House Price Bubble Babble

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After the tech stock bubble burst, and with house prices, according to some measures, rising sharply in the past few years, there has been increasing concern expressed about the possibility that a bubble has developed, or is developing, in house prices.[1] Other price measures, however, don't show much evidence of a nationwide surge in house prices. Moreover, even where prices have increased, the increases may not be unsustainable or inconsistent with the changes that have occurred in incomes, interest rates, and other fundamental demand and supply factors.

Price Measures

House prices are more difficult to measure than the prices of stocks or bonds, in part because each house is unique and is sold infrequently. Summary measures such as median or average house prices will change because of changes in the mix of homes being sold, as well as because of changes in the valuations of the same homes or groups of homes.

Some house price measures attempt to correct for changes in the mix of sales. One method for doing so involves a statistical technique called hedonic regression. Regression estimates of the value of different features or locations are calculated, and used to adjust average prices for changes in the presence of those characteristics. This method is used by the Census Bureau to construct their index of new home prices.[2]

Another device for dealing with changes in the mix of homes sold involves matching sales or appraised values with previous sales or appraisals of the same homes.[3] The price changes between matched transactions are incorporated into estimates of price changes for the overall market during each of the intervening periods.[4] The "repeat-sales" technique has been used by the Office of Federal Housing

Enterprise Oversight (OFHEO) and by Freddie Mac and Fannie Mae to construct price indices for the nation and for states and metropolitan areas. The OFHEO and Freddie-Fannie indices are both calculated from records of mortgages sold to Freddie and Fannie, although they use slightly different methods to identify repeat transactions and to aggregate the data.

The hedonic and repeat-sales measures both involve clever, elegant statistical methods, but they are imperfect and possibly biased in ways that are not fully understood.

Table 1 shows the principal measures of national home prices. The OFHEO and Freddie-Fannie indices indicate higher rates of increase in recent years than any of the other measures, including the median and average prices that are presumed to have an upward bias because of the trend toward larger homes with more amenities. The repeat sales indices may have increased because of a greater tendency for rapidly-appreciating homes to be resold or refinanced, as well as for other reasons such as improvements to homes between sales. During some earlier years, however, such as 1993 and 1994, the repeat sales indices indicated smaller increases than the other measures.

A bubble presumably means that prices are out of line with fundamental supply and demand factors. Possible indications of a misalignment of house prices include increases in prices relative to incomes and relative to rental values. Also, if prices are high relative to construction costs and more of the home value is attributable to land, the potential for a downward correction is greater.

Depending on which measures of

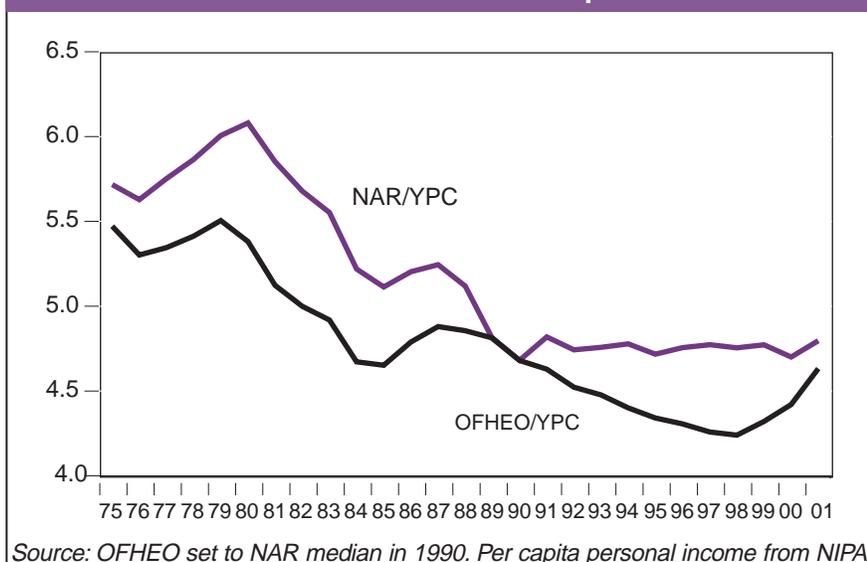**Figure 1. Existing Home Price Relative to Personal Income Per Capita**

Source: OFHEO set to NAR median in 1990. Per capita personal income from NIPA.

