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The Price of Residential Land in Large U.S. Cities

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Abstract

Combining data from several sources, we build a database of home values, the cost of housing structures, and residential land values for 46 large U.S. metropolitan areas from 1984 to 2004. Our analysis of these new data reveal that since the mid-1980s residential land values have appreciated over a much wider range of cities than is commonly believed. And, since 1998, almost all large U.S. cities have seen significant increases in real residential land prices. Averaging across the cities in our sample, by year-end 2004, the value of residential land accounted for about 50 percent of the total market value of housing, up from 32 percent in 1984. An implication of our results is that the future course of home prices — their average rate of appreciation and their volatility — is likely to be determined even more by the course of land prices than used to be the case.

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1 Introduction

In this paper, we extend the methods proposed by Davis and Heathcote (2004) to decompose home values in 46 of the largest U.S. metropolitan areas into the value of housing structures and and the market value of residential land. Thus, this paper introduces new data for studying secular trends and cyclical dynamics of home prices over the period from 1984 through 2004, and emphasizes some new facts about residential land values over the past twenty years that should help in thinking about the future course of home prices around the country.

For us, learning about home prices means studying land prices. This is because housing structures can be easily produced and, thus, should be supplied elastically to the market. So, the replacement cost of any existing housing structure should be tightly linked to the costs of building a similar structure – the costs of building materials and wages in the construction industry. By contrast, the land, location, and amenities associated with an existing home ("land", for short) cannot necessarily be easily reproduced. Land's relatively inelastic supply means that its market value should largely be determined by demand-side factors, such as household incomes, interest rates, or even speculative activity. Moreover, substantial differences in residential land values across metropolitan areas means that land values can, at times, paint a somewhat different picture of pricing dynamics than home values would seem to imply.

Following Davis and Heathcote (2005), our measurement and analytical framework centers on the idea that the percentage change in home prices in city j during period t (denoted g_{jt}^{hp}) equals the weighted average of the percentage change in construction costs (g_{jt}^{cc}) and the change in residential land prices (g_{jt}^{lp}):[1]

$$g_{jt}^{hp} = \omega_{jt-1}^{l} g_{jt}^{lp} + (1 - \omega_{jt-1}^{l}) g_{jt}^{cc}. \tag{1}$$

Here, the weight ω_{jt-1}^{l} equals the share of home value accounted for by the market value of residential land at the beginning of the period.

We take observations on the percentage change in home prices in major MSAs from Freddie Mac's Conventional Home Price Index (CMHPI), and we obtain construction costs at the city level from data published by R.S. Means Company. To infer the percentage change in land prices, we compute the weights in equation (1) at a benchmark date with estimates based on data on home values and housing characteristics from the Metropolitan American Housing Surveys that are available for 46 large U.S. metropolitan areas ("cities", for short). Given these estimates at

[1] If p_{jt}^{h} denotes an index for home prices in city j for period t, $g_{jt}^{hp} = \frac{p_{jt}^{h}}{p_{jt-1}^{h}} - 1$.

the benchmark date, we apply a dynamic equation that is compatible with (1) to derive a full time-series for land's share of home values (back to 1984) based on observed changes in home prices and construction costs in each metro area.

Using these new data, we show that across the wide range of cities in our sample — along the coasts and across the nation's interior — land prices have significantly outpaced construction costs since 1984, driving up land's share of home value (ω_{jt}^{l}) by an average of almost 20 percentage points over this period. Although we estimate that residential land accounted for less than a quarter of home value in quite a number of large U.S. metro areas twenty years ago, these days that is true only in Oklahoma City.

Another striking result is just how widespread the strength of land prices has been in the current housing boom — taken to have begun at the end of 1998. We show that in 43 of the 46 large metropolitan areas in our sample, a rapid pace of land price appreciation has pushed up land's share of home value markedly in just the past six years. To be sure, since 1998 land has appreciated at the fastest pace in cities along the East and West coasts, where new residential land was arguably in shortest supply. In these areas — where in 1998 land already accounted for a large share of home value — home prices and land prices tell quite a similar story. But, because in 1998 land was not so expensive in places like Houston, Kansas City, Milwaukee, Minneapolis, Pittsburgh, St. Louis, and Tampa, our data on land prices show the significant imprint that has been left by the recent housing boom — an imprint which is understated to an important extent in data on home prices.

We also emphasize that even though residential land has appreciated significantly, on net, over the past past twenty years, for most large metro areas the path has been more of a roller coaster ride than a steady upward march. Indeed, we show that 39 of the 46 cities in our sample have experienced a clear peak in the real residential land price index, and in many of these cities it has taken 10 years or more for land prices to fully recover from their previous troughs.

Our point estimates for residential land values and their price indexes are derived using several formulas, different sources of data, and a few assumptions about unobserved quantities. However, our main results are rather robust, as they come from interpreting the sizes of changes in Freddie Mac's CMHPI relative to changes in construction costs, measured by data from R.S. Means. Consider, for example, the cases of Minneapolis-St. Paul and San Francisco. Few would disagree that residential land is relatively inexpensive in the former city; our methods estimate land's share of home value in 1984 to have been 0.12 in Minneapolis-St. Paul and 0.75 in San

Francisco. Now, suppose that construction costs were flat in real terms in both cities so that equation (1) reduces to

$$g_{jt}^{hp} = \omega_{jt-1}^{l} g_{jt}^{lp}$$

for $j = \{SF, MSP\}$. If land prices had increased at about the same rate in both cities ($g_{j=SF,t}^{lp} = g_{j=MSP,t}^{lp}$), then we would have expected real real home prices to have risen about 6-1/4 times faster in San Francisco than in Minneapolis-St. Paul after 1984 ($\omega_{j=SF,t-1}^{l}/\omega_{j=MSP,t-1}^{l} = 0.75/0.12 = 6.25$). But according to the CMHPI, from 1984 through 2004, home prices in San Francisco rose only about 3 times as fast as in Minneapolis-St. Paul. Thus, we infer that land values must have risen faster in Minneapolis-St. Paul than in San Francisco. All told, we estimate that by 2004, land's share of home value jumped by 34 percentage points in Minneapolis-St. Paul — to 46 percent — whereas in San Francisco, the share increased by 13 percentage points to 88 percent.

To be sure, Minneapolis-St. Paul is an extreme case from our sample, but it may help to clarify that our main results stem from recognizing that in places where land is relatively inexpensive and when land prices are stable, one would expect home prices to move closely with construction costs. And, if one observes home prices outpacing construction costs in places where land has been relatively inexpensive, land must be appreciating at a fairly rapid clip.

The data we bring to bear on these issues is similar to that of Glaeser *et al.* (2005) and others, but our specific estimation methods differ somewhat from theirs, as do our our points of emphasis and conclusions. For example, Gyourko and Saiz (2004) compare construction costs and home prices around the country, but focus on the distribution of land values *within* metropolitan areas. A similar emphasis on differences across neighborhoods within MSAs led Glaeser *et al.* (2004, p. 2) to state that "In the sprawling cities of the American heartland, land remains cheap . . ."

In contrast, we focus on the average value of residential land across an MSA, recognizing that our estimation methods implicitly put relatively greater weight on homes in the more expensive neighborhoods in each MSA. And, although land may be cheap for a sizable fraction of the homes in each large city, we report that, on average, land commands a significant share of home value in most of them. Indeed, as shown in table 6 (toward the end of the paper), by year-end 2004, land accounted for just under half of home value in the median metropolitan area in our sample (Denver). And, even among the bottom quartile of cities in our sample, land's share of home value averaged 29 percent in 2004, up from just 8 percent in 1984. To be sure, land has remained much less expensive across the "heartland" than in cities along the coasts, but over the past two decades — particularly in the past six years — it has become much more expensive just about everywhere.

We should note that in this paper we do not take a firm stand on just why land values have soared everywhere, or on whether current or historical valuations look about "right" around the country. Glaeser *et al.* (2005) and Quigley and Raphael (2005) have argued that zoning restrictions have played a large role in land-price appreciation, at least in some major metro areas. Zoning restrictions would hold down the elasticity of supply of residential land, and thus might explain the surge in the value of land associated with existing homes. Additionally, Campbell *et al.* (2006) have argued that real interest rates, which have trended down over the past two decades and have been near historic lows in recent years, have also played an important role in stimulating the demand for housing. According with the logic outlined above, we would expect the effects of low interest rates to lead to a particularly rapid appreciation of residential land across the country, although variation in zoning regulations could imply different rates of appreciation in different cities. Further, Davidoff (2005) has argued that the price of land capitalizes the net present value of income opportunities in each metro area, and recent changes to land prices may reflect the extent to which these opportunities have changed. At this point though, we have left to future research an assessment of the quantitative significance of differential zoning regulations, interest rates, or other factors on land valuations across the country.

That said, we emphasize the implication of our data and analysis that, with residential land having appreciated so significantly over the past twenty years around the country, the future course of land prices is expected to play an even more prominent role in governing home prices — in terms of average appreciation rates and volatility — in the next two decades.

The next section of the paper is a detailed description of our source data and methods for estimating land's share of home value and generating a constant-quality price index for residential land across large U.S. metropolitan areas. Section 3 reports evidence on the average pace of appreciation and variability of land prices across our sample of metropolitan areas since 1984, with a particular emphasis on the patterns seen in the current housing boom. The final section of the paper discusses the implications of our main empirical results.

2 Data and Methods

In this section, we describe exactly how we merge different sources of data to compute quarterly time-series estimates, for 46 major MSAs in the United States, of (a) the average value of land as a fraction of average home value and (b) the growth rates of residential land prices (constant-quality). For each MSA, the estimation process occurs in 3 steps that are each discussed in detail below.[2] The complete set of data we create and use (except for the R.S. Means data) are available upon request. For reference, the data labels original to each source (CMHPI, R.S Means, and BEA) are listed in table 1.

2.1 Merging house price, construction cost, and household data

In the first step, we merge MSA-level data from three different sources. We use the MSA-specific Conventional Mortgage House Price Index ("CMHPI"), produced by Freddie Mac, for information on changes of prices of existing homes; MSA-indexes for the growth and level of construction costs as published by R.S. Means (2004); and an estimate of the number of households in each MSA that we create from data from the Bureau of Economic Analysis ("BEA") and the Census Bureau.

Changes in home prices. The CMHPI is a repeat-transactions price index for existing homes published quarterly.[3] Changes in this price index provide an estimate of growth in house prices holding quality roughly fixed between two consecutive periods. Appendix A presents evidence that the published level of the MSA-specific CMHPI contains significant measurement error, and describes a state-space model that we use to filter the quarterly CMHPI for each city.[4]

Changes in construction costs. The book "Square Foot Costs," published by R.S. Means, contains time-series price indexes for residential construction costs for most major cities in every state, with annual observations beginning in 1982.[5] Since the published index values refer to "January" of each year, we shift the series slightly and relabel the published index value for January of year y as the index value for the fourth quarter of year $y-1$. We generate a quarterly index for each city by assuming constant quarterly growth rates between years. The indexes can

[2] We use the words "city" and "MSA" interchangeably, although all our data are for MSAs.

[3] The raw CMHPI data are available for download at http://www.freddiemac.com/finance/cmhpi/.

[4] As shown by King and Rebelo (1993), the state-space model encompasses the well-known Hodrick-Prescott filter. This filtering does not materially alter any of our results because the noise in the CMHPI is not so pronounced after 1984.

[5] As reported in table 1, R.S. Means does not publish construction cost indexes for Oakland and San Jose. For these two MSAs, we use the construction cost index for San Francisco.

be combined with time-series information (also from R.S. Means) on residential construction costs nationwide to construct dollar costs-per-square-foot for building single-family homes in each city since 1982. As described below, we merge these square foot construction costs with data from the Metropolitan American Housing Surveys to estimate the value of residential structures in each city.

