Volume Working Title: The Economics of Agglomeration

Volume Editor / Conference Organizer: Edward L. Glaeser

Volume Publisher: University of Chicago Press

Volume URL: http://www.nber.org/books/glae08-1

Conference Date: November 30-December 1, 2007

Title: Dispersion in House Price and Income Growth Across Markets: Facts and Theories

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Date Received: March 19, 2009

URL: http://www.nber.org/chapters/c7979

# Dispersion in House Price and Income Growth Across Markets: Facts and Theories


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Draft of January 30, 2009


Abstract

Urban success increasingly has taken two different forms in the post-war era. One involves very high house price growth with relatively little population growth. The other pairs strong population expansion with mild house price appreciation. We document the heterogeneity across MSAs in the long-run house price growth rate and show that house price growth and housing unit growth tend to be inversely related. Income growth, too, varies widely across MSAs and high house price growth markets experience both high income growth and a right-shift of their entire income distribution. We then discuss four possible explanations for these relationships. One is differences the growth of urban amenities; another is changes in urban productivity; a third is differential growth in agglomeration economies; the last explanation relies on growth in the population of rich households at the national level. These households differentially sort by income into supply-constrained metropolitan areas, with the rich having to outbid other potential residents for the scarce slots available in supply-constrained metropolitan areas. The evidence suggests that this latter explanation is responsible for a significant portion of the urban outcomes we see, but it also is clear that much more work is needed to pin down the relative contributions of these basic factors.



A previous version of this paper was written for the NBER Economics of Agglomeration Conference to be held in Cambridge, MA, on November 30, 2007-December 1, 2007. We appreciate the comments of Ed Glaeser and anonymous referees. Gyourko and Sinai also thank the Research Sponsors Program of the Zell/Lurie Real Estate Center at The Wharton School for financial support. Mayer thanks the Milstein Center for Real Estate at the Columbia Business School for its support.

## I. Introduction

One of the most striking patterns in the American socio-economic landscape since World War II involves the skewness of long-run house price growth. Real house prices in metropolitan areas (MSAs) such as San Francisco, Boston, and New York have appreciated at rates well above the national average over the post-war period. Indeed, this time period has witnessed two very different patterns of urban success. One pairs strong population expansion with mild house price appreciation. But the other involves very high house price growth with relatively little population growth.

This latter phenomenon is especially intriguing because high house price growth in a MSA implies that new residents have to pay ever-increasing amounts to live there, especially relative to the MSAs with greater population growth. Of course, basic price theory tells us that consistently high prices require some limits on new supply. After all, if land were plentiful and homebuilders could supply new units whenever prices rose sufficiently above production costs to provide them a competitive return, prices would never exceed construction cost in the long run. Others have studied supply side constraints, and there is no doubt that many localities have become expert at imposing a myriad of hurdles that raise the cost of developing new housing (Glaeser and Gyourko (2003), Glaeser, Gyourko and Saks (2005a,b); Gyourko, Saiz and Summers (2008); Saks (2008)).

While inelastic supply is necessary for above-average long-run house price growth, it is not sufficient. Some factor must drive demand for living in the high price-growth MSAs so that households are willing to pay an increasing house price premium to live there. In this paper, we consider four potential explanations that stem from recent urban research. One possibility is that the value of agglomeration is rising in some inelastically supplied cities. Another is that these cities simply have become more productive, but not due to agglomeration. A third possibility is that the level of amenities in these cities has grown. And the fourth explanation is that the dispersion in house price growth arises from an increasing number of high income families at the national level, combined with households sorting across metropolitan areas. In this case, the rich households ultimately outbid others for the scarce slots available in supply-constrained metropolitan areas. We will conclude that the evidence suggests that this sorting mechanism is at least partially responsible for the urban outcomes we see, but it also is clear that much more work is needed to pin down the relative contributions of these basic factors.

We begin in the next section by describing some basic facts about the long-run evolution of house prices over time by MSA. [1] There is considerable heterogeneity in long-run house price growth across MSAs, and those cross-MSA differences persist. We show that many MSAs that experienced high house-price growth had little population growth, and vice versa. Following Gyourko, Mayer, and Sinai (2006), we classify a subset of MSAs with high house price growth and low population growth as "superstar cities." These cities experienced growing demand that was capitalized into land prices rather than being manifested as new construction.

In Section 3, we use a spatial equilibrium structure developed by Glaeser and Tobio (2008) to decompose the patterns of income, population, and housing unit growth to shed light on how Superstar cities differ from other cities in regard to growth in their amenities, productivity, and housing supply. This framework implies that Superstar cities have much lower housing supply growth than other cities. It also shows little difference between Superstars and other cities in the growth rate of amenities or productivity.

[1] Because we use decennial census data, our empirical analysis stops before the recent housing market bust. While this cycle is very interesting for a variety of reasons, our story and analysis are much more about trends that are not dependent upon short-run dynamics.

The spatial distribution of income growth is brought to bear in Section 4, as another set of stylized facts that need explaining. Not only do long-run income growth rates vary widely across MSAs, those MSAs with growing house prices experience more rapidly growing average incomes as well as a right-shift in the entire income distribution. This fact is not true for any high-demand MSA, only those where it is difficult to construct new housing.

In Sections 5 and 6, we discuss how the various possible explanations for urban growth – growing amenities, greater productivity, agglomeration benefits, or growth in the right tail of the national income distribution – comport with the stylized facts we established earlier. Section 7 briefly concludes.

## II. Stylized Facts on the Growing Dispersion in House Prices

### *A. House Price Growth*

We use and discuss a variety of data from the U.S. decennial censuses, aggregated to the level of the metropolitan area, which corresponds to the local labor market. We use a sample of 280 such areas that had populations of at least 50,000 in 1950 and are in the continental United States.[2] Information on the distribution of house values, family incomes, population, and the number of housing units were collected.

[2] Thirty-six areas with populations under 50,000 in 1950 were excluded from our analysis because of concerns about abnormal house quality changes in markets with so few units at the start of our period of analysis. Those MSAs are: Auburn-Opelika, Barnstable, Bismarck, Boulder, Brazoria, Bryan, Casper, Cheyenne, Columbia, Corvallis, Dover, Flagstaff, Fort Collins, Fort Myers, Fort Pierce, Fort Walton Beach, Grand Junction, Iowa City, Jacksonville, Las Cruces, Lawrence, Melbourne, Missoula, Naples, Ocala, Olympia, Panama City, Pocatello, Punta Gorda, Rapid City, Redding, Rochester, Santa Fe, Victoria, Yolo, and Yuma. That said, none of our key results are materially affected by this paring of the sample. Similar concerns account for our not using data from the first *Census of Housing* in 1940 in the regression results reported below. (All individual housing trait data from the 1940 census were lost, so we cannot track any trait changes over time from that year.) However, we did repeat our MSA-level analysis over the 1940-2000 time period. While the point estimates naturally differ from those reported above, the magnitudes, signs, and statistical significance are essentially unchanged. Finally, the New York PMSA is missing crucial house price data for 1960, and is excluded from the analysis reported below. The census did not report house value data for that year because it did not believe it could accurately assess value for cooperative units, the preponderant unit type in Manhattan at that time.

Since the definitions of metro areas change over time, we use one based on 1999 county boundaries to project consistent metro area boundaries forward and backward through time.[3] Data were collected at the county level and aggregated to the metropolitan statistical area (MSA) or primary metropolitan statistical area (PMSA) level in the case of consolidated metropolitan statistical areas. Data for the 1970-2000 period are obtained from GeoLytics, which compiles long-form data from the decennial *Censuses of Housing and Population*. We hand-collected 1950 and 1960 data from hard copy volumes of the *Census of Population and Housing*. Both sources are based on 100 percent population counts. All dollar values are converted into constant 2000 dollars.[4]

In each data set, we divide the distribution of real family incomes into five categories that are consistent over time. The income categories in the original Census data change in each decade. We set the category boundaries equal to 25, 50, 75, and 100 percent of the 1980 family income topcode, and populate the resulting five bins using a weighted average of the actual categories in $2000, assuming a uniform distribution of families within the bins. Since 1980 had amongst the lowest topcode in real terms, using it as an upper bound reduces miscategorization of families into income bins. We call a family "poor" if its income is less than $39,179 in $2000. "Middle-poor" are those families with incomes between $39,179 and $78,358, "middle" income families have incomes between $78,359 and $117,537, "middle-rich" families lie between $117,538 and $156,716, and "rich" families have incomes in excess of the 1980 real topcode of $156,716.

[3] We use definitions provided by the Office of Management and Budget, available at http://www.census.gov/population/estimates/metro-city/90mfips.txt. One qualification is that in the case of NECMAs, the entire county was included if any part of it was assigned by the OMB.
[4] We also use some data for 1940. Population and housing unit data for that year area based on 100 percent counts, but housing values are averages from the 1940 sample provided by the Integrated Public Use Micro Samples (IPUMs) housed at the University of Minnesota. We do not yet use any family income data for 1940.

Using these data, we begin by detailing the remarkable dispersion – and even skewness – across MSAs in house price growth over the 1950 to 2000 period. Figure 1A plots the kernel density of average annual real house price growth between 1950 and 2000 for our sample of 280 metropolitan areas. The tail of growth rates above 2.6 percent is especially thick and the distribution is right-skewed. Table 1, which lists the average real annual house price growth rate between 1950 and 2000 for the ten fastest and ten slowest appreciating metropolitan areas out of the 50 MSAs with populations of at least 500,000 in 1950, documents that the dispersion seen in this figure is not an artifact of a few areas that were small initially and then experienced abnormally rapid price growth.[5]

These annual differences in house price growth rates compound to very large price gaps over time even within the top few markets. For example, San Francisco's 3.5 percent annual house price appreciation implies a 458 percent increase in real house prices between 1950 and 2000, more than twice as large as seventh-ranked Boston at 212 percent, which itself still grew 50 percent more than the sample average of 132 percent for the 50 most populous metropolitan areas.[6] Figure 2A, which plots a kernel density estimate of the 280 metropolitan area average house values in 1950 and 2000, shows that skewness has increased over the last 50 years, with a relative handful of markets ending up commanding enormous price premiums. Figure 2B normalizes the means and standard deviations of the 1950 and 2000 house value distributions so they are equal and plots them against each other. In 2000, the right tail of the MSA house value distribution extends to four times the mean, more than twice the highest MSA from the right tail

[5] A complete list of house price appreciation rates by metropolitan area, along with 1950 and 2000 mean housing prices is reported in Appendix 1.

[6] It is worth emphasizing that the extremely high appreciation seen in the Bay Area, southern California, and Seattle markets is not restricted to the past couple of decades. The top five markets in terms of annual real appreciation rates between 1950-1980 are as follows: (1) San Francisco, 3.65 percent; (2) San Diego, 3.49 percent; (3) Los Angeles, 3.20 percent; (4) Oakland, 2.99 percent; and (5) Seattle, 2.88 percent.

of the 1950 Census. The left tail ends at about half the mean in both years, although it is slightly more skewed in the 2000 Census.

There also is long-run persistence in the markets which exhibit above-average price growth. Across the two 30-year periods from 1940-1970 and 1970-2000, average annual percentage house price growth has a positive correlation of about 0.3. The root of this latter result can be seen in Table 2, which reports the transition matrix for MSAs ranked by their average real house price growth rates computed over the two 30-year periods of 1940-1970 and 1970-2000. Most high appreciation areas do not move very far in their relative price growth ranking. For example, of the 32 MSAs in the top quartile of annual house price growth between 1940 and 1970, half were still in the top quartile and nearly two-thirds remained ranked in the top half between 1970-2000. Outside of the top growth rate areas, there is more movement across the distribution.[7]

B. *House Price and Housing Unit Growth*

Typically, the markets with high long-run house price growth have not experienced much growth in the number of housing units, although that relationship has evolved over time as housing supply has presumably become more inelastic in some cities. In Table 3, we document the relationship between housing price and housing unit growth over time for the high price appreciation markets. To estimate this relationship, we regress the decadal growth in the number of housing units at the MSA level on the long-run growth in house price, allowing a different intercept and slope for those areas in the top quartile of the price appreciation distribution. Specifically, we estimate

(1) $\%\Delta H_{i,t} = \alpha + \beta*\%\Delta P_i + \gamma*(TopQuartile_i) + \delta*(\%\Delta P_i* TopQuartile) + \varepsilon_{i,t}$,

[7] Over shorter horizons such as a decade, MSAs can experience large price swings. In fact, the correlation in house price appreciation rates across decades often is negative.

where $\%\Delta H_{i,t}$ is the percentage change in housing units in metropolitan *i* during decade *t*, $\%\Delta P_{i,}$ is the percentage house price growth in metropolitan area *i* during between 1960-2000, and TopQuartile is a dummy indicator for whether the metropolitan area is among the top quartile of areas in terms of house price appreciation over the 1960-2000 period.

These results show that the price growth/unit growth relationship for the top quartile of the price appreciation distribution essentially has disappeared between the 1960s and the 1990s. For the bottom 75 percent of the price growth distribution, the relationship between average price growth and unit growth is positive, and with the exception of the 1980s, flat over the decades. The MSAs in the top quartile in terms of price appreciation start out in 1970 with a slightly less positive correlation than for the lower 75 percent (11.12 – 3.12 = 8.0 correlation). By the 1970s, however, the highest price growth markets already are in negative territory (17.18 – 18.14 = -0.96), while there still is a large positive relationship between long-run price growth and housing unit production for the other metropolitan areas. The negative correlation for the top quartile increases over time, to -3.62 in the 1980s and -3.89 in the 1990s.