Table 1. House Price Measures

Year	Repeat-sales Indices		New Homes Sold			Existing Homes Sold		Monthly Payment	
	OFHEO	Freddie	Median	Avg.	Quality Adjusted	Median	Avg.	Med. New	Med. Existing
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1975	63.0	43.7	39.3	42.6		35.3	39.0	$254	$228
1976	66.9	46.9	44.2	48.0		38.1	42.2	$281	$242
1977	74.1	52.0	48.8	54.2		42.8	47.0	$310	$271
1978	83.8	59.5	55.7	62.5		48.7	55.1	$379	$332
1979	95.0	67.0	62.9	71.8	89.9	55.5	64.0	$487	$430
1980	102.5	72.7	64.6	76.4	99.0	62.1	72.7	$602	$578
1981	108.0	77.2	68.9	83.0	106.8	66.1	78.0	$769	$738
1982	111.2	79.5	69.3	83.9	109.3	67.7	80.4	$747	$730
1983	115.4	82.0	75.3	89.8	111.7	69.8	82.5	$678	$628
1984	120.8	85.4	79.9	97.6	116.1	72.3	85.9	$751	$680
1985	127.9	89.5	84.3	100.8	117.6	75.4	90.6	$716	$640
1986	137.8	95.6	92.0	111.9	122.1	80.3	98.3	$657	$573
1987	148.6	102.3	104.5	127.2	128.8	85.6	106.2	$747	$611
1988	157.9	108.6	112.5	138.3	133.6	89.2	112.5	$813	$644
1989	166.9	115.3	120.0	148.8	138.9	89.4	114.2	$865	$645
1990	171.3	119.1	122.9	149.8	141.6	91.8	115.1	$872	$652
1991	173.4	121.3	120.0	147.2	143.4	96.7	124.2	$790	$637
1992	177.2	124.6	121.5	144.1	145.3	99.6	126.5	$741	$607
1993	180.2	127.3	126.5	147.7	151.6	102.6	128.7	$694	$563
1994	183.7	130.5	130.0	154.4	158.9	106.9	133.2	$791	$650
1995	188.6	134.6	133.9	158.7	163.4	109.8	135.2	$781	$640
1996	195.2	139.8	140.0	166.4	166.4	115.5	141.4	$807	$666
1997	202.1	145.3	146.0	176.2	171.2	121.4	149.9	$825	$686
1998	212.9	153.4	152.5	181.9	175.6	127.9	158.4	$807	$677
1999	224.6	162.1	161.0	195.6	184.2	133.0	167.6	$895	$739
2000	242.9	175.2	169.0	207.0	192.0	138.4	175.9	$997	$816
2001	263.7	190.4	174.1	211.9	198.8	146.3	184.2	$924	$777
Change									
'00-'01	8.6%	8.7%	3.0%	2.4%	3.6%	5.7%	4.7%	-7.3%	-4.9%
'99-'00	8.1%	8.1%	5.0%	5.8%	4.2%	4.1%	5.0%	11.3%	10.4%
'96-'01	35.1%	36.2%	24.4%	27.3%	19.5%	26.7%	30.3%	14.5%	16.6%
'91-'01	52.1%	57.0%	45.1%	44.0%	38.6%	51.3%	48.4%	17.0%	22.0%
'81-'91	60.5%	57.1%	74.2%	77.3%	34.3%	46.3%	59.2%	2.7%	-13.8%

Notes: Columns (1) and (2) are indexes, equal to 100 in the first quarter of 1980 and the first quarter of 1987, respectively.
Columns (3) to (7) are in thousands of dollars.
Columns (8) and (9) are based on median new and existing sales prices and 30 year mortgage with 80% LTV.
Sources: Office of Federal Housing Enterprise Oversight, Freddie Mac, Census Bureau, National Association of Realtors.

prices and incomes are used, the current ratio of house prices to incomes is about the same as, or is less than, ratios in the 1970s and 1980s. In the past few years, however, some measures of prices increased faster than incomes. From 1996 to 2001, per capita personal incomes increased by about 26 percent and median household incomes increased by about 24 percent, which was less than the 35 to 36 percent increases in the repeat-sale house price indices. But the income increases were generally in line with the increases in median new and existing home prices and were above the 20 percent increase in the quality-adjusted hedonic index of new home prices. Over the longer period from 1991 to 2001, increases in incomes were comparable to increases in the repeat-sales price indices and the median and average existing home prices. The new home price measures increased by less than income over that period.

Figure 1 shows the ratio of existing home prices to personal income per capita. Two measures of existing home prices are used: the median sales price reported by the National Association of Realtors, and estimates based on the OFHEO repeat-sales index. The OFHEO index is converted to a dollar value by setting it equal to the NAR median in 1990. Despite the increases in the OFHEO index in the past few years, the price/income ratio in 2001 was virtually equal to the ratio in 1991. The NAR price was a nearly-constant multiple of per capita income throughout the past decade. Both ratios were lower in 2001 than in the 1970s or 1980s.

Figure 2 shows the ratio of existing home prices to median household income, as reported in the Census Bureau's Current Population Survey. Median household incomes have not increased as fast as per capita personal incomes, partly because an increased share of households now consist of people living alone, with married couples representing a smaller share. Also, more income has gone to people in the upper end of the income distribution, which raises the per capita average without necessarily raising the median. With median household income as the denominator, the price to income ratio was slightly higher in 2001 than in 1991.

