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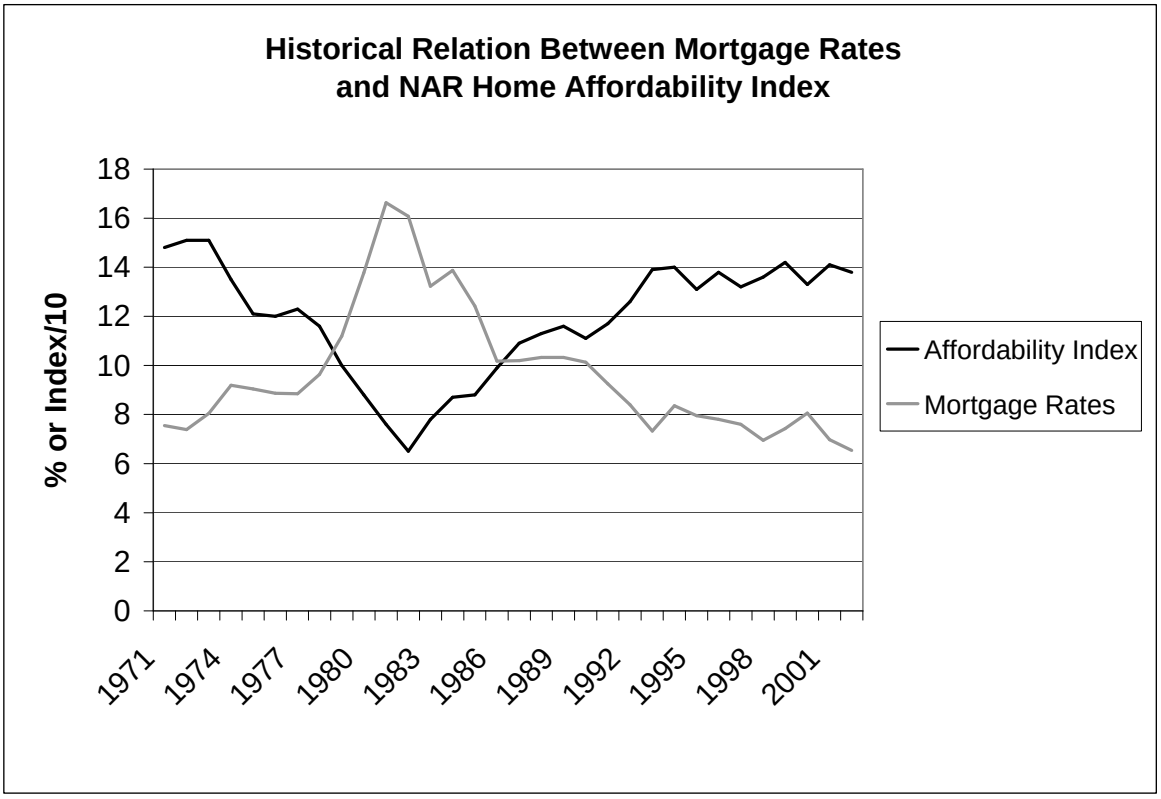
[11] Jack Goodman (2001) "Housing Affordability in the United States: Trends, Interpretations, and Outlook," a report prepared for the Millienial Housing Commission, Nov. 21, 2001.

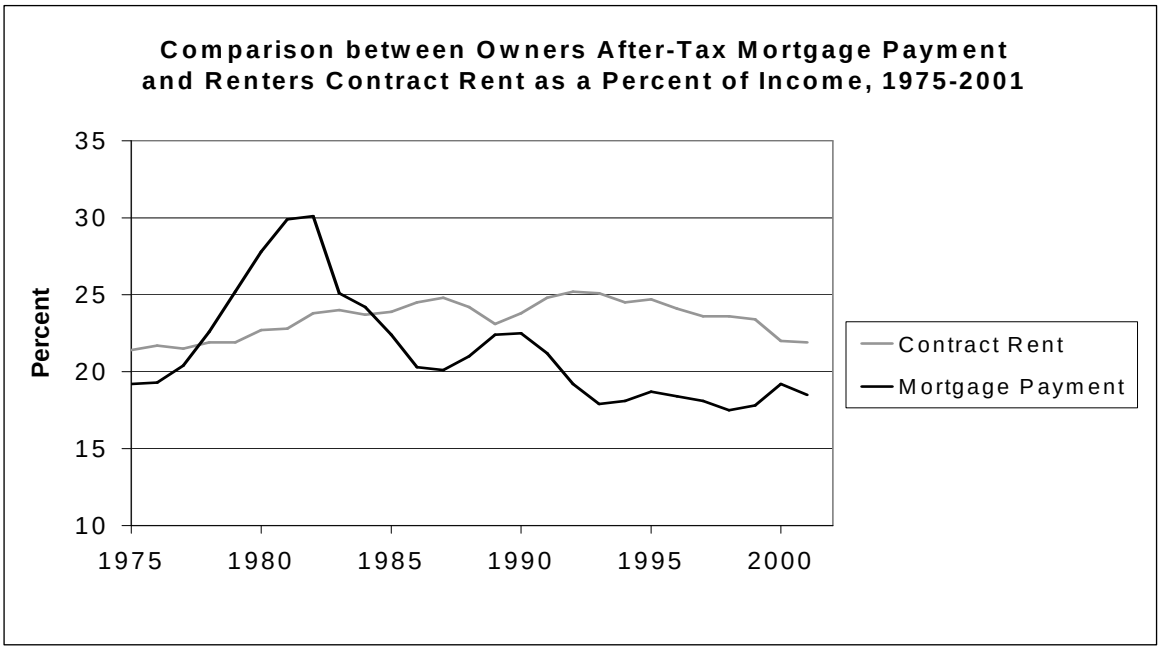
[12] Joint Center for Housing Studies of Harvard University (2002) *The State of the Nation's Housing*, Table A-3, p. 32.