Changes in the number of households. We cannot find time-series on the number of households in each MSA, which we use to proxy the pace of construction of new homes (described later). Instead, we create an estimate by dividing annual data on the population in each MSA, published by the BEA, by annual data on aggregate U.S. household size from the Census Bureau. We convert the data to a quarterly basis by assuming that the annual data refers to the second quarter of each year and by assuming constant quarterly growth rates between years.

Our data for household size in the aggregate U.S. comes from Table HH-4, "Households by Size: 1960 to Present," of the Current Population Survey (CPS) Reports.[6] The BEA population-by-MSA data are available in the Regional Economic Accounts, Local Area Annual Estimates, Table CA1-3, "Personal income and population summary estimates," for Metropolitan Statistical Areas.[7] The BEA publish population estimates for all CSAs ("Consolidated Statistical Areas"), MSAs, Metropolitan Divisions, and Micropolitan Statistical Areas. For almost all our cities, we use the MSA estimates; for Los Angeles and Anaheim, Dallas and Fort Worth, and San Francisco and Oakland we use the Metropolitan Division data; and for the New York MSA, we add together the New York-White Plains-Wayne and Nassau-Suffolk Metropolitan Divisions.

Of course, the assumption that household size is the same across MSAs is most likely incorrect. However, for our calculations on changes in land prices to be accurate, we only require that the percent change in the number of households is correct, not the actual number of households.

2.2 Creating Benchmark Structures Shares

In the next step of the process, we combine micro data for a few key variables from the Metropolitan American Housing Survey, denoted throughout as AHS-M, with data on construction costs from R.S. Means to estimate a benchmark structures share of house value for each city. The specific MSAs surveyed and dates of the survey that are included in our study are

[6] These reports are available at http://www.census.gov/population/www/socdemo/hh-fam.html.

[7] These data are available at http://www.bea.doc.gov/bea/regional/reis/.

listed in the rightmost column of table 1. For each MSA we use data from the most recent AHS-M, with the exception of New York, Los Angeles, Chicago, Philadelphia, and Detroit. For these cities, we use data from the 1989, 1991, or 1993 AHS-M. For these cities, a specific AHS-M is not collected after 1993, rather the cities are oversampled in the national AHS. We do not use the national AHS because the top-code value for home values has been fixed at $350,000 for some time, and it is therefore quite difficult to reliably calculate average home values in these cities. For example, in the 2003 national AHS more than 40 percent of the observations of owner-occupied single-family detached units in the Los Angeles MSA are top-coded.[8]

We use the following set of variables from each AHS-M:[9]

- *tenure* and *nunit2*. *tenure* characterizes the owned/rented/vacant status of the unit. *nunit2* specifies whether the structure is single-family detached or attached or in a multiple-unit building. Our sample includes only owner-occupied single-family detached dwellings.

- *built*, *cellar*, *garage*, *floors*, and *unitsf*. *built* records the year the structure was built, *cellar* whether the unit has a partial or full basement, *garage* indicates whether the unit has an attached or detached garage, *floors* the number of floors of the structure, and *unitsf* is the finished square footage of the structure. We use these variables, along with data from R.S. Means, to compute the new building cost of the structure according to the procedure described later in this section.

- *value*. *value* denotes the self-reported market value of the housing unit.

- *weight*. *weight* specifies the sampling weight of the unit reported in the AHS-M.

We discard from our sample any housing unit that is missing data for any of these 9 variables. In some cases, *built* brackets the year in which the house was built, in which case the midpoint of the bracket is chosen. Also, *cellar* had to be recoded slightly: We specify that a housing unit has a basement if it has a basement under all or part of the building, but not a concrete slab, crawl space, or "something else" under the building. Finally, *unitsf* and *value* are top-coded at or around the 97th percentile for each city in each AHS-M. We do not adjust the

[8]The top-coded percentages for this set of homes in the New York, Chicago, Philadelphia, and Detroit MSAs in the 2003 national AHS are 38, 16, 14, and 6 percent, respectively.

[9]A full description of each of these variables can be found in the AHS codebook. The current codebook can be downloaded from http://www.huduser.org/Datasets/ahs/AHS_Codebook.pdf.

square-footage of the unit for top-coding but we multiply the top-code of *value* by 1.5, an adjustment we believe is approximately correct based on results in Davis and Heathcote (2004).

The raw unweighted number of observations that meet all of our criteria are listed in table 2. The median number of observations for each AHS-M sample is just under 1,800, with a minimum sample of about 800 (single-family owner-occupied) for the New York metro area and a maximum of more than 2,500 for Salt Lake City.

For each AHS-M and each housing unit in our sample, we calculate an estimate of the cost of rebuilding the structure if it were brand new as of the AHS-M date. To do this, we start by estimating a regression equation to approximate the cost per square foot of rebuilding any given housing unit in 2003:Q4 for a single-family home in an average U.S. city (denoted by R.S. Means as the "National 30-city average"). The estimated equation, which primarily is meant to account for the nonlinear relationship between building costs per square foot and the size of a residential structure, takes the form:

$$\begin{aligned} &\textit{Predicted cost per square foot} = \\ &\$77.8625 + \$11.675 * cellar - \$4.50 * I\,(floors \geq 2) \\ &+\$0.027 * d * (1900 - unitsf) - \$0.008 * (1 - d) * (unitsf - 1900)\,. \end{aligned} \tag{2}$$

$I\,(.)$ is an indicator function; it is equal to 1 if the expression in parentheses is true, 0 otherwise. The dummy variable d is set to 1 if the reported square footage of the unit is less than 1900 square feet, 0 otherwise. The predicted cost-per-square-foot equation (2) captures the facts that, as suggested by the R.S. Means data, a basement increases the building cost per square foot by about 15 percent, multiple-story structures cost less per square foot to build than single-story structures, and the average cost per square foot declines with the total square-footage of the unit, with a kink in the rate of decline at 1900 square feet. To summarize, the estimated coefficients in equation (2) provide a parsimonious way to pool the residential construction costs published by R.S. Means for many different sizes of single-family housing structures with different attributes. In our particular application, the cost per square foot in (2) roughly applies to an "average" structure, with three-quarters brick and one-quarter wood veneer, and a basement that is half-finished.[10]

[10] R.S. Means estimates cost-per-square-foot for 11 possible values for total square-feet of living area, for each of four housing units of different quality ("Economy", "Average", "Custom", and "Luxury"), for six different styles of structure for each quality ("1 story", "1-1/2 Story", "2 Story", "2-1/2 Story", "Bi-Level", and "Tri-Level"), and for multiple exterior wall and basement options. See the R.S. Means book for details.

To convert the cost per square foot to a total cost for an average U.S. city at year-end 2003, we multiply the cost-per-square foot from (2) by the reported square footage of the unit and then add $10,000 if the unit has a garage (cost taken from R.S. Means). Finally, to convert the total cost from an average U.S. city in 2003:4 to the appropriate MSA at the date of the AHS-M survey, we multiply this total cost by

$$\frac{\text{R.S. Means Index for the AHS-M MSA, date of AHS-M survey}}{\text{R.S. Means Index for the National 30-city average, 2003:4}}. \tag{3}$$

An example might help clarify how these calculations work. Suppose we wish to calculate the cost of a new single-family home to be built new in the Washington DC MSA in 1998:2, and suppose the home is 2,500 square-foot, with two stories, a garage, and a basement. According to (2), the nationwide cost-per-square foot in 2003:4 would be

$$\$77.8625 + \$11.675 - \$4.50 - \$0.008 * 600 = \$80.24. \tag{4}$$

And, the total nationwide construction cost in 2003:4 (including the garage) would be

$$\$80.24 * 2,500 + \$10,000 = \$210,594. \tag{5}$$

Converting the nationwide construction cost in 2003:4 to the cost for the Washington DC MSA in 1998:2 requires applying the DC area's 1998:2 factor,

$$\$210,594 * \frac{110.07}{133.0} = \$174,286, \tag{6}$$

where 110.07 is the (estimated) R.S. Means index value for Washington, DC in 1998:2 and 133.0 is the R.S. Means Index value for the National 30-city average in 2003:4.

Once we have calculated the cost of building the structure brand new, we depreciate the structure to better estimate its true replacement cost (or market value of the structure). The way to think about depreciation in this context is that it measures the expense required to bring an existing aged structure up to "like-new" standards. This includes expenditures on physical repairs, such as fixing a roof, as well as expenditures on functional improvements, such as improving the insulation. In our calculations, the depreciation on a structure is simply a function of its age. Let $n_{i,t}$ refer to the new building cost of the structure associated with household i in period t and $s_{i,t}$ refer to the replacement cost of the structure after accounting for depreciation. We calculate

$$s_{i,t} = n_{i,t} * \left(\frac{1}{1+\delta}\right)^{age_{i,t}}, \tag{7}$$

where $age_{i,t}$ is the age of the structure of housing unit i, in years, at date t and δ is the annual rate of depreciation. We set $\delta = 0.015$ and discuss the implications of this choice in Appendix B.

Our final step with the AHS-M data, we calculate a benchmark MSA-wide average structures share for the period corresponding to the AHS-M survey date, denoted ω_t^s, as in period t, as

$$\omega_t^s = \frac{\sum_i weight_{i,t} * s_{i,t}}{\sum_i weight_{i,t} * value_{i,t}}. \tag{8}$$

Where $weight_{i,t}$ and $value_{i,t}$ refer to the AHS-M variables associated with housing unit i in period t and the summation in the numerator and denominator is over all households in our included sample for that particular MSA. A nice property of this estimate of ω_t^s is that it does not require that $s_{i,t}$ and $value_{i,t}$ are exactly accurate for every i.[11] Rather, our estimate is consistent even in the presence of additive measurement error in $s_{i,t}$ and $value_{i,t}$ as long as the expected value of the measurement error is 0. That is, if in expectation, homeowners accurately report the value of their house, and, in expectation or on average, our estimates of replacement cost within an MSA are correct, then our estimate of the structures weight in the MSA is not biased.

2.3 Extrapolating Benchmark Structures Shares

In the final step of our procedure, we extrapolate our benchmark structures share for each MSA to uncover a quarterly time-series of structures shares. First, remember that we consider the total value of housing in any MSA in any period t, denoted as $p_t^h h_t$, as the sum of the replacement cost of structures in that MSA, $p_t^s s_t$, and the market value of the land in that MSA, $p_t^l l_t$, that is,

$$p_t^h h_t = p_t^s s_t + p_t^l l_t. \tag{9}$$

Next, we use the observation that the total nominal value of structures in an MSA at period $t+1$, $p_{t+1}^s s_{t+1}$, is equal to the total nominal value in period t, $p_t^s s_t$, revalued for changes to construction costs, plus nominal net new structures — that is, new structures less depreciation. We write this identity as

$$p_{t+1}^s s_{t+1} = p_t^s s_t \left(\frac{p_{t+1}^s}{p_t^s}\right) + p_{t+1}^s \Delta s_{t+1} \tag{10}$$

where $\left(p_{t+1}^s / p_t^s\right)$ accounts for revaluation due to changes in construction costs and $p_{t+1}^s \Delta s_{t+1}$ denotes nominal value of net new structures.

[11] This is unlike Gyourko and Saiz (2004), who graph something like the distribution of $value_{i,t}/s_{i,t}$ within an MSA.

