordability ratio increased the most for the lowest quintile (from 2.50 in 1985 to 2.93 in 1999) and actually declined for the highest quintile (from 2.31 in 1985 to 2.10 in 1999).

Another simple affordability measure is the share of income spent on housing in terms of a flow of housing service rather than as an asset. Policymakers have set 30 percent of income as the standard for affordable housing, and this standard can be applied to both renters and owners. Housing costs are measured as out-of-pocket costs, such as mortgage and insurance payments for owners and

contract rent for renters.[27] The percentage of income measure does not adjust for the quality of the unit or the tax-free capital gain accruing to owners. Most renters would gladly pay the same amount in mortgage payments as they pay in rent if they could be building up equity with their monthly payments. Also, some people might be willing to pay beyond 30 percent of their income for a better unit in a nicer neighborhood. Nevertheless, 30 percent provides a consistent benchmark, and researchers can use either AHS or Census to gauge how many families have housing cost burden greater than 30 percent.[28]

In his book, *Shelter Poverty*, Stone (1993) rightly points out that the lowest income households cannot afford 30 percent of their income for housing. Instead, Stone proposes a sliding scale according to income, household size, and type. The maximum amount available for housing is the amount remaining after the household pays for a minimal standard for non-housing consumption. If actual housing costs exceed what the household can afford to pay after minimal non-housing consumption, the household is shelter poor. Applying this measure in 1991, there were 15 million more people in shelter poverty, who paid more than 30 percent of the income for housing.

Lerman and Reeder (1987) compare the 30 percent of income standard with a "quality-based" measure of affordability. The quality-based measure determines for how many households 30 percent of income is too little to rent a minimally adequate but decent, safe and sanitary unit using the HUD Section 8 adequacy standard. Using AHS data, the researchers found that 35 percent of the households with affordability problems defined by the conventional measure had no affordability problem as defined by the quality-based measure, and 19 to 23 percent of rental households with affordability problems by the quality-based measure were not burdened according to the conventional measure. Overall, the conventional measure overestimated the extent of quality-based affordability by 20 percent in 1975 and 24 percent in 1983. An important assumption is that households could find an available unit at the "adequate" rent. While the quality-based approach points to some of the limitations of the 30 percent standard, the standard is an easy way to measure the demand for affordable housing.

The NAR Home Affordability Index (HAI) compares the median family income to the cash flow needed to afford the median house.[29] The calculation assumes a 20 percent down payment, and the monthly payment is determined by the current interest rate according to the Federal Housing Finance Board and HSH Associates. The median income value comes from Census. An index value of 100 means the median income family spends 25 percent of its monthly income to pay the mortgage on the median priced house. An index value of 120 means the median family income is 120 percent of the income needed to pay for the median house. A higher index value indicates the housing market is more affordable.

The HAI is primarily designed for the potential homebuyer (Glascock and Slawson, 1996). In fact, NAR provides several variants, with calculations based on a fixed-rate mortgage (FRM), an

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[27] In both cases, out-of-pocket costs include utilities.

[28] The Center for Housing Policy considers 50 percent the limit for severe cost burden. By that measure and using National AHS data, the fraction of low- and moderate-income working homeowners with severe cost burden went from 7.8 percent in 1997 to 9.9 percent in 2001. During that same period, the number of low- and moderate-income working homeowners increased 30 percent. Lipman (2002), Table 3.

[29] The calculation methodology for the NAR Home Affordability Index is described on the website: http://www.realtor.org/Research.nsf/Pages/HAmeth .

adjustable-rate mortgage (ARM), and a composite reflecting the FRM and ARM shares in the market. NAR also reports a first-time homebuyer index adjusted for the common terms of the mortgage prevailing in the market. Down payment and income ratios have become more lenient over time, and the NAR does not want to discourage renters from becoming homebuyers. However, the HAI does not adjust for quality of houses over either time or place. A city may appear more affordable because the quality of housing there is lower. There is also no adjustment for inflation, taxes or capital gains and the focus is clearly on the middle of the income distribution. The underlying assumption is that the median house price reflects the relative supply vs. demand for whatever housing is on sale in the market. This makes sense for a local housing market.

At the national level, however, NAR's Home Affordability Index follows a path that closely resembles the inverse of mortgage rates.[30] The index shows increases from 1982 to 1993, but little gain since then. In recent years the increase in house prices has offset the fall in interest rates, so that affordability has remained essentially the same.

More complex affordability measures attempt to control for tax effects and capital gains from the investment value of a house. House price increases make housing more expensive for potential owners, but actually less expensive for existing owners. The appreciation in house value increases the equity and wealth of the homeowner, so that a forward-looking, rational owner would recognize the capital gain as a reduction in the cost of housing. The tax code allows tax-free capital gains on owner-occupied housing up to $500,000. Furthermore, property taxes and mortgage interest are deductible from current income. The value of these tax deductions depends on the marginal tax rate of the owner, which varies over time and between owners.

The Joint Center for Housing Studies of Harvard University publishes annually *The State of the Nation's Housing*, which includes housing costs as a percent of income. Although not touted specifically as an affordability index, it captures many of the aspects of a good affordability index. First, the index and its components are clearly explained. In the 2002 publication, all dollar amounts are in constant 2001 dollars. Monthly income data comes from the Current Population Survey. House prices are based on 1990 NAR median house prices, with annual adjustments using the Freddie Mac Conventional Mortgage Home Price Index. Mortgage costs assume a 30-year mortgage with 10 percent down, and the interest rate comes from the Federal Housing Finance Board. Tax savings are based on the excess of housing and non-housing deductions over the standard deduction. The net result, shown in Exhibit 2 (above), is that after-tax mortgage payment as a percent of income has fluctuated without a clear trend around 18 percent from 1992 to 2001 (with a high of 19.2 in 1992 and 2000 and a low of 17.5 in 1998). At least at the national level and for the middle-of-distribution homeowner, there does not appear to be an affordability problem. Next, we look at the metropolitan level to see where there are affordability problems.

News reports provide us a glimpse of proprietary affordability indexes that are designed primarily for investors. These are affordability indexes because a primary ingredient is the relationship between house prices and income. It is impossible to know exactly how these indexes are calculated, and it may be difficult to get a consistent time series to see how the indexes track the complete housing cycle. However, they do focus our attention on cities with extreme price increases or declines. They

[30] The National Association of Home Builders (NAHB) discontinued its cash flow affordability index named the Housing Opportunity Index (HOC) as of the first quarter of 2002. This index by NAHB was comparable to NAR's Housing Affordability Index.

are also more likely to provide forecasts of expected appreciation rates, which are so important to investors and mortgage insurance companies. For example, United Guaranty publishes the ACUFactor mortgage risk index that rates the best and worst metropolitan housing markets according to: home prices, overall economy, population stability and mortgage delinquency trends.[31] By this index, the markets most likely to face house price declines are: Anchorage, Topeka, Colorado Springs, Fort Smith and Honolulu. The least risky MSAs (or housing markets most likely to have affordability problems due to house price increases) are: Asheville, Santa Rosa, Las Vegas, Orange County and Fresno.

Another mortgage insurance company, The PMI Group, reports the PMI Risk Index.[32] This index shows there is no evidence of a housing price "bubble," but there was a 32 percent increase in the likelihood of significant house price declines over the next two years. The national score of 126 in July 2002 means there is a 6.8 percent likelihood of house price decline. For the 50 largest metropolitan areas, the index score is 140, which implies a 7.6 percent likelihood of decline. The high risk cities include: Austin, San Jose, Portland, Seattle, Salt Lake City, Phoenix, Denver, San Francisco and Oakland. Cities with a low risk of price declines are: Philadelphia, Providence, San Diego, Washington, D.C., Baltimore and Norfolk-Virginia Beach-Newport News. There appears to be little correspondence in the rankings of ACUFactor and the PMI Risk Index.

One other proprietary model found on the Web is the Housing Cycle Barometer™ devised by John Burns to help "real estate industry executives with their strategic decisions by simplifying complicated and often conflicting information."[33] Although Burns does not provide full detail for his model, the Barometer readings (shown in Exhibit 11) are a weighted average of the price/income ratios and the mortgage payment/income ratios. There is a strong emphasis on comparing current readings to the historical median, with the underlying presumption that markets revert toward the mean over the long run. He explains that low interest rates historically contribute to house price increases, but some cities have become so overpriced that even low mortgage rates cannot support sustained appreciation. Barometer readings range from 0 (underpriced) to 10 (overpriced) and readings from 7.5 to 10 have a high probability of price decline (labeled "large housing bubble").

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31 Rick Grant (2002) "New Index Ranks Risk in MSAs," *National Mortgage News*, August 12, 2002.

32 National Mortgage News (2002) "Index Finds Risk of Home Price Bubble Growing," October 21, 2002, p. 11.

33 John Burns (2002) "The Housing Cycle Barometer: Which Markets Are Poised for Rapid Appreciation, and Which Are Not," June, 26, 2002, http://www.housingzone.com/topics/hz/economics/hz02fa606.asp .

Exhibit 11. Housing Cycle Barometer™ Readings for the Most Overpriced and Underpriced MSAs

Overpriced	Housing Cycle Barometer™	Current Price/Income	Historical Median Price/Inc.	Current Mortgage/Inc	Historical Mortg/Inc
Boston	9.3	7.0	4.4	44.9%	40.4%
San Diego	7.8	6.7	4.9	43.1%	39.2%
Ft. Lauderdale	7.6	4.5	3.3	29.1%	25.1%
San Francisco	7.3	7.3	5.5	46.7%	45.6%
Miami	7.1	4.7	3.7	30.0%	27.7%
Underpriced					
Hartford	1.0	3.3	3.5	21.0%	29.9%
Dallas	0.8	2.4	2.7	15.5%	20.6%
St. Louis	0.6	2.1	2.5	13.3%	19.8%
Indianapolis	0.0	2.1	2.3	13.4%	18.8%
Philadelphia	0.0	2.5	2.9	16.2%	23.5%
U.S. Average	4.0	3.5	3.3	22.1%	25.2%

According to Burns, the outlook for the next 10 years is:

- Rising homeownership rates driven by the aging of the baby boom and federal programs promoting homeownership.
- Constraints on new housing supply in many markets prevent the construction of affordable new housing.
- High home equity and low mortgage rates generate more luxury and second-home purchases.
- Strong employment growth continues for highly-skilled individuals.

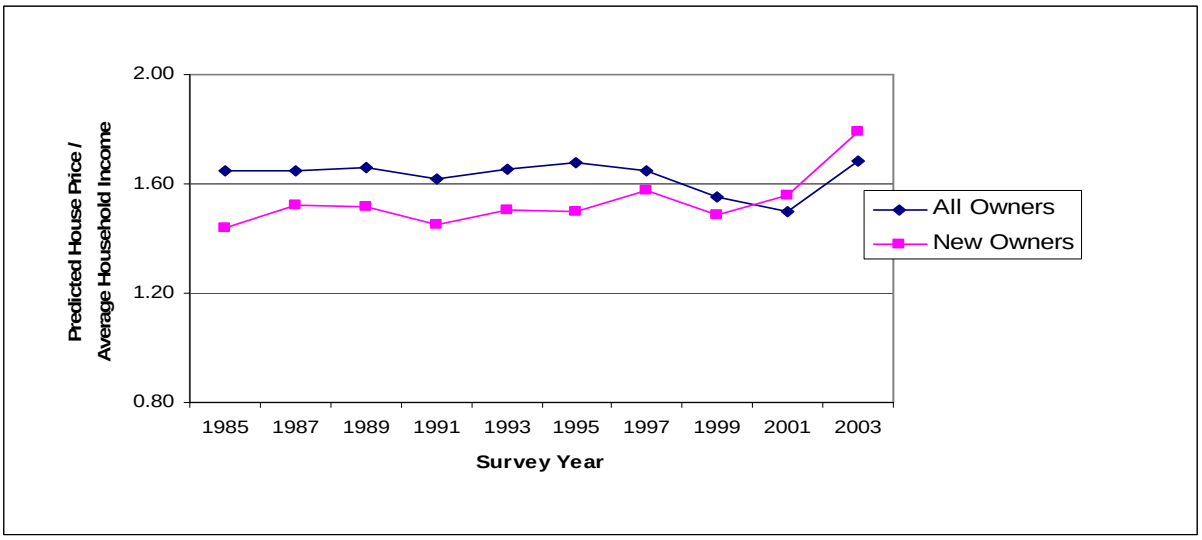
It is difficult to know what model is used to create this forecast, but it does represent the current conventional wisdom in the real estate industry.

One way to improve on the national affordability indexes is to customize them for metropolitan and local housing markets. Another enhancement would be to customize the income, tax and capital gain calculations for each household in a survey such as AHS or Census. Bourassa (1996) has developed a borrowing constraint method and applied it to Australian survey data. In essence, the models estimate the probability of renters becoming owners under alternative underwriting and economic policies. A logical extension is to estimate more complete supply and demand models, some of which we review below. A disadvantage of the more elaborate models is they require much more data down to the household level. This level of detail makes it impossible to cover smaller cities or to provide annual reports.

House Price Burdens Using AHS Data, 1985-2003

As a continuation of the AHS data analysis, we divide house prices by household income to determine whether quality-adjusted house prices are growing faster than incomes. Exhibit 12 shows that all owners have an average house price to income ratio of 1.63 compared with 1.53 for new owners.[34] The pattern was fairly consistent from 1985 to 1997 when the ratio fell for all owners and was surpassed by new owners. Since 2001, the new owners have shouldered higher house prices relative to their incomes. Part of the explanation for the switch is that the income of new owners has not grown as fast as the income of all owners. In 1995, all owner income was 5 percent higher than for new owners (same as 1987). However, by 1999 all owner income was 10 percent higher than new owner income and by 2003 it was 20 percent higher.[35] House prices followed a different pattern. All owner house prices were 12 percent higher in 1985 and 2003. In between, the ratio crept up to 18 percent higher in 1993 before retreating. The net effect of lower relative incomes and the same relative house prices is that the house price burden has increased for new owners.

Exhibit 12. House Price to Income Ratios for All Owners and New Owners



A logical extension is to look at house price burdens by income subgroups. The top two paths in Exhibit 13 show the house price burdens for low-income owners. Recall that all owners include retirees with low current income, while many new owners recently qualified for a mortgage based on their income. Therefore, it is not surprising that the house price burden is highest for low-income "all" owners. A cause for concern is the increase in house prices relative to incomes for both the low-income and medium income groups since 1997. House price burdens have increased 17 to 30 percent between 1997 and 2003 for the low and medium-income groups. Only the high-income groups have had a growth in income to match their house price appreciation.

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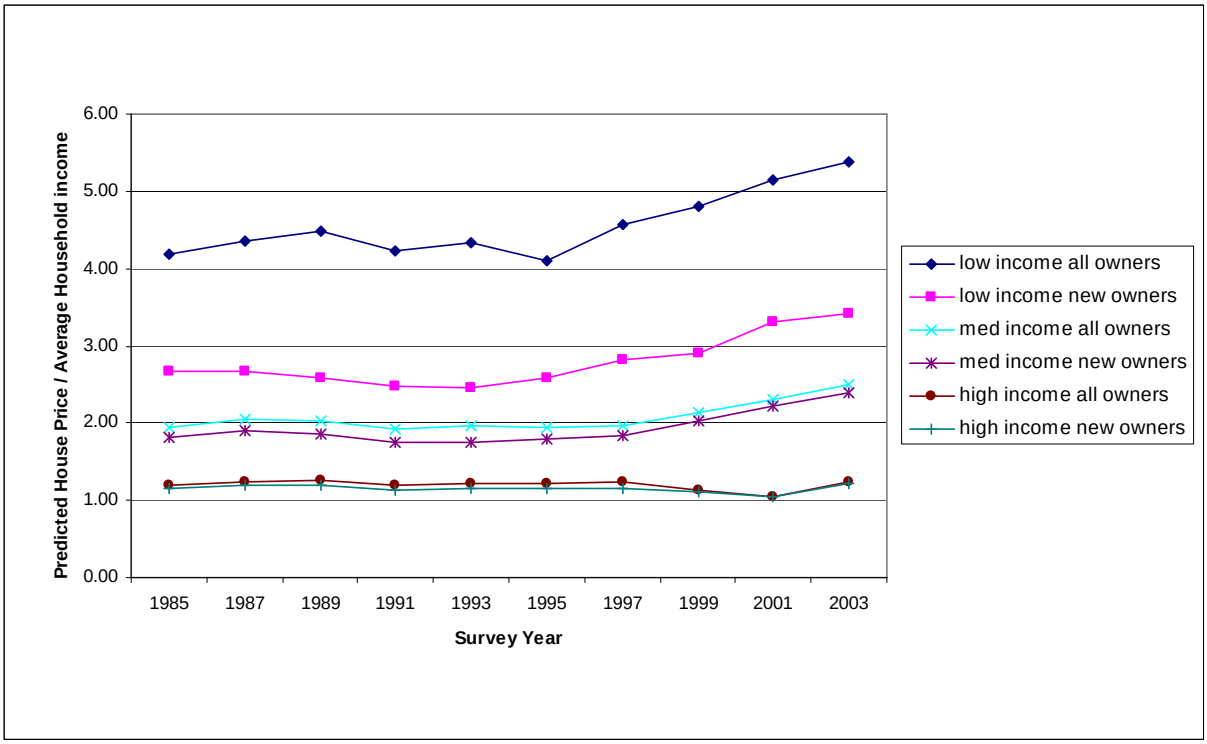
[34] The ratios in Exhibits 12 and 13 are calculated as the hedonic's predicted price for a constant –quality house divided by the mean household income for the specified group of owners.

[35] The mean income of all owner households (in 2003 $) was $58,066 in 1995, $67,209 in 1999, and $72,729 in 2003. For new owners, the corresponding figures were $55,294, $60,840, and $60,822. The lagging income growth of new owners may be attributable to a changing composition of this group, as lower interest rates and more accommodating underwriting allowed more lower income households to become owners.

Exhibit 13. House Price to Income Ratios, By Income Group



Financing Costs Relative to Income

Most non-elderly owners finance their house purchase with a mortgage and the size of the monthly mortgage payment is sensitive to the mortgage interest rate. The key question in this section is whether the drop in mortgage rates has offset the increase in house prices. In other words, what share of monthly income goes toward mortgage payments? We assume the mortgage is a 30-year fixed rate mortgage with 5 percent downpayment refinanced at the average rate obtained by new owners in each survey period. This simplifying assumption, which conforms more to behavior for new owners than for all owners, allows us to focus on the financing terms that were available in the market at various times, whether or not consumers chose to tap them. Many existing owners do not bother to refinance for small decreases in mortgage rates, but the reductions in interest rates during the 1985 to 2003 period were so large that most owners did refinance at some point. Exhibit 14 shows the pattern of financing cost to income for all owners and new owners. On average, financing costs are about 10 percent of income for owners. For most of the period new owners paid a smaller share of their income for housing than all owners, but recently they have become essentially equal. The main point is that the drop in interest rates has meant that households have paid about the same share of their monthly income for mortgage payments since 1985 despite the substantial increases in house prices relative to income, especially in the most recent years.

Again, we can examine the patterns by income subgroup, as shown in Exhibit 15. Low-income households pay a high share of their monthly income for housing (assuming they have an outstanding mortgage). However, the upward slope in the house price to income ratio has been leveled out when house prices are replaced by financing costs. The reduction in mortgage interest rates has offset the increase in house prices such that the house cost burden has stayed essentially unchanged.

Exhibit 14. Financing Costs to Income for All Owners and New Owners

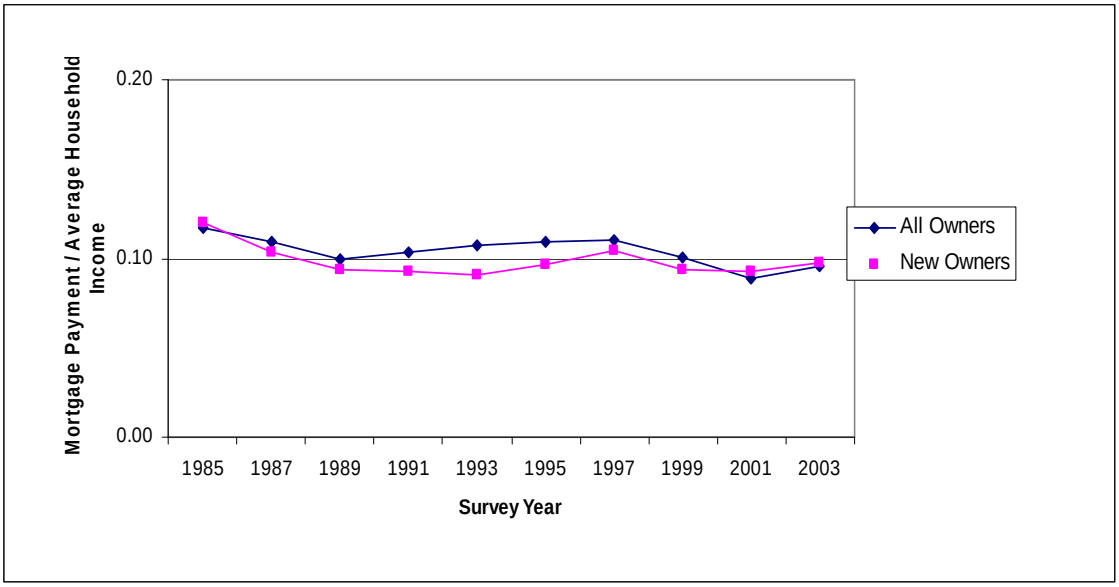
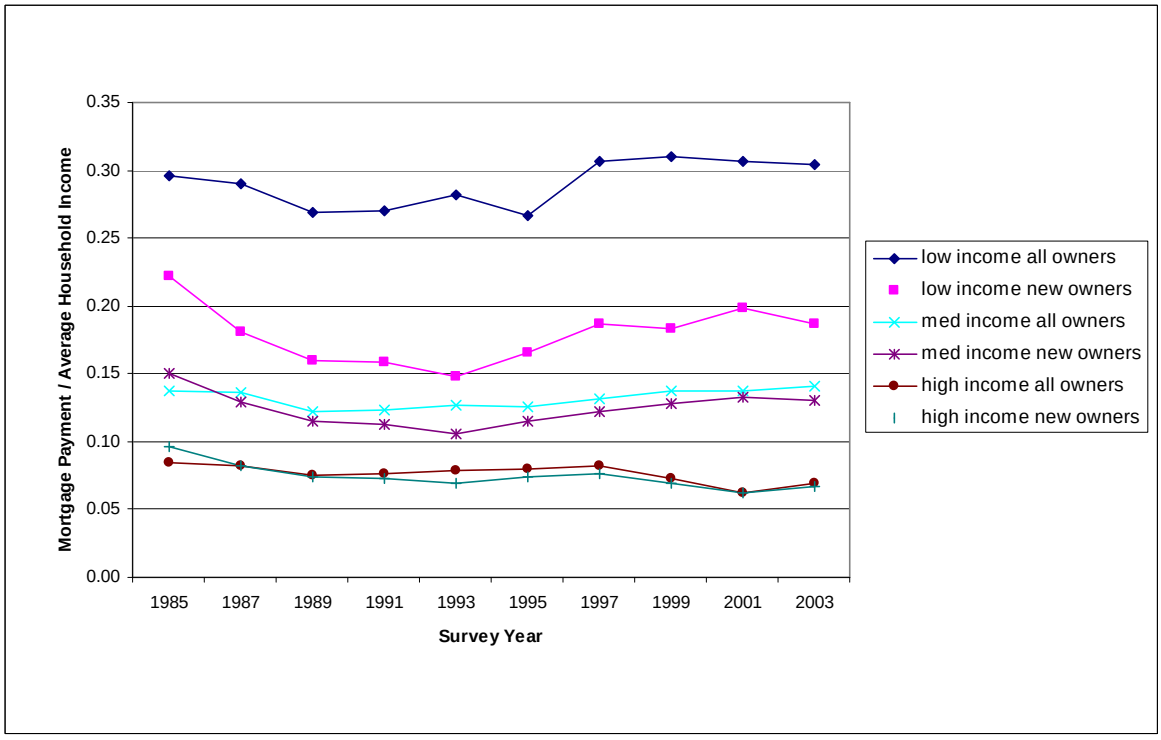


Exhibit 15. Financing Costs to Income Ratios, by Income Group



Adjust User Cost for Expected Capital Gain

The cost of homeownership is much more complicated than mortgage payments. However, many factors, such as income deduction of mortgage interest and property taxes, do not change dramatically over time. The factor that can change substantially is the expected capital gain when the house is sold. The house provides both consumption value as a place to live and investment value as an appreciating asset that will eventually be sold. The owner builds up equity as the house increases in value. Even if the monthly payments are a large share of the owner's income, the owner may consider it a worthwhile investment if he or she will recover that investment with a high rate of return on sale.[36] The challenge is to estimate how much the typical owner expects house prices to increase over a normal holding period. There is no one solution (Green and Malpezzi, 2003). As a simple demonstration, we assume the owner expects the next 8 years to be the same as the last 8 years. When the owner sells the property after a holding period of 8 years, the owner expects the real house value to have increased as much as the OFHEO index over the last 8 years. We rule out negative gains under the assumption that the buyer would not be willing to buy a house if she thought it would lose value. The future capital gain is discounted using a deflated value of the 10-year Treasury rate. The monthly user cost is calculated as the mortgage payment less the expected capital gain (prorated per month). The analysis is done for the 13 largest CMSAs identified in AHS. Spreadsheets for the 13 CMSAs are in Appendix A2.

To clarify, consider the calculation for the Los Angeles CMSA, as depicted on Exhibit 16. The first two blocks show the predicted house price (in logs and dollars) for all owners and new owners. The next block to the right assumes a 5 percent downpayment and calculates the mortgage amount relative to the predicted house price. The next two blocks give current mortgage interest rates on an annual basis followed by the conversion of those interest rates into real monthly interest rates. Those interest rates are then used to calculate a monthly mortgage payment. On the lower panel of the spreadsheet, the capital gain is calculated assuming that the OFHEO house price index will increase over the following 8 years as it had in the previous 8 years. That future value is then discounted by the 10-year Treasury note rate (deflated by CPI) and then divided by 96 to get the monthly share of capital gain. In Los Angeles, the capital gains for the previous 8 years actually turned negative for 1995 to 1999, so the capital gains are limited to zero in Steps 1 and 2. In Step 3, the user cost of capital is calculated as the monthly mortgage payment less the expected capital gain. The user cost can be negative if the expected capital gain is larger than the monthly mortgage payment. In reality, there are other user costs beyond the mortgage payment, such as maintenance and insurance, but there are also other discounts, such as the interest rate deduction and property taxes. However, these amounts do not vary nearly as much as the capital gains, so we focus on the first order effects of mortgage payments and capital gains. The final block gives the user cost to income ratio. Again, because the capital gain can exceed the mortgage payment, the user cost can be negative and thus the user cost to income ratio can also be negative.

In Los Angeles, the history of the user cost to income ratio has fluctuated significantly over the period 1985 to 2003. House prices were rising rapidly in the late 1980s until the California recession hit in 1991 to 1995. By 1997, house prices began to increase again, but our backward-looking expectations continue to have zero expected capital gains until 2001. By 2003, the expectations of capital gains were so large that they exceeded the monthly mortgage payment and the user cost to income ratio

[36] Motoko Rich (2005) "Speculators Seeing Gold in a Boom in the Prices for Homes," New York Times, March 1 as posted on the internet (www.nytimes.com/2005/03/01/national/01spec.html?pagewanted=print&position=)

became negative. There are considerable uncertainties about future capital gains so the owner may discount those expected values and include them with a shorter lag than our method. Nevertheless, the main point is that as long as the owner expects to benefit from the house price increases, either from gain on sale or borrowing on the accumulated equity, then the house price increases can lower the owner's cost of capital.

Exhibit 17 presents the user cost to income ratios for other CMSAs. A high line, such as Los Angeles, means the user cost is high relative to income in that CMSA. Most lines follow a pattern of decline after 1997 and new owners have a similar pattern. The recent increases in house prices can actually reduce the user cost to owners assuming the owners can take advantage of those higher prices when they sell their property. This presentation is not to deny that house prices are increasing or that owners are spending a higher share of their income on housing. However, housing is an investment good as well as a consumption good. As a durable asset with continuing demand and constrained supply, owners take into account the equity gain associated with price appreciation. It is difficult to measure how important the expected value is to owners,[37] but by almost any measure the incorporation of expected capital gains lowers the current user cost of housing.