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

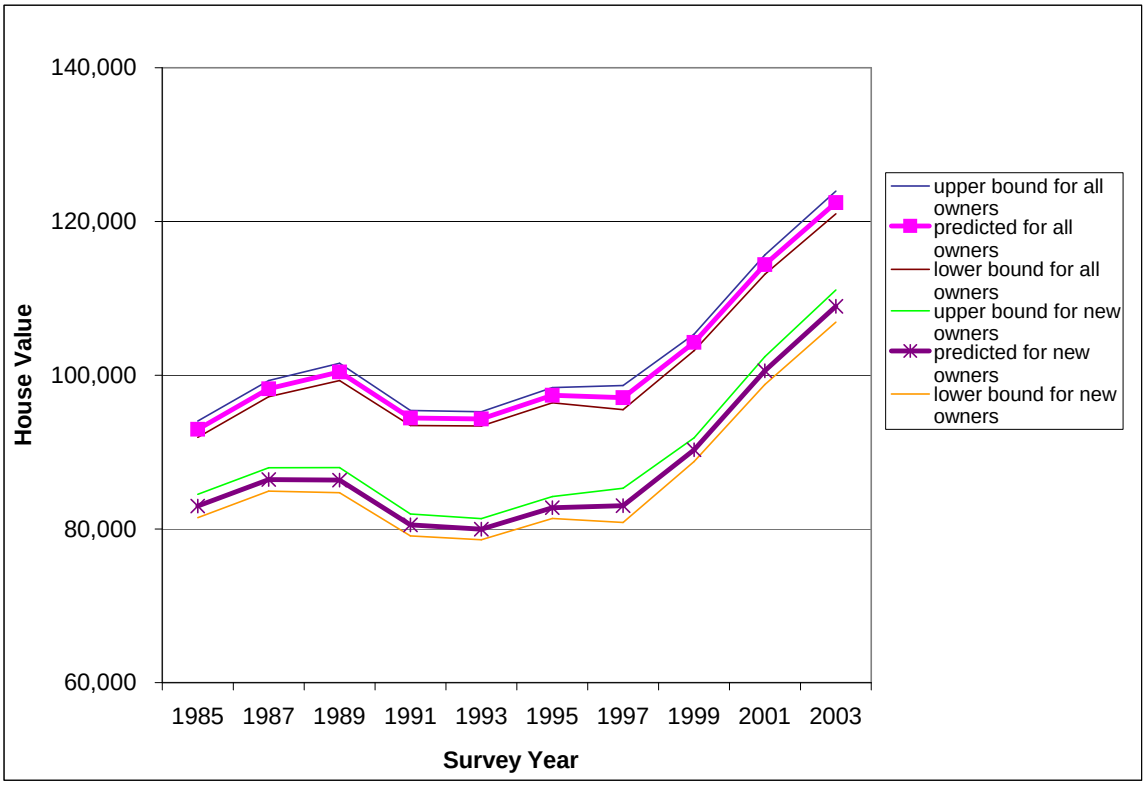
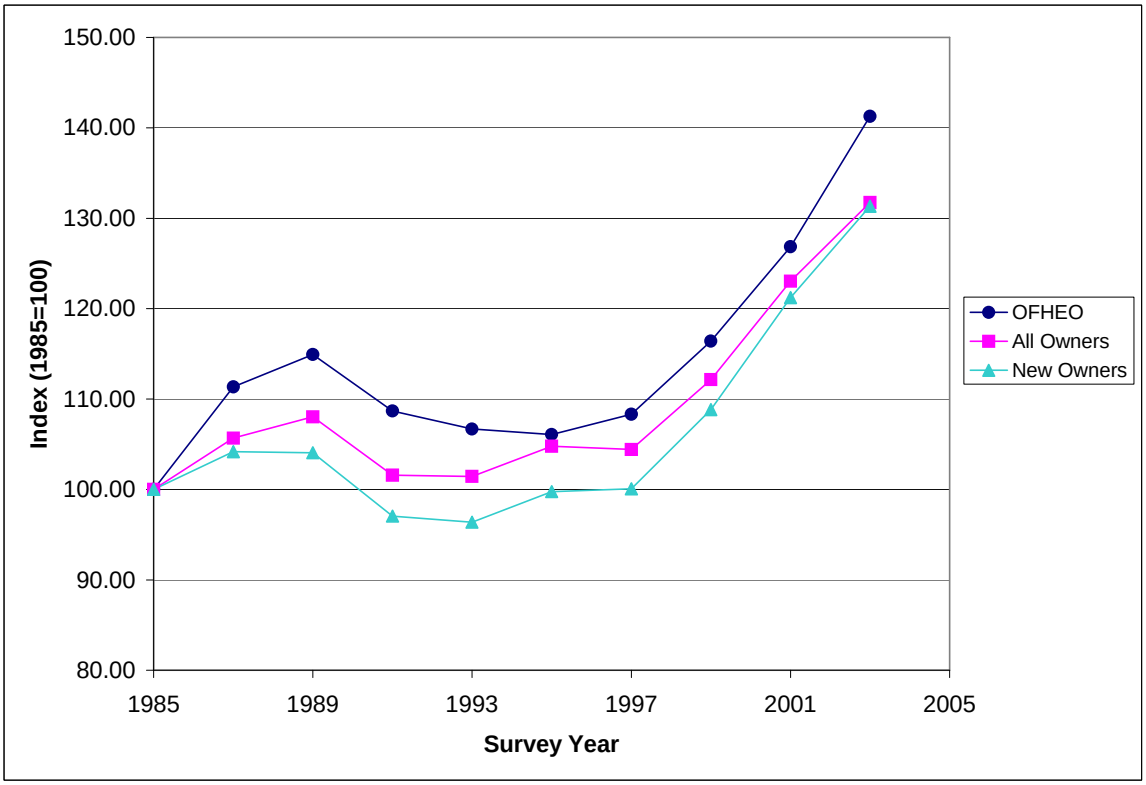


