

Highlights—Part I

Technical Changes in the Construction of the U.S. Index

With this release, OFHEO has made two modifications to the way in which its national house price indexes are computed. The technical changes, which affect the all-transactions and purchase-only indexes,¹ are used in constructing the 2007Q4 index estimates and will be implemented in all future HPI releases.

The first alteration involves the weights that are used in building the national index. OFHEO has always computed and will continue to compute the national index as a weighted average of the nine Census Division indexes. Until this release, the weights employed were the shares of one-unit, detached properties in each Division as estimated in the 2000 Census.² The 2000 Census shares were used to construct the entire historical U.S. series. For example, the Year 2000 shares were used in constructing the national index value for 1976, even though the proportion of properties in each Census Division may have differed in that earlier period.

An improved method, the one which will be employed hereafter, allows the shares to differ by time period. The weight for a given Census Division in a particular year reflects an estimate of the share of properties that were in that Census Division *at the time*. Unfortunately, Census data are only available every ten years. To arrive at a reasonable estimate for a given year, however, one can use data from the preceding and subsequent Census shares. One convenient methodology is to construct a weighted average of the relevant shares in the prior and subsequent Censuses, where the weights are changed by ten percentage points each year.

To illustrate, under this system, the Pacific Division weights for the years between 1975 and 1981 are:

1975: 0.5 x the Pacific Division's share of single-family, detached properties estimated in 1970 Census + 0.5 x the Pacific's share of single, family detached properties estimated in 1980 Census

1976: 0.4 x the Pacific Division's share of single-family, detached properties estimated in 1970 Census + 0.6 x the Pacific's share of single, family detached properties estimated in 1980 Census

1977: 0.3 x the Pacific Division's share of single-family, detached properties estimated in 1970 Census + 0.7 x the Pacific's share of single, family detached properties estimated in 1980 Census

1978: 0.2 x the Pacific Division's share of single-family, detached properties estimated in

¹ The "purchase-only" indexes are estimated using the same methodology as the traditional HPI, except appraisal valuations from refinances are omitted from the estimation sample.

² See <http://www.census.gov/hhes/www/housing/census/historic/units.html> for estimates from the 2000 Census and previous years' estimates.

1970 Census + 0.8 x the Pacific's share of single, family detached properties estimated in 1980 Census

1979: 0.1 x the Pacific Division's share of single-family, detached properties estimated in 1970 Census + 0.9 x the Pacific's share of single, family detached properties estimated in 1980 Census

1980: 1.0 x the Pacific Division's share of single-family, detached properties estimated in 1980 Census + 0.0 x the Pacific's share of single, family detached properties estimated in 1990 Census

1981: 0.9 x the Pacific Division's share of single-family, detached properties estimated in 1980 Census + 0.1 x the Pacific's share of single, family detached properties estimated in 1990 Census

Because the 2010 Census Data are currently unavailable, for all years 2000 and later, shares from the 2000 Census data will be used. Those shares are: South Atlantic 18.6 percent, East North Central 17.7 percent, Pacific 13.9 percent, West South Central 11.8 percent, Middle Atlantic 11.3 percent, West North Central, 8.2 percent, East South Central 7.0 percent, Mountain 6.6 percent, and New England 4.9 percent. Once the 2010 Census data become available, then the 2000-2009 national index figures will be adjusted to reflect the new methodology.

Under the new methodology, for years prior to 2000, the Census Division shares do not change dramatically, even over decades-long intervals. For example, the share of properties in the South Atlantic Census Division—the Division with the greatest change—grew from about 16.2 percent in 1975 to 18.6 percent in the most recent Census. Because the 2000 Census data were used previously, this change does not have an impact on post-2000 estimates. Because pre-2000 share changes are very small, this adjustment generally has a minimal effect on the overall national HPI.

The second change to the national index construction is unrelated to the first issue and has a slightly larger impact on index estimates. Under the past methodology, which constructed a national index as a weighted average of Census Division index *levels*, price changes for the national index are more influenced by price trends in divisions that have experienced greater price growth since the base period. This greater influence is not desired: for OFHEO's purposes, the national index aims to weight the Census Divisions in a way that only reflects their current shares of the relevant housing stock.

One way of mitigating this problem would be to periodically rebase the index, resetting the base period frequently so that the differences in absolute index levels across Census Divisions remain small. This approach is inconvenient, however. A more direct method, which OFHEO will now use, is to calculate the weighted average price changes across the nine Census Divisions. Instead of constructing the national index as a weighted average of the Census Division index *levels*, the approach calculates the weighted average quarterly price change across the nine Census Divisions, and then changes the prior national index value by the weighted average percentage. The

weights in the calculation are as described earlier—they are the year-specific estimates of the Census Division’s share of the housing stock.