Now, assume that the nominal value of net new structures in an MSA is equal to some proportion, call it θ_t, of the nominal value of net new housing value in that MSA, denoted $p^h_{t+1}\Delta h_{t+1}$,

$$p^s_{t+1}\Delta s_{t+1} = \theta_t p^h_{t+1}\Delta h_{t+1}. \tag{11}$$

This is the same assumption used by Davis and Heathcote (2004).[12] Inserting (11) into (10) produces

$$p^s_{t+1}s_{t+1} = p^s_t s_t\left(\frac{p^s_{t+1}}{p^s_t}\right) + \theta_t p^h_{t+1}\Delta h_{t+1}. \tag{12}$$

To finish, divide both sides of (12) by the nominal value of housing at $t+1$, $p^h_{t+1}h_{t+1}$:

$$\frac{p^s_{t+1}s_{t+1}}{p^h_{t+1}h_{t+1}} = \frac{p^s_t s_t}{p^h_t h_t}\frac{\left(\frac{p^s_{t+1}}{p^s_t}\right)}{\left(\frac{p^h_{t+1}}{p^h_t}\right)}\left(\frac{h_t}{h_{t+1}}\right) + \theta_t\frac{\Delta h_{t+1}}{h_{t+1}}. \tag{13}$$

Note that we used the identity $p^h_{t+1}h_{t+1} = p^h_t h_t\left(\frac{p^h_{t+1}}{p^h_t}\right)\left(\frac{h_{t+1}}{h_t}\right)$ when dividing $p^s_t s_t\left(\frac{p^s_{t+1}}{p^s_t}\right)$ by $p^h_{t+1}h_{t+1}$.

Define the total structures share of aggregate house value in an MSA in period t as $\omega^s_t = \frac{p^s_t s_t}{p^h_t h_t}$. By definition — see equation (9) — this equals $(1-\omega^l_t)$ from equation (1). Substituting this into (13) yields

$$\omega^s_{t+1} = \omega^s_t\frac{\left(\frac{p^s_{t+1}}{p^s_t}\right)}{\left(\frac{p^h_{t+1}}{p^h_t}\right)}\left(\frac{h_t}{h_{t+1}}\right) + \theta_t\frac{\Delta h_{t+1}}{h_{t+1}}. \tag{14}$$

Equation (14) gives us a formula we can use to update our structures share in an MSA from its benchmark value that we calculated in the last section using the AHS-M micro data; that is, given a structures share in period t, ω^s_t, the growth rate of construction costs $\left(p^s_{t+1}/p^s_t\right)$, the growth rate of home prices $\left(p^h_{t+1}/p^h_t\right)$, a value for θ_t (the structures intensity of nominal net new housing), and a proxy for the growth rate of the real housing stock, structures and land, (h_{t+1}/h_t), we can calculate a new structures share, ω^s_{t+1}.

Notice the implications of equation (14). First, in the absence of growth in the housing stock, i.e. $h_{t+1} = h_t$, the structures share in $t+1$ simply equals the structures share in t, adjusted for growth in construction costs relative to house prices. In growing cities, that is, $h_{t+1} > h_t$, the growth of construction costs relative to existing home prices matters less in determining the

[12] Davis and Heathcote assume that, on average, the nominal value of structures accounts for roughly 87.5 percent of the nominal value of new housing. This estimate, which was obtained during conversations with staff at the Census Bureau, is based on an unpublished Census study from 1999.

structures share next period. Instead, the share of new homes accounted for by structures plays a role, since new homes account for a nonzero fraction of the total stock next period.

To implement this equation for each MSA, we start by benchmarking the structures share at the appropriate date to our estimate of the structures share derived from AHS-M data that was detailed earlier. To update this benchmark share — that is, to produce a continuous quarterly time series of the structures share from 1984:4 through 2004:4 according to equation (14)– we use MSA-level construction cost indexes from R.S. Means and the corrected CMHPI for $\left(p^s_{t+1}/p^s_t\right)$ and $\left(p^h_{t+1}/p^h_t\right)$, respectively.[13]

To complete the updating, we make two more assumptions. First, we assume that (h_{t+1}/h_t) is proportional to growth in the number of households in an MSA. This assumption is consistent with the Davis and Heathcote (2004) data on the real stock of housing and data from the Census Bureau on the number of households in the U.S.[14] Second, we assume that the fraction of *new* home value accounted for by the structure is

$$\theta_t = \frac{\exp\left(3.243 * \omega^s_t\right)}{1 + \exp\left(3.243 * \omega^s_t\right)}. \tag{15}$$

This specification of θ_t allows developers to vary the land-intensity of new homes with the average land-intensity in the MSA. Since ω^s_t is, by definition, never less than 0 or more than 1, θ_t is bounded from below by 0.50 and from above by 0.96, and the function is concave between those values (see figure 1). We chose the scale parameter 3.243 such that when the average structures share in an MSA is 0.60, the structures share of new housing is 0.875, values that are consistent with the assumptions in Davis and Heathcote (2005) and roughly consistent with the Census Bureau's data on construction value put in place.[15]

For a few midwestern cities early in the sample period, our algorithm implies near-zero point estimates for land's average share of home value; we set land's share to 0.05 in these few cases.

Finally, we use a transformation of equation (1) to compute percent changes for a

[13] We should note that it is unclear that changes to the R.S. Means construction cost indexes fully incorporate changes in builders' margins. If not, fluctuations in builders margins will be attributed to the value of land. We're confident that our results are not importantly affected by this consideration.

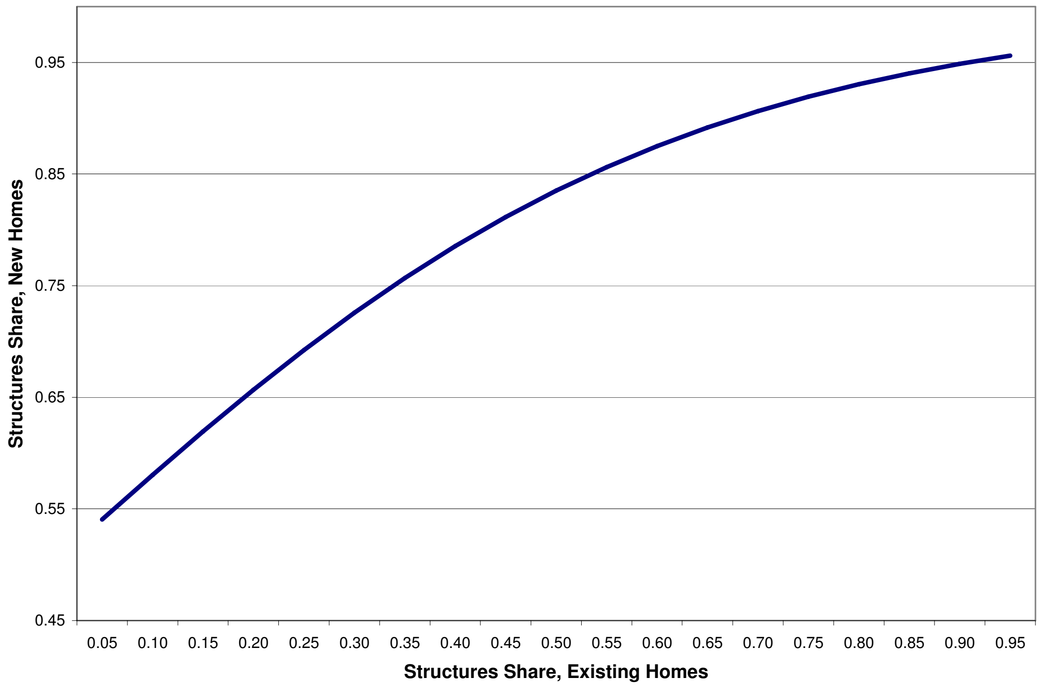
[14] According to the Davis and Heathcote data, the aggregate real stock of housing grew at 1.45 percent per year between 1975 and 2003; for comparison, the aggregate number of households grew 1.51 percent per year over the same time period.

[15] Our results would be qualitatively similar if we simply set $\theta_t = 0.875$ for all MSAs.

Figure 1

Assumed Relationship between Structures Share of Home Value for Existing Homes (ω_t^s) and for Newly Built Homes (θ_t)

$$\theta_t = \frac{\exp\left(3.243 * \omega_t^s\right)}{1 + \exp\left(3.243 * \omega_t^s\right)}$$



Note. This figure plots the function used in this study to map the share of home values accounted for by residential structures for the stock of existing homes to the share for newly built homes.

(constant-quality) index of residential land prices:

$$g_{jt}^{lp} = \frac{1}{\omega_{jt-1}^l}[g_{jt}^{hp} - (1 - \omega_{jt-1}^l)g_{jt}^{cc}]. \tag{16}$$

g_{jt}^{lp} is the value-weighted average growth rate of residential land containing the existing stock of homes in MSA j between periods $t-1$ and t. As long as the growth rate of construction costs g_{jt}^{cc} and home prices g_{jt}^{hp} are derived from constant-quality price indexes, then g_{jt}^{lp} is, by construction, a constant-quality growth rate. Note that g_{jt}^{lp} is not a "dollars-per-acre" concept, nor is it necessarily related to growth in the price of farmland on the outskirts of an MSA. g_{jt}^{lp} simply tracks the growth rate of the price of the combined set of attributes of existing homes that make these homes more expensive than the replacement cost of their structures, including premiums for location and other local amenities.

3 Results

The algorithm of the previous section results in a database of quarterly observations on the components of home values from 1984 through 2004 for 46 large U.S. metropolitan areas. More specifically, we have estimated average values for the stock of single-family, owner-occupied homes and their structure and land components, and we have constructed price indexes for residential land, as well.[16] In this section, we describe the basic trends uncovered by these new data, focusing on 5 broad geographic regions — cities in the Midwest, Southeast, Southwest, and along the East and West coasts.[17] The data show some variation across cities within these regions, but the regional variation is predominant. We describe changes in the components of home value from 1984 through 1998, then focus on the housing boom that has affected most of the country since 1998. After documenting the trends in land values since 1984, we show that most cities across the country have experienced a significant land pricing-cycle since the mid-1980s, in which the real price of residential land reached a significant peak followed by a long period of recovery. In large cities in the southwest, the peak occurred around 1985 — essentially following a boom in energy production in that region; in other cities, the peaks were around 1990. Only for a handful of large midwest cities have real residential land prices exhibited a fairly steady upward march over the past two decades.

3.1 Components of home value in 1984

Table A shows that in the mid-1980s homes were, on average, much less expensive in large U.S. cities in the Midwest and the Southeast than along the East and West coasts. The regions differed little in terms of their average replacement cost of residential structures, but there were large regional differences in the value of residential land. In 2004 dollars, the average residential

[16] These data are available upon request. In the text, we include tables reporting data at the regional level; tables 3 through 6 at the end of the paper include data for all 46 cities in our sample, and they show how the cities are distributed among the 5 broad geographic regions.

[17] In aggregating to the regional and full-sample level, we report simple averages across cities — not weighting by population or home value. The distribution of home values is sufficiently skewed that weighted averages would closely resemble the patterns shown for the cities located just along the East and West coasts.

lot in 1984 was worth just $14,000 in the Midwest, $135,000 along the West Coast, and $62,000 across our entire sample of large cities.[18] As of year-end 1984, on average, residential land accounted for just 11 percent of home value in cities in the Midwest, 55 percent of value in cities along the West Coast, and 32 percent of value across our full sample.

Table A
Components of Home Value in 1984 by Geographic Region

Region	Home value (*$1000s*)	Structure value (*$1000s*)	Land value (*$1000s*)	Memo: Land's share of value (*percent*)
a. Midwest	120	106	14	11
b. Southeast	129	94	36	27
c. Southwest	158	100	58	35
d. East Coast	172	105	67	38
e. West Coast	226	91	135	55
f. Full sample	162	100	62	32

2004 dollars. Unweighted averages across sample-cities in each region. Components may not sum to totals due to rounding.

3.2 Changes in home value, 1984 through 1998

The following table B documents the cumulative changes in the components of home value between 1984 and 1998 in the 5 geographic regions. In real terms — that is, relative to the core PCE price index — homes became considerably more valuable in 4 of the 5 regions — the exception being in cities in the Southwest.[19] In real terms, average home values in the Southwest and the share of home value accounted for by the market value of residential land was lower in 1998 than in 1984. By contrast, the two other regions of the country that had relatively low home values in 1984 — the Midwest and the Southeast — experienced significant increases, on net, over the next 15 years, and the lion's share of those increases can be traced to very fast appreciation of residential land. Indeed, as reported in the table, land's share of home values rose by 16 percentage points and 9 percentage points, respectively, in Midwest and Southeast cities from 1984 through 1998. Appreciating land values also pushed up home values, in real terms, in cities

[18] We convert to 2004 dollars using the BEA's chain-weighted price index for personal consumption expenditures excluding food and energy items.