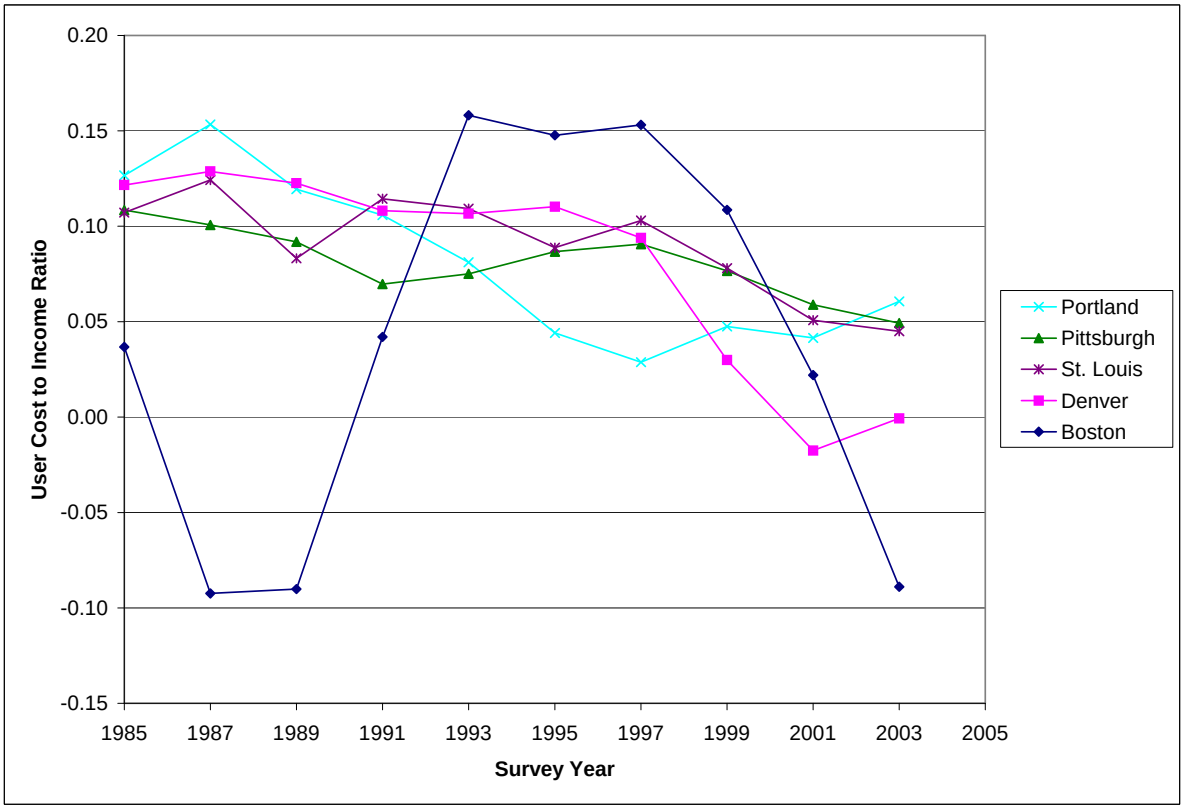
[37] For more information on expectations, please see the final section of this report "Behavioral Finance and the Formation of Price Expectations."

Exhibit 16. Effect of Expected Capital Gains on Owner Costs by CMSA, Los Angeles

					Calculating monthly mortgage payment for Step 3							
	all owners		**new owners**		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	12.1844	195,714	12.04846	170,836	185,928	162,294	9.91%	11.52%	0.53%	0.66%	1,156	1,186
1987	12.1973	198,249	12.11477	182,548	188,337	173,421	9.41%	9.59%	0.48%	0.50%	1,100	1,034
1989	12.4884	265,232	12.4016	243,190	251,970	231,031	9.66%	9.93%	0.40%	0.43%	1,329	1,255
1991	12.4599	257,777	12.30231	220,204	244,888	209,194	9.58%	9.60%	0.45%	0.45%	1,371	1,173
1993	12.3173	223,530	12.16519	191,988	212,353	182,389	8.52%	7.89%	0.46%	0.41%	1,210	967
1995	12.2873	216,930	12.14896	188,898	206,084	179,453	8.37%	8.27%	0.46%	0.45%	1,174	1,012
1997	12.1215	183,772	12.02761	167,311	174,583	158,946	8.12%	8.03%	0.49%	0.48%	1,027	926
1999	12.1512	189,312	12.04832	170,812	179,846	162,272	7.68%	7.44%	0.46%	0.44%	1,018	894
2001	12.2586	210,786	12.18477	195,785	200,247	185,995	7.60%	7.64%	0.40%	0.40%	1,045	976
2003	12.5539	283,200	12.46406	258,864	269,040	245,921	6.60%	6.28%	0.36%	0.33%	1,335	1,174

			Step 1		**Step 2**		**Step 3**				**Step 4**	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	34,747	30,330	20,261	17,686	211	184	945	1,002	6,214	6,362	15.2%	15.8%
1987	29,017	26,718	19,998	18,414	208	192	892	842	6,760	6,194	13.2%	13.6%
1989	130,248	119,424	97,891	89,756	1,020	935	309	321	6,721	6,194	4.6%	5.2%
1991	123,570	105,558	93,254	79,662	971	830	400	344	6,481	5,890	6.2%	5.8%
1993	64,151	55,099	51,240	44,009	534	458	676	509	5,790	5,530	11.7%	9.2%
1995	-	-	-	-	-	-	1,174	1,012	5,853	5,345	20.1%	18.9%
1997	-	-	-	-	-	-	1,027	926	6,054	5,032	17.0%	18.4%
1999	-	-	-	-	-	-	1,018	894	6,994	6,292	14.6%	14.2%
2001	13,656	12,684	11,545	10,723	120	112	925	864	8,004	6,532	11.6%	13.2%
2003	160,100	146,342	139,699	127,695	1,455	1,330	(121)	(156)	7,208	5,857	-1.7%	-2.7%

Exhibit 17. User Cost to Income Ratios, by CMSA



V. Determinants of House Prices

To better understand why house prices are increasing so rapidly in some cities and not in others, it is useful to have a theoretical framework for the supply and demand factors. This section describes the traditional stock-flow model, along with innovations developed by DiPasquale and Wheaton (1994). Following sections provide more detail about the component factors for demand and supply.

The traditional stock-flow model assumes the stock or supply of housing equals demand in equilibrium, and the change in supply (ΔS) is new construction less depreciation of existing stock. Housing demand is a function of demographics and income (X_1), the real price of housing (P), the user cost of financing (U) and rent (R). New construction (C) is a function of factor costs (land, labor and building supplies), financing costs, government intervention (such as government subsidies and zoning), which we combine to call X_2, and the real price of housing (P). The rate of depreciation is represented by δ.

$$S = D(X_1, P, U, R)$$
$$\Delta S = C(X_2, P) - \delta S$$

When S is measured in owner-occupied units, it reflects household formation and tenure choice. Alternatively, S can be measured in dollars, so that it reflects the quality of housing services as well as the quantity of units.

The user cost of capital variable, U, incorporates the after-tax cost of debt adjusting the nominal interest rate, i, and marginal property tax rate, t_p, by one minus the marginal income tax rate, t_y, and subtracting the expected capital gain rate, $E(\Delta P/P)$.

$$U = (i + t_p)(1 - t_y) - E\left(\frac{\Delta P}{P}\right)$$

Research findings based on estimating the traditional stock-flow model provide three conclusions. First, the housing market has a somewhat predictable cycle, with positive serial correlation in prices, i.e., current prices are correlated with lagged prices. Rational expectations assume all the relevant information is incorporated into current prices. An efficient market is one in which all the information from past prices is fully reflected in the asset's current price.[38] Therefore, serial correlation violates the efficient market assumption, because past prices help to predict future prices above and beyond the information coming from current prices.

A second conclusion from the stock-flow model is that the housing market exhibits significant disequilibrium, and forecasts of construction work better if there is more information than current (or past) prices. One explanation for the significance in the disequilibrium term is that housing markets

[38] Campbell, Lo and MacKinlay (1997) explain efficiency this way: "This notion of efficiency has a wonderfully counterintuitive and seemingly contradictory flavor to it: The more efficient the market, the more random is the sequence of price changes generated by the market, and the most efficient market of all is one in which price changes are completely random and unpredictable." (p. 31).

are slow to respond to disequilibrium, either because the permitting and physical construction takes time or because the realization of disequilibrium takes time. Another part of the explanation is the notion that there is a stable equilibrium condition that the market is seeking, based largely on the signals given by price changes. High prices stimulate more construction and discourage demand until supply is back in equilibrium with demand. Conversely, low prices reduce supply (through conversion or demolition) and increase demand until equilibrium is restored.

The third conclusion from the traditional stock-flow model is that the construction costs for the various factors of production do not seem closely related to the amount of construction. It seems logical to expect higher costs for land, labor, and building materials to be negatively related to the amount of construction. After all, those increasing costs are what we normally think are behind the upward-sloping supply curve. However, the coefficient estimates are often insignificant, suggesting the construction costs (particularly land) are poorly measured or incomplete.

Considering these problems with the traditional stock-flow model, DiPasquale and Wheaton (1994) incorporated several innovations that make the model more flexible and more realistic. The first innovation is to assume there is a hypothetical equilibrium price, P*, and a convergence rate, τ, such that prices adjust gradually towards equilibrium.

$$\Delta P = \tau(P^* - P)$$

The justification is that the wide variety of property types and locations makes search time-consuming and costly. The resulting uncertainty means that it takes time for the market to sort out a mismatch between supply and demand, but eventually the price will settle back to equilibrium.

Corresponding to the gradual price adjustment is a less strict form of rational expectations. Prices follow serial correlation because there is uncertainty about future, or even current, exogenous variables. As that information gets gradually updated, the information affects the market, but the information flow is costly and slow.

The third innovation introduces an equilibrium stock, S*, such that construction adjusts the existing supply toward the equilibrium stock. In the long run, S=S* implies that supply elasticity is equal to construction elasticity, i.e., the ability of supply to respond to prices ultimately depends on the ability of new construction to respond to prices. The supply response to price changes depends upon the rate at which construction can provide new supply. The speed of adjustment, α, is small, say 0.02 per year.

$$\Delta S = C - \delta S = \alpha[S^*(X_2, P) - S] - \delta S$$

The ΔP becomes $P_t - P_{t-1}$ so that the solution for P_t becomes:

$$P_t = \tau P_t^* + (1-\tau)P_{t-1}$$

In words, current prices are a weighted average between the equilibrium price and lagged actual price. The model improves when we allow the gradual price adjustment to incorporate lagged prices, which improve the fit very significantly for the demand model. Estimating on national data from 1961-1990, the resulting price elasticity of demand ranges from -.09 to !.19, and the income elasticity of

demand is from 0.3 to 0.7. The supply model does not fit as well, but that is not unusual because supply data are not as good, especially at the national level where local differences are lost. The estimated long run price elasticity of supply is from 1.2 to 1.4.

The real reason for reviewing this model in detail is not the empirical results, but rather the clear presentation of the theoretical model. The focus in the theoretical model should be on how the structure helps explain house price changes rather than on the variables used to actually estimate a reduced form of the model. Typically, some of the model elegance is lost when the model confronts the limitations of available data. Malpezzi, Chun and Green (1998) have provided one of the best examples of integrating hedonic-type price models with a reduced-form equilibrium model that includes both demand and supply factors. Separate hedonic price equations were estimated for 272 MSAs using 1990 Census PUMS data (Public Use Microdata Sample). Housing markets are not clearly defined geographically, but they certainly do not stretch across the entire country. Only the Census has broad enough coverage to estimate such a large cross-section of cities. The disadvantage of relying on a single Census year is that the model is limited to estimating price levels, not changes, so it cannot explain price dynamics. However, the approach is good for estimating price level indexes that control for house quality and are suitable for comparisons between cities.

In the second stage, Malpezzi, Chun and Green (1998) use the hedonic prices as the dependent variable to determine which demand and supply factors are most important in determining house prices. The quantity of housing demanded is assumed to be a negative function of house prices (P_h), a positive function of income and wealth (I), a positive function of demographics and population (D) and a function of fiscal and local public goods variables (F). The quantity supplied is assumed to be a positive function of house prices (P_h), a negative function of topographical constraints (G), and a negative function of regulatory constraints (R). Topographical constraints mean that developable land is limited by water, a large park (such as an Indian reservation by Albuquerque) or a military base. Regulatory constraints include local government policies such as zoning, building codes and licensing, which control the type and amount of development in each part of a city.

$$Demand: Q_D = f_1(P_h, I, D, F)$$
$$Supply: Q_S = f_2(P_h, G, R)$$

Using the equilibrium condition that $Q_D = Q_S$, the authors solve for house prices as a function of demand and supply factors in a reduced-form equation.

$$P_h = f_3(I, D, G, R, F, \varepsilon_3)$$

Regulatory constraints not only determine prices, but also they reflect prices and growth. A zoning board can respond to higher prices and rapid growth by changing allowable building densities or changing the pace of permit approval. Given that R is endogenous in the price equation, the researchers estimate an instrumental variable (IV) equation so that the predicted R_{IV} is not correlated with ε_3 and the coefficients in the house price equation are unbiased.

The regulation instrumental variable equation is presented in Exhibit 18, which shows how hard it is to find good instruments for regulatory constraints. The dependent variable (Regtest) is the unweighted sum of seven variables collected by Linneman, Summers, Brooks and Buist (1990). The component variables of regulatory constraint are:

1. Change in approval time for single-family projects from 1983-1988.
2. Estimated number of months between application for rezoning and issuance of permit for small subdivisions (<50).
3. Same as (2) for large subdivisions.
4. Qualitative assessment of supply vs. demand for land zoned for single-family development.
5. Same as (4) for multifamily development.
6. Percent of zoning changes approved.
7. Adequacy of roads and sewers compared with demand for it.

Regtest ranges from 7 (least restrictive) to 35 (most restrictive). The most restrictive regulation is in Honolulu, San Francisco, Sacramento, San Diego, Boston and New York. The lowest regulation is in Chicago, Dayton, Gary, Dallas and St. Louis.

The first point to notice from the regulation model results in Exhibit 18 is that there are only three significant variables (t-statistic > 2.0 in bold). However, several of the estimated coefficients are large relative to the range of values of the corresponding independent variable and the dependent variable, and the independent variables as a group explain nearly half of the variance of the dependent variable, so the lack of statistical significance is likely due more to the small (n=55) sample than to an absence of correlation between the independent and dependent variables. Two of the significant independent variables, percentage of household head 65 or older and the percentage of owner-occupied, may be correlated with one another. Homeownership is much higher for elderly households. The negative coefficient on percentage owner-occupied is an odd result, given that we normally expect zoning and regulation to protect house values, but that effect may be largely picked up by the elderly household head variable. It may be that the homeownership rate is a proxy for lower population density, where regulation is less necessary. Despite these peculiarities, the instrumental variable model explains 45 percent of the variation in the dependent variable, Regtest, and the predicted values can be treated as exogenous in the house price model.

The second stage house price models are shown in Exhibit 19. The large model includes additional demographic control variables plus a property tax variable, which forces the number of observations to shrink from 242 to 192 cities. Although this is a reduced-form price model, it is dominated by demand factors. This is quite common in the literature, because it is very hard to find reliable supply-side data at the metropolitan level (DiPasquale, 1999). As expected, the demand factors, income and population, raise house prices. Larger households and older household heads (by median age) tend to increase prices. The percentage black has no effect on the small model, but is significant and negative in the large model. The large model also includes negative effects for young household heads, married couples, and property taxes. The highly significant negative impact of married couples is counter-intuitive, but left unexplained by the authors. Age picks up some complicated effects, with heads 65 or older reducing house prices, but increasing regulation (from the Instrumental Variable equation) and regulation has a positive effect on prices. The percent owner-occupied and the state dummies are excluded from the price equations.

Exhibit 18. Instrumental Variable Regulation Model

Independent Variables	Coefficient	t-Statistic
California State Dummy	**5.19**	**3.2**
New York City Dummy	2.00	0.5
Honolulu Dummy	5.12	1.4
Log of Median Household Income	5.01	1.6
Log of MSA Population	-1.13	-1.6
Annual Growth in Population	23.14	0.6
Persons per Household	1.93	0.5
Percentage of HH Head 65 or older	**0.43**	**2.3**
MSA Adjacent to Park, etc.	0.62	-0.5
Percentage Owner-Occupied	**-18.78**	**-2.2**
Intercept	-14.65	-0.4
	R^2 = .45	Obs. = 55

Source: Malpezzi, Chun and Green (1998), p. 254.

Exhibit 19. House Price Model

	Small Model		Large Model	
Independent Variables	Coefficient	t-Statistic	Coefficient	t-Statistic
Log of Household Income, 1990	0.79	11.0	0.83	7.80
Annual Change in Household Income, 1980-1990	8.59	7.41	7.26	5.06
Log of MSA Population, 1990	0.12	10.28	0.06	3.64
Annual Change in MSA pop., 1980-90	-3.39	-4.18	-0.64	-0.65
Persons per household, 1990	0.16	2.55	0.79	5.87
Metro Median Age of HH Head, 1990	<0.01	0.20	0.04	3.36
MSA Located Adjacent to Park, etc.	0.16	7.13	0.11	4.49
Percentage Black Households, 1990	<0.00	-1.02	<0.00	-2.70
Percentage Indian Households, 1990			0.03	1.56
Percentage Asian Households, 1990			<0.01	0.92
Percentage Other Race, 1990			<0.01	0.44
Percentage Married Couples, 1990			-0.02	-4.64
Metro Percentage Under 18 years, 1990			-0.03	-4.24
Metro Percentage 65 or older, 1990			-0.02	-2.60
Property Tax per $ Income, 1990			-0.30	-0.80
Instrumental Regulatory Index	0.08	17.16	0.06	8.29
Intercept	-1.26	-1.76	-0.90	-1.06
Adjusted R^2	.89		.92	
Observations	242		192	

Source: Malpezzi, Chun and Green (1998): 259-261.

The exceptional characteristics of this house price model are that it includes a composite measure for regulation and that the coefficients are positive and significant in a variety of specifications tested. The specifications shown here control for "natural" limitations (MSA Located Adjacent to a Park, etc.), so the "man-made" limitations are being picked up by the regulation index. It is worth noting that these two variables are the only supply variables. Also, the regulation variable is estimated on 55 cities, and then predicted for all 242. It is certainly possible that other supply or production limitations are being channeled through these variables. But, the positive and significant coefficients on the regulation variable provide strong evidence that the net effect from regulatory constraints is higher house prices in a metropolitan area. Shifting the level of regulation from the first quartile to the third quartile drives up house prices between 31 and 46 percent.

In summary, house prices are determined by a combination of demand and supply factors. Key demand factors are: household income, wealth, MSA population, age of household heads, racial composition, local tax policy, and interest rates. Key supply factors are: land constraints and regulatory constraints. Other supply factors, such as construction costs, may be significant if accurately measured at the local level, but data limitations seem to create inconsistent results.

VI. Demand Factors

This section provides more details on housing demand factors. We start with demographics. Households need a place to live, and household formation plus in-migration are the most basic sources of demand for housing. Households may determine how many units are needed, but income and wealth determine the quality of those units. The increase in income dispersion, fueled especially by stock market gains and tax breaks for upper-income families, may have accelerated the increase in house prices. The increase in the homeownership rate gives evidence that higher incomes, easier credit and government promotions of homeownership are shifting demand from rental to owner-occupied housing.[39]

Demographics

In 1987, Mankiw and Weil published "The Baby Boom, The Baby Bust, and the Housing Market," which sent shivers down the backs of urban economists. The thesis was that house price increases in the 1970s were largely driven by the baby boom generation reaching the home buying age. Aging of a population cohort is easy to forecast, so rational builders should have anticipated the increase in demand. The chilling part was their forecast that real house prices would fall after 2010 as the baby boom cohort retired and moved to smaller accommodations. Many papers were written in the housing literature to counter this forecast, mostly on the basis that income and immigration growth would fill in any shortfall in demand by the baby boomers. Nevertheless, the population is an important driving force in the demand for housing.

One response to Mankiw and Weil was by Green and Hendershott (1996), who found housing demand to be flat or increasing with age. Census evidence reported by Dowell Myers supports this prediction, showing increases in homeownership among the elderly. Green and Hendershott distinguish the partial age derivative from the total age derivative, which allows all demographic characteristics (education, real income, household size, race, gender, and marital status) to vary with age. Holding those other factors constant, the demand for housing remains stable or rises slightly with age, whereas allowing all characteristics to change with age shows declining demand. Their point is that it is not age, per se, which causes retirees to reduce their housing demand, but rather the decline in age-related factors such as income and household size which lower the demand.[40]

More recently, George Masnick (2001) analyzed the 2000 Supplementary Survey to get an early read on the changes since the 1990 Census. Comparing owner cost burdens (i.e., house prices relative to income) between 1990 and 2000, Masnick found that some of the greatest increases were in states

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[39] Lew Sichelman (2005) "Freddie Introduces New Lineup of Low Downpayment Loans," National Mortgage News, February 21, 2005, p. 23. "`Home Possible' will give lenders an automated, easy-to-use application that offers borrowers flexible credit terms, aggressive debt-to-income ratios and cash contributions as low as $500."

[40] When estimated on a cross-sectional basis, half the decline in housing demand among the elderly is due to lower education and the other half due to lower income. Education levels have been rising over time so that older cohorts tend to have less education than younger cohorts. Given that people do not lose their educational status over time, this cross-sectional difference will have less impact over time.

with strong population growth from in-migration, including Florida, Nevada, Washington, and Oregon. There is also a close correspondence between renter and owner cost burden, with large increases in both in Hawaii, California, Nevada, Arizona, New Mexico, Florida, Washington, Oregon and New York. However, high house prices also can reduce or delay household formation, so care must be taken not to assume demographic measures are exogenous.

Income

Income plays an important role in determining how much and what kind of housing (rental or owner-occupied housing) households can afford. Although median income fell about 7 percent (in 1999 constant dollars) from 1989 to 1993, it rose about 13 percent from 1993 to 1999. The gain was especially strong for young households with heads aged 25 to 34, who are ready to buy their first home. The income gains were also shared by minority households. However, the income dispersion increased because the top income quintile increased twice as fast as the lower quintiles.

High levels of foreign immigration and domestic minority growth mean that minority households accounted for 23 percent of all households in 1995 but 68 percent of the growth from 1995 to 2000. This trend will continue, so that the share of minority owners will increase. Masnick projects that the percentage of owner households who are minorities will increase from 18 percent in 2000 to 25 percent in 2020. Given that minorities average less income than whites in every income quintile, we get an interesting picture of higher house prices and higher house cost burdens as the minority share increases.

Suppose housing supply favors high quality housing as more profitable, perhaps because zoning boards are trying to limit growth and excess demand pushes up house prices. The increase in income dispersion makes it more likely that upper income households will outbid lower-income households. Also, even though real incomes are increasing for both whites and minorities, the share of households with high cost burdens could be increasing along with the share of minority owners. In order to participate in homeownership, minority households have to pay a higher share of their income for housing. Ideally, housing supply would quickly adapt to household incomes. But, housing is durable and the stock is slow to adapt, so that rapid increases in income can drive up prices for houses at nearly all quality levels until supply catches up.

Wealth

Wealth has traditionally been both a signal of low risk and a reflection of permanent income. Households with some wealth can continue to make monthly mortgage payments even if their income stream is interrupted temporarily. Wealth also affects housing demand as the savings that are available to pay for the down payment, particularly for first-time homebuyers (Linneman and Wachter, 1989; Zorn, 1989). For most prospective homebuyers, the down payment constraint is the biggest obstacle. Monthly rents are often similar to monthly mortgage payments, especially after those payments are adjusted for tax benefits and capital gains. But, a renter cannot become a homeowner without first accumulating sufficient savings for the down payment. Recognizing this limitation, lenders have become more lenient in down payment requirements during the 1990s, and this has helped boost both homeownership rates and house prices.

Haurin, Hendershott and Wachter (1996) point out that wealth may also be the result of a household's deciding to become a homeowner. Focusing on new homeowners, they identify offsetting effects of house prices on wealth. Higher house prices require more down payment so prospective homebuyers save more. However, at the margin, higher house prices will convince some renters not to bother saving to buy a house, which reduces wealth. The researchers use the National Longitudinal Survey of Youth for 1985-1990 and find that the net effect of house prices on wealth is small for average house prices. For white, married men, a one standard deviation increase in house prices above the mean decreases the probability of ownership from 0.46 to 0.40. The negative impact of house prices on ownership offsets the positive, direct effect of house prices on wealth, so that the net effect of house prices on wealth is very small for average prices. However, in areas with high real house prices, the negative effect of reduced ownership dominates, and the wealth of youth is substantially lower.

For existing homeowners, rising house prices build equity and wealth. The Corporation for Enterprise Development promotes a measure they call "asset poverty," meaning the household does not have sufficient net worth to sustain living at the federal poverty level for three months if its income were to stop.[41] By that measure in 1998, 26 percent of all households were in asset poverty. In most cases, the big difference is homeownership. Oliver and Shapiro (1997) found that over 60 percent of African American households and 54 percent of Hispanic households have zero or negative net financial assets, compared with only 33 percent for all American households. Home equity represents 57 percent of the net worth for African Americans and 71 percent for Hispanics, compared to only 40 percent for whites. Homeowners benefit from house price appreciation, and home equity can be used to finance education or income shortfalls. Moreover, the wealth can be passed on to their children either as a bequest or as a gift that can be used for a down payment. Wealth, particularly home equity, not only enables a household to demand more housing, but also enables new households in the next generation to become homeowners. Increasing house prices, therefore, widen the wealth divide between owners and renters.

Ownership as a Hedge Against Rent Risk

A recent paper by Sinai and Souleles (2003) focuses on rent risk as another reason why renters demand owner-occupied housing. The underlying model is a tenure choice model in which the renter faces uncertain rent changes each year but no risk of capital loss when the renter moves. Owners, on the other hand, can avoid uncertain annual increases by purchasing a house with a fixed-rate mortgage. There is still the risk of capital loss when the owner finally sells the property, but the longer the holding period the more that future risk is discounted. Given the substitutability between rental and owner-occupied units, house price risk is highly correlated with rent risk. But, the owner only faces that risk at the end of the holding period, whereas the renter faces it every year. Also, the renter's risk is that rents will go up and the owner's risk is that prices will go down. The empirical analysis shows that rent risk dominates house price risk, which means households use ownership to shield against rent increases. In finance language, households can hedge against rent risk by buying their home. The demand for homeownership increases with the expected holding period and the cumulative rent volatility (i.e., rent volatility during the holding period), but decreases with house price volatility.

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[41] Corporation for Enterprise Development (2002) State Asset Development Report Card: Benchmarking Asset Development in Fighting Poverty.

Not surprisingly, households with a high housing cost burden are most sensitive to rent risk. In particular, elderly households living in places with high rent variance are more likely to own their home. A household with a 60-year old head is 10 percent more likely to own if the house is in a market in the top quartile of rent variance. Elderly people often live on fixed incomes so they are especially averse to rent increases. Finally, Sinai and Souleles found that the expected rent level and rent variance get capitalized into house prices. Households are willing to pay a risk premium for housing that ensures stable housing costs. A one standard deviation increase in rent variance raises the average price-to-rent ratio from 15.7 to 16.3. This translates into a 2 to 4 percent increase in house prices.

Tax Effects on Housing Demand

As described in the Affordability Index section, the cost of financing a house purchase is significantly lowered by the deductibility of property taxes and mortgage interest. Moreover, the capital gains from selling a house are not taxed in most cases. Poterba (1991) calculates the real user cost of homeownership as:

$$c = (1-\theta)(i+\tau_p) + \delta + \alpha + m - \pi^e$$

where θ is the investor's marginal tax rate, i is the nominal interest rate, τ_p is the property tax rate, δ is the depreciation rate, α is the risk premium for housing, m is the maintenance cost per unit value and π^e is the investor's expected rate of nominal house price appreciation. One of the key points in the user cost equation is that households in a high tax bracket (high θ) benefit more from the tax break on property taxes and mortgage interest than households in a low tax bracket. This means that, when the marginal tax rate was lowered in the Tax Reform Act of 1986, this should have reduced the demand for housing by high-income households.[42] Adjustments in the marginal tax rate during the 1990s should have reversed that effect, but Glaeser and Shapiro (2002) show that homeownership rates are not very sensitive to marginal tax rate changes. The *net* effect of taxes on housing is still large.

Glaeser and Shapiro (2002) claim that the home mortgage interest deduction is a poor tool for promoting homeownership, but quite effective at encouraging high-income households to spend more on housing. The foundation of their argument is the alignment of income, itemization, house quality and building structure. Explicitly, higher-income households, nearly all of whom itemize, prefer single-family detached houses because they are higher quality housing with more control over maintenance. In fact, 86 percent of people in detached single-family houses are owners, while 86 percent of people in multifamily units are renters. It is not practical for renters to be responsible for the maintenance in apartment buildings because the systems are shared, complex and expensive. Homeowners can handle the maintenance for single-family properties. The building structure is already established and the homeownership status is linked to the type of structure. Changes in

[42] Maki (2001) points out that the same tax act phased out the deductibility of consumer interest which motivated households to shift consumer debt to mortgage debt. This may have increased the desirability of homeownership offsetting some of the reduction in demand associated with the flattening of the marginal tax rates.

marginal tax rates have little effect on homeownership rates because the building stock is slow to change.

