Did Changing Rents Explain Changing House Prices During the 1990s?

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April 2005

This paper was produced for the American Real Estate and Urban Economics Association 2004 Annual Meetings, held in Washington, DC on January 3-5, 2004.

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Abstract

House prices in the United States rose 14 percent in real terms during the 1990s; by historical standards, this was strong performance. Some analysts have worried that this performance was too strong, perhaps indicating an asset bubble, and could not be explained by fundamentals.

This paper focuses on this relationship between rent and house value changes in 27 American metropolitan areas through 1998 using hedonic price and rental regressions on American Housing Survey Data to separate the extent to which house value and rent increases were due to changes in the quality of the housing stock, and how much were due to changes in price of housing services. We find that almost all of these markets demonstrated home value and rental growth during the 1990s that was well explained by economic fundamentals.

Did Changing Rents Explain Changing House Prices During the 1990s?

1. Introduction

House prices in the United States rose 14 percent in real terms during the 1990s; by historical standards, this was strong performance. Some analysts (e.g. Leamer 2002) have worried that this performance was too strong, and could not be explained by fundamentals.

Past papers (Hendershott and Shilling 1982, Meese and Wallace 1994) have explored the relationship between rents and house prices. These papers show that in equilibrium, house prices should be equal to the present value of the discounted stream of rents earned by the house. This implies that over the long run, in the absence of changes in the after tax discount rate, house price growth should be nearly equal to rental growth.

This paper focuses on this relationship between rent changes and house price in 27 American metropolitan areas through 1998. Specifically, it uses American Housing Survey Data and the techniques used in Malpezzi, Chun and Green (1998) to perform hedonic price and rental regressions in these cities, and then separates the extent to which house value and rent increases were due to changes in the quality of the stock, and how much were due to changes in price.

We have confidence in our AHS regression results because the raw, unadjusted changes in house prices we produce closely mimic those of the Freddie Mac Conventional Mortgage Home Price Index MSA series and the OFHEO House Price Index. Surprisingly, we found that rents (not adjusting for quality) rose faster than price in 13 of the 27 MSAs. After adjusting for quality we found that in 19 of 27 MSAs, quality-adjusted rents rose more rapidly than quality adjusted prices, and not all 13 of the unadjusted rents-rising-faster-than-prices MSAs were among the 19 post-adjustment rents-rising-faster-than-prices MSAs. This suggests to us that through 1998-2002, house prices in the MSAs we studied were grounded in fundamentals. We also explore whether we can find a relationship between the dynamics of the 1990s and house price dynamics at the beginning of the current decade. AHS data, while enabling regressions that allow us to separate price and quantity changes, is not sufficiently recent for us to use it to make determinations about the relationship between rents and prices between 1998-2002 and

2004. It does show, however, that relying entirely on rents and values without a quality adjustment can lead to spurious inferences about relative changes in values and rents.

2. Some Background on Bubbles

Beginning in the late 1990s, the American popular press has been worrying about whether the American housing market has been overheated: a quick search of Nexus shows there were more than 1000 articles (the default limit on our subscription) about a housing "bubble" between 1998 and 2002. The following from Dean Baker (2002) is typical:

> "…there is no obvious explanation for a sudden increase in the relative demand for housing which could explain the price rise. There is also no obvious explanation for the increase in home purchase prices relative to rental prices. In the absence of any other credible theory, the only plausible explanation for the sudden surge in home prices is the existence of a housing bubble. This means that a major factor driving housing sales is the expectation that housing prices will be higher in the future. While this process can sustain rising prices for a period of time, it must eventually come to an end.
>
> At present market values, the collapse of the housing bubble will lead to a loss of between $1.3 trillion and $2.6 trillion of housing wealth. This collapse will slow the economy both by derailing housing construction and by its impact on consumption through the wealth effect. In addition, millions of families are likely to face severe strains in their personal finances. The average ratio of equity to home values is already near record lows. This ratio will plunge precipitously if the housing bubble collapses, leaving many families with little or no equity in their homes. This situation is especially troublesome since the population is comparatively old, with much of the baby boom generation on the edge of retirement."

The popular press is not alone in its concern: Case and Shiller (2002) thought that California house prices in were too high, and predicted that in the San Jose area they would fall by 10 percent. Edward Leamer (2002) worried about the rapid price-earnings ratio growth of the California housing market: in the Bay Area it grew by more than 70 percent over the 1990s.

"Too rapidly" is of course a normative construct. This paper seeks to take a more positivist approach. In it we will review the theoretical literature about how rents change and how rents and prices are linked; we will then discuss how to appropriately measure rents and prices in the housing market. Then we will use American Housing Survey data to follow the trajectory of rents and prices.

3. The Relationship Between House Prices And Rents

When Leamer worries about changes in the "price-earnings" ratio for housing, he is implying that when the PE ratio gets too large, the housing market is out of equilibrium. It is worth considering what constitutes equilibrium in the housing market.

DiPasquale and Wheaton (1996) express the equilibrium relationship between rents and asset prices in a city in their equation 3.16:

$$\frac{P_0(d)}{R_0(d)} = \frac{1}{i} + \frac{kb_0 g}{i(i-g)R_0(d)} \tag{1}$$

where:

d	≡	distance from the periphery of a city
P_0	≡	price at time 0
R_0	≡	rent at time 0
i	≡	the nominal interest rate
g	≡	expected rent growth arising from population growth
b_0	≡	the boundary of the city at time 0
k	≡	transporation cost per unit distance

Their price-rent ratio is similar to a PE ratio for stocks, and it is the inverse of the cap rate.

Notice the following interesting results from their equation. If the city is not growing, the cap rate is just i. The faster the city grows, the lower the cap rate, or the higher the PE ratio. As transportation costs grow, the lower the cap rate, or the higher the PE ratio. And of course, as interest rates less expected growth fall, the lower the cap rate, or the higher the PE ratio.

Beyond all of this, it is important to note that *R* and *P* must be defined properly across time. The rent and price data used in Leamer contain median values – his rent value is *RQ* and price value is *PQ*, where *Q* is quantity of housing services. If the *Q* for the median owned house changes at a different rate from the *Q* from the median rental property, one could observe an apparent change in the PE ratio where in fact no change has taken place. We will discuss this issue at much greater length when discussing our price-quality regressions.

In the mean time, it is worth briefly examining the determinants of i in equation (1). Capozza, Green and Hendershott (1996) note that a good approximation for i is

$$i = (1-ltv)(1-\tau_y)i_r + ltv(1-\tau_y)i_m + \tau_p(1-\tau_y) + m \tag{2}$$

where

ltv	=	loan-to-value ratio
τ_y	=	marginal income tax rate
τ_p	=	property tax rate
i_r	=	return on housing equity

i_m = mortgage interest rate

m = maintenance expenses as a share of value.

Over the course of the 1990s, property tax rates, marginal income tax rates, and, presumably, maintenance expenses, were relatively stable, and we will assume they are for this model as well.[1]

One thing that did change markedly was the mortgage interest rate. According to the Freddie Mac Primary Mortgage Market Survey, the rate fell from an average rate of 10.1 percent with 2.0 origination points and fees in 1990 to 6.5 with 0.6 points in 2002 – Figure 1 shows 30-year, fixed mortgage interest rates and origination fees and points from 1985 through 2004. We assume the average borrower expects to amortize points over 7 years.[2]

Now we turn to the calculations. We assume an average marginal tax rate of 20 percent, and that maintenance and property tax costs are two percent. In 1990, i (inclusive of points) was roughly 10.6 percent; by 1998 it was 7.2 and by 2002 it was 6.7 percent. Rent inflation was remarkably constant over the decade—it was 3.5 percent during 1991 and 3.2 percent during 1998 and in 2002 it was 3.1 percent.[3] Putting these rates into (1) (i.e., the DiPasquale-Wheaton equation) implies that house values should have risen 47 percent faster than rents between 1991 and 2002, assuming no change in transportation costs. If real transportation costs increased, house values would have risen even faster.[4] As we will see, prices generally rose much less quickly than this relative to rents over the 1990s.

Second, i can be highly variable across MSAs. Each component listed above (except for mortgage interest rates) varies from place to place. Capozza, Green and Hendershott (1996) showed how average marginal tax rates in 1990 ranged from 27 percent in El Paso to 28 percent in San Jose. Property tax rates vary from well under one percent in many California cities (because of Proposition 13) to as high as four percent in older cities such as Detroit and

[1] The average federal marginal tax rate remained roughly 20 percent (Feenberg 2005) and the average property tax rate remained at roughly two percent. This figure is derived by dividing property taxes collected as reported in U.S. Department of Commerce: Bureau of Economic Analysis and dividing it by the value of the housing stock as reported in the Federal Reserve Bulletin Flow of Funds Report.

[2] Over Freddie Mac's history, the average life of loans in its PCs has been roughly seven years. This does not necessarily mean that this is the average borrower's expectation about the time over which she will amortize (see Stanton and Wallace 1998), but to be practical we will use it here. It is also likely that expected loan life has shrunk dramatically over the past few years with the 40 percent decline in 30-year, fixed mortgage rates that occurred over the period 2000-2003 (see Freddie Mac Primary Mortgage Market Survey).

[3] Consumer Price Index – Urban Consumer Rent of Shelter, January over January change. The growth rate in 1990, the first year of the series, the growth rate was 5.8 percent.

[4] If expectations about nominal growth are faster than one percent, the value-to-rent ratio should have grown even faster.

Milwaukee. If maintenance expenses are fairly constant in dollar terms across the country, then they will be low as a percent of value in places with high house prices and high in places with low house prices.

4. An Empirical Model

Housing is a composite commodity. As such, rents and values quoted in the marketplace do not of themselves reflect the economic price of housing; they are products of price and the quantity of services that come from a particular unit. Hedonic regression allows us to separate price from quantity.

We follow Green and Malpezzi's (2003) treatment of hedonic regressions. The method of hedonic equations is one way expenditures on housing can be decomposed into measurable prices and quantities so that rents for different dwellings or for identical dwellings in different places can be predicted and compared. A hedonic equation is a regression of expenditures (rents or values) on housing characteristics, and will be explained in some detail below. The independent variables represent the individual characteristics of the dwelling, and the regression coefficients may be transferred into estimates of the implicit prices of these characteristics. The results provide us with estimated prices for housing characteristics, and we can then compare two dwellings by using these prices as weights. For example, the estimated price for a variable measuring number of rooms indicates the change in value or rent associated with the addition or deletion of one room. It tells us in a dollar and cents way how much "more house" is provided by a dwelling with an extra room.

Once we have estimated the implicit prices of measurable housing characteristics in each market, we can select a standard set of characteristics, or bundle, and price a dwelling meeting these specifications in each market. In this manner we can construct price indexes for housing of constant quality across markets. In a similar fashion we can use the results from a particular market's regression to estimate how prices of identical dwellings vary with location *within* a single market (e.g., with distance from the city center) or even to decompose the differences in rent or house values into price and quantity differences. Some simplified examples will make these procedures clear.

The hedonic regression assumes that we know the determinants of a unit's rent:

$$R = f(S, N, L, C), \qquad (3)$$

where

R = rent; or substitute V, value, if estimating hedonics for homeowners or using sales data or owner-assessments of value.

S = structural characteristics;

N = neighborhood characteristics;

L = location within the market; and

C = contract conditions or characteristics, such as utilities included in rent.

4.1 Choice of Functional Form

There is no strong theoretical basis for choosing the correct functional form of a hedonic regression (see Halverson and Pollakowski 1981 and Rosen 1974). Follain and Malpezzi (1980), for example, tested a linear functional form as well as a log-linear (also known as semi-log) specification. But they found the log-linear form had a number of advantages over the linear form, detailed below.

The log-linear form is written:

$$Ln\, R = \beta_0 + S\beta_1 + N\beta_2 + L\beta_3 + C\beta_4 + \varepsilon\,, \tag{4}$$

where $Ln\, R$ is the natural log of imputed rent, S, N, L and C are structural, neighborhood, locational, and contract characteristics of the dwelling as defined above,[5] and β_i and ε are the hedonic regression coefficients and error term, respectively.

The log-linear form has five things to recommend it. First, the semi-log model allows for variation in the dollar value of a particular characteristic so that the price of one component depends in part on the house's other characteristics. For example, with the linear model, the value added by a third bathroom to a one bedroom house is the same as it adds to a five bedroom house. This seems unlikely. The semi-log model allows the value added to vary proportionally with the size and quality of the home.

Second, the coefficients of a semi-log model have a simple and appealing interpretation. The coefficient can be interpreted as approximately the percentage change in the rent or value given a unit change in the independent variable. For example, if the coefficient of a variable representing central air conditioning is 0.219, then adding it to a structure adds about 22 percent to its value or its rent. Actually, the percentage interpretation is an approximation, and it is not necessarily accurate for dummy variables. Halvorsen and Palmquist (1980) show that a much

[5] Without loss of generality, we've written one of each, when there will usually be several; or if you like, consider each (S, N, L, and C) as a *vector*.

better approximation of the percentage change is given by $e^b - 1$, where b is the estimated coefficient and e is the base of natural logarithms. So a better approximation is that central air will add $e^{0.219} - 1 = 24$ percent.

Third, the semi-log form often mitigates the common statistical problem known as heteroskedasticity, or changing variance of the error term. Fourth, semi-log models are computationally simple, and so well suited to examples. The one hazard endemic to the semi-log form is that the anti-log of the predicted log house price does not give an unbiased estimate of predicted price. This can, however, be fixed with a simple adjustment (see Goldberger 1968). Alternatives to the linear and semi-log forms exist, but we won't detail them here.[6] Finally, we note that in our example below, the independent variables are mostly dummy (or indicator) variables. This allows us a fair amount of flexibility in estimation.

4.2 The Specific Model

We use cross-sectional data from the American Housing Survey, which we will describe further below, to look at quality adjusted rent and value changes across the 1990s in 27 metropolitan areas: Anaheim, Baltimore, Birmingham, Boston, Buffalo, Cincinnati, Columbus, Dallas, Ft. Worth, Houston, Kansas City, Miami, Milwaukee, Minneapolis, Norfolk, Oakland, Phoenix, Portland, Providence, Riverside, Rochester, Salt Lake City, San Diego, San Francisco, San Jose, Tampa and Washington, DC.

These cities were essentially chosen for us, in that they are the only cities for which we have data from both the beginning and end of the 1990s. Our data span, for the beginning period, 1988 to 1991; for the end period, 1998 to 2002.

Table 1 gives some descriptive statistics on each metropolitan area, including average change in house values and in rents over the observation period and Leamer's "price-earnings ratio" for both observation years.

Note that the over the decade of the 1990s, the "PE" ratio rises in only 13 of the 27 cities, and in fact falls precipitously in Oakland and San Francisco. The reason for this, of course, is that the early 1990s represented a housing market peak for California. Otherwise, these crude data suggest that prices did not generally move ahead of rents. However, this fails to tell the whole story—for that, we need to adjust for the quality of the renter and owner stock of housing.

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[6] An example is the general transformation suggested by Box and Cox (1964), or the translog model of Christensen, Jorgenson and Lau (1975). See Halvorsen and Pollakowski (1981) for additional detail.

Our hypothesis is that the owner stock generally increased in quality more rapidly than the renter stock. The reason for this is principally because of differences in vintage: over the course of the 1990s, 77 percent of housing built in the United States was single family housing;[7] this compares with an ownership rate at the beginning of the decade of 64 percent.[8] While the correspondence between the single-family percentage and the owner percentage is not perfect, we find it likely that it understates the disproportionate newness of the owner stock. Census data suggest that when single-family housing is built, it is built almost entirely for owner-occupants, while when multi-family housing is built the rental housing market is favored; however, a good percentage of multifamily housing is built for owner-occupiers as well. Consequently, it is almost certainly the case that the average vintage of the owner-stock became younger relative to the rental stock during the 1990s.

Owners also invest heavily in additions and renovations that are less likely to occur in the rental housing market. For example, owner-occupiers of single-family housing can add an additional bedroom to their house, while renters living in multifamily units cannot, and renters living in single-family homes are unlikely to make such large capital improvements in an asset they do not own. In the early 1990s, annual aggregate expenditures on home improvements totaled between $50 and $60 billion. By 1999, annual aggregate home improvement expenditures were over $110 billion.

The quality of owner housing thus likely increased more than the quality of rental housing, and so any apparent rise in non-quality-adjusted owner values relative to rental values is likely exaggerated. Our hedonic models will reveal the extent to which differences in apparent changes in rents and values are a function of true underlying price changes, and to what extent these changes are the results of changes in quality.

Table 2 presents the explanatory variables in the hedonic models, the number of observations in each regression and the R^2 statistics.[9] We use many categorical variables so as to give the model a relatively flexible functional relationship. The variables may be divided into categories: vintage, number of bedrooms, utilities and amenities, neighborhood characteristics (i.e., neighborhood problems and characteristics of nearby structures), building condition, living

[7] Bureau of the Census C-40 reports, 2001.
[8] U.S. Census Bureau, Census of Population and Housing of the United States (1990).
[9] Specific regression results are available from the authors upon request.

area size and (for single-family housing) lot size. We comment briefly on some of the specification issues. Our discussion is based on results from past literature. [10]

Past literature shows that the most important characteristics of a house are how large its living area and lot sizes are. However, the relationship between size and value often gets smaller as houses get larger, so it makes sense to have both linear and quadratic terms

We use several categorical variables for vintage because the relationship between age and value is not linear, or necessarily even monotonic. As houses get older, selectivity begins to affect average values. High quality houses in good neighborhoods tend to stay in the stock longer than poor quality houses, so it can appear that, after a point, as houses age they become more valuable.

Bedrooms can have a peculiar effect on value, after controls are put into place for living area. While more bedrooms might seem unambiguously positive, bedrooms can have an adverse impact on floor plans. A married couple with no children might want a lot of open area; bedrooms reduce the amount of open area given a particular living area size. One might think that such married couples without children might be outbid for houses with bedrooms by couples with children. But much of the housing stock in the United States was developed when families were larger (household size has declined by nearly 30 percent since the end of World War II), so the stock has a mismatch between household composition and floor plans.

Bathrooms are a different matter; more are almost always better than fewer. Garages and Central Air Conditioning almost always add to value as well. The other characteristics on the list have variable impacts, depending on location.

5. Summary of Results

Complete results for the 27 cities may be found in an appendix that is available from the authors on request. For now, we note the following:

5.1 Variables determining value of owner occupied housing

In all metropolitan areas, the most important explanatory variable determining value is living area, defined as the total square feet in the house. Bigger houses are worth more but the marginal value of living area is decreasing in living area in all of the 54 regressions.

[10] Malpezzi (2003) provides a good review. We use the same regression variable specifications for AHS rental units and owner-occupied units as Cutts and Olsen (2002) used in their study on rental units. Observations that reported receiving rent subsidies or other rent reductions were omitted.

Lot size is significantly different from zero in 36 of the 54 regressions, and is decreasing in area in 5 of 54 regressions. Four of the regressions where lot size was not significant at all come from Houston (two years), Dallas (2 years) and Tampa (one year). These are cities with much available developable land and little land-use regulation, so the marginal value of urban land at the fringe could well be close to zero. Moreover, because these are sprawl cities, the price gradient is likely nearly flat. There is thus no reason to expect lot size to have a large impact on property value.

Vintage matters nearly everywhere, but the relationship between age and value varies considerably from place to place. In Baltimore, for example, middle-aged houses (those between 10 and 30 years old) are less valuable than others. In Washington DC, on the other hand, the oldest houses are the most valuable. These results are reassuring—Washington, DC's most valuable neighborhoods (the area of the city west of Rock Creek Park, Bethesda and Chevy Chase in Maryland and McLean and Arlington in Virginia) were largely developed before World War II.

Among the 27 cities, none had a consistently positive and significant impact from the number of bedrooms in the home over the two time periods.

As we would expect, there is always a relationship between bathrooms and value, although in most instances the impact does not show up until the third bathroom is added; garages add value everywhere and central air conditioning adds value everywhere but Anaheim, Portland, San Diego and San Francisco – all very mild climates.

5.2 Variables determining value of rental occupied housing

The principal difference in results between rental occupied and owner occupied housing is that the regression coefficients are generally more precise for owners than they are for renters, with average R^2 statistics for owner-occupant regressions that are 15 percentage points higher than those in the renter regressions. This could well be the result of the fact that renter housing is more homogeneous, and therefore it is more difficult to identify the effects of individual variables on rents. The fact that renters are more likely to live in non-family households than owners may also matter, although this is a matter for further reflection.[11]

As in the owner-occupant regressions, larger rental units in terms of total square feet have higher values and the marginal impacts are generally decreasing, but the number of bedrooms

[11] The Bureau of the Census (2002) reports that 75 percent of owners live in family households, whereas only 52 percent of renters do.

does not have a consistently significant impact, either positively or negatively. Otherwise there are no consistent trends beyond the size of the unit within the renter regressions.

5.3 Quality Adjusted Rent Growth During the 1990s

Table 3 presents the decomposition of price and quality growth for both owner-occupied and rental units for the 15 cities observed between 1988/91 and 1998 (1999 for Washington, DC); Table 4 shows this same decomposition for the 12 cities observed between 1988/91 and 2002. From this decomposition, we may arrive at how rents (and values) changed between over the 1990s after keeping quality constant at the earlier period means.

We can divide the list into three categories: (1) those places where rents or values grew a lot (more than 4 percent on an annualized basis – the national annualized average growth rate over the 1990s); (2) those places where rent or values grew moderately (between 2 and 4 percent, annualized); and (3) those where rent or values grew little (between a slightly negative rate and 2 percent, annualized).

Two of the six cities in the "fast rent growth" group: San Francisco and San Jose, (and Oakland too, which just missed the "fast" cutoff) have much in common: obviously, they are part of one large Consolidated Metropolitan Statistical Area, which featured strong economic growth and a limited supply of land available for development. Salt Lake City, while very different from the Bay Area in terms of household composition, was also a place with strong economic growth over the period as it became a major center for technology companies. However, the rapid rise in rents is surprising in light of the fact that the area has plentiful land and not particularly stringent land use controls.[12] The surprising entrant on this list is Birmingham, Alabama. Birmingham did not have particularly strong economic or population growth over this period—its population growth rate ranked 271 out of 273 metropolitan areas between 1990 and 1997.[13] Yet its rent growth was among the highest in the country. The other cities in the "fast rent growth" category are Forth Worth, Portland and San Diego.

The 14 MSAs in the "middle growth" category are Anaheim, Boston, Buffalo, Cincinnati, Columbus, Dallas, Houston, Kansas City, Miami, Milwaukee, Oakland, Phoenix, Rochester and Tampa. It is a little strange that Rochester is in this middle category, given that it actually lost

[12] However, Salt Lake City has natural limits on growth due to a lack of water resources. Rental housing, especially high-density apartment buildings, place less demand on water resources than owner-occupied housing and should thus be less bound by this constraint. See Northwest Environment Watch (2004).
[13] See U.S. Bureau of the Census (1998).

population over the course of the period we study. Houston, Phoenix and Tampa all grew rapidly over the period.

The six MSAs in the slow growth categories are Providence (which declined from a peak in the late 1980s), Baltimore and Norfolk (which have been in decline for some time), Minneapolis (the fastest growing MSA in the Midwest during the 1990s), Washington, DC (which recovered from a bust in the early 1990s), and Riverside, CA (a city that did not, until recently, experience the same rapid growth that the coastal California cities had).

Finally, it is worth noting that in 15 cases, quality-adjusted rent rose more rapidly than average rent, in six MSAs, they rose about equally, and in six cases, the quality-adjusted rents rose much less rapidly.

5.4 Decomposition of House Price Growth

Tables 3 and 4 also present the decomposition of value changes into price and quality growth for owner housing for the 27 cities.

The first surprising result is that three MSAs saw quality-adjusted prices rise faster than unadjusted prices: Providence, Rochester and Salt Lake City. The latter two MSAs also saw quality-adjusted rents rise faster than unadjusted rents.

5.5 Putting Rents and Values Together

After adjusting for quality, in 18 out of 27 cases, rents rose more rapidly than values between the earlier and the later period; without adjusting for quality, rents rose faster than values in 13 of the 27 MSAs. Of the 18 MSAs with faster rent quality-adjusted rent growth, 13 of them had quality adjusted annualized rent growth exceed quality-adjusted annualized value growth by more than one percentage point (a pace equivalent to a 10% or greater cumulative difference over a decade). Eight of the 18 cities (Anaheim, Boston, Oakland, Providence, Riverside, San Diego, San Francisco and Washington DC) had low house-price growth over the 1990s because of declines from peaks in the later 1980s and early 1990s. It is an interesting question as to whether these were “bubble” cities in the late 1980s. They are also places where economic fundamentals were problematic: the technology sector did not perform well during the early 1990s, defense spending was cut (resulting in 575,000 job losses in Southern California alone)[14], and the financial services sector in California and New England was in a state of near collapse.[15]

[14] Bureau of Labor Statistics; Southern California for this purpose is defined as Los Angeles, Orange County and San Diego.
[15] In large part because of the Savings and Loan crisis in the 1980s.

Two other cities, Baltimore and Norfolk, are places where rents did not grow much, so it is not surprising that prices didn't grow much either. In another city, Rochester, rents did grow a little, but prices didn't. As already noted, the fact that rent grew in Rochester is something of a surprise; that prices didn't is not. The puzzling cities are Houston and Tampa, where prices rose far less than rents – both cities experienced rapid growth over the period, which suggests that both rents and values should have risen strongly.

There are three cities where owner-occupied quality appeared to fall: Providence, Rochester and Salt Lake City. It is not difficult to believe the results for Providence and Rochester, as they are older, slow-growth cities. But Salt Lake City is a puzzle, especially given the building and preparation for the Winter Olympics in 2002.

In only six places did values rise substantially more than rents: Cincinnati, Columbus, Milwaukee, Minneapolis, Portland and Salt Lake City. Outside of Portland, it is fair to say that none of the cities have been recent sources of "bubble" stories in the media.

The reason this outcome is surprising is that user cost for owner-occupied housing should have fallen during the 1990s, because mortgage interest rates fell by more than any measure of inflation, marginal tax rates rose (a bit), and property tax rates fell (again a bit). It is possible that Boston, San Francisco, Providence, Oakland and Washington were out of equilibrium in the early 1990s, and so simply wound up at an equilibrium level by decades end. Still, it is worth predicting house price dynamics under the assumption that 1991 was an equilibrium state for the 27 housing markets.

5.6 Implications for 1998-2002

A limitation of our data is its timeliness—the most recent data we have is from 2002. The popular press did start indicating concern about bubbles in 1998-99, when reporters wrote articles suggesting that the housing markets in San Francisco and San Jose had gained value too quickly to be sustainable. The "bubble talk" then spilled over to the national market as home values continued to rise strongly after the NASDAQ crashed and the recession turned into a job-loss recovery. But our evidence suggests that quality-adjusted rents in these two cities rose by more than quality-adjusted values.

While our degrees of freedom are limited, we perform a simple-minded experiment, and look at the relationship between the change in value-to-rent relationships over the 1990s and the change in the Conventional Mortgage Home Price Index (a repeat sales index) between

1998/2002 and 2004 for our two groups of cities.[16] Figures 2 and 3 plot the relationship between the price and rent growth differential and subsequent house price growth.

The figures show a negative relationship between the two: if rents in a city grew more rapidly than values over the course of the 1990s, values in that city generally rose more rapidly than in the average city. The correlation coefficient between the difference in rent and value growth is -0.57 for cities observed in 1998 and -0.68 for cities observed in 2002.[17] This suggests a mean reverting tendency that is consistent with a reasonably well functioning housing market.

6. Conclusions

This paper has sought to find whether changes in rents can explain changes in house prices in 27 large Metropolitan Areas in the United States. After adjusting for quality, house prices in 21 of the 27 MSAs we examined can be supported with economic fundamentals, if we assume that markets were in equilibrium at our first point of observation, in 1988-1991.

The only cities in which quality-adjusted values rose dramatically more than rents were Cincinnati, Portland, Providence and Salt Lake City. We note that in the cases of Cincinnati, Providence and Salt Lake City, house prices remain quite low relative to incomes despite the relatively large run up in prices over the last 10-15 years. Our regressions cannot capture changes in the industrial mix for jobs, which could also have a big impact on the economic stability and income growth in these cities. Similarly, we do not capture land-use restrictions or geographically imposed land-supply constraints. In Portland, land-use regulation has made high-density development easier and low-density development harder, meaning that supply restrictions there might influence owner-occupied housing more than multifamily rental units.[18]

We find solid support for the P/E ratio hypothesis for home prices, and, moreover, demonstrate that a careful examination of price and quality changes is warranted when examining rent and home value dynamics. A simple comparison of widely available indices that do not control for quality changes could lead to incorrect conclusions, perhaps even to thoughts of tiny imaginary bubbles.

[16] The results are similar when the OFHEO House Price Index is used.

[17] Dallas, Fort Worth and Buffalo were omitted from the regression as outliers – house prices grew less than rents over the 1988/89 to 2002 period, and prices have grown very little since then as well.

[18] See Downs (2002) and Fischel (2002) for details on Portland's land use policies and for opposing views on the effects of those policies on house price growth there.

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Table 1
Leamer PE Ratios

MSAs Observed Over 1988/91 to 1998

MSA Survey Dates	Average Price Change	Average Rent Change	Leamer PE Ratio 1988/91	Leamer PE Ratio 1998
Baltimore, MD 1991 and 1998	7.60%	14.57%	23.61	22.18
Birmingham, AL 1988 and 1998	75.14%	61.27%	20.64	22.42
Boston, MA 1989 and 1998	12.25%	26.72%	26.56	23.52
Cincinnati, OH 1990 and 1998	55.89%	26.36%	19.86	24.50
Houston, TX 1991 and 1998	18.69%	20.34%	15.52	15.31
Minneapolis, MN 1989 and 1998	35.55%	19.02%	16.26	18.52
Norfolk, VA 1992 and 1998	17.31%	11.73%	19.07	20.03
Oakland, CA 1989 and 1998	13.46%	40.76%	34.84	28.08
Providence, RI 1992 and 1998	2.68%	-6.28%	21.39	23.43
Rochester, NY 1990 and 1998	12.52%	22.61%	19.00	17.44
Salt Lake City, UT 1992 and 1998	82.40%	49.92%	20.13	24.50
San Francisco, CA 1989 and 1998	13.44%	47.51%	44.17	33.97
San Jose, CA 1988 and 1998	48.71%	54.25%	31.25	30.13
Tampa, FL 1989 and 1998	11.31%	28.04%	17.70	15.39
Washington, DC 1989 and 1998	0.32%	17.10%	25.15	21.55

MSAs Observed Over 1988/91 to 2002

MSA Survey Dates	Average Price Change	Average Rent Change	Leamer PE Ratio 1988/91	Leamer PE Ratio 2002
Anaheim, CA 1990 and 2002	51.58%	35.84%	28.10	31.35
Buffalo, NY 1988 and 2002	58.99%	65.87%	20.31	19.47
Columbus, OH 1991 and 2002	63.38%	45.68%	21.58	24.20
Dallas, TX 1989 and 2002	52.68%	59.71%	20.54	19.64
Fort Worth, TX 1989 and 2002	49.41%	68.68%	18.08	16.02
Kansas City, MO 1990 and 2002	73.55%	49.31%	16.51	19.19
Miami, FL 1990 and 2002	69.45%	37.81%	20.65	25.39
Milwaukee, WI 1988 and 2002	115.10%	61.52%	17.92	23.86
Phoenix, AZ 1989 and 2002	90.75%	52.85%	18.88	23.57
Portland, OR 1990 and 2002	125.20%	60.18%	18.63	26.19
Riverside, CA 1990 and 2002	19.47%	25.58%	24.93	23.72
San Diego, CA 1991 and 2002	56.00%	56.07%	32.17	32.15

Source: Authors' calculations based on the American Housing Survey Metropolitan Area Files from 1988, 1989, 1990, 1991, 1998 and 2002.

Table 2
Summary of Rent and Price Hedonic Regressions

Summary of Regressors	MSA Survey Dates	Tenure	Number of Observations 1988/91	 1998/02	R^2 Adjusted 1988/91	 1998/02
Unit built in 1980-1989	Anaheim, CA	Owner	909	1,699	0.536	0.440
Unit built in 1970-1979	1990 and 2002	Renter	931	996	0.417	0.375
Unit built in 1960-1969	Baltimore, MD	Owner	1,298	1,693	0.571	0.628
Unit built in 1950-1959	1991 and 1998	Renter	441	520	0.419	0.384
Unit built in 1940-1949	Birmingham, AL	Owner	1,109	2,428	0.532	0.607
Unit built in 1930-1939	1988 and 1998	Renter	480	718	0.531	0.434
Unit built in 1929 or earlier	Boston, MA	Owner	976	1,067	0.400	0.498
Two bedroom unit	1989 and 1998	Renter	283	418	0.274	0.238
Three bedroom unit	Buffalo, NY	Owner	1,035	1,365	0.455	0.525
Four or more bedroom unit	1988 and 2002	Renter	312	370	0.446	0.415
Total number of rooms in unit	Cincinnati, OH	Owner	1,228	1,476	0.534	0.601
Total number of rooms squared	1990 and 1998	Renter	384	361	0.548	0.556
Two or more bathrooms in unit	Columbus, OH	Owner	1,055	2,033	0.513	0.508
Three or more bathrooms in unit	1991 and 2002	Renter	606	688	0.377	0.432
Unit has central air conditioning	Dallas, TX	Owner	740	2,108	0.497	0.629
Unit has window air conditioners	1989 and 2002	Renter	792	944	0.355	0.499
Unit connected to public sewer	Fort Worth, TX	Owner	862	1,993	0.553	0.645
Unit has working fireplace	1989 and 2002	Renter	763	844	0.278	0.330
Unit has porch	Houston, TX	Owner	675	1,658	0.536	0.631
Unit has garage	1991 and 1998	Renter	827	848	0.236	0.495
Unit in central city of MSA	Kansas City, MO	Owner	1,221	2,222	0.614	0.516
Unit has dining room	1990 and 2002	Renter	780	592	0.264	0.391
Bothersome litter in neighborhood	Miami, FL	Owner	907	1,498	0.518	0.499
Bothersome noise in neighborhood	1990 and 2002	Renter	590	717	0.411	0.429
Traffic problem in neighborhood	Milwaukee, WI	Owner	1,154	1,591	0.540	0.467
Crime problem in neighborhood	1988 and 2002	Renter	497	662	0.509	0.430
Junk and trash in neighborhood	Minneapolis, MN	Owner	1,212	2,356	0.516	0.610
Building has sagging roof	1989 and 1998	Renter	494	436	0.192	0.533
Building has hole in roof	Norfolk, VA	Owner	1,596	1,666	0.476	0.568
Building has crumbling foundation	1992 and 1998	Renter	812	600	0.261	0.456
Building has sloping walls	Oakland, CA	Owner	532	1,681	0.556	0.512
Building has broken windows	1989 and 1998	Renter	322	659	0.526	0.362
Unit has holes in floor	Phoenix, AZ	Owner	802	2,051	0.644	0.598
Unit has broken plaster or paint	1989 and 2002	Renter	825	815	0.396	0.453
Unit has cracks or holes in ceiling or walls	Portland, OR	Owner	1,589	2,378	0.536	0.450
Unit has additional other rooms	1990 and 2002	Renter	1,112	905	0.391	0.378
Water leak from outside	Providence, RI	Owner	1,593	1,224	0.370	0.488
Water leak from inside	1992 and 1998	Renter	378	330	0.234	0.352
Tenant's satisfaction with neighborhood	Riverside, CA	Owner	1,306	2,460	0.612	0.564
Tenant's satisfaction with unit	1990 and 2002	Renter	891	904	0.452	0.441
Commercial buildings nearby	Rochester, NY	Owner	1,515	1,945	0.499	0.584
Highrise buildings nearby	1990 and 1998	Renter	431	335	0.607	0.465
Midrise buildings nearby	Salt Lake City, UT	Owner	1,600	2,551	0.583	0.577
Residential parking lot nearby	1992 and 1998	Renter	829	678	0.340	0.404
Open space, park, woods nearby	San Diego, CA	Owner	1,102	1,580	0.597	0.461
Road repairs needed nearby	1991 and 2002	Renter	1,193	997	0.580	0.384
Waterbody nearby	San Francisco, CA	Owner	379	1,152	0.483	0.515
Unit square foot in 1000s	1989 and 1998	Renter	223	539	0.531	0.311
Unit square foot squared in 100,000s	San Jose, CA	Owner	1,092	1,713	0.542	0.614
	1988 and 1998	Renter	1,019	792	0.438	0.245
	Tampa, FL	Owner	904	1,943	0.540	0.573
	1989 and 1998	Renter	617	674	0.226	0.233
	Washington, DC	Owner	1,067	1,536	0.445	0.525
	1989 and 1998	Renter	383	444	0.430	0.368

Source: Authors' calculations based on the American Housing Survey Metropolitan Area Files from 1988, 1989, 1990, 1991, 1998 and 2002.
Note: Observations with missing values were omitted; rental units where family receives rent subsidy or reduced rent for any reason excluded; MSAs in which some characteristics were irrelevant (such as high rise buildings) excluded these characteristics from the regressions.

Table 3
Decomposition of Price and Rent Versus Quality Changes By Tenure
MSAs Observed Over 1988/91-1998

MSA		Original Total Value	New Total Value	Price Change Holding Quality Constant	Quality Change Holding Price Constant	Total Change in Value or Rent	Percent Change in Price		Percent Change in Quality		Total Percent Change in Value or Rent	
		$P_{t-1}*Q_{t-1}$	P_t*Q_t	$(P_t-P_{t-1})*Q_{t-1}$	$P_t*(Q_t-Q_{t-1})$	$(P_t*Q_t)-(P_{t-1}*Q_{t-1})$	$(P_t-P_{t-1})/P_{t-1}$		$(Q_t-Q_{t-1})/Q_{t-1}$		$(P_tQ_t-P_{t-1}Q_{t-1})/(P_{t-1}Q_{t-1})$	
Survey Dates	Tenure						Absolute	Annualized	Absolute	Annualized	Absolute	Annualized
Baltimore, MD	Owner	146,104	157,214	7,441	3,669	11,110	5.09%	0.71%	2.39%	0.34%	7.60%	1.05%
1991 and 1998	Renter	516	591	74	1	75	14.42%	1.94%	0.13%	0.02%	14.57%	1.96%
Birmingham, AL	Owner	64,517	112,996	29,699	18,780	48,479	46.03%	3.86%	19.93%	1.83%	75.14%	5.76%
1988 and 1998	Renter	260	420	125	34	160	48.08%	4.00%	8.91%	0.86%	61.27%	4.90%
Boston, MA	Owner	214,699	241,003	22,218	4,085	26,303	10.35%	1.10%	1.72%	0.19%	12.25%	1.29%
1989 and 1998	Renter	674	854	172	8	180	25.58%	2.56%	0.91%	0.10%	26.72%	2.67%
Cincinnati, OH	Owner	93,150	145,215	40,575	11,489	52,065	43.56%	4.62%	8.59%	1.04%	55.89%	5.71%
1990 and 1998	Renter	391	494	102	1	103	26.16%	2.95%	0.16%	0.02%	26.36%	2.97%
Houston, TX	Owner	83,451	99,048	1,480	14,118	15,597	1.77%	0.25%	16.62%	2.22%	18.69%	2.48%
1991 and 1998	Renter	448	539	123	-32	91	27.51%	3.53%	-5.62%	-0.82%	20.34%	2.68%
Minneapolis, MN	Owner	105,231	142,639	35,438	1,970	37,408	33.68%	3.28%	1.40%	0.15%	35.55%	3.44%
1989 and 1998	Renter	539	642	125	-23	103	23.24%	2.35%	-3.43%	-0.39%	19.02%	1.95%
Norfolk, VA	Owner	113,224	132,821	8,667	10,930	19,597	7.65%	1.24%	8.97%	1.44%	17.31%	2.70%
1992 and 1998	Renter	495	553	67	-9	58	13.61%	2.15%	-1.65%	-0.28%	11.73%	1.87%
Oakland, CA	Owner	258,880	293,730	29,188	5,662	34,850	11.27%	1.19%	1.97%	0.22%	13.46%	1.41%
1989 and 1998	Renter	619	872	254	-1	252	40.99%	3.89%	-0.17%	-0.02%	40.76%	3.87%
Providence, RI	Owner	148,775	152,766	7,198	-3,207	3,991	4.84%	0.79%	-2.06%	-0.35%	2.68%	0.44%
1992 and 1998	Renter	580	543	-18	-19	-36	-3.06%	-0.52%	-3.32%	-0.56%	-6.28%	-1.08%
Rochester, NY	Owner	104,643	117,742	17,629	-4,529	13,100	16.85%	1.97%	-3.70%	-0.47%	12.52%	1.49%
1990 and 1998	Renter	459	563	105	-1	104	22.87%	2.61%	-0.21%	-0.03%	22.61%	2.58%
Salt Lake City, UT	Owner	92,877	169,403	80,795	-4,269	76,526	86.99%	11.00%	-2.46%	-0.41%	82.40%	10.54%
1992 and 1998	Renter	384	576	204	-12	192	53.16%	7.36%	-2.12%	-0.36%	49.92%	6.98%
San Francisco, CA	Owner	398,242	451,748	16,976	36,530	53,506	4.26%	0.46%	8.80%	0.94%	13.44%	1.41%
1989 and 1998	Renter	751	1,108	331	26	357	44.00%	4.13%	2.44%	0.27%	47.51%	4.41%
San Jose, CA	Owner	275,739	410,055	114,397	19,919	134,316	41.49%	3.53%	5.11%	0.50%	48.71%	4.05%
1988 and 1998	Renter	735	1,134	435	-36	399	59.14%	4.76%	-3.07%	-0.31%	54.25%	4.43%
Tampa, FL	Owner	89,341	99,445	-207	10,311	10,104	-0.23%	-0.03%	11.57%	1.22%	11.31%	1.20%
1989 and 1998	Renter	421	539	129	-11	118	30.75%	3.02%	-2.07%	-0.23%	28.04%	2.78%
Washington, DC	Owner	208,804	209,478	-12,049	12,724	675	-5.77%	-0.66%	6.47%	0.70%	0.32%	0.04%
1989 and 1998	Renter	692	810	124	-6	118	17.90%	1.85%	-0.68%	-0.08%	17.10%	1.77%

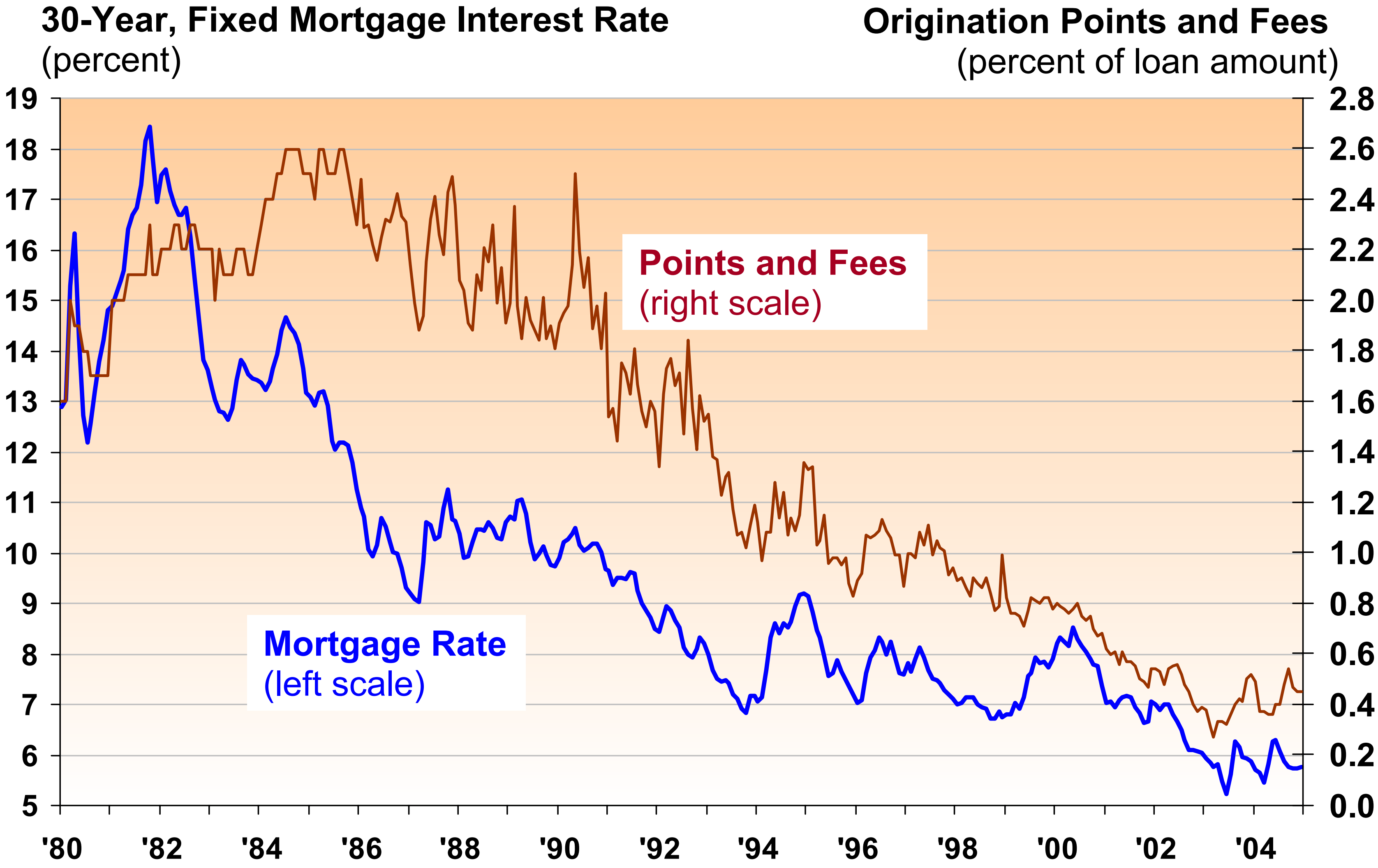
Source: Authors' calculations based on the American Housing Survey Metropolitan Area Files from 1988, 1989, 1990, 1991, 1998 and 2002.

Table 4
Decomposition of Price and Rent Versus Quality Changes By Tenure
MSAs Observed Over 1988/91 to 2002

MSA		Original Total Value	New Total Value	Price Change Holding Quality Constant	Quality Change Holding Price Constant	Total Change in Value or Rent	Percent Change in Price		Percent Change in Quality		Total Percent Change in Value or Rent	
		$P_{t-1}*Q_{t-1}$	P_t*Q_t	$(P_t-P_{t-1})*Q_{t-1}$	$P_t*(Q_t-Q_{t-1})$	$(P_t*Q_t)-(P_{t-1}*Q_{t-1})$	$(P_t-P_{t-1})/P_{t-1}$		$(Q_t-Q_{t-1})/Q_{t-1}$		$(P_tQ_t-P_{t-1}Q_{t-1})/(P_{t-1}Q_{t-1})$	
Survey Dates	Tenure						Absolute	Annualized	Absolute	Annualized	Absolute	Annualized
Anaheim, CA	Owner	306,047	463,916	125,421	32,448	157,869	40.98%	2.90%	7.52%	0.61%	51.58%	3.53%
1990 and 2002	Renter	908	1,233	385	-60	325	42.47%	2.99%	-4.65%	-0.40%	35.84%	2.59%
Buffalo, NY	Owner	81,745	129,971	37,639	10,586	48,225	46.04%	2.74%	8.87%	0.61%	58.99%	3.37%
1988 and 2002	Renter	335	556	266	-45	221	79.37%	4.26%	-7.53%	-0.56%	65.87%	3.68%
Columbus, OH	Owner	114,271	186,692	65,555	6,866	72,422	57.37%	4.21%	3.82%	0.34%	63.38%	4.56%
1991 and 2002	Renter	441	643	209	-7	202	47.34%	3.59%	-1.12%	-0.10%	45.68%	3.48%
Dallas, TX	Owner	116,605	178,028	22,399	39,024	61,423	19.21%	1.36%	28.07%	1.92%	52.68%	3.31%
1989 and 2002	Renter	473	755	287	-5	282	60.67%	3.72%	-0.60%	-0.05%	59.71%	3.67%
Fort Worth, TX	Owner	91,924	137,348	20,496	24,928	45,424	22.30%	1.56%	22.17%	1.55%	49.41%	3.14%
1989 and 2002	Renter	424	715	350	-59	291	82.58%	4.74%	-7.62%	-0.61%	68.68%	4.10%
Kansas City, MO	Owner	92,344	160,260	42,566	25,350	67,916	46.09%	3.21%	18.79%	1.45%	73.55%	4.70%
1990 and 2002	Renter	466	696	190	39	230	40.84%	2.89%	6.01%	0.49%	49.31%	3.40%
Miami, FL	Owner	144,288	244,503	59,272	40,943	100,215	41.08%	2.91%	20.11%	1.54%	69.45%	4.49%
1990 and 2002	Renter	582	803	242	-22	220	41.59%	2.94%	-2.67%	-0.23%	37.81%	2.71%
Milwaukee, WI	Owner	91,837	197,542	74,858	30,848	105,706	81.51%	4.35%	18.51%	1.22%	115.10%	5.62%
1988 and 2002	Renter	427	690	265	-3	263	62.10%	3.51%	-0.36%	-0.03%	61.52%	3.48%
Phoenix, AZ	Owner	112,263	214,144	65,352	36,529	101,881	58.21%	3.59%	20.57%	1.45%	90.75%	5.09%
1989 and 2002	Renter	495	757	281	-20	262	56.82%	3.52%	-2.53%	-0.20%	52.85%	3.32%
Portland, OR	Owner	108,282	243,854	111,693	23,879	135,572	103.15%	6.08%	10.86%	0.86%	125.20%	7.00%
1990 and 2002	Renter	484	776	271	20	292	55.96%	3.77%	2.71%	0.22%	60.18%	4.00%
Riverside, CA	Owner	177,252	211,771	23,681	10,838	34,519	13.36%	1.05%	5.39%	0.44%	19.47%	1.49%
1990 and 2002	Renter	593	744	169	-18	152	28.58%	2.12%	-2.34%	-0.20%	25.58%	1.92%
San Diego, CA	Owner	269,101	419,791	96,509	54,180	150,690	35.86%	2.83%	14.82%	1.26%	56.00%	4.13%
1991 and 2002	Renter	697	1,088	405	-14	391	58.14%	4.25%	-1.31%	-0.12%	56.07%	4.13%

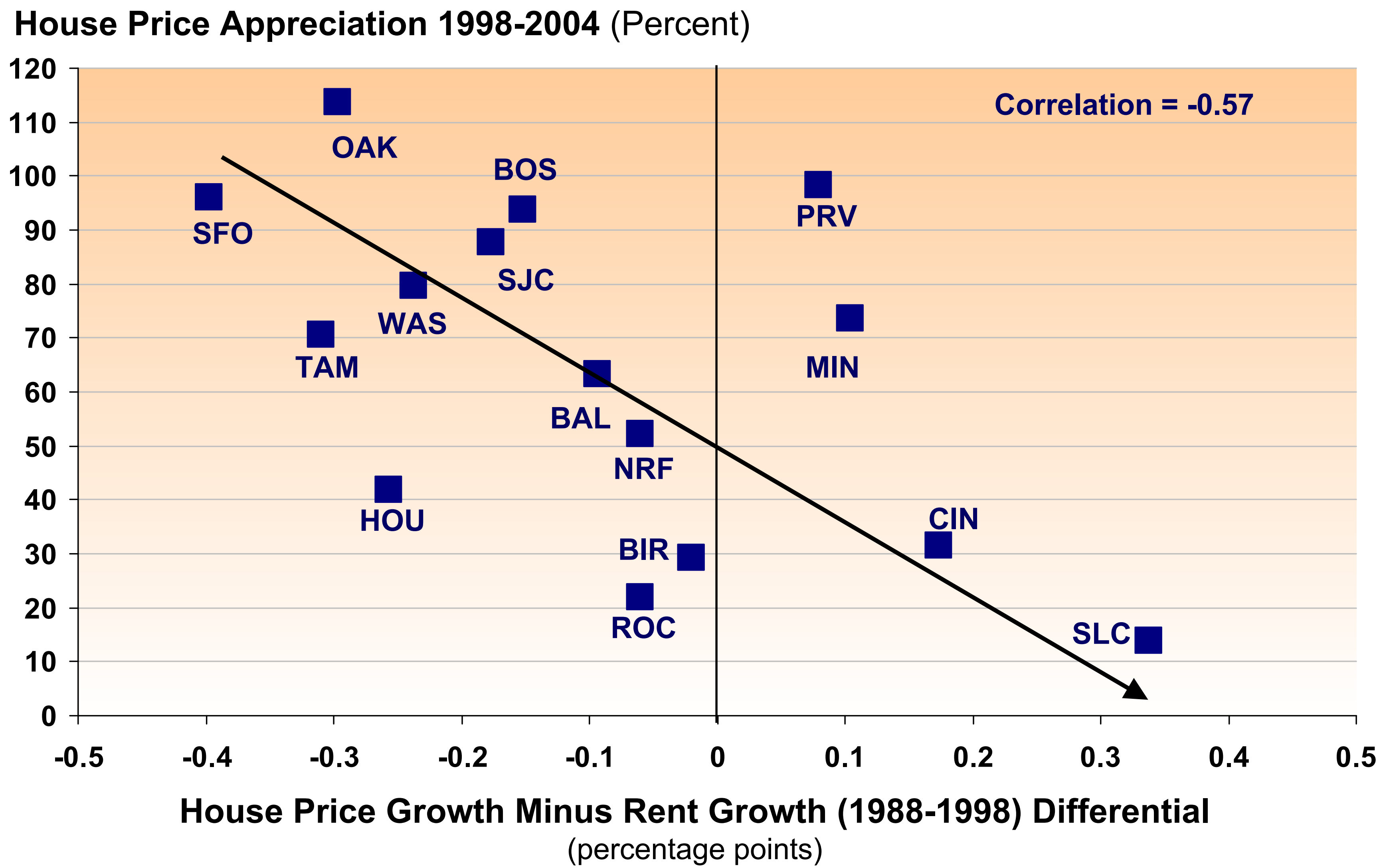
Source: Authors' calculations based on the American Housing Survey Metropolitan Area Files from 1988, 1989, 1990, 1991, 1998 and 2002.

Figure 1
Monthly Average Mortgage Rates and Originations Points and Fees
1980-2004



Source: Freddie Mac Primary Mortgage Market Survey, FHFB Monthly Interest Rate Survey

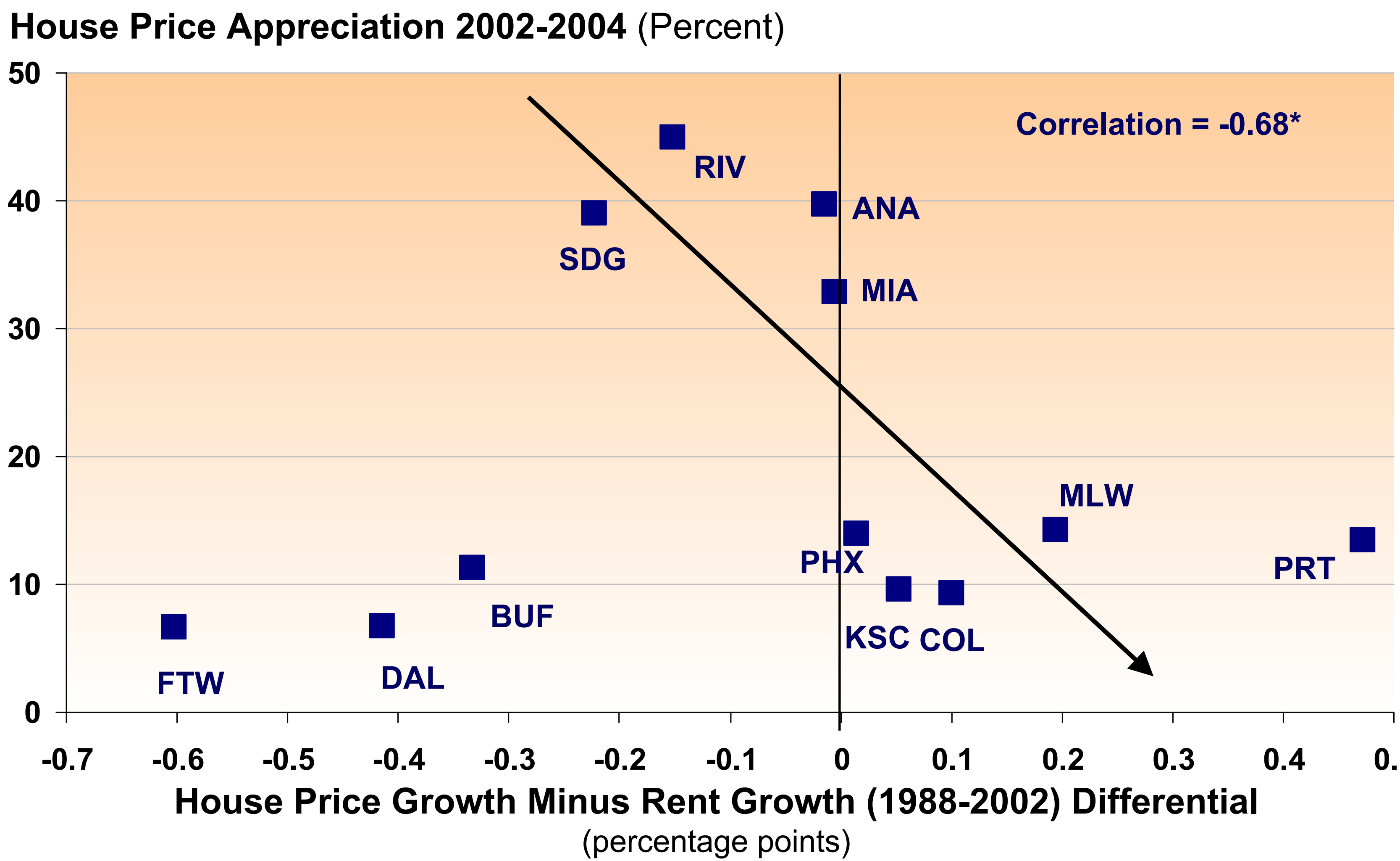
Figure 2
1988/01 – 1998 Rents and House Prices Growth Differential Versus House Price Growth 1998-2004



Source: Authors' Calculations

Figure 3

1988/01 – 2002 Rents and House Prices Growth Differential Versus House Price Growth 2002-2004



*without Fort Worth, TX, Dallas, TX, and Buffalo, NY

Source: Authors' Calculations