[19] In that region, very high energy prices from the late 1970s had provided a substantial boost to economic activity, and, based on the Freddie Mac data, evidently, resulted in an exceptional pace of home price appreciation ending in the mid-1980s.

along the East and West coasts, but the average increases in land's share of home value — 3 and 6 percentage points, respectively, over this period — were not as large as in the Midwest and Southeast. Looking across all the large cities in our sample, the real value of average residential lots increased 50 percent from 1984 through 1998, and land's share of home value increased 8 percentage points, from 32 percent to 40 percent.

Table B
Change in Components of Home Value
by Geographic Region — 1984 through 1998

Region	Cumulative change in: Home value (*pct*)	Structure value (*pct*)	Land value (*pct*)	Change in land's share of value (*pctg pts*)
a. Midwest	26	2	208	16
b. Southeast	14	0	53	9
c. Southwest	-9	-4	-17	-4
d. East Coast	24	8	49	3
e. West Coast	39	20	51	6
f. Full sample	22	5	48	8

In real terms; unweighted averages across sample-cities in each region.

3.3 Changes in home value, 1999 through 2004

Table C indicates how widespread across the country the recent housing boom has been. All 5 regions have seen substantial real increases in average home values since 1998 — about 25 percent (cumulatively) in large cities in the Midwest, Southeast, and Southwest, and around 80 percent along the East and West coasts. In addition, although construction costs around the country have generally outpaced consumer price inflation — leading to increases in the real value of residential structures on the order of 10 to 18 percent since 1998 — the more important story has been a widespread rapid appreciation of residential land. We estimate increases in the market value of residential lots around 50 percent in the Southeast and Southwest, 75 percent in the Midwest, and around 125 percent along the East and West coasts. Thus, land's share of home value has risen considerably in each of the 5 regions of the country, up 7 to 10 percentage points in the South and Midwest and 13 or 18 percentage points along the coasts.

Indeed, among the 46 large cities in our sample, only Charlotte and Salt Lake City show lower land shares of home value in 2004 than in 1998, and Memphis's share only edged up by 1 percentage point. Since 1998, the largest increases in land's share of home value were registered in

Providence, RI (26 percentage points), New York City (23), Minneapolis/St. Paul (21), St. Louis (18), and Washington, DC (18). In St. Louis, land's 30 percent share of home value was still well below our sample-average (51 percent), but was appreciably greater than the 12 percent share recorded just six years earlier. Since 1998, home values in St. Louis rose 34 percent in real terms — well below the sample-average pace — but the relatively low value of residential lots in 1998 led this to translate into more than a 200 percent cumulative increase in the real value of residential land — right up there with the other fastest increases in our sample (Sacramento and San Bernardino, CA, and Providence, RI).

Table C
Change in Components of Home Value
by Geographic Region — 1999 through 2004

Region	Cumulative change in: Home value (*pct*)	Structure value (*pct*)	Land value (*pct*)	Change in land's share of value (*pctg pts*)
a. Midwest	28	9	75	10
b. Southeast	26	15	45	7
c. Southwest	24	10	52	8
d. East Coast	77	14	115	18
e. West Coast	81	18	145	13
f. Full sample	56	13	105	11

In real terms; unweighted averages across sample-cities in each region.

3.4 Components of home value in 2004

As can be seen in table D, by year-end 2004, single-family owner-occupied homes remained much more expensive in cities along the East and West coasts ($376,000 and $568,000, respectively) than in the other regions of the country, where the average was near $185,000. Our estimates of the value of residential structures for homes along the coasts were not much greater than those for the other 3 regions, so that nearly all of the difference in home values reflected differences in the value of their land components. The average lot was worth about $75,000 in cities in the Midwest, Southeast, and Southwest, but was valued at $245,000 on the East Coast, and $440,000 in West Coast cities. At year-end 2004, we estimate that land's share of home value had risen to 75 percent along the West Coast, 65 percent on the East Coast, compared with about 40 percent in the other 3 regions and 51 percent across the entire sample of 46 cities.

Still, despite the wider differences in home values across the country in 2004, we find that 4 of the 5 regions saw substantial increases in land values and land shares since 1984. Midwest cities saw their share rise to 36 percent from just 11 percent twenty years earlier — the largest percentage-point increase of the 5 regions — and these cities saw the largest cumulative increase in average land values as well, averaging more than a four-fold increase over the twenty-year period. On net, the slowest average rates of increase in home and land values were found for cities in the Southwest, and, by our estimates, there were several cities in that region for which average home values in 2004 remained below their 1984 levels (in real terms) — Dallas, Fort Worth, Houston, Houston, Oklahoma City, and San Antonio. Overall, though, we estimate that, on average, real land values rose 26 percent since 1984 in our Southwest cities, and land's share of home value edged up 4 percentage points, on net, to 38 percent at year-end 2004.[20]

Table D
Components of Home Value in 2004 by Geographic Region

Region	Home value (*$1000s*)	Structure value (*$1000s*)	Land value (*$1000s*)	Land's share of value (*percent*)	Memo: Land's share in 1984 (*percent*)
a. Midwest	192	119	73	36	11
b. Southeast	187	108	79	42	27
c. Southwest	179	106	73	38	35
d. East Coast	376	131	245	64	38
e. West Coast	568	128	440	74	55
f. Full sample	307	120	187	51	32

Unweighted averages across sample-cities in each region.

3.5 Changes in the distribution of land's share of home value, 1984 through 2004

The widespread net increase in land's share of home value across the U.S. since the mid-1980s is evident in figure 2, which shows the cumulative distribution function of land's share of home value across the 46 large cities in our sample as of year-end 1984, 1998, and 2004. As was consistent with the relatively fast appreciation of real land values in the Midwest and Southeast from 1984 through 1998, figure 2 shows a relatively large rightward shift in the distribution of land share for

[20]These numbers were boosted by real increases in residential land values in New Orleans, Denver, and Salt Lake City, which we included in the Southwest grouping based on their similar time-series paths for land and home values (discussed below).

cities in the lower two-thirds of the distribution. By contrast, for cities with the largest land shares, the line segment in 1998 lies just about on top of the 1984-segment, indicating that cities shuffled their order at the top of the distribution in that period; but, overall, there was not a material net increase in land's share in the most expensive cities. Between 1998 and 2004, the entire distribution function for land's share of home value shifted noticeably to the right, with somewhat larger increases generally occurring among cities in the top half of the distribution. At year-end 2004, the average share of home value we attribute to residential land ranged from a low of about 25 percent in Oklahoma City to nearly 90 percent in San Francisco. The range from lowest to highest is about the same as in 1984, as land's share of home value was less than 5 percent in a handful of cities in the middle of the country — running from Buffalo down to Pittsburgh and over to St. Louis, for example — and reached about 75 percent in San Francisco and Anaheim.

3.6 Changes in the distribution of residential land values, 1984 through 2004

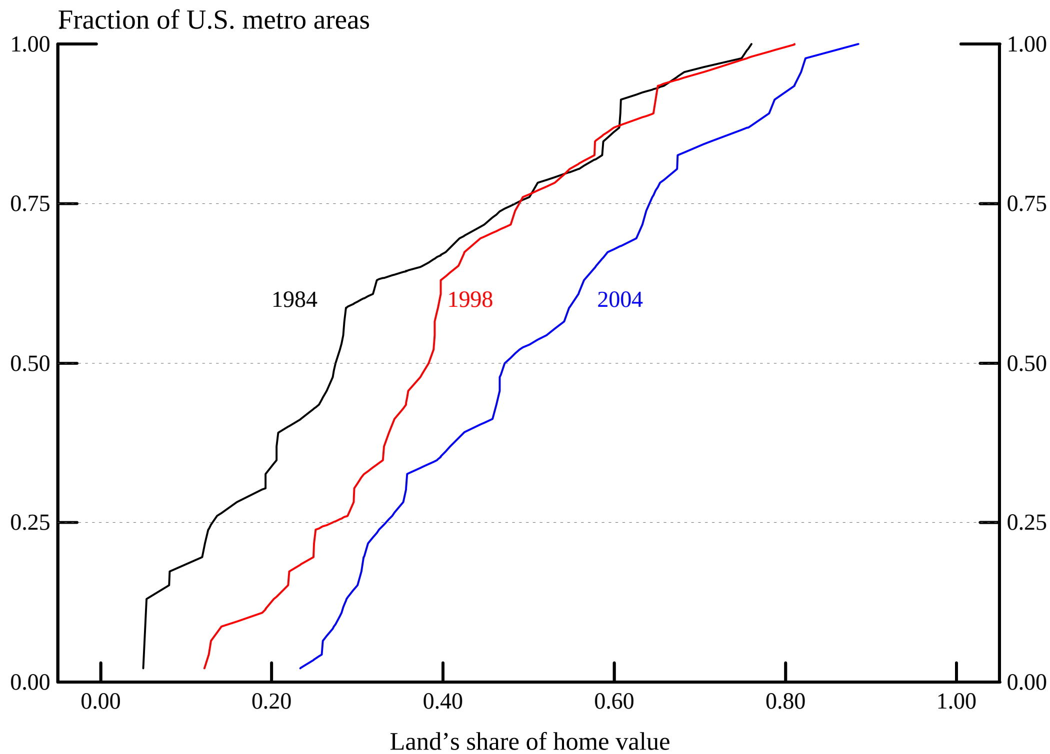
Figure 3 shows how far the distribution of average real land values shifted between 1984 and 1998, and then again over the past six years. Consistent with the patterns evident in figure 2, real land values in cities in the lower half of the distribution can be seen to have shifted by proportionately more from 1984 to 1998 (note the log scale for the x-axis). Although the entire distribution shifted further to the right between 1998 and 2004, in recent years the disproportionate increases in real land values occurred in cities in the top half of the distribution.

3.7 Volatility of real land prices since 1984

The previous subsections have emphasized net changes in the components of home value, in real terms, over a rather long period of time — 1984 through 1998 — and in the current housing boom — 1999 through 2004. In the course of that discussion, we mentioned that real land and home values in large cities in the Southwest have taken quite a roller coaster ride, and it was not until the early 2000s that many of those cities saw their average real home values return to levels last registered in the mid-1980s! This subsection emphasizes that the majority of large cities in other regions of the country has also experienced significant and prolonged decline in real land prices — generally in the latter 1980s or early 1990s, when national indexes of existing home prices fell in real terms.