C. *Classifying 'Superstar Cities'*

We now turn to other work we have done (Gyourko, Mayer and Sinai (2006)) to identify those markets with high house price growth and low housing unit growth. Such markets are termed 'superstar' markets in that research, and they are markets that are in high demand and in which something prevents the development of many new homes.[8] Thus, house price growth is very high, but housing unit growth is not.

Because we do not observe the true state of demand and the literature does not provide high quality estimates of the elasticity of supply, the following two measures are combined to

[8] That something could be a natural constraint such as an ocean or a man-made constraint in the form of binding growth controls on housing development.

determine whether a market is a 'superstar'. First, a market is classified as in high demand if the sum of its housing unit and housing price growth is above the sample median for the relevant period of analysis. Second, a metropolitan area is defined to have a low elasticity of supply if its ratio of housing price growth to housing unit growth is at or above the 90$^{th}$ percentile of the distribution for all metropolitan areas over the relevant period of analysis.

Each of these measures is constructed using data from the two decades prior to the year for which a superstar designation is made. Thus, the status of each metropolitan area is classified from 1970-2000, with 1970 being the first year because the underlying data begin in 1950.[9] Figure 3 documents the outcome of this methodology for the most recent period—using 1980-2000 data to determine superstar status in 2000. Average real annual house price growth between 1980-2000 is on the y-axis, with housing unit growth over the same two decades on the x-axis. The single downward-sloping line reflects the boundary between markets with a sum of price and unit growth above the sample median across all our MSAs for 1980-2000. Any metro area lying below that line is a relatively low demand place by definition. The left-most and steepest positively-sloped line from the origin captures the elasticity of supply at the 90$^{th}$ percentile of the distribution of the ratio of price growth to unit growth. For this twenty year period, the MSA at the 90$^{th}$ percentile has a ratio of real annual house price growth to unit growth above 1.7. The right-most and flattest positively-sloped line from the origin reflects the inverse of the 90$^{th}$ percentile ratio value (i.e., 1/1.7, or 0.59).

Cities in the region marked 'A', which is both above the boundary determining low demand status and above the boundary marking significant inelasticity of supply, include many

[9] Because the empirical task here is to document whether equilibrium relationships implied by our model exist in the data rather than to identify causal mechanisms for why a place becomes a superstar, the use of lagged data is not driven by endogeneity concerns (which these lags would not deal with effectively in any event). Rather, we wish to be able to classify superstar status in the most recent census data from the year 2000, and we suspect that any relationship between income segregation and house price effects occur after the superstar market has 'filled up'.

coastal markets including San Francisco, New York, and Boston that have experienced very strong house price appreciation (indicating high latent demand), but little supply response in terms of new construction over the past two decades. The other markets in relatively high demand areas are divided into two groups for the purposes of the empirical analysis below. What we term 'Non-superstars' are the metropolitan areas in the 'C' range, which include markets with relatively high housing unit production and relatively low housing price growth. These high demand markets, which include Las Vegas and Phoenix, build sufficient new housing to satisfy demand so that real price growth is low. The remaining high demand markets are in-between the Superstars and Non-Superstars and lay in the 'B' range in Figure 3. They have experienced relatively high demand, and have both built at least a modest amount of new units and experienced a moderate amount of real house price appreciation. The final set of metropolitan areas are in low demand, and lay in the 'D' region below the negatively-sloped line in Figure 3.

This nonlinear categorization is useful because it allows us to observe how MSAs evolve over time. It seems natural that metropolitan areas could become more inelastically supplied as they grow and begin to "fill up" in the face of geographic constraints or politically-imposed restrictions on development. This would appear as a market moving over time from area C to B to A in Figure 3. We do observe such an evolution over time. In 1980, only San Francisco and Los Angeles clearly qualified as superstars in 1980, with the other markets filling up over time.

## III. Characteristics of Superstar Market Growth: Decomposing the Roles of Productivity, Amenities and Housing Supply

As a first pass in understanding what determines the unique price growth of superstar markets, we apply a strategy developed by Glaeser and Tobio (2008). Their approach uses structure imposed by a Rosen-Roback style theory to transform MSA-differences in house price growth, population growth, and income growth into implied differences in the growth of MSA-specific amenities, productivity, and housing supply. We use this decomposition to see how superstars vary from other cities on these dimensions.

Following Glaeser and Tobio (2008), every market in the U.S. is characterized by a location-specific productivity level of A, and firm output of $AN^{\beta}K^{\gamma}Z^{1-\beta-\gamma}$, where *N* represents the number of workers, *K* is traded capital, and *Z* is non-traded capital. Traded capital always can be purchased for a price of one. The location has a fixed supply of non-traded capital equal to $\overline{Z}$.

Three equilibrium conditions can be derived involving households, firms, and the housing market. One involves consumers who are presumed to have Cobb-Douglas utility defined over tradable goods and housing, the non-traded good. The equations below assume the following utility function defined over traded goods (C), housing (H), and city amenities (θ): $\theta C^{1-\alpha}H^{\alpha}$. Standard optimizing behavior assumptions yield indirect utility of $\alpha^{\alpha}(1-\alpha)^{1-\alpha}\theta W p_H^{-\alpha}$. Spatial equilibrium requires household utility to be the same everywhere, with the level determined by the utility available (denoted $\underline{U}$) in the reservation market, which always is open to any household or firm.

The second equilibrium condition involves firms, who are presumed to behave competitively, so they cannot earn excess profits in any one market in equilibrium. Hence, their labor demand function is derived from the firm's first-order conditions as usual.[10]

[10] As in Rosen (1979) and Roback (1982), the spatial equilibrium assumption does not mean that wages corrected for local price (real wages) are equal across space, but that higher real wages in some places are offsetting lower amenity levels. However, spatial equilibrium is presumed to hold at every point in time, which does imply that housing prices are sufficiently flexible to offset differences in wages and amenities, not that labor or capital has perfectly adjusted at all times and place..

An important innovation of Glaeser and Tobio (2008) that is quite relevant for this chapter is its introduction of housing supply heterogeneity into the classic urban spatial equilibrium framework. Specifically, housing is produced competitively with height (*h)* and land (*L)*, so that the total quantity of housing supplied equals *hL*. There is a fixed quantity of land in the market area, denoted $\bar{L}$, which will determine an endogenous price for land ( $p_L$ ) and housing ( $p_H$ ). The cost of producing *hL* units of structure on *L* units of land is presumed to be $c_0 h^{\delta} L$. Given these assumptions, the developer's profit for producing these *hL* units of housing is $p_H hL - c_0 h^{\delta} L - p_L L$, where $\delta > 1$. Of course, this must equal zero given that we have presumed free entry of developers. The first order condition for height then implies the area's housing supply.

The firms' labor demand equation, the equality between indirect utility in the town and reservation utility, and the housing price equation are three equations with the three unknowns of population, income and housing prices. Solving these equations for the unknowns yields equations (2)-(4) from Glaeser and Tobio (2008):

$$(2)\;\; Log(N) = K_N + \frac{(\delta + \alpha - \alpha\delta)Log(A) + (1-\gamma)\left(\delta Log(\theta) + \alpha(\delta-1)Log(\bar{L})\right)}{\delta(1-\beta-\gamma) + \alpha\beta(\delta-1)}$$

$$(3)\;\; Log(W) = K_W + \frac{(\delta-1)\alpha Log(A) - (1-\beta-\gamma)\left(\delta Log(\theta) + \alpha(\delta-1)Log(\bar{L})\right)}{\delta(1-\beta-\gamma) + \alpha\beta(\delta-1)} \text{ and}$$

$$(4)\;\; Log(p_H) = K_P + \frac{(\delta-1)\left(Log(A) + \beta Log(\theta) - (1-\beta-\gamma)Log(\bar{L})\right)}{\left(\delta(1-\beta-\gamma) + \alpha\beta(\delta-1)\right)}$$

where $K_N$, $K_W$ and $K_P$ are constant terms that differ across cities, but not over time within a city, and all other terms are as defined above.

These static relations are transformed into dynamic ones by presuming that changes to productivity, amenities and housing supply are characterized by the following growth equations:

(5) $Log(A_{t+1}/A_t) = K_A + \lambda_A S + \mu_A$;

(6) $Log(\theta_{t+1}/\theta_t) = K_\theta + \lambda_\theta S + \mu_\theta$;

(7) $Log(\overline{L}_{t+1}/\overline{L}_t) = K_L + \lambda_L S + \mu_L$,

where S is a dummy variable reflecting Superstar market status as defined above, the terms $K_A$, $K_\theta$ and $K_L$ are constants, the terms $\lambda_A$, $\lambda_\theta$ and $\lambda_L$ are the expected difference in growth rates for Superstar markets, and $\mu_A$, $\mu_\theta$ and $\mu_L$ are standard error terms. Given this, equations (2)-(4) imply the following:

(8) $Log\left(\frac{N_{t+1}}{N_t}\right) = K_{\Delta N} + \chi^{-1}\left((\delta + \alpha - \alpha\delta)\lambda_A + (1-\gamma)(\delta\lambda_\theta + \alpha(\delta-1)\lambda_L)\right)S + \mu_N$

(9) $Log\left(\frac{W_{t+1}}{W_t}\right) = K_{\Delta W} + \chi^{-1}\left((\delta-1)\alpha\lambda_A - (1-\beta-\gamma)(\delta\lambda_\theta + \alpha(\delta-1)\lambda_L)\right)S + \mu_W$

(10) $Log\left(\frac{P_{t+1}}{P_t}\right) = K_{\Delta P} + \chi^{-1}(\delta-1)(\lambda_A + \beta\lambda_\theta - (1-\beta-\gamma)\lambda_L)S + \mu_P$

where $\chi = (\delta(1-\beta-\gamma) + \alpha\beta(\delta-1))$.[11]

Equations (8)-(10) enable us to transform differential changes in population, incomes, and house prices across Superstar and other cities into differences in innovations in productivity, amenities, and housing supply over time. Each of the equations can be estimated using OLS by regressing each of log population, income, or house price growth on a constant and a Superstar indicator variable, recovering the estimated coefficients on the Superstar dummy, which are $B_{pop}$, $B_{inc}$, and $B_{val}$, respectively. Then, some algebra yields that the connection between Superstar status and productivity growth ($\lambda_A$) equals (1-β-γ) $B_{pop}$ + (1-γ)$B_{inc}$, where $B_{pop}$ and $B_{inc}$ are the

[11] The interested reader should see Glaeser and Tobio (2008) for more detail on the derivation of these equations.

estimated coefficients on a Superstar market dummy variable from the population and wage change regressions, respectively. The weight on the population regression coefficient is the share of production associated with immobile capital. The weight on the income regression coefficient is the share of production associated with labor plus immobile inputs.[12]

The connection between between Superstar status and changing amenities is given by $\lambda_\theta$, which equals $\alpha B_{val} - B_{inc}$, where $\alpha$ is the share of expenditure going towards housing, and $B_{val}$ is the coefficient from the house price change regression. Given that traded goods always cost one and that housing is the only non-traded good, this difference reflects the change in real wages. If real wages are decreasing, then amenities are rising, so that the basic insight of the static Rosen/Roback compensating differential model also holds in this more dynamic context.[13]

The connection between housing supply growth and Superstar status, $\lambda_L$, equals $B_{pop}$ + $B_{inc} - [\delta/(1-\delta)]B_{val}$, where $\delta$ reflects the elasticity of housing supply. In this equation, population directly affects housing supply one for one, as everyone in the market has to live in a housing unit. Hence, if Superstar markets have relatively low population growth, the $B_{pop}$ term will be negative. The population/housing supply relationship is then adjusted for income and price effects. Higher relative income growth in Superstars will raise the estimate of $\lambda_L$. However, house price growth that is substantially higher in Superstar markets will lower the value of $\lambda_L$, with the weight determined by the elasticity of supply.[14]

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[12] In the results reported below, we follow Glaeser and Tobio (2008) in presuming that labor's share of input costs ($\beta$) equals 0.6, with that for mobile capital ($\gamma$) being 0.3.

[13] In the results reported below, we presume that $\alpha$=0.3, which Glaeser and Tobio (2008) also used based on their examination of *Consumer Expenditure Survey* data over time.

[14] We presume that $\delta$=3 in the analysis below. Supply would be perfectly elastic if $\delta$=1, which clearly is not the case in at least some markets or for the nation on average. Glaeser and Tobio (2008) also worked with $\delta$=3. The value of $\delta$ does affect the magnitude of the housing supply innovations, although no reasonable value changes the relative magnitudes of the contributions of productivity, amenities, or housing supply.

To estimate $B_{pop}$, $B_{inc}$, and $B_{val}$, for each decade we regress the decadal log change in population, mean income, or mean house price on a dichotomous dummy for whether the market *ever* was a Superstar during our sample period. Thus, the Superstar indicator is constant within each MSA. We also included a number of controls, including beginning of period mean population, mean income, mean house price, and the share of the adult population with a college degree. Those regression coefficients are reported in Table 4. The results typically were not economically or even statistically different if we omitted the controls.

It is worth noting that our definition of a Superstar market, as described in the preceding section, is a function of the prior two decades' house price and housing unit growth. Since our data starts in 1950, our first decade where Superstar status is fully pre-determined is 1970. However, since we are using an indicator for whether an MSA *ever* was defined as a Superstar, we feel comfortable backcasting the Superstar identification to 1960. When we use a time-varying definition of Superstar status, in the next section, we will restrict our attention to 1970 and later.