Owner-occupied housing receives favorable tax treatment compared to rental housing. Although the deductability of mortgage interest and property taxes is often mentioned, it is the non-taxation of the rental value of owner-occupied housing that is the dominant source of its preferential tax treatment. Owners of rental housing, like owner occupants, can deduct mortgage interest and property taxes (as well as other cash operating expenses and a depreciation allowance), but rental property owners pay tax on their rental revenues. The preferential tax treatment of owner-occupied housing is sometimes justified by purported external societal benefits of homeownership and more generally of higher levels of housing consumption. There is some evidence of positive externalities from housing consumption, particularly for children, but they primarily benefit children in higher-income households and neighborhoods[43] (Bratt, 2002; Green and White, 1996). The researchers find that the tax breaks afforded owner-occupied housing exceed the size of the externality from housing consumption. In fact, the negative impacts of subsidizing housing consumption are described in Gyourko and Voith (2001) and Bier (2001). The mortgage interest deduction is blamed for expediting suburbanization through encouraging higher-income families to move out of the city. The property tax deduction also encourages owners to vote for more spending on community amenities that boost the owner's property value. The taxes create a barrier to low-income families and increase the degree of spatial income separation. Glaeser and Shapiro conclude that the main consequence from the mortgage interest and property tax deductions is to increase the consumption of housing without a substantial increase in the homeownership rate.

Easier Mortgage Financing

A key component in the user cost of capital is the nominal interest rate, which declined through most of the 1980s and 1990s to reach 40-year lows in 2003. Interest rates determine the size of monthly mortgage payments. The lower the rates and payments go, the more people can qualify for a mortgage. Mortgage lenders used to focus on the front-end ratio of mortgage payment to monthly income, but there were many compensating factors that would permit borrowers with high front-end ratios to still be considered prudent risks. During the 1990s lenders developed more sophisticated techniques for weighing multiple risk factors, often using credit scores and automated underwriting. Lenders became more aggressive in their loan terms, as they realized the power of automated underwriting scores to separate high risks from low risks. For example, down payments became smaller (Marschoun, 2000; Sichelman, 2005). Only 8 percent of loans in 1990 had down payments smaller than 10 percent (LTV>90 percent) compared to 22 percent in 2000 (Federal Housing Finance Board, Terms on Conventional Mortgages, Annual Historical Tables). Another important change was the more extensive use of risk-based pricing and subprime lending that allowed higher-risk borrowers to obtain loans at higher interest rates. New loan products were developed, such as the "Timely Payment Rewards Mortgage" by Fannie Mae and the "Affordable Merit Rate Mortgage" by Freddie Mac, which reduce the interest rate after the first 24 monthly payments without delinquency (Bhattacharya, Fabozzi and Chang, 2001). HUD encouraged increased lending to low-income and minority households through the Community Reinvestment Act (CRA) and GSE Housing Goals designed to promote homeownership and community development.

[43] Newman and Harkness (2002) provide an alternative view that children in low-income households benefit from homeownership even in poor neighborhoods.

Not all of these new loan programs have been successful, especially when house prices declined. Adjustable rate mortgages were marketed aggressively in California in the early 1990s, but ran into default trouble as California house prices fell for the first time in years. Manufactured housing has also gone through a boom-and-bust cycle peaking in 1998 with an all-time high of 373,000 units or almost 1/3 of new production of single-family homes (HUD, US Housing Markets, 2002). By 2001, manufactured housing placements had dropped to 185,000, and by 2002 two of the biggest players in the market, Oakwood and Conseco, were bankrupt. A major factor in their demise was aggressive lending to marginally qualified borrowers who could not keep up their monthly payments (Apgar et al., 2002). The repossession of many of those properties depressed the value of manufactured homes in general and led to additional defaults by borrowers with negative equity in their homes.

The main point is that aggressive mortgage financing can boost demand for housing, and that demand can drive up house prices. As interest rates fall and loan terms relax, borrowers have more buying power to raise the offer price on home purchases. In the late 1990s, with a hot labor market and stock market, housing demand was fueled by a combination of population growth, income, wealth, supportive government policy, and easy credit.

VII. Supply Factors

The supply of housing depends on the rate of new construction, renovation, depreciation and conversion or demolition. This section starts with an explanation of why we know so little about housing supply. We then discuss the concept of filtering, through which a property changes value over time depending on the degree of maintenance, renovation and market demand. The elasticity of supply measures the responsiveness of supply to price changes, and we review a variety of attempts to measure elasticity of supply. In most places with housing affordability problems, the lack of supply response is evident. We introduce obstacles to construction before a detailed section on regulatory constraints.

Housing supply is quite different from housing demand in that the decisions are made by companies rather than households. Developers and construction companies build housing and, big or small, they all rely heavily on the availability of land and financing. Land is not like other durable goods (DiPasquale, 1999). Land is inelastically supplied meaning, its supply is fixed and the cost for development (whether greenfield or infill) keeps rising. Location and zoning approval are critical to the value. Time and the uncertainty for zoning approval make financing important. We know the planning and development process can be very political. However, there are few surveys that capture the decision-making processes of developers or their complicated financial deals. Even a national survey might not help much because builders are judging the opportunities in idiosyncratic, local housing markets. It is ironic that structures are so easy to see (unlike housing demand), but buildings are hard to value and each market is different.

Most of what we do know about housing supply comes from the American Housing Survey (AHS) or the Census series on construction. The National AHS is a representative sample of 55,000 residential properties surveyed every other year, and the Metropolitan AHS is a rotating panel of 47 cities surveyed on a rotating basis, about 12 cities per year and 2,500 units per city. The AHS is a longitudinal survey following the same units (rather than the same households) from one survey to the next. To keep the survey representative of new construction, new units are added to the sample. The survey is completed by the current residents, with considerable detail about the quality of the unit, the costs of renting or owning, the income and demographics of the household, and some questions about the neighborhood. Owners can knowledgably report on all aspects of the current property, including maintenance, additions, and financing, but usually do not know the details of original construction. Renters know about their own unit, but cannot report on the maintenance or financing issues for the entire building.

A special survey called the Property Owners and Managers Survey (POMS) was drawn in 1996 from 1993 AHS rental properties, with the intention of getting information at the building level from building owners or supervisors. Unfortunately, the respondents were not familiar with important information about building costs and financing. The high rate of missing responses undercuts the usefulness of the1996 POMS, and there appear to be no plans to repeat that survey.

The Census provides a series of construction reports that give useful monthly or quarterly snapshots of new construction at the national or regional level, but generally do not have the sample sizes to report details at the metropolitan housing market level. The series include: housing starts (C20), housing completions (C22), new one-family houses sold (C25), price index of new one-family houses, value of construction put in place (C30), housing units authorized by building permits (C40),

and expenditures for residential improvements and repairs (C50). Census data can help us measure the degree of construction activity, but lack information on conversions and demolitions, as well as data on land costs or profitability. Importantly, most of these data sources provide raw counts of units built, with no adjustments for changes in housing quality, which can be a significant omission in studies of supply trends over long periods of time.

The Residential Finance Survey (RFS) is done every 10 years, following the decennial Census. The Census provides the best information on the size and location of the housing stock, while the RFS collects mortgage information from property owners and lenders, including multifamily properties. The 2001 RFS has a sample of approximately 68,000 properties. The survey does not give information about construction directly, but it does give a broad picture of mortgage finance in 2001 and allow comparisons with previous RFS back to 1951.

One of the primary reasons we do not know more about supply is that there is no collection of information from a representative sample of builders about the factors that they use to make decisions.[44] Given the large number of small contractors and the high rate of turnover in this industry, such a data collection effort would be expensive, especially if done at the metropolitan level. In the meantime, we do our best to infer supply responses over time from national data.

Notwithstanding data limitations, here is a summary of what we do know about housing supply and construction. The 2000 Census shows that U.S. population grew by 32.7 million people or 13.2 percent during the 1990s (Laing, 2002). This exceeded the growth during the 1980s or 1970s and nearly matches the boom period of the 1960s. However, new housing totaled 13.3 million units, which is far fewer than the 14.8 million new units in the 1980s or 17 million units in the 1970s. A big change was in multifamily units, which dropped from over 5 million in the 1970s to 4.2 million in the 1980s and down to 2.2 million in the 1990s. The most dramatic declines occurred on the coasts. California construction of single and multifamily units dropped from 2.1 million in the 1980s to 1.1 million in the 1990s. Similarly, the Northeast gained more population in the 1990s than in the 1980s, but new construction fell by 570,000 units. Again the drop was far more dramatic for multifamily than for single-family construction.

Market Segmentation and Filtering

The stock of housing contains a wide range of units by quality and location. No two units are exactly alike because, even if they have exactly the same features they cannot occupy exactly the same location. The homebuyer has to make tradeoffs among property features, neighborhood amenities, and price. Similarly, the homebuilder has to determine which combination of house features will receive timely approval from the zoning board and command the highest profit net of construction costs and land prices. Builders know that a fancy house in the middle of a crowded, rundown neighborhood will sell for much less than the same house in a new development surrounded by other fancy houses. Properties and neighborhoods change over time. Owners can affect the rate of

[44] Private companies, such as R.S. Means, do collect information on costs of construction. For example, Residential Cost Data, 19th Annual Edition, 2000; Square Foot Costs, 21st Annual Edition, 2000 and Building Construction Cost Data, 60th Annual Edition, 2002. Despite the fact that this appears to be ideal information, regression modeling using this data often finds the results are insignificant or even have the wrong sign.

depreciation with maintenance, renovations, and additions. Owners have less control over their neighborhoods, but good schools and public services will attract other households willing and able to pay for those amenities. Property values increase or decrease relative to the values of competing properties that are more or less substitutes for one another.

The concept of filtering has a long tradition, with roots in the writings of Adam Smith and with early contributions in the modern era by Lowry (1960), Grigsby (1963) and Olsen (1969). We focus on the contributions of O'Flaherty (1996). Filtering, in this case, means high quality properties can gradually deteriorate to become low quality properties if they are under-maintained or their features go out of favor. The rate of depreciation depends on the relative cost of construction and maintenance. High quality houses are expensive to build, and owners can preserve their value with timely maintenance. Low quality houses would sell for such a low price that it does not cover the cost of construction plus land (Gyourko and Tracy, 1999). There are low quality houses, but they have filtered down from medium quality houses that were not well maintained. Ultimately, the housing service provided drops below a price sufficient to cover the operating cost, and the owner decides to replace or abandon the property. In a steady-state equilibrium, new properties start at high quality and gradually deteriorate to supply lower quality housing before getting replaced.

Galster (1996) and Downs (1994) have pointed out that downward filtering occurs when net housing construction exceeds net household formation. In the owned housing context, the new households would have to have sufficient income to purchase a house. Assuming that the new households can generate more demand for more owner-occupied housing than is being constructed, then the downward filtering is reversed into upward filtering. Units on the market go to the highest bidder. On the demand side, the increased prices go beyond what some households can afford, so those households remain renters. On the supply side, the increased prices make it profitable for some property owners to convert rental units to owner-occupied units or to improve existing units. Theoretically, the market would eventually return to an equilibrium in which a steady stream of new construction is just enough to allow a gradual downward filtering and offset the rate of conversions and demolitions.

Empirical tests of filtering have focused primarily on rental housing, using AHS data. Malpezzi and Green (1996) estimate that an increase in the rental stock of 1.4 percent from new construction will increase the number of lower-priced, low quality units by 2.5 percent. Somerville and Holmes (2001) use multinomial logit estimation to estimate transitions of affordable units to higher rent (26 percent), owner-occupied (4 percent) or demolition (7 percent). Net of those changes, 52 percent of the units remain affordable and another 10 percent remain affordable with government subsidies. Somerville and Holmes also found that affordable units in mixed neighborhoods (with many unaffordable units in the same AHS zone[45]) are more likely to filter up.

An analysis of affordable owner-occupied housing is provided by Collins, Crowe and Carliner (2001). Starting with the 1999 AHS, they divide owner-occupied houses into quartiles by market value. The comparison among quartiles shows that the income and education of the occupants, unit size, percentage of units detached, quality of unit and quality of neighborhood are positively correlated with house price, while the household head age, first-time buyer status, percent minority and the percent manufactured housing are negatively related to house price. Of particular note, the bottom

[45] An AHS zone is a contiguous territory of about 100,000 people with an effort made to group together socio-economically similar neighborhoods.

quartile contains 32.5 percent manufactured housing and a significant portion of retirees, which account for the effect on both high age and low income. When 1997 and 1999 data is separated by regions of the country, the research shows that the share of low-income homeowners living in manufactured homes is increasing, especially in the South. Also, low-income homeownership rates have decreased slightly in high-cost areas such as the Northeast.

Adjusting for user cost of capital and metropolitan median incomes, taxes and insurance, a unit is designated as affordable if a household with 80 percent of area median income would qualify for a mortgage using conventional underwriting requirements (10 percent down payment and 28 percent housing payment-to-income ratio). By that standard, the affordable owner-occupied stock has shrunk from 47.3 percent in 1997 to 44.2 percent in 1999. Excluding manufactured housing, the West region saw the biggest drop, from 26.0 percent in 1997 to 21.3 percent in 1999. While low-income households generally live in the affordable stock, one-quarter to one-third of high-income households live in homes that meet the standard of affordability. From the high-income householder's point of view, income can be spent on non-housing consumption rather than moving into a more expensive house. From the low-income householder's point of view, the available stock of affordable units is smaller after the high-income households have had their pick. Undoubtedly, many low-income households cannot find a unit at their preferred balance of quality and cost, so their demand is channeled to the closest substitute, which is usually more expensive.

Focusing on additions between 1997 and 1999 to the owner-occupied stock considered affordable to households with 60 percent of the area median income, there were a total of 540,000 units built within that 2 year period. Of those units, 69 percent (375,000) were manufactured houses, two-thirds of which (251,000) did not include ownership of the land. As for filtering of the existing stocks, upward filtering dominated with 1.4 value increases for each decrease. On net, 1.7 million units became unaffordable through changes in value. Another 153,000 became affordable as the net result of conversions and 157,000 were lost from the affordable stock due to vacancies. Overall, the affordable stock shrank between 1997 and 1999 primarily due to upward filtering, i.e., price increases.

Renovation

Based on AHS data for the 1990s, each year homeowners spent over $91 billion on remodeling, with a disproportionate share in the largest 35 metropolitan areas surveyed in the metropolitan AHS (Reade, 2001). Over 70 percent of the work is done by professionals, and the rest are do-it-yourself (DIY) projects. Of the total, 40 percent of the remodeling is spent on replacement projects and 38 percent for discretionary projects. Discretionary projects include kitchen and bath remodels, room additions, and space reconfigurations, while replacement projects are major system upgrades or substitutions of new for old. Discretionary spending is highest in high-cost cities such as San Francisco, Boston, New York City and Los Angeles. Replacement spending is most common in cities with older housing stock, such as Portland (OR), San Francisco, Cincinnati and Philadelphia. In addition, Duda (2001) notes that each year the federal government spends about $6 billion to renovate the housing stock. These funds are generally matched by state and local government funds as well as private spending. However, it is believed that most of that spending is not recorded in the remodeling expenditure statistics.

The latest statistics from the 2001 AHS show remodeling expenditures have reached $214 billion with $132 billion in homeowner improvements and $34 billion in homeowner maintenance and repairs and $48 billion on rental properties (Joint Center for Housing Studies, 2003). Since 1995, almost 90 percent of the 7 percent annual growth rate in remodeling expenditures is by owners. Projects costing $20,000 or more have gone from one-third of expenditures in 1994-95 to nearly one-half in 2000-01. Remodeling by minority owners is growing. Between 1995 and 2001, minorities accounted for 40 percent of the increase in homeowners and 39 percent of the improvement expenditures (compared to 5 percent growth among white owners). Regionally, the older homes, higher incomes, and limited new development of the Northeast have combined to make home improvement expenditures larger than new construction, especially in center cities.

The combination of low interest rates and growing house values has created a boom in cash-out refinancing. According to the Federal Reserve Board, between January 2001 and June 2002, 4.9 million households refinanced their homes and cashed out $131 billion of their equity. Of that amount, an estimated $46.3 billion was used for home improvement spending. There appears to be a positive feedback loop in which increasing house prices lead to increased equity, which allows cash-out refinancing used for home improvements, resulting in higher house values.[46] All that is needed to speed up the process is low interest rates.

Elasticity of Supply

If supply is responsive to price increases (elastic supply), economic theory says the any increase in housing demand will be met primarily by an increase in the quantity of housing supplied, with little if any long run increase in real house prices. On the other hand, if supply is not responsive to increases in housing demand (inelastic supply), most of the impact of increased demand will be observed in house prices rather than in the quantity of housing supplied. One possible explanation for rapidly increasing house prices in certain metropolitan areas is that supply is inelastic. We first review what is known about supply elasticity, based on national time series, and then discuss why supply is inelastic.

Some of the earliest studies found evidence for elastic supply, though their methods and data are considered simplistic by today's standards. Muth (1960) found no significant relation between the price of housing and the quantity supplied for data from 1919 to 1934. The real value of new construction was regressed on the relative price of housing, controlling for building input prices. An insignificant coefficient on housing prices suggested that supply was so elastic that the quantity of housing could be high or low without much impact on prices, i.e., the supply curve was nearly flat. One problem with this approach is that it cannot distinguish between perfectly elastic and perfectly inelastic supply. In either case, there is no significant relationship between quantity supplied and price.

[46] Case, Quigley, and Shiller (2001) show that housing wealth has a distinctly higher impact on consumption (elasticity about 0.06) than stock market wealth (elasticity about 0.03). During much of the 1990s, both the stock market and house prices rose together, boosting consumption. Since 2000, stock prices have been falling, but consumption has held up on the strength of house price appreciation and been facilitated by cash-out refinancing.

Follain (1979) improved on the econometrics,[47] but similarly found elastic supply for data from 1947 through 1975. Olsen (1987) criticized the specifications used by both Muth and Follain, arguing that the input prices they used were not exogenous and, therefore, should not have been considered independent variables. Blackley (1999) used a long time series, 1950-1994, and found elasticity estimates of 1.6 to 3.7. An elasticity of 1.6 means that an increase in house prices of 1 percent generates an increase in housing supply of 1.6 percent. Topel and Rosen (1988) used quarterly data on starts from 1963-1983 and found a long-run elasticity of 3.0. In another analysis using national data for 1963 to 1990, DiPasquale and Wheaton (1994), estimated supply elasticity in the range of 1.0 to 1.4. The traditional dividing point between elastic and inelastic is 1.0, so that findings of DiPasquale and Wheaton continue to suggest that housing supply is moderately elastic.

In reviewing the previous findings, Malpezzi and Maclennan (2001) thought the range of results might be sensitive to the time period examined. The highly elastic findings of Muth and Follain reflected a period of relatively flat or declining prices, whereas Topel and Rosen used years with rising prices. To avoid this sensitivity to time period, Malpezzi and Maclennan used the longest possible time series they could collect, 1889 to 1997, although their post-WWII models provide the most useful information for us. Malpezzi and Maclennan estimated two different kinds of models, a flow model (which assumes all adjustment takes place in a single year) and a stock adjustment model (which assumes an adjustment of 0.3 per year). Supply elasticity estimates for the flow model range from 6 to 13, while the elasticity estimates for the stock adjustment model were from 1 to 6. One reason for estimating a stock adjustment model is the assumption that supply is inelastic in the short run, but increases in the long run when developers have fully responded to the price change. That being the case, the authors could not explain why the stock adjustment model gave lower elasticity estimates and called for more research.

Mayer and Somerville (2000a) provide a different approach linked to Tobin's q theory (Tobin, 1969) and price changes rather than price levels. The idea is that construction starts are positive as long as q, the ratio of the market price of new housing to construction cost (including financing, land, labor and materials), is greater than one. Timing is important because it takes time for developers to obtain land suitable for building. A major source of delay and uncertainty is obtaining approval from local planning and zoning boards. Therefore the land available at time t (ld_t) is a function of expectations at time t-1 of the changes in house prices (Δp_t) and construction costs (Δc_t).

$$ld_t = f(E_{t-1}(\Delta p_t, \Delta c_t)) = g(\Delta p_{t-1}, \Delta c_{t-1})$$

Starts are constrained to be the minimum of the ideal construction starts (S^*), given current demand, and the land that is available and ready for building (ld_t). S^* is a function of the current growth in house prices and construction costs, while ld_t is a function of lagged growth in house prices and construction costs. By substituting in the functions for S^* and ld_t, we get a new function for S_t in terms of the current and lagged changes of house prices and construction costs.

$$S_t = \min[S_t^*, ld_t] = \min[S_t^*(\Delta p_t, \Delta c_t), ld_t(\Delta p_{t-1}, \Delta c_{t-1})] = g[\Delta p_t, \Delta c_t, \Delta p_{t-1}, \Delta c_{t-1}]$$

This model supports an approach of estimating supply responses in terms of first differences rather than levels. Each housing market may have a different equilibrium level according to its location and

[47] The regression models had better controls for simultaneity and serial correlation.

industrial structure, but the supply response to price changes from the equilibrium level are expected to be similar. Moreover, in levels, supply and house prices are nonstationary[48] variables (Meese and Wallace, 1994; Rosenthal, 1999), and a regression of nonstationary variables can lead to spurious correlations (Granger and Newbold, 1974). The solution is to estimate the regression with first differences or changes, which are stationary variables. Thus, starts (the change in supply) are regressed on changes in house prices and construction costs.

Using quarterly national data from 1975-1994 (76 observations), Mayer and Somerville estimate that a 10 percent increase in real prices leads to a 0.8 percent increase in the housing stock created by a temporary 60 percent spurt in starts spread over 4 quarters. The authors criticize the stock-adjustment model for adjusting too slowly. The DiPasquale and Wheaton (1994) model closes the gap between actual and desired stock by only 2 percent per year, taking 35 years to reach the desired stock. The Mayer and Somerville model estimates an abrupt change in starts that lasts for a very short period of time and makes a surprisingly small change in the stock. The results may be sensitive to the relatively short estimation period, or the instrumental variable estimation for endogenous house prices and construction costs may be weakening the results.[49] Despite the weak empirical results, the model highlights the importance of land constraints in supply responsiveness.

A separate paper by Mayer and Somerville (2000b) emphasizes the impact that land use regulation can have on supply elasticity. They divide regulatory constraints into two classes: development/impact fees and delays in the approval process. The model attempts to determine whether it is the fees or the delay that is most responsible for a low supply response. Expecting delays, developers hold an inventory of land that is more-or-less ready for building. Greater uncertainty about the approval process could motivate developers to hold more land in inventory. When prices do increase, developers draw on their inventory, which suggests a fairly quick response in the short run that slows down as their inventory is depleted. In the long run, the supply response is limited by the approval process. That approval process can itself slow down either by political choice or as a result of bureaucratic overload from new requests.

Using AHS quarterly data for 44 metropolitan areas from 1985 to 1996, Mayer and Somerville regress the log of single-family permits on the change in house prices (and 5 lags), change in prime interest rate, log of population, and three measures of regulatory control. Once again, the regulation variables come from the Wharton Urban Decentralization Project (Linneman and Summers, 1991). The three regulatory measures are:

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[48] A variable, y_t, is stationary if (for all t=1,2,...,n and for all k=...,-2,-1,0,1,2,... given t-k>=1) the following conditions are met:

$$E(y_t) = \mu$$
$$E[(y_t - \mu)^2] = \gamma_0$$
$$E[(y_t - \mu)(y_{t-k} - \mu)] = \gamma_k$$

Loosely, the conditions for stationarity are that the variable has a fixed mean and variance. Variables that are trending upward have an increasing mean and variance. First differencing takes out the upward trend and usually leaves a stationary variable suitable for regression modeling. (Fanses, 1998, p. 68)

[49] The construction cost variable is insignificant in the Mayer and Somerville (2000a) models as it is in most of the DiPasquale and Wheaton (1994) supply models.

1. The number of months for subdivision approval,
2. A count of the number of ways growth management techniques have been introduced in the MSA (referendum, legal action, municipal, county, state authority or administrative action),
3. An indicator of whether development or impact fees are imposed in the MSA.

The model results show that a standard deviation increase in months delay causes a 20 to 25 percent reduction in the number of permits. Each additional method of growth management causes a 7 percent decline in permits. Put together, an MSA with 4.5 months delay and 2 methods of growth control has a 45 percent reduction in permits compared to an MSA with 1.5 months delay and no growth management. The coefficient on fees is insignificant, whereas the coefficient on delay is negative and significant, suggesting that delay is a bigger factor in supply inelasticity than fees. A model with price changes interacted with a regulation dummy lends support to the land inventory idea, because the negative impact of regulation takes several quarters to take effect. The key point, however, is that supply elasticity is lower in highly regulated housing markets. Even though supply elasticity is hard to measure and probably varies over time, we do have evidence that it is lower in a highly regulated environment.

Summary of Supply Factors

In summary, data sources for supply factors are not available either locally or nationally, whereas demand factors, like population and income, are tracked both locally and nationally. We know less about supply factors than demand factors, in part because supply decisions are made by builders in the local housing market. Households make demand decisions based on demographics, income, and wealth, which are easier to capture in a national survey of households. Primary data sources, like AHS and Census, do track changes in stock, but not usually on an annual basis. However, those data sources show that population in the 1990s increased by 33 million, at a faster rate than in previous decades, but construction only increased supply by 13 million, which is slower rate than in previous decades. Given cyclical patterns, especially in construction, changes across decades may be a crude measure, but it does appear that supply is not responsive to price changes in high-cost metropolitan markets. One explanation is that the housing market is really a set of market segments by quality. In equilibrium markets, new construction adds to high quality market segments and the older units filter down to supply affordable housing. In “hot” markets with excess demand, the downward filtering process is reversed, reducing the supply of lower-cost housing. Renovations and remodeling can exacerbate the problem by upgrading affordable units, which then become higher cost.

High house prices seem in many instances to be attributable to inelastic supply, but it has been quite difficult to derive a consistent measure. One reason may be that supply elasticity varies by market, and it is difficult to get data for a large panel of metropolitan areas. The evidence we do have from a panel of AHS cities suggests that land availability and regulatory constraints are important factors in the responsiveness of supply to house prices. Furthermore, most of the evidence and analysis to date examine short run supply elasticity, and typically at the top end of the market, where most new construction occurs. More work is needed to isolate and calibrate the separate determinants of short-run and long-run supply elasticity, and to distinguish between supply influences operating at the high quality end of the market and those, notably filtering, that play a larger role in the supply of middle- and lower-quality housing.

VIII. Regulatory Constraints

Regulatory constraints (or development controls) is a very large topic in the planning literature, and we have necessarily been highly selective in the articles covered. At the core of the issue, there is tension about how to handle growth over time. Unregulated development along the urban fringe, i.e., suburban sprawl, provides inexpensive growth in the short run, but exacerbates problems of center city decline and the spatial mismatch of jobs and low-income workers. Suburban regulation, particularly large-lot zoning, protects the property values of existing suburban landowners, but blocks the development of low cost housing. Infill development can provide additional housing, but it is normally more expensive to build, and high-income families prefer backyards for their children and garages for their vehicles. Our goal is to point out the ways in which regulatory constraints are connected to house prices and homeownership affordability. The first part of this chapter reviews selected conceptual papers, and the second part presents empirical studies.

Conceptual Papers

Malpezzi (1996) provides an excellent review of the papers up to the mid-1990s on how land use and regulation affect house prices. He points out that regulations are designed to shift supply and demand to an equilibrium point that is socially optimal. For example, traffic congestion is an externality from high building densities. Regulation on building heights could shift the private supply of housing toward the social optimum. Other cost externalities include environmental costs, infrastructure costs, fiscal effects and neighborhood composition effects. There are also external benefits from additional housing, such as higher labor productivity and better racial integration. Externalities provide the economic justification for regulation, but there are many conflicting externalities and most of them are difficult to value.

A second point made by Malpezzi and many others is that regulations often raise the value of a property, but it is difficult to identify whether that price increase is a demand effect or a supply effect. For example, a park generally raises the value of surrounding properties. Are those surrounding properties more valuable because the owners are willing to pay for a nice park to walk in and lower density or because the park reduces the number, and thereby raises the price, of buildable lots? In many cases, regulations boost demand and depress supply. A model that does not control for both possibilities is likely to exaggerate the impact from included variables.