Exhibit 6. OFHEO and AHS House Price Indexes



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

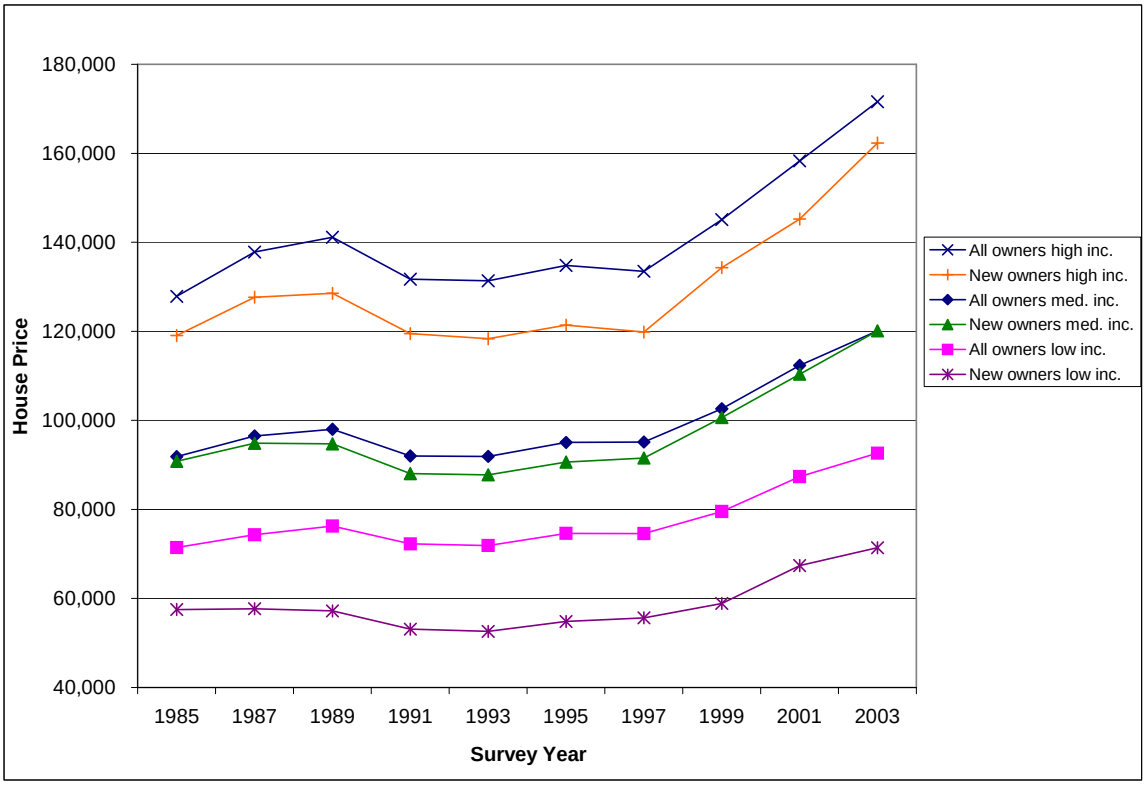
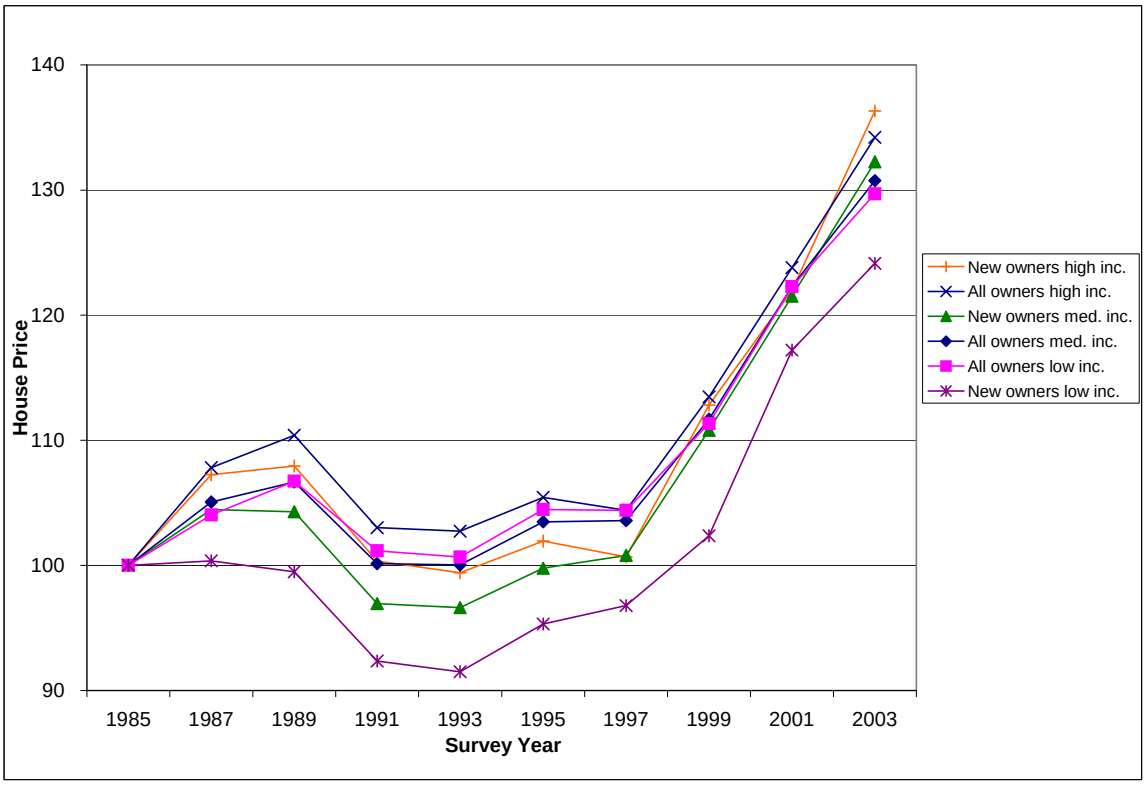