Figure 3 shows the ratio of the price of new homes to per capita income. The price measure is the Census Bureau's quality-adjusted

Figure 2. Ratio of Existing Home Price to Median Household Income
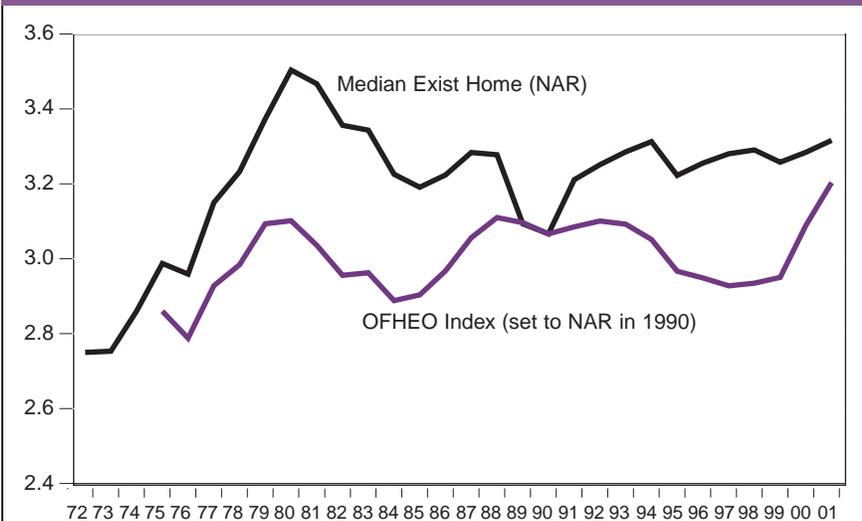
Source: House prices based on NAR and OFHEO, income from Current Population Survey (with NAHB estimate for 2001).

estimate of what new homes with characteristics equivalent to those sold in 1996 would have cost in each year. The ratio in 2001 was a record low. Compared to the 1979 start of the quality-adjusted price series, the ratio was down by nearly a third.

Declines in mortgage rates have meant that monthly payments of principal and interest as a share of income are generally much lower than 10 or 20 years ago. Figure 4 shows the principal and interest on a mortgage to buy an existing home, as a share of median household income. The calculation assumes a 30-year mortgage with a loan-to-value ratio of 80 percent. The mortgage rate used in the calculation is the annual average from Freddie Mac's weekly survey of lenders. The mortgage payment burden in 2001 was near the lowest value since the early 1970s. The jump in the OFHEO house price measure in 2001was more than off-set by the drop in mortgage rates. Indeed, the impact of the mortgage rate is so dominant that it is diffi-cult to recognize that the price and income values incorporated in fig-

ure 4 are the same as in figure 2.

The ratio of the market values of properties to the rents they could generate can be an indication of speculative valuation. When sales prices are high relative to current rents, for a given level of interest rates, it implies that purchasers expect rents to increase, or that they expect someone else will pay even more for the stream of actual or implicit rent payments in the future.

Since 1983, the Bureau of Labor Statistics has calculated an index for the implicit rental value of owner-occupied homes, based on the rents paid on renter-occupied homes that are similar in terms of location and structure type. Figure 5 shows the ratio of the OFHEO house price index to the CPI for Owners' Equivalent Rent, with the ratio set to 100 in 1990. The value of this price to rent measure was 108 in 2001. The rent index grew more slowly than any of the home price measures in recent years. With lower interest rates, however, the 22 percent increase since 1991 in principal and interest payments on a mortgage to buy a median-priced existing home was well below the 37 percent increase in the rent index. Investors (or households investing in their own homes) will be willing to pay more for the stream of (actual or implicit) rents when the cost of funds, as well as the returns available on alternative investments, are low.

The share of the cost of a new home attributable to the cost of the finished lot in 2000 was no higher than in earlier years,[5] with the national average share (including

Figure 3. Ratio of 1996-Type New Home to Per Capita Income
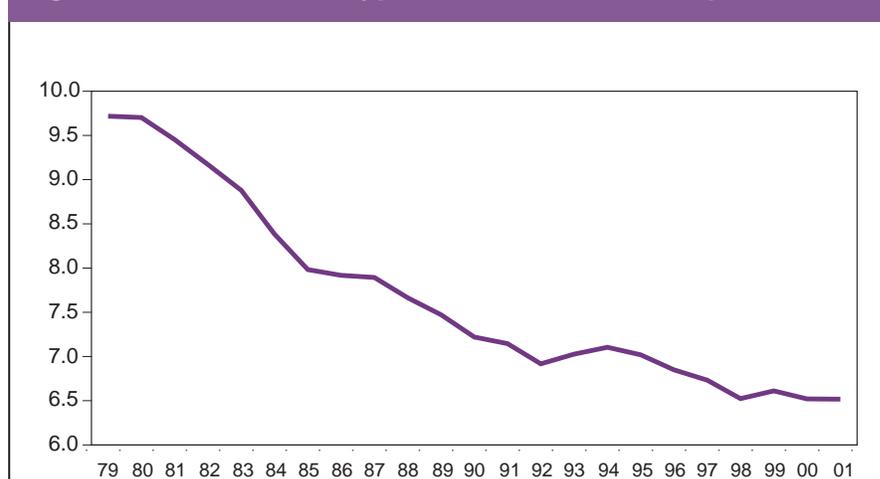
Source: New home price based on average price in 1996 and Census Quality-Adjusted Index. Personal income per capital from NIPA, table 8-7.