In the 1960s, population growth in markets that ultimately became Superstars was not materially different from those that did not. However, it has been appreciably lower in every subsequent decade, with the gap widening over time. These estimated coefficients are reported in the first four columns of the top panel of Table 4. Superstar MSAs had almost 4 percentage points lower population growth (relative to other MSAs) in the 1970s, almost 5 percentage points lower in the 1980s, and almost 8 percentage points lower in the 1990s. To smooth out some decade-to-decade fluctuations, the last two columns of Table 4 pool the 1960 and 1970s decades, and the 1980s and 1990s decades. Over the 1960-1980 period, Superstars had statistically insignificantly lower population growth.  But during 1980-2000, Superstars' population growth averaged almost 5.5 percentage points lower than other MSAs.

Superstar markets also experienced higher income and house price growth, as can be seen in the middle and bottom panels of Table 4, respectively.  However, all of the higher growth came in the 1960s and 1980s.  Indeed, during the 1970s and 1990s, Superstar markets had income and price growth below that of other cities (with the exception of house price growth in the 1970s).  However, the more rapid growth for Superstars in the 1960s exceeded the decline in the 1970s, and the growth in the 1980s exceeded the decline in the 1990s.  Thus, in the last two columns of Table 4, which average across decade pairs, Superstars had income and house price growth that typically exceeded that of other MSAs.  Over the 1960-1980 period, Superstars had almost no excess income growth, but had almost 5 percentage points higher house price growth. Over the 1980-2000 period, Superstars experienced almost 4 percentage points higher income growth and almost 8 percentage points higher house price growth.

The decade-to-decade volatility in the estimated Superstar coefficients is not so surprising given the well-known mean-reversion in house prices.  If Superstars have higher trend income and house price growth, but also greater volatility around that trend, then excess growth in one decade should be followed by less growth the next.  This effect is compounded by our observing house prices and incomes only once per decade.  Instead, what Table 4 shows is that the *long-run* trends for Superstars in income and house price growth are above those of other MSAs, while their long-run population growth is below that of other markets on average.

Next, we apply equations 8-10 to convert the estimated coefficients in Table 4 into innovations in productivity, amenities, and housing supply in Table 5.[15] At the decadal frequency, Superstar markets do not exhibit consistently higher productivity or amenity growth (the first two panels). The estimates are positive in some decades and negative in others. For productivity, only in the 1980s did Superstar MSAs seem to experience sizeable excess productivity growth. The decadal amenity results are small in general, indicating that Superstar markets are not very different from the average along this dimension.

When we look at the 20-year periods, in the last two columns of Table 5, the pattern becomes clearer. Superstars had effectively no excess productivity growth during the 1960-1980 period, but they did have 2.2 percentage points higher productivity growth during the 1980-2000 period. By contrast, Superstars' amenity growth is not much different from that of other cities and, over the 1980-2000 period, was actually below that of non-superstar markets.

Superstar markets are most consistently different from other areas in terms of their housing supply growth, as can be seen in the bottom panel of Table 5. It was much less (9 percentage points) even in the 1960s before these places 'filled up' according to our measure of 'superstarness'. Relative housing supply was similarly low in the 1970s, with these markets building dramatically less in the 1980s. The results for the 1990s indicate a marked change in this pattern, although the estimate is only slightly positive at 2.9 percentage points. This discrepancy is swamped by the overall trend, as can be seen in the last two columns. Over 1960-1980, Superstars' supply growth was 8.2 percentage points lower than for other cities. That difference rose to 13.5 percentage points during 1980-2000.

[15] All regression coefficients and assumptions regarding consumption and sector shares are taken at face values in these calculations, which is why no standard errors are reported for these figures. They should be interpreted as stylized facts, not as precise estimates.

In sum, the only clear pattern is that Superstars have long had much less housing production than other markets. There is some evidence that productivity growth was higher for Superstars in the last two decades, but as noted before, the productivity growth results are sometimes positive and sometimes negative with just the 1980s generating the bulk of the higher measured productivity growth. Thus, not only are the magnitudes of the productivity differences smaller than the housing supply effects, there is less of a clear pattern indicating that Superstar markets are more (or less) productive than other markets.

## IV. The Distribution of Income Within Metropolitan Areas: Superstars vs. Non-Superstars

What enabled us to distinguish productivity and amenity growth in Section III was the relationship between the growth of average income and average house prices. If house price growth were large relative to income growth in a given MSA, one could conclude that amenities were improving since the after-housing income would have declined. If income or population growth were high, that indicates greater local productivity leading to greater demand for living in the city. In large part, what Tables 4 and 5 tell us is that house price growth and income growth must have been highly correlated within MSA. Indeed, the distribution of income growth rates across MSAs looks very much like that of house price growth, with wide dispersion and some right-skew. This partly can be seen in Figure 4, which plots the kernel density of average annual real income growth over the 1950 to 2000 period by MSA. It shows that growth rates range from 0.8 percent per year to 3.1 percent.

However, another important stylized fact is that the entire distribution of income, not just the average, has been changing differentially for Superstar MSAs, even relative to the nation as a whole. Over the last 50 years, the U.S. has experienced growth in the absolute number, population share, and income share of high-income households (Autor *et al* (2006), Piketty and Saez (2003), Saez (2004)). The left panel of Figure 5 shows that the aggregate distribution of family income across all MSAs in the U.S. has been shifting to the right in real dollars as the right tail of the income distribution has grown much faster than the mean. The right panel of Figure 5 then displays the evolution of the number of families in each of the income bins. Most of the growth in the number of families was among those earning more than the $78,358 median value for our sample.

These changes in the national high-income share were accompanied by very disparate patterns at the metropolitan area level. Two canonical MSAs – San Francisco and Las Vegas – provide a vivid contrast. San Francisco experienced low levels of new construction and high house price growth (Figure 6). Between 1950 and 1960, the San Francisco primary metropolitan statistical area (PMSA) expanded its population by about 48,000 families. Over the subsequent *four* decades, San Francisco grew by only 44,000 families, with two-thirds of that growth taking place between 1960 and 1970. Real house prices spiked in San Francisco after 1970, growing between 3 and 4 percent per year between 1970 and 1990, about 1.5 percentage points above the average across all MSAs, and 1.4 percent per year between 1990 and 2000, almost one percentage point above the all-MSA average. By contrast, over the same time period, Las Vegas saw explosive population growth, expanding from fewer than 50,000 families in 1960 to the size of the San Francisco PMSA by 2000 (Figure 7). Yet, it experienced modest real house price growth that was well below the national average.

Note that San Francisco's high-income share grew disproportionately. San Francisco, which always had relatively more rich families and fewer poor families than Las Vegas, became even more skewed toward high income families between 1960 and 2000. Since the number of families in the San Francisco MSA did not grow by much, the MSA actually experienced an increase in the number of rich families and a reduction in the number of lower income ones. In fact, only the richest groups, with incomes of $78,358 and above, increased their share of the number of families in the San Francisco MSA.

In stark contrast, the overall income distribution in Las Vegas did not keep up with the nation (left panel of Figure 7), leaving that metropolitan area progressively more poor relative to both San Francisco and the U.S. metropolitan area aggregate. The large numbers of new families in Las Vegas were both rich and poor, leading to substantial growth in the number of families across Las Vegas' income distribution. Relative to the national income distribution, however, the growth in Las Vegas was skewed towards poorer families.

We can generalize this pattern beyond San Francisco and Las Vegas by comparing the evolution of the income distribution in our Superstar MSAs to other MSAs. Table 6 reports regression results on the link between income distributions and house prices using our earlier categorization of cities into Superstar versus non-superstar status. We start with the cross sectional relationship and then examine the data over time. Specification (11) investigates whether a typical superstar market's household income is skewed to the right of the U.S. income distribution, as we saw was the case for San Francisco. Specifically, we estimate the following regression for MSA *i* in year *t*:

$$(11)\quad \frac{\#\text{ in Income Bin}_{\text{yit}}}{\#\text{ of Households}_{\text{yit}}} = \beta_1(\text{Superstar}_{\text{i}}) + \beta_2(\text{Non-superstar}_{\text{i}}) + \beta_3(\text{Superstar}_{\text{it}}) + \beta_4(\text{Non-superstar}_{\text{it}}) + \gamma_1(\text{Low Demand}_{\text{i}}) + \gamma_1(\text{Low Demand}_{\text{it}}) + \delta_t + \varepsilon_{it}\ .$$

Essentially, this regression relates the share of a MSA's families that are in each income bin to its superstar status, and controls for total demand.[16]

[16] See Appendix Table 2 for summary statistics on all variables used in these regressions.

The first column of the top panel of Table 6 is based on a pooled cross section of 1,116 MSA × year observations.[17] As in Table 4, this regression treats superstar status as a (non-exclusive) fixed MSA characteristic, including indicator variables for whether the MSA ever was a superstar over the 1970-2000 period, whether it is ever in the non-superstar range, whether the MSA ever moved inside the low-demand area, and time dummies. The intermediate, high demand MSAs from region *B* of Figure 3 are the excluded category in all the regressions reported in Table 6.

The difference in income distribution between superstars and all other MSAs is pronounced. MSAs that ever were superstars have a 2.5 percentage point greater share of their families that are in the rich category relative to the excluded high-demand cities (row 1, column 1). This effect is largest at the high end of the income distribution and declines in magnitude as incomes fall. For example, as reported in square brackets in row 1, the high income share of superstar MSAs is about 83 percent more than the 3 percent share rich for the average MSA that is not a superstar. The share of the next-highest income category is 69 percent greater in superstars relative to the average of other MSAs, and 34 percent higher in the middle category. Markets that have ever been superstars also have a nearly 9 percentage point lower share of poor families (row 1, column 5), almost 21 percent less than the other MSAs.

Non-superstar cities appear similar to the in-between group (row 2). Those coefficients are relatively small and do not exhibit a clear pattern. Low-demand MSAs are less high-income and poorer relative to all of the high demand categories of MSAs, although the magnitudes are modest (row 3).

The second panel of Table 6 adds time-varying superstar, non-superstar, and low demand indicator variables to the previous specifications. Prior to becoming superstars, MSAs

[17] This represents 279 MSAs in each census year from 1970-on.

that eventually will become a superstar are richer on average, with a 1.3 percentage point greater share rich and a 7.1 percentage point lower share poor (row 1 of panel 2). When these areas are actually in the superstar region, their share rich goes up by an additional 2.8 percentage points and their share poor declines by a further 4.1 percentage points (row 4 of panel 2). As a baseline, superstar cities have a 43 percent higher share rich, declining monotonically to 17 percent lower share poor, than other MSAs. After their transition to superstar status, these MSAs have an additional 80 to 90 percent greater share of the top two income groups and an 8 to 10 percent lower share of the bottom two income categories. As before, this pattern of results is robust to adding a host of controls for potential unobservables, such as MSA fixed effects, differential time trends for superstars vs. not, or separate year dummies for superstars/non-superstars/low-demand MSAs.

## V. Urban Productivity Differences and the Skewing of House Prices and Incomes

We now turn to a discussion of existing theories of urban growth and how consistent they are with the set of stylized facts that we have established. We first consider growth in amenities as an explanation, then turn to differences in productivity across MSAs, and finally consider dynamic agglomeration economies. In the next section, we will discuss a less traditional story that links national growth in the high-income population to the presence of housing supply constraints in some labor market areas to induce income-based sorting.

The standard spatial equilibrium model in urban economics developed by Rosen (1979) and Roback (1982) suggests that house price differences across markets are a function of amenity and wage (productivity) differentials. Glaeser and Saiz (2003) and Shapiro (2006) investigate the effect of amenities on the growth of population and employment. Both conclude that the link between education and metro area population/employment growth largely is due to productivity, with amenities playing a smaller role.  Going beyond the reduced form OLS estimation standard in the literature, Shapiro (2006) calibrates a neoclassical urban growth model and estimates that about 60 percent of the impact of a higher local population share of college graduates on metropolitan area employment growth is due to productivity, as reflected in wage growth.  This does leave room for improvements in the quality of life to play a role, too, and they appear related to 'consumer city'-type attributes as reflected in various local cultural traits (Glaeser, Kolko and Saiz (2001)).

In our context, growth in amenities conceivably could cause the excess growth in house prices in Superstar markets.  However, this seems unlikely since the results of the decomposition in Section III indicate that amenities play little – if any – role.  This makes intuitive sense: The growth in amenities in some MSAs would have to be substantial in order to match the patterns of long-run house price growth we observe.  In addition, the amenities would have to be favored by high-income households in order to generate the cross-MSA changes in income distributions.

An alternative explanation for our stylized facts is that urban productivity differentials are growing sufficiently to account for the increases in house price and income dispersion that we observe in the data.  Van Nieuwerburgh and Weill (2006) investigate the role of productivity by developing a dynamic, general equilibrium version of the Rosen-Roback model, in which they then run calibration exercises to see whether there has been enough growth in wage dispersion across labor markets to account for the growth in house price dispersion.[18]  Essentially, they assume homogeneous physical markets receive unobservable exogenous productivity shocks and they investigate whether their model can then match the increase in the coefficient of variation in

[18] Van Nieuwerburgh and Weill (2006) provides one of the first truly dynamic frameworks to analyze spatial equilibria.  Glaeser and Gyourko (2006) also have produced a dynamic model, but it is designed to investigate higher frequency movements in house prices.

house prices across markets between two steady states. This exercise yields a very good match of the mean annual increase in house prices between 1975 and 2004 as well as a tight fit of the increase in the coefficient of variation in house prices across markets. This simulation also results in a good match of the growth of population in the productive places with higher wages. Although the framework is dynamic, the essential insight of Rosen and Roback still holds—housing costs are the price one has to pay to access the productivity of a given labor market area.[19]

Although the results in Van Nieuwerburgh and Weill (2006) are consistent with growing urban productivity differentials being the cause of the growing house price dispersion across labor market areas, they are not conclusive in proving causality. In particular, their results are not consistent with the empirical fact in our Table 3 and Figure 3 that the MSAs that experience long-run house price growth often have little population growth, and vice versa. A careful review of Van Nieuwerburgh and Weill's (2006) data indicates that the productive/high wage markets to which the model predicts people should move include both high price growth/low population growth cities in the 'A' section of our Figure 3, as well as high population growth/low price growth cities in the 'C' section. More generally, there is a mixture of both types of markets in Van Nieuwerburgh and Weill's (2006) predicted top wage quintile. Thus, it appears that their model's ability to match the data is at least partially the result of it picking up much of the growing price dispersion from very high price (and price appreciation) coastal markets that have very little home building and population growth; analogously, it looks to be picking up much of the housing unit/population growth from large Sunbelt markets that have relatively low house price levels and that have experienced relatively little price appreciation.

