The "Plane of Living" and the Recent Evolution of Housing Values in the United States

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Abstract This paper investigates the relationship between quality of life differentials and the evolution of housing values in the United States with an eye toward implications for federal policy in general and the ongoing financial crisis in particular. The analysis combines older spatial demographic methods (systematic mapping of quality of life differentials) with newer spatial econometric methods (spatial autoregressive modeling) to deliver a panoramic view of the contemporary "plane of living" and evaluate its influence on housing values. Housing values are inextricably bound to geography — both natural amenities and human amenities matter, but in somewhat different ways. The influence of natural amenities is growing more powerful, but human amenities offer an opportunity to address housing market conditions because they can readily be enhanced via public policy. Overall, the findings suggest that Obama administration's emphasis on improving metropolitan and nonmetropolitan quality of life is sound — and that it may help speed the recovery of the housing market.

1. Introduction

Over 70 years ago, Goodrich et al (1935) advanced the concept of the "plane of living" to characterize quality of life differentials across the United States. At the time, the nation was in the

grip of the Great Depression and policymakers had a pressing need to understand how the spatial arrangement of the population had evolved to that point — and, going forward, how to influence future migration flows in a way that enhanced economic opportunity and personal wellbeing (Goodrich et al 1936). This research is one of the earliest examples of spatial demography — the demographic analysis of spatial aggregates (Voss 2007) — and, also, of work that explicitly connects place-to-place variation in quality of life to the disposition of the greater economic landscape (Greenwood and Hunt 2003). It was exceptionally innovative and it helped establish an enduring analytical framework wherein quality of life is viewed as fundamental to a wide array of socioeconomic processes and outcomes.

Today, the United States is in the midst of another economic dislocation that is widely considered to be the worst since that of the 1930s and, although the circumstances of the two eras are quite different, the plane of living is again central to understanding the nature of the crisis and, perhaps, the long-term implications of it. In particular, the recession that (according to the National Bureau of Economic Research[1]) commenced in December 2007 was brought on by the implosion of a massive bubble[2] in the housing market — a bubble that that extended nationwide but was unevenly inflated due, in large part, to quality of life differentials. Housing is a complex commodity and its consumption involves the concurrent consumption of any location-specific amenities and disamenities associated with it. When viewed across the nation as a whole, factors that contribute to (take away from) quality of life, like mild (harsh) weather and good (poor) public services, raise (lower) housing values because they increase (decrease) the level of competition there is to occupy places that have (lack) them. In this way, households factor all kinds of environmental conditions into their calculus when deciding where to live and at what cost, meaning that the topography of housing values more or less mirrors that of the plane of living. Although this relationship is well known, its implications for the current crisis — and, as important, for federal housing policy more generally — are not.

This paper addresses both aspects of the matter by examining the nation's contemporary plane of living and using it to identify how housing values evolved to their pre-crisis levels through time and across geographic space. There are three specific objectives: (*i*) to illustrate how housing values vary from place-to-place and explain why quality of life differentials cause them to vary so dramatically; (*ii*) to estimate a series of simple income capitalization models aimed at weighing the relative importance of household income versus quality of life in the recent

[1] For information on NBER's recession dating procedure, see: *http://www.nber.org/cycles/recessions.html*.
[2] On December 15, 2008, the popular real estate website *Zillow.com* reported that, in that year alone, homes across the United States lost an estimated $2 trillion in value — an amount equal to about 20% of the nation's GDP. See: *http://zillowblog.com/2-trillion-in-home-values-lost-in-08/2008/12/*.

evolution of housing values; and (*iii*) to evaluate the implications for federal policy with a particular eye toward the ongoing crisis. The analysis, which covers the entire continental United States, provides a panoramic look at the housing value landscape in 1980, 1990, and 2000. Like Goodrich et al (1935, page 1), who observed that they "ought not try to say where people should move without first learning where they have moved," this work is concerned first with ascertaining the temporal and spatial trajectories of housing values vis-à-vis income and quality of life differentials, and then with identifying some ways of applying that information in a forward looking way. Because "past is prologue" — and because housing values are so inextricably bound to geography — the experience of the last decades holds valuable lessons for those yet to come.