Table 2. Income and Other Prices					
		CPI		Income	
Year	Mortgage Rate	All Items	Owner's Rent	Per Cap Personal	Median Househld
	(1)	(2)	(3)	(4)	(5)
1975	9.1	53.8	na	6.17	11.80
1976	8.9	56.9	na	6.77	12.87
1977	8.9	60.6	na	7.43	13.57
1978	9.6	65.2	na	8.30	15.06
1979	11.2	72.6	na	9.25	16.46
1980	13.7	82.4	na	10.21	17.71
1981	16.6	90.9	na	11.30	19.07
1982	16.0	96.5	na	11.92	20.17
1983	13.2	99.6	102.5	12.58	20.89
1984	13.9	103.9	107.3	13.85	22.42
1985	12.4	107.6	113.2	14.74	23.62
1986	10.2	109.6	119.4	15.43	24.90
1987	10.2	113.6	124.8	16.32	26.06
1988	10.3	118.3	131.1	17.43	27.23
1989	10.3	124.0	137.4	18.59	28.91
1990	10.1	130.7	144.8	19.61	29.94
1991	9.3	136.2	150.4	20.07	30.13
1992	8.4	140.3	155.5	21.00	30.64
1993	7.3	144.5	160.5	21.57	31.24
1994	8.4	148.2	165.8	22.37	32.26
1995	7.9	152.4	171.3	23.28	34.08
1996	7.8	156.9	176.8	24.30	35.49
1997	7.6	160.5	181.9	25.43	37.01
1998	6.9	163.0	187.8	26.91	38.89
1999	7.4	166.6	192.9	27.86	40.82
2000	8.1	172.2	198.7	29.45	42.15
2001	7.0	177.1	206.3	30.51	44.13
Change					
'00-'01		2.8%	3.8%	3.6%	4.7%
'99-'00		3.4%	3.0%	5.7%	3.3%
'96-'01		12.9%	16.7%	25.6%	24.3%
'91-'01		30.0%	37.1%	52.0%	46.5%
'81-'91		49.8%	na	77.6%	57.9%

Notes:Column (1) in percent, annual average for mortgage commitment rate
Columns (2) and (3) are index values with 1982-84=100 and Dec. 1982=100, respectively
Columns (4) and (5) in thousands of dollars
Sources: Freddie Mac, Bureau of Labor Statistics, Bureau of Economc Analysis, Census Bureau. Median household income for 2001 estimated by NAHB.

the cost of installing infrastructure and other development expenses) at about 20 percent. The potential for a price decline is greater when land accounts for a high share of value. The reproduction cost of the structure serves as an effective floor for home prices, at least in places with any need for additional housing, but there is no comparable floor for the value of raw land (except perhaps for agricultural value). Even in the more expensive locations in the U.S., the land share is much lower than it was in places like Tokyo or London, where there were sharp drops in house prices during the past decade.

At the local level, where house price bubbles and actual declines in house prices are more likely to occur, the information available to identify bubbles is more limited, and subject to greater measurement error. Prices for new homes are generally not available, with or without adjustments for quality change. Median prices for existing homes sales in 139 metropolitan areas are available from the National Association of Realtors, and there are repeat-sales indices from OFHEO and/or Freddie Mac for 185 areas. Since 1991, NAHB has been tabulating sales price data for about 170 metropolitan areas in connection with the construction of a Housing Opportunity Index. The HOI data include sales of both new and existing homes. Employment and permit data are available on a monthly basis for most areas.

Information is shown in table 3 for the 26 metropolitan areas for which CPI data are available. The CPI data actually cover broader "consolidated" metropolitan areas (CMSAs) in many cases, but they are used here along with house price and income data for the largest primary metropolitan area (PMSA) within the CMSA.6 Estimates of per capita personal income for 2000 and 2001 were calculated by *economy.com* and NAHB. HUD estimates of median family income are also shown.

The relationship of house prices to income in 2001 is shown by the ratio of the median existing home price to per capita personal income, as well as by NAHB's Housing Opportunity Index, which measures the share of homes sold in the area that would be affordable with HUD's estimate of median family income. In addition, the price/income ratio for each area is compared with ratios for other years from 1982 (based on OFHEO and per capita income). For example, the highest ratio over the 1982-2001 period in Philadelphia was in 1988, and the 2001 ratio was 77 percent of the 1988 ratio.