[19] There are a host of other results, ranging from the role of supply-side constraints to the change in the ratio of house prices to construction costs. We do not review those findings here, so as to stay focused on the relationship between the skewing of incomes and house prices across markets.

This suggests that it remains an open question whether the growing dispersion in house prices and matching dispersion in income growth is being driven exclusively by random productivity shocks.

Much has been written in urban economics and the broader growth literature about agglomeration effects and the potential for increasing returns in some markets that conceivably could causally link the endogenous relationship between house price and income growth documented above. Indeed, Lucas (1988) explicitly notes that cities are a natural laboratory in which to test growth models involving some type of productivity spillover. Glaeser, et. al. (1992, 1995) and Henderson, et. al. (1995) soon followed with analyses of dynamic agglomeration economies that extend across time. While there is much debate about the precise nature of the spillovers involved, there is widespread agreement that there are long-run effects from urban agglomerations.[20]

Much of the more recent agglomeration research starts with the basic fact that skilled cities growth more quickly, where growth is measured in terms of quantities such as population or employment. For example, Glaeser and Saiz (2003) document that at the metropolitan area level, a 1 percentage point higher population share for college graduates is associated with about a 0.5 percentage point higher decadal population growth rate. Similarly, Shapiro (2006) shows that from 1940 through 1990, a ten percent higher concentration of college graduates is associated with a 0.8 increase in future employment growth (also at the metropolitan area level).

Ever since Rauch (1993), we have known wages in a market rise with the skill level of that market, holding constant individual worker skills. Moretti (2004) recently confirmed Rauch's basic correlation, identifying human capital externalities via an instrumental variables

[20] See Rosenthal and Strange (2003) for an extensive review of the urban agglomeration literature.

estimation that uses the presence of land grant universities as an instrument that proxies for human capital in the area, but is plausibly exogenous to wages.[21]

Urban wage premia do appear to be relatively large. Glaeser and Mare (2001) estimate them to be on the order of 20-35 percent for workers in larger cities. Those authors also find that long-term residents in bigger cities earn a premium over new arrivals, and that when long-term workers leave their city for another, their wages in the new location are higher the larger the size of their previous market.[22]

While there is much evidence consistent with the presence of dynamic spillovers, the agglomeration literature has not focused on the relationship between house price and income dispersion. However, it is not hard to see a natural link. If productivity differences across markets are growing, then the higher wages that result in the most productive agglomerations should be capitalized into land values (and thus, house price) in markets where the supply of housing is constrained.

This story requires a very high rate of value growth, consistency in the location of agglomeration benefits in areas with inelastic supply slides to their housing markets, and firms that will not move to cheaper places. It certainly is not hard to understand how difficult it would be to recreate somewhere else the production or consumption externalities that lead to increasing returns. In the short-run, this probably is impossible, although it seems more open to debate whether we should expect mobility of people and firms to be high over half-century long periods. In addition, it is not immediately clear why such productivity would tend to occur in supply-constrained markets.

[21] That said, there is some debate about the strength of such externalities, with Acemoglu and Angrist (2000) finding small effects, but at the state level. See Moretti (2003) for a recent review of the literature on human capital externalities in cities.

[22] There is research on the firm side, too. For example, Henderson (1997) shows that concentrations of own-industry employment have measureable impacts on growth many years into the future.

## VI. Household Sorting and Supply Constraints As Explanations for the Spatial Skewing of House Prices and Incomes

While a positive relationship between house prices and incomes across MSAs suggests that there might be innate differences in productivity across locations, productive people might agglomerate rather than agglomerations make people more productive. (Glaeser and Mare (2001)) In addition, people may value grouping together for various reasons that do not have anything to do with production. (Waldfogel (2003))

Given that, an alternative explanation for the stylized facts described earlier can be found in Gyourko, Mayer and Sinai (2006). In that paper, the growth in incomes and house prices across MSAs is due to inelastic supply in certain MSAs, heterogeneity in preferences for living in various MSAs across households, and a growing absolute number of high-income households at the national level. Importantly, neither the elasticity of supply nor the distribution of tastes for MSAs need vary over time for the Gyourko, Mayer and Sinai (2006) hypothesis. Instead, changes in the income distribution at the national level percolate down to differences in the composition of families at the MSA level.

In addition, the comparative statics do not depend upon the reasons for location preferences or the inelasticity of supply in the one market. All that is required is that some households prefer one city over the others and that there be some binding limit (natural or regulatory) on the supply of new housing units in some MSAs. Ultimately, the relatively rich with a preference for the market with an inelastic housing supply outbid the poor for the scarce slots. Gyourko, Mayer and Sinai (2006) conclude that it is increases in the number of rich people nationally that should be correlated with the spatial skewing of prices and incomes. The intuition is that skewing can continue and increase as long as the growth in the number of rich people, at least some of whom have a preference for the supply-constrained market, exceeds the growth in supply in that market. The urban productivity model does not predict any such relationship with national aggregates.

That the right tail of the national income distribution has indeed been getting thicker over time is confirmed in Figure 8, which reports data from Saez (2004) on the share of U.S. income by population percentile over time. The tax return data Saez (2004) uses provides a very clear picture of changes at the high end of the income distribution. The share of income held by the very top percentiles of the U.S. population – the top one-hundredth or 0.01 percentile, the 0.1 to 0.01 percentile, and the 0.5 to 0.1 percentile – all increased dramatically over the last 40 years. The income share of the top 1% grew from under 10% in 1960 to almost 17% in 2000. Even the share of income held by the first to tenth percentiles of the population went up, from about 23 percent in 1960 to about 27 percent in 2000. While the income data reported in the decennial censuses in Figure 5 are not nearly as fine or detailed as that available to Saez (2004), this source also shows skewing over time similar to that observed in the IRS data.

Gyourko, Mayer and Sinai (2006) show that changes in the national income distribution are correlated with more rapid house price growth in Superstar markets. They regress a proxy for the entry price of a home (they use the 10$^{th}$ percentile house value in each metropolitan area) on a set of indicators for superstar/non-superstar/low growth status that are also interacted with the national number of rich families. Their findings imply that when the national number of rich families is ten percent higher, the gap in the 10$^{th}$ percentile house value between MSAs that are ever superstars and those 'in-between' markets is 1.1 percent greater.[23]

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[23] Gyourko, Mayer, and Sinai (2006) report results from several other empirical tests that are designed to distinguish between growth in the value of a location (such as from productivity growth) and growth and willingness-to-pay for the same utility (such as a greater number of high-income households who must choose between MSAs). We refer the interested reader to that paper for details.

## VII. Conclusion

The growing dispersion in house price and income growth rates across MSAs is one of the most important stylized facts about metropolitan areas in America. The spatial sorting by income that it necessarily involves goes to the heart of how we live and organize ourselves socially. Whether these phenomena are due primarily to increasing value from amenities and productivity benefits or are the result of a growing number of high income families willing to pay increasingly large amounts to live in a few supply-constrained markets is likely to have much to say about how many of us view this on-going development.

This paper has documented the basic facts about the spatial distribution of house prices and incomes, and has outlined several possible explanations for the patterns we see in the data. Our review concludes that it is unlikely that growth in urban amenities, urban productivity, or agglomeration benefits are the sole causal forces involved. Rather, the skewing of the income distribution nationally is interacting with binding supply-side constraints in certain (primarily coastal) markets to help generate the variation observed. However, the empirical importance of the different explanations remains unresolved. Parsing this out is an essential task for future research that will not be easy, but is important for our understanding of urban markets.[24]

More generally, these changes in the nature of metropolitan America have profound implications for the evolution of urban areas. If the skewing and dispersion continues to grow, even large metropolitan areas could evolve into markets that are affordable only by the rich. In effect, an entire labor market area could have the income distribution of an exclusive resort. We do not know whether such a MSA is sustainable. Moreover, should public policy ensure that living in a particular city is available to all, or since superstar cities are like luxury goods, should

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[24] Even if preference-based sorting explains the moves of the rich into markets like San Francisco, it is possible that once the rich agglomerate in that market, productivity then increases. Hence, the two forces may interact in various ways.

we not care whether lower income households can buy into those markets any more than we care whether they can buy a Mercedes? The answer also has important implications for views on policy issues such as tax-based subsidies to homeownership. While economists can justify subsidies based on positive externalities involving better citizenship or improved outcomes for children (DiPasquale and Glaeser (1999) and Green and White (1997)), the case becomes harder if one believes that the high prices in America's coastal markets are due more to preference-based sorting combined with binding local regulation on home building than to productivity. These and other questions will provide fertile ground for thought and research by economists interested in urban agglomerations.

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**Table 1: Real annualized house price growth, 1950-2000, Top and Bottom 10 MSAs with 1950 population>500,000**

| Top 10 MSAs by Price Growth<br>Annualized growth rate, 1950-2000 | | Bottom 10 MSAs by Price Growth<br>Annualized Growth Rate, 1950-2000 | |
|---|---|---|---|
| San Francisco | 3.53 | San Antonio | 1.13 |
| Oakland | 2.82 | Milwaukee | 1.06 |
| Seattle | 2.74 | Pittsburgh | 1.02 |
| San Diego | 2.61 | Dayton | 0.99 |
| Los Angeles | 2.46 | Albany (NY) | 0.97 |
| Portland (OR) | 2.36 | Cleveland | 0.91 |
| Boston | 2.30 | Rochester (NY) | 0.89 |
| Bergen-Passaic (NJ) | 2.19 | Youngstown-Warren | 0.81 |
| Charlotte | 2.18 | Syracuse | 0.67 |
| New Haven | 2.12 | Buffalo | 0.54 |

Population-weighted average of the 50 MSAs in this sample: 1.70

**Table 2: 30-Year House Price Appreciation Rate Transition Matrix**

| | | 1970-2000 | | | |
|---|---|---|---|---|---|
| | | Top Quartile | 2nd | 3rd | 4th |
| 1940-1970 | Top Quartile | 16 | 6 | 6 | 4 |
| | 2nd | 8 | 8 | 7 | 9 |
| | 3rd | 4 | 7 | 7 | 14 |
| | 4th | 4 | 11 | 12 | 6 |

Note: The underlying sample for this table includes only 129 metropolitan areas due to limitations on data available back to 1940.

**Table 3: The Relationship Between High Long-Run Price Growth MSAs and the Change in the Number of Housing Units, by Decade**

| | ***1960s*** | ***1970s*** | ***1980s*** | ***1990s*** |
|---|---|---|---|---|
| Average House Price Growth, 1960-2000 | 11.12<br>(4.76) | 17.18<br>(3.77) | 11.73<br>(2.19) | 9.37<br>(1.51) |
| In Top Quartile of Average Price Growth | 6.10<br>(16.02) | 35.23<br>(12.68) | 31.99<br>(7.38) | 24.99<br>(5.08) |
| Average Price Growth x In Top Quartile | -3.12<br>(7.91) | -18.14<br>(6.26) | -15.35<br>(3.64) | -13.26<br>(2.51) |
| Adj. $R^2$ | 0.04 | 0.10 | 0.16 | 0.15 |

Notes: The left-hand-side variable is the decadal percent change in the number of housing units. Standard errors in parentheses. To be in the top quartile, average real house price growth must have exceeded 1.75 percent over the 1960-2000 period.

| Table 4: Decadal Population, Income and House Price Growth Regressions | | | | | | |
|---|---|---|---|---|---|---|
| | *Population Growth on Superstar Market Dummy* | | | | | |
| | 1960s | 1970s | 1980s | 1990s | 1960-1980 | 1980-2000 |
| $B_{pop}$ | 0.0046<br>(0.0159) | -0.0394**<br>(0.0167) | -0.0483**<br>(0.0125) | -0.0771**<br>(0.0146) | -0.0096<br>(0.0143) | -0.0542**<br>(0.0110) |
| | *Income Growth on Superstar Market Dummy* | | | | | |
| | 1960s | 1970s | 1980s | 1990s | 1960-1980 | 1980-2000 |
| $B_{inc}$ | 0.0205**<br>(0.0090) | -0.0127<br>(0.0091) | 0.1085**<br>(0.0125) | -0.0110<br>(0.0082) | 0.0016<br>(0.0051) | 0.0384**<br>(0.0063) |
| | *House Price Growth on Superstar Market Dummy* | | | | | |
| | 1960s | 1970s | 1980s | 1990s | 1960-1980 | 1980-2000 |
| $B_{val}$ | 0.0773**<br>(0.0129) | 0.0284<br>(0.0247) | 0.3510**<br>(0.0289) | -0.0777**<br>(0.0262) | 0.0492**<br>(0.0132) | 0.0794**<br>(0.0117) |

| Table 5: Growth Decomposition—Productivity, Amenities, and Housing Supply | | | | | | |
|---|---|---|---|---|---|---|
| | *Innovations to Productivity* | | | | | |
| | 1960s | 1970s | 1980s | 1990s | 1960-1980 | 1980-2000 |
| Superstar , with controls | 0.019 | -0.013 | 0.071 | -0.015 | 0.0002 | 0.022 |
| | *Innovations to Amenities* | | | | | |
| | 1960s | 1970s | 1980s | 1990s | 1960-1980 | 1980-2000 |
| Superstar, with controls | 0.003 | 0.021 | -0.003 | -0.012 | 0.013 | -0.015 |
| | *Innovations to Housing Supply* | | | | | |
| | 1960s | 1970s | 1980s | 1990s | 1960-1980 | 1980-2000 |
| Superstar, with controls | -0.091 | -0.095 | -0.466 | 0.029 | -0.082 | -0.135 |