A related caveat to the second point is that the amount of data available to control for supply constraints is actually very limited. It is time-consuming and expensive to collect measures of regulatory constraints from a cross-section of metropolitan areas. Segal and Srinivasan (1985), Rose (1989a, 1989b), and Linneman et al. (1990, this is the Wharton Urban Decentralization Project data) have made valuable contributions that have been repeatedly used by others. However, these measures are for a single point in time for a limited number of cities and a very limited number of aspects of the regulatory constraints in those cities. This is not a theoretical point, *per se*, but it does limit the progress that can be made in theoretical modeling when those models cannot be tested.

William Fischel (1999) argues that American metro areas are too spread out as a result of local land use controls. He estimates that about one quarter of suburbanization is due to flight from central city

disamenities, while most of the rest results from growth controls and low-density lots. The growth controls mean that suburbs spread out excessively and that low-income households cannot afford to move out of the center city. For evidence, Fischel cites five phenomena.

1. High-income communities almost always have more restrictive zoning regulations than others.
2. Rezoning the land to higher density almost always increases land value, implying the old zoning was depressing the land value.
3. Metropolitan areas divided into many town governments and zoning authorities tend to have less income mixing. Each town tries to prevent "undesirable" developments within its own area.
4. Without zoning, developers try to build high-density projects in affluent areas to take advantage of higher-quality services (especially schools) and lower taxes.
5. Homeowners are most politically effective in suburban government, where the median voter is a homeowner.

Downs (2001b) is a strong proponent of metropolitan government as a way of balancing the property value focus of suburban homeowners with the need for access to employment and housing for everyone. Fischel rejects this solution as too easily manipulated by wealthy developers influencing politicians. Instead Fischel recommends reinforcing the property rights of landowners just beyond the urban fringe who want to sell their land for development. The value of that land is too low because the zoning board restricts the development to large lots. If the Courts insisted that the land value be set according to "normal suburban densities," then the suburban governments would have to compensate the seller for the difference between the "normal lot" value and the "large" lot value. This would be so expensive that only the wealthiest suburban governments would persist with large lot zoning. Presumably the higher density development would gradually meet demand and lower house prices generally.

Taking a more aggressive approach to social engineering, Nelson et al. (2002) distinguish growth management from growth control. In their definition, growth management is an integrated approach that steers development to achieve broad public goals, whereas growth control is the traditional, rigid approach that uses permitting caps and exclusionary zoning to keep affordable housing scarce and results in concentrated poverty. The authors claim that growth controls increase prices and hurt affordability, but growth management can provide more affordable units, depending on the development design, implementation of growth management regulations and circumstances of the local economic environment. For example, even the urban growth boundaries pioneered by Portland, Oregon, have not created affordability problems, because other growth management policies have ensured an increase in housing supply relative to demand. The point is that homeownership affordability depends on the type of regulations and the degree of enforcement more than the number of regulations. Unfortunately for empirical work, it is much harder to measure the degree of enforcement than to count the number of regulations on the books.

For a cogent explanation of Smart Growth, we turn to Bruce Katz (2002). The goal of Smart Growth advocates is to revitalize center cities by reusing abandoned brownfield land and creating more socially mixed inner neighborhoods.

First, we present a capsule version of the problem for center cities. The 2000 Census has confirmed that suburbs are growing at twice the rate of center cities (18 percent vs. 9.1 percent) and this differential is true for all types of big cities, whether growing or not (Berube, 2002). Job growth has followed population growth to the suburbs. Glaeser and Kahn (2001) report that across the largest 100 MSAs, only 22 percent of people work within 3 miles of center city, and over 35 percent go to work more than 10 miles from downtown. Even minority immigrants are going directly to the suburbs, leaving African Americans increasingly isolated in center city areas away from employment growth and educational opportunity (Singer et al., 2001). Jargowsky linked Census tract data from 1970 to 1990 and found the number of people living in high poverty neighborhoods (greater than 40 percent poverty) nearly doubled from 4.1 to 8.0 million. These areas of concentrated poverty have poor schools, scarce jobs and weak employment information networks. Children growing up in these neighborhoods are more likely to live in poor, female-headed households surrounded by welfare, drugs and crime. Because more inexpensive housing is there, center cities have a disproportionate share of welfare cases. For example, Philadelphia has 12 percent of the population in Pennsylvania, but 49 percent of the state welfare cases. Similarly, Baltimore has 13 percent of the Maryland population, but 56 percent of the state welfare cases (Allen and Kirby, 2000). In other words, some metropolitan areas are becoming income segregated with high income, good housing, and job growth in the suburbs and the opposite left in deteriorating city neighborhoods. Moreover, government policies from highway spending to tax treatment for homeowners to large lot zoning are contributing to the problem.

Smart Growth promises to correct those problems by slowing decentralization and promoting urban reinvestment with infill development that is mixed-use, mixed-income, transit-oriented and pedestrian-friendly. Opinions differ as to the appropriate mix of tools to achieve these objectives, but the following are among those commonly mentioned:

- Metropolitan governance
- Growth management
- Land use reforms and land acquisition
- Targeted infrastructure spending within the urbanized area
- Tax sharing

The primary purpose of growth management is to limit fringe development and promote infill development. At the same time, growth management intends to overcome exclusionary zoning by wealthy suburbs to distribute affordable housing widely. There is little doubt that it could prove difficult to overcome the opposition of many suburbs to affordable housing.[50]

The former governor of Maryland and now head of the Smart Growth Leadership Institute, Parris Glendening, claims that Smart Growth can have a major impact by "not just staving off sprawl, but by saving huge social costs of urban disinvestment, unnecessary outlays for water systems, roads and exurban schools, and the rising public-health costs of today's auto-oriented sedentary lifestyles." (Pierce, 2003.)

The Wendell Cox Consultancy prepared a report for the Millenial Housing Commission (2002) entitled "Smart Growth and Housing Affordability," which puts Smart Growth in a less favorable

[50] As an example of the challenge, Retsinas and Belsky consider targeting homeownership tax incentives to areas of low homeownership rates (Retsinas and Belsky, 2000).

light. According to the report, Smart Growth is responsible for development impact fees that communities levy on new developments to defray the cost of new infrastructure. The cost of the impact fees is not only passed on to the homebuyers of new houses (from 63 percent to 212 percent of the fee amount), but also increases the cost of existing housing (from 63 percent to 171 percent of the fee amount for new housing, Braden and Coursey, 1999). Impact fees are used extensively in California, where a limitation on property taxes has forced counties to rely on impact fees to pay for infrastructure extension (Landis et al., 2001; on Colorado see Singell and Lillydahl, 1990). As a per-unit cost, impact fees induce developers to build higher-cost housing, which usually have higher profit margins. The net effect is less supply of affordable housing, although relatively little new construction would be affordable even without the fees. Growth management advocates might say that new development should bear the cost of the new infrastructure to offset the externalities of urban sprawl and to reduce the tax burden on existing units. However, the California impact fees are proportionately higher on multiple unit construction, which discourages higher-density infill development favored by growth management.

Cox is also critical of urban growth boundaries that limit development at the suburban fringe. He believes that virtually any development control that reduces supply will be associated with higher housing cost and that most attempts to channel development entail more expensive construction than unregulated greenfield projects. Given this perspective, Cox might argue that the growth management policies advocated by Katz would increase the supply of low-cost housing and shift some of the cost burden onto higher-income households.

Michael Schill (2001) lists the range of regulations that contribute to the cost of housing production as:

- Land use and zoning
- Subdivision regulations and exactions
- Impact fees
- Growth controls and urban growth boundaries
- Historic landmark laws
- Environmental approvals
- Building codes

Each community has a different set of regulations and review boards, but in most cases local government officials have authority to require changes in development plans. Opponents to the development can either fight the approval in the review board hearings or challenge the decisions in the courts. Impact statements and litigation can add substantial costs and uncertainty to the approval process.

Boston, Massachusetts is often cited as a high-cost metropolitan area, and Charles Euchner (2003) blames the tangle of state and local regulations. Since 1980, Massachusetts house prices have increased 441 percent, compared to a national average of 182 percent (according to OFHEO), but permits have only increased 3 percent, compared to a national average of 37 percent (according to the Census Bureau). Not only are permits hard to obtain, the construction costs in Boston are high. Census data shows that Boston was third highest (after San Francisco and Nashville) in average per unit construction costs in 2001. The major obstacles are land availability and regulation. In Euchner's words (p. 2):

> The regulations affect every phase of housing construction – from land acquisition to siting of units on the land, from architecture design to rehabilitation of existing structures, from the placement of cesspools to the allocation of parking. No one rule, in itself, appears to cripple the housing production process- but combined, the regulations make the goal of major housing production suffer the death of a thousand cuts.

Growth management advocates would agree that this is not the right way to regulate growth, because low-income households bear the brunt of the high housing costs. However, the regulations did not happen by mistake. Town leaders across the Commonwealth have intentionally created development barriers.

Euchner also discusses two examples of policies intended to promote housing development in Massachusetts, Chapter 40b and the Community Preservation Act (CPA). The Comprehensive Permit Law (Chapter 40b) was instituted in 1969 as a tool to help developers override local zoning restrictions in towns in which less than 10 percent of the housing stock is affordable. Among Chapter 40b projects, an average of more than 25 percent of units have been set aside for low- and moderate-income households. However, only 25,000 units have been built in 30 years. Despite 40(b), as of 2001 only 23 of the 351 cities and towns in Massachusetts have met the 10 percent goal. All the other cities and towns have less than 10 percent affordable housing. Apparently 40b has not generated a substantial increase in affordable housing as intended.

One problem with Chapter 40b is that only government-subsidized units count as affordable and Euchner claims this discourages private development of affordable housing. On the other hand, all 40b units count toward the affordable goal even though only 25 percent are subsidized and the rest are market rate. The real problem seems to be that local officials resent the override aspect of 40b. Rather than state and local officials cooperating on approaches to create affordable housing, town leaders and state government officials have been locked in a bitter battle.

The Community Preservation Act was passed by the state legislature in 2000 and is gradually being approved by local towns so it may be too soon to judge it effects. CPA imposes a property tax surcharge, with matching funds from the state, to support affordable housing, open space, and historic preservation. Cities and towns have to devote 10 percent of the revenues from the surcharge plus the match for each of the 3 purposes, but have flexibility to choose among the three purposes for the remaining 70 percent. CPA fits with the growth management concept in that the Act is intended for existing communities and preservation of open space is targeted for exurban areas. However, as implemented thus far, most of the money has gone to the purchase of open space, which precludes new housing construction.

A theoretical model by Mayo and Sheppard (2001) considers the impact of stochastic development control. In other words, what happens when there is uncertainty about gaining approval from local planning boards about a development project? The authors' hypothesis is that, holding the expected duration of delay constant, the increase in variance of approval delay will increase the value of vacant land and decrease the supply of housing in the current period. One possibility is that developers deal with the uncertainty by proposing high-end projects that are more likely to be approved. The pay-off may not be as great, but there is more certainty of positive pay-off. This approach could increase the supply of high-quality homes, but shrink the supply of affordable homes. The theoretical model shows that the structure of supply could change due to the uncertainty as developers have an incentive to withhold land until the uncertainty is resolved. Ironically, longer, but more certain, delays could

increase the supply of housing. The net effect depends on the inventory adjustments undertaken by developers and the target of delayed approval (high-end vs. low-end). The model also suggests that planners could very effectively constrain supply by delaying approval rather than outright denying a development plan, which could be challenged in court.

Empirical Studies on Regulatory Constraints

In the section on Determinants of House Prices, we presented the results of Malpezzi, Chun and Green (1998). They estimated an instrumental variable equation for the regulatory constraint variable, Regtest, on 55 MSAs and found significant relations for only three variables. The California state dummy and percentage of household heads 65 or older are positive and significant variables, while the percentage owner-occupied is negative and significant. These results do not fit easily into the picture that zoning boards are catering to median voter homeowners anxious to protect their house values. It is, however, quite possible that wealthy or established suburbs tend to have a high percentage of elderly heads, so the drive for tighter regulation flows through the elderly variable.

Green (1999) examined how regulation affects house prices in Waukesha County, Wisconsin. He used Census tract data from 1990 with regulation data collected by Scheutz and White (1992) to estimate a reduced-form price equation. The main findings were that forbidding manufactured houses increases prices by 7.1 to 8.5 percent, and each additional 10 feet of frontage required increases in prices by 6.1 to 7.8 percent. When measured in terms of affordability (share of owner-occupied houses in the tract that are less than $75,000), forbidding manufactured houses reduces affordability by 6 to 8 percentage points and each additional 10 feet of required frontage reduces affordability by 3 to 4 percentage points. These are substantial changes relative to a mean affordability share of 16 percent. Green also notes that land use regulations have a non-linear impact on prices because they are not binding on the choices of households earning over $150,000. The regulations affect lower-income households more directly. The author suggests, “By reducing the stock of affordable housing, communities perhaps seek to immunize themselves from social spending.” (p. 16)

Another local analysis is a study of Portland, Oregon, by Phillips and Goodstein (2000).[51] Portland instituted an urban growth boundary (UGB) in 1979, with the purpose of reducing sprawl and promoting higher density, infill development. In the 1990s, housing prices increased rapidly in Portland, as in other western cities, so it was natural to ask what role the urban growth boundary had on rising house prices. The authors conclude that, “the UGB has had a small, and statistically weak, upward influence on housing prices (p. 334).” The primary measure for regulatory constraints is Malpezzi’s Regtest variable based on data from the Wharton Urban Decentralization Project. Malpezzi et al. (1998) expressed concern about the possible endogeneity of this variable, but Phillips and Goodstein used the original variable, with a boost in index value for Portland from 16 to 30. The idea is that the Wharton data was for 1990, six years before the time of Portland house price increases, so the authors attempted to compensate by giving Portland a higher regulation level than Honolulu or San Francisco. The OLS regression results show that the regulation variable is significant at the 10 percent level, but the coefficient becomes insignificant when a speculation variable (price change from 1990-95) is introduced. Curiously, the Boeckh construction cost index is positive and significant at the 1 percent level, which is theoretically correct but uncommon in

[51] See Katz and Rosen (1987) for an analysis of growth controls raising house prices in San Francisco by 17 to 38 percent.

empirical work. Unfortunately the sample size is small (only 37) and disaggregated data on various regulatory constraints over time is what is really needed before we can determine whether urban growth boundaries have a significant impact on house prices.

The National Association of Home Builders (1999) asked builders in 42 MSAs for a detailed breakdown of construction costs for a standard size house of 2,150 square feet on a standard lot. Relative to an average sales price of $226,668 in 1998, builders estimated that the house price could be reduced by an average 10 percent if "unnecessary" regulations, fees, and delays were eliminated. The estimates for savings ranged from 4 percent in Grand Rapids to 29 percent in San Francisco. The survey also found a wide distribution for delays in permitting. When land had to be rezoned, 11 percent received their permit in 6 months or less, while 22 percent had to wait 24 months or longer. Even without a need for rezoning, 60 percent of builders claimed permits took 7 months or longer.

Luger and Temkin (2000) report on a similar survey of New Jersey developers, in which regulatory costs were divided into normal and excessive. Regulations necessary for the preservation of health, safety and environmental quality are considered "normal"; others are deemed "excessive." For example, under subdivision regulations, streets, curbs, sidewalks, sewers, and street lighting are "normal," whereas landscaping, street trees, underground utility lines and negotiated open space set-asides are "excessive." Similarly, under zoning regulations, street width and lot width are "normal," while restrictions on clustering, bond release difficulties and discretionary planning board decisions are "excessive." Based on median responses, the authors calculate that regulations add $38,375 to the cost of a new home in New Jersey, of which $8,900 is considered "excessive." To that amount the authors add excessive amounts for plan preparation, review, application costs and fees, and delay in permitting to derive a total excessive regulatory cost of $19,500. A case study conducted by the same authors provides more conservative estimates of $10,200 to $13,400 calibrated for a median new house price of $236,000 in 1996.

The impact of excessive regulation does not stop at direct costs of $10,000 to $20,000. Luger and Temkin claim that there is a multiplier process, whereby the regulatory costs get further marked-up by the developer. They estimate the overall multiplier to be 4, which means the overall impact of excessive regulation could add $40,000 to $80,000 to the final price of a new house. The authors assert that these price increases are responsible for a slowdown in construction for lower end houses, with many low-income households priced out of homeownership. Luger and Temkin have done a valuable service in collecting the kind of detailed information needed to assess the impact of regulations. However, this information needs to be paired with more complete information about the developers' output and profitability as well as housing market conditions to confirm such large price impacts from excessive regulation.

Based on international comparisons of supply elasticities, Malpezzi (1990) found that a high price-to-income ratio is a symptom of an inelastic market. Gyourko and Voith (1992) investigated house price changes for 56 MSAs between 1971 and 1989 and found that they had significant serial correlation (errors are related over time) and mean convergence (house prices tended toward a long run average), but they could not reject the hypothesis of equal appreciation over the long run. This suggested to Malpezzi (1999) that there could be a constant, k, which is the price-to-income ratio in equilibrium. The change in prices could be modeled as a function of the difference between the actual P/Y ratio and the constant k over n-period lags.

$$Equilibrium: \qquad \frac{P_t^e}{Y_t^e} = k_t = Z\delta + \eta_t$$

where Z is a vector of market conditions and other determinants of k, such as regulation; and

$$Price\ Change: \qquad dP_t = \beta_0 + \beta_1\left(\frac{P_{t-1}}{Y_{t-1}} - k\right) + \ldots + \beta_n\left(\frac{P_{t-n}}{Y_{t-n}} - k\right) + X_\alpha + \varepsilon_t$$

where X is a vector of market conditions and other determinants of price changes other than disequilibrium and random shocks.

To estimate the equilibrium relationship, the author selected observations in which the change in price was less than 1 percent in absolute value. Stable MSAs were given more weight in the regression. The equilibrium model included controls for regulatory constraints and land constraints, along with a standard set of variables for income, population, and interest rates. The model was applied to house price data from the Fannie Mae/Freddie Mac repeat sales indexes and Bureau of Economic Affairs (BEA) data on per capita income for 133 MSAs from 1979 to 1996. The regulatory constraint variable is the instrumental variable version from Malpezzi, Chun and Green (1998). It has a surprisingly large positive effect (t-statistic is 18 and the standardized coefficient is twice as large as the next largest standardized effect). Malpezzi (1999) found that metropolitan areas with tight regulatory constraints have higher house prices relative to area income. However, in the price change model, higher levels of regulation are associated with lower house price increases, just the opposite of what was expected. The coefficient is positive when the actual regulation index is used, but negative when the instrumental variable predictions for regulation are used. The instrumental variable is preferred to avoid endogeneity (prices affecting regulation), but the instrumental variable equation is not particularly strong. Another possibility is that fixed effects are picking up much of the regulatory effects. When the fixed effects are removed, the regulatory coefficient (IV version) is positive, but the overall fit (adjusted R^2) drops from 0.28 to 0.15. Malpezzi concluded that the instrumental regulatory variable is an incomplete measure of regulation and the true effect is a combination of the variable and the fixed effects.

Malpezzi's price change equation can be used to simulate responses to price shocks. Highly regulated markets are slower to converge back to equilibrium, and that equilibrium price-to-income ratio is higher. In this model, real income and population changes have a positive impact on house price changes, while mortgage interest rates and the degree of disequilibrium have a negative impact. The model suggests that house prices will increase during periods of income and population increases and interest rate declines (late 1990s). When real incomes stall during a recession or interest rates start to rise, then the negative disequilibrium effect will pull house prices back in line with income. However, cities with stringent regulatory constraints may be slower to respond, meaning house prices will take longer to return to equilibrium levels.

While housing affordability has traditionally been measured as housing costs relative to household income, Glaeser and Gyourko (2002) argue this approach confuses the issue of housing being too expensive with the income distribution issue of households being too poor. Instead, they believe a housing affordability problem means that housing is expensive relative to construction costs. Using the R.S. Means Company's data on construction costs (which excludes land costs), the author's calculate the average single-family detached home of 1,704 square feet, at $75 per square foot, cost

$127,500 to build compared to a median home value of $120,000 reported in the 2000 Census. Analysis using AHS data shows that at least half the nation's housing costs no more than 20 percent more than the physical construction costs for an average quality home. From this they conclude that house prices are in line with construction costs in most housing markets, and that land comprises only about 20 percent of the total value. In high cost areas, houses are expensive either because a limited supply of land is in great demand (the traditional model) or because government regulation has limited the construction of new housing (the regulatory constraint model).

To test their hypothesis, Glaeser and Gyourko compare the intensive value of land (i.e., value measured by a hedonic regression) with the extensive value (i.e., value measured by subtracting construction cost from total house value). If the traditional model is correct, land should have the same value by either method. Empirically, they find the hedonic estimates of land value are only about 10 percent as large as the value estimates of the extensive methodology, which supports the regulatory constraint hypothesis. That is, there is some other factor than just the land itself, which is left in the residual of house value less construction cost. Glaeser and Gyourko suggest that other factor is the cost of regulation.

A second test compares housing density across high-priced places. The traditional model would predict that houses would have smaller lots where land is expensive. Alternatively, prices may be high because of an implicit "zoning tax," which does not vary with the size of the lot. They find that there is no statistical relationship between density and prices. Owners cannot increase their utility by conserving on expensive land, because regulation constrains the market supply.

A third test is a correlation between measures of regulation and house prices. As Malpezzi et al. (1998) have pointed out, regulation may be endogenous with regulation, both causing and being caused by high prices. The high correlation, therefore, may exaggerate the degree to which regulation is responsible for high house prices. Using the Wharton data (once again) to measure regulation, Glaeser and Gyourko find a significant positive relation between the percentage of units in a city valued at over 140 percent of construction costs and the time between application for rezoning and issuance of building permit for development of a subdivision. As usual with the Wharton data, the sample size is small (only 40 cities) and the model is kept very simple. Nevertheless, even when the regression includes controls for income and population, the results show a very significant relation between rezoning delays and the percentage of high-cost units.[52]

Summary of Regulatory Constraints

Regulatory constraints are designed to alter supply or demand in recognition of externalities, i.e., effects beyond those on the parties in a private transaction. To properly identify whether increases in house prices are due to amenities or supply constraints, one would need to have variables controlling for each effect. Unfortunately, there have been precious few data sets that quantify the effect of regulatory constraints for a cross-section of cities. The 1989 Wharton Urban Decentralization Project data is one of the very few, and it has been used extensively. There is an urgent need to update and extend these data to more cities.

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[52] Glaeser, Gyourko and Saks (2004b) further develop their arguments by considering the house prices in Manhattan where they find property prices exceed replacement cost by 100 percent due to high land prices and restrictive regulation.

Suburban sprawl and the concentration of poverty have spurred many researchers to look for alternative urban development patterns. Fischel promotes the property rights of landowners, claiming that there would be more construction of moderate quality houses if suburbs were forced to compensate owners when land is zoned for low density. Katz promotes a Smart Growth agenda that includes land use reforms and growth management to redirect development toward infill projects. For Katz, this would require substantial changes in metropolitan governance and tax sharing, which are very likely to be resisted by suburban leaders. In addition, growth management could lead to higher development costs. Cox focuses on the negative effect of impact fees, while Euchner highlights a tangle of local and state regulations that slow down affordable housing development and raise house prices for all housing, new and existing.

Empirical research has attempted to measure the impact of regulatory constraints on house prices. Green found evidence that prohibiting manufactured housing raises house prices by about 8 percent, and each additional 10 feet of frontage width raises prices by about 7 percent. From a survey of homebuilders, NAHB claims that unnecessary regulations, fees, and delays raise house prices by roughly 10 percent. Luger and Temkin interview builders in New Jersey and find "excessive" regulation responsible for $40,000 to $80,000 of new house prices, or loosely 15 to 20 percent. Malpezzi finds regulatory constraints definitely raise house prices, but it is less clear what the impact is on price changes. However, it appears that regulation slows the supply response to house price shocks. Finally, Glaeser and Gyourko claim that housing affordability should be measured in terms of house prices relative to construction costs rather than household income. Their analysis concludes that regulation is like a zoning tax that gets added to the land value, so the total cost of housing is much higher than implied by hedonic land values plus construction costs. In sum, we found no research claiming that regulation lowered house prices and a loud chorus claiming regulation is responsible for higher house prices. However, the issue remains undecided as to whether the house price increase is for an amenity that people are willing to pay for or a regulatory cost without a corresponding benefit.

IX. House Price Dynamics

As Malpezzi (1999) pointed out in his research on regulatory constraints, house prices can be studied in either levels or changes. The next two chapters are devoted to the extensive literature on house price changes or dynamics. Chapter IX focuses on the determinants of metropolitan house price changes, with a review of the relative efficiency of housing markets. We also consider the way in which the financial accelerator impacts the sensitivity of house prices to income shocks and credit constraints. Chapter X examines house price bubbles, how they build and collapse, and reviews the current evidence for house price bubbles. Economists often associate bubbles with irrational behavior, and, in fact, most strict tests of housing market efficiency fail. Chapter XI on behavioral finance considers how buyers and sellers form price expectations in an uncertain, dynamic housing market.

In a fine review of the earlier dynamics literature, Cho (1996) defines the three forms of informational efficiency identified by Fama (1970). The strong form of efficiency assumes that investors cannot consistently earn above-normal, risk-adjusted returns using either public or private information. A semi-strong form of efficiency assumes that above-normal returns are possible only with private information, not public information. The weak form of efficiency assumes that above-normal returns are not possible using only past public information on prices and returns. It is actually the weak form of efficiency that has been tested extensively, because it is possible to avoid the endogeneity of current information and test the significance of lagged prices and lagged returns. For example, Case and Shiller (1989) found that both house prices and after-tax excess returns are positively serially correlated which violates the weak form of efficiency assumption. From an overview of the literature, Cho concludes that both house prices and excess returns exhibit a positive serial correlation in the short run. Although the housing market does not appear to be efficient, the deviations are not large enough for investors to systematically profit from them given the high transaction costs.[53]

Abraham and Hendershott (1993) use Freddie Mac repeat-sales data for 29 cities to estimate a house price change equation from 1977 to 1991. Following Case and Shiller (1989), the best model specification includes lagged real house price appreciation. Showing the sign in parentheses, the specification also contains real construction cost inflation (+), employment growth (+), real income growth (+), and change in real after-tax interest rate (-). A deviation variable, calculated as the difference between national prices and local prices ($P_{National}$-P_{Local}), is not significant when lagged price changes are in the model. The idea is that some cities have temporary shocks, but they tend to revert back to the national average house price growth. The driving force comes from the growth variables for employment and income. In a comment, Wilcox recommends including an error correction mechanism, and Apgar suggests adding controls for demographics and growth controls.

Similar findings are presented by Jud and Winkler (2002), who estimate the percentage price change as reported by OFHEO for 130 metropolitan areas from 1984 to 1998. The independent variables (shown in Exhibit 20) are in percentage change form, so the coefficients are elasticities. For example,

[53] See also Clayton (1996) for a rational expectations model that works well on Vancouver, BC data from 1979-1991 during less volatile times, but misses the boom periods. The conclusion is that house prices deviate from market fundamentals during the extremes of real estate cycles when the market is less efficient and expectations are less rational.

a 1 percent increase in income is associated with a house price increase of 0.17 percent. Surprisingly, after including the lagged effect, a 1 percent increase in the stock market index is associated with a 0.16 percent increase in house prices, nearly as large as for a similar change in real per capita income. As expected, income, stock market wealth, population and construction costs also have a positive effect on house prices. The unexpected finding is that changes in after-tax real mortgage interest rates have a *positive* effect, especially given that interest rates fell throughout most of the estimation period. Fixed-effect dummies for the MSAs are included in the specification and nearly all are negative. The authors show a positive correlation between those fixed effects and other measures of regulatory constraints. Thus, they conclude the fixed effects represent "the magnitude of restrictions on housing growth attributable to specific metropolitan areas" (p. 40). The top four positive fixed effects are for: San Francisco, Los Angeles, Honolulu and San Jose.

Exhibit 20. Determinants of House Price Percentage Changes for 130 MSAs from 1984-1998

Independent Variables (%Δ)	Coefficient	t-Statistic
Real Income per capita	0.168	6.43
S&P 500 Stock Index	0.099	21.00
S&P 500 lagged 1 year	0.063	18.93
After-tax Mortgage Interest Rate	0.024	13.01
Population of MSA	1.089	11.19
Construction Cost (lagged 1 year)	0.122	12.00
R^2 =0.65 with a full set of MSA fixed effects (n=1,690)		

Source: Jud and Winkler (2002), p. 34.