A preliminary analysis of annual house price data for these areas over the past 20 years reveals that there is

Figure 4. Mortgage Payment (P&I) as a Share of Median Household Income

P&I on NAR Median/Median Household Income

P&I on OFHEO/Median Household Income
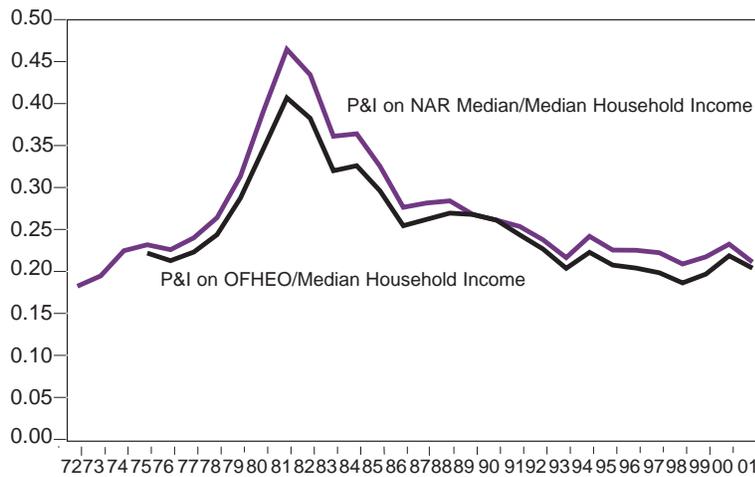
Source: P&I based on home price with 80% LTV and 30 year mortgage rate (Freddie Mac survey).

a lot of momentum, or "serial correlation" in house prices. Moreover, large increases are more common than large decreases. In cases where prices have declined, because of large unsustainable house price increases in preceding years and/or because the local economy suffered a shock such as the collapse of the energy sector or large defense cutbacks, the slump generally consisted of several years of stagnant prices or modest reductions in prices, rather than a short, severe correction—a fizzle rather than a pop.

Demand and Supply

Even though new construction accounts for a relatively small share of the total supply of housing in an area, the supply of newly-built homes, relative to growth in demand, is a key factor in house price dynamics. Areas where demand has grown but where new construction hasn't adequately increased in response tend to experience large increases in house prices. Conversely, when there is an abundance of new housing, but demand growth is low and/or decel-

erating, house prices soften.

One shorthand measure of the growth in demand relative to construction is the ratio of change in employment to housing permits. Table 3 shows this ratio for the last 5 years, as well as for the preceding 5 years. Over the past decade, at the national level, growth in payroll employment has averaged about 1.6 to 1.7 times the number of permits. A

ratio of change in employment to permits in a local area above 2.0 may signal upward pressure on house prices, as well as potential for increased construction. A ratio much below 1.5 may imply weakness in prices and a possible decline in starts.

This rule of thumb is, however, simplistic. Employment does not directly translate into housing demand. The actual elements of demand, such as population growth and household formations, are not accurately measured on a timely basis, so employment is used as a proxy. Employment growth will generate, and will reflect, migration into an area, as well as an improved economic climate allowing more current residents to form independent households. In 2001, when most areas saw net reductions in employment, the lack of growth in area employment was less likely to represent net outmigration.

In primary metropolitan areas that are part of larger clusters, the people employed in the area may be housed in other nearby areas, so additional employment may not translate into housing demand. This

Figure 5. House Price/Owner's Rent

1990 = 100
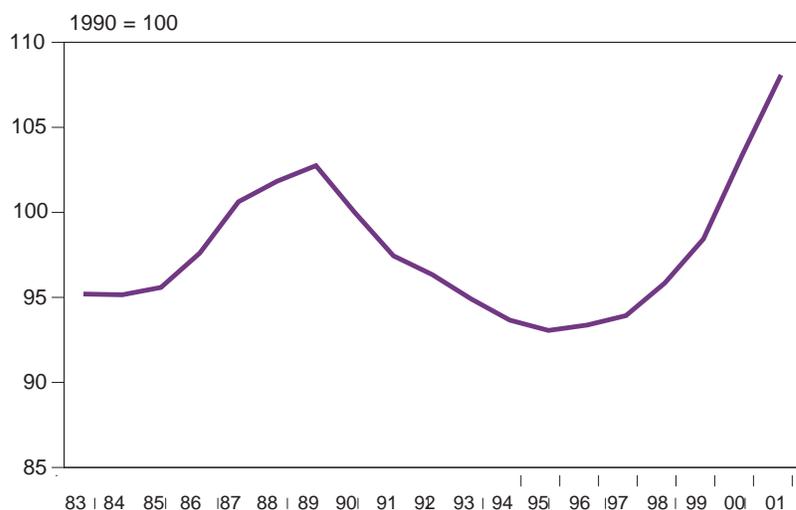
Source: Based on OFHEO House Price Index and CPI.

commuter effect is reflected in the very high ratios shown in table 3 for Los Angeles, San Francisco, and New York. Even if data on employment and permits for the broader consolidated metropolitan areas centered in New York, Los Angeles, and San Francisco are used, however, those areas still had ratios of employment change to permits of over 3 during the latest 5 years.