Figure 2

Cumulative Distribution of Land's Share of Home Value
across Metropolitan Areas in Selected Years



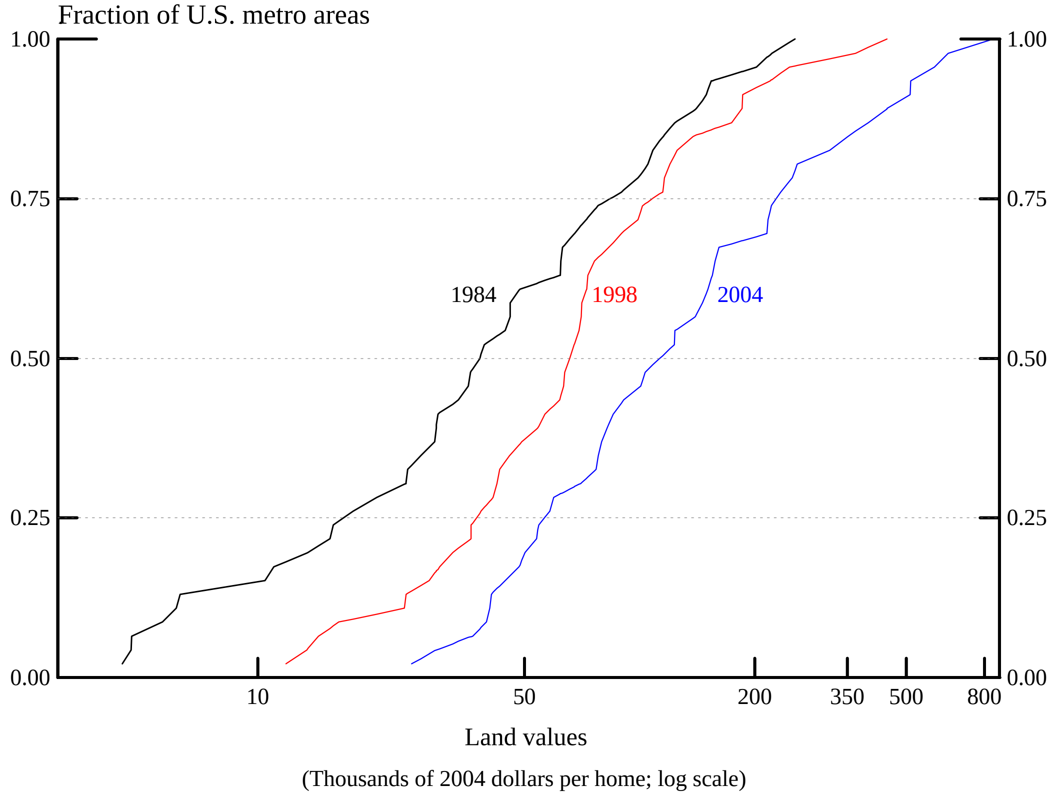
Note. This figure plots cumulative distribution functions of land's share of home value across our sample of 46 large metropolitan areas in 1984, 1998, and 2004.

Real land prices in the Southwest after 1985. Figure 4 plots indexes of real land prices across 9 cities in the southwestern U.S. that experienced a peak near early-1985. The indexes are normalized so that their value in 1985:Q1 is 100, and separate indexes are shown for the median city in each quarter after 1985:Q1 (the black line) and for the cities representing the 20th and 80th percentiles of the distribution (the blue and red lines).[21] According to figure 4, the median city in this group — Houston — saw its land price index fall 50 percent, cumulatively, in real terms, over the five years ended in 1989. Although real land prices in Houston began rising gradually in 1990, our estimates imply that the index did not fully return to its early-1985 level

[21]The 9 cities are: Dallas, Denver, Fort Worth, Houston, New Orleans, Oklahoma City, Phoenix, Salt Lake City, and San Antonio. For Phoenix, the index is set to 100 in 1986:Q1 because 1985 saw a decent-sized increase in real land prices there. Note that the 20th and 80th percentiles are computed for each quarter, and there is a little shuffling among cities in the distribution over the time period shown.

Figure 3

Cumulative Distribution of Residential Land Values
across Metropolitan Areas in Selected Years



Note. This figure plots the cumulative distribution functions of average real residential land values across our sample of 46 large metropolitan areas in 1984, 1998, and 2004.

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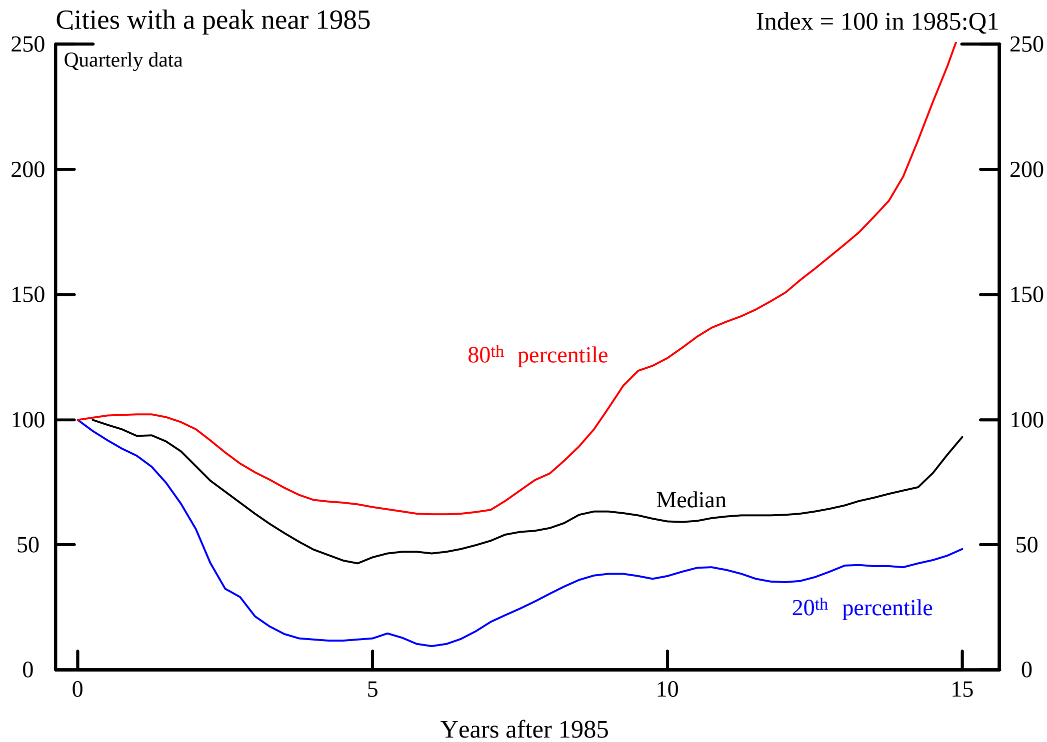
until 1999 — 15 years later! Denver's experience is reflected in the red line: There, real land prices fell, cumulatively, by 60 percent from 1985 through 1991; however, the recovery in that city was much sharper, and by the mid-1990s Denver's index of real land prices had returned to its 1985-level. By 1999 (the last period shown in figure 4), the index of real land prices was two-and-a-half times as high as it had been 15 years earlier. By contrast, San Antonio — whose experience is reflected in the blue line — saw a remarkably large drop in real land prices, and by 1999 the level of the index in that city had recovered only about halfway. Indeed, we estimate that after a fairly rapid period of appreciation from 1999 through 2004, the index of real land prices in San Antonio finally returned to its 1985-level.

Peaks in real land prices in cities elsewhere across the U.S. Moving beyond the 9 Southwest cities in which real land prices peaked around 1985, 30 of the remaining 37 cities in our sample

Figure 4

Real Residential Land Prices
in Southwest Metropolitan Areas after 1985



Note. This figure plots the 20th, 50th, and 80th percentiles of the distribution of real land prices in 7 Southwest cities over the fifteen years following the peak experienced around early 1985. For 6 of the 7 cities in this group, the index of real residential land prices is normalized to 100 in 1985:Q1; for Phoenix, the index is set to 100 in 1986:Q2.

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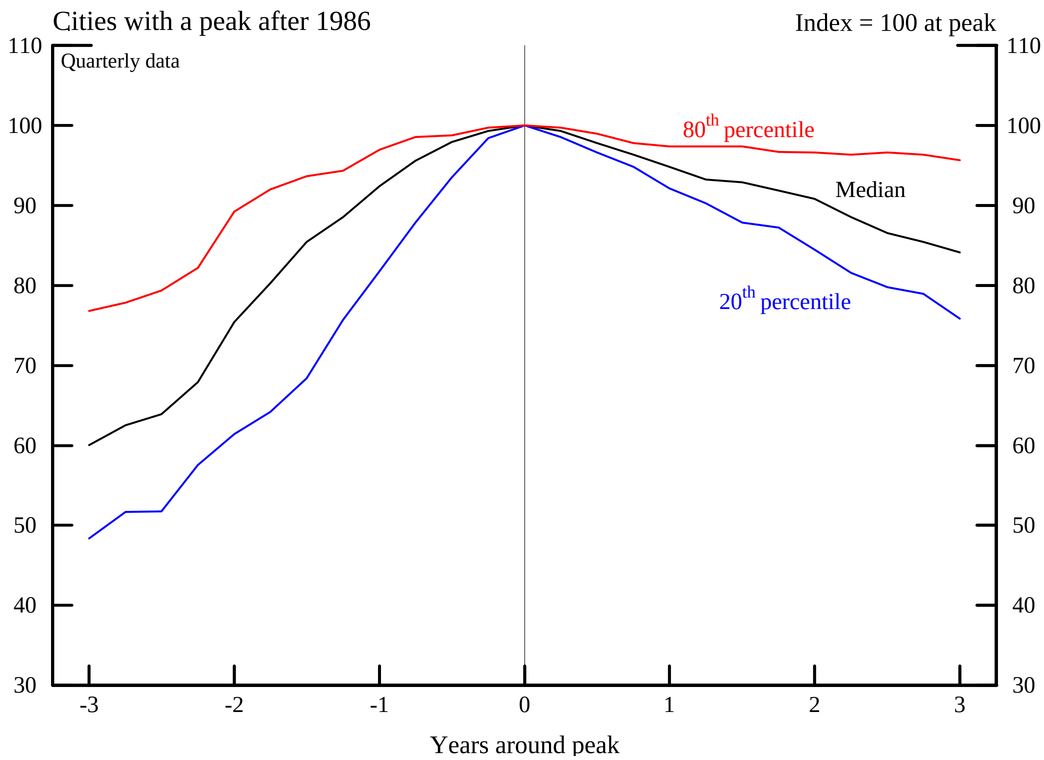
experienced a peak sometime after 1986 — figure 5 uses a “butterfly chart” to summarize those episodes. To generate figure 5, we identified for each of these 30 cities the quarter in which their real land price index reached a “local” peak, normalized the level of the price index in the peak-quarter to 100, and then computed the relative level of the index in all quarters around the peak. The black line is the median normalized index among the 30 cities, and the blue and red lines, respectively, denote the 20th and 80th percentiles across the distribution of cities at each quarter surrounding their respective peaks. The left-hand portion of the graph represents the behavior of real residential land prices three years before the peak-quarter, and the right-hand portion shows prices in the three years following the peak.

Thus, considering the path of the “median” line, figure 5 reveals that 15 of the 30 large U.S.

Figure 5

Real Residential Land Prices around Previous Peaks



Note. This figure plots the 20th, 50th, and 80th percentiles of the distribution of real land prices for 30 cities that experienced a peak in between 1987 and 1992. The figure shows the paths for real land prices from three years before a peak to three years after the peak. For each of the 30 cities in this group, an index of real land prices is normalized to 100 in the peak-quarter.

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cities in this broad group have experienced, at some point since 1986, a cumulative, net *three-year decline* in real land prices of 16 percent or more. This broad set of cities includes Boston (a 24 percent three-year decline through 1991:Q4), Kansas City (30 percent, 1990:Q3), Los Angeles (19 percent, 1992:Q4), New York (28 percent, 1991:Q2), Sacramento (24 percent, 1993:Q4), San Diego (15 percent, 1993:Q1), San Francisco (18 percent, 1992:Q4), St. Louis (26 percent, 1990:Q3) and Washington DC (12 percent, 1992:Q4). Figure 5 does not show the full recovery period for this group of cities, but for the median city (Tampa) it took a full ten years for the real land price index to return to the level at its previous peak. In a number of large cities — including Los Angeles, Philadelphia, Providence, RI, and Sacramento — real land prices did not reach their 1990 peaks until 2001 or 2002, well into the current housing boom.

Considering the portion above the median in figure 5, 15 cities in our sample experienced a relatively mild cycle for land prices around 1990 — their cumulative real decline was generally less than 10 percent and the level of their real land price index had returned to its peak level by the mid-1990s. Indeed, by the time the current housing boom was getting underway toward the end of 1998, their real land price index was considerably above the level at the time of the previous peak. This group includes Charlotte, Detroit, Memphis, Miami, and Minneapolis-St. Paul. With the exception of Charlotte and Memphis — where land prices have languished in real terms since 1998 — this group of cities continued to see a rapid expansion of residential land values through 2004.