One disadvantage of inter-metropolitan models is the wide diversity of local economic effects, which make it difficult to tell a unified story. Case and Mayer (1995b) analyze the house price appreciation for 168 towns in the Boston metropolitan area from 1982 to 1994. Each town has its own repeat-sales index from a subset of the total 135,000 pairs of sales. Despite some mixed results, they manage to draw out a compelling story. The underlying idea is that towns compete with one another, offering a mix of amenities, taxes, and land for development. The housing price in any particular town is a function of the amenities, taxes, and developable land for all the towns. Shifts in employment affected demand for housing as manufacturing towns like Lawrence and Lowell lost jobs, while financial service industries downtown and in certain western suburbs gained jobs. Accessibility was also important, as towns close to the business district had faster house price appreciation. Towns that allowed more rapid development enjoyed slower price growth. The baby boomers reached middle age during this time, and they pushed up house prices, as Mankiw and Weil (1989) described elsewhere. However, as fewer families had children in school, the premium fell for houses in towns with good schools. Schools are a good example of an amenity that cannot be replicated easily to meet the demand of house buyers and mitigate any relative price changes.

Another way to look at house price changes is to decompose the current change into a serial correlation component, a mean reversion component, and a change in fundamental price component. Capozza, Hendershott, Mack and Mayer (2002) start with the following model.

$$P_t - P_{t-1} = \alpha(P_{t-1} - P_{t-2}) + \beta(P^*_{t-1} - P_{t-1}) + \gamma(P^*_t - P^*_{t-1})$$

The first term on the right is the serial correlation component, and α drives the amplitude and persistence from past prices. Mean reversion is captured in the second term, with P^* representing the fundamental value for a city that equalizes supply and demand on average. The coefficient β measures the speed of adjustment back to the mean. The third term shows the degree of change in the fundamental value. The fundamental value, P^*, is not observed, so the researchers estimate a steady state house price levels equation as the first stage. Predicted values from this first stage model can then be used in the second stage house price changes regression.

Capozza et al. test hypotheses on information dissemination (assuming there is more information from active markets), on supply constraints (assuming government regulation hampers new construction and market adjustment) and on expectation formation (assuming there are more backward-looking expectations and serial correlation in hot growth markets). The data is a panel of 62 MSAs from 1979 to 1995. The authors find that serial correlation is higher in MSAs with higher real incomes, population growth and real construction costs. Reversion to the mean is higher in MSAs with larger size, faster population growth and lower construction costs. Substantial overshooting of prices occurs in areas with high real construction cost, with high serial correlation, and with low mean reversion (such as coastal cities like Boston, New York, San Francisco, Los Angeles and San Diego). To the extent that government regulation drives up real construction costs and weakens mean reversion, this model suggests that regulation could also result in house prices overshooting their fundamental value.

Metropolitan housing markets can be influenced by regional effects and national effects, though the correlations can vary over time. Calem, Case, and Fetter (2003) study house price changes in 137 MSAs from 1982 to 2000. In four of nine regions (including the West and Northeast), they found short-term (one-year) positive serial correlation coupled with a strong five-year mean reversion. Although the timing of the cycles was quite different, the authors conclude that the correlations in house prices are high enough among MSAs that geographic diversification would be difficult. Another curious finding is that income shocks to the West coast and Northeast appear to take much longer to be absorbed, despite the strong mean reversion. A standard deviation income change or shock is milder and more quickly absorbed in the Southeast, Central and Plains districts where serial correlation is weaker and cycles less pronounced.

Recent work by Glaeser and Gyourko (2004) focuses on the asymmetric growth patterns of cities linked to the durability of housing. Cities typically grow more quickly than they decline because population growth is readily accommodated by new construction, but population decline does not lead to a commensurate removal of housing units. Positive shocks, stemming from increased productivity, may lead to house price increases in the short run depending on the elasticity of supply. But in the longer run, new construction will satisfy demand and house prices will represent the price of land/regulation and construction costs. Negative shocks tend to decrease housing prices more than they decrease population such that house prices fall below construction costs and the existing structures gradually decline from under-maintenance. The asymmetric pattern described by Glaeser and Gyourko is rapid growth versus protracted decline. The decline is exacerbated by the movement

of skilled labor toward growth cities, while unskilled labor is attracted to cheap housing. Declining cities are trapped in low growth by a surplus of low quality housing and workers.[54]

Financial Accelerator Model

One explanation for why some cities react differently than others to income shocks is that some cities have a higher proportion of highly leveraged homeowners. These highly leveraged homeowners, often in starter homes, rely heavily on an increase in their house value to provide the equity necessary for moving up to a nicer home. A favorable income shock in a city may increase the number of new homeowners, but it can have an even bigger impact by providing the equity, and thus down payment, for many existing homeowners to buy a bigger home. Stein (1995) divides families into three groups:

- unconstrained movers,
- constrained movers, and
- constrained non-movers.

The first group is wealthy enough that its members do not have to rely on house prices to make their optimal housing choice. It is the second group of constrained movers that plays a destabilizing role in the model, because their net demand for housing is an increasing function of price. As house prices increase, this relaxes the wealth constraint and allows these movers to choose their preferred level of housing. If a large fraction of owners have high LTV ratios, then a small increase in price can trigger a wave of moving and house buying that compounds the initial price increase. The amplifying effect, sometimes called the financial accelerator (Almeida, Campello and Liu, 2002; Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997), can also compound a fall in house prices. With so many homeowners highly leveraged, a small decrease in house price can put many homeowners into a situation of negative equity. With no ownership stake and a large mortgage, some homeowners are more likely to default or sell their house in a surplus market. The excess supply of houses on the market drives down prices further in a downward spiral.

Lamont and Stein (1999) use the 44 metropolitan areas in the AHS from 1984-1994 to verify Stein's theoretical model. A one percent shock in per capita income causes house prices in a highly leveraged city to increase by 0.64 percent in the first year, growing to 1.23 percent in the third year. In contrast, the same income shock in a low-leverage city causes a smaller increase (0.19 percent) in the first year and only 0.68 percent by the third year. House prices are nearly twice as responsive in a high-leverage city as in a low-leverage one. The empirical challenge is that leverage is endogenous and, as often is the case, the instruments used in the instrumental variable estimation are weak. Buyers might be more willing to enter into high-LTV loans when they expect house prices to rise, and certainly lenders would be more willing to lend in those circumstances. Once again, how people form their expectations is key to the responsiveness of house prices and the likelihood of overshooting.

Ortalo-Magné and Rady (2002a) study housing market fluctuations through a life-cycle model, with households varying in income and preferences. The underlying assumption is that there is a property

[54] Glaeser, Gyourko and Saks (2004a) also claim that differences in regulation among MSAs account for differences in house prices (more regulation causing higher house prices) and how the MSA house prices respond to increases in productivity (more regulation generally reduces supply elasticity so that increases in productivity lead to larger increases in house prices rather than more housing).

ladder that households are trying to ascend. Young households want to become homeowners, but they do not have the necessary down payment for their ideal house. Instead, they buy a low-cost, starter-home and then use the equity from that leveraged investment to trade up. One of the important assumptions is that supply is relatively inelastic. Otherwise, a small increase in prices would lead to expanded supply, and homeowner equity would not increase. Another assumption is that the non-starter homes are higher quality and have a positive spread relative to the price of starter homes. A hierarchy of house qualities is matched by a hierarchy of homeowner wealth such that existing homeowners can outbid new homeowners by using the capital gains from their houses.

As in the Stein model, Ortalo-Magné and Rady find that housing prices can over-react to income shocks. Moreover, a relaxation of the down payment constraint can initiate a boom-bust cycle. Liberal underwriting may exacerbate house price overshooting, but the model also shows faster correction because adjustments are made at the lowest quality level. Essentially a big wave of new homeowners gets stuck on the bottom rung of the property ladder. A less sanguine possibility is many new homeowners fall off the bottom of the ladder, and their accumulated defaults can harm whole neighborhoods. The proliferation of low-down payment loan products has made it possible for wealth-constrained households to become homeowners. The government has promoted this trend, but Ortalo-Magné and Rady point out an increased vulnerability to greater cyclical fluctuations.

Another finding of the model is that housing prices and the number of housing transactions are positively correlated. Some researchers, Follain and Velz (1995) and Hort (2000), have found a negative correlation and claim the relationship is sensitive to time period and specification. Berkovec and Goodman (1996) explained the positive correlation between prices and sales in the context of a search model, in which buyers are more sensitive to house prices than sellers. One reason for this asymmetry is that buyers are more directly affected by income shocks, i.e., they rely more heavily on income than on their wealth to qualify for the mortgage. (Of course, this explanation works better for first-time homebuyers.) Another reason for buyers to be more sensitive to the market is that they spend so much time searching in that market, whereas the sellers may be focused as buyers on a higher quality market or a different location. A third explanation suggested by Case and Shiller (1988, 1990) is that sellers form their expectation about the appropriate selling price in reference to the price they paid. As a consequence, sellers are reluctant to lower their asking price below their purchase price. This makes house prices sticky downward, and thus sales drop along with prices. Potential sellers, who have flexibility, may wait for “up” markets.

In the Berkovec and Goodman model, the sellers are under time pressure, although price discounts remain very small for a long time. Eventually the sellers have to sell in order to get the money for their own purchase or to avoid a bridge loan. Both buyers and sellers have backward-looking, adaptive expectations, in which the price expectations for the next period are a weighted average of the current price and the current market-clearing price. The market-clearing price isn’t revealed until market participants see how many buyers enter relative to the number of new and continuing sellers. Once the participants see fewer buyers coming into the market, then they adjust their price expectations. The lag in adjustment means that sales react more quickly than prices to a demand shock. Over the longer run, prices and sales move together, but in the short-run adjustment period sales can run counter to prices. In fact, Berkovec and Goodman found a closer relationship between sales and prices in annual observations than in monthly or quarterly observations. This suggests one reason that house price indexes have difficulty tracking short-term changes is that they need to control

for sales transactions.[55] Some of the initial response to demand changes occurs in the sales transactions before getting transmitted to price.

In a separate theoretical model on homeownership, Ortalo-Magné and Rady (2002b) consider how heterogeneous households[56] make the joint decisions of location and tenure mode. The dynamic stochastic equilibrium model[57] with homeownership is compared to a rental-only version in their response to a labor shock. One of the findings common to both of their models is that homeownership adds to the price volatility of a housing market.

The more disturbing finding is that households that consume the most housing gain the most from the ability to own their own home. Existing owners not only benefit from the capital gains when strong demand causes their house to appreciate, but also they can use that cumulated equity to sustain them if their income drops. And, in a down market, the owners do not have to sell. Particularly in up markets, the presence of owners means fewer houses on the market, and wider price swings. Newcomers suffer from higher housing cost fluctuations and fewer housing choices. Ironically, homeownership alleviates the risk of fluctuating prices for the existing owners, but can exacerbate the costs and fluctuations for renters and potential new homeowners.

Summary for House Price Dynamics

Housing markets are not informationally efficient, as shown by the significance of lagged prices, but excess returns are generally not large enough to be profit opportunities because transaction costs are high for housing. Abraham and Hendershott estimated a house price change equation and found positive effects for employment growth, income growth, construction cost, and lagged price appreciation, and (as expected) a negative effect from interest rates. Jud and Winkler also found positive effects from stock market wealth, population growth, and, surprisingly, real interest rates. Focusing on one metropolitan area (Boston), Case and Mayer found positive price effects from the baby boom cohort, but negative effects for manufacturing towns and towns that allowed more rapid development.

Trying to understand the circumstances behind serial correlation of prices and reversion of prices to the mean, Capozza et al. found serial correlation is higher in MSAs with higher real incomes, population growth, and construction costs, while mean reversion is higher in MSAs with larger size, faster population growth, and lower construction costs. Regulatory constraints increase construction

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[55] Clapp and Giaccotto (1992; 1994) posit that starter homes are over-represented in repeat sales price indexes because these properties are more likely to be sold repeatedly. This "starter home effect" means that repeat sales indexes contain more homes that are smaller and less expensive than the entire housing stock. As a result, repeat sales indexes are more sensitive to unemployment and interest rates than the assessed value (AV) method that is more representative of the complete cross-section of owners.

[56] Heterogeneous households, in this context, means the characteristics of the households vary over a multi-dimensional distribution. The alternative would be homogeneous households which all share the same set of characteristics. As an example of heterogeneous households, households with high income tend to be owners, but not all rich households are owners and not all low-income households are renters.

[57] A stochastic model allows for variables drawn from a random distribution. A non-stochastic model would be a deterministic model that does not allow for random variation. In a stochastic equilibrium model, there is an underlying equilibrium condition, but the model is not necessarily in equilibrium due to random error in the variables. A dynamic stochastic equilibrium model allows for changes over time in the stochastic variables, which would converge back to equilibrium, but for the random shocks.

costs, so regulatory constraints can contribute to higher serial correlation and weaker mean reversion. Substantial "overshooting" is most likely to occur when MSAs have high construction cost, high serial correlation, and low mean reversion. This pattern can be found in Boston, New York, San Francisco, Los Angeles and San Diego. Calem, Case and Fetter found that shocks take longer to be absorbed in the West and Northeast, despite the apparent strong mean reversion there.

Lamont and Stein found that income shocks can be compounded by a financial accelerator. In metropolitan areas where many owners are highly leveraged, those owners increase their housing demand when capital gains on their current houses make it possible for them to move up the property ladder. However, the high leverage can lead to overshooting and collapse. Ortalo-Magné and Rady associate the positive correlation of prices and sales transactions with the financial accelerator, but Berkovec and Goodman associate it with buyers being more sensitive than sellers to income shocks and market prices. Both buyers and sellers are assumed to have backward-looking expectations, but the faster realization and response to changing prices by buyers lead to a change in sales that precedes the change in prices. Usually rising sales precede rising prices and falling sales come before falling prices. In a different model, Ortalo-Magné and Rady find that homeownership can facilitate mixed income neighborhoods, but homeownership can also increase housing costs and price fluctuations, which are detrimental to renters and new homebuyers.

X. Bubbles

The thrilling rise and abrupt fall of the stock market in recent years has led many homeowners and a few analysts to wonder if housing markets could follow the same path (Schulte, 2002; Shiller, 2002a; Laing, 2002). Despite the evidence in the last section that positive serial correlation and high construction costs can lead to overshooting, housing economists, including Federal Reserve Chairman Greenspan,[58] do not foresee housing prices falling in more than a few metro areas. In this section we consider the positions expressed by housing experts in the popular media, as well as studies published in the academic literature.

Michael Carliner (2002), Chief Economist for the National Association of Home Builders, disparages what he calls "house price bubble babble" by showing that the rapid increase in house prices is in line with income and rents at the national level. There has been a dramatic increase in the ratio of house prices to owner's rent[59] since 1995, however, that followed a nearly equal drop from 1989 to 1995, so that the ratio in 2001 was only 5 percent higher than in 1989. Falling interest rates during this period have made homeownership more affordable generally. Carliner concedes that house prices are high relative to incomes in metropolitan areas with physical barriers to growth or regulatory constraints. The analogy to the stock market may be misleading, according to Carliner, because corporate earnings are much less stable than household income. The price-to-earnings ratio (P/E) is really analogous to the price-to-rent ratio in the housing market, and that ratio has remained within the historical range.

Even if house prices have not soared above rents, they have been growing at unsustainable *rates* in a number of cities. According to David Levy, chairman of the Jerome Levy Forecasting Center, the 6-8 percent national growth rate is unsustainable (Bernasek, 2002). Douglas Duncan of the Mortgage Bankers Association agrees that house price growth is more likely to be in the 2-4 percent range in coming years. In this scenario, bubbles will not necessarily burst, but will stop expanding. However, Robert Shiller of Yale claims that the San Francisco bubble began bursting in the fall of 2001, as house prices dropped 7 percent in the fourth quarter (Bernasek, 2002). Shiller warns that Seattle, Denver, New York City, and Portland, Oregon, have the highest risk of a bubble burst in the near future.

According to Bernasek (2002), a bubble bursts for a variety of reasons. First, interest rates will eventually rise, which will make housing less affordable. As affordability decreases, demand decreases. This causes prices to stagnate or drop. If house prices drop, current homeowners who are well off may begin to decrease their spending, including maintenance, because they feel a drop in their real wealth. Current homeowners who are not well off may find themselves in a negative equity situation as their mortgage debt exceeds the home's current value. This will lead to increased defaults.

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[58] "'Clearly, after their very substantial run-up in recent years, home prices could recede,' Greenspan said. 'A sharp decline, the consequences of a bursting bubble, however, seems most unlikely.'" From a speech to the Independent Community Bankers as reported in The Record, "Greenspan Expects Housing Market to Cool; Consumer Spending Could Slow," (Bergen County, NJ), March 5, 2003.

[59] Owners do not pay rent, but the concept is how much the owner would have to pay as a renter for the same quality housing unit.

However, for a bubble to burst, there must be one or more precipitating events. Among the possibilities are affordability reduced by rising interest rates or a lack of consumer confidence caused by some other action (war, oil crisis, weakening dollar). Optimistic analysts claim that demand does not appear to be slowing and, therefore, the bubble (if indeed there is one) will not burst in the near future (Bernasek, 2002). These same analysts claim that the current housing supply does not support the idea of a bubble, either. In previous housing price run-ups, there was a glut of new construction that caused supply to exceed demand. In the current market, however, new construction is at a 30-year low. Optimistic analysts point to the fact that, although house prices have increased dramatically in some areas (California and the Northeast) in the last several years, the increases are still much lower than the increases during the mid- to late-1980s. These analysts also argue that interest rates will not rise as long as inflation stays in check.

According to Mark Zandi, chief economist at Economy.com, "[t]here's no widespread bubble, but there are bubble-ettes across the country." Zandi cites several of the top bubble contenders, including San Diego, San Francisco, Denver, and Boston.

Analyst Ingo Winzer, who has published the Local Market Monitor for 12 years, claims that there are more overpriced regional markets in 2002 than he has ever recorded. Winzer's formula for determining equilibrium home prices requires that the ratio of the local equilibrium home price to the national home price should equal the ratio of the average local income to the average national income multiplied by a constant factor that varies by market. That multiplicative factor is lower in the Midwest and South and higher in many California markets. Winzer claims that most markets become unbalanced – deviated from their equilibrium price – when there is a sudden surge of demand, such as when technology and Internet firm employees experienced a large jump in personal wealth in the late 1990s. According to Winzer, when the market prices of homes rise well above the equilibrium price for that area, either the equilibrium price will rise or a local recession will force actual prices down closer to the equilibrium level. Winzer places Salinas, CA at the top of his list of overpriced housing markets (prices are 45 percent above equilibrium levels) followed by Boston and Orange County, CA (36 percent).

Shifting to more academic arguments, Joseph Stiglitz (1990, p. 13) defines bubbles this way: "if the reason that the price is high today is *only* because investors believe that the selling price will be high tomorrow-- when 'fundamental' factors do not seem to justify such a price—then a bubble exists." While it may not be rational to believe that a bubble can persist forever, there can be enough uncertainty about when it will break that bubbles can build temporarily. Information is costly and information about housing markets is not complete. In particular, unlike stocks, housing cannot be sold "short," so even if it would be rational to bet against an exuberant housing market, the market lacks a suitable vehicle.

Flood and Hodrick (1990) point out an indeterminacy in the pricing of durable assets, which allows bubbles to be "rational," at least in the short run. The current price is the discounted sum of future dividends (or rents) and the future price. Given that the current price depends on the expectation of the future price and the expectation of the future price depends on the current price, there appear to be an infinite set of possible combinations. The current price can include a bubble component in addition to the discounted dividends, as long as the bubble is expected to continue into the future, at least until the sale. A problem with testing for bubbles is that future dividends are truncated at the point of future sale. Ideally the test would isolate the bubble component as being an additional

amount beyond the present value of future dividends, but there appears no feasible way to make that separation with actual prices. A further difficulty for housing is that "dividends" are rents the owner pays to himself for the use of the house, which are unobserved. Risk aversion is also unmeasured, yet the discount factor for future rents depends on risk aversion. Uncertain information about future rents can lead to changes in the discount factor and volatile prices. Neither the investor nor the researcher may be able to disentangle the speculative bubble from poorly measured rents or changes in the discount factor.

Undaunted, Cutler, Poterba and Summers (1991) attempted to estimate the speculative dynamics of returns on stocks, bonds, foreign exchange, collectibles, and real estate. The study covered 13 countries from 1960-1988 and used the Case and Shiller (1989) constant quality house price index. One common feature across assets is that returns tend to be positively serially correlated in the short run (less than 1 year) and weakly negatively correlated in the long run. Another feature is that deviations of asset values from proxies for the fundamental value have predictive power in explaining returns (Malpezzi, 1999).

Such common results for different assets suggest they are underlying characteristics of speculative dynamics. One plausible explanation is that the market is a mix of rational traders and feedback traders. Rational traders base their demand on expected future returns, while feedback traders focus on realized past returns (i.e., backward-looking or adaptive expectations). In the conventional view, approaching market peaks are times of low risk so investors lower their required returns and pay a higher price for the asset. Under feedback trading, peaks are caused by over-optimism by some investors who drive prices too high. As the market rises, there are more and more feedback traders. The transaction data appears to be additional information that reduces uncertainty, but, in fact, the traders are feeding off of one another. Ultimately the rational traders realize the market price is disconnected from the fundamental price. Once the rational traders begin selling, the tide turns quickly and prices fall rapidly. Owner-occupied house prices may not collapse so quickly, because owners need a place to live and owners usually have the option to take their house off the market. Nevertheless, the idea of feedback trading seems to fit real estate markets because houses are so difficult to price in a market with few similar transactions.

Building on the idea that prices can be decomposed into a fundamental component and a bubble component, Abraham and Hendershott (1996) estimate a house price appreciation model on 30 MSAs from 1977 to 1992. The model for the equilibrium or fundamental price changes includes growth in real income, growth in real construction costs, and changes in the real after-tax interest rate. The bubble component has two drivers, a bubble builder and a bubble buster. The bubble builder is the positive serial correlation with lagged house price changes. In effect, this term captures the tendency of the market to be backward-looking and tend to extend past trends. The bubble buster is the difference between last period's equilibrium price and the actual price. If the actual price falls below the equilibrium price, the positive coefficient on the difference will work toward eliminating the difference and bringing the market back into equilibrium.

The model is estimated in two passes, so that the first pass can focus on the equilibrium equation without the deviation term. The second pass predicts the equilibrium value for prices and includes the deviation term or bubble buster. In the econometric results, the deviation term has a small effect, but it is twice as big for the 14 coastal cities as it is for the inland cities. The bubble builder or serial

correlation is significant for all cities, but it is also bigger for the coastal cities.[60] A model *without* lagged appreciation or the deviation term (just the other control variables) can explain 40 percent of price changes, nearly the same as the model with *only* lagged appreciation and the deviation term (and no other control variables). Put together, the model with lagged appreciation, deviation term and other control variables explains 60 percent. From the model simulations, the authors show that the most intense bubble busting of house prices occurs 3 to 6 years after the boom ends, with a potentially long adjustment period unless offset by strong economic growth. On net, the model estimates a 15 percent premium or bubble for the coastal cities in 1994. The California housing market was in a slump in 1994, so we might expect a much larger premium in 1999 or 2003.

Summary of Bubbles Literature

Distinguishing a bubble from a price increase is a matter of judging whether fundamental demand supports the rise or speculative forces have separated prices from supply and demand. Carliner looks at the national house price picture and finds no broad evidence for a house price bubble. Even though house prices rose rapidly at the end of the 1990s, so did household income. And the price-to-rent ratio, which is analogous to a stock's price-to-earnings ratio, is only 5 percent higher than in 1989. Nevertheless, as Zandi and Winzer point out, it is hard to deny bubble-like price hikes in California and Northeastern MSAs. So far, relatively stable wages, modest new construction, and extremely low interest rates have prevented house prices from falling.

A perfectly rational economic agent would price an asset today based on expected dividends and the future resale value. But a reasonable future price depends on the current price. Moreover, the bubble component could inflate both the current price and the resale value, especially if the future is not very far off. Cutler, Poterba, and Summers compare a number of assets, including real estate, to find some other distinguishing features besides high prices. Speculative dynamics feature positively serially correlated returns in the short run. Also, deviations in prices from the estimated fundamental values help predict future changes in the asset returns. One explanation for these features is that the market has a mix of rational traders and feedback traders. Toward the end of a rising trend, the feedback traders look at past prices and expect continued increases. Once a significant number of rational traders see the "disconnect" between prices and fundamental values, selling begins and the feedback traders rush to leave the market.

Abraham and Hendershott estimated a dynamic house price model, with measures for past prices (bubble builder) and the deviation of lagged prices from lagged fundamental values (bubble buster). The results showed that coastal cities were more likely to have both a bigger bubble builder and a bigger bubble buster. As of 1994, the coastal cities had a 15 percent price premium. At their peak, the premium was almost surely higher.

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[60] A similar study of New Zealand house price dynamics by Bourassa, Hendershott and Murphy (2001) shows that the US has a larger bubble builder component (lagged prices) and a smaller bubble buster (error correction).

XI. Behavioral Finance and the Formation of Price Expectations

Given the evidence that housing markets are not perfectly efficient, can we learn more about how non-rational or backward-looking traders form price expectations? Often it appears that market participants do not know the degree of balance between supply and demand forces. Rather, they focus on a combination of newspaper reports and their own personal experience to determine a "fair" price. For sellers, real estate agents and appraisers should offer reliable guidance, but they are biased toward high turnover. This section considers survey data and a few alternative models about how people respond to the market, given so much uncertainty about the fundamentals.[61]

Case and Shiller (1988) sent out questionnaires to recent buyers in four markets: two booming markets in California, one post-boom market (Boston) and one stable market (Milwaukee). The response was not large (886), but there were thought-provoking themes. Few showed much knowledge of market fundamentals or the underlying causes for price movements. Curiously, interest rates were blamed for the price changes even though the price changes were quite different in each market, while the interest rates were the same. Apparently, people form expectations from observed price movements and then look for a logical explanation to justify their beliefs.

The researchers found evidence that during market booms the news media exaggerated stories about prices paid over the asking price, yet ignored the same phenomenon at other times. The news articles seemed to be successful in spreading panic among households about being priced out of the market if they did not buy soon. In booming California, 75 percent agreed with the statement "Housing prices are booming. Unless I buy now, I won't be able to afford a home later." This fear may help explain why sales speed up with rising prices. Another explanation for a speed-up in sales is upward rigidity in asking prices. Real estate agents make more money from many listings and quick sales. Therefore, rather than advising sellers to price the home for sale at the new, higher market-clearing price, agents suggest a below-market price, which leads to many offers (some above asking).

The survey also presented evidence of downward rigidity in asking prices during a slow market. One explanation from prospect theory is that traders have a psychological preference to sell winners and hold losers (Kahneman and Tversky, 1979). By not realizing the loss with a sale, the owner can avoid the pain of regret and hope the market will come back in his favor. Market participants want to believe in the notion of the fair price or intrinsic worth. They use past history to gauge the intrinsic worth, and they are most aware of the past price they paid to buy the house. The owner assumes the purchase was at a fair price and is thus reluctant to sell below that fair price.

Survey respondents tend to deny the role of mob psychology, particularly in their own price expectations. Yet, the researchers conclude that the suddenness of booms and busts has to be based on investors reacting to one another (feedback trading) and recent price changes. However, respondents could not cite a trigger event for the booms, and there appeared to be no fundamental change to start the boom. Ironically, offer prices above asking prices may do more to feed a speculative bubble than a quick jump in prices. The high offers serve to increase demand (panic

[61] The field of behavioral finance is growing rapidly. To do it justice, see Richard Thaler (2003).

buying) and the appearance of excess demand also serves to increase demand in a vicious circle. The spiral is triggered by the illusion of a shortage (Shiller, 1990).

Genesove and Mayer (2001) analyze the Boston condominium market from 1982 to 1998. During that time, nominal prices rose by 170 percent (1982-89) before falling 40 percent (1989-93) and then booming to new heights (1995-98). Condo owners facing nominal losses set higher asking prices by 25 percent to 35 percent of the difference between the property's expected selling price and the original purchase price. In part by being patient, these same condo owners eventually received higher selling prices that were 3 percent to 18 percent of the difference between expected selling price and the original purchase price.

These findings are consistent with prospect theory, which posits that sellers have a reference point (in this case their original purchase price). The value function around that reference point is asymmetric, with gains favored less than losses are regretted. Condo sellers try to avoid a loss by setting a high reservation price. The high asking price extends the time to sale and the transactions price, but the ultimate sale price is above the reference point.

These findings are also consistent with the positive price-transaction volume correlation noted by Berkovec and Goodman (1996). The loss aversion by sellers results in lower transaction volume in markets with falling prices. One implication from this research is that prices are determined by seller characteristics (own price history) as well as unit attributes. Once again this provides evidence that the housing market is less than a perfect asset market.