Because net migration into an area will depend on employment growth relative to growth elsewhere, the difference between the rate of employment growth in an area and the national rate of employment growth may also be an important indication of housing demand and potential house price increases in the area.

The data show that there is no single factor that obviously accounts for the differences in house price movements among the areas shown. In some cases house price increases have come along with increased rents, but in areas such as Chicago and Dallas rent increases exceeded the national average during 1996 to 2001, but price increases were smaller than the national average. Boston, San Diego, San Francisco, and other areas appear to have had price increases, as well as rent increases, propelled by employment growth that has outpaced home building. There were also, however, above-average increases in prices and rents in Atlanta and Minneapolis, where construction has generally kept pace with employment growth.

The changes during 1996 to 2001 often made up for inconsistencies during 1991 to 1996. For example, during the earlier period rents increased far more than house prices in many areas, including Houston, New York, Philadelphia, and Washington, DC. In last 5 years, price increases exceeded rent increases in those areas, even more than elsewhere.

House prices don't necessarily tend to move toward the national average. In fact, some of the largest price increases over the past 2 decades were in places that were already expensive in the early 1980s. Places where there are physical barriers to growth, such as an ocean, a large lake, or mountains, or where there are strict regulatory barriers, may have persistently high prices relative to income.[7] Such places are, however, more likely to experience large (positive or negative) price changes than areas with fewer supply constraints.

Statistical analysis of annual price changes since 1989 in the 26 areas shown in table 3 indicates that there is a significant negative correlation between house price increases and the ratios of price to income and price to rent—relative to past ratios for the same area. Price changes were also negatively correlated with mortgage rates. Price changes were positively correlated with employment growth relative to housing starts, with a lag of 1 to 2 years, as well as with similarly-lagged employment growth relative to the nation. Strong momentum in prices, shown by a high correlation of area price changes with price changes in the preceding year, means that prices have to get pretty far out of line with incomes and rents, or there has to be a large shock to employment, in order to stop or reverse a boom, and such corrections do not occur quickly.

The places on the list that have seen their house price to income ratios rise recently to exceed or approach previous peaks include several that are still very affordable, such as Detroit, Chicago, Cleveland, and Milwaukee. Seattle, Portland, Miami, and Denver are not quite as affordable, so record or near-record ratios there may be more worrisome. Places such as the Washington DC, Boston, and New York have seen fairly-large increases in the ratio of house prices to income recently, but the ratios for those areas are still lower than in the late 1980s, and with current mortgage rates, prices are much more affordable than they were then. Areas in California also have ratios that are lower than in the past. The major Texas metros are very affordable, and are far below previous peak ratios of price to income.

Where's the Bubble?

Overall, evidence of a bubble in house prices is underwhelming. A substantial increase in interest rates could lower prices, but prices do not seem to have fully responded to the declines in interest rates that have occurred over the last decade. A few areas may face lower or stagnant prices, but the reasons often have more to do with weakness in the local job market than with distortions in the housing market. In places like Boston, New York, and Washington, as well as southern California, there are still strong upward pressures from growing demand and limited supply, even though price increases in those areas cannot continue at double-digit rates indefinitely.

In some of the articles suggesting a house price bubble, analogies have been made between price to earnings ratios in the stock market and house price to income ratios. A better analogy would be to the price to rent ratio. In any case, depending on the time frame and data used, house price ratios haven't increased, or have increased modestly, unlike the stock market, where P/E ratios became, and remain, far above his-