Exhibit 7b. Constant Quality House Price Index for All Owners and New Owners, by Income Group, Normalized (1985=100)



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

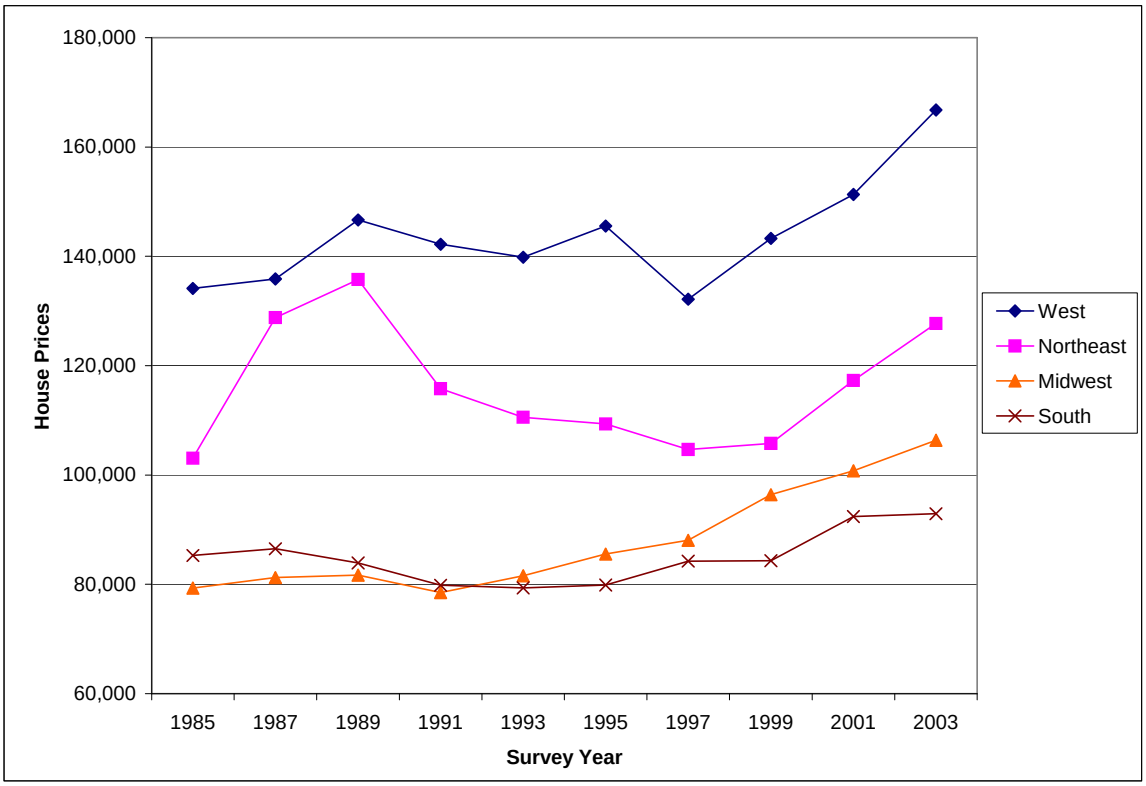


Exhibit 8b. Constant Quality House Price Index for All Owners, by Region, Normalized (1985=100)

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

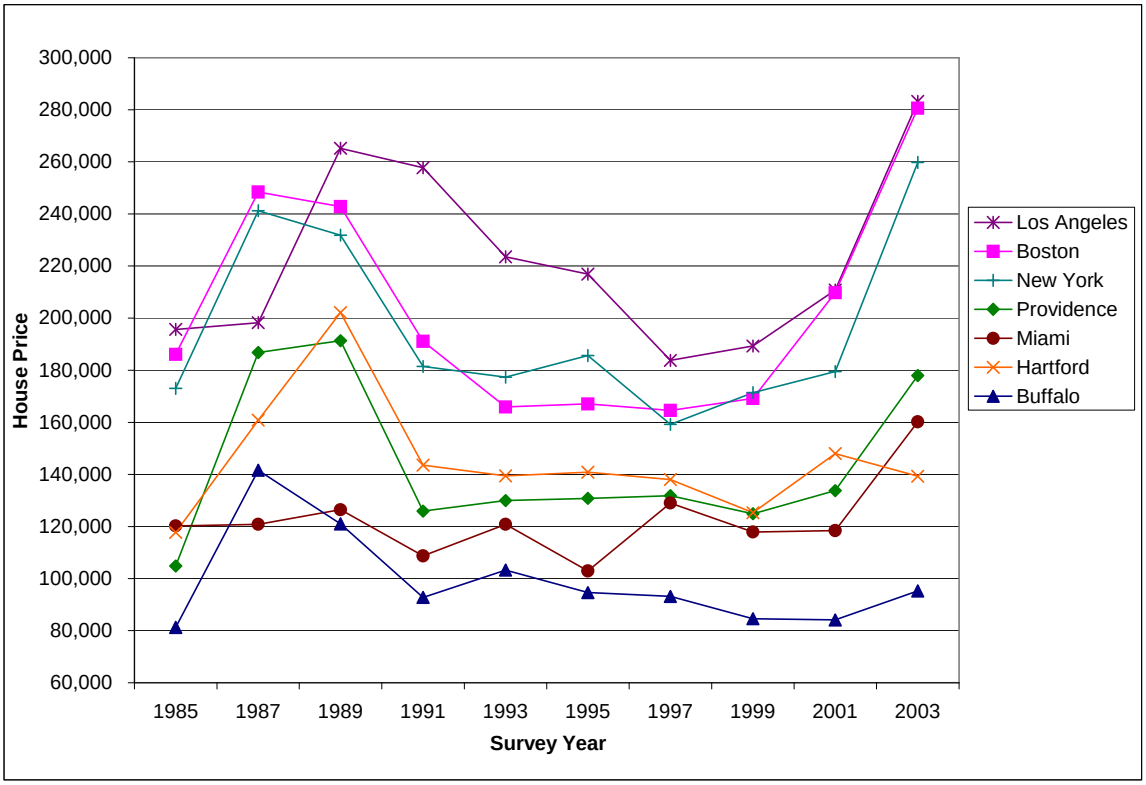


Exhibit 9b. Constant Quality House Price Index for All Owners, by CMSA, Normalized (1985=100)