**Table 6: The income distribution in superstar MSAs**

| | Left-hand-side variable: Share of MSA's families in income bin: | | | | |
|---|---|---|---|---|---|
| | Rich | Middle-rich | Middle | Middle-poor | Poor |
| Cross-section: | | | | | |
| $Superstar_i$ [Relative to mean share] | 0.025<br>(0.001)<br>[0.833] | 0.022<br>(0.001)<br>[0.688] | 0.042<br>(0.003)<br>[0.339] | -0.004<br>(0.004)<br>[-0.010] | -0.086<br>(0.007)<br>[-0.208] |
| $Non\text{-}superstar_i$ | 0.005<br>(0.001) | 0.003<br>(0.001) | 0.002<br>(0.002) | -0.023<br>(0.003) | 0.013<br>(0.006) |
| $Low\ Demand_i$ | -0.008<br>(0.001) | -0.007<br>(0.001) | -0.010<br>(0.003) | 0.007<br>(0.004) | 0.017<br>(0.007) |
| Adj. $R^2$ | 0.442 | 0.621 | 0.377 | 0.178 | 0.214 |
| Time-varying superstar/non-superstar status | | | | | |
| $Superstar_i$ [Relative to mean share] | 0.013<br>(0.002)<br>[0.433] | 0.011<br>(0.002)<br>[0.344] | 0.035<br>(0.004)<br>[0.282] | 0.013<br>(0.005)<br>[0.0325] | -0.071<br>(0.009)<br>[-0.171] |
| $Non\text{-}superstar_i$ | 0.005<br>(0.001) | 0.005<br>(0.001) | 0.002<br>(0.003) | -0.022<br>(0.004) | 0.010<br>(0.007) |
| $Low\ Demand_i$ | -0.006<br>(0.001) | -0.006<br>(0.001) | -0.009<br>(0.003) | 0.000<br>(0.004) | 0.021<br>(0.007) |
| $Superstar_{it}$ [Relative to mean share] | 0.028<br>(0.003)<br>[0.903] | 0.027<br>(0.002)<br>[0.818] | 0.017<br>(0.006)<br>[0.135] | -0.030<br>(0.008)<br>[-0.075] | -0.041<br>(0.015)<br>[-0.100] |
| $Non\text{-}superstar_{it}$ | -0.003<br>(0.002) | -0.006<br>(0.001) | -0.004<br>(0.004) | 0.010<br>(0.005) | 0.003<br>(0.009) |
| $Low\ Demand_{it}$ | -0.003<br>(0.001) | -0.003<br>(0.001) | -0.003<br>(0.003) | 0.015<br>(0.004) | -0.006<br>(0.007) |
| Adj. $R^2$ | 0.504 | 0.669 | 0.383 | 0.207 | 0.219 |
| Mean of LHS: $Superstar_i$=0 [$Superstar_{it}$=0] | 0.030<br>[0.031] | 0.032<br>[0.033] | 0.124<br>[0.126] | 0.400<br>[0.402] | 0.414<br>[0.409] |

Notes: Number of observations is 1,116, for four decades (1970-2000) and 279 MSAs. Standard errors are in parentheses. All specifications include year dummies. $Superstar_{it}$ is equal to 1 when an MSA's ratio of real annual price growth over the previous two decades to its annual housing unit growth over the same period exceeds 1.7 (the $90^{th}$ percentile) and the sum of price and unit growth over that period exceeds the median. $Superstar_i$ is equal to 1 for an MSA if $superstar_{it}$ is ever equal to 1. $Non\text{-}superstar_{it}$ is equal to 1 when the price growth/unit growth ratio is below 1/1.7, and $non\text{-}superstar_i$ is an indicator whether $non\text{-}superstar_{it}$ is ever 1. To control for MSA-demand, the top panel includes an indicator variable for whether the MSA's sum of annual price growth and unit growth over any 20-year period fell below the median in that period. The bottom panel includes that variable plus a time-varying variable for whether the sum of the growth rates over the preceding 20 years was below the median.