Table 3. Metro Pric

	Anchorage, AK	Atlanta, GA	Boston, MA-NH	Chicago, IL	Cincinnati OH-KY-IN	Cleveland, OH	Dallas, TX	Denver, CO	Detroit, MI	Honolulu, HI	Houston, TX	Kansas City,
House Price 2001												
HOI Median Price	$145	$154	$245	$194	$126	$125	$156	$199	$147	$211	$137	$116
NAR Median Price	$145	$139	$355	$197	$130	$137	$130	$217	$162	$298	$123	$135
Price Chg 2000-2001												
NAR Median Price	#N/A	6.1%	7.6%	11.1%	2.1%	6.2%	6.0%	10.8%	6.6%	0.9%	6.8%	7.2%
OFHEO Index	6.3%	8.4%	12.1%	6.9%	5.6%	6.2%	7.5%	11.0%	6.6%	6.7%	7.4%	6.5%
2001 Income												
Personal Income Per Cap	$37.3	$34.1	$41.9	$36.8	$32.2	$32.2	$37.5	$38.8	$33.9	$30.8	$34.9	$33.1
HUD Family Income	$60.5	$66.5	$70.0	$70.5	$60.5	$57.0	$64.4	$64.4	$66.5	$62.4	$58.5	$62.2
House Price/Income 2001												
NAR Median/Personal Per Cap	3.9	4.1	8.5	5.4	4.0	4.2	3.5	5.6	4.8	9.7	3.5	4.1
Housing Opportunity Index	79.0	74.4	45.8	59.9	80.1	75.1	67.1	54.3	66.5	54.6	65.4	83.9
'01 Ratio/Max ('82-'01) Ratio	0.71	0.81	0.81	0.98	0.86	0.99	0.59	0.94	1.00	0.76	0.54	0.76
Year of Maximum Ratio	1983	1982	1987	1989	1983	1983	1982	1982	2001	1991	1983	1982
Chg 1996-2001												
OFHEO House Price Index	21%	40%	66%	29%	28%	26%	33%	62%	45%	-1%	36%	36%
NAR Median Price	#N/A	38%	88%	29%	25%	22%	26%	63%	46%	-11%	45%	37%
Personal Income Per Cap	23%	23%	39%	23%	26%	22%	31%	31%	26%	12%	29%	28%
CPI Owners Rent	10%	18%	25%	21%	15%	16%	21%	30%	16%	-1%	18%	19%
Employment	14%	15%	11%	6%	7%	3%	20%	17%	5%	2%	17%	12%
Chg in Empl/Permits '96-'01	2.2	1.0	3.5	1.4	1.2	1.0	1.9	1.4	1.1	0.7	1.8	1.5
Chg 1991-1996												
OFHEO House Price Index	16%	16%	9%	18%	21%	26%	9%	45%	30%	-4%	8%	20%
NAR Median Price	#N/A	13%	12%	17%	23%	30%	17%	50%	38%	-2%	15%	29%
Personal Income Per Cap	13%	29%	25%	27%	24%	21%	29%	29%	27%	11%	25%	24%
CPI Owners Rent	22%	20%	11%	20%	14%	17%	15%	35%	15%	14%	21%	13%
Employment	8%	26%	9%	9%	9%	7%	17%	19%	11%	-3%	11%	13%
Chg in Empl/Permits '91-'96	1.7	1.9	3.0	2.0	1.5	2.1	2.0	2.2	2.4	-0.6	1.9	1.9
Chg 1986-1991												
OFHEO House Price Index	-10%	13%	7%	46%	30%	34%	-11%	0%	42%	118%	5%	9%
NAR Median Price	#N/A	1%	3%	54%	34%	30%	-5%	3%	39%	100%	5%	17%
Personal Income Per Cap	17%	28%	32%	33%	34%	31%	22%	30%	23%	42%	36%	27%
CPI Owners Rent	1%	12%	31%	29%	25%	21%	8%	3%	28%	52%	12%	16%
Employment	9%	14%	0%	7%	16%	19%	7%	6%	1%	18%	16%	8%
Chg in Empl/Permits '86-'91	5.6	1.0	0.1	1.6	2.4	4.6	1.5	1.5	0.2	3.7	4.4	1.2

Note: Median home prices for some cities and years estimated by NAHB to fill in missing values
Sources: Office of Federal Housing Enterprise Oversight, National Association of Realtors, Bureau of Labor Statistics, Census Bureau, NAHB.

torical norms. Moreover, corporate earnings are much less stable than household incomes or residential rents. As Elliot Eisenberg describes elsewhere in this issue, earnings per share for the S&P 500 fell by half in 2001. No similar collapse of incomes or rents is conceivable.

[1] For example, Erin Schulte, "Housing's Strength Raises Another Bubble Concern," *Wall Street Journal,* March 29, 2002; Jonathan R. Laing, "Home Groan," *Barrons,* April 15, 2002.

[2] See Paul Emrath, "Quality-Adjusted New Home Prices." *Housing Economics,* September 1998, pp. 6-9.

[3] The technique was proposed in M.J. Bailey, R.F. Muth, and H.O. Nourse, "A Regression Model for Real Estate Price Index Construction," *Journal of the American Statistical Association*, v.58 (1963), pp. 933-942. It was refined and popularized by Karl E. Case and Robert J. Shiller, "Prices of Single Family Homes Since 1970: New Indexes for Four Cities," *New England Economic Review*, Sep/Oct 1987.