We note that for most of these cities that experienced a peak in real residential land prices around 1990, the subsequent real depreciation involved a stagnation of land prices in nominal terms that was eroded over time by an increase in core consumer prices. That is, the price index for personal consumption expenditures excluding food and energy items in the National Income and Product Accounts (NIPA) — which is the index we use to convert nominal values and price indexes into real terms — rose about 15 percent over three-year periods from 1989 through 1994. This is about the same order of magnitude as our estimate of real peak-to-trough declines in residential land prices for most of these cities, so our data do not suggest widespread, outright nominal declines in land prices. Still, the minority of cities in this group that are estimated to have experienced real land-price declines around 20 percent are also estimated to have seen their nominal land-price indexes fall in the peak-to-trough period.

Midwest cities that have not experienced a previous peak in land prices. According to our estimates, 7 large cities in the midwest have seen a more smooth upward march in real land prices and average land values since 1984, rather than the roller coaster experience of the majority. This group, which includes Chicago, Cincinnati, Indianapolis, and Milwaukee, registered increases in home prices that outpaced construction costs and general price inflation year after year since 1984. In general, for cities in this group, land accounted for a small portion of home value in 1984 — about 10 percent. By 1998, however, land's share of home value had risen to 30 percent, and, by 2004, the share in these cities had nearly reached 40 percent, not too far below the average across all cities in our sample.

4 Discussion

This paper has introduced methods we developed to build a new database for measuring the evolution of residential land values across large U.S. metropolitan areas since the mid-1980s. We have not yet used the data to estimate models capable of explaining just which economic factors have caused changes in land prices in different areas at different times, but we have documented, for the first time, some key facts that a model would need to explain. In particular, we have shown that, over the past twenty years, residential land has become relatively more expensive in just about every large metro area in the U.S. — not only in places along the east and west coasts of the country, as some have suspected — though the pace of appreciation has, of course, varied considerably from region to region. Moreover, we have demonstrated that the current housing boom, which began around the end of 1998, has left its imprint in the form of a rapid appreciation of residential land values just about everywhere. In addition, we have shown that, at some point since 1984, the majority of large U.S. cities have experienced one pronounced price-cycle in which residential land lost value for an extended period of time, usually following several years of particularly rapid appreciation. In real terms, land prices have generally taken several years to go from peak to trough, and the subsequent recovery from these price-declines has generally occurred at a more gradual pace.

To us, the most important implication of our findings is that, looking forward, cycles in land prices will shape the contour of home values to a greater extent than they have in the past — because in just about every large U.S. metro area land's share of home value is now much higher than it used to be. More specifically, land's greater share of home value could mean faster home-price appreciation, on average, and possibly larger swings in home prices.

To gauge the possible magnitudes, we consider how current land values would translate into future home-price appreciation in cities along the East and West coasts should land prices and construction costs repeat their average performance (in real terms) in recent history. From 1984 through 1998 (ignoring the current boom), these two regions experienced average annual real increases in land prices of 4.2 percent and 4.7 percent, respectively; over the same period, their real construction costs fell by an average of 0.3 percent and 0.8 percent, respectively. In 1984 and 2004, land accounted for 38 percent and 64 percent of home value, on average, in large cities along the East Coast; in cities along the West Coast, land's share was 55 percent in 1984 and 74 percent in 2004. In table E, we plug these values into equation (1) to compute, for each region, the percentage increase in home prices resulting from a repeat-experience of land prices and construction costs from 1984 through 1998. Our calculations imply that simply by taking into account the more expensive land values currently in place we would expect real home prices to accelerate by more than 1 percentage point per year in cities along both coasts. So, even if land prices were to increase from now on at the average pace seen before the current boom, home prices might rise more quickly, on average, than they did before.

Table E
Effect of Higher Land Share on Prospective Home-Price Appreciation

Using Land's Share in 1984:	
East Coast:	$1.4\% = 0.38 * (4.2\%) + (1 - 0.38) * (-.3\%)$
West Coast:	$2.2\% = 0.55 * (4.7\%) + (1 - 0.55) * (-.8\%)$
Using Land's Share in 2004:	
East Coast:	$2.6\% = 0.64 * (4.2\%) + (1 - 0.64) * (-.3\%)$
West Coast:	$3.3\% = 0.74 * (4.7\%) + (1 - 0.74) * (-.8\%)$
Acceleration in Home Prices from Higher Land Shares:	
East Coast:	1.2 ppt $= 2.6\% - 1.4\%$
West Coast:	1.1 ppt $= 3.3\% - 2.2\%$

The consequences for future home-price volatility could be just as significant because we would expect cycles in home prices to continue to be driven by cycles in real land prices. Again, in our framework, variance of home prices depends on the variances of land prices and construction costs, and the greater current share of home value accounted for by residential land has significantly pushed up the weight on land-price volatility.[22] Of course, it is possible that some of the factors driving up residential land prices so significantly over the past twenty years could also work to decrease their volatility, which would offset the simple "accounting effect" of land's greater share of home value. We see this to be an important avenue for future research.

[22]There is a positive covariance over time between real land prices and construction costs that also affects the variance of home prices.

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Appendix

A Measurement Error, CMHPI

As noted in the text, the MSA-level CMHPI seems to be measured with significant error, and the measurement error is responsible for much of the observed volatility in the house price indexes. For example, as shown by Davis and Heathcote (2004) for the national CMHPI, measurement errors in the level of the index can explain the high degree of negative autocorrelation in percentage changes computed from the series. To see this, suppose that the log of the observed housing price index, $\log\left(p_t^h\right)$, is equal to the log of the true price index, $\log\left(p_t^{h*}\right)$, plus some i.i.d. measurement error $e_t \sim N\left(0, \sigma_e^2\right)$, that is

$$\log\left(p_t^h\right) = \log\left(p_t^{h*}\right) + e_t. \tag{17}$$

The first difference of (17) is

$$\Delta \log\left(p_t^h\right) = \Delta \log\left(p_t^{h*}\right) + \Delta e_t. \tag{18}$$

The left-hand side of (18) is the observed growth rate of the price index and, depending on the properties of $\Delta \log\left(p_t^{h*}\right)$, the observed growth rate could be negatively autocorrelated since Δe_t will be negatively autocorrelated.

To purge the national OFHEO price index of measurement error, Davis and Heathcote (2004) detrend the OFHEO for overall consumer price inflation,[23] assume that the true real growth rate of the OFHEO is a random walk ($\Delta \log\left(p_t^{h*}\right) = u_t$ with u_t an i.i.d. draw from $N\left(0, \sigma_u^2\right)$), and finally assume that u_t is uncorrelated with e_s for all t and s. Given this framework, Davis and Heathcote estimate the variance of e_t and u_t using the Kalman Filter. They uncover the real sequence of p_t^{h*} using the Kalman Smoother, and convert the real sequence to a nominal sequence by adding back consumer price inflation.

Since we measure land prices residually — that is, we use data on house prices and construction costs to infer land prices — any measurement error in the metro-area CMHPI price indexes will feed through to our land price series. We feel it is important to generate, as best as possible, a measurement-error free version of the CMHPI, and, thus, we apply the Davis and Heathcote procedure to data for each MSA. In estimation, we allow for a break in the variance of

[23] Davis and Heathcote detrend by the price index for personal consumption expenditures excluding food and energy in the National Income and Product Accounts ("NIPA") as published by the BEA, line 23 of NIPA table 2.3.4.

the measurement error in each series anywhere between 1980:1 and 1992:4 for each MSA, and choose the break date to maximize the estimated log-likelihood of the sample. Given our estimates of σ_u^2 and σ_e^2 (before and after the break date), we construct a measurement-error free series of the real level and growth rate of the CMHPI using the Kalman Smoother. We call these estimates our "corrected" real estimates, and convert the corrected real estimates to nominals by factoring in the NIPA price index for personal consumption expenditures excluding food and energy (the "core PCE price index").[24]

Three results stand out from our work. First, estimated break-dates for the measurement error process typically occur in the mid 1980s: The median break-date is 1984:2, which is why the analysis in our paper begins in 1984. Second, for almost all MSAs covered by the CMHPI, the variance of the measurement error is much larger in the earlier part of the sample than in the latter part. The median ratio of the standard deviation of the measurement error in the early part of the sample to the standard deviation in the later part is 6.3. Third, much of the variance in the observed growth rate in the MSA-specific CMHPI data seems to reflect measurement error. For example, we find that in the period from 1992:1 through 2004:4, the median ratio of the standard deviation of the error-corrected growth rates of home prices to the standard deviation of the published growth rate is 0.51.

B Checking δ

Obviously, our estimates of the land and structures share of homes in each MSA is sensitive to our assumptions, but some sensitivity analyses we have run suggest that our choice of δ is potentially important. Specifically, if we were to have chosen a lower (higher) value for δ, our estimated replacement cost of structures would account for a higher (lower) fraction of house value.

Taking the new building cost data from R.S. Means as accurate, we can justify our value of δ in three ways. First, $\delta = 0.015$ is almost exactly the value used by the BEA when it constructs its estimate of aggregate stock of residential structures (Davis and Heathcote 2005). Second, a lower estimate of δ will imply that the value of land, on average, was negative in many Midwestern cities in the mid 1980s.

Third, we can approximate the aggregate land share using our MSA-level data and a back-of-the-envelope formula; a value of $\delta = 0.015$ gives a back-of-the-envelope estimate that is

[24]Our estimates of σ_u^2 and σ_e^2 for every MSA-level CMHPI index published by Freddie Mac (including many outside the 46-city sample used in this paper) are available upon request.

quite close to the more carefully constructed estimate produced by Davis and Heathcote (2004). To make these calculations, we first estimate the number of households in single-family owner-occupied housing units in each MSA by multiplying the percentage of households in each MSA that live in single-family owner-occupied housing (derived from AHS-M weights) by our estimate of the total number of households. This estimate is shown in the first column of table A.1. Next, we multiply the number of households living in single-family owner-occupied housing units by the average value of these houses (and the land associated with these houses) to derive the total value of housing and land for these homes in each MSA. The third column in table A.1 lists our estimate of the aggregate value of housing, by MSA, for the stock of single-family owner-occupied homes in 2000:2. The fourth column shows the fraction of U.S. total home value (for single-family owner-occupied homes) that is accounted for by each MSA; for each MSA, it is calculated as the value in the third column divided by \$9,037.3 billion.[25] In 2000, our sample of about 24 million households (44 percent of the total number of households in single-family owner-occupied housing units) accounts for \$5,066 billion in house value, about 56 percent of U.S. total value. The average price of the housing units in our sample of MSAs is \$212,000. According to the 2000 Decennial Census of Housing, the average home value in the U.S. for the single-family owner-occupied stock was \$167,000 in 2000:2, implying the average price of homes that are not included in our sample was \$109,000, about the average value of homes in Buffalo in 2000.

Our aggregate land share will be $0.56 * \bar{w}_t^l + 0.44 * X$, where $\bar{w}_t^l$ is the value-weighted average share of house value attributable to land in our sample of MSAs and X is the fraction of house value attributable to land for the 44 percent of aggregate house value for which we do not know land's share. We find that $\bar{w}_t^l$ is about 50.2% in 2000:2. For the aggregate land share to be equal to 40 percent in 2000 (about the estimate we get using the Davis and Heathcote method for the single-family owner-occupied stock), X must be 27 percent, approximately the same as land's share in Houston 2000:2.

[25] According to calculations using the 2000 Decennial census, the market value of single-family owner-occupied homes in the entire U.S. was \$9,037.3 billion. For reference, using data from the 1990 Census, we estimate the value of single-family owner-occupied homes in the U.S. to have been \$5,508 billion; in 1990:2, the estimated value of housing across our sample of MSAs is \$3,119 billion.