The final paper on expectations formation is by Capozza and Sequin (1996). They use Census data from 1960 to 1990 to examine 10-year price changes for a cross-section of 64 MSAs. If markets were competitive, the total risk-adjusted expected returns should be equal across urban areas. In simplified terms:

$$E[TR_{it}] = \frac{R_{it}}{P_{it}} + \frac{E[\Delta P_{it}]}{P_{it}}$$

where TR_{it} is the total return, R_{it} is the rent and P_{it} is the house price for city *i* at time *t.* To avoid problems with measurement error, the first stage is an instrumental variable equation of R/P regressed on log income, change in log income, log population, change in log population, tax rate, utility rate, median number of bathrooms, conditional land supply and census year dummies. The first stage model acts like an equilibrium equation. The predicted rent-to-price ratio is the equilibrium rate given those market conditions, and the residual is the deviation from the equilibrium value. In the second stage, the 10-year change in log house prices ($\ln P_{10} - \ln P_1$) is regressed on the predicted R_1/P_1 from the first stage, change in log population, change in log real income, and the lagged residuals from the first stage.

The equilibrium rent-to-price ratio does predict future price growth. Cities with low equilibrium rent-to-price ratios (4 percent) appreciate by 27 to 40 percent more price growth per decade than cities with high ratios (8 percent).

Another finding is that the residuals or disequilibrium components from the first stage have significant predictive power. The residuals may be picking up an omitted variable, such as for risk, or capturing a mean reversion (error correction) effect. The authors interpret the significance of the

residuals as an indication that the housing markets are not efficient. A third finding is that lagged income growth has a negative and significant effect on house price growth. In places with high-income growth, house price growth slows in the next decade. This finding may reflect mean reversion in incomes and house prices, or, as the authors suggest, represent euphoria in expectations, in which rents are set too high relative to house prices. The strong income and house price growth of the past decade is carried forth into the next decade by backward-looking expectations, but it is disappointed on average.

Summary of Behavioral Finance

From survey evidence, Case and Shiller determine most buyers have little understanding of housing market fundamentals. Rather, buyers focus on recent news about house prices. It is simply too difficult to get all the relevant information needed to determine the theoretical market-clearing price. Most buyers, once committed to the market, feel compelled to choose from the possibilities of houses on the market. If the supply were perfectly elastic, then the market would stay close to equilibrium and market prices would be a sufficient statistic, i.e., all the market participants would need to know about past or present prices. But supply is not that elastic, particularly in highly regulated markets. Moreover, buyers are susceptible to panic buying, especially on news of offers above the asking price. Nervous about missing their chance to buy before prices go up, panic buying can quickly lead to self-fulfilling expectations of faster sales and higher prices.

Sellers are averse to losses and expect a sales price that is at least what they paid for the property. Consistent with prospect theory, sellers use their own purchase price as a reference point for setting their expectations of a “fair” selling price. This tends to make prices “sticky” downward and slows sales.

As further evidence of backward-looking expectations, Capozza and Sequin provide evidence that income growth from the past decade can help predict the current decade’s price changes. Apparently strong income growth in the past leads to euphoric expectations about future price gains, which, on average, are not fulfilled. In short, clear information is hard to obtain and the supply response is sluggish, so that prices can become disconnected from the underlying fundamentals.

XII. Summary

This report summarizes the literature on house price trends and homeownership affordability and provides some new estimates derived from the American Housing survey. Our goal is not to draw firm conclusions about the direction of house prices or the possibility of a sudden collapse in house prices. Rather, our purpose is to understand what is happening and why, from the best research available. In addition to the findings of researchers on house prices and affordability, this chapter makes some recommendations on further research.

House prices have been rising rapidly in the past few years. The median price of existing homes sold in 2004 was up 8.3 percent from 2003, and in 2003 the gain was nearly as strong at 7.5 percent. The latest report (May 2005) shows median house prices have increased by 15 percent in the last year. These house price increases are much larger than the economy-wide inflation as measured by the CPI. The ratio of average house prices to disposable income has been gradually increasing from 6.75 in 1995 to 7.5 in 2002, with house prices outpacing income. Interest rates have been trending downward for 20 years and have reached a 40-year low in 2003. These low interest rates have kept monthly payments affordable for existing owners, but at the same time help fuel price increases. Homeownership rates rose during the 1990s and early this decade, and have been in the 68 to 69 percent range for the past several years. The aging of the large baby boomer cohort has certainly helped push the ownership rate this high, but there were also large gains for low-income households and minority households. For the bottom income quintile, the homeownership rate increased from 42.5 percent in 1985 to 48.5 percent in 1999. Although single-family housing starts set a record high in 2004, sales too have been strong and new home inventories remain relatively lean, at about a 5 month supply as of early 2005. The short-term projection is for lower house price growth and gradually rising interest rates, but there is considerable uncertainty. Mortgage rates have remained low despite repeated increases in short term rates. What is clear is that high house prices pose the largest challenge for new homebuyers trying to save for a down payment.

House Price Indexes

The most widely available house price index is the National Association of Realtors (NAR) median house price index. Comparisons over time can be somewhat misleading, because there are no controls for changes in quality or for how representative the sales transactions are. Nevertheless, it is transparent and available for a broad cross-section of metropolitan areas. Hedonic indexes do control for house quality. The most common data source is the American Housing Survey (AHS) data, which is limited to about 44 MSAs. The house values are self-reported, but studies confirm that those valuations are close to correct (about 5 percent high) and seem to track the market over time. The Census C27 series is another common price index controlling for constant quality.

Repeat-sales indexes, such as the Freddie Mac-Conventional Mortgage Home Price Index or the Office of Federal Housing Enterprise Oversight (OFHEO) House Price Index, control for quality changes by taking the difference in sales prices for the same house. This limitation to repeat sales reduces the sample size, but that has been offset by a comprehensive data collection effort from the mortgage purchases that funnel through Freddie Mac and Fannie Mae. The indexes are designed to track price changes, rather than levels, so they are often anchored by house prices from the decennial

Census. Repeat-sales indexes can be biased if the repeat sales are not representative of the entire housing stock. Hybrid approaches have been suggested to broaden the repeat-sales with tax assessor data or controls for remodeling with additional data. The challenge remains to collect such data for a broad cross-section of houses over time.

New Hedonic Indexes from the American Housing Survey

Another widely used technique for house price index construction is hedonic regression analysis. By this method house prices are related to the physical and locational attributes of the property. The regression-estimated influence of those attributes on property prices define implicit prices for those housing features. The attribute prices can then be aggregated for different bundles of housing features to determine estimated prices for houses with those features. These bundles can be re-priced at different locations or at different times to generate cross-sectional estimates of house price differences from place to place and time series estimates of house price inflation.

The American Housing Survey is well-suited for estimation of hedonic indexes of house prices and has been used extensively for this purpose. This report builds on previous research in this area and uses the AHS to estimate house price indexes for different locations and submarkets over the period 1985 through 2003. We find that:

- The typical house nationwide rose 32 percent in real terms between 1985 and 2003, as measured by a hedonic index and deflated by the CPI less its shelter component.
- New home owners – those buying for the first time -- are of interest because they show conditions in the starter house market. The AHS shows that they buy less house, but the typical bundle purchased rose in real price by 31 percent between 1985 and 2003, almost matching the increase in the market overall.
- These two AHS hedonic indexes rose less than did house prices as measured by the OFHEO repeat sales index between 1985 and 2003 – up 41 percent. Possible reasons for the difference include the treatment of quality changes arising from remodeling and the possibility that houses that sell at least twice and thus are in the OFHEO index are not representative of the broader market.
- Manufactured housing has lower values per property than does site-built housing, and shifts over time in the manufactured share of all single-family housing may account for some of the differences between house price inflation by different measures.
- Price increases were greatest between 1985 and 2003 for houses occupied by higher income homeowners, and least among houses typically occupied by those in the bottom third of the homeowner income distribution. This same pattern by income held among the subset of first time home buyers.
- The AHS hedonic index estimates for regions and large metro areas are generally consistent with estimates from other sources in showing the West and Northeast to have posted the biggest house price increases between the late 1990s and 2003.

Affordability Indexes

Affordability indexes range from the simple to the very complex, but nearly all relate the cost of housing to some measure of income. Goodman (2001) uses AHS data to show that the ratio of house cost to income for all homeowners has increased from 2.08 in 1985 to 2.17 in 1999, while for the lowest income quintile of homeowners the ratio has increased from 2.50 in 1985 to 2.93 in 1999. The NAR Home Affordability Index calculates affordability as the median family income relative to the cash flow needed to afford the median priced house in the local market. This index is highly correlated (-0.94) to mortgage rates, so the gradual decline in rates has essentially offset the increase in house prices to keep affordability level. A more sophisticated indicator of affordability is produced for *The State of the Nation's Housing* (2002), and controls for tax effects. Mortgage interest and property taxes are deductible. This index shows that the share of income going to housing for all owners has fluctuated around 18 percent for the last ten years.

A number of proprietary affordability indexes calculate the risk of house price changes. There is an underlying assumption of mean reversion, so the indexes look for house prices at the extreme of their historical range. Selected cities are high cost by this measure, especially in California and the Northeast, and the producers of proprietary indexes claim that there is considerable risk for declines in these markets.

New Affordability Estimates from the AHS

The AHS-based hedonic price indexes presented earlier can be combined with information about household income and mortgage interest rates to develop several measures of house price burdens and affordability. Using the AHS data files for the period 1985-2003, we find that:

- As measured by the price index for the typical owner-occupied house, house prices rose at about the same rate as average household income over the period 1985 to 1997 and consequently the ratio of the price of this constant-quality house to income held at about 1.6. Subsequently, income gains outpaced house price increases until 2001 and the ratio dipped to 1.5. Between 2001 and 2003, however, sharp increases in house prices boosted the ratio back up to 1.7.
- Among new home owners, the price to income ratio was flat at a level slightly below that of all homeowners up through 1999, but the ratio subsequently rose rapidly and in 2003 was 1.8, exceeding the ratio for all owners.
- By income group, the ratio of constant quality house price (for houses occupied by that income group) to income since 1985 has been highest among those households in the bottom third of the income distribution. In addition, since 1995 the ratio has risen the most among low-income owners. These patterns by income hold among all owners and among the subset of new home owners.
- Owing to substantial declines in mortgage interest rates, the cash costs of mortgage payments on constant quality houses, as a ratio to household income, did not increase appreciably between 2001 and 2003, despite the sharp rise in the ratio of house prices to incomes over this period. Indeed, the payment-to-income ratio by this measure in 2003 was near its lowest point since at least the mid-1980's. This pattern holds among all owners and also among new home owners.

- Housing demand has been fueled not only by the mortgage rate reductions but also by consumers' expectations of future capital gains from continued house price appreciation, according to findings of previous research. Illustrative calculations of our AHS data, under the assumption that future house price expectations are based on the experience of the past eight years, show that a simplified measure of "user costs" (mortgage payments less expected capital gains) of constant quality houses fell sharply between 1997 and 2003 in a diverse set of large metro housing markets nationwide.

Determinants of House Prices

The traditional stock-flow model is represented by DiPasquale and Wheaton (1994) in two equations. The first is an equilibrium equation matching supply to demand. The second is a flow equation showing the change in stock as a function of new construction and depreciation of existing stock. In a steady state, new construction just offsets demolition and conversion. Designating the sign of the effect in parentheses, we can describe the basic factors of demand and supply. Housing demand is a function of demographics (+), income (+), price relative to rent (-) and user cost (-), which is the interest rate adjusted for taxes and capital gains. Housing supply is a function of construction costs (-), financing costs (-), government intervention (+/-) and price relative to rent (+).

The housing market is not perfectly efficient, in part because supply, demand, and price data are not so readily available. The inefficiency means that the market is slow to respond to disequilibrium between supply and demand and that lagged prices help predict future prices. Construction prices are particularly difficult to measure when they include land prices, because of the uncertainties associated with regulatory approval for development. A common modification of the traditional stock-flow model is to include a disequilibrium term. In a regression model, the coefficient on the disequilibrium term gives the speed at which a disequilibrium gap closes.

Malpezzi, Chun and Green (1998) augment a single-equation form of the stock-adjustment model with topographical constraints and regulatory constraints. House prices are predicted in a first stage hedonic model to control for quality. A separate instrumental variable equation is estimated for regulatory constraints, because they could be endogenous. Regulation can boost demand and restrict supply causing prices to increase, or regulations can be put into effect as a result of higher prices. Some measures of regulatory constraints are: large lot zoning, delay in approvals, amount of impact fees and the number of sources of regulation. The study finding is that regulatory constraints have a significant positive effect on prices.

Demand Factors

Considering the demand factors in detail, we start with *demographics*. The most distinctive demographic feature in the post-WWII era is the baby boom. This large cohort of households increased the demand and prices for housing. As they have aged, they have increased the homeownership rate. What is less clear is how fast baby boomers will leave their suburban homes after they retire. In-migration is a less predictable source of housing demand for cities, but, in combination with foreign immigration, another powerful upward force on prices. It is predicted that

the minority share of homeowners will increase from 18 percent in 2000 to 25 percent in 2020 (Masnick, 2001).

Although everyone needs a place to live, it is *income* that enables a household to demand housing on the market. In the late 1990s, there was a strong gain in income at nearly all levels as the economy flourished, but also growing income dispersion as the top quintile grew twice as fast as lower quintiles. *Wealth* is another demand factor and often seen as a measure of permanent income or defense against default risk. One of the big differences between new homebuyers and existing homeowners is usually the degree of wealth. For prospective homebuyers, it is unclear whether higher prices motivate the prospective buyer to save more or discourage the renter who thinks homeownership is now out of reach. For existing owners, however, house prices are positively related to wealth through home equity. For minority households, home equity is the majority of their wealth (57 percent for African Americans and 71 percent for Hispanics, compared to 40 percent for whites). Homeownership can act as a hedge against rent risk (Sinai and Souleles, 2003). People are willing to pay more to buy a house in order to avoid high variance in rent.

Taxes affect the user cost of homeownership. The standard formula for user cost starts with real interest rates and adjusts for the marginal tax rate. Theoretically, the size of the mortgage interest deduction and the property tax deduction depends on the marginal tax rate of the homeowner. Practically, there might not be much effect, because most of the households in the upper tax brackets are homeowners. Historically the homeownership rate has been relatively stable despite tax rate changes. The other important tax break is that capital gains are tax free up to $500,000. The justification for these tax breaks is often stated in terms of supporting homeownership and strong communities. An unintended side effect may be overinvestment in housing, especially luxury housing, which does not improve the productivity of the economy. Through more stringent regulation (e.g., exclusionary zoning), the high-quality housing might even crowd out the development of affordable housing.

More liberal mortgage financing has contributed to the increase in demand for housing. During the 1990s, lenders have been encouraged by HUD and banking regulators to increase lending to low-income and minority households. The Community Reinvestment Act (CRA), Home Mortgage Disclosure Act (HMDA), government-sponsored enterprises (GSE) housing goals and fair lending laws have strongly encouraged mortgage brokers and lenders to market to low-income and minority borrowers. Sometimes these borrowers are higher risk, with blemished credit histories and high debt or simply little savings for a down payment. Lenders have responded with low down payment loan products and automated underwriting, which has allowed them to more carefully determine the risk of the loan. Other factors that have facilitated liberal financing include low and falling interest rates, low default rates, rising house prices, competition from subprime lenders and strong investor demand for mortgage-backed securities (MBS). The net effect has been a booming mortgage market that has generated strong demand for housing, which, in turn, has boosted house prices.

Supply Factors

We know less about supply decisions, which are made by builders, not households, and there are few publicly available surveys of builders. Also, construction and supply are location specific and have a complex interaction with local land use constraints. Despite these caveats, we do know that population grew faster in the 1990s than in previous decades while housing supply grew slower. The

major difference has been in the construction of multifamily housing, which declined by nearly half, especially on the Coasts. Housing ranges widely in quality, and new housing tends to be high quality. According to the filtering model, as housing gets older it declines in quality and value, though high quality units are often cheaper to maintain at a high level rather than to under-maintain and then replace.

Unfortunately, there is no simple way to distinguish the market segments. One way is to divide the housing stock into quartiles by house price. Using AHS data, Collins, Crowe and Carliner (2001) report that the bottom quartile has a high concentration of manufactured houses (particularly in the South) and a disproportionate share of retirees. Adjusting for local costs and assuming an income of 80 percent of median income, the affordable owner-occupied stock shrank from 47.3 percent in 1997 to 44.2 percent in 1999. The biggest drop in affordable housing was in the West region. While there was movement in both directions, upward filtering dominated, with 1.4 value increases for each unit decrease, so that 1.7 million units became unaffordable due to price increases.

Renovation and remodeling are closely connected to filtering up. In the Northeastern cities, home improvement spending is larger than new construction. The older and larger cities, in particular, have a lot of replacement of systems, whereas high-cost cities and suburbs are active in discretionary remodeling. Rising prices build equity, which homeowners often tap to do renovation projects, through either home equity loans or cash-out refinancing.

The sensitivity of supply to prices is measured by the price elasticity of supply. An increase in demand would not necessarily boost prices, even if unexpected, as long as new supply could be created to offset the increased demand. However, if there were little change in supply, the increased demand chasing the same amount of housing would force up the price of housing. Unfortunately, there is little agreement about the elasticity of supply, and that seems to be because it varies over time and place. Malpezzi and Maclennan (2001) have done the most exhaustive research at the national level and found wide ranges with variation over time. Using a flow model (assumes the adjustment takes place in one year), the elasticity is between 6 and 13 whereas for a stock-adjustment model (assumes an adjustment of 0.3 per year) the elasticity is between 1 and 6. The standard assumption is that supply becomes more elastic in the long run. A major factor in the delayed response is obtaining land and approval for new development. Some empirical analysis shows that developers respond faster out of their existing inventory of land, and the response slows down when new land has to be approved for development. Mayer and Somerville (2000b) estimate that a one standard deviation increase in delay causes a 20 to 25 percent decline in permits, whereas the impact of fees is insignificant. The main point is that supply is less elastic in highly regulated environments.

Regulatory Constraints

The purpose of regulation is to shift from the private market equilibrium to the socially optimal equilibrium. The main difference between the two is externalities, which the private market tends to ignore. Local planners and politicians design regulations to reduce negative effects or channel positive effects. The influence of regulation on land use is so strong that it is not simple to distinguish whether house prices are higher because of increased demand or decreased supply. For example, large-lot zoning makes the neighborhood more spacious and desirable, but at the same time it reduces the number of dwelling units. Also, there are many layers of regulations so that density restrictions may be offset by environmental requirements. In empirical work, it is ideal to control for

both supply and demand effects, but there are very few data sets with cross-sectional measures for regulatory constraints. Most of the studies reviewed use the data collected for the Wharton Urban Decentralization Project. There is a great need for new data to stimulate empirical analysis. Ideally there would be a time-series component to the data collection, so researchers could see how much both regulations and their implementation vary over time.

Fischel (1999) claims that growth controls are a major factor in suburban sprawl and the shortage of affordable housing for low-income households. Suburban governments, especially in high-income communities, have more restrictive zoning regulations that cater to the home-owning median voter. The zoning boards in those towns judge any project in terms of cost to the town and impact on property values. Low-income projects have to be relatively high density to spread the fixed cost of development over the low cost units and still keep the per-unit cost affordable. The high density increases the infrastructure cost and burden on the town. In addition, local zoning boards are concerned about the impact of the project on the neighboring house values. A common presumption is that a high-density, low-income development will lower neighboring property values. Those homeowners most affected may become highly motivated to challenge the project at the ballot box and, if necessary, in court.

Fischel's solution is to protect the landowner/farmer whose land is about to be subdivided for development. Large-lot zoning makes that land less valuable. Suburban governments could still require large lots, but they would have to compensate the seller for the loss caused by large-lot zoning relative to "normal" lot sizes. This financial burden would be enough to discourage most towns from insisting on large-lot zoning and open the way for more affordable housing.

An alternative solution is offered by Anthony Downs, who proposes metropolitan government control of land use decisions. His expectation is that metropolitan governments would balance the need for affordable housing with the interests of suburban homeowners.

"Smart Growth" advocates go further in advocating limits on suburban sprawl so as to promote infill development. More compact cities are better environmentally and socially, with more mixed-income neighborhoods. Not only do these cities make better use of the existing infrastructure, but they also provide affordable housing closer to employment opportunities and avoid the concentration of poverty in hollowed-out central cities. Smart Growth opponents blame the regulations associated with Smart Growth for raising the cost of construction and reducing the supply, particularly of affordable housing.

Empirical evidence shows a consistent connection between higher house price levels and regulatory constraints. The evidence is less clear about the impact of regulations on price changes, and it appears that regulation slows down the dynamic adjustment process of demand shocks back to equilibrium.

House Price Dynamics

Another important strain in the literature on house prices is the study of house price changes over time and housing market efficiency. Housing markets are not informationally efficient, meaning the current house price does not reflect all of the information available in the market. Rather, prices gradually adjust to new information, so that past prices have predictive power. This suggests that the

market does not adjust fully to equilibrium each period and that measures of disequilibrium have explanatory power. However the market is rarely so inefficient that arbitrage opportunities develop, because transaction costs are high and there is no short selling.

Generally, the same factors that cause high prices also cause price increases, i.e., population growth, income growth, employment growth and construction costs. The effect of interest rates is less clear, because increased rates slow both construction and demand. Higher real incomes, population growth and construction costs seem to increase the correlation of current prices to lagged prices, while larger city size, faster population growth and lower construction costs increase mean reversion (the tendency of prices to return to a long run average). Substantial overshooting tends to occur in MSAs with high serial correlation and low mean reversion. The empirical evidence shows that serial correlation dominates mean reversion in the large MSAs in California and the Northeast.

A demand-side explanation for price overshooting is the financial accelerator or the process by which small price increases compound to large increases as homeowners move up the quality scale. Many homeowners are highly leveraged. These homeowners want a better house, but they are wealth-constrained. As soon as prices increase enough to create equity, the owners use that equity to trade up to a better house. An income shock, which lifts prices a small amount, can be compounded by the financial accelerator process. As owners trade up the property ladder, they increase demand, sales volume and house prices. Relaxed underwriting can trigger the same response. The self-reinforcing loop of prices, equity, demand and sales can convert small price increases in one part of the housing market into widespread price increases throughout the housing market.

The financial accelerator can also explain the positive correlation between house prices and sales. When prices are increasing, the market is very active with a lot of trading up, whereas when prices are sagging the re-sale market dries up. An alternative explanation for the positive correlation of prices and transaction volume is that buyers are more sensitive than sellers to income shocks and price increases. A leading indicator of strong demand is quick sales. Once sellers discover that houses are selling quickly, they adjust their asking prices upward.

Another aspect of the financial accelerator model is that higher homeownership rates can raise both housing costs and the degree of price fluctuations. Existing owners are largely shielded from price fluctuations with fixed-rate mortgages, but renters and new homebuyers are more vulnerable. The market tries to resolve the disequilibrium between supply and demand by changing the prices on the units turning over. If turnover slows down in a housing recession, there is greater pressure on the prices of the few units passing through the market to equilibrate supply and demand. Ironically, higher turnover in an up-market often means more demand is coming into the market from trade-up sellers who are also buyers. Rather than dissipating the demand pressure over more units selling in the market, the additional transactions bring more demand pressure to the market and push prices even higher. These house price dynamics occasionally lead to extreme price increases and then collapse, as occurs in price bubbles.

Bubbles

Following the telecom, technology and stock market collapses in 2000-01, there was concern that housing might be the next industry to have its bubble burst. However, distinguishing a bubble from a fundamental price increase is a matter of judgment, and experts differed. Carliner and Greenspan did

not see a bubble, because they believe fundamental demand has continued strong relative to supply. Zandi and Winzer pointed to unsustainable price hikes in California and the Northeast. At this point in 2003, projected rising interest rates and slowing income growth will likely slow the markets without a real drop in prices.

Rational economic agents value assets as the present value of a future stream of dividends followed by a resale value. But the future price depends on the current price, and the current price depends on the future resale value. A speculative or bubble component to the price may be difficult to discern if it appears in both the current price and the future price. In fact, that is what sustains a bubble – the expectation that whatever the bubble component is now, it will be the same or greater when the owner goes to sell. If the owner expects the bubble to burst during ownership, she is far less likely to buy the asset, and the speculative component disappears from both the future and current values.

Cutler, Poterba and Summers (1991) find similar speculative dynamics in a range of assets, including real estate. In addition to positive serial correlation in the short run, they note that deviations in prices from the estimated fundamental values help predict future changes in asset returns. When house prices soar above the fundamental values justified by supply and demand, then they are subsequently likely to fall back to the fundamental value. One explanation of the market mechanism is that there is a mix of rational (fundamental) traders and feedback (speculative) traders in the market. As prices trend upward, more and more feedback traders jump into the market. They do not necessarily recognize the fundamentals under the market, but rather focus on recent price trends, which they expect to continue into the future – or at least until they sell. As prices ascend to dizzying heights, rational traders recognize that fundamental demand cannot support those prices relative to supply, so the rational traders exit the market. The savvy feedback traders start getting worried when price growth stalls and may decide to leave too. Sooner or later, the other feedback traders catch on, and there develops a full-scale stampede to sell before prices fall further. Of course, this drives prices lower, and probably too low, before fundamental traders re-enter the market and prices gradually return to a fundamental equilibrium.

Abraham and Hendershott (1996) estimate a dynamic house price model, which captures these features in terms of a bubble builder (lagged prices) and a bubble buster (deviation from fundamental values). Their findings show that coastal cities were more likely to have both a larger bubble builder and bubble buster components. As of 1994, the coastal cities had a 15 percent price premium and it almost certainly would be larger for conditions in 1999 or today.

Behavioral Finance and the Formation of Price Expectations

Experimental work and surveys in the behavioral finance field have helped us better understand how market participants collect information and form price expectations. In particular, the work by Case and Shiller (1989) shows that most buyers have little understanding of the market fundamentals. Instead of carefully collecting information on supply and demand, they see the news about recent price trends and project them forward. If prices are rising, and especially if houses are moving quickly through the market, buyers seem prone to panic buying. Anxious not to miss their chance to buy before prices go higher, buyers make offers over the asking price.

Sellers suffer a different fear. Sellers are afraid of realizing a loss relative to what they paid for the property. They may not be much better informed than buyers about the general market, but sellers do

know what they paid for the property and expect to be able to sell it for at least that much. If there are no buyers willing to pay that price, sellers are more likely to wait rather than lower the price and take a loss. This behavior makes prices "sticky" downward and accounts for slower sales preceding price decreases.

Another study demonstrating backward-looking expectations is by Capozza and Sequin (1996). Using Census data to look at 10-year changes in metropolitan prices, the study shows that income growth from the past decade can help predict the current decade's price changes. This seems a remarkably long time for the market to adjust for old information. The authors claim that past strong income growth creates "euphoria" about future price gains that do not materialize on average. Much more study is needed to understand how people perceive market fundamentals and prices. The evidence to date suggests that homebuyers act like feedback traders without realizing how far current market prices are from fundamental values.

Implications for the Current Housing Market

By way of summary, how does this research help us understand the current housing market?

First, median house prices provide a quick measure of level and trends, but do not control for changes in quality, types of units being sold or inflation. Repeat-sales indexes and hedonic indexes provide better measures for comparisons over time and place, if sufficient data is available to control for quality.

Second, affordability indexes measure housing costs relative to incomes, but there are many ways to measure both housing costs and incomes. A simple ratio of house prices to income misses the fact that homebuyers finance their house purchase and the tax code reduces house costs through the deductibility of mortgage interest and local property taxes. A further complication is that an owner is at the same time part consumer and part investor. The expected capital gain from eventual house sale can offset the current cash costs of mortgage payment and maintenance. But, the sale price is uncertain and the sale date may be many years away. In most cases, it is too difficult to customize an affordability index for expectations about capital gains, so a simpler version of current house costs relative to current income is used. In the late 1990s, income gains outpaced house price increases to improve affordability. Falling interest rates lowered mortgage payments throughout the 1990s to 2004. However, the Federal Reserve has been increasing short term rates and the economic forecasts predict gradually rising mortgage rates. Assuming house prices continue to rise faster than household incomes, the increase in interest rates will cause affordability problems for prospective homebuyers and many existing owners with adjustable rate mortgages.

House prices are determined by demand and supply. Increasing house prices reflect demand exceeding supply. Certainly population, immigration and income are the fundamental sources of demand, but the availability of mortgage credit is also important in demand. In particular, active buying by investors in mortgage-backed securities (MBS) provides the secondary market for mortgages that makes funds available to primary lenders and keeps interest rates low. Relatively low mortgage default rates make the MBS investments profitable despite the historically low interest rates. Rising house prices help to maintain low default rates by giving the owner refinancing options. A stall in house prices could increase defaults forcing investors and lenders to demand higher interest rates. The key point is that housing demand is closely tied to financing and interest rates.