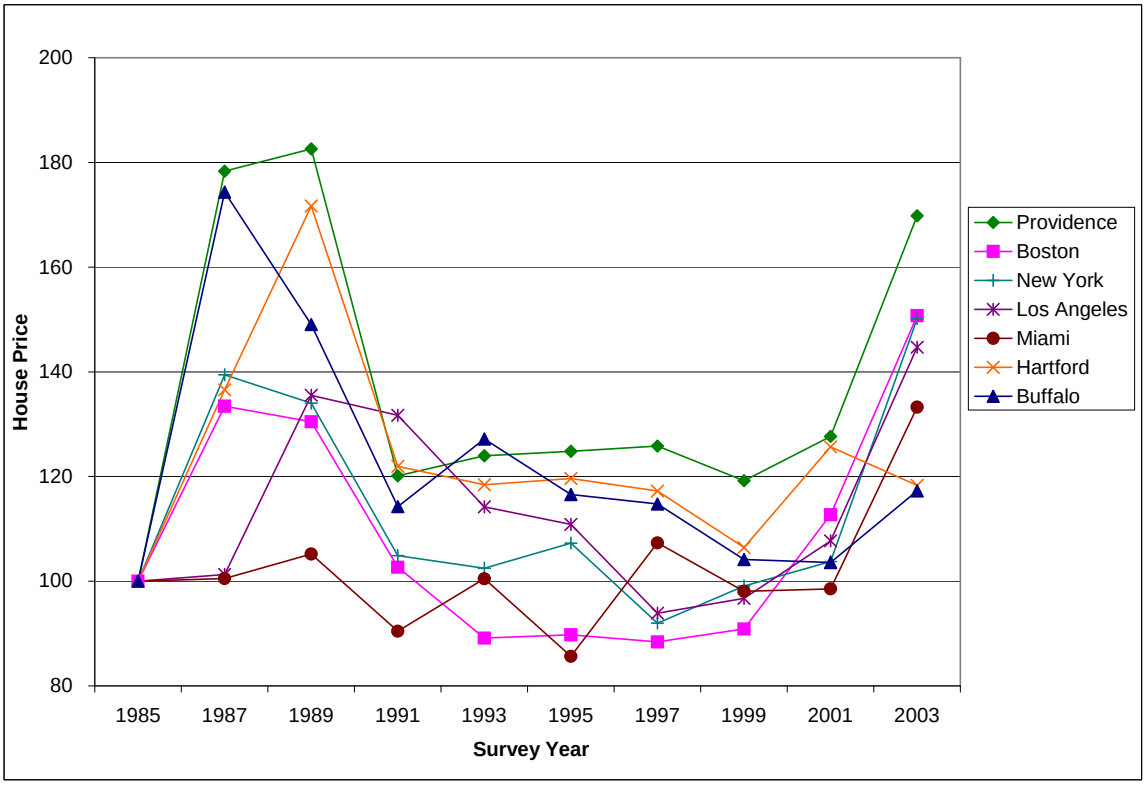


Exhibit 10a. Constant Quality House Prices for All Owners, for More CMSAs

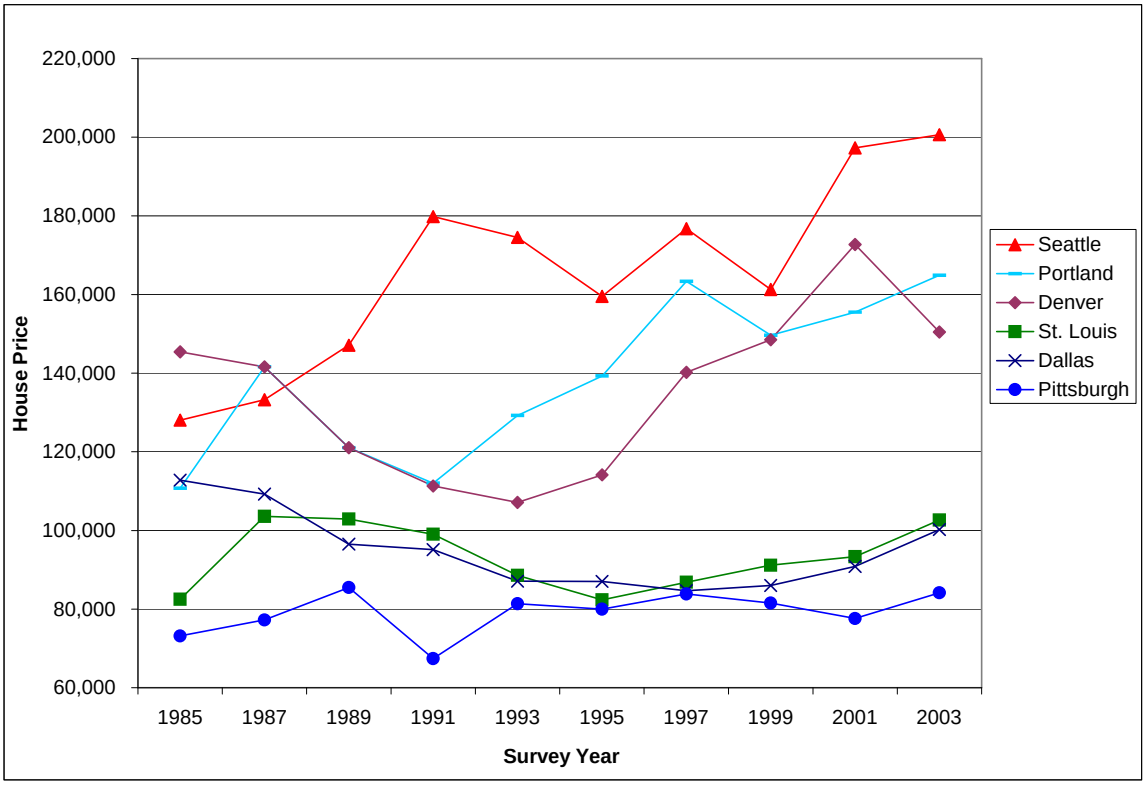
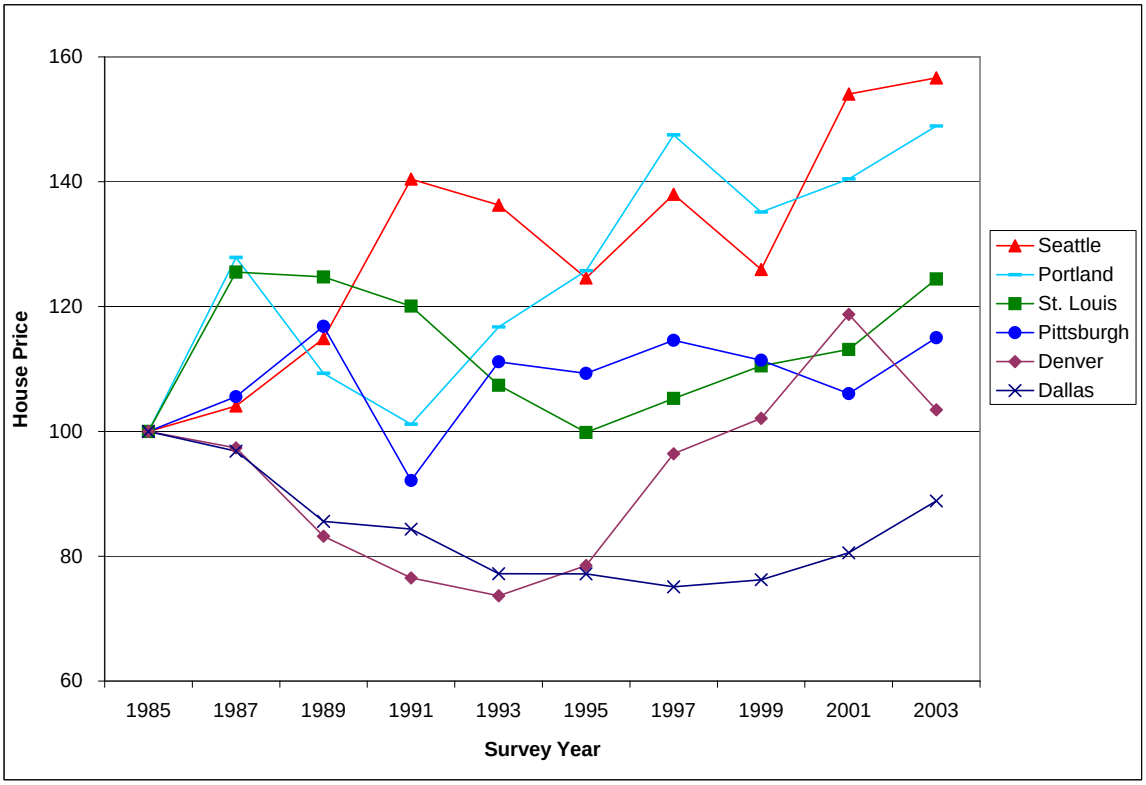


Exhibit 10b. Constant Quality House Price Index for All Owners, for More CMSAs, Normalized (1985=100)