**Figure 1: Density of 1950-2000 Annualized Real House Price Growth Rates Across MSAs with 1950 population > 50,000**

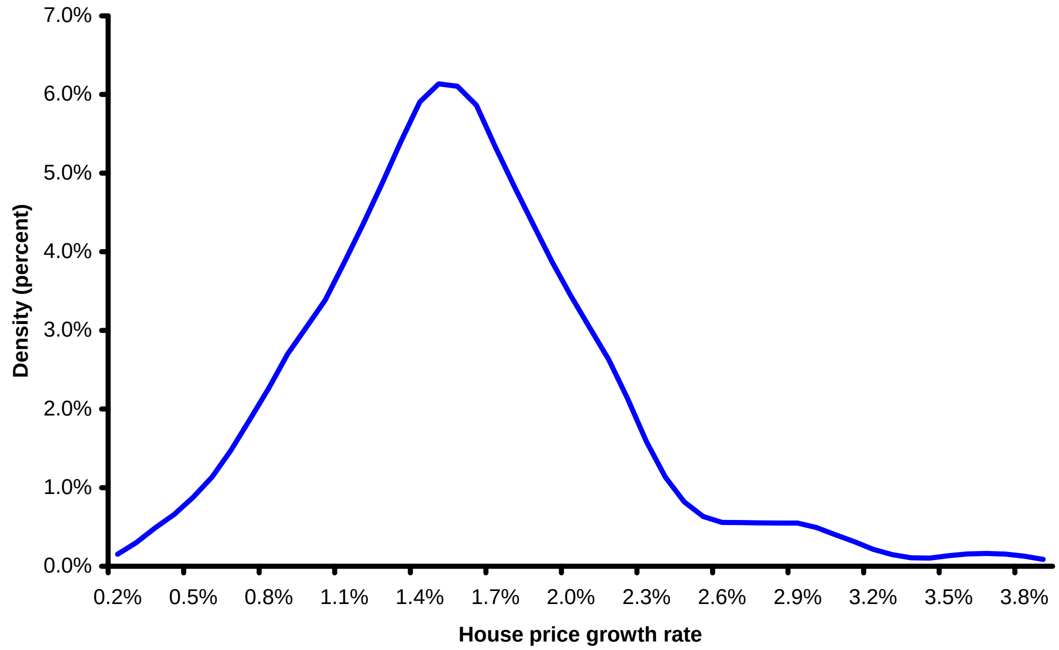


**Figure 2A**
**Density of Mean House Values Across MSA's**
**1950 versus 2000**

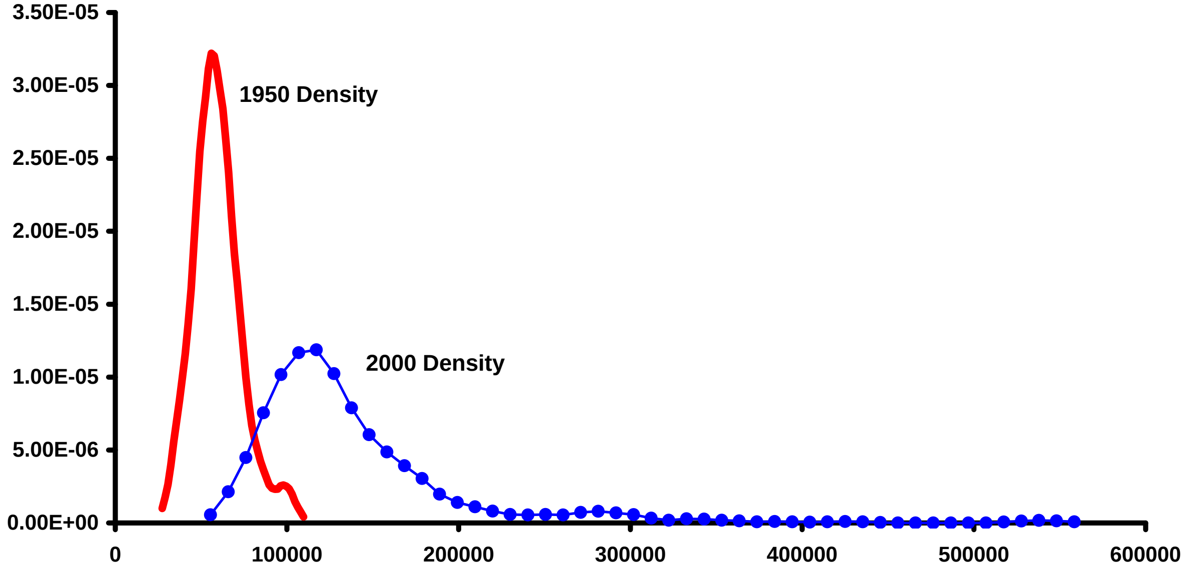



**Figure 2B**
**Skewness in Mean House Values Across MSA's**
**1950 versus 2000**

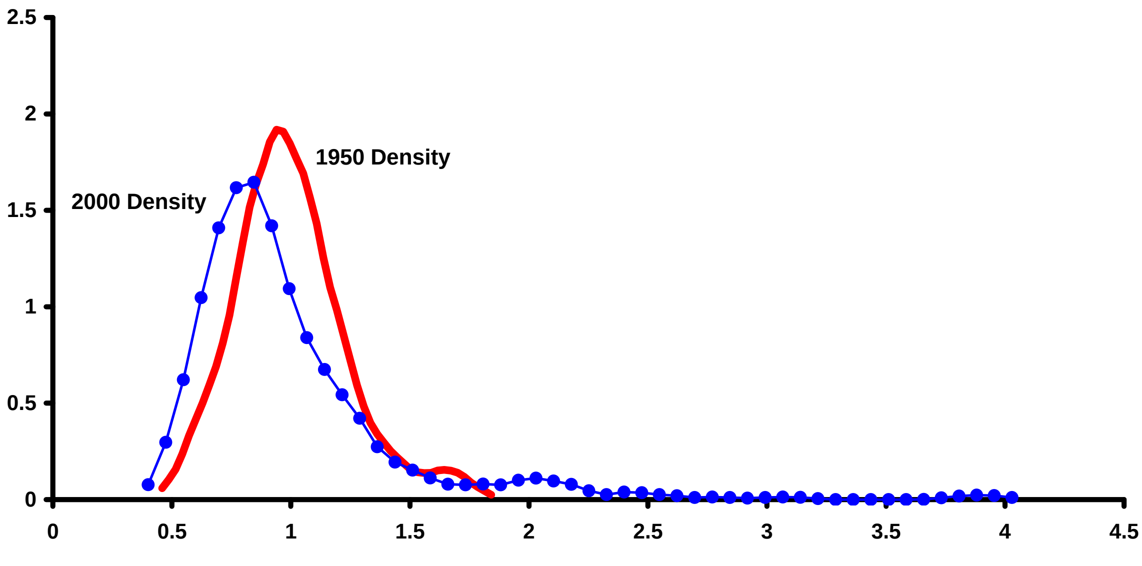


**Figure 3: Real annual house price growth versus unit growth, 1980-2000**

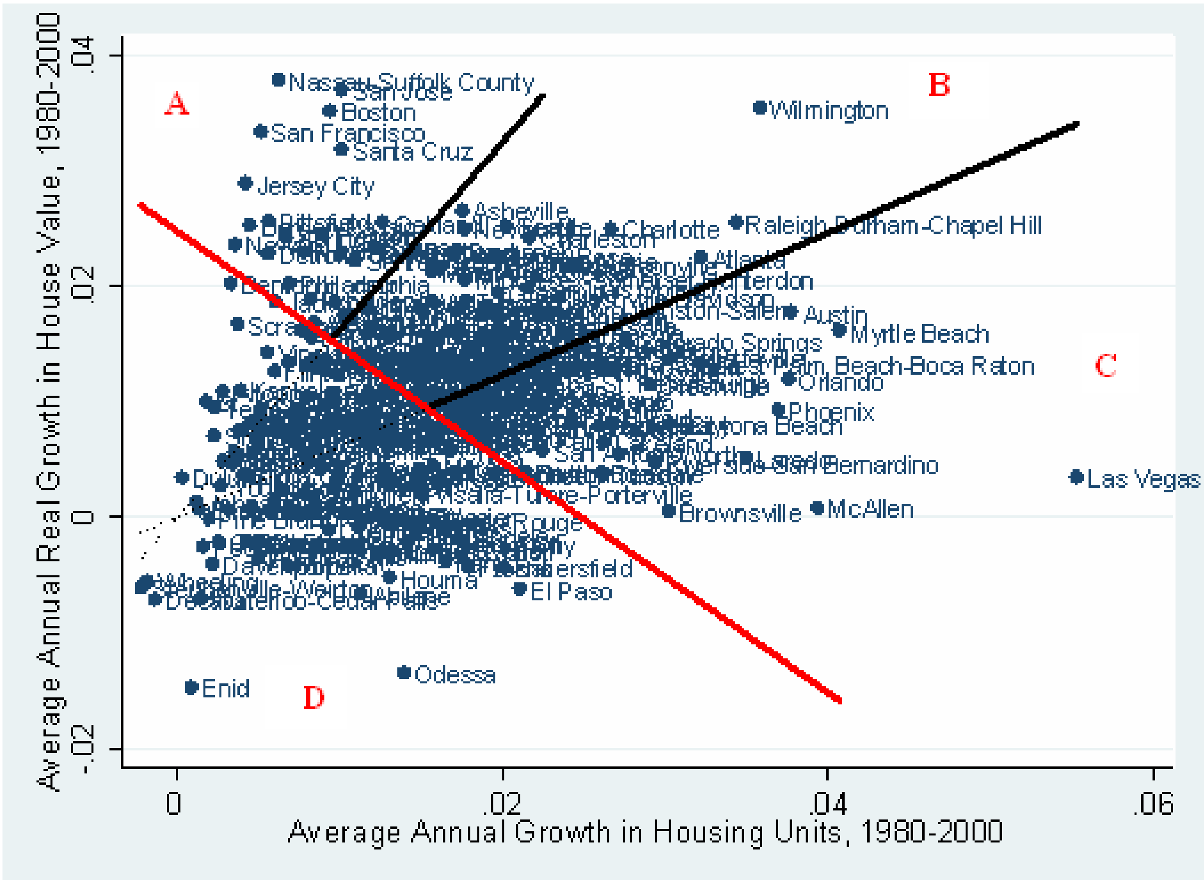
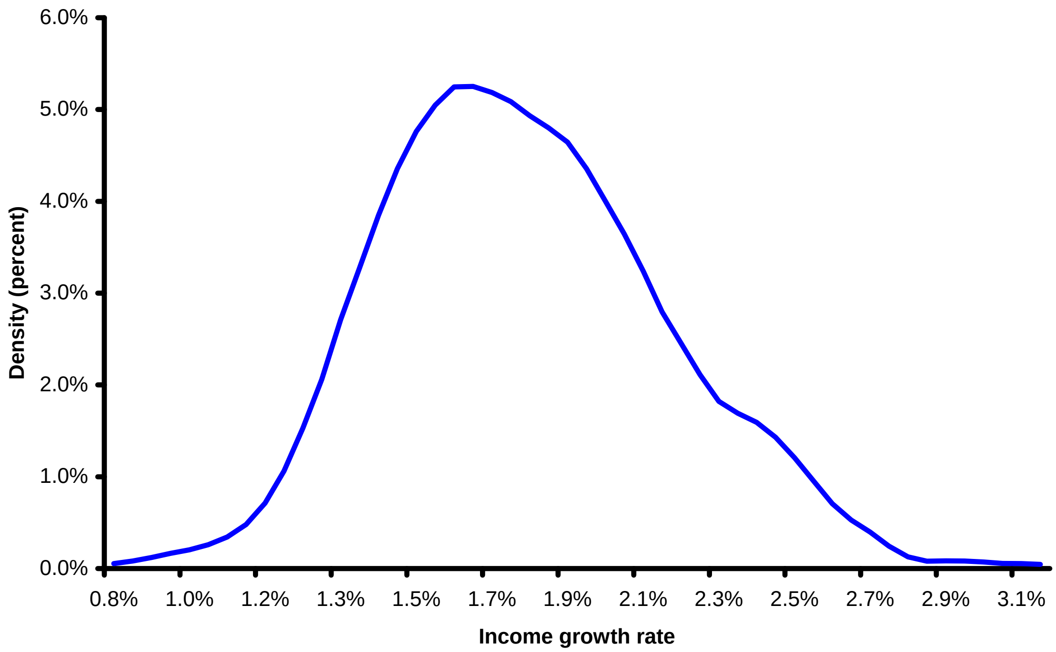
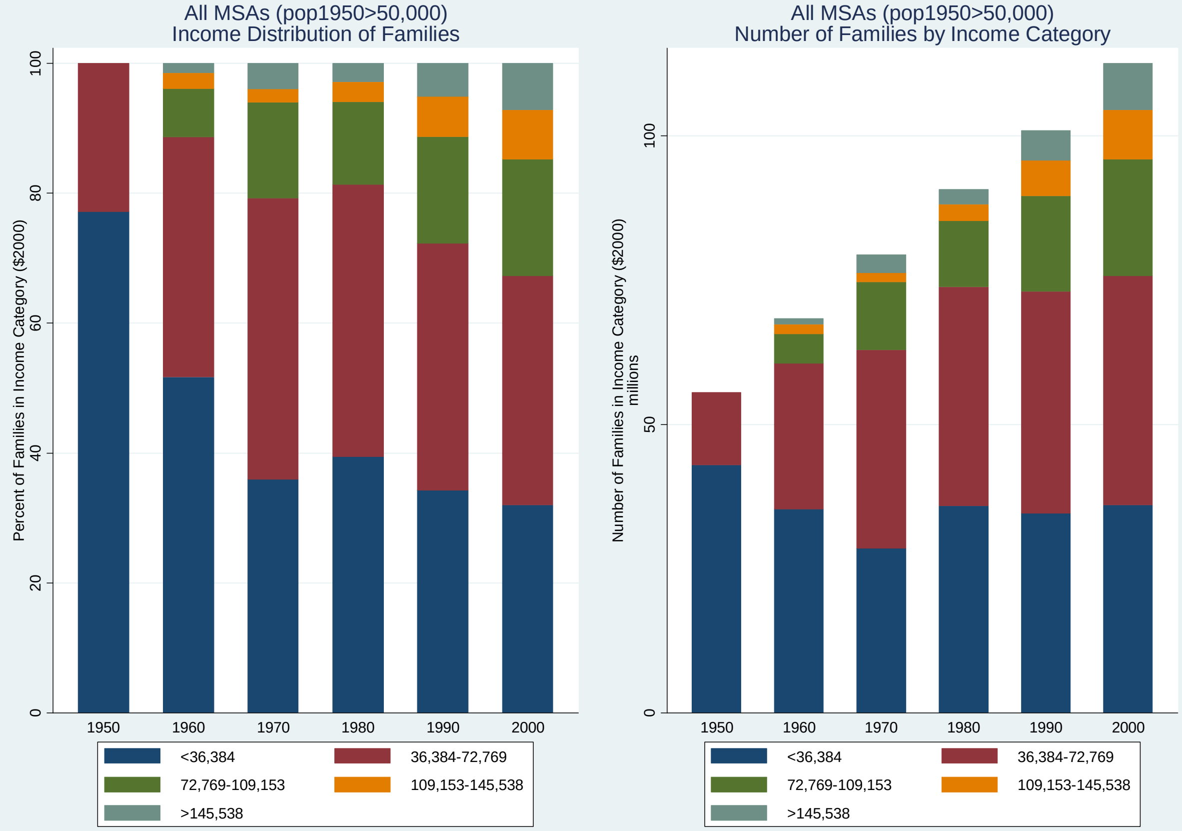


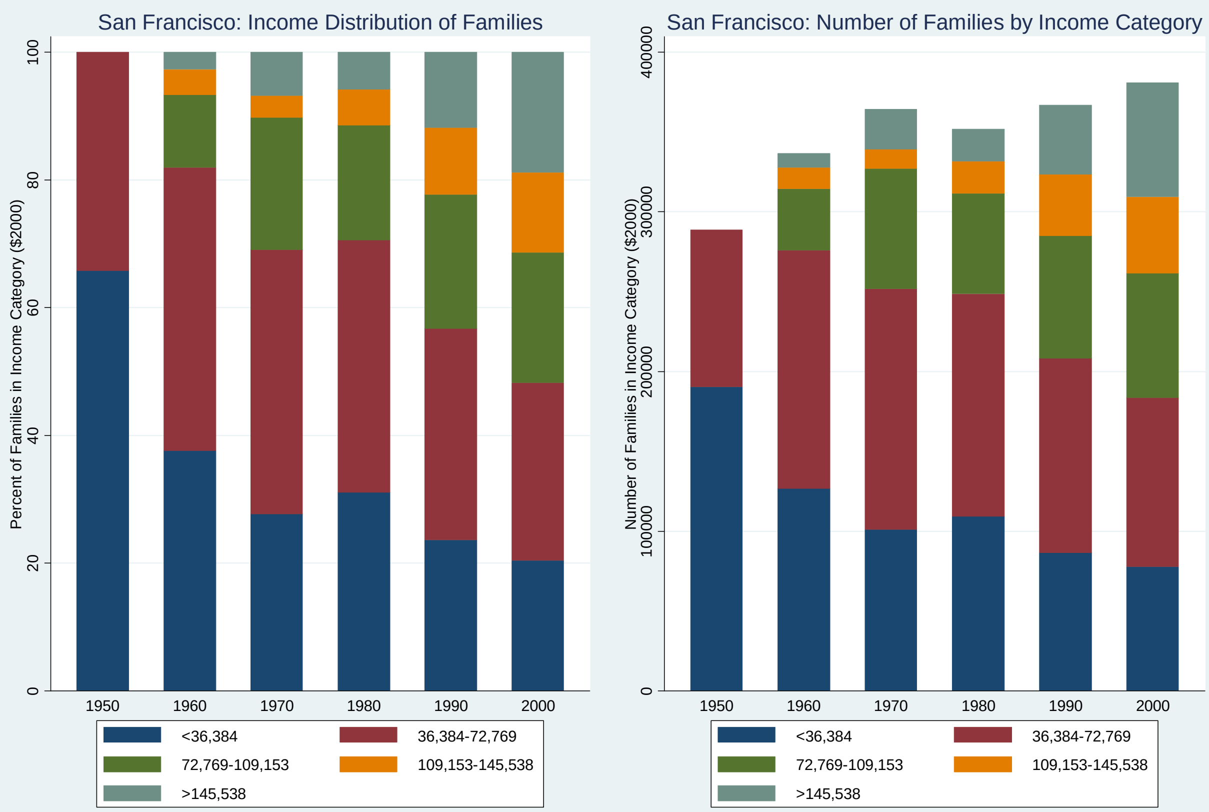
**Figure 4: Density of 1950-2000 Annualized Real Income Growth Rates Across MSAs with 1950 population > 50,000**



# Figure 4: The Evolution of the National Income Distribution



# Figure 5: San Francisco (big price growth) gains rich, loses poor



# Figure 6: Las Vegas (big unit growth) gains rich and poor, shares stay constant

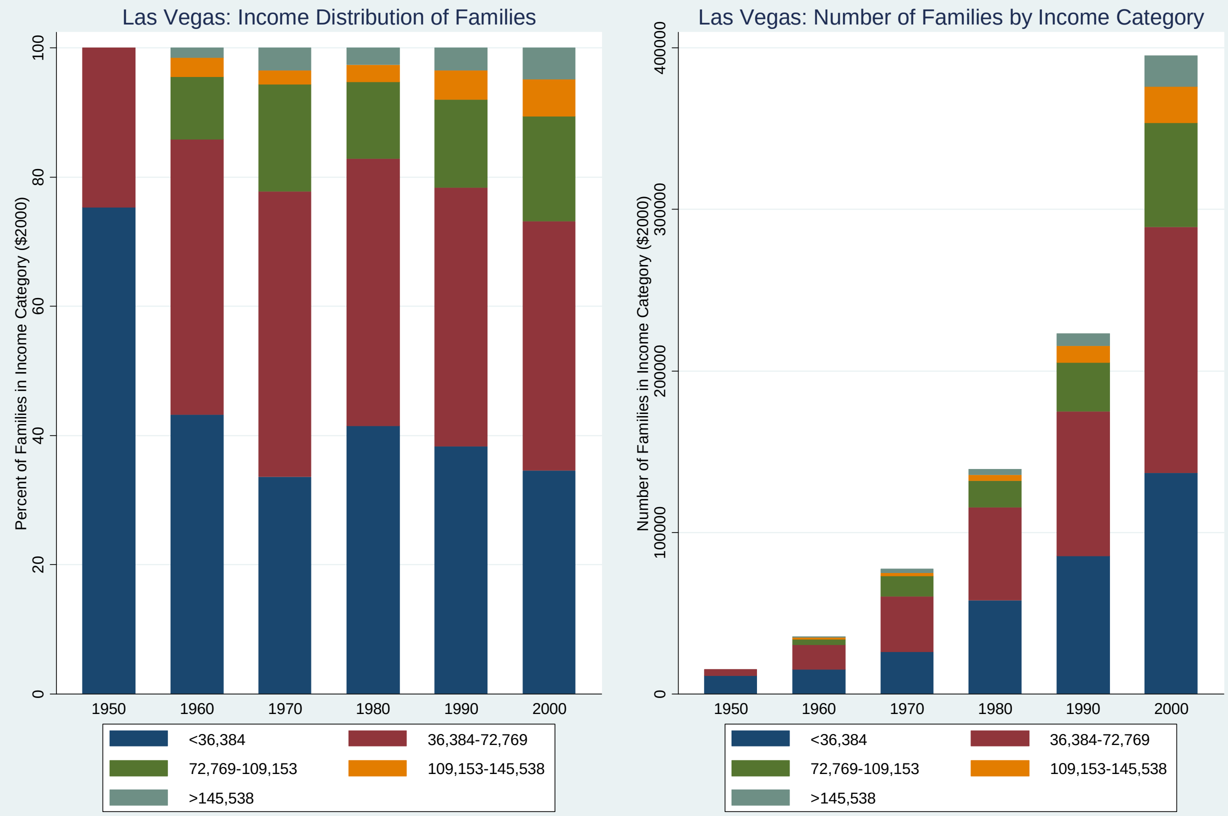
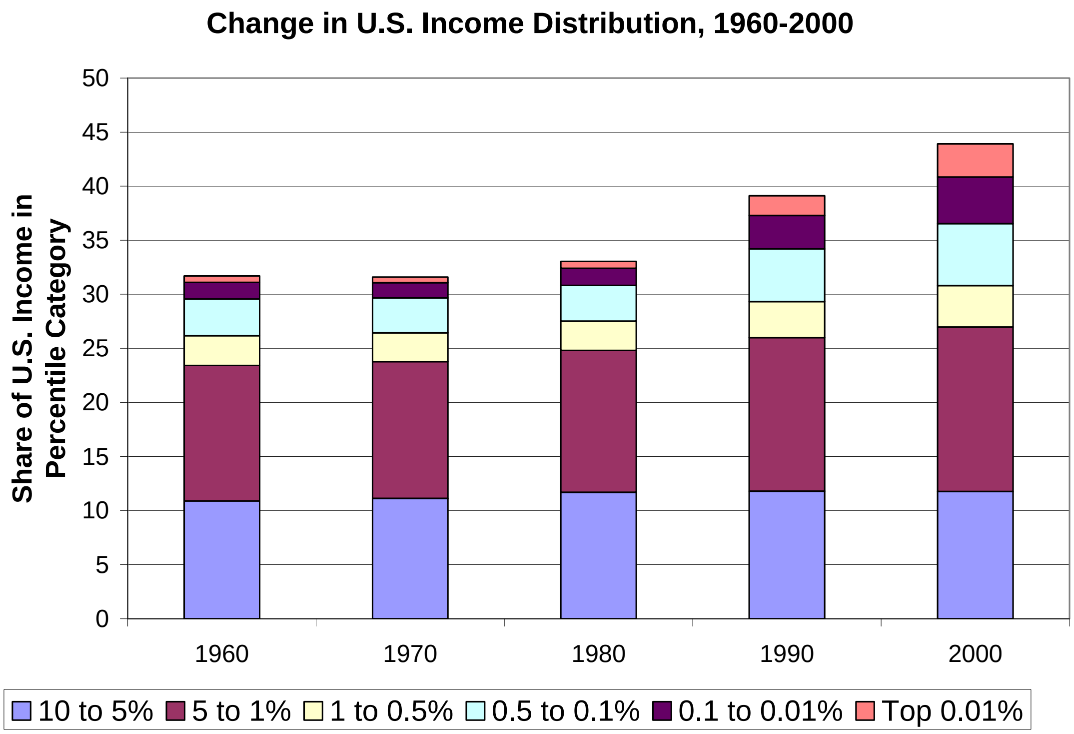