Housing supply is also sensitive to interest rates. Both the purchase of existing property and the construction of new property are done through financing. An important difference, however, is that construction requires permit approval by zoning boards and code inspectors. Throughout the country there has been an increase in the number and stringency of land use regulations that affect supply, primarily, but can also affect demand. Regulations tend to decrease supply, while increasing demand. The net effect is to increase house prices. Ironically, one reason that house prices are not expected to fall substantially is that regulations constrain overbuilding.

When supply and demand are out of equilibrium, house prices change and often in complicated ways. To simplify, most theories of house price dynamics start with a market in equilibrium. A shock is imposed on the market, which creates a disequilibrium between supply and demand and prices adjust as the market returns to equilibrium. Information about house prices is usually a key factor in the rate of adjustment. Markets with rapid growth, low construction costs and short approval times can adjust quickly. Sometimes a disequilibrium can increase before it returns to equilibrium. For example, in the financial accelerator model an income boost (more demand) can push up house prices, which provide owners with enough equity for the down payment of a nicer house. The chain reaction of higher prices causing more demand for more expensive houses can drive up prices much higher than the original increase. This pattern of trading up and price increases may explain why prices rise much higher in some cities and not others despite the same interest rates and credit availability.

In extreme cases, price increases may be labeled as bubbles. The implication of the "bubbles" label is that the price increase will abruptly reverse when the bubble bursts. The sign of a bubble is when many investors are speculating on the continued upward trend in house prices. Although they are buying rental properties, the profit from the transaction relies heavily on the capital gain at resale not the monthly rents. Demand from owner-occupiers may be augmented when they buy a vacation home or remodel their existing home, but if house prices fall the owners are likely to remain in their primary residence. Speculators assume they can sell their investments before all the capital gain disappears. Even if they take a loss on the current transaction, they expect to retain their profits from earlier deals.

Unfortunately, it is difficult to identify speculators from sales records, but the popular press offers accounts of condos bought and sold before its first occupant moves in (Leonhardt,2005). A weak stock market may contribute to investor interest in real estate and house prices have been increasing long enough that buyers assume prices will keep going up. Even Federal Reserve Chairman Greenspan notes the froth in certain markets, especially in California, Florida and the Northeast. As long as the demand by owner-occupiers exceeds the supply, then an increase in interest rates might not deflate house prices drastically. The signs of speculative buying may be a warning of future price declines in select markets.

Market fundamentals are hard to measure and most households rely on news reports about house price trends to form their price expectations. The literature shows that buyers are prone to panic when house prices are trending upward for fear of missing out on an opportunity to become owners. These buyers are not necessarily, or even usually, speculators. The buyers are not real estate mavens who can distinguish inflated house prices. More likely, the buyers have little experience in real estate transactions and are reacting to news reports of rapid sales and offers over the asking price.

Sellers in a down market suffer from the opposite problem. When the market prices start going down, sellers hesitate to reduce their asking price especially if it forces them to realize a loss relative to what the seller originally paid for the house. In other words, prices are "sticky" downward. Both phenomena, panic buying and reluctant selling, make it more difficult for the market to adjust prices back to equilibrium. Researchers have had difficulty determining how people form price expectations, but it is clear that price data is much more commonly available than measures of fundamental supply and demand. In the current market with rapidly increasing prices, a tendency of buyers to focus on recent trends serves to boost demand and propel prices even higher. Eventually, house prices will get high enough that there are not enough buyers with income or credit to afford the high asking prices. Prices need not collapse at that point, but double-digit increases cannot be sustained indefinitely.

Recommendations for Future Research

Research on house prices to date has been more successful in answering some questions than others.

While better data and analytic techniques are always possible, house price research in the U.S. is in relatively good shape with regard to the key outcome measure – house prices. From the decennial Census, American Housing Survey, industry surveys, and other sources, many data are available on the sales prices of single-family homes and the market value of houses that do not transact. These data are available for a wide range of geographies and time periods. Hedonic indexes, repeat sales indexes, and other analytic tools have been developed to adjust house prices for differences in quality and location. Researchers, policy makers, the business community, and consumers are all able to compare house prices across markets and to track price changes over time.

Similarly, there are both data and understanding of some of the determinants of housing prices, notably the key tangible determinants of housing demand. How housing demand and house prices depend on income, demographics, interest rates, and tax laws have been the subjects of extensive theoretical work that has been tested in a large number of econometric studies over the past fifty years.

But research has been less successful in answering other questions about the determinants of house prices. Beginning with the demand side of the market, the intangible determinants of consumer choices are a fruitful field for future research. As described in this report, research on consumers' decision making process has been expanding lately, but more work is needed both on the theoretical/conceptual side and also regarding collection of data that will allow those theories to be tested. How consumers form their house price expectations and their assessments of the total costs of home ownership are not yet adequately understood. More generally, how consumers gather and process information about market conditions and determine the "right" time to buy or sell a house are key to understanding housing demand and short-run price dynamics.

The supply side of the housing market continues to be less researched and less well understood than the demand side, although there does seem to be growing recognition of the importance of supply conditions for house prices. Perhaps the biggest limitation has been the lack of data about supply conditions. Construction cost indexes are available, but these cover only labor and materials. Land costs are becoming a larger part of total development costs in many markets, and for the most part only anecdotal and case study information is available on the prices of buildable lots. More data on

land costs, preferably comparable across markets and over time, are needed before major progress can be made on calibrating supply influences on house prices.

Government actions are major drivers of housing supply. Government regulation of land use and building design affects the cost of land, what can be built on it, and ultimately house prices. Some data are available and have been researched to estimate the effects of building codes on construction costs, but how land use regulation affects the supply and cost of housing remains a large question mark. Beyond the data sources on land use regulation described in this report, much more is needed to allow these land use controls and how they affect housing prices to be well understood. The data task is formidable, given the multidimensionality of land use controls and the importance not just of the regulations but also their enforcement, but these controls are unquestionably a major driver of housing supply, its elasticity, and house prices.

Another area of needed supply side research is on the decision making of developers, renovators, and their financiers. Even less is known here than about the decision making of consumers. What, for example, causes the time lags in suppliers' responses to changing demand and the common overshooting of supply when the response does come? Both of these features of the supply side, which have implications for house price dynamics, are observed in the aggregate but are the result of the decisions of many individuals working with imperfect information and varying incentives.

A last area of needed house price research investigates the interaction of demand and supply as it affects house prices. How do the peculiarities of housing as a durable heterogeneous good, trading infrequently in markets with imperfect information and often inelastic supply, affect house prices over time and across markets? What are the causes and consequences, especially those pertaining to house prices, of the transactions volume or turnover rate of housing in a local market? What are the unique features of extreme markets? For example, what triggers panic buying in rapidly inflating markets? And in softening markets, what determines how firmly sellers hold on to their reference selling prices? One goal would be to understand the tipping point at which fear of large price increases, or decreases, converts an orderly market into a disorderly one.

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Appendix

Appendix A1. Hedonic Regressions on All Owners by AHS Survey Year: 1985, 1987

1985

Number of obs = 21224
F(31, 21192) = 480.57
Prob > F = 0.0000
R-squared = 0.4128
Adj R-squared = 0.4119
Root MSE = .71688

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.066	0.013	5.090	0.000
nonmet	-0.320	0.015	-20.910	0.000
baths10	-0.274	0.012	-22.690	0.000
bdrms0	-0.409	0.187	-2.180	0.029
bdrms1	-0.218	0.032	-6.780	0.000
bdrms2	-0.068	0.013	-5.210	0.000
bdrms4p	0.101	0.014	7.330	0.000
attached	-0.080	0.030	-2.640	0.008
twoto4	-0.043	0.034	-1.270	0.205
fiveto9	0.116	0.074	1.560	0.118
tento19	-0.060	0.089	-0.670	0.502
twentyp	-0.012	0.051	-0.240	0.814
mobile	-1.511	0.023	-66.720	0.000
unitage	-0.006	0.000	-19.830	0.000
hsys2	0.243	0.017	14.210	0.000
hsys3	0.032	0.026	1.210	0.225
hsys4	0.061	0.018	3.420	0.001
hsys5	-0.208	0.028	-7.470	0.000
hsys6	-0.018	0.018	-0.990	0.323
acsys2	-0.074	0.013	-5.830	0.000
acsys3	0.030	0.014	2.210	0.027
sewer	0.052	0.012	4.300	0.000
adequate	0.229	0.026	8.810	0.000
agehead	0.000	0.000	-0.200	0.841
goodnbhd	-0.065	0.010	-6.310	0.000
fairpoor	-0.225	0.033	-6.920	0.000
black	-0.324	0.021	-15.510	0.000
hispanic	0.012	0.027	0.460	0.646
crowds	-0.146	0.023	-6.320	0.000
sqft	0.000	0.000	22.980	0.000
yearsin	-0.001	0.001	-1.400	0.162
_cons	11.550	0.044	265.350	0.000

1987

Number of obs = 25412
F(31, 25380) = 660.67
Prob > F = 0.0000
R-squared = 0.4466
Adj R-squared = 0.4459
Root MSE = .76983

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.050	0.013	3.730	0.000
nonmet	-0.372	0.015	-24.060	0.000
baths10	-0.282	0.012	-23.870	0.000
bdrms0	-0.199	0.166	-1.200	0.231
bdrms1	-0.233	0.032	-7.320	0.000
bdrms2	-0.092	0.013	-7.160	0.000
bdrms4p	0.102	0.014	7.500	0.000
attached	-0.026	0.029	-0.900	0.367
twoto4	0.051	0.037	1.380	0.169
fiveto9	0.085	0.077	1.110	0.269
tento19	-0.031	0.085	-0.370	0.711
twentyp	0.245	0.053	4.600	0.000
mobile	-1.674	0.020	-81.900	0.000
unitage	-0.006	0.000	-20.810	0.000
hsys2	0.349	0.017	20.410	0.000
hsys3	0.014	0.023	0.590	0.558
hsys4	0.014	0.018	0.810	0.417
hsys5	-0.174	0.027	-6.330	0.000
hsys6	-0.084	0.018	-4.690	0.000
acsys2	-0.070	0.013	-5.510	0.000
acsys3	-0.021	0.013	-1.610	0.107
sewer	0.009	0.011	0.740	0.458
adequate	0.288	0.027	10.760	0.000
agehead	0.001	0.000	1.640	0.101
goodnbhd	-0.095	0.010	-9.460	0.000
fairpoor	-0.232	0.033	-7.010	0.000
black	-0.312	0.021	-14.720	0.000
hispanic	0.006	0.027	0.230	0.821
crowds	-0.175	0.023	-7.580	0.000
sqft	0.000	0.000	23.820	0.000
yearsin	-0.002	0.001	-3.880	0.000
_cons	11.610	0.044	265.480	0.000

Appendix A1. Hedonic Regressions on All Owners by AHS Survey Year: 1989, 1991

1989

Number of obs = 22511
F(31, 22479) = 520.77
Prob > F = 0.0000
R-squared = 0.4180
Adj R-squared = 0.4172
Root MSE = .80975

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.105	0.014	7.340	0.000
nonmet	-0.387	0.017	-22.610	0.000
baths10	-0.276	0.013	-21.000	0.000
bdrms0	0.061	0.200	0.300	0.761
bdrms1	-0.297	0.036	-8.160	0.000
bdrms2	-0.106	0.015	-7.260	0.000
bdrms4p	0.126	0.015	8.390	0.000
attached	0.046	0.031	1.460	0.145
twoto4	0.067	0.041	1.630	0.103
fiveto9	0.031	0.073	0.420	0.673
tento19	-0.249	0.095	-2.630	0.009
twentyp	0.229	0.056	4.110	0.000
mobile	-1.714	0.024	-71.140	0.000
unitage	-0.006	0.000	-16.430	0.000
hsys2	0.375	0.019	19.310	0.000
hsys3	-0.003	0.021	-0.150	0.882
hsys4	0.089	0.021	4.300	0.000
hsys5	-0.195	0.029	-6.600	0.000
hsys6	-0.054	0.022	-2.470	0.013
acsys2	-0.107	0.015	-7.240	0.000
acsys3	-0.051	0.015	-3.350	0.001
sewer	0.008	0.013	0.630	0.528
adequate	0.176	0.025	6.950	0.000
agehead	0.002	0.000	4.610	0.000
goodnbhd	-0.100	0.011	-8.850	0.000
fairpoor	-0.335	0.038	-8.840	0.000
black	-0.282	0.023	-12.370	0.000
hispanic	-0.008	0.029	-0.270	0.789
crowds	-0.144	0.026	-5.600	0.000
sqft	0.000	0.000	21.890	0.000
yearsin	-0.003	0.001	-4.930	0.000
_cons	11.618	0.046	250.030	0.000

1991

Number of obs = 25742
F(31, 25710) = 629.72
Prob > F = 0.0000
R-squared = 0.4316
Adj R-squared = 0.4309
Root MSE = .80604

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.081	0.014	5.820	0.000
nonmet	-0.363	0.016	-22.340	0.000
baths10	-0.286	0.012	-23.400	0.000
bdrms0	-1.025	0.170	-6.020	0.000
bdrms1	-0.166	0.034	-4.860	0.000
bdrms2	-0.075	0.014	-5.540	0.000
bdrms4p	0.120	0.014	8.700	0.000
attached	0.028	0.029	0.950	0.340
twoto4	0.057	0.039	1.490	0.137
fiveto9	-0.005	0.074	-0.060	0.948
tento19	-0.061	0.083	-0.740	0.461
twentyp	-0.043	0.054	-0.790	0.427
mobile	-1.782	0.022	-81.380	0.000
unitage	-0.006	0.000	-19.640	0.000
hsys2	0.351	0.018	19.770	0.000
hsys3	0.009	0.019	0.450	0.649
hsys4	0.088	0.020	4.490	0.000
hsys5	-0.212	0.028	-7.480	0.000
hsys6	0.037	0.020	1.860	0.063
acsys2	-0.166	0.014	-11.830	0.000
acsys3	-0.088	0.014	-6.260	0.000
sewer	0.028	0.012	2.340	0.019
adequate	0.125	0.023	5.390	0.000
agehead	0.003	0.000	6.060	0.000
goodnbhd	-0.063	0.010	-6.000	0.000
fairpoor	-0.351	0.037	-9.610	0.000
black	-0.302	0.022	-13.820	0.000
hispanic	0.018	0.027	0.670	0.503
crowds	-0.146	0.024	-6.020	0.000
sqft	0.000	0.000	23.950	0.000
yearsin	-0.003	0.001	-5.200	0.000
_cons	11.604	0.043	267.430	0.000

Appendix A1. Hedonic Regressions on All Owners by AHS Survey Year: 1993, 1995

1993

Number of obs = 23180
F(31, 23148) = 618.49
Prob > F = 0.0000
R-squared = 0.4530
Adj R-squared = 0.4523
Root MSE = .75088

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.094	0.013	7.150	0.000
nonmet	-0.323	0.016	-20.430	0.000
baths10	-0.301	0.012	-25.120	0.000
bdrms0	-0.223	0.212	-1.050	0.292
bdrms1	-0.191	0.035	-5.470	0.000
bdrms2	-0.086	0.013	-6.350	0.000
bdrms4p	0.103	0.013	7.680	0.000
attached	0.030	0.027	1.100	0.272
twoto4	0.029	0.038	0.760	0.445
fiveto9	-0.003	0.069	-0.050	0.964
tento19	-0.100	0.073	-1.370	0.170
twentyp	0.079	0.050	1.570	0.116
mobile	-1.803	0.022	-81.140	0.000
unitage	-0.005	0.000	-17.590	0.000
hsys2	0.310	0.018	17.710	0.000
hsys3	-0.021	0.018	-1.160	0.246
hsys4	0.065	0.020	3.330	0.001
hsys5	-0.123	0.032	-3.790	0.000
hsys6	-0.058	0.021	-2.810	0.005
acsys2	-0.174	0.014	-12.210	0.000
acsys3	-0.113	0.014	-8.220	0.000
sewer	-0.011	0.012	-0.900	0.371
adequate	0.333	0.026	12.950	0.000
agehead	0.002	0.000	4.410	0.000
goodnbhd	-0.083	0.010	-8.040	0.000
fairpoor	-0.300	0.035	-8.500	0.000
black	-0.307	0.021	-14.810	0.000
hispanic	-0.003	0.025	-0.130	0.898
crowds	-0.172	0.024	-7.100	0.000
sqft	0.000	0.000	25.000	0.000
yearsin	-0.002	0.001	-4.480	0.000
_cons	11.473	0.044	260.620	0.000

1995

Number of obs = 25159
F(31, 25127) = 547.18
Prob > F = 0.0000
R-squared = 0.4030
Adj R-squared = 0.4023
Root MSE = .80066

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.092	0.013	6.850	0.000
nonmet	-0.319	0.017	-19.340	0.000
baths10	-0.306	0.012	-24.850	0.000
bdrms0	-0.015	0.197	-0.070	0.941
bdrms1	-0.223	0.035	-6.300	0.000
bdrms2	-0.101	0.014	-7.250	0.000
bdrms4p	0.108	0.014	7.880	0.000
attached	-0.024	0.027	-0.900	0.368
twoto4	-0.045	0.038	-1.180	0.237
fiveto9	0.008	0.060	0.130	0.894
tento19	-0.161	0.074	-2.170	0.030
twentyp	0.077	0.048	1.610	0.107
mobile	-1.812	0.023	-77.530	0.000
unitage	-0.004	0.000	-13.650	0.000
hsys2	0.237	0.018	13.100	0.000
hsys3	-0.047	0.018	-2.620	0.009
hsys4	0.085	0.020	4.270	0.000
hsys5	-0.122	0.035	-3.510	0.000
hsys6	-0.035	0.023	-1.560	0.119
acsys2	-0.214	0.015	-13.990	0.000
acsys3	-0.125	0.015	-8.620	0.000
sewer	0.007	0.013	0.520	0.602
adequate	0.160	0.026	6.180	0.000
agehead	0.002	0.000	4.180	0.000
goodnbhd	-0.087	0.011	-8.220	0.000
fairpoor	-0.297	0.037	-7.960	0.000
black	-0.363	0.021	-17.530	0.000
hispanic	-0.032	0.024	-1.350	0.178
crowds	-0.111	0.025	-4.490	0.000
sqft	0.000	0.000	22.990	0.000
yearsin	-0.003	0.001	-4.770	0.000
_cons	11.667	0.045	257.520	0.000

Appendix A1. Hedonic Regressions on All Owners by AHS Survey Year: 1997, 1999

1997

Number of obs = 21141
F(31, 21109) = 488.67
Prob > F = 0.0000
R-squared = 0.4178
Adj R-squared = 0.4170
Root MSE = .79342

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.084	0.015	5.590	0.000
nonmet	-0.242	0.018	-13.770	0.000
baths10	-0.270	0.013	-20.380	0.000
bdrms0	0.234	0.281	0.830	0.406
bdrms1	-0.367	0.042	-8.790	0.000
bdrms2	-0.158	0.015	-10.180	0.000
bdrms4p	0.167	0.014	11.790	0.000
attached	0.126	0.079	1.600	0.110
twoto4	-0.202	0.137	-1.470	0.142
fiveto9	0.160	0.240	0.670	0.505
tento19	-0.035	0.301	-0.120	0.908
twentyp	0.210	0.230	0.910	0.360
mobile	-1.713	0.023	-73.860	0.000
unitage	-0.004	0.000	-12.410	0.000
hsys2	0.171	0.020	8.390	0.000
hsys3	-0.017	0.019	-0.930	0.352
hsys4	0.035	0.022	1.580	0.115
hsys5	-0.230	0.038	-6.120	0.000
hsys6	-0.042	0.032	-1.290	0.197
acsys2	-0.173	0.017	-10.180	0.000
acsys3	-0.106	0.016	-6.750	0.000
sewer	-0.030	0.013	-2.330	0.020
adequate	0.206	0.031	6.550	0.000
agehead	0.002	0.000	4.160	0.000
goodnbhd	-0.075	0.011	-6.610	0.000
fairpoor	-0.362	0.042	-8.600	0.000
black	-0.250	0.022	-11.310	0.000
hispanic	-0.133	0.025	-5.280	0.000
crowds	-0.139	0.026	-5.290	0.000
sqft	0.000	0.000	21.060	0.000
yearsin	-0.004	0.001	-5.940	0.000
_cons	11.620	0.051	227.930	0.000

1999

Number of obs = 26519
F(31, 26487) = 646.11
Prob > F = 0.0000
R-squared = 0.4306
Adj R-squared = 0.4299
Root MSE = .7977

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.060	0.013	4.540	0.000
nonmet	-0.296	0.016	-18.250	0.000
baths10	-0.309	0.012	-25.870	0.000
bdrms0	-1.616	0.207	-7.810	0.000
bdrms1	-0.278	0.036	-7.750	0.000
bdrms2	-0.152	0.014	-10.920	0.000
bdrms4p	0.215	0.013	17.030	0.000
attached	-0.126	0.025	-5.100	0.000
twoto4	-0.169	0.042	-4.010	0.000
fiveto9	-0.037	0.064	-0.580	0.561
tento19	-0.146	0.077	-1.890	0.058
twentyp	0.037	0.051	0.730	0.464
mobile	-2.020	0.022	-91.720	0.000
unitage	-0.003	0.000	-11.700	0.000
hsys2	0.205	0.018	11.410	0.000
hsys3	-0.087	0.017	-5.150	0.000
hsys4	0.060	0.021	2.900	0.004
hsys5	-0.205	0.035	-5.910	0.000
hsys6	-0.053	0.033	-1.620	0.106
acsys2	-0.245	0.016	-15.020	0.000
acsys3	-0.141	0.015	-9.430	0.000
sewer	-0.022	0.012	-1.820	0.069
adequate	0.205	0.028	7.270	0.000
agehead	0.000	0.000	0.350	0.728
goodnbhd	-0.106	0.010	-10.460	0.000
fairpoor	-0.427	0.041	-10.530	0.000
black	-0.294	0.019	-15.080	0.000
hispanic	-0.096	0.021	-4.470	0.000
crowds	-0.210	0.024	-8.810	0.000
sqft	0.000	0.000	17.830	0.000
yearsin	-0.003	0.001	-4.970	0.000
_cons	12.062	0.045	270.420	0.000

Appendix A1. Hedonic Regressions on All Owners by AHS Survey Year: 2001, 2003

2001

Number of obs = 25796
F(31, 25764) = 557.26
Prob > F = 0.0000
R-squared = 0.4014
Adj R-squared = 0.4007
Root MSE = .82502

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.067	0.014	4.840	0.000
nonmet	-0.319	0.017	-19.000	0.000
baths10	-0.330	0.013	-25.950	0.000
bdrms0	0.147	0.251	0.580	0.560
bdrms1	-0.465	0.038	-12.400	0.000
bdrms2	-0.174	0.015	-11.730	0.000
bdrms4p	0.229	0.013	17.370	0.000
attached	-0.018	0.026	-0.720	0.472
twoto4	-0.154	0.045	-3.440	0.001
fiveto9	-0.150	0.067	-2.230	0.026
tento19	0.126	0.073	1.740	0.082
twentyp	0.208	0.050	4.180	0.000
mobile	-1.737	0.022	-77.530	0.000
unitage	-0.003	0.000	-10.000	0.000
hsys2	0.214	0.019	11.180	0.000
hsys3	-0.111	0.017	-6.500	0.000
hsys4	0.034	0.022	1.490	0.135
hsys5	-0.217	0.038	-5.770	0.000
hsys6	-0.114	0.034	-3.350	0.001
acsys2	-0.293	0.018	-16.390	0.000
acsys3	-0.212	0.016	-13.140	0.000
sewer	-0.030	0.013	-2.310	0.021
adequate	0.208	0.030	6.970	0.000
agehead	0.001	0.000	1.540	0.122
goodnbhd	-0.116	0.011	-10.910	0.000
fairpoor	-0.410	0.042	-9.800	0.000
black	-0.249	0.020	-12.330	0.000
hispanic	-0.102	0.022	-4.730	0.000
crowds	-0.158	0.025	-6.360	0.000
sqft	0.000	0.000	21.190	0.000
yearsin	-0.003	0.001	-6.530	0.000
_cons	12.126	0.047	259.510	0.000

2003

Number of obs = 28837
F(31, 28805) = 509.40
Prob > F = 0.0000
R-squared = 0.3541
Adj R-squared = 0.3534
Root MSE = .92374

lnvalue	Coef.	Std. Err.	t	P>|t|
suburb	0.036	0.015	2.490	0.013
nonmet	-0.416	0.018	-22.960	0.000
baths10	-0.338	0.013	-25.190	0.000
bdrms0	-0.467	0.281	-1.660	0.096
bdrms1	-0.218	0.040	-5.400	0.000
bdrms2	-0.150	0.016	-9.440	0.000
bdrms4p	0.246	0.014	17.930	0.000
attached	-0.005	0.025	-0.210	0.837
twoto4	-0.057	0.043	-1.330	0.182
fiveto9	0.107	0.064	1.680	0.093
tento19	-0.107	0.072	-1.500	0.134
twentyp	0.196	0.050	3.930	0.000
mobile	-1.879	0.025	-74.470	0.000
unitage	-0.002	0.000	-8.600	0.000
hsys2	0.279	0.020	13.710	0.000
hsys3	-0.094	0.018	-5.070	0.000
hsys4	0.091	0.024	3.830	0.000
hsys5	-0.256	0.041	-6.190	0.000
hsys6	-0.118	0.038	-3.130	0.002
acsys2	-0.288	0.020	-14.590	0.000
acsys3	-0.207	0.018	-11.700	0.000
sewer	0.069	0.014	4.860	0.000
adequate	0.232	0.033	7.020	0.000
agehead	0.001	0.000	2.650	0.008
goodnbhd	-0.105	0.011	-9.340	0.000
fairpoor	-0.448	0.046	-9.660	0.000
black	-0.323	0.021	-15.140	0.000
hispanic	-0.080	0.022	-3.690	0.000
crowds	-0.080	0.026	-3.080	0.002
sqft	0.000	0.000	17.200	0.000
yearsin	-0.004	0.001	-6.430	0.000
_cons	12.086	0.051	237.590	0.000

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Boston

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	12.134	186,126	11.998	162,467	176,820	154,344	9.91%	11.52%	0.53%	0.66%	1,100	1,128
1987	12.423	248,396	12.340	228,721	235,976	217,285	9.41%	9.59%	0.48%	0.50%	1,379	1,295
1989	12.400	242,853	12.313	222,671	230,710	211,537	9.66%	9.93%	0.40%	0.43%	1,216	1,150
1991	12.161	191,123	12.003	163,265	181,566	155,102	9.58%	9.60%	0.45%	0.45%	1,017	870
1993	12.019	165,917	11.867	142,505	157,621	135,379	8.52%	7.89%	0.46%	0.41%	898	718
1995	12.026	167,029	11.888	145,445	158,677	138,172	8.37%	8.27%	0.46%	0.45%	904	779
1997	12.011	164,522	11.917	149,786	156,296	142,296	8.12%	8.03%	0.49%	0.48%	919	829
1999	12.038	169,121	11.936	152,595	160,665	144,965	7.68%	7.44%	0.46%	0.44%	909	799
2001	12.254	209,762	12.180	194,833	199,274	185,092	7.60%	7.64%	0.40%	0.40%	1,040	971
2003	12.545	280,593	12.455	256,478	266,563	243,655	6.60%	6.28%	0.36%	0.33%	1,322	1,164

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	142,938	124,769	83,349	72,754	868	758	231	370	6,299	7,161	3.7%	5.2%
1987	272,491	250,908	187,799	172,924	1,956	1,801	(578)	(506)	6,254	6,187	-9.2%	-8.2%
1989	231,191	211,979	173,758	159,318	1,810	1,660	(594)	(510)	6,587	6,990	-9.0%	-7.3%
1991	94,611	80,821	71,400	60,993	744	635	273	235	6,490	7,666	4.2%	3.1%
1993	-	-	-	-	-	-	898	718	5,677	6,078	15.8%	11.8%
1995	-	-	-	-	-	-	904	779	6,125	5,588	14.8%	13.9%
1997	-	-	-	-	-	-	919	829	6,003	8,129	15.3%	10.2%
1999	20,988	18,937	15,960	14,401	166	150	743	649	6,840	6,391	10.9%	10.2%
2001	96,391	89,530	81,491	75,691	849	788	191	182	8,705	8,082	2.2%	2.3%
2003	214,187	195,779	186,893	170,832	1,947	1,779	(625)	(616)	7,020	7,877	-8.9%	-7.8%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Buffalo