Mathematically, the national index in period t (I_t) is constructed as follows:

$$I_t = I_{t-1} \cdot \left[1 + \sum_{Div=1}^9 (S_{Div,t} \cdot \% \text{ Price Change}_{Div}) \right]$$

where Div identifies each of the nine Census Divisions, S is the share (or weight) of a Division, and the $\% \text{ Price Change}$ is the percentage price change for the Census Division relative to the prior quarter.³ As is done currently, the index value is set equal to 100 in 1980Q1 for the quarterly all-transactions HPI and 1991Q1 for the quarterly purchase-only index.⁴ The new monthly index uses January 1991 as its base period (i.e., the index is set to 100 in January 1991).

The impact of the new methodology on the national index is small but nontrivial. Using the latest HPI data, Figures 1a and 1b compares four-quarter price changes for the national index calculated using the old and new methodologies. Figure 1a shows the impact of the change on the purchase-only index and 1b reveals the impact on the all-transactions index. In all cases, the estimates are constructed using the year-specific housing stock shares rather than the static 2000 Census shares.

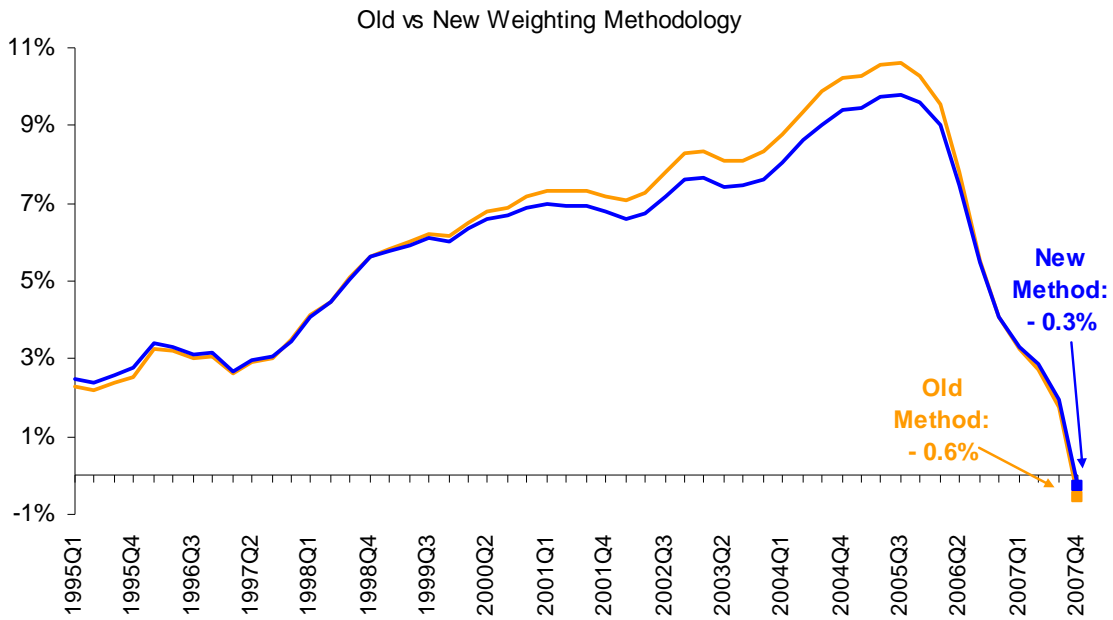
The graphs reveal that the new indexes tend to show lower appreciation rates during the housing boom early in this decade and slightly more modest (though still dramatic) slowdown in recent periods. This difference is a function of the previous methodology’s implicit upweighting of the New England, Middle Atlantic, and Pacific Census Divisions. Those areas experienced the greatest historical appreciation and thus price trends in those areas had relatively strong influence on “national” price trends. Because those areas experienced greater-than-average appreciation during the boom and more significant price weakness of late, once the implicit upweighting of those areas is removed, the new national figures show lower boom-period appreciation and slightly stronger market conditions over the latest year.

³ Note that the new national monthly index is constructed using this new methodology, except the monthly price changes for the Census Divisions are used.

⁴ Under the previous methodology, although the purchase-only index had a stated base period of 1991Q1, it was computed using 1980Q1-based indexes and then re-based to 1991Q1. In other words, the index was estimated in two steps: (1) a weighted average of the 1980Q1-based Census Division indexes was calculated and (2) values of the resulting index were divided by the value of the index in 1991Q1 and multiplied by 100. The result of this “rebased” effort was that the implicit upweighting of high-appreciation Census Division would be similar for the purchase-only index as it was for the all-transactions index.

Under this new approach, the implicit upweight no longer occurs and the choice of base periods does not affect measured appreciation rates.

**Figure 1a: Four-Quarter Prices Changes by Period
U.S. Purchase-Only HPI (Seasonally Adjusted)**



**Figure 1b
Four-Quarter Appreciation in All-Transactions HPI Using Old and New Methodologies
1995Q1 - 2007Q4**