Table 1
List of Data Sources and Data Labels

CMHPI	R.S. Means	BEA Population	AHS-M	AHS-M date
ORANGE COUNTY CA PMSA	Anaheim	Santa Ana-Anaheim-Irvine, CA Metropolitan Division	Anaheim-Santa Ana, CA PMSA**	2002
ATLANTA GA MSA	Atlanta	Atlanta-Sandy Springs-Marietta, GA (MSA)	Atlanta, GA MSA	1996
BALTIMORE MD PMSA	Baltimore	Baltimore-Towson, MD (MSA)	Baltimore, MD MSA	1998
BIRMINGHAM AL MSA	Birmingham	Birmingham-Hoover, AL (MSA)	Birmingham, AL MSA	1998
BOSTON MA-NH PMSA	Boston	Boston-Cambridge-Quincy, MA-NH (MSA)	Boston, MA-NH CMSA	1998
BUFFALO-NIAGARA FALLS NY MSA	Buffalo	Buffalo-Niagara Falls, NY (MSA)	Buffalo, NY CMSA**	2002
CHARLOTTE-GASTONIA-ROCK HILL NC-SC	Charlotte	Charlotte-Gastonia-Concord, NC-SC (MSA)	Charlotte, NC-SC MSA	2002
CHICAGO IL PMSA	Chicago	Chicago-Naperville-Joliet, IL-IN-WI (MSA)	Chicago, IL PMSA	1991***
CINCINNATI OH-KY-IN PMSA	Cincinnati	Cincinnati-Middletown, OH-KY-IN (MSA)	Cincinnati, OH-KY-IN PMSA**	1998
CLEVELAND-LORAIN-ELYRIA OH PMSA	Cleveland	Cleveland-Elyria-Mentor, OH (MSA)	Cleveland, OH-KY-IN PMSA**	1996
COLUMBUS OH MSA	Columbus	Columbus, OH (MSA)	Columbus, OH MSA	2002
DALLAS TX PMSA	Dallas	Dallas-Plano-Irving, TX Metropolitan Division	Dallas, TX PMSA	2002
DENVER CO PMSA	Denver	Denver-Aurora, CO (MSA)	Denver, CO MSA	1995
DETROIT MI PMSA	Detroit	Detroit-Warren-Livonia, MI (MSA)	Detroit, MI PMSA	1993***
FORT WORTH-ARLINGTON TX PMSA	Fort Worth	Fort Worth-Arlington, TX Metropolitan Division	Ft. Worth-Arlington, TX PMSA	2002
HARTFORD CT PMSA	Hartford	Hartford-West Hartford-East Hartford, CT (MSA)	Hartford, CT MSA	1996
HOUSTON TX PMSA	Houston	Houston-Sugar Land-Baytown,TX (MSA)	Houston, TX PMSA	1998
INDIANAPOLIS IN MSA	Indianapolis	Indianapolis, IN (MSA)	Indianapolis, IN MSA**	1996
KANSAS CITY MO-KS MSA	Kansas City	Kansas City, MO-KS (MSA)	Kansas City, MO-KS MSA	2002
LOS ANGELES-LONG BEACH CA PMSA	Los Angeles	Los Angeles-Long Beach-Glendale, CA Metropolitan Division	Los Angeles-Long Beach, CA PMSA**	1989***
MEMPHIS TN-AR-MS MSA	Memphis	Memphis, TN-MS-AR (MSA)	Memphis, TN-AR-MS MSA	1996
MIAMI FL PMSA	Miami	Miami-Fort Lauderdale-Miami Beach, FL (MSA)	Miami-Ft. Lauderdale, FL CMSA	2002
MILWAUKEE-WAUKESHA WI PMSA	Milwaukee	Milwaukee-Waukesha-West Allis, WI (MSA)	Milwaukee, WI PMSA	2002
MINNEAPOLIS-ST. PAUL MN-WI MSA	Minneapolis	Minneapolis-St. Paul-Bloomington, MN-WI (MSA)	Minneapolis-St. Paul, MN-WI MSA	1998
NEW ORLEANS LA MSA	New Orleans	New Orleans-Metairie-Kenner, LA (MSA)	New Orleans, LA MSA	1995
NEW YORK NY PMSA	New York	New York-Nassau-Suffolk-Orangeˆ	New York-Nassau-Suffolk-Orange, NY PMSA	1991***
NORFOLK-VIRGINIA BEACH-NEWPORT NEWS	Norfolk	Virginia Beach-Norfolk-Newport News, VA-NC (MSA)	Norfolk-Virginia Beach-Newport News, VA MSA	1998
OAKLAND CA PMSA	San Francisco	Oakland-Fremont-Hayward, CA Metropolitan Division	Oakland, CAˆ	1998
OKLAHOMA CITY OK MSA	Oklahoma City	Oklahoma City, OK (MSA)	Oklahoma City, OK MSA	1996
PHILADELPHIA PA-NJ PMSA	Philadelphia	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD (MSA)	Philadelphia, PA-NJ PMSA**	1989***
PHOENIX-MESA AZ MSA	Phoenix	Phoenix-Mesa-Scottsdale, AZ (MSA)	Phoenix, AZ MSA**	2002
PITTSBURGH PA PMSA	Pittsburgh	Pittsburgh, PA (MSA)	Pittsburgh, PA MSA	1995
PORTLAND-VANCOUVER OR-WA PMSA	Portland	Portland-Vancouver-Beaverton, OR-WA (MSA)	Portland, OR-WA PMSA	2002
PROVIDENCE-FALLS RIVER-WARWICK RI-MA	Providence	Providence-New Bedford-Fall River, RI-MA (MSA)	Providence-Pawtucket-Warwick, RI-MA PMSA	1998
ROCHESTER NY MSA	Rochester	Rochester, NY (MSA)	Rochester, NY MSA	1998
SACRAMENTO CA PMSA	Sacramento	Sacramento-Arden-Arcade-Roseville, CA (MSA)	Sacramento, CA PMSA	1996
SALT LAKE CITY-OGDEN UT MSA	Salt Lake City	Salt Lake City, UT (MSA)	Salt Lake City, UT MSA	1998
SAN ANTONIO TX MSA	San Antonio	San Antonio, TX (MSA)	San Antonio, TX MSA	1995
RIVERSIDE-SAN BERNARDINO CA PMSA	Riverside	Riverside-San Bernardino-Ontario, CA (MSA)	Riverside-San Bernardino-Ontario, CA PMSA**	2002
SAN DIEGO CA MSA	San Diego	San Diego-Carlsbad-San Marcos, CA (MSA)	San Diego, CA MSA**	2002
SAN FRANCISCO CA PMSA	San Francisco	San Francisco-San Mateo-Redwood City, CA Metropolitan Division	San Francisco, CA	1998
SAN JOSE CA PMSA	San Francisco	San Jose-Sunnyvale-Santa Clara, CA (MSA)	San Jose, CA PMSA	1998
SEATTLE-BELLEVUE-EVERETT WA PMSA	Seattle	Seattle-Tacoma-Bellevue, WA (MSA)	Seattle-Everett, WA PMSA	1996
ST. LOUIS MO-IL MSA	St. Louis	St. Louis, MO-IL (MSA)	St. Louis, MO-IL MSA	1996
TAMPA-ST. PETERSBURG-CLEARWATER FL	Tampa	Tampa-St. Petersburg-Clearwater, FL (MSA)	Tampa-St. Petersburg, FL MSA	1998
WASHINGTON DC-MD-VA-WV PMSA	Washington	Washington-Arlington-Alexandria, DC-VA-MD-WV (MSA)	Washington, DC-MD-VA MSA	1998

** From AHS documentation: "Same area since beginning. All other areas change boundaries over time."
*** Most recent AHS-M is not used due to top-coding issues. See text for details.
Ŝum of New York-White Plains-Wayne, NY-NJ Metropolitan Division and Nassau-Suffolk, NY Metropolitan Division.

Table 2
Observations Used to Benchmark Structures Share

MSA	AHS-M year	Number of Observations
Anaheim	2002	1,582
Atlanta	1996	1,990
Baltimore	1998	1,316
Birmingham	1998	2,264
Boston	1998	1,071
Buffalo	2002	1,391
Charlotte	2002	2,289
Chicago	1991	1,313
Cincinnati	1998	1,470
Cleveland	1996	1,474
Columbus	2002	2,029
Dallas	2002	2,082
Denver	1995	2,181
Detroit	1993	1,986
Fort Worth	2002	1,924
Hartford	1996	2,065
Houston	1998	1,650
Indianapolis	1996	2,242
Kansas City	2002	2,233
Los Angeles	1989	1,190
Memphis	1996	1,924
Miami	2002	1,378
Milwaukee	2002	1,637
Minneapolis/St. Paul	1998	2,237
New Orleans	1995	1,424
New York	1991	791
Norfolk	1998	1,629
Oakland	1998	1,715
Oklahoma City	1996	2,032
Philadelphia	1989	1,049
Phoenix	2002	1,975
Pittsburgh	1995	1,894
Portland	2002	2,321
Providence	1998	1,232
Rochester	1998	1,897
Sacramento	1996	1,760
Salt Lake City	1998	2,513
San Antonio	1995	1,797
San Bernardino	2002	2,262
San Diego	2002	1,573
San Francisco	1998	1,132
San Jose	1998	1,684
Seattle	1996	2,077
St. Louis	1996	1,868
Tampa	1998	1,768
Washington, DC	1998	1,336

Table 3
Components of Home Value by Region of the U.S.:
Cumulative Changes from 1984 through 2004

	Home value	Land value	Structure value
	—— percent (cumulative) ——		
Full sample	89.8%	203.8%	18.9%
By region:			
Midwest	60.2%	437.3%	11.9%
Southeast	44.8%	121.2%	15.6%
Southwest	13.0%	26.2%	5.3%
East Coast	119.3%	266.3%	22.1%
West Coast	151.2%	225.0%	41.2%
Cities within regions:			
Midwest			
Buffalo	50.7%	765.5%	13.1%
Chicago	106.1%	422.9%	24.3%
Cincinnati	56.3%	662.5%	3.2%
Cleveland	60.3%	1208.6%	-0.2%
Columbus	56.3%	244.2%	11.5%
Detroit	102.1%	1214.6%	43.5%
Indianapolis	38.0%	605.6%	6.1%
Kansas City	35.5%	161.3%	11.7%
Milwaukee	79.7%	568.0%	9.7%
Minneapolis/St. Paul	83.6%	591.6%	13.3%
Pittsburgh	50.6%	682.1%	17.3%
Rochester	11.4%	52.6%	0.8%
St. Louis	48.2%	788.9%	9.3%
Southeast			
Atlanta	45.6%	104.6%	25.4%
Birmingham	46.0%	339.2%	6.5%
Charlotte	43.6%	45.1%	41.6%
Memphis	25.7%	181.5%	1.2%
Tampa	61.5%	199.6%	12.1%
Southwest			
Dallas	-6.8%	-26.5%	21.0%
Denver	54.6%	169.5%	11.9%
Fort Worth	-12.1%	-33.2%	5.0%
Houston	-1.0%	12.7%	-6.2%
New Orleans	20.3%	95.9%	-10.0%
Oklahoma City	-14.8%	-28.9%	-9.3%
Phoenix	37.4%	26.6%	54.0%
Salt Lake City	44.7%	537.6%	1.8%
San Antonio	-10.4%	-18.4%	-7.2%
East Coast			
Baltimore	100.3%	220.5%	19.2%
Boston	142.6%	266.6%	18.3%
Hartford	73.4%	229.7%	11.2%
Miami	102.7%	145.9%	41.2%
New York City	170.7%	466.4%	30.1%
Norfolk	77.2%	124.8%	11.6%
Philadelphia	109.7%	454.2%	19.7%
Providence	166.6%	805.1%	14.4%
Washington DC	120.2%	217.3%	35.0%
West Coast			
Anaheim	147.1%	166.0%	87.0%
Los Angeles	143.7%	215.7%	32.1%
Oakland	158.4%	232.5%	44.1%
Portland	117.0%	436.7%	19.3%
Sacramento	135.8%	299.9%	36.9%
San Bernardino	110.8%	161.3%	58.1%
San Diego	177.5%	241.6%	53.8%
San Francisco	179.4%	230.3%	27.4%
San Jose	162.7%	217.3%	45.6%
Seattle	125.5%	343.9%	23.7%