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	11.3048	81,206	11.1688	70,884	77,146	67,340	9.91%	11.52%	0.53%	0.66%	480	492
1987	11.8607	141,587	11.77816	130,374	134,508	123,855	9.41%	9.59%	0.48%	0.50%	786	738
1989	11.7038	121,025	11.61698	110,966	114,973	105,418	9.66%	9.93%	0.40%	0.43%	606	573
1991	11.438	92,779	11.28044	79,256	88,140	75,293	9.58%	9.60%	0.45%	0.45%	494	422
1993	11.545	103,259	11.39289	88,689	98,096	84,254	8.52%	7.89%	0.46%	0.41%	559	447
1995	11.4579	94,650	11.31956	82,418	89,917	78,297	8.37%	8.27%	0.46%	0.45%	512	441
1997	11.4423	93,178	11.34843	84,832	88,519	80,591	8.12%	8.03%	0.49%	0.48%	521	470
1999	11.3452	84,559	11.24238	76,296	80,331	72,482	7.68%	7.44%	0.46%	0.44%	455	399
2001	11.3397	84,095	11.26587	78,110	79,890	74,204	7.60%	7.64%	0.40%	0.40%	417	389
2003	11.4639	95,215	11.37404	87,033	90,454	82,681	6.60%	6.28%	0.36%	0.33%	449	395

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		User Cost to Income Ratio	
	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	-	-	-	-	-	-	480	492	3,710	3,618	12.9%	13.6%
1987	8,082	7,442	5,570	5,129	58	53	728	685	3,830	3,534	19.0%	19.4%
1989	39,639	36,344	29,792	27,316	310	285	296	288	3,954	3,447	7.5%	8.4%
1991	31,131	26,594	23,494	20,069	245	209	249	213	4,075	3,362	6.1%	6.3%
1993	25,114	21,570	20,059	17,229	209	179	350	267	4,394	3,514	8.0%	7.6%
1995	706	615	530	462	6	5	507	437	4,229	3,697	12.0%	11.8%
1997	-	-	-	-	-	-	521	470	4,005	2,962	13.0%	15.9%
1999	-	-	-	-	-	-	455	399	5,102	4,880	8.9%	8.2%
2001	-	-	-	-	-	-	417	389	5,077	3,041	8.2%	12.8%
2003	2,411	2,203	2,103	1,923	22	20	427	375	5,267	7,849	8.1%	4.8%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Dallas

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	11.6333	112,792	11.49735	98,455	107,152	93,532	9.91%	11.52%	0.53%	0.66%	666	684
1987	11.6011	109,221	11.51862	100,571	103,760	95,543	9.41%	9.59%	0.48%	0.50%	606	569
1989	11.4775	96,515	11.39068	88,493	91,689	84,068	9.66%	9.93%	0.40%	0.43%	483	457
1991	11.463	95,127	11.30543	81,262	90,371	77,199	9.58%	9.60%	0.45%	0.45%	506	433
1993	11.3748	87,095	11.22265	74,806	82,741	71,065	8.52%	7.89%	0.46%	0.41%	471	377
1995	11.3743	87,059	11.23596	75,808	82,706	72,018	8.37%	8.27%	0.46%	0.45%	471	406
1997	11.3467	84,683	11.25283	77,098	80,449	73,243	8.12%	8.03%	0.49%	0.48%	473	427
1999	11.362	85,989	11.25914	77,586	81,689	73,707	7.68%	7.44%	0.46%	0.44%	462	406
2001	11.4168	90,837	11.34299	84,372	86,295	80,153	7.60%	7.64%	0.40%	0.40%	450	420
2003	11.5152	100,223	11.42529	91,609	95,212	87,029	6.60%	6.28%	0.36%	0.33%	472	416

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		User Cost to Income Ratio	
	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	26,871	23,456	15,669	13,677	163	142	503	541	6,206	7,937	8.1%	6.8%
1987	-	-	-	-	-	-	606	569	5,955	5,691	10.2%	10.0%
1989	-	-	-	-	-	-	483	457	5,751	5,983	8.4%	7.6%
1991	-	-	-	-	-	-	506	433	5,628	6,110	9.0%	7.1%
1993	-	-	-	-	-	-	471	377	5,404	5,218	8.7%	7.2%
1995	-	-	-	-	-	-	471	406	4,834	4,285	9.7%	9.5%
1997	-	-	-	-	-	-	473	427	5,415	3,975	8.7%	10.7%
1999	3,254	2,936	2,475	2,233	26	23	437	383	6,048	6,291	7.2%	6.1%
2001	11,472	10,655	9,699	9,008	101	94	349	327	6,731	6,046	5.2%	5.4%
2003	20,535	18,771	17,919	16,379	187	171	286	245	7,142	4,046	4.0%	6.1%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Denver

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	11.8875	145,431	11.75152	126,946	138,160	120,599	9.91%	11.52%	0.53%	0.66%	859	882
1987	11.8607	141,587	11.77816	130,374	134,508	123,855	9.41%	9.59%	0.48%	0.50%	786	738
1989	11.7038	121,025	11.61698	110,966	114,973	105,418	9.66%	9.93%	0.40%	0.43%	606	573
1991	11.62	111,306	11.4625	95,082	105,741	90,328	9.58%	9.60%	0.45%	0.45%	592	507
1993	11.5816	107,113	11.42953	91,999	101,757	87,399	8.52%	7.89%	0.46%	0.41%	580	464
1995	11.6454	114,163	11.50701	99,410	108,455	94,440	8.37%	8.27%	0.46%	0.45%	618	532
1997	11.851	140,217	11.75711	127,658	133,207	121,275	8.12%	8.03%	0.49%	0.48%	784	707
1999	11.9083	148,490	11.80544	133,979	141,065	127,280	7.68%	7.44%	0.46%	0.44%	798	701
2001	12.0593	172,705	11.98551	160,413	164,070	152,393	7.60%	7.64%	0.40%	0.40%	856	799
2003	11.9215	150,460	11.8316	137,530	142,937	130,654	6.60%	6.28%	0.36%	0.33%	709	624

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	27,193	23,736	15,856	13,841	165	144	694	737	5,707	3,627	12.2%	20.3%
1987	-	-	-	-	-	-	786	738	6,102	4,625	12.9%	16.0%
1989	-	-	-	-	-	-	606	573	4,945	3,983	12.3%	14.4%
1991	-	-	-	-	-	-	592	507	5,477	4,291	10.8%	11.8%
1993	-	-	-	-	-	-	580	464	5,436	3,739	10.7%	12.4%
1995	6,390	5,564	4,800	4,180	50	44	568	489	5,155	5,064	11.0%	9.7%
1997	37,266	33,928	27,210	24,772	283	258	500	449	5,325	3,640	9.4%	12.3%
1999	76,587	69,103	58,241	52,550	607	547	192	154	6,418	3,283	3.0%	4.7%
2001	112,264	104,274	94,911	88,156	989	918	(132)	(119)	7,542	6,318	-1.8%	-1.9%
2003	78,583	71,830	68,570	62,677	714	653	(5)	(29)	7,208	5,444	-0.1%	-0.5%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Hartford

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	11.6763	117,742	11.5403	102,775	111,855	97,637	9.91%	11.52%	0.53%	0.66%	696	714
1987	11.9879	160,789	11.90534	148,055	152,750	140,652	9.41%	9.59%	0.48%	0.50%	892	838
1989	12.2166	202,125	12.12988	185,328	192,018	176,061	9.66%	9.93%	0.40%	0.43%	1,012	957
1991	11.8746	143,576	11.71708	122,649	136,397	116,516	9.58%	9.60%	0.45%	0.45%	764	654
1993	11.8455	139,455	11.69338	119,776	132,483	113,787	8.52%	7.89%	0.46%	0.41%	755	604
1995	11.8555	140,853	11.7171	122,651	133,810	116,519	8.37%	8.27%	0.46%	0.45%	763	657
1997	11.8353	138,033	11.7414	125,668	131,132	119,385	8.12%	8.03%	0.49%	0.48%	771	696
1999	11.7384	125,295	11.6356	113,052	119,031	107,399	7.68%	7.44%	0.46%	0.44%	674	592
2001	11.9048	147,980	11.83101	137,449	140,581	130,577	7.60%	7.64%	0.40%	0.40%	734	685
2003	11.8443	139,288	11.75444	127,318	132,324	120,952	6.60%	6.28%	0.36%	0.33%	656	578

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	9,911	8,651	5,779	5,045	60	53	635	661	5,531	6,227	11.5%	10.6%
1987	95,274	87,729	65,662	60,462	684	630	208	208	5,409	6,080	3.9%	3.4%
1989	158,214		118,910	109,028	1,239	1,136	(226)	(179)	5,398	5,928	-4.2%	-3.0%
1991	53,404	45,620	40,302	34,428	420	359	344	295	6,056	5,781	5.7%	5.1%
1993	-	-	-	-	-	-	755	604	6,045	4,903	12.5%	12.3%
1995	-	-	-	-	-	-	763	657	5,955	7,043	12.8%	9.3%
1997	-	-	-	-	-	-	771	696	5,384	5,411	14.3%	12.9%
1999	145,066	-	-	-	-	-	674	592	6,951	4,158	9.7%	14.2%
2001	9,534	8,856	8,061	7,487	84	78	650	607	5,498	9,385	11.8%	6.5%
2003	40,749	37,247	35,556	32,501	370	339	286	239	6,635	5,882	4.3%	4.1%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Los Angeles

	all owners		new owners		Calculating monthly mortgage payment for Step 3: after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	12.1844	195,714	12.04846	170,836	185,928	162,294	9.91%	11.52%	0.53%	0.66%	1,156	1,186
1987	12.1973	198,249	12.11477	182,548	188,337	173,421	9.41%	9.59%	0.48%	0.50%	1,100	1,034
1989	12.4884	265,232	12.4016	243,190	251,970	231,031	9.66%	9.93%	0.40%	0.43%	1,329	1,255
1991	12.4599	257,777	12.30231	220,204	244,888	209,194	9.58%	9.60%	0.45%	0.45%	1,371	1,173
1993	12.3173	223,530	12.16519	191,988	212,353	182,389	8.52%	7.89%	0.46%	0.41%	1,210	967
1995	12.2873	216,930	12.14896	188,898	206,084	179,453	8.37%	8.27%	0.46%	0.45%	1,174	1,012
1997	12.1215	183,772	12.02761	167,311	174,583	158,946	8.12%	8.03%	0.49%	0.48%	1,027	926
1999	12.1512	189,312	12.04832	170,812	179,846	162,272	7.68%	7.44%	0.46%	0.44%	1,018	894
2001	12.2586	210,786	12.18477	195,785	200,247	185,995	7.60%	7.64%	0.40%	0.40%	1,045	976
2003	12.5539	283,200	12.46406	258,864	269,040	245,921	6.60%	6.28%	0.36%	0.33%	1,335	1,174

	Step 1				Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	34,747	30,330	20,261	17,686	211	184	945	1,002	6,214	6,362	15.2%	15.8%
1987	29,017	26,718	19,998	18,414	208	192	892	842	6,760	6,194	13.2%	13.6%
1989	130,248	119,424	97,891	89,756	1,020	935	309	321	6,721	6,194	4.6%	5.2%
1991	123,570	105,558	93,254	79,662	971	830	400	344	6,481	5,890	6.2%	5.8%
1993	64,151	55,099	51,240	44,009	534	458	676	509	5,790	5,530	11.7%	9.2%
1995	-	-	-	-	-	-	1,174	1,012	5,853	5,345	20.1%	18.9%
1997	-	-	-	-	-	-	1,027	926	6,054	5,032	17.0%	18.4%
1999	-	-	-	-	-	-	1,018	894	6,994	6,292	14.6%	14.2%
2001	13,656	12,684	11,545	10,723	120	112	925	864	8,004	6,532	11.6%	13.2%
2003	160,100	146,342	139,699	127,695	1,455	1,330	(121)	(156)	7,208	5,857	-1.7%	-2.7%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Miami

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	11.6972	120,238	11.56128	104,954	114,226	99,707	9.91%	11.52%	0.53%	0.66%	710	729
1987	11.7024	120,861	11.61989	111,289	114,818	105,725	9.41%	9.59%	0.48%	0.50%	671	630
1989	11.7477	126,465	11.66095	115,954	120,142	110,156	9.66%	9.93%	0.40%	0.43%	633	599
1991	11.5967	108,735	11.43913	92,886	103,298	88,242	9.58%	9.60%	0.45%	0.45%	578	495
1993	11.7019	120,805	11.54982	103,758	114,764	98,570	8.52%	7.89%	0.46%	0.41%	654	523
1995	11.5422	102,975	11.40387	89,668	97,826	85,185	8.37%	8.27%	0.46%	0.45%	557	480
1997	11.7678	129,033	11.67398	117,475	122,581	111,601	8.12%	8.03%	0.49%	0.48%	721	650
1999	11.6776	117,899	11.57475	106,378	112,004	101,059	7.68%	7.44%	0.46%	0.44%	634	557
2001	11.6824	118,462	11.60853	110,032	112,539	104,531	7.60%	7.64%	0.40%	0.40%	587	548
2003	11.9843	160,219	11.89445	146,452	152,209	139,129	6.60%	6.28%	0.36%	0.33%	755	664

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		User Cost to Income Ratio	
	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	-	-	-	-	-	-	710	729	5,196	4,178	13.7%	17.4%
1987	-	-	-	-	-	-	671	630	5,398	6,663	12.4%	9.5%
1989	-	-	-	-	-	-	633	599	5,290	5,079	12.0%	11.8%
1991	-	-	-	-	-	-	578	495	5,124	4,440	11.3%	11.1%
1993	-	-	-	-	-	-	654	523	4,595	6,104	14.2%	8.6%
1995	-	-	-	-	-	-	557	480	4,281	3,503	13.0%	13.7%
1997	-	-	-	-	-	-	721	650	4,402	4,094	16.4%	15.9%
1999	5,632	5,082	4,283	3,864	45	40	589	517	5,665	4,573	10.4%	11.3%
2001	22,062	20,492	18,652	17,324	194	180	393	368	6,245	4,641	6.3%	7.9%
2003	77,584	70,917	67,698	61,881	705	645	50	20	5,948	8,636	0.8%	0.2%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, New York City

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	12.0612	173,023	11.92524	151,031	164,372	143,479	9.91%	11.52%	0.53%	0.66%	1,022	1,049
1987	12.3938	241,289	12.31124	222,179	229,224	211,070	9.41%	9.59%	0.48%	0.50%	1,339	1,258
1989	12.3539	231,865	12.26715	212,596	220,272	201,966	9.66%	9.93%	0.40%	0.43%	1,161	1,098
1991	12.1088	181,460	11.95125	155,011	172,387	147,260	9.58%	9.60%	0.45%	0.45%	965	826
1993	12.0856	177,293	11.93344	152,274	168,429	144,661	8.52%	7.89%	0.46%	0.41%	960	767
1995	12.1316	185,639	11.99319	161,650	176,357	153,568	8.37%	8.27%	0.46%	0.45%	1,005	866
1997	11.9777	159,167	11.88387	144,910	151,209	137,665	8.12%	8.03%	0.49%	0.48%	889	802
1999	12.052	171,442	11.94917	154,689	162,870	146,954	7.68%	7.44%	0.46%	0.44%	922	810
2001	12.0981	179,532	12.02428	166,755	170,556	158,417	7.60%	7.64%	0.40%	0.40%	890	831
2003	12.4677	259,811	12.37785	237,483	246,821	225,609	6.60%	6.28%	0.36%	0.33%	1,224	1,077

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	87,025	75,964	50,745	44,295	529	461	494	588	6,031	6,770	8.2%	8.7%
1987	237,199	218,414	163,476	150,529	1,703	1,568	(364)	(310)	6,823	7,524	-5.3%	-4.1%
1989	221,956	203,511	166,817	152,954	1,738	1,593	(576)	(496)	7,052	7,031	-8.2%	-7.1%
1991	96,276	82,243	72,656	62,066	757	647	208	180	6,536	7,560	3.2%	2.4%
1993	24,265	20,841	19,382	16,647	202	173	758	594	6,017	6,862	12.6%	8.7%
1995	-	-	-	-	-	-	1,005	866	6,533	6,706	15.4%	12.9%
1997	-	-	-	-	-	-	889	802	6,527	5,912	13.6%	13.6%
1999	1,167	1,053	887	801	9	8	913	801	8,069	7,706	11.3%	10.4%
2001	39,537	36,723	33,425	31,046	348	323	542	508	9,029	7,423	6.0%	6.8%
2003	148,380	135,628	129,473	118,346	1,349	1,233	(124)	(155)	8,835	9,270	-1.4%	-1.7%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Pittsburgh

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	11.2008	73,191	11.06488	63,888	69,532	60,693	9.91%	11.52%	0.53%	0.66%	432	444
1987	11.2551	77,276	11.17263	71,156	73,412	67,598	9.41%	9.59%	0.48%	0.50%	429	403
1989	11.3564	85,511	11.26963	78,404	81,235	74,484	9.66%	9.93%	0.40%	0.43%	428	405
1991	11.119	67,440	10.96145	57,610	64,068	54,729	9.58%	9.60%	0.45%	0.45%	359	307
1993	11.3066	81,355	11.15447	69,875	77,287	66,382	8.52%	7.89%	0.46%	0.41%	440	352
1995	11.2898	80,005	11.15147	69,666	76,004	66,183	8.37%	8.27%	0.46%	0.45%	433	373
1997	11.337	83,871	11.24319	76,358	79,677	72,540	8.12%	8.03%	0.49%	0.48%	469	423
1999	11.3088	81,534	11.20594	73,566	77,457	69,888	7.68%	7.44%	0.46%	0.44%	438	385
2001	11.2595	77,615	11.18568	72,091	73,734	68,486	7.60%	7.64%	0.40%	0.40%	385	359
2003	11.3408	84,183	11.2509	76,949	79,974	73,102	6.60%	6.28%	0.36%	0.33%	397	349

	Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	-	-	-	-	-	-	432	444	3,986	4,075	10.8%	10.9%
1987	-	-	-	-	-	-	429	403	4,258	4,755	10.1%	8.5%
1989	4,555	4,176	3,423	3,139	36	33	393	372	4,275	4,631	9.2%	8.0%
1991	4,938	4,218	3,726	3,183	39	33	320	274	4,589	5,961	7.0%	4.6%
1993	12,830	11,020	10,248	8,802	107	92	334	260	4,444	4,342	7.5%	6.0%
1995	5,601	4,877	4,207	3,663	44	38	389	335	4,490	3,295	8.7%	10.2%
1997	4,242	3,862	3,097	2,820	32	29	436	393	4,815	2,617	9.1%	15.0%
1999	6,407	5,780	4,872	4,396	51	46	388	339	5,061	3,659	7.7%	9.3%
2001	5,449	5,062	4,607	4,279	48	45	337	315	5,725	13,227	5.9%	2.4%
2003	13,972	12,771	12,191	11,144	127	116	270	233	5,472	4,791	4.9%	4.9%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Portland

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	11.6148	110,726	11.47886	96,651	105,189	91,818	9.91%	11.52%	0.53%	0.66%	654	671
1987	11.8607	141,587	11.77816	130,374	134,508	123,855	9.41%	9.59%	0.48%	0.50%	786	738
1989	11.7038	121,025	11.61698	110,966	114,973	105,418	9.66%	9.93%	0.40%	0.43%	606	573
1991	11.6263	112,005	11.46876	95,680	106,405	90,896	9.58%	9.60%	0.45%	0.45%	596	510
1993	11.7695	129,255	11.61742	111,015	122,792	105,464	8.52%	7.89%	0.46%	0.41%	700	559
1995	11.8441	139,263	11.70575	121,267	132,300	115,204	8.37%	8.27%	0.46%	0.45%	754	649
1997	12.0034	163,316	11.9096	148,687	155,150	141,253	8.12%	8.03%	0.49%	0.48%	913	823
1999	11.916	149,648	11.81321	135,024	142,165	128,273	7.68%	7.44%	0.46%	0.44%	805	707
2001	11.9545	155,512	11.88065	144,444	147,737	137,222	7.60%	7.64%	0.40%	0.40%	771	720
2003	12.0131	164,896	11.92322	150,726	156,651	143,190	6.60%	6.28%	0.36%	0.33%	777	684

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		User Cost to Income Ratio	
	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners	all owners	new owners
1985	-	-	-	-	-	-	654	671	5,166	4,054	12.7%	16.6%
1987	-	-	-	-	-	-	786	738	5,122	3,692	15.3%	20.0%
1989	-	-	-	-	-	-	606	573	5,078	3,319	11.9%	17.3%
1991	8,002	6,835	6,039	5,158	63	54	533	456	5,034	2,957	10.6%	15.4%
1993	34,275	29,438	27,377	23,513	285	245	414	314	5,109	3,995	8.1%	7.9%
1995	66,528	57,931	49,975	43,517	521	453	233	196	5,286	6,729	4.4%	2.9%
1997	99,722	90,790	72,811	66,289	758	691	154	133	5,365	5,672	2.9%	2.3%
1999	68,209	61,544	51,870	46,801	540	488	264	219	5,560	6,438	4.8%	3.4%
2001	54,680	50,788	46,228	42,938	482	447	289	273	6,986	7,091	4.1%	3.8%
2003	41,921	38,319	36,579	33,436	381	348	396	336	6,530	5,553	6.1%	6.0%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Providence

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	11.5596	104,778	11.42365	91,459	99,539	86,886	9.91%	11.52%	0.53%	0.66%	619	635
1987	12.138	186,844	12.05552	172,046	177,502	163,444	9.41%	9.59%	0.48%	0.50%	1,037	974
1989	12.1617	191,325	12.07496	175,424	181,759	166,653	9.66%	9.93%	0.40%	0.43%	958	906
1991	11.743	125,864	11.58542	107,519	119,571	102,143	9.58%	9.60%	0.45%	0.45%	670	573
1993	11.7745	129,903	11.62243	111,573	123,407	105,994	8.52%	7.89%	0.46%	0.41%	703	562
1995	11.7811	130,758	11.64273	113,861	124,220	108,168	8.37%	8.27%	0.46%	0.45%	708	610
1997	11.7893	131,828	11.69541	120,020	125,236	114,019	8.12%	8.03%	0.49%	0.48%	737	664
1999	11.7353	124,898	11.63242	112,693	118,653	107,058	7.68%	7.44%	0.46%	0.44%	672	590
2001	11.804	133,784	11.73015	124,262	127,095	118,049	7.60%	7.64%	0.40%	0.40%	663	619
2003	12.0891	177,925	11.99927	162,636	169,029	154,504	6.60%	6.28%	0.36%	0.33%	838	738

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	19,482	17,006	11,360	9,916	118	103	501	532	4,939	4,486	10.1%	11.9%
1987	119,019	109,593	82,027	75,531	854	787	182	187	5,700	5,579	3.2%	3.4%
1989	190,927	175,058	143,496	131,570	1,495	1,371	(536)	(465)	4,896	6,673	-11.0%	-7.0%
1991	83,026	70,925	62,658	53,525	653	558	17	15	4,928	1,351	0.3%	1.1%
1993	34,213	29,386	27,327	23,471	285	244	418	318	5,404	5,012	7.7%	6.3%
1995	-	-	-	-	-	-	708	610	4,786	2,823	14.8%	21.6%
1997	-	-	-	-	-	-	737	664	4,740	7,123	15.5%	9.3%
1999	-	-	-	-	-	-	672	590	5,226	2,990	12.8%	19.7%
2001	20,214	18,775	17,089	15,873	178	165	485	454	5,668	4,116	8.6%	11.0%
2003	100,958	92,282	88,093	80,523	918	839	(79)	(101)	5,398	2,667	-1.5%	-3.8%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, St. Louis

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	11.3204	82,487	11.18445	72,002	78,363	68,402	9.91%	11.52%	0.53%	0.66%	487	500
1987	11.5479	103,558	11.46538	95,357	98,380	90,589	9.41%	9.59%	0.48%	0.50%	575	540
1989	11.5416	102,910	11.45485	94,358	97,764	89,640	9.66%	9.93%	0.40%	0.43%	515	487
1991	11.5033	99,041	11.34576	84,606	94,089	80,376	9.58%	9.60%	0.45%	0.45%	527	451
1993	11.3915	88,568	11.23942	76,071	84,140	72,267	8.52%	7.89%	0.46%	0.41%	479	383
1995	11.3185	82,332	11.18014	71,692	78,215	68,108	8.37%	8.27%	0.46%	0.45%	446	384
1997	11.3719	86,850	11.2781	79,071	82,508	75,117	8.12%	8.03%	0.49%	0.48%	485	438
1999	11.4204	91,163	11.31757	82,254	86,604	78,142	7.68%	7.44%	0.46%	0.44%	490	431
2001	11.4439	93,326	11.37002	86,684	88,659	82,349	7.60%	7.64%	0.40%	0.40%	463	432
2003	11.539	102,643	11.44916	93,823	97,511	89,131	6.60%	6.28%	0.36%	0.33%	484	426

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	-	-	-	-	-	-	487	500	4,549	4,676	10.7%	10.7%
1987	-	-	-	-	-	-	575	540	4,625	3,040	12.4%	17.8%
1989	9,831	9,014	7,389	6,775	77	71	438	417	5,270	5,185	8.3%	8.0%
1991	3,911	3,341	2,952	2,521	31	26	496	425	4,338	4,643	11.4%	9.1%
1993	-	-	-	-	-	-	479	383	4,388	3,507	10.9%	10.9%
1995	-	-	-	-	-	-	446	384	5,023	3,345	8.9%	11.5%
1997	-	-	-	-	-	-	485	438	4,710	4,387	10.3%	10.0%
1999	8,894	8,025	6,764	6,103	70	64	420	367	5,378	4,522	7.8%	8.1%
2001	18,143	16,852	15,339	14,247	160	148	303	284	5,966	2,025	5.1%	14.0%
2003	27,984	25,579	24,418	22,320	254	232	229	193	5,103	3,363	4.5%	5.7%

Appendix A2. Effect of Expected Capital Gains on Owner Costs by CMSA, Seattle

					Calculating monthly mortgage payment for Step 3							
	all owners		new owners		after 5% downpaid		Current yearly interest rates		Real Monthly interest rates		Monthly mortgage pmt after 5% downpaid	
	pred val	exp(pred val)	pred val	exp(pred val)	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	11.7602	128,057	11.62429	111,780	121,654	106,191	9.91%	11.52%	0.53%	0.66%	757	776
1987	11.8001	133,263	11.71756	122,708	126,600	116,572	9.41%	9.59%	0.48%	0.50%	740	695
1989	11.899	147,116	11.81221	134,889	139,761	128,145	9.66%	9.93%	0.40%	0.43%	737	696
1991	12.0998	179,841	11.9423	153,630	170,849	145,948	9.58%	9.60%	0.45%	0.45%	957	819
1993	12.0697	174,500	11.91757	149,877	165,775	142,383	8.52%	7.89%	0.46%	0.41%	944	755
1995	11.9801	159,546	11.84172	138,929	151,569	131,983	8.37%	8.27%	0.46%	0.45%	864	744
1997	12.0823	176,709	11.98842	160,881	167,874	152,837	8.12%	8.03%	0.49%	0.48%	987	891
1999	11.9909	161,274	11.88803	145,514	153,210	138,239	7.68%	7.44%	0.46%	0.44%	867	762
2001	12.1924	197,280	12.11856	183,241	187,416	174,079	7.60%	7.64%	0.40%	0.40%	978	913
2003	12.2092	200,616	12.1193	183,377	190,586	174,208	6.60%	6.28%	0.36%	0.33%	945	832

			Step 1		Step 2		Step 3				Step 4	
	Future capital gain applying the same growth rate to the next 8 years		Current value of future gain (discounted by 10 year treasury note)		Expected Capital Gain per month		User cost of Capital = (monthly mortg pmt - expected K gain per month)		monthly household income		**User Cost to Income Ratio**	
	all owners	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**	**all owners**	**new owners**
1985	12,013	10,486	7,005	6,114	73	64	684	713	5,615	4,716	12.2%	15.1%
1987	-	-	-	-	-	-	740	695	6,077	5,493	12.2%	12.6%
1989	13,875	12,722	10,428	9,561	109	100	628	597	5,830	5,191	10.8%	11.5%
1991	66,984	57,221	50,551	43,183	527	450	430	369	5,811	5,200	7.4%	7.1%
1993	65,272	56,062	52,135	44,779	543	466	401	289	5,574	6,974	7.2%	4.1%
1995	53,669	46,734	40,316	35,106	420	366	444	378	5,502	4,165	8.1%	9.1%
1997	39,931	36,355	29,156	26,544	304	277	684	614	5,864	4,756	11.7%	12.9%
1999	28,205	25,448	21,448	19,352	223	202	644	560	6,744	5,815	9.5%	9.6%
2001	56,480	52,461	47,750	44,352	497	462	481	451	6,979	6,078	6.9%	7.4%
2003	73,848	67,502	64,437	58,900	671	614	274	218	7,037	6,086	3.9%	3.6%