**Figure 8 (from Saez (2004))**



## Appendix 1: House Prices and Appreciation

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Abilene, TX | 34.6% | $54,917 | $73,918 |
| Akron, OH | 93.9% | $69,720 | $135,174 |
| Albany, GA | 61.7% | $60,388 | $97,630 |
| Albany, NY | 62.3% | $75,522 | $122,604 |
| Albuquerque, NM | 132.6% | $64,411 | $149,835 |
| Alexandria, LA | 98.9% | $46,114 | $91,722 |
| Allentown, PA | 110.3% | $61,811 | $129,981 |
| Altoona, PA | 99.2% | $43,163 | $85,966 |
| Amarillo, TX | 54.4% | $61,713 | $95,299 |
| Ann Arbor, MI | 177.2% | $70,125 | $194,421 |
| Anniston, AL | 132.5% | $37,222 | $86,527 |
| Appleton, WI | 93.3% | $63,152 | $122,098 |
| Asheville, NC | 192.3% | $50,005 | $146,159 |
| Athens, GA | 191.4% | $49,138 | $143,184 |
| Atlanta, GA | 178.8% | $61,933 | $172,667 |
| Atlantic City, NC | 128.3% | $68,581 | $156,590 |
| Auburn-Opelika, AL | 151.5% | $50,779 | $127,708 |
| Augusta, GA | 138.9% | $45,543 | $108,814 |
| Austin, TX | 193.8% | $55,895 | $164,223 |
| Bakersfield, CA | 94.7% | $57,461 | $111,850 |
| Baltimore, MD | 148.6% | $65,817 | $163,594 |
| Bangor, ME | 113.3% | $43,328 | $92,403 |
| Barnstable, MA | 205.5% | $76,239 | $232,912 |
| Baton Rouge, LA | 115.3% | $56,276 | $121,178 |
| Beaumont, TX | 47.6% | $51,200 | $75,580 |
| Bellingham, WA | 276.4% | $49,780 | $187,380 |
| Benton Harbor, MI | 103.9% | $59,222 | $120,727 |
| Bergen-Passic, NJ | 196.0% | $98,065 | $290,265 |
| Billings, MT | 48.4% | $79,117 | $117,401 |
| Biloxi, MS | 170.4% | $39,205 | $106,029 |
| Binghamton, NY | 24.4% | $70,626 | $87,873 |
| Birmingham, AL | 178.1% | $47,949 | $133,362 |
| Bismarck, ND | 72.0% | $61,250 | $105,354 |
| Bloomington, IN | 112.1% | $61,691 | $130,870 |
| Bloomington, IL | 176.3% | $47,973 | $132,556 |
| Boise City, ID | 142.6% | $58,231 | $141,275 |
| Boston, MA | 212.4% | $76,168 | $237,974 |
| Boulder, CO | 377.2% | $61,206 | $292,063 |
| Brazoria, TX | 123.5% | $46,086 | $103,025 |
| Bremerton, WA | 280.4% | $51,233 | $194,886 |
| Brownsville, TX | 73.8% | $39,569 | $68,775 |
| Bryan, TX | 137.9% | $48,788 | $116,046 |
| Buffalo, NY | 31.1% | $79,254 | $103,880 |
| Burlington, VT | 131.9% | $65,502 | $151,915 |
| Canton, OH | 78.4% | $65,215 | $116,324 |
| Casper, WY | 37.8% | $72,285 | $99,579 |
| Cedar Rapids, IA | 76.4% | $69,121 | $121,942 |
| Champaign, IL | 49.6% | $75,056 | $112,277 |
| Charleston, SC | 236.8% | $47,790 | $160,960 |
| Charleston, WV | 56.0% | $67,951 | $105,994 |
| Charlotte, NC | 194.1% | $53,454 | $157,233 |
| Charlottesville, VA | 158.7% | $66,377 | $171,734 |
| Chattanooga, TN | 154.3% | $45,327 | $115,264 |
| Cheyenne, WY | 75.5% | $68,901 | $120,934 |

## Appendix 1: House Prices and Appreciation (continued)

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Chicago, IL | 113.7% | $97,920 | $209,302 |
| Chico, CA | 173.8% | $53,621 | $146,827 |
| Cincinnati, OH | 76.2% | $82,734 | $145,774 |
| Clarksville, TN | 146.1% | $39,349 | $96,846 |
| Cleveland, OH | 57.0% | $91,687 | $143,988 |
| Colorado Springs, CO | 162.7% | $67,264 | $176,709 |
| Columbia, MO | 106.2% | $64,039 | $132,067 |
| Columbia, SC | 109.0% | $62,560 | $130,741 |
| Columbus, GA | 97.8% | $52,647 | $104,113 |
| Columbus, GA | 112.5% | $68,152 | $144,797 |
| Corpus Christi, TX | 60.8% | $52,261 | $84,055 |
| Corvallis, OR | 190.3% | $65,383 | $189,834 |
| Cumberland, MD | 78.8% | $45,269 | $80,950 |
| Dallas, TX | 138.4% | $60,875 | $145,125 |
| Danville, VA | 79.1% | $49,789 | $89,160 |
| Davenport, IA | 46.4% | $69,396 | $101,616 |
| Dayton, OH | 63.9% | $72,429 | $118,740 |
| Daytona Beach, FL | 100.2% | $56,285 | $112,670 |
| Decatur, AL | 39.7% | $59,324 | $82,878 |
| Decatur, IL | 162.9% | $39,426 | $103,651 |
| Denver, CO | 184.3% | $75,357 | $214,261 |
| Des Moines, IA | 104.8% | $59,610 | $122,069 |
| Detroit, MI | 123.8% | $72,666 | $162,595 |
| Dothan, AL | 132.9% | $41,834 | $97,447 |
| Dover, DE | 142.0% | $52,372 | $126,746 |
| Dubuque, IA | 55.7% | $71,399 | $111,178 |
| Duluth, MN | 77.0% | $50,214 | $88,899 |
| Dutchess County, NY | 103.9% | $84,876 | $173,021 |
| Eau Claire, WI | 106.0% | $53,068 | $109,346 |
| El Paso, TX | 21.9% | $68,651 | $83,652 |
| Elkhart, IN | 124.8% | $51,894 | $116,662 |
| Elmira, NY | 19.8% | $65,681 | $78,693 |
| Enid, OK | 35.4% | $52,425 | $70,985 |
| Erie, PA | 60.8% | $63,623 | $102,287 |
| Eugene, OR | 169.8% | $60,521 | $163,308 |
| Evansville, IN | 104.6% | $51,168 | $104,673 |
| Fargo, SD | 65.2% | $64,995 | $107,401 |
| Fayetteville, NC | 163.0% | $44,821 | $117,882 |
| Fayetteville, AR | 131.1% | $46,057 | $106,439 |
| Flagstaff, AZ | 226.7% | $50,500 | $164,989 |
| Flint, MI | 108.4% | $52,717 | $109,844 |
| Florence, AL | 105.7% | $53,411 | $109,874 |
| Florence, SC | 143.6% | $41,008 | $99,881 |
| Fort Collins, CO | 246.9% | $58,103 | $201,557 |
| Fort Lauderdale, FL | 112.5% | $76,577 | $162,733 |
| Fort Myers, FL | 224.3% | $47,951 | $155,498 |

## Appendix 1: House Prices and Appreciation (continued)

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Fort Pierce, FL | 164.5% | $55,601 | $147,065 |
| Fort Smith, AR | 123.3% | $38,849 | $86,732 |
| Fort Walton Beach, FL | 310.2% | $32,220 | $132,178 |
| Fort Wayne, IN | 81.9% | $58,417 | $106,245 |
| Fort Worth, TX | 125.2% | $51,794 | $116,627 |
| Fresno, CA | 110.9% | $61,792 | $130,339 |
| Gadsden, AL | 95.6% | $43,564 | $85,218 |
| Gainesville, FL | 131.6% | $52,261 | $121,013 |
| Galveston, TX | 73.9% | $62,502 | $108,689 |
| Gary, IN | 79.6% | $68,478 | $123,004 |
| Glens Falls, NY | 111.5% | $52,596 | $111,252 |
| Goldsboro, NC | 117.0% | $48,770 | $105,809 |
| Grand Forks, ND | 84.0% | $52,702 | $96,954 |
| Grand Junction, CO | 182.4% | $50,121 | $141,565 |
| Grand Rapids, MI | 122.4% | $61,120 | $135,937 |
| Great Falls, MT | 60.5% | $66,267 | $106,331 |
| Greeley, CO | 240.5% | $47,601 | $162,079 |
| Green Bay, WI | 92.0% | $69,589 | $133,603 |
| Greensboro-Winston-Salem, NC | 160.4% | $51,382 | $133,785 |
| Greenville, NC | 126.8% | $53,496 | $121,353 |
| Greenville, SC | 136.4% | $51,358 | $121,431 |
| Hagerstown, MD | 128.9% | $56,392 | $129,058 |
| Hamilton, OH | 101.9% | $67,859 | $136,985 |
| Harrisburg, PA | 104.5% | $60,176 | $123,036 |
| Hartford, CT | 85.9% | $94,780 | $176,237 |
| Hattiesburg, MS | 157.9% | $37,870 | $97,658 |
| Hickory, NC | 169.4% | $43,043 | $115,939 |
| Houma, LA | 161.1% | $36,392 | $95,011 |
| Houston, TX | 100.2% | $63,203 | $126,516 |
| Huntington, WV | 60.5% | $52,196 | $83,751 |
| Huntsville, AL | 204.2% | $41,005 | $124,754 |
| Indianapolis, IN | 123.2% | $60,474 | $134,977 |
| Iowa City, IA | 101.6% | $77,367 | $155,995 |
| Jackson, MI | 112.1% | $47,567 | $100,887 |
| Jackson, MS | 123.8% | $51,349 | $114,931 |
| Jackson, TN | 77.8% | $61,374 | $109,126 |
| Jacksonville, FL | 134.7% | $56,494 | $132,578 |
| Jacksonville, NC | 226.7% | $31,850 | $104,044 |
| Jamestown, NY | 31.3% | $58,609 | $76,940 |
| Janesville, WI | 76.8% | $62,627 | $110,704 |
| Jersey City, NJ | 136.8% | $72,622 | $171,946 |
| Johnson City, TN | 121.3% | $46,771 | $103,517 |
| Johnstown, PA | 65.9% | $45,873 | $76,127 |
| Jonesboro, AR | 128.9% | $43,218 | $98,938 |
| Joplin, MO | 143.5% | $34,162 | $83,176 |
| Kalamazoo, MI | 97.9% | $58,856 | $116,504 |