Table 4
Components of Home Value by Region of the U.S.:
Cumulative Changes from 1984 through 1998

	Home value	Land value	Structure value
	—— percent (cumulative) ——		
Full sample	21.7%	48.2%	5.3%
By region:			
Midwest	25.6%	207.7%	2.3%
Southeast	14.8%	53.0%	0.2%
Southwest	-9.0%	-17.2%	-4.3%
East Coast	23.9%	49.4%	7.6%
West Coast	38.8%	51.4%	19.9%
Cities within regions:			
Midwest			
Buffalo	29.1%	422.5%	8.4%
Chicago	44.6%	180.1%	9.6%
Cincinnati	29.4%	440.7%	-6.6%
Cleveland	36.9%	884.3%	-7.7%
Columbus	31.4%	165.6%	-0.6%
Detroit	64.7%	717.9%	30.3%
Indianapolis	23.0%	474.9%	-2.5%
Kansas City	5.8%	46.1%	-1.8%
Milwaukee	32.7%	250.3%	1.5%
Minneapolis/St. Paul	15.0%	137.8%	-2.0%
Pittsburgh	22.6%	209.1%	12.8%
Rochester	-1.5%	5.0%	-3.2%
St. Louis	10.3%	166.9%	2.1%
Southeast			
Atlanta	13.9%	29.0%	8.8%
Birmingham	22.2%	216.9%	-4.0%
Charlotte	26.5%	30.6%	21.3%
Memphis	12.3%	143.6%	-8.4%
Tampa	-1.3%	23.2%	-10.1%
Southwest			
Dallas	-22.5%	-43.8%	7.6%
Denver	12.0%	58.5%	-5.2%
Fort Worth	-24.3%	-50.0%	-3.4%
Houston	-21.1%	-45.6%	-11.8%
New Orleans	-6.5%	16.4%	-15.7%
Oklahoma City	-28.1%	-66.8%	-13.1%
Phoenix	-1.8%	-22.3%	29.7%
Salt Lake City	37.9%	542.1%	-6.0%
San Antonio	-25.0%	-62.7%	-10.0%
East Coast			
Baltimore	22.1%	46.7%	5.4%
Boston	33.9%	60.3%	7.3%
Hartford	14.7%	59.9%	-3.3%
Miami	12.3%	10.4%	15.0%
New York City	40.7%	93.8%	15.5%
Norfolk	2.6%	2.2%	2.8%
Philadelphia	30.9%	117.1%	8.4%
Providence	36.2%	175.8%	2.9%
Washington DC	19.8%	26.5%	13.9%
West Coast			
Anaheim	20.3%	11.4%	48.4%
Los Angeles	23.7%	32.1%	10.8%
Oakland	33.9%	42.4%	20.7%
Portland	72.6%	291.4%	5.7%
Sacramento	15.6%	21.2%	12.2%
San Bernardino	2.7%	-21.5%	28.0%
San Diego	25.6%	24.1%	28.3%
San Francisco	61.1%	74.4%	21.4%
San Jose	64.0%	81.7%	26.0%
Seattle	64.9%	183.9%	9.4%

Table 5
Components of Home Value by Region of the U.S.:
Cumulative Changes from 1999 through 2004

	Home value	Land value	Structure value
	—— percent (cumulative) ——		
Full sample	56.0%	105.0%	12.8%
By region:			
Midwest	27.6%	74.6%	9.4%
Southeast	26.1%	44.6%	15.4%
Southwest	24.2%	52.3%	10.0%
East Coast	77.0%	145.2%	13.5%
West Coast	81.0%	114.7%	17.7%
Cities within regions:			
Midwest			
Buffalo	16.8%	65.7%	4.4%
Chicago	42.6%	86.7%	13.4%
Cincinnati	20.8%	41.0%	10.5%
Cleveland	17.1%	33.0%	8.2%
Columbus	18.9%	29.6%	12.1%
Detroit	22.7%	60.7%	10.1%
Indianapolis	12.2%	22.8%	8.8%
Kansas City	28.1%	78.9%	13.7%
Milwaukee	35.5%	90.7%	8.1%
Minneapolis/St. Paul	59.6%	190.8%	15.6%
Pittsburgh	22.8%	153.0%	4.0%
Rochester	13.1%	45.2%	4.1%
St. Louis	34.4%	233.1%	7.0%
Southeast			
Atlanta	27.8%	58.7%	15.3%
Birmingham	19.5%	38.6%	11.0%
Charlotte	13.5%	11.2%	16.7%
Memphis	12.0%	15.6%	10.5%
Tampa	63.7%	143.1%	24.6%
Southwest			
Dallas	20.2%	30.8%	12.4%
Denver	38.0%	70.1%	18.1%
Fort Worth	16.1%	33.6%	8.7%
Houston	25.4%	107.2%	6.3%
New Orleans	28.7%	68.3%	6.7%
Oklahoma City	18.5%	113.9%	4.4%
Phoenix	39.9%	62.9%	18.7%
Salt Lake City	4.9%	-0.7%	8.3%
San Antonio	19.4%	118.8%	3.1%
East Coast			
Baltimore	64.1%	118.5%	13.1%
Boston	81.2%	128.6%	10.2%
Hartford	51.2%	106.2%	15.1%
Miami	80.5%	122.8%	22.8%
New York City	92.4%	192.3%	12.7%
Norfolk	72.8%	119.9%	8.6%
Philadelphia	60.2%	155.3%	10.5%
Providence	95.8%	228.2%	11.2%
Washington DC	83.8%	150.9%	18.5%
West Coast			
Anaheim	105.4%	138.8%	26.0%
Los Angeles	96.9%	139.0%	19.2%
Oakland	93.1%	133.5%	19.4%
Portland	25.7%	37.1%	12.9%
Sacramento	104.0%	230.0%	22.1%
San Bernardino	105.2%	232.8%	23.5%
San Diego	121.0%	175.2%	19.9%
San Francisco	73.5%	89.4%	5.0%
San Jose	60.2%	74.6%	15.6%
Seattle	36.8%	56.3%	13.1%

Table 6
Land's Share of Home Value by Region of the U.S., 1984 to 2004

	1984	1998	2004
	—— share ——		
Full sample	0.320	0.397	0.509
By region:			
Midwest	0.107	0.265	0.362
Southeast	0.267	0.359	0.415
Southwest	0.346	0.308	0.384
East Coast	0.376	0.461	0.644
West Coast	0.550	0.608	0.738
Cities within regions:			
Midwest			
Buffalo	0.050	0.202	0.287
Chicago	0.205	0.398	0.521
Cincinnati	0.081	0.337	0.393
Cleveland	0.050	0.360	0.408
Columbus	0.193	0.389	0.424
Detroit	0.050	0.248	0.325
Indianapolis	0.053	0.249	0.273
Kansas City	0.159	0.220	0.307
Milwaukee	0.125	0.331	0.466
Minneapolis/St. Paul	0.121	0.251	0.458
Pittsburgh	0.050	0.126	0.260
Rochester	0.205	0.219	0.281
St. Louis	0.050	0.121	0.300
Southeast			
Atlanta	0.255	0.288	0.358
Birmingham	0.119	0.308	0.357
Charlotte	0.559	0.577	0.565
Memphis	0.136	0.295	0.305
Tampa	0.264	0.329	0.489
Southwest			
Dallas	0.586	0.425	0.462
Denver	0.271	0.383	0.472
Fort Worth	0.448	0.296	0.341
Houston	0.274	0.189	0.312
New Orleans	0.286	0.357	0.466
Oklahoma City	0.279	0.129	0.233
Phoenix	0.606	0.479	0.558
Salt Lake City	0.080	0.373	0.353
San Antonio	0.284	0.141	0.258
East Coast			
Baltimore	0.403	0.484	0.645
Boston	0.501	0.600	0.757
Hartford	0.285	0.397	0.541
Miami	0.587	0.578	0.713
New York City	0.322	0.444	0.674
Norfolk	0.419	0.418	0.593
Philadelphia	0.207	0.343	0.547
Providence	0.193	0.390	0.654
Washington DC	0.467	0.493	0.674
West Coast			
Anaheim	0.760	0.704	0.819
Los Angeles	0.608	0.649	0.787
Oakland	0.607	0.646	0.781
Portland	0.234	0.531	0.579
Sacramento	0.376	0.394	0.638
San Bernardino	0.511	0.390	0.633
San Diego	0.658	0.651	0.811
San Francisco	0.749	0.811	0.885
San Jose	0.682	0.756	0.824
Seattle	0.318	0.548	0.626

Table A.1
Total Home Value in 2000, by MSA, and as a fraction of U.S. Total[26]

MSA	Number of Households (millions)	Average Home Value	Total Home Value ($billions)	Percentage of U.S. Total
Los Angeles	1.39	$292,978	$408.04	4.52%
New York	1.34	$298,608	$401.25	4.44%
Chicago	1.50	$213,725	$320.48	3.55%
Boston	0.75	$329,916	$247.40	2.74%
Washington, DC	0.77	$259,465	$200.12	2.21%
San Jose	0.31	$596,146	$184.97	2.05%
Anaheim	0.47	$373,424	$175.38	1.94%
Oakland	0.44	$398,061	$173.47	1.92%
Detroit	1.02	$150,546	$153.81	1.70%
San Francisco	0.23	$662,740	$151.86	1.68%
Atlanta	0.86	$174,456	$150.58	1.67%
Philadelphia	0.81	$182,811	$148.54	1.64%
Seattle	0.55	$264,350	$146.46	1.62%
San Diego	0.45	$315,524	$141.50	1.57%
Miami	0.71	$198,389	$139.97	1.55%
Minneapolis/St. Paul	0.69	$181,982	$125.76	1.39%
Phoenix	0.64	$191,011	$121.75	1.35%
San Bernardino	0.65	$183,335	$118.87	1.32%
Houston	0.87	$133,004	$115.45	1.28%
Dallas	0.69	$166,073	$114.84	1.27%
Denver	0.42	$211,938	$88.87	0.98%
Baltimore	0.42	$201,935	$84.48	0.93%
Portland	0.40	$207,863	$82.39	0.91%
St. Louis	0.58	$136,723	$79.76	0.88%
Cleveland	0.45	$167,222	$75.42	0.83%
Cincinnati	0.42	$166,848	$70.01	0.77%
Sacramento	0.34	$201,412	$67.77	0.75%
Pittsburgh	0.53	$110,121	$57.95	0.64%
Kansas City	0.41	$139,434	$57.52	0.64%
Columbus	0.33	$165,840	$54.37	0.60%
Providence	0.30	$180,214	$53.93	0.60%
Tampa	0.41	$129,033	$52.28	0.58%
Milwaukee	0.29	$164,459	$47.99	0.53%
Charlotte	0.28	$171,937	$47.85	0.53%
Fort Worth	0.37	$122,065	$45.28	0.50%
Norfolk	0.28	$148,796	$42.40	0.47%
Hartford	0.22	$186,811	$41.50	0.46%
Indianapolis	0.33	$125,267	$41.17	0.46%
Salt Lake City	0.23	$175,263	$39.49	0.44%
Memphis	0.25	$126,773	$31.76	0.35%
Birmingham	0.23	$134,957	$30.73	0.34%
San Antonio	0.32	$93,108	$29.96	0.33%
New Orleans	0.24	$125,306	$29.50	0.33%
Rochester	0.22	$121,127	$27.13	0.30%
Buffalo	0.23	$111,554	$26.20	0.29%
Oklahoma City	0.22	$89,243	$19.38	0.21%

[26] All variables (including households) refer to single-family owner-occupied units.