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.

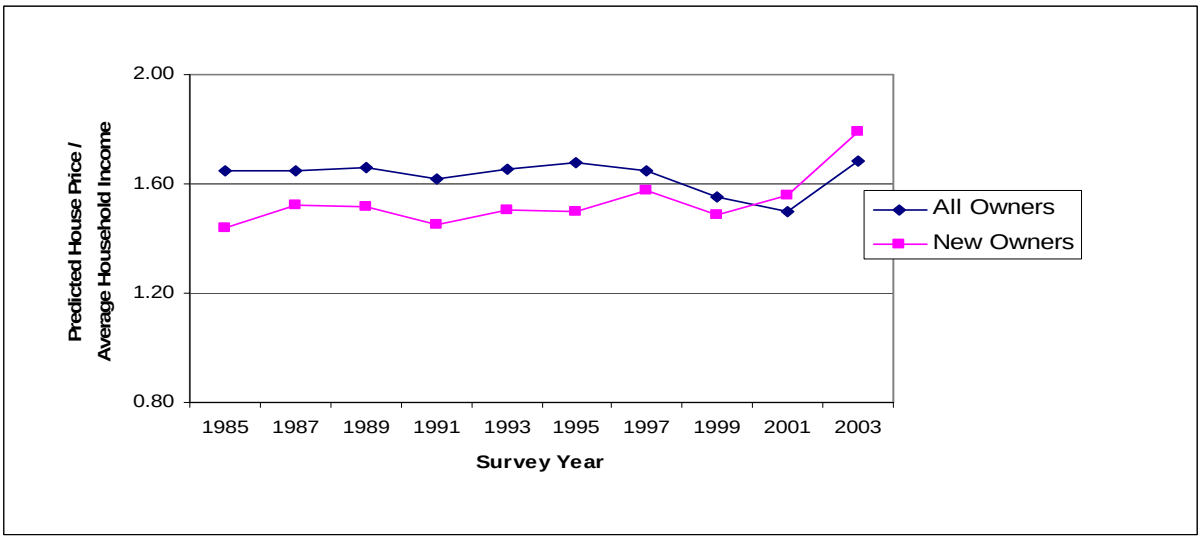
It is difficult to know what model is used to create this forecast, but it does represent the current conventional wisdom in the real estate industry.