2. Background

2.1 Housing Values, Migration, and Quality of Life Differentials

The pool of scientific research on housing holds literally thousands of studies dealing with the United States alone. But, as Bourne (1981) and others have emphasized, the analysis of housing is not restricted to any of the traditional academic disciplines or to any professional field. Consequently, housing and housing-related issues have been addressed from diverse perspectives and individual studies involve very different motivations, ideologies, and research designs. For example, housing is sometimes viewed as a differentiated commodity having a set of attributes that are consumed together; sometimes as a social good; sometimes as an asset class; and sometimes as a sector of regional and/or national economies. Whatever the particular research orientation, the value of housing is almost universally recognized as a cornerstone of the market economy because homes not only provide shelter — but, also, access to amenities, social status, wealth, and more. Since this paper is focused on the relationship between housing values and the plane of living, it draws mainly on work done in the fields of economics, geography, and regional science (see Bartik and Smith 1987, Gyourko et al 1999, and/or Mulligan et al 2004 for in-depth reviews).

The best-known cross-national research on housing values and quality of life originates from the hedonic price methodology developed by Rosen (1974, 1979) and extended by Roback (1982, 1988). Within this so-called "compensating differentials" framework, equilibrating processes — namely, population, employment, and wage growth (Carruthers and Mulligan 2008) — ensure that households are indifferent among locations, a situation that implies that the value of wages plus the value of quality of life minus the cost of housing is more or less the equivalent

across the country (see Glaeser 2007). Rosen (1979) first used hedonic price analysis to estimate the value of quality of life differentials by regressing wages, the price of labor, on job and personal attributes and a set of location-specific natural amenities. Roback (1982, 1988) then extended the approach to the housing market by separating out the local land and labor markets, revealing that housing values also capitalize quality of life differentials. In these studies, desirable (undesirable) living conditions negatively (positively) influence wages because, everything else being equal, people living in attractive (unattractive) places demand less (more) pay for their work; conversely, desirable (undesirable) living conditions positively (negatively) influence housing values because people living in attractive (unattractive) places are willing to pay more (less) for their homes. Both Rosen (1979) and Roback (1982, 1988) used their estimates to develop place-to-place quality of life rankings, which rated regions having nice weather and other natural amenities, like San Francisco, at the top.

Berger et al (1987), Hoehn et al (1987), and Blomquist et al (1988) further extended this approach to developing quality of life rankings by simultaneously analyzing the effects of location-specific amenities across and within metropolitan areas. Their more complex models added a dimension of realism because the influence of amenities in one county could spill over into adjacent counties. In addition, the set of amenities examined was extended beyond natural amenities to include education, a human amenity. Quality of life rankings were generated for entire metropolitan areas and, where appropriate, for the individual counties making up those regions. Many of the places estimated to have the highest quality of life in 1980 were comparatively small metropolitan areas located in the Sunbelt, like Denver and Tucson. Next, Gyourko and Tracy (1989, 1991) suggested that local public finance could also generate compensating differentials in labor and housing markets. In their analysis, fiscal conditions accounted for almost as much variation in both wages and rents as natural amenities. However, more recently, Gyourko et al (1999) have expressed concerns about the accuracy of the quality of life rankings that come out of hedonic price analysis due to the large location-specific errors commonly associated with the estimates. These concerns are similar in spirit to those expressed by urban planners working with various other indicators — see, for example, Landis and Sawicki (1988), Sawicki and Flynn (1996), Sawicki (2002), and Wong (2002) — and, in recent years, a number of alternative econometric approaches have been devised for comparing quality of life across regions (Freeman 2003).