## Appendix 1: House Prices and Appreciation (continued)

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Kankakee, IL | 70.3% | $68,181 | $116,145 |
| Kansas City, MO | 118.4% | $58,259 | $127,225 |
| Kenosha, WI | 93.3% | $71,148 | $137,515 |
| Killeen, TX | 100.3% | $44,527 | $89,207 |
| Knoxville, TN | 179.7% | $44,710 | $125,053 |
| Kokomo, IN | 129.7% | $45,759 | $105,114 |
| La Crosse, WI | 99.0% | $56,323 | $112,078 |
| Lafayette, LA | 155.4% | $39,681 | $101,363 |
| Lafayette, IN | 108.3% | $59,286 | $123,521 |
| Lake Charles, LA | 95.2% | $50,583 | $98,730 |
| Lakeland, FL | 101.7% | $49,523 | $99,883 |
| Lancaster, PA | 100.4% | $67,637 | $135,567 |
| Lansing, MI | 118.0% | $56,559 | $123,283 |
| Laredo, TX | 181.2% | $30,869 | $86,801 |
| Las Cruces, NM | 157.1% | $43,025 | $110,607 |
| Las Vegas, NV | 147.5% | $65,114 | $161,166 |
| Lawrence, KS | 187.3% | $49,050 | $140,902 |
| Lawton, OK | 72.7% | $48,036 | $82,946 |
| Lewiston, ME | 92.2% | $52,248 | $100,434 |
| Lexington-Fayette, KY | 113.7% | $60,367 | $129,025 |
| Lima, OH | 72.7% | $56,382 | $97,381 |
| Lincoln, NE | 105.5% | $61,336 | $126,018 |
| Little Rock, AR | 117.1% | $50,879 | $110,443 |
| Longview, TX | 123.2% | $37,678 | $84,102 |
| Los Angeles, CA | 236.6% | $85,150 | $286,633 |
| Louisville, KY | 113.4% | $60,413 | $128,893 |
| Lubbock, TX | 36.1% | $62,442 | $84,999 |
| Lynchburg, VA | 124.4% | $52,348 | $117,452 |
| Macon, GA | 133.0% | $44,416 | $103,502 |
| Madison, WI | 99.0% | $86,136 | $171,383 |
| Mansfield, OH | 49.3% | $64,370 | $96,099 |
| McAllen, TX | 99.9% | $33,393 | $66,759 |
| Medford, OR | 199.0% | $56,647 | $169,383 |
| Melbourne, FL | 114.9% | $55,488 | $119,262 |
| Memphis, TN | 100.7% | $61,886 | $124,183 |
| Merced, CA | 121.8% | $58,295 | $129,318 |
| Miami, FL | 95.2% | $83,286 | $162,594 |
| Middlesex-Somerset-Hunterdon, NJ | 185.6% | $80,437 | $229,739 |
| Milwaukee, WI | 69.3% | $92,698 | $156,918 |
| Minneapolis-St. Paul, MN | 117.6% | $77,421 | $168,496 |
| Missoula, MT | 162.5% | $59,653 | $156,573 |
| Mobile, AL | 184.0% | $41,465 | $117,766 |
| Modesto, CA | 162.2% | $55,669 | $145,969 |
| Monmouth-Ocean, NJ | 160.2% | $77,938 | $202,758 |
| Monroe, LA | 101.7% | $49,470 | $99,781 |
| Montgomery, AL | 107.2% | $55,648 | $115,307 |

## Appendix 1: House Prices and Appreciation (continued)

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Muncie, IN | 66.8% | $51,851 | $86,505 |
| Myrtle Beach, SC | 176.3% | $52,277 | $144,456 |
| Naples, FL | 406.7% | $51,144 | $259,155 |
| Nashville-Davidson, TN | 178.8% | $56,363 | $157,166 |
| Nassau-Suffolk County, NY | 167.6% | $99,692 | $266,806 |
| New Haven, CT | 185.4% | $103,118 | $294,297 |
| New London, CT | 132.5% | $74,479 | $173,185 |
| New Orleans, LA | 81.2% | $71,836 | $130,140 |
| New York, NY | 181.4% | $103,209 | $290,412 |
| Newark, NJ | 155.2% | $101,549 | $259,115 |
| Newburgh, NY | 125.2% | $70,748 | $159,289 |
| Norfolk, VA | 150.2% | $54,670 | $136,783 |
| Oakland, CA | 300.8% | $86,596 | $347,050 |
| Ocala, FL | 146.8% | $40,186 | $99,169 |
| Odessa, TX | 27.4% | $59,116 | $75,294 |
| Oklahoma City, OK | 65.8% | $58,078 | $96,278 |
| Olympia, WA | 194.8% | $57,586 | $169,788 |
| Omaha, NE | 104.3% | $59,470 | $121,483 |
| Orange County, CA | 356.1% | $72,185 | $329,206 |
| Orlando, FL | 122.8% | $61,908 | $137,919 |
| Owensboro, KY | 72.7% | $55,968 | $96,648 |
| Panama City, FL | 238.7% | $34,908 | $118,233 |
| Parkersburg, WV | 64.7% | $56,158 | $92,516 |
| Pensacola, FL | 185.6% | $40,422 | $115,431 |
| Peoria-Pekin, IL | 59.8% | $66,167 | $105,723 |
| Philadelphia, PA | 121.6% | $66,426 | $147,186 |
| Phoenix, AZ | 209.2% | $53,106 | $164,191 |
| Pine Bluff, AR | 113.6% | $33,106 | $70,724 |
| Pittsburgh, PA | 66.1% | $64,015 | $106,345 |
| Pittsfield, MA | 96.9% | $73,066 | $143,854 |
| Pocatello, ID | 71.7% | $60,819 | $104,417 |
| Portland, OR | 221.4% | $63,337 | $203,578 |
| Portland, ME | 169.3% | $60,377 | $162,576 |
| Providence, RI | 94.1% | $81,189 | $157,574 |
| Provo-Orem, UT | 207.3% | $61,174 | $187,982 |
| Pueblo, CO | 120.8% | $50,635 | $111,798 |
| Punta Gorda, FL | 215.2% | $39,342 | $124,010 |
| Racine, WI | 72.1% | $74,706 | $128,537 |
| Raleigh-Durham-Chapel Hill, NC | 205.7% | $58,153 | $177,794 |
| Rapid City, SD | 89.5% | $59,458 | $112,668 |
| Reading, PA | 96.3% | $59,750 | $117,313 |
| Redding, CA | 168.0% | $52,416 | $140,465 |
| Reno, NV | 115.4% | $96,874 | $208,650 |
| Richland, WA | 117.2% | $60,700 | $131,811 |
| Richmond-Petersburgh, VA | 116.5% | $64,964 | $140,677 |
| Riverside-San Bernardino, CA | 173.7% | $59,725 | $163,483 |

## Appendix 1: House Prices and Appreciation (continued)

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Roanoke, VA | 103.8% | $60,679 | $123,680 |
| Rochester, MN | 68.1% | $81,995 | $137,822 |
| Rochester, NY | 56.1% | $72,348 | $112,926 |
| Rockford, IL | 51.2% | $73,216 | $110,727 |
| Rocky Mount, NC | 109.4% | $50,538 | $105,837 |
| Sacramento, CA | 167.9% | $71,504 | $191,567 |
| Saginaw, MI | 90.4% | $54,865 | $104,471 |
| Salem, OR | 159.8% | $59,484 | $154,551 |
| Salinas, CA | 316.6% | $83,456 | $347,705 |
| Salt Lake City, UT | 157.1% | $70,810 | $182,029 |
| San Angelo, TX | 52.8% | $50,539 | $77,215 |
| San Antonio, TX | 75.2% | $56,397 | $98,829 |
| San Diego, CA | 262.4% | $78,640 | $284,952 |
| San Francisco, CA | 465.9% | $96,703 | $547,206 |
| San Jose, CA | 513.3% | $86,667 | $531,562 |
| San Luis Obispo, CA | 346.0% | $59,995 | $267,605 |
| Santa Barbara-Santa Maria, CA | 328.4% | $89,559 | $383,707 |
| Santa Cruz, CA | 522.0% | $68,494 | $426,041 |
| Santa Fe, NM | 284.9% | $66,127 | $254,503 |
| Santa Rosa, CA | 362.5% | $69,007 | $319,124 |
| Sarasota, FL | 166.7% | $62,131 | $165,729 |
| Savannah, GA | 153.5% | $53,867 | $136,552 |
| Scranton, PA | 111.5% | $49,142 | $103,948 |
| Seattle, WA | 285.7% | $70,684 | $272,603 |
| Sharon, PA | 58.4% | $56,123 | $88,901 |
| Sheboygan, WI | 84.6% | $67,042 | $123,742 |
| Shermon-Denison, TX | 119.4% | $38,321 | $84,065 |
| Shreveport-Bossier, LA | 61.6% | $57,812 | $93,411 |
| Sioux City, IA | 55.1% | $57,815 | $89,660 |
| Sioux Falls, SD | 87.5% | $64,197 | $120,400 |
| South Bend, IN | 66.4% | $62,322 | $103,678 |
| Spokane, WA | 119.0% | $60,147 | $131,739 |
| Springfield, IL | 83.1% | $60,736 | $111,198 |
| Springfield, MA | 93.7% | $72,294 | $140,063 |
| Springfield, MO | 128.5% | $47,932 | $109,543 |
| St. Cloud, MN | 135.0% | $48,134 | $113,132 |
| St. Joseph, MO | 126.5% | $39,063 | $88,484 |
| St. Louis, MO | 78.6% | $72,973 | $130,348 |
| State College, PA | 145.6% | $54,367 | $133,541 |
| Steubenville-Weirton, OH | 34.4% | $57,706 | $77,550 |
| Stockton, CA | 171.8% | $60,531 | $164,517 |
| Sumter, SC | 93.4% | $47,929 | $92,696 |
| Syracuse, NY | 39.8% | $69,624 | $97,341 |
| Tacoma, WA | 201.6% | $58,269 | $175,746 |
| Tallahassee, FL | 137.0% | $53,971 | $127,889 |
| Tampa-St. Petersburgh, FL | 109.4% | $58,714 | $122,967 |

## Appendix 1: House Prices and Appreciation (continued)

Decadal Census, All Values in $2000

| MSA | % House Appreciation 1950-2000 | 1950 Mean Value ($2000) | 2000 Mean Value ($2000) |
|---|---|---|---|
| Terre Haute, IN | 134.0% | $36,094 | $84,467 |
| Texarkana, TX | 123.4% | $35,200 | $78,620 |
| Toledo, OH | 80.4% | $65,783 | $118,705 |
| Topeka, KS | 72.1% | $54,593 | $93,969 |
| Trenton, NJ | 189.2% | $67,916 | $196,431 |
| Tucson, AZ | 130.5% | $63,094 | $145,417 |
| Tulsa, OK | 99.0% | $53,533 | $106,510 |
| Tuscaloosa, AL | 178.6% | $46,197 | $128,691 |
| Tyler, TX | 97.4% | $52,262 | $103,168 |
| Utica-Rome, NY | 30.6% | $64,791 | $84,587 |
| Vallejo, CA | 233.4% | $69,620 | $232,145 |
| Ventura, CA | 319.6% | $70,971 | $297,826 |
| Victoria, TX | 57.2% | $55,147 | $86,680 |
| Vineland-Millville-Bridgeton, NJ | 91.2% | $53,459 | $102,201 |
| Visalia-Tulare-Porterville, CA | 159.7% | $46,174 | $119,908 |
| Waco, TX | 70.1% | $48,552 | $82,577 |
| Washington, DC | 112.7% | $106,235 | $225,914 |
| Waterloo-Cedar Falls, IA | 40.2% | $64,682 | $90,685 |
| Wausau, WI | 114.3% | $51,753 | $110,908 |
| West Palm Beach-Boca Raton, FL | 159.7% | $73,275 | $190,261 |
| Wheeling, WV | 46.3% | $53,928 | $78,871 |
| Wichita, KS | 62.9% | $60,499 | $98,554 |
| Wichita Falls, TX | 57.4% | $47,826 | $75,266 |
| Williamsport, PA | 82.3% | $53,625 | $97,759 |
| Wilmington, DE | 90.8% | $82,087 | $156,661 |
| Wilmington, NC | 310.6% | $42,865 | $176,011 |
| Yakima, WA | 140.7% | $54,809 | $131,944 |
| Yolo, CA | 205.7% | $65,842 | $201,293 |
| York, PA | 104.8% | $60,915 | $124,730 |
| Youngstown-Warren, OH | 49.8% | $63,044 | $94,470 |
| Yuba, CA | 146.4% | $51,463 | $126,793 |
| Yuma, AZ | 156.6% | $44,473 | $114,101 |

**Appendix 2: MSA Summary Statistics**

| Variable | Mean | Standard deviation |
|---|---|---|
| MSA time-invariant characteristics: | | |
| Average Annual Real House Price Growth, 1950-2000 (N=279) | 1.57 | 0.56 |
| Average Annual Housing Unit Growth, 1950-2000 (N=279) | 2.10 | 0.98 |
| Average Annual Real Income Growth, 1950-2000 (N=279) | 1.82 | 0.35 |
| Ever a "superstar" | 0.165 [46] | 0.372 |
| Ever a "non-superstar" | 0.337 [94] | 0.474 |
| Ever "low demand" | 0.821 [229] | 0.384 |
| MSA time-varying characteristics: | | |
| Average 20-year Real House Price Growth | 1.50 | 1.04 |
| Average 20-year Housing Unit Growth | 2.10 | 1.20 |
| Average 20-year house price growth + housing unit growth | 3.60 | 1.86 |
| Average ratio of 20-year price growth to 20-year unit growth | 0.936 | 0.642 |
| Real house value | 111,329 | 54,889 |
| Average price/average annual rent | 17.00 | 3.99 |
| Year | # "superstars" | # "non-superstars" |
| 1970 | 3 | 55 |
| 1980 | 3 | 34 |
| 1990 | 30 | 43 |
| 2000 | 21 | 36 |
| Income Distribution | Mean | Standard deviation |
| Share of an MSA's population that is "rich" | 0.033 | 0.021 |
| Share "middle-rich" | 0.035 | 0.024 |
| Share "middle" | 0.129 | 0.043 |
| Share "middle-poor" | 0.400 | 0.050 |
| Share "poor" | 0.402 | 0.095 |
| National number "rich" | | |
| 1970 | 1,571,136 | |
| 1980 | 1,312,103 | |
| 1990 | 2,611,178 | |
| 2000 | 4,098,324 | |