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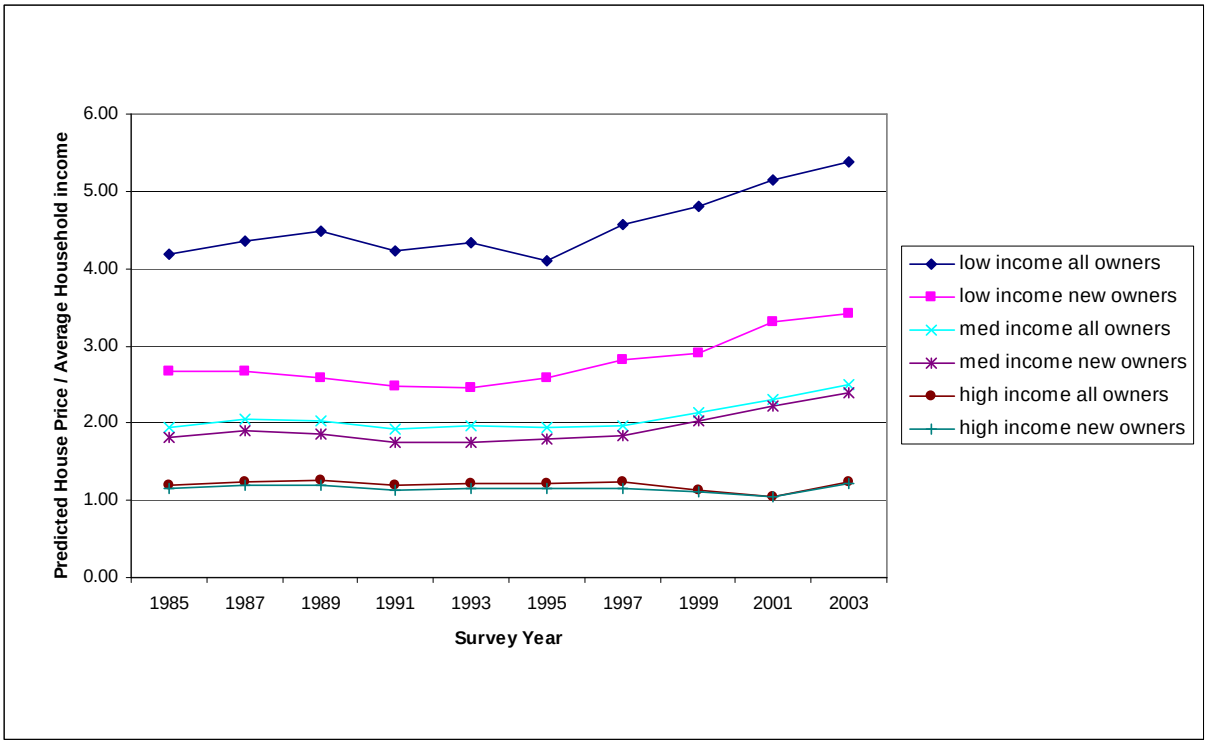
[34] The ratios in Exhibits 12 and 13 are calculated as the hedonic's predicted price for a constant –quality house divided by the mean household income for the specified group of owners.