A key limitation of cross-national hedonic research is that it is almost entirely confined to metropolitan areas, so little is known about how quality of life differentials are valued in smaller micropolitan and rural areas. This is unfortunate because many social scientists and policymakers

are also interested in the situation of nonmetropolitan places — especially in the context of problems like the present economic crisis, which is truly national in scope. One reason for this limitation is that it is difficult to obtain the kind of detailed household-level data needed for estimating hedonic price equations all across the country, and, especially, at multiple points in time. For this reason, researchers commonly end up using median housing value (and corresponding housing attribute) data reported by the Census Bureau (see, for example, Chay and Greenstone 2005; Welch et al 2007; Greenstone and Gallagher 2008). The drawback of this approach lies in the risk of generating what is variously called "aggregation bias," an "ecological fallacy," or a "modifiable areal unit problem" — all of which are ways of describing what happens when spatially aggregated data is used to draw conclusions about household-level behavior (Voss 2008). That being said, aggregated data do represent a viable alternative, just as long as care is taken when making inferences from it.

Another major empirical gap is that very little is known about the relative importance of household income versus quality of life in the temporal and spatial evolution of housing values. As early as the 1950s, Ullman (1954) — following an even earlier insight made by Hoover (1948) on the effects of both "physical" and "cultural" amenities — argued that "pleasant living conditions" contribute to differential rates of regional development, and that these differentials were likely to accelerate as the population grew more footloose and wealthier. And, indeed, they have: households are evermore free to choose where to live on the basis of their wellbeing, and can commonly afford to do so (see Kahn 2006 for a broad overview of the implications). Accordingly, migration specialists now recognize that models specified without measures of location-specific amenities suffer from omitted variable bias (Graves 1980; Greenwood and Hunt 1989; Clark and Hunter 1992; Hunt 1993; Mueser and Graves 1995). Because of this changing balance between household income and quality of life, there is every reason to expect that the resulting topography of housing values has shifted as well. Moreover, any nationwide effort to overcome present circumstances in the housing market may ultimately have to confront the fact that different geographic segments of the population face big differences in the relative costs and benefits of homeownership — so it is obviously important to know more about how those differences have evolved.

Table 1, which lists data for each of the 48 contiguous states plus Washington, DC in 1980 and 2005, illustrates the situation. In the earlier year, the median value of owner-occupied housing units (in 2005 dollars) ranged from a high of $198,600, or 179.08% of the national median, which was then $110,900, in California to a low of $72,900, or 63.73% of the national median, in Arkansas. In the later year, the median value of owner-occupied housing units ranged

from a high of $477,700, or 185.19% of the national median, which was then $167,500, in California to a low of $82,700, or 49.37% of the national median, in Mississippi. Between the two years, the median value of owner-occupied housing units grew the most, by $279,100, in California and at the fastest rate, by 215.82%, in Massachusetts. Meanwhile, it actually fell in three states, by $14,100, $6,600, and $5,900, in North Dakota, Wyoming, and West Virginia, respectively, and it grew at the slowest rate, by just 0.89%, in Louisiana. Clearly, these differences correspond to geographic patterns of economic performance and, hence, household income, but they just as clearly reflect household responses to various kinds of quality of life differentials (Perloff et al 1960).

Finally, before going further, it is worth reemphasizing the importance of equilibrating forces to the spatial outcomes associated with the plane of living. In particular, the process of regional development happens in two interconnected ways: (*i*) via demand-induced growth, which occurs when households make moves for reasons having to do with economic opportunity; and (*ii*) via supply-induced growth, which occurs when households make moves for reasons having to do with personal preference (Carruthers and Mulligan 2008). The reality, of course, is that virtually all migration involves some balance of the two: the equilibrating tendency is so strong that both opportunity and preference help direct population flows (Clark et al 2003). Each form of growth results in increased pressure on the housing market, but only demand-induced growth is accompanied by a corresponding increase in income (see DiPasquale and Wheaton 1996). Demand induced growth drives up housing values and income, meaning that the two remain more or less in synch; supply-induced growth drives up housing values, but not income, meaning that the two fall out of synch. As a corollary, decline drives down housing values and income in a way that keeps the two in synch unless it is preference related, in which case the two fall out of synch — though by moving in the opposite directions from growth. The semantics may be a bit awkward, but the bottom line is straightforward and intuitive: people live in homes valued high relative to their incomes in attractive places and in homes valued low relative to their incomes in unattractive places. In this way, housing values are observed to capitalize both household income and the level of amenities that households enjoy (Glaeser et al 2001; Carruthers and Mulligan 2006).

2.2 Population Growth, Housing Values, and Household Income

The continental United States contains 3,103 county equivalents, including all counties and independent cities — of these: 1,082, accounting for about 83% of the population, belong to metropolitan areas; 687, accounting for about 10% of the population, belong to micropolitan

areas; and 1,244, accounting for about 7% of the population, are not part of a core-based statistical area (CBSA). The spatial distribution of the population within individual counties is shown in Figure 1, a map of CBSA and non-CBSA counties with population-weighted center-points marking each county's center of gravity.[3] The center-points identify where people are concentrated rather than the geometric centers of the county polygons, and they represent the socioeconomic pegs that fix the plane of living, an enduring dimension of the space economy (Isard 1956), in place and give it its shape.

To set the scene for what follows in the ensuing econometric analysis, Figure 2 displays trend surfaces of population change across the United States from (2a) 1970 – 1980, (2b) 1980 – 1990, and (2c) 1990 – 2000; Figure 3 displays trend surfaces of median housing value (in 2005 dollars) in (3a) 1980, (3b) 1990, and (3c) 2000; and Figure 4 displays trend surfaces of median household income (again in 2005 dollars) in (4a) 1979, (4b) 1989, and (4c) 1999. Each of the three groups of maps shares a common scale, so the figures are internally consistent — that is to say, (-a), (-b), and (-c) are directly comparable — and, for all three, the darker the shading, the greater the value. The trend surfaces in these and all subsequent figures were generated via an inverse distance weighting (IDW) procedure, which is the simplest method of interpolating a surface from point data. Specifically, IDW estimates values between points *i* and *j* as a weighted average, where the weight given to each point is determined by a standard distance decay function (Longley et al. 2001):

$$f(d_{ij}) = 1/d_{ij}^2 \qquad (1)$$

To generate the maps, relevant county-level data, all of which is available from the Census Bureau, was attached to the points shown in Figure 1 and the surfaces were interpolated from there.

Figure 2, which maps population change, illustrates a systematic pattern of population deconcentration wherein regions with warm, dry climates, plentiful human capital, and/or automobile-oriented transport systems grew at the expense of regions without those characteristics (Glaeser and Shapiro 2003). Because this set of maps displays rates of change, the effect is particularly striking in the 1970 – 1980 decade, when many of the most rapidly growing areas were still comparatively small. In the 1980 – 1990 decade, the same general pattern of growth continued but it became more focused around specific regions like the Atlanta, Denver, Las Vegas, Los Angeles, and San Antonio metropolitan areas. In the 1990 – 2000 decade, the national pattern became more focused still, except that many individual regions, for example the

[3] The population-weighted center-points were calculated in *ArcGIS* via the "mean center" tool using census tract level data from 1990.

Denver, Salt Lake City, and Tampa Bay metropolitan areas, began to also exhibit rapid growth at the fringe (Carruthers 2003). Across all three timeframes, many of the more rural parts of the country experienced steep trends of population decline. Together, the three maps illustrate an intensifying pattern of spatial focusing (see Plane and Mulligan 1997) in the nation's migration system — a crystallization, really, of growth and decline around what Frey (2002) has labeled the "Three Americas:" (*i*) the low-density, suburban "Sunbelt;" (*ii*) the high-density, urban "Melting-pot;" and (*iii*) the declining rural "Heartland." The overall effect has been to shift the country's demographic center of gravity steadily to the southwest, from {38.53°N, 90.27°W} in 1980 to {38.43°N, 90.58°W} in 1990 to {38.24°N, 91.05°W} in 2000.

Moving on, Figure 3 illustrates how the topography of housing values has evolved, both through time and across geographic space. In 1980, median housing values were relatively uniform beyond major metropolitan areas but, by 1990, they began to exhibit more polarization along the metropolitan ⇔ nonmetropolitan continuum, which persisted in 2000 but with an important spatial twist — namely, that they also rose significantly across the entire country. In particular, market conditions nationwide ratcheted up to a point where many smaller metropolitan, micropolitan, and even rural areas exhibited values (in constant 2005 dollars) found only in major metropolitan areas in the preceding years. Although the median housing values reported by the Census Bureau are obviously not the same as sales prices — they are derived from homeowner-provided estimates — they have been found to be a remarkably good indicator of actual market value (see Kiel and Zabel 1999). Across the United States, and, above all, in the rapid growth areas identified in Figure 2, housing values had already reached unprecedented levels by 2000, the year the country essentially locked in on a course toward the housing bubble and subsequent financial collapse.[4] To provide some specific numbers, Table 2 lists the median housing values for the 25 counties having the highest values in 1980, 1990, and 2000. The three lists contain many of the same counties, indicating a large degree of stability at the top end of the nation's housing market. In fact, this stability has persisted across the entire distribution of median housing values: the correlation between the 1980 and 1990 county-level values is great (Pearson's r = 0.85) and the correlation between the 1990 and 2000 values is greater still (Pearson's r = 0.93). Even so, the coefficient of variation for median housing value first rose from 0.39 in 1980 to 0.62 in 1990, and then declined to 0.56 in 2000. These descriptive statistics are

[4] Beginning in 2000, the conventional 30-year mortgage rate fell consistently through 2005, when it started slowly rising again. See, for example, the Federal Reserve Bank of St. Louis' FRED (Federal Reserve Economic Data) database: *http://research.stlouisfed.org/fred2/series/MORTG?cid=114*.

compelling because they highlight the initial polarization and subsequent nationwide ratcheting up of values evidenced in Figure 3.

Next, Figure 4 shows that, from 1979 to 1999, median household incomes likewise hardened around major metropolitan areas but, at the same time, extended out into more remote areas, especially in the Atlantic Southeast and Rocky Mountain West. Maps based on wages would look rather different, but unearned components of income, including retiree pensions, dividend payments, and more, are integral to the matter at hand. In 1979, county-level median household incomes ranged from $17,808 – $80,730, with an average value of $38,317; in 1989, they ranged from $13,537 – $93,372, with an average value of $37,559; and in 1999 they ranged from $14,878 – $97,215, with an average value of $41,334 (all in 2005 dollars). Table 3, which lists the median household incomes for the 25 counties having the highest values in 1979, 1989, and 1999, illustrates that income does not necessarily line up with housing value: though some members of the lists also appear in the lists in Table 2, most do not. Just like housing value, household income exhibits a great deal of temporal stability: the correlation between 1979 and 1989 was very strong (Pearson's $r = 0.88$) and the correlation between 1989 and 1999 was even stronger (Pearson's $r = 0.95$). But it is noteworthy that, despite this apparent stability, over the twenty-year time frame, the standard deviation of median household income nonetheless rose from $8,918 to $10,353 — and so, not surprisingly, the income distribution grew increasingly skewed, rising from just 0.77 in 1979 to the much higher levels of 1.32 in 1989 and 1.36 in 1999. As a set, these figures and tables illustrate: (*i*) the great wealth that has been amassed in the housing market; and (*ii*) the deconcentration of household income that has been realized in recent years. Together, they point to fundamental changes in household location choice and, in fact, the very nature of housing consumption.

Finally, there has been much recent evidence that both income and wealth are becoming increasingly concentrated in the United States (Lynch 2003). Whether this is attributable to tax policy, changes in reward levels for advanced skills and education, the ageing of the population, or whatever else, the impact on housing is doubtless. Household income and housing values are highly correlated (Pearson's $r > 0.70$ in all three years) so increasing income inequality translates directly into increasing housing inequality. Moreover, Americans currently exhibit historically low savings rates — in part because many view the equity in their homes as an important part of their overall savings plan. But, with the onset of the present economic crisis, it seems that the two forms of inequality may have collided in a particularly potent way: as reported by the *New York*

Times[5] and other media organizations, the spatial pattern of subprime mortgages bears a strong resemblance to the spatial patterns of growth and decline shown in Figure 2. In the face of the kind of nationwide housing bubble beginning to take shape in Figure 3 — which, critically, was not accompanied by corresponding income growth — many households used exotic financial instruments to attain homeownership and/or to gain access to equity in their homes. That many of these households are apparently concentrated in areas of endemic economic decline and, added to that, in areas that do not have the kind of natural appeal of, for example, formerly natural resource-oriented areas in the Rocky Mountain West, is a real problem. For, just as the quality of life differentials manifest in the plane of living have caused the housing bubble to inflate unevenly — they may yet offer a path out of the crisis for some households, even as they leave others mired in it.

2.3 The Contemporary Plane of Living

As for the plane of living itself, both natural and human amenities matter — so, to close out this section, each is addressed in turn. Ten years ago, McGranahan (1999) constructed an index of natural amenities covering all counties in the continental United States.[6] The index is based on six separate sub-indices: (*i*) January temperature; (*ii*) hours of sunshine in January; (*iii*) the January-July temperature gap; (*iv*) July humidity; (*v*) topographic variation; and (*vi*) relative water area, including access to coasts. Values of the six sub-indices were transformed into *z*-scores and then signed positive or negative according to established household preferences — for example, January sunshine, an amenity, is positive and July humidity, as disamenity, is negative. The scores were then aggregated (by adding them up) into a composite natural amenities index. McGranahan (1999) provides statistical evidence that the six sub-indices are not highly correlated with one another and maps are provided to give a sense of the geographic variation in each. As shown in Figure 5, counties registering the highest (lowest) scores are located in the most (least) environmentally appealing parts of the country. Some specific counties are identified in the leftmost column of Table 3, which lists the top and bottom 10 in their ordinal ranking. All of the top counties are located in the warm, sunny environs of coastal California, and all of the bottom counties are located in the cold-in-the-winter / hot-in-the-summer environs of the flat, landlocked Great Plains and Midwest. This index has been used in all sorts of empirical research and is a good predictor of both migration and land use change (Carruthers and Vias 2005).

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[5] For an interactive map with accompanying data, see: *http://www.nytimes.com/interactive/2007/11/03/weekinreview/20071103_SUBPRIME_GRAPHIC.html?scp=1&sq=subprime%20map&st=cse*.

[6] The natural amenities scale and underlying data are available online from the USDA's Economic Research Service, here: *http://www.ers.usda.gov/Data/NaturalAmenities/*.

While the natural amenities index distinguishes areas of the country according to their natural appeal, a corresponding human amenities index is needed to identify areas with high and low human appeal. The index — which was constructed by the authors for the purposes of this paper — is composed of four sub-indices: (*i*) the percent of the population having a college degree, from the Census; (*ii*) per capita local government expenditure, from the Census of Governments; (*iii*) per capita property tax revenue, from the Census of Governments; and (*iv*) territorial density, or the county's population divided by its land area, from the Census. The data from the Census corresponds to census years but, since the Census of Governments is only conducted on off-census years, