

## Is There a "Bubble" in the Housing Market Now?\*

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**Abstract.** Real home prices have been rising strongly since the mid-1990s, and have continued to do so even as the economy has weakened. This has sparked the concern as to whether there is a bubble in the housing market, the collapse of which could harm the overall economy. Taking into account fundamentals—including more appropriate price indices and interest rates—aggregate home prices are relatively high but not yet out of line. Home prices in some areas still may be set for a fall; however, prices in these areas typically have been volatile. Previous large home value declines in these areas have not had a sizable negative effect on the aggregate economy.

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## 1. Introduction

In an earlier paper (McCarthy and Peach [2004]), we addressed the question of whether there was a “bubble” in home prices. In contrast to many analysts, we concluded that there was not one at that time (2003Q2). We argued that once the decline of nominal interest rates, other demand factors (including demographics), and improving quality of homes were taken into account, the rise of home prices through the middle of 2003 could be explained by fundamental factors.

Since the completion of that study, home price indices, particularly the commonly-used OFHEO repeat sales index, have risen at even faster rates than they did in the 1995-2003 period (Chart 1).<sup>1</sup> For those analysts that were convinced there was a bubble at the time of our earlier study, the recent sharp rise indicates that prices are even more out of line with fundamentals. Moreover, the rise has prompted other analysts to become convinced that there may be a bubble.

This paper updates our earlier analysis to examine whether the recent surge of home prices now has led to a housing “bubble.” Our overall conclusion is that although home prices are not as “inexpensive” relative to fundamentals as they were at the time of our previous study, they are not yet at levels inconsistent with those fundamentals. However, a continued surge on the order of the last year probably would put prices significantly above levels consistent with their fundamentals; particularly when one accounts for the increases in short-term interest rates in the past 1½ years and the more recent increases in mortgage rates.

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<sup>1</sup> This calculation is based on the Office of Federal Housing Enterprise Oversight (OFHEO) repeat sales home price index relative to the personal consumption expenditures (PCE) deflator. This and other measures of home prices will be discussed later in the paper.

Beyond the direct interest in the health of the housing market, another reason that there is great interest about housing prices is that many analysts have expressed concerns that a sharp decline in home prices, whether from the bursting of a bubble or from rising interest rates, will erase a significant portion of household wealth.<sup>2</sup> In that case, already overextended consumers may scale back spending in an effort to boost current saving and repair their weakened financial condition. Such effects may be exacerbated (compared to a decline in equity market wealth) because housing is the major asset for a majority of households.<sup>3</sup> As such, the fundamental health of the housing market can have implications for the broader economy.

The remainder of the paper is organized as follows. The next section discusses the most recent surge in home prices and the various alternative home price measures. Section 3 presents standard metrics of home price fundamentals that suggest a bubble and then shows that controlling for quality changes can affect the conclusions from such metrics. Section 4 examines the effects of interest rates on measuring home price fundamentals and housing affordability. Section 5 examines home prices at more disaggregated levels for evidence of “froth” in regional markets. Section 6 provides some concluding remarks.

## **2. The recent rise of home prices and home price measures**

As one would expect from recent news reports, home prices have risen rapidly over the past year. Chart 1 displays the year-over-year percentage change in the repeat-sales index compiled by the Office of Federal Housing Enterprise Oversight (OFHEO—

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<sup>2</sup> See, for example, Baker (2002).

<sup>3</sup> See Tracy, Schneider, and Chan (1999) and Tracy and Schneider (2001).

the regulator of Fannie Mae and Freddie Mac).<sup>4</sup> For the year through 2005Q3, this index has risen 12.0 percent, the fifth consecutive quarter the year-over-year change has been over 10 percent, which has not occurred since the high-inflation late-1970s.

To account for the differing general inflation environments across the years, Chart 1 also presents the real appreciation of home prices.<sup>5</sup> The recent exceptional behavior of home prices is even more evident from this measure. The boom in home prices since the mid-1990s is twice as long as previous booms in the late 1970s and late 1980s, and continued through the 2001 recession, whereas previous booms ended with the onset of recessions. Moreover, real home prices have increased 63 percent during the current boom, which is equivalent to a 4.9% annual rate that is considerably higher than the increases during previous housing booms.

Although the OFHEO index is one commonly cited index in discussions of housing price trends, it is only one of many indices. Because home sales do not occur in centralized markets (as is the case for corporate equity), constructing an index of home prices across the nation or a region is not a simple task. Moreover, as will be seen in the subsequent section, the price index used has ramifications for one's assessment of the existence of a home price bubble. Here we will illustrate the long-run behavior of a number of national housing price measures: the median price of existing homes sold (from the National Association of Realtors), the median price of new homes sold (from the Census Bureau), the repeat sales price index (both the OFHEO and the conventional

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<sup>4</sup> The basic methodology for repeat sale indices was first described in Bailey, Muth, and Nourse (1963). Case and Shiller (1989), in developing the first home price repeat sales indices, modified the methodology to correct for possible heteroskedasticity induced by varying time between sales for different properties. Specific details about common home price repeat sales indices are discussed in Stephens, *et al.* (1995) and Calhoun (1996).

<sup>5</sup> To calculate the real index, the OFHEO index is deflated by the personal consumption expenditures (PCE) deflator.

mortgage home price index published by Freddie Mac), and the constant quality new home price index (from the Census Bureau). More discussion of the properties of these various housing price measures can be found in McCarthy and Peach (2004).<sup>6</sup>

Chart 2 presents the levels of these various measures, each indexed to 100 in 1979Q1 to facilitate comparisons of the long-run behavior among them. One remarkable feature of the chart is that, even though there are noticeable differences in their short- and medium-term behavior, the two median sales price series and the two repeat sales indices have behave quite similarly over the 1979-2005 period as all of these have risen about 400 percent. In contrast, the constant-quality index, which uses hedonic methods to control for changing quality, has risen only about 300 percent during this period, and the gap between it and the other indices has widened considerably over recent years.<sup>7</sup>

The OFHEO home price index is sometimes referred to as a “constant quality” home price index because it is based on prices of the same properties at different points in time.<sup>8</sup> However, we know that the quality of the median new home sold—measured by size and amenities—has increased over time.<sup>9</sup> The fact that the OFHEO index has increased roughly the same as the median new home price, which does not control for quality, suggests that the OFHEO index is not truly a constant quality index.

One explanation for this observation is that the repeat sales method appears not to take fully into account changes in the physical characteristics of homes and thus does not control for additions and alterations between sale dates that could have changed the quality of the home. As further evidence in this regard, we plot the ratio of the OFHEO

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<sup>6</sup> Wang and Zorn (1997) discuss in more detail the various types of home price indices and how the intended application of an index affects the appropriateness of a particular index.

<sup>7</sup> Details about this index can be found at [http://www.census.gov/const/www/descpi\\_sold.pdf](http://www.census.gov/const/www/descpi_sold.pdf).

<sup>8</sup> For example, see Hatzius (2002), p. 10, fn. 2.

index to the constant quality index in the upper panel of Chart 3 and a measure of property improvements per unit in the lower panel. From this chart, the OFHEO index rises relative to the constant-quality index during periods when home improvement spending is particularly strong, such as in the late 1980s and in the last ten years.<sup>10</sup> This suggests that improvements and renovations may explain part of the growth of the OFHEO index over the past 25 years. Therefore, although the OFHEO repeat sales index controls for changes in the geographic mix of units sold, it does not control for changes in the mix within states and for changes in quality that occur within units.<sup>11</sup>

These comparisons of the various home price series suggest that a significant portion of price increases in the OFHEO index can be attributed to increases in quality. As will be seen in our subsequent analysis, the home price index used can have dramatic implications for one's assessment of the possible existence of a home price bubble. Of the indices available, we believe the constant-quality new home price index is most appropriate for this assessment because it is the only one that explicitly controls for changes in quality over time.<sup>12</sup> Any assessment of the existence of a bubble should attempt to control for changing quality and mix over time. Otherwise, a perceived

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<sup>9</sup> See U.S. Census Bureau (1999, 2000).

<sup>10</sup> Gyourko and Tracy (2003), using American Housing Survey (AHS) data, find that households tend to spend more on maintenance and improvements when home prices in the metropolitan area are rising. This phenomenon could further accentuate the rise in the OFHEO price index.

<sup>11</sup> Meese and Wallace (1997) identify some shortcomings of repeat sales indices for studying real estate prices at the municipality level. These include the possibility that repeat sales are not representative of overall sales, small sample problems, and the non-constancy of implied housing characteristic prices (an implicit assumption of repeat sales indices is that such implicit prices are constant). At the aggregate level, the first two problems probably are not important; however, the relationship presented in Chart 3 suggests that the latter problem remains relevant for repeat sales indices at the national level. See also Wang and Zorn (1997) about the appropriate use of repeat sales indices.

<sup>12</sup> Nonetheless, the hedonic method used in constructing this index is not without its problems and its critics; e.g., see Hulten (2003). Another issue concerning the new home constant quality price index is that it does not adequately capture changes in land value, especially if new construction occurs only in “fringe” areas where land prices may not be rising as rapidly as in other portions of a metropolitan area. However,

increase in home prices may reflect only the demand for more housing services that can be obtained through better-quality, greater-amenity homes, even as the price of a standardized unit of housing services remains the same.

In the next section, we examine the standard metrics of home price fundamentals that underlie analysis of a possible home price bubble. We then consider the effects of more fully accounting for home quality changes on the standard bubble analysis.

### **3. Standard home price metrics, alternative price series, and evidence of a bubble**

Before discussing the existence of a bubble in home prices, it is necessary to define exactly what the term “bubble” means. We subscribe to the following definition from Stiglitz (1990):

“[I]f the reason the price is high today is *only* because investors believe that the selling price will be high tomorrow—when ‘fundamental’ factors do not seem to justify such a price—then a bubble exists.” [p. 13]

Accordingly, the key features of a bubble are: (1) that the level of prices has been bid up beyond what is consistent with underlying fundamentals, and (2) that buyers of the asset do so with the expectation of future price increases.

Although some press accounts treat the rapid rate of increase of national home price series as *prima facie* evidence of a housing bubble, our definition indicates that such increases alone are necessary but not sufficient evidence. Additional evidence that relates current home prices to their fundamental determinants is required to solidify any claim of a bubble. Two common metrics of housing fundamentals that have been used to

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we believe that land prices do not substantially affect our conclusions using this index; see McCarthy and Peach (2004) for more on this.

support bubble claims are home prices relative to rents and home prices relative to household income.<sup>13</sup>

One metric to evaluate home price fundamentals is to compare home prices to the implicit rents that homeowners receive from owning their homes. Implicit rent, or owners' equivalent rent, is defined as the rent a homeowner would have to pay to rent a housing unit similar to his home, or equivalently, the rent a homeowner could receive if she rented her home to a tenant. As such, implicit rent is a return to the homeowner from owning her home, much like a dividend is a return to the stockholder from owning a share of stock in a company.

Therefore, the ratio of the owners' equivalent rent index from the Consumer Price Index to the OFHEO home price index can be thought as the real estate equivalent of a dividend-price ratio for corporate equities. A low value of the rent-price ratio suggests that the return on the housing asset for homeowners is low relative to the return on other assets that they could hold and thus is unlikely to persist. To increase the return to a level comparable to that provided by competing assets, home prices likely would have to fall.<sup>14</sup> Thus a low rent-price ratio would suggest that prices are high relative to fundamentals and could be expected to fall.<sup>15</sup>

Chart 4 presents the rent-price ratio using the OFHEO index and the Census constant-quality index as alternative home price indices. When using the OFHEO index as the denominator of the ratio, the blue line in Chart 4, the rent-price ratio has fallen

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<sup>13</sup> Beyond this, some commentators have pointed to the high turnover rate of the housing stock, although this has been high for some time.

<sup>14</sup> See Campbell and Shiller (2001) for a discussion of this mechanism in regard to the dividend-price ratio for corporate equities.

<sup>15</sup> Even though they may not describe the current situation as a bubble, some analysts have used these same measures to argue that the rate of home price appreciation will slow dramatically in the near future. See, for example, Hatzius (2002).



steadily since 2000, with particularly steep drops in the past two years. Its current level is well below its historic levels. This would indicate that prices are considerably out of line with rents, which would be consistent with a bubble in the housing market and would suggest home prices may decline in the future.

However, we believe that the ratio using the OFHEO index is misleading. In calculating tenant and owner equivalent rents, the Bureau of Labor Statistics (BLS), which calculates the CPI, adjusts contract rents for changes in the characteristics and quality of the surveyed units.<sup>16</sup> Therefore, if we are to compare apples to apples in the rent-price ratio, the home price series also should adjust for quality changes. The previous section suggests that the OFHEO index does not adequately adjust for such changes; if so, the Census constant quality index is more appropriate.

When using the constant quality index to calculate the rent-price ratio, the red line in Chart 4, we come to a quite different conclusion. Although this alternative ratio has declined in the last two years, the decline is not nearly as steep as that for the ratio using the OFHEO index, and the level of the ratio is not out of line with its historic values. Therefore, although this ratio would indicate that homes are becoming more expensive relative to their fundamentals, especially compared to the late 1990s and early 2000s, they probably are not yet at bubble-like levels. Of course, unless rents begin to rise more rapidly, even this alternative ratio would begin to slip to unusually low levels if home prices continued to rise rapidly; therefore, by this metric, home prices are becoming more “stretched” relative to their fundamentals.

The other common metric to evaluate home price fundamentals is the ratio of the median home price to median household income, which is one measure of home

ownership affordability. If this ratio is relatively high, then households should find both downpayments and monthly mortgage payments more difficult to meet, which should decrease demand and eventually lead to downward pressure on home prices.

As for the rent-price ratio, we calculate the home price-income ratio using the OFHEO index and the constant quality index, both of which we present in Chart 5. Again, the contrasting results are striking. When using the OFHEO home price index, the price-income ratio has risen sharply since 2000, and is now at a level that is well above its historic levels (blue line). This would suggest that prices are out of line with their fundamentals and that there is a bubble in the housing market.

However, if preference shifts have increased demand for more size and greater amenities in homes, then households may want to allocate more income toward home purchases. Although we cannot directly measure such preference shifts, there are some pieces of circumstantial evidence supporting this contention. The first is the increase in home size and amenities mentioned earlier.<sup>17</sup> The second is that rising price-income ratios appear concentrated at higher-end homes, where the shift toward larger homes with greater amenities has been most pronounced. Chart 6 shows, using data from the American Housing Survey, the home value-income ratio for various percentiles of the home value distribution. The ratio has risen significantly for the higher percentiles (75<sup>th</sup> and 80<sup>th</sup>), but it has been relatively flat at the lower percentiles (25<sup>th</sup> and 50<sup>th</sup>).<sup>18</sup> One other piece of evidence is presented in Chart 7, which shows that owners' equivalent rent (red line) has risen more rapidly than prices for other goods (blue line) over recent years.

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<sup>16</sup> See, for example, Ptacek and Baskin (1996).

<sup>17</sup> See U.S. Census Bureau (1999, 2000).

<sup>18</sup> It does appear that the demand shift toward such homes may have begun to moderate, as evidenced by profit warnings from some high-end builders in the US such as Toll Brothers.

One interpretation of this is that housing services are becoming more valued as preference shifts toward such services.

Under these circumstances, we probably would get a better sense of the fundamentals in the housing market if the home price series is adjusted to give the price of a standard unit of housing services. This again argues for the constant quality series. When using that series to calculate the price-income ratio (the red line), its rise since 2000 is less dramatic than that using the OFHEO index. Although its current level is relatively high compared to its historic values, it is not out of line.

Overall, this analysis indicates that when quality changes in homes have been controlled for, then home prices appear to be at the higher end of the range consistent with the fundamentals of the housing market. As such, there still does not appear to be a bubble in the market, although there appears to be less room for more rapid appreciation.

#### **4. Interest rates and home price fundamentals**

Beyond the questions of the appropriate home price series to use, a flaw in the standard home price metrics presented in the previous section is that they do not take interest rates into account. Clearly, interest rates should matter in assessing the existence of a bubble because they affect home ownership affordability and because they represent the yield on a competing asset. The downward trend in nominal mortgage interest rates, a major feature of the housing market over most of the past decade, thus has significant implications for home ownership affordability (the home price-income ratio) and for the equilibrium return on housing (the rent-price ratio). Accounting for this trend in interest rates in the analysis casts doubt on the existence of a bubble.

The effect of lower nominal interest rates (and rising incomes) on housing affordability is illustrated in Chart 8. For this chart, we calculate in each year, based on standard mortgage underwriting criteria, the maximum 30-year fixed-rate mortgage obtainable at the average mortgage rate and median family income of that year.<sup>19</sup> We then compare the value of that hypothetical loan to home prices measured by the OFHEO index, setting each series equal to 100 in 1980 to facilitate long-run comparisons. From the chart, we see that the maximum loan amount (red line) has risen much more than home prices (blue line) since 1980, illustrating the power of declining interest rates, partially the result of lower inflation during this period, on housing affordability.<sup>20</sup>

Because of the declines in nominal mortgage interest rates, cash-flow affordability of homes has remained fairly high despite the sharp rise in home prices. Chart 9 displays the housing affordability index compiled by the National Association of Realtors. This index was quite high throughout most of past decade, only recently declining to a significant degree. Still, it remains well above 100, indicating that median income is above qualifying (for median price home) income. Therefore, taking into account interest rates and their effect on affordability leads to a quite different assessment of current home prices than does the simple home price-income ratio: a standard single-family home still remains affordable from a cash flow standpoint even though home prices have increased rapidly, suggesting that home prices have risen in line with the

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<sup>19</sup> We assume a 30-year amortization and that a maximum of 28 percent of pre-tax income can be devoted to principal and interest payments.

<sup>20</sup> This is the opposite of the effect that the rise in inflation had on affordability in the late 1970s. As discussed by Kearl (1979), the rise of nominal interest rates combined with the nominal long-term fixed rate mortgage contract meant that households whose real permanent income was sufficient to purchase a particular home could not because the initial real payments were beyond the household's current resources.

declines in mortgage interest rates and increases in median family income. This argues against the existence of a housing price bubble.<sup>21</sup>

The standard rent-price ratio also fails to take into account the significant decline of interest rates. A home is an income-producing asset through implicit rent, and thus conceptually similar to a stock. The value of an asset is the discounted present value of the net income it provides, with the discount rate being the current yield on a competing asset with comparable risk characteristics. Even if the net income stream remains constant, a decline in the discount rate will boost the equilibrium value of the asset.

A simple asset pricing model allows us to incorporate interest rates into the rent-price ratio. For example, Poterba (1984) suggests that, in equilibrium, homeowners equalize the marginal cost and benefit of the services derived from the housing assets they own. The marginal benefit is the real implicit rental price from the structure, while the marginal cost is the user cost of the asset. As defined originally by Jorgenson (1963), the user cost is the sum of the after-tax opportunity cost of holding the capital asset, depreciation and repair, and property taxes, minus the expected capital gain of the asset. This arbitrage condition can be expressed as:

$$(1) \quad R_t = P_t[(1 - \tau_t^y)(i_t + \tau_t^p) + \delta_t - E(\pi_t^H)].$$

In equation (1),  $R_t$  is the implicit rent of the structure,  $P_t$  is the housing price index,  $\tau_t^y$  is the income tax rate,  $i_t$  is the interest rate,<sup>22</sup>  $\tau_t^p$  is the property tax rate,  $\delta_t$  is

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<sup>21</sup> Because we assume a constant loan-to-value (LTV) ratio in this calculation, an increase in LTV ratios over this period would result in higher values in later years of our affordability ratio than we show. However, although LTV ratios rose during the 1990s, they have declined recently and the current average ratio is near that of the mid-1980s. For example, the average LTV was 74.9% in 2004 and 74.1% in October 2005, compared to 74.3% in 1983 and 77.0% in 1984 (Federal Housing Finance Board data, these exclude refinancing loans).

<sup>22</sup> Note that equation (1) uses the nominal interest rate because the tax deductibility of interest payments on home mortgages is based on nominal payments. However, because nominal home price appreciation is

the depreciation (plus repair) rate, and  $E(\pi_t^H)$  is expected capital gains from the housing asset. Rearranging equation (1), we get a form that expresses the interest rate adjustment to the rent-price ratio.

$$(2) \quad (R_t / P_t) - [(1 - \tau_t^y)(i_t + \tau_t^p) + \delta_t] = -E(\pi_t^H).$$

Equation (2) shows that the rent-price ratio should be adjusted by subtracting the interest rate and property tax rate, both on an after-tax basis, and the depreciation rate. This adjusted ratio is then inversely related to expected home price appreciation. In equilibrium then, unusually low levels of the adjusted rent-price ratio suggest that housing market participants expect high rates of home price appreciation, a key ingredient of an asset bubble.

We calculate the expression on the left-hand side of equation (2) using the OFHEO index for the home price index and two alternative interest rate series.<sup>23</sup> The theory underlying equations (1) and (2) imply that a short-term interest rate should be used in the calculation: we use the 3-month T-bill rate in this case, the results of which are presented in Chart 10. However, if we account for the impact of expected future interest rates, as measured from the yield curve, on expected home price appreciation, a long-term interest rate should be used in the calculation.<sup>24</sup> For this, we use a mortgage rate series (although the results would be similar using long-term Treasury rates), and the corresponding results are presented in Chart 11.

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subtracted from interest payments in equation (1), the equation can be rearranged to present a relation in terms of the real interest rate, real home price appreciation, and general inflation.

<sup>23</sup> In this calculation, the income tax rate is the marginal rate for a household with twice the median income and the property tax rate is a weighted aggregate across states; both are from the Federal Reserve Board. The depreciation rate is calculated using the depreciation and net stock of single-family housing from the Bureau of Economic Analysis Fixed Assets and Consumer Durables database. We arrive at similar conclusions when using the Census constant-quality index.

<sup>24</sup> See Himmelberg, Mayer, and Sinai (2005) for more on this point.

The basic conclusions derived from the two series are similar. In both cases, the adjusted rent-price ratio has declined in the past year and a half, and is now below its average over 1984-2000. Because short-term interest rates have risen more than long-term rates with the tightening of monetary policy over this period, the decline in the ratio has been more dramatic when the short-term interest rate is used.<sup>25</sup> Nevertheless, the current level of each ratio is within historical norms—for example, it is comparable to the levels that prevailed through much of the late 1990s—and is well above the level that prevailed in 2000. This metric thus indicates that fundamentals probably can still explain current home price levels, but the room for home prices to continue to rise at rapid levels probably has disappeared.

Our analysis in this section indicates that when more of the fundamentals of the housing market, in particular interest rates, are incorporated into home price metrics, prices still appear to be consistent with fundamentals and one does not have to resort to a bubble to explain home prices. Of course, this conclusion is reliant on interest rate remaining low: if for some reason long-term interest rates rise significantly—e.g., because there is a “bubble” in bond markets as some have argued—then it would be harder to justify current home prices based on fundamentals.

## **5. Home prices in regional markets**

As can be seen in Chart 1, national home prices are not volatile compared to other assets like corporate equities. One reason for the moderate volatility of national home prices is that the housing market is comprised of many heterogeneous regional housing

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<sup>25</sup> However, mortgage rates have risen in October and November to average around 6.2% so far in 2005Q4. Assuming everything else the same, this would indicate that the opportunity cost adjusted rent-price ratio would be under 0.5, the lowest it has been since 2000Q4.

markets.<sup>26</sup> In the past, some regions experienced wide swings in real home prices from local factors that were not apparent in the aggregate statistics: for example, real home prices in California and Massachusetts have been much more volatile than for the nation as a whole. Currently, many analysts are concerned about regional bubbles occurring, the end of which could have significant negative impact on the national economy.

The regional heterogeneity is illustrated in Tables 1 and 2, which gives a regional summary (for metropolitan statistical areas and states respectively) of home price appreciation over the past year. From these tables, we see the regional heterogeneity: the range of MSA appreciation is over 33 percent and the range of state appreciation is over 26 percent. We also see that the mean national increase is considerably greater than the median increase, although even the median increase is relatively high. Finally, we see that only about a third of MSAs and states are above average, thus the high appreciation has been driven by a relatively small number of regions. However, many of these regions are large, prompting the concern of some analysts about price declines in those areas.

Therefore, it is important to see if we can explain the high appreciation in these areas. In McCarthy and Peach (2004), we argued that one such factor is the ease of increasing supply. Over the 1999-2004 period, home price appreciation was highest in states such as California, Massachusetts, New Hampshire, New York, and New Jersey, and in the District of Columbia.<sup>27</sup> Some recent research suggests that, because of population density and building restrictions, the supply of new housing units is likely to

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<sup>26</sup> Another reason that home prices are less volatile is that when demand is weak, reported prices may not include the value of seller concessions (e.g., below-market financing). See Peach and Crellin (1985).

<sup>27</sup> Interestingly, Case and Shiller (2003) find that most of these states traditionally have had a more unstable relationship between home prices and income.



be relatively inelastic in these areas.<sup>28</sup> In contrast, in states like Utah, New Mexico, Idaho, and North Dakota, where supply probably is more elastic, home price appreciation has been more moderate.

Because inelastic supply implies larger price responses to similar-sized shifts in demand, supply elasticity may be an important factor behind some of the recent larger price increases across regions. To investigate the role of supply elasticity, we compare the volatility of home price appreciation to recent home price appreciation.

If supply elasticity has been an important factor behind recent home price movements, we would expect that states with higher recent home price appreciation have had more volatile home prices. In Chart 12, we compare home price appreciation over 1999-2004 to the standard deviation of home price appreciation over 1975-1999 and find this to be true. States such as California, Massachusetts, New Hampshire, New York, and New Jersey, as well as the District of Columbia historically tend to have the most volatile home prices as well as strong appreciation over recent years.

Although we have not done an analysis of regional home prices based on user costs similar to the analysis in the previous section, a recent paper by Himmelberg, Mayer, and Sinai (2005) has done some analysis for a number of metropolitan areas. Their conclusions are that valuations in a number of areas are high relative to long-run historical averages, but they remain well below the prevailing levels from the late 1980s and early 1990s. As such, they see prices in most areas supported by fundamentals (in particular, low interest rates), with few signs of any regional bubbles in home prices.

## **6. Conclusion**

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<sup>28</sup> See Glaeser and Gyourko (2003).

In this paper, we still find little evidence to support the existence of a national home price bubble, as prices have yet to rise out of line with fundamentals. Even so, with the strong rise in home prices, the current level of home prices is more expensive relative to fundamentals than they were just a couple of years ago.

Although there does not appear to be a bubble in home prices, the fact that they are now more expensive relative to fundamentals implies that they may be more susceptible to deteriorating fundamentals than they have been in recent years. However, historical observations also suggest that home prices probably will not plunge in response to deteriorating fundamentals to the extent envisioned by some analysts. Real home prices have been less volatile than other asset prices (e.g., equity prices). Several reasons have been cited for the lower volatility, including the cost to speculate in the housing market.<sup>29</sup> However, there have been examples of extreme home price volatility where it presumably has been costly to speculate, such as in Japan in the late 1980s and the 1990s. Therefore, we prefer to emphasize that the lower volatility of national home prices probably stems from the disjointed nature of the US housing market.

We concluded our analysis by examining home prices at the state level. While prices have risen much faster recently for some states than for the nation, the supply of housing in those states appears to be inelastic, making home prices in those areas more volatile. Therefore, we conclude that much of the volatility at the state level is the result of changing fundamentals rather than evidence of regional bubbles. Nevertheless,

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<sup>29</sup> For example, in testimony before the Joint Economic Committee on April 17, 2002, Federal Reserve Board Chairman Greenspan said: "[...] sales in the real estate market incur substantial transactions costs and, when most homes are sold, the seller must physically move out. Doing so often entails significant financial and emotional costs and is an obvious impediment to stimulating a bubble through speculative trading in homes."

weaker fundamentals may cause home price declines in those areas with inelastic supply.  
But if the past is any guide, that is unlikely to plunge the U.S. economy into a recession.

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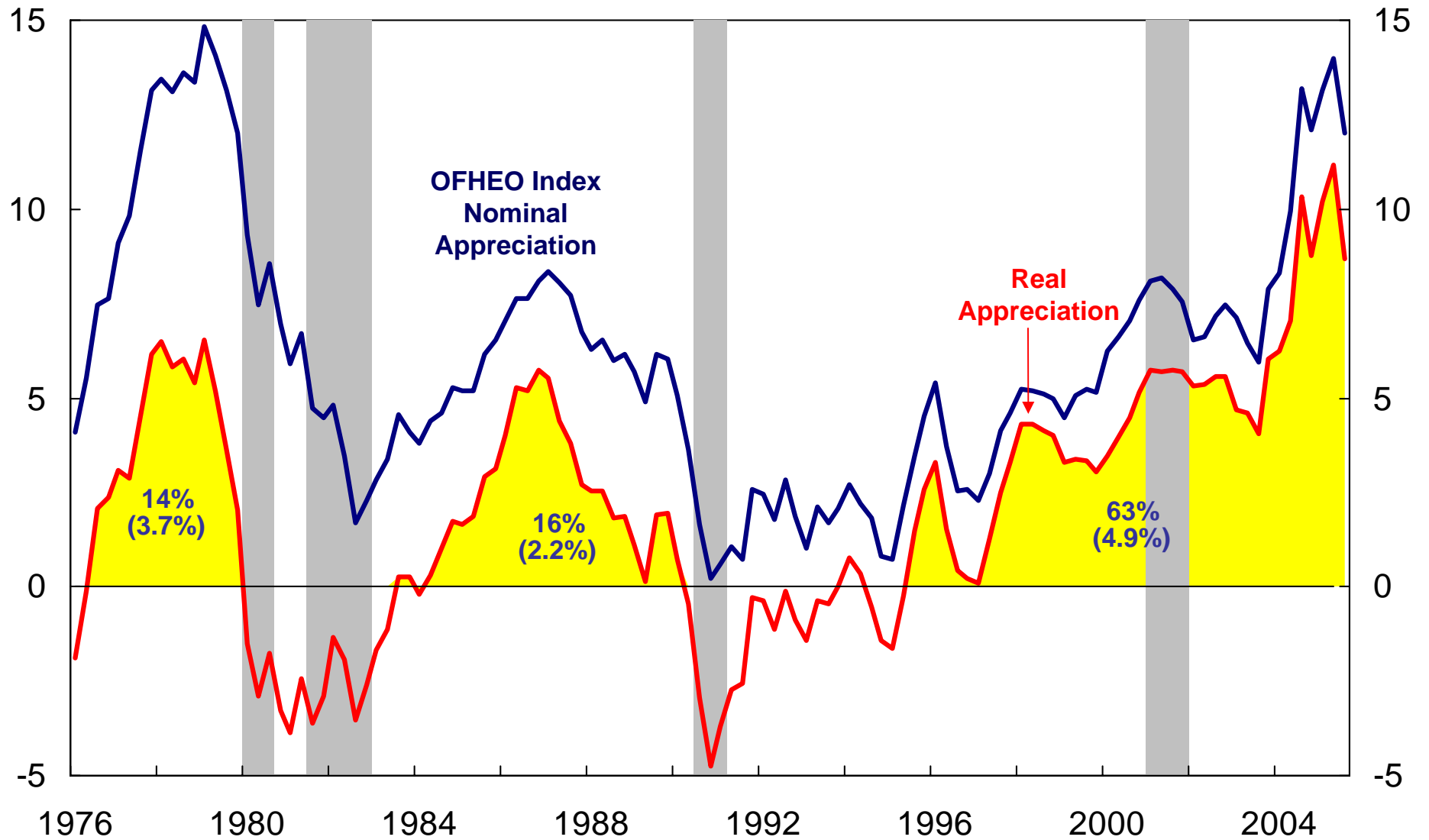
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Chart 1

# Home Price Appreciation

% Change - Year to Year

% Change - Year to Year



Source: Office of Federal Housing Enterprise Oversight and Bureau of Economic Analysis.

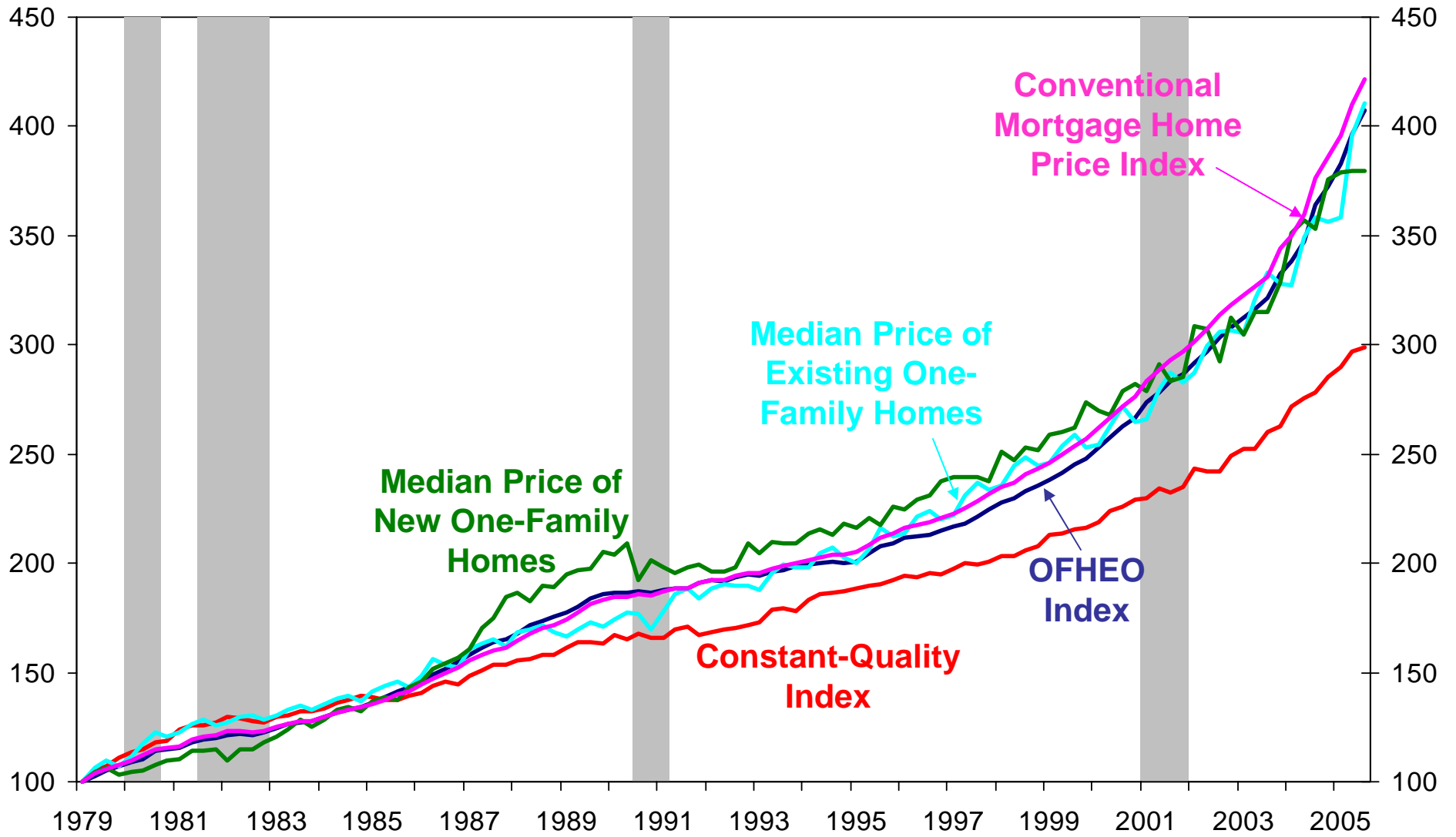
Note: Shading represents NBER recessions.

Chart 2

# Home Price Measures Since 1979

Index, 1979 Q1 = 100

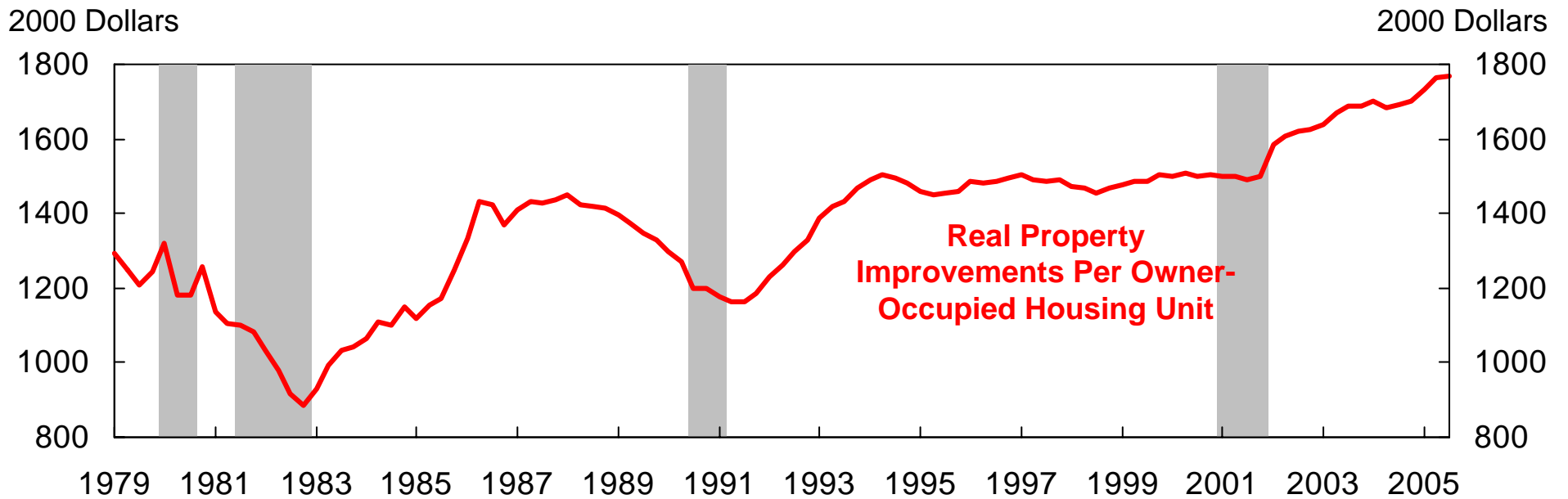
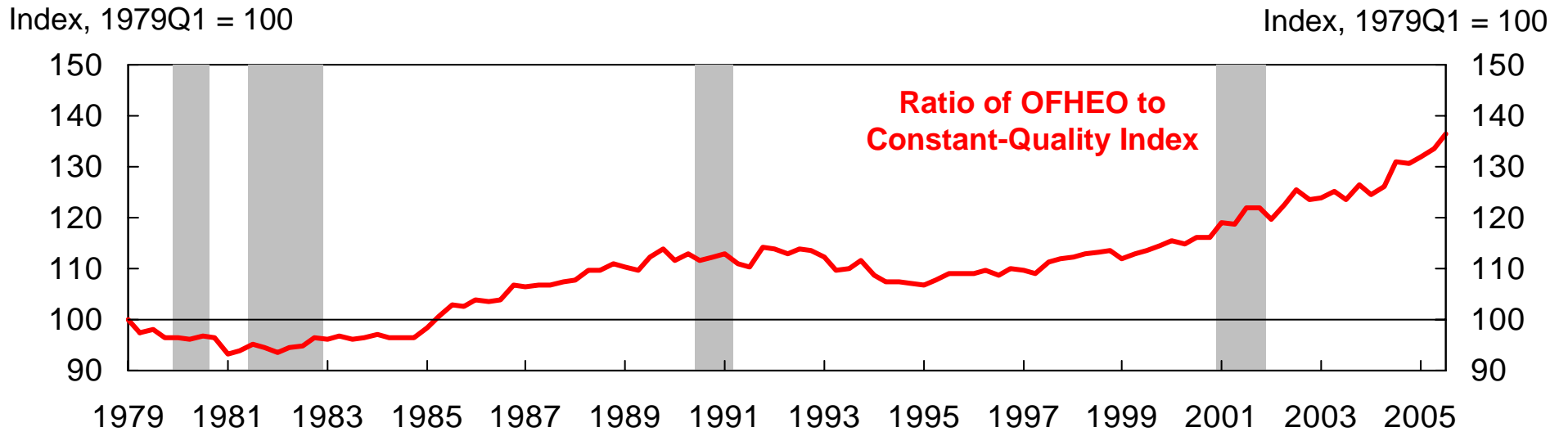
Index, 1979 Q1 = 100



Source: Census Bureau, Bureau of Economic Analysis, Office of Federal Housing Enterprise Oversight. Shading represents NBER recessions.

### Chart 3

# OFHEO Index and Home Improvements.



Source: Census Bureau, Office of Federal Housing Enterprise Oversight (OFHEO) and Bureau of Economic Analysis

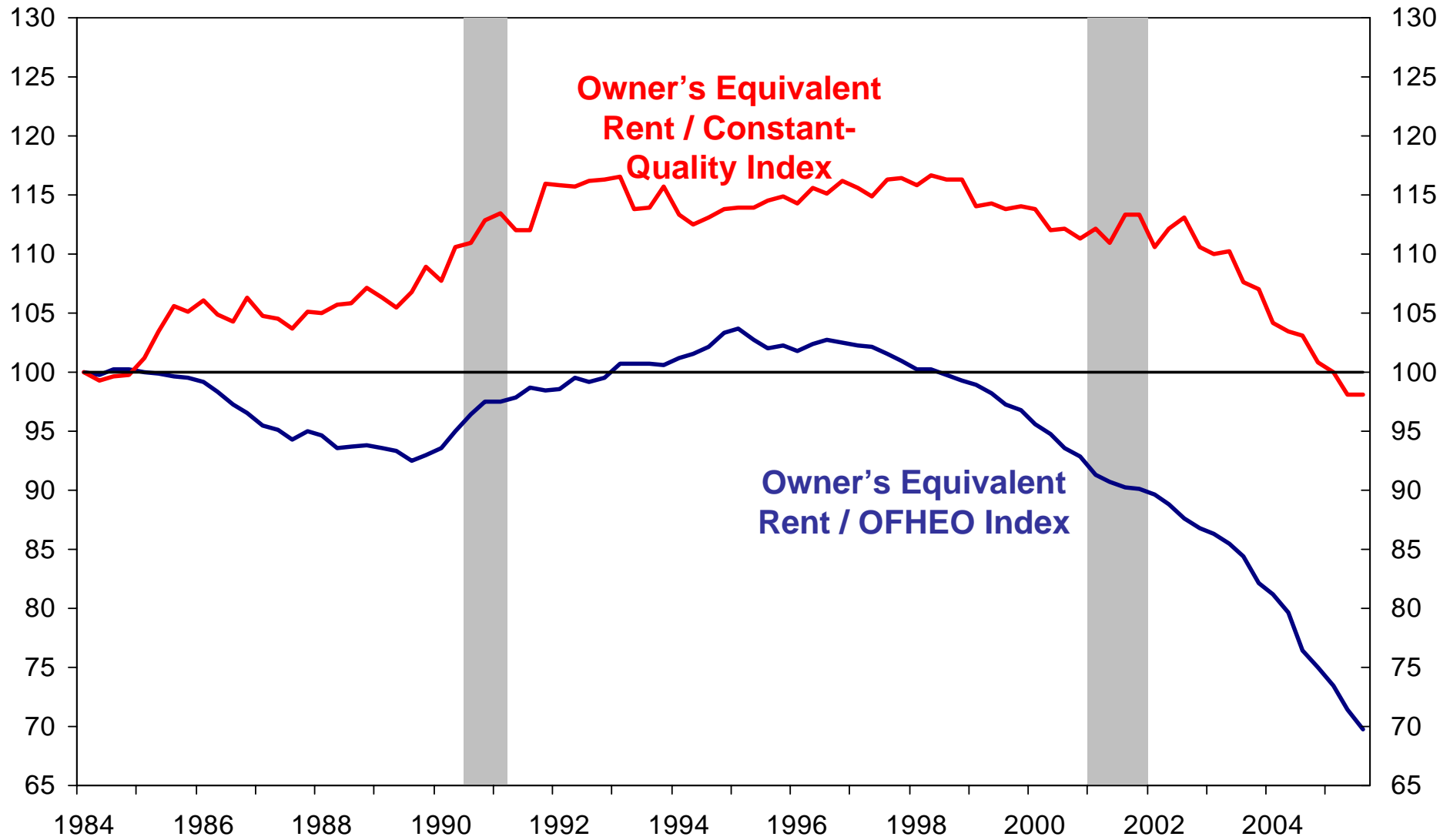


Chart 4

# Owner-Occupied Rent-Price Ratios Using Different Price Indexes

Index, 1984 Q1 = 100

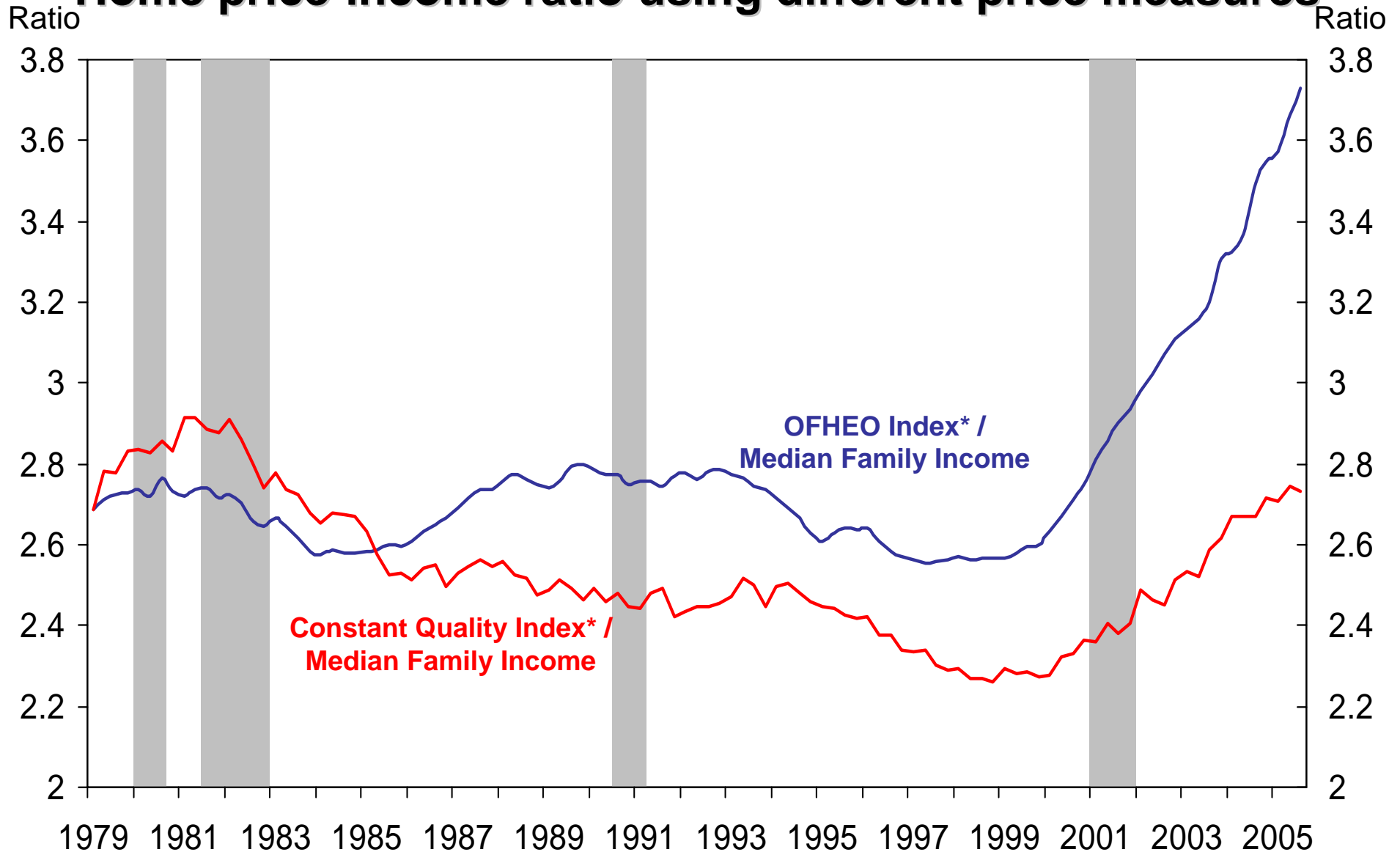
Index, 1984 Q1 = 100



Source: Census Bureau, Bureau of Economic Analysis, Office of Federal Housing Enterprise Oversight.  
Shading represents NBER recessions.

Chart 5

# Home price-income ratio using different price measures

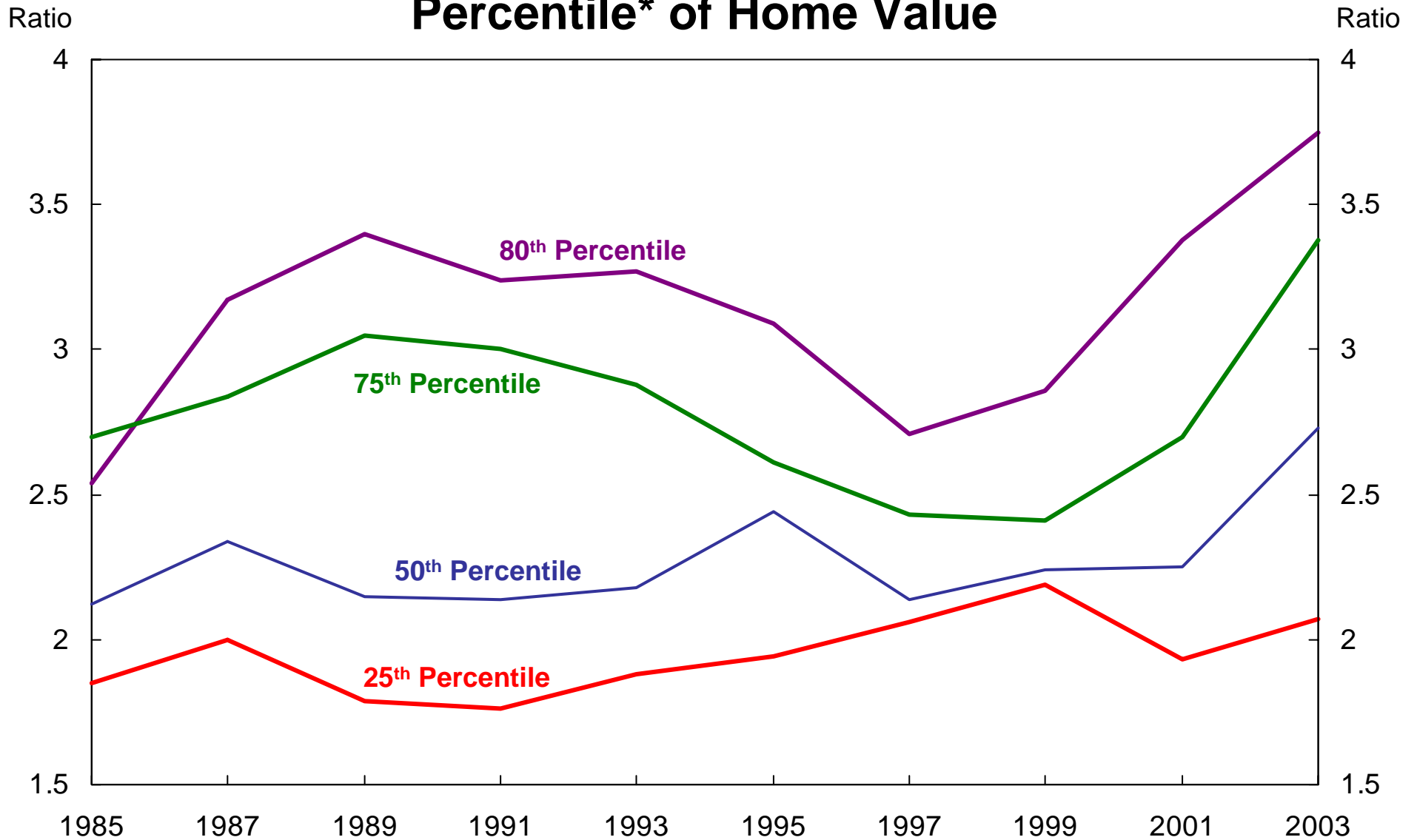


\*Both indices have been converted to dollars using the median price of existing homes in 1979Q1

Source: Office of Federal Housing Enterprise Oversight, Bureau of Economic Analysis. Note: Shading represents NBER recessions.

Chart 6

# Ratios of Median Home Value to Median Family Income by Percentile\* of Home Value



\*Home value percentile groups are defined by 3-percentile ranges centered around the cited percentile point.

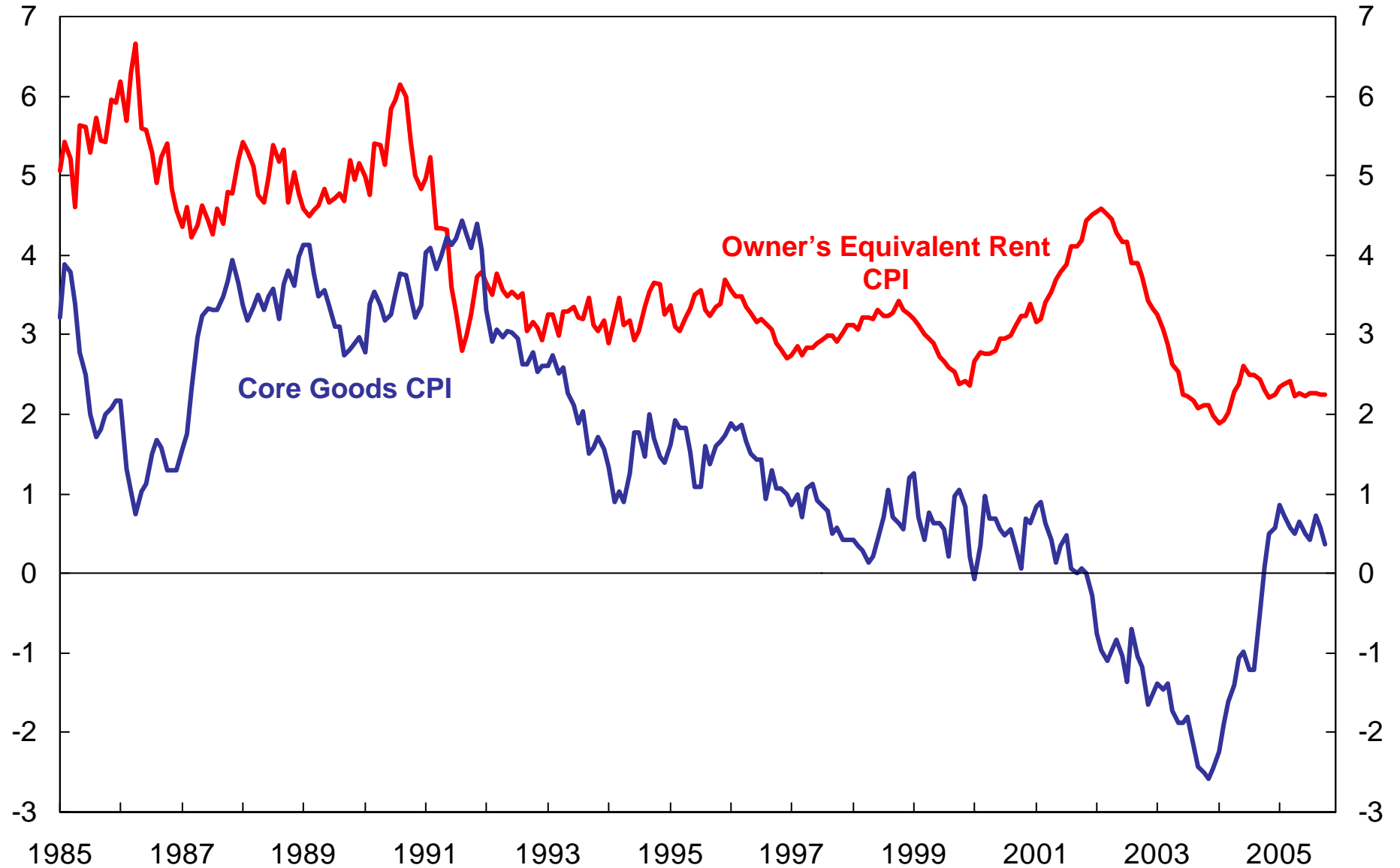
Source: American Housing Survey

Chart 7

# CPI Goods and Housing Price Indices

% Change – Year to Year

% Change – Year to Year



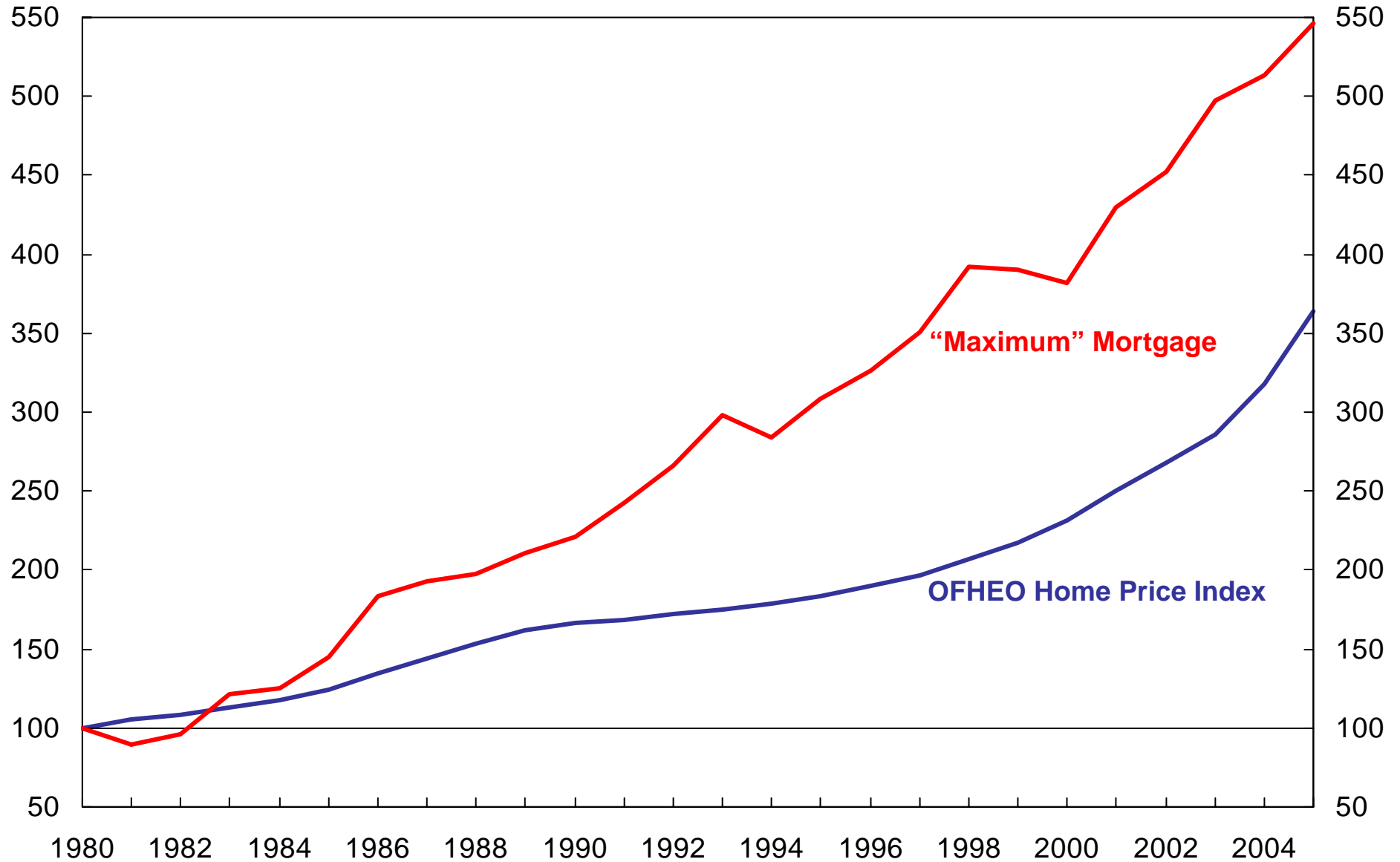
Source: Bureau of Labor Statistics

Chart 8

# Home Prices and “Maximum” Mortgage for Median Income

Index, 1980 = 100

Index, 1980 = 100



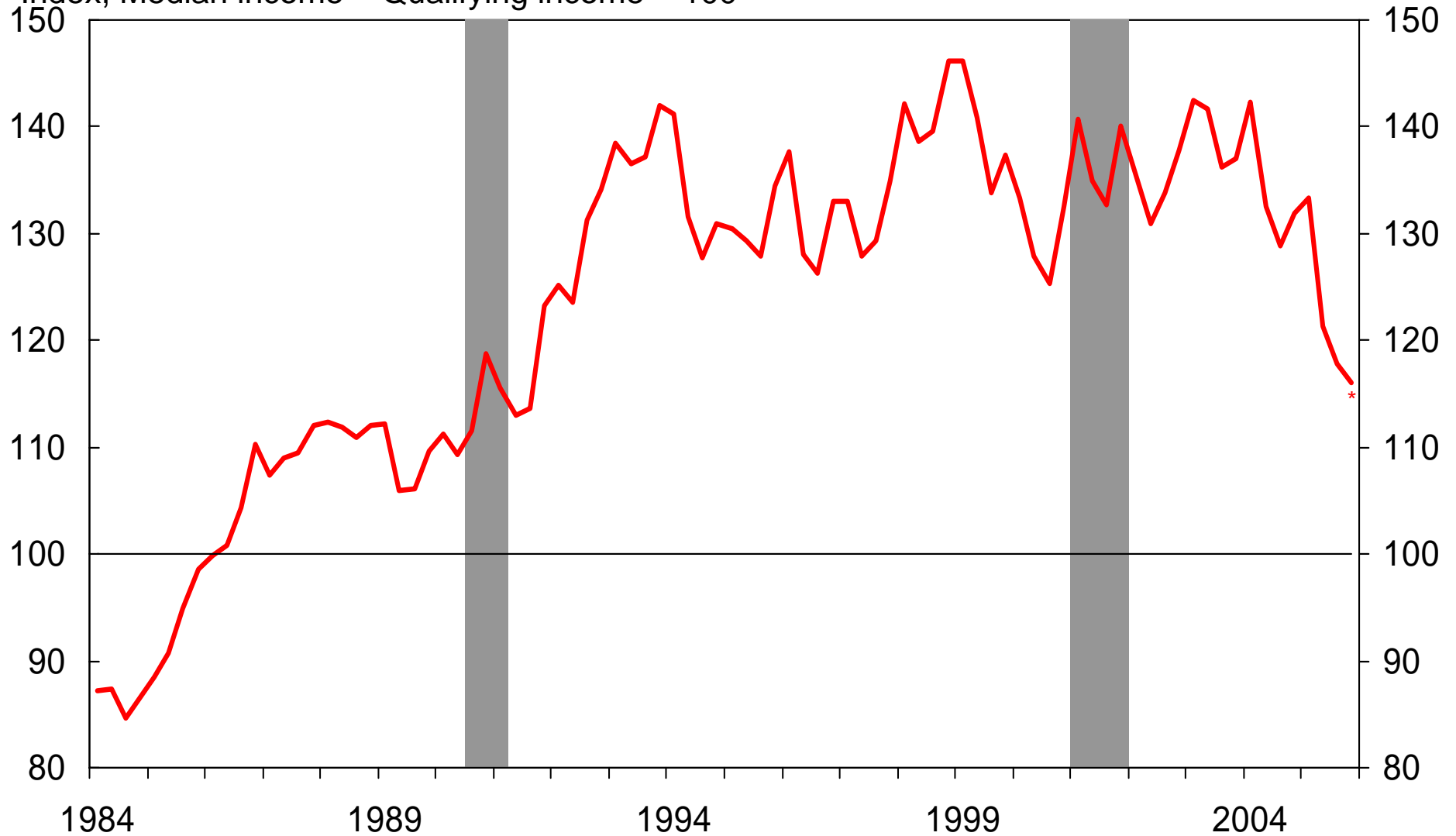
Source: Census Bureau, Office of Federal Housing Enterprise Oversight (OFHEO), Federal Reserve Board

Note: 2005 values are for 2005Q3. Median family income uses estimate from National Association of Realtors.

# Chart 9

## Composite Housing Affordability Index

Index, Median income = Qualifying income = 100



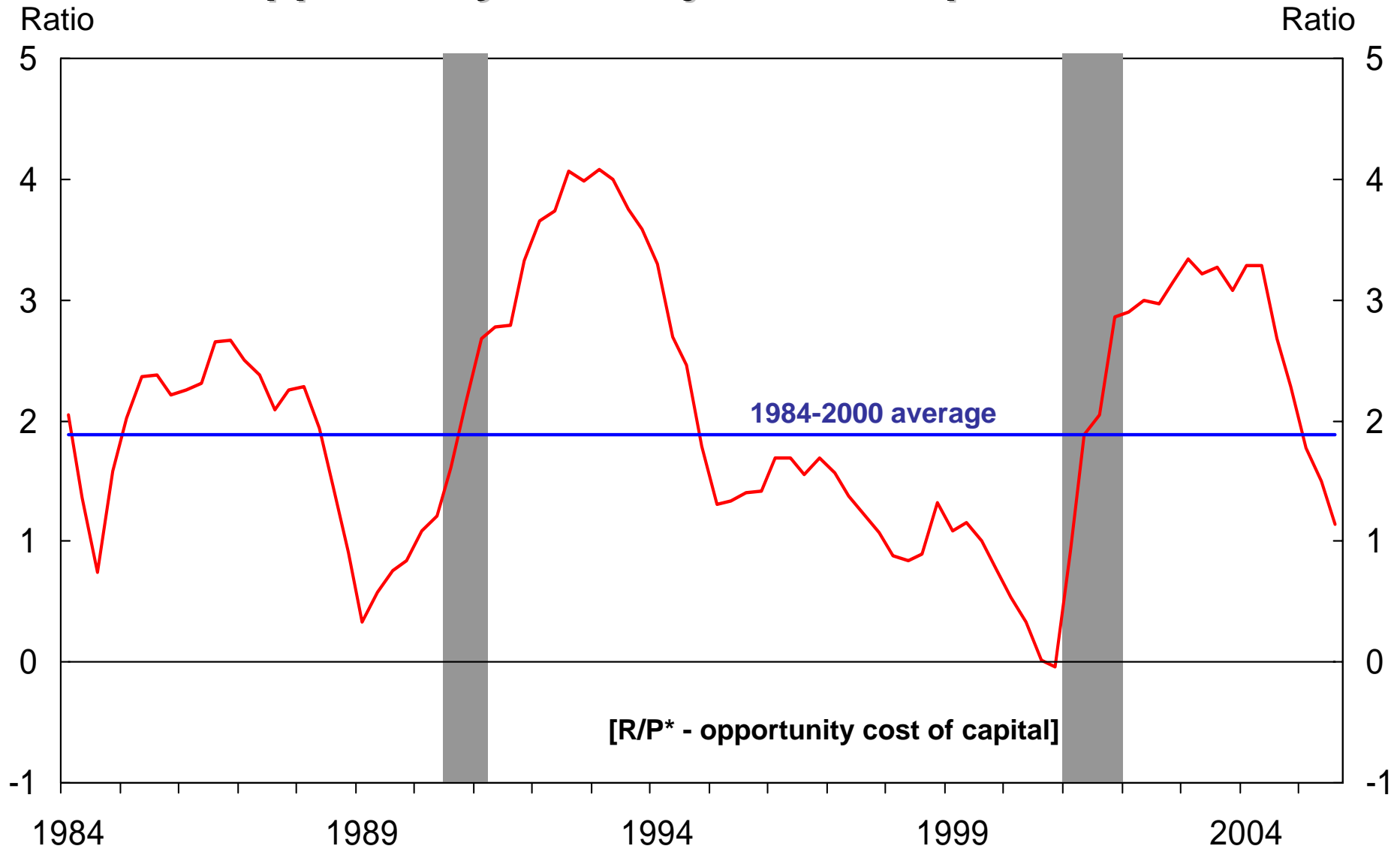
\* 2005Q4 number is for October only

Source: National Association of Realtors.

Shading represents NBER recessions.

Chart 10

# Opportunity cost adjusted rent-price ratio

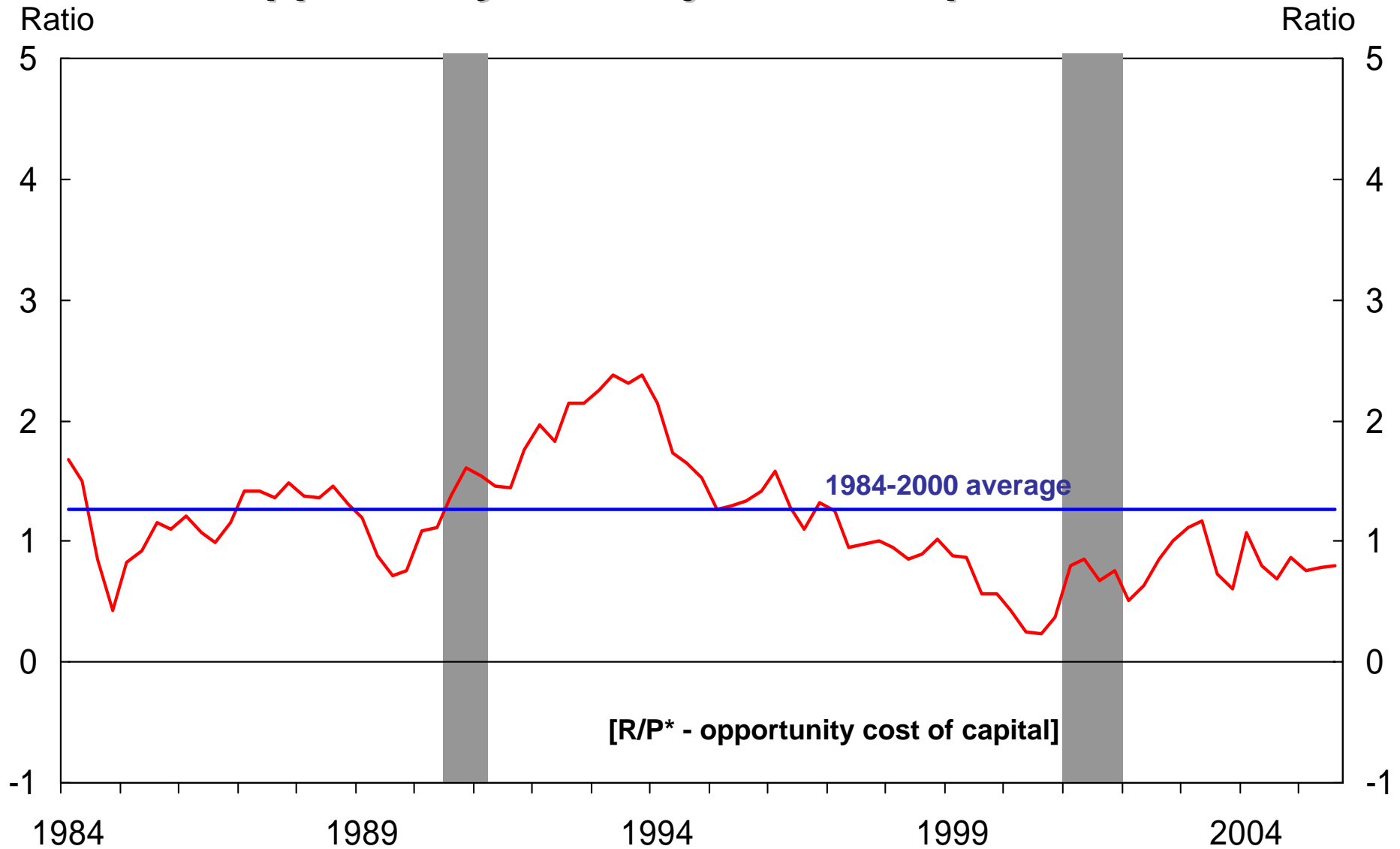


\* Constructed using the OFHEO home price index and 3-month T-bill rate.

Source: OFHEO, Bureau of Economic Analysis, Federal Reserve Board. Shading represents NBER recessions.

Chart 11

# Opportunity cost adjusted rent-price ratio



\* Constructed using the OFHEO home price index and mortgage rate.

Source: OFHEO, Bureau of Economic Analysis, Federal Reserve Board. Shading represents NBER recessions.



Table 1

# Home price appreciation for year through 2005Q3: MSA breakdown

US average: 12.0%

Number of MSAs above US average: 89

Maximum: Phoenix-Mesa-Scottsdale, AZ—34.4%

Number of MSAs below US average: 176

Minimum: Mansfield, OH—0.8%

Median MSA: Champaign-Urbana, IL—8.2%

Table 2

# Home price appreciation for year through 2005Q2: State breakdown

US average: 12.0%

Number of states above US average: 16

Maximum: Arizona—30.3%

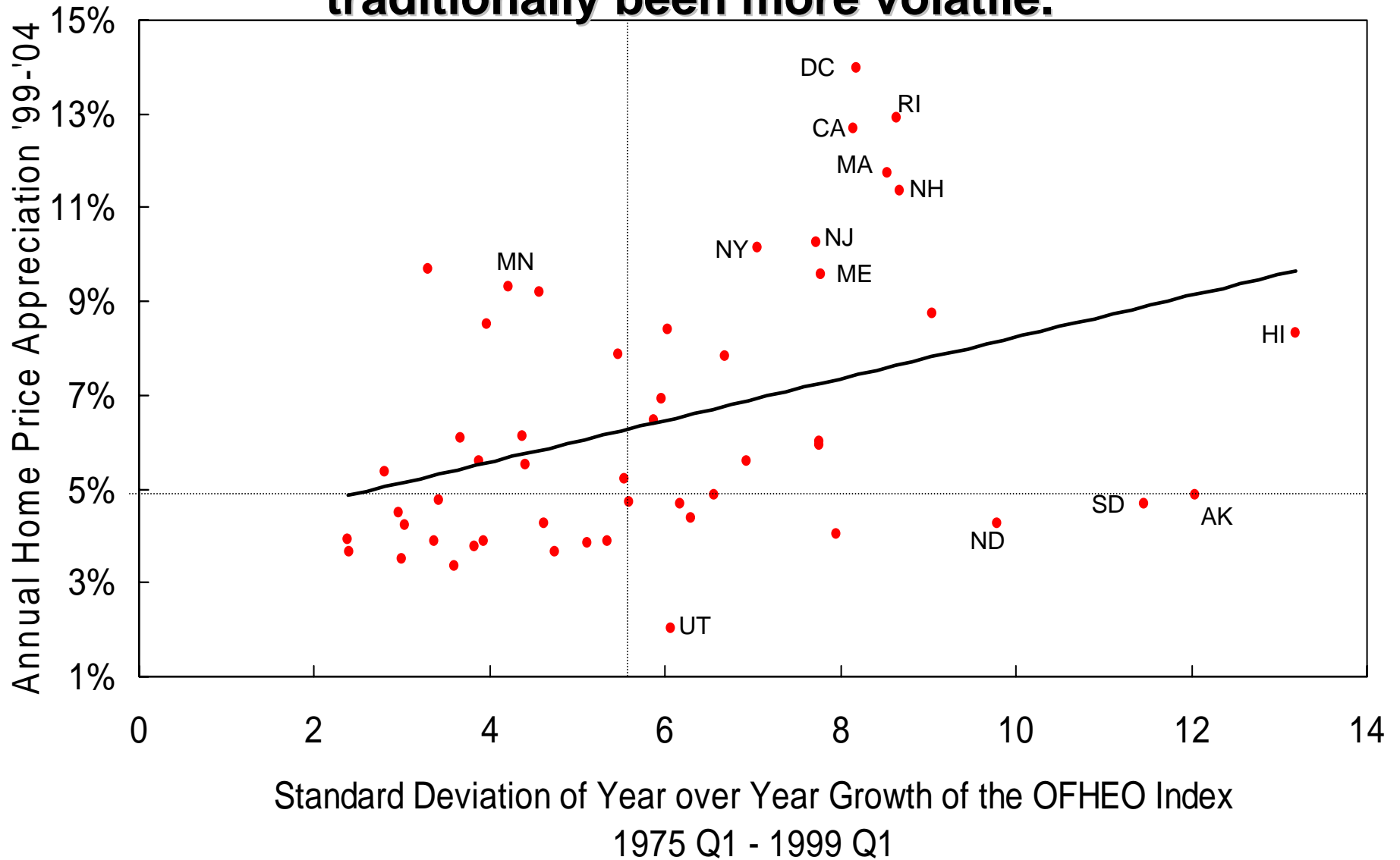
Number of states below US average: 35

Minimum: Michigan—4.0%

Median state: New Hampshire—9.5%

Chart 12

# Higher appreciation areas have traditionally been more volatile.



Source: Office of Federal Housing Enterprise Oversight.