[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

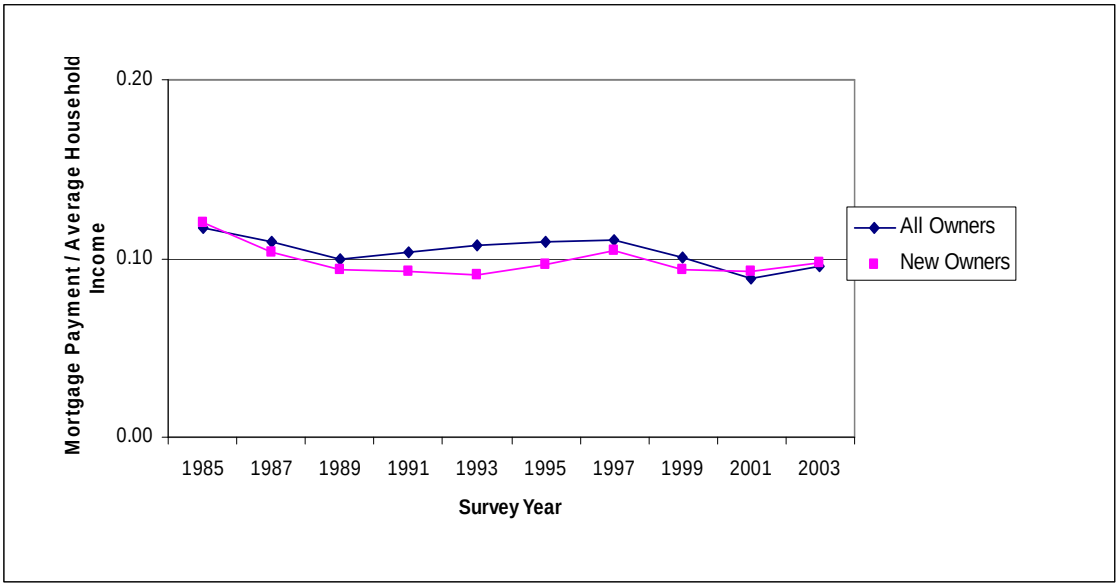
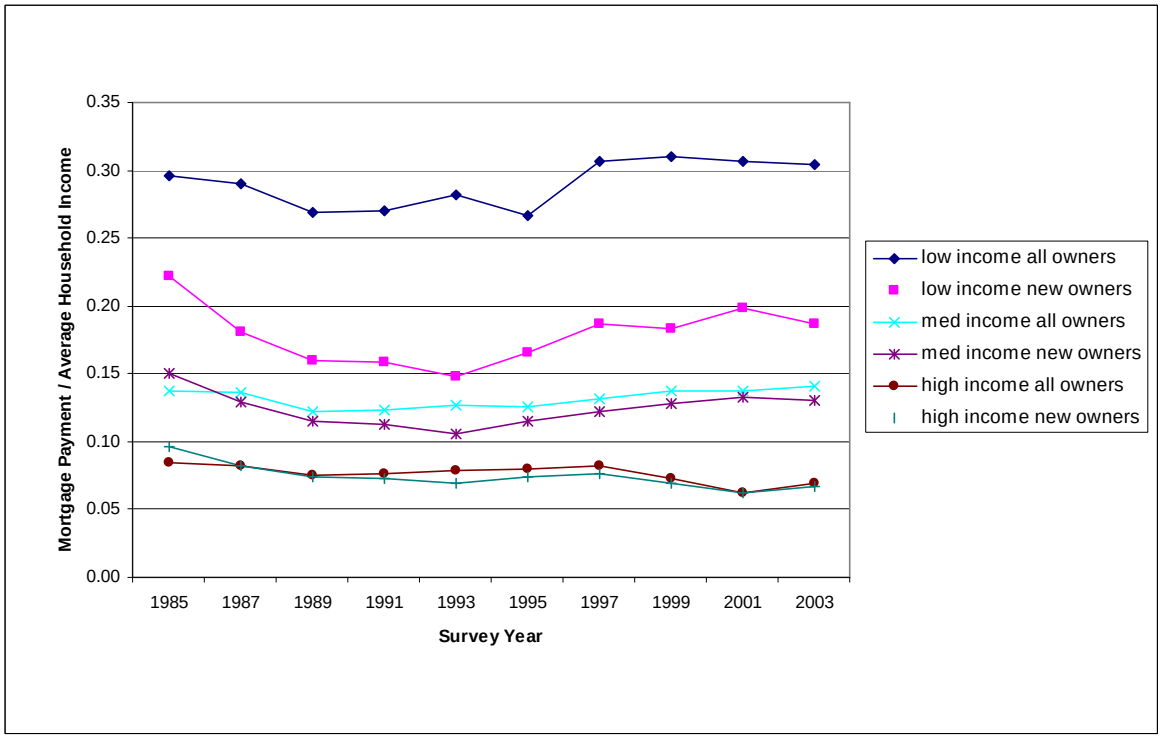


Exhibit 15. Financing Costs to Income Ratios, by Income Group



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.

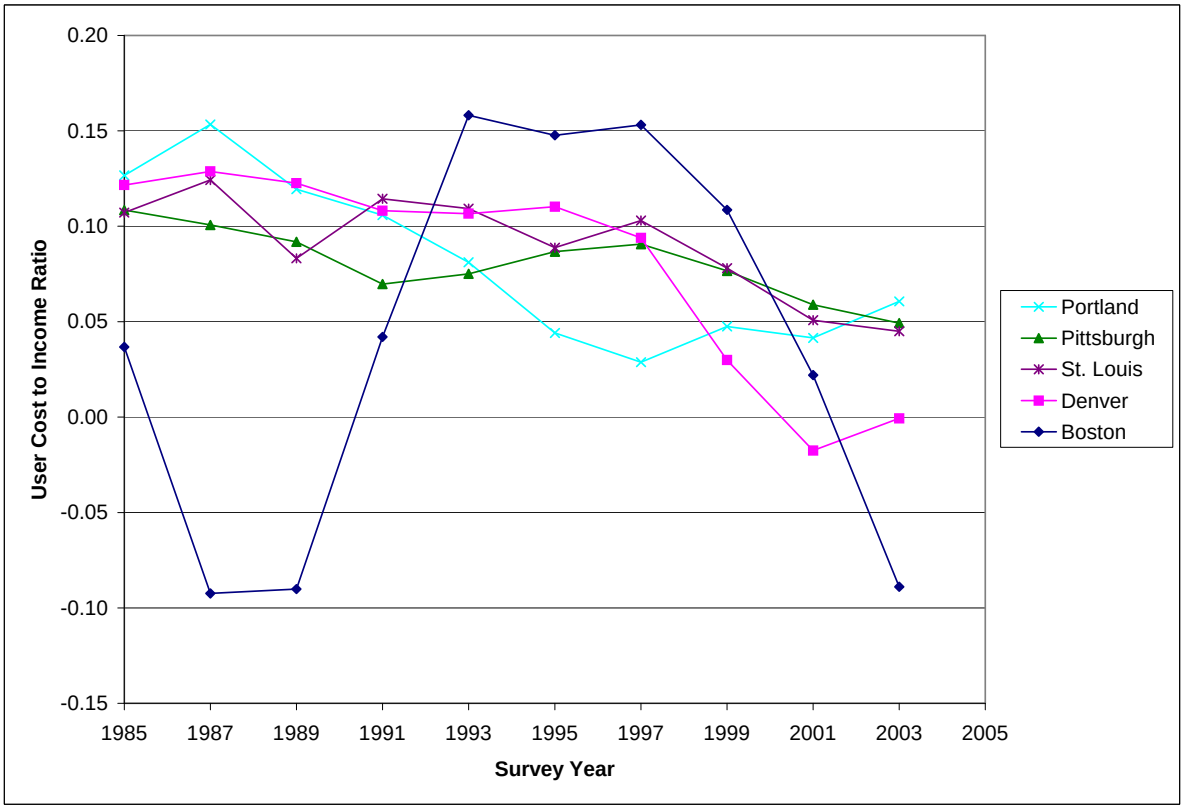
[37] For more information on expectations, please see the final section of this report "Behavioral Finance and the Formation of Price Expectations."

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.