[4] This means that any new transaction may change the estimates for the market as a

es, Incomes, and Rents

Los Angeles, CA	Miami, FL	Milwaukee, WI	Minneapolis, MN-WI	New York, NY	Philadelphia, PA-NJ	Pittsburgh, PA	Portland, OR-WA	San Diego, CA	San Francisco, CA	Seattle, WA	St. Louis, MO-IL	Tampa, FL	Washington, DC	U.S.
$225	$130	$129	$169	$200	$139	$105	$170	$265	$529	$228	$130	$111	$189	$157
$240	$163	$149	$166	$256	$134	$97	$172	$299	$476	$243	$112	$122	$211	$146
11.0%	13.2%	7.0%	11.9%	11.1%	8.2%	4.3%	1.2%	11.3%	5.5%	5.2%	3.9%	9.4%	16.0%	5.8%
9.9%	12.2%	6.0%	11.5%	11.5%	8.6%	7.9%	5.9%	13.1%	11.1%	7.4%	6.4%	11.4%	12.0%	8.6%
$31.4	$25.9	$33.5	$38.4	$41.4	$35.1	$32.5	$32.4	$34.1	$56.8	$41.9	$32.7	$30.3	$42.6	$30.5
$54.5	$45.6	$63.5	$74.7	$59.1	$60.1	$45.5	$55.9	$56.9	$80.1	$72.2	$60.4	$47.7	$85.6	$52.5
7.6	6.3	4.5	4.3	6.2	3.8	3.0	5.3	8.7	8.4	5.8	3.4	4.0	5.0	4.8
38.2	57.2	74.2	78.6	50.9	68.3	64.5	39.6	24.1	7.4	56.5	75.7	74.9	76.2	63.7
0.79	0.94	0.96	0.88	0.78	0.77	0.83	1.00	0.90	0.93	0.99	0.87	0.75	0.83	0.92
1989	1982	1983	1982	1987	1988	1983	2001	1990	1989	1990	1983	1982	1989	1982
42%	32%	28%	53%	49%	25%	24%	28%	62%	88%	48%	31%	41%	33%	35%
40%	44%	26%	45%	46%	12%	15%	22%	71%	79%	48%	24%	50%	32%	27%
26%	16%	23%	29%	24%	25%	28%	21%	37%	41%	34%	24%	24%	29%	26%
16%	12%	9%	20%	17%	14%	10%	16%	28%	41%	24%	9%	15%	15%	17%
8%	10%	6%	10%	10%	8%	7%	10%	21%	13%	14%	4%	21%	15%	11%
4.3	1.5	1.5	1.6	5.0	2.3	2.3	1.1	3.1	5.6	1.9	0.9	2.1	2.0	2.0
-19%	25%	29%	22%	2%	2%	19%	52%	-9%	-4%	13%	16%	10%	1%	13%
-21%	21%	32%	26%	3%	2%	15%	59%	-7%	2%	15%	15%	14%	3%	19%
13%	19%	27%	27%	25%	22%	22%	27%	16%	26%	24%	24%	26%	19%	21%
6%	21%	25%	16%	17%	12%	24%	26%	6%	12%	17%	15%	17%	11%	18%
-5%	10%	8%	14%	0%	3%	4%	21%	5%	1%	9%	8%	19%	6%	10%
-4.6	1.6	1.8	2.2	-0.2	1.0	1.5	1.9	1.4	0.8	1.4	1.6	2.5	0.9	1.8
75%	20%	31%	17%	24%	49%	32%	42%	60%	73%	71%	15%	10%	50%	26%
70%	14%	29%	17%	7%	56%	30%	44%	59%	70%	85%	12%	17%	53%	21%
26%	25%	30%	28%	39%	35%	38%	34%	24%	33%	36%	29%	28%	33%	30%
30%	18%	32%	16%	38%	38%	20%	33%	25%	23%	34%	20%	#N/A	30%	26%
3%	7%	11%	12%	-4%	2%	20%	36%	19%	4%	26%	6%	13%	15%	9%
0.7	0.8	2.0	1.6	-2.9	0.4	5.6	2.9	1.5	1.5	2.1	1.1	1.2	1.7	1.4

whole for all periods since the last time that the property was sold or appraised. At the national level, revisions are generally small, but at the local level are often large, and the revised estimates of price increases tend to be smaller than the initial estimates. See John M. Clapp and Carmelo Giaccotto, "Revisions in Repeat-Sales Indexes: Here Today, Gone Tomorrow?" *Real Estate Economics*, v. 27, no. 1 (1999), pp. 79-104.

[5] Michael Carliner, "New Home Structures and Land," *Housing Economics,* January 2002, pp. 6-8.

[6] In the case of Boston, some of the data in the table and in the pooled regression analysis are for the larger New England County Metropolitan Area. In the New England states, unlike the rest of the nation, PMSAs and CMSAs are defined in terms

of towns, rather than counties.

[7] An attempt to measure the effects of such factors in a hedonic model is reported in Stephen Malpezzi, Gregory H. Chun, and Richard K. Green, "New Place-to-Place Price Indexes for U.S. Metropolitan Areas, and Their Determinants," *Real Estate Economics* v. 28 (1999), no. 2, pp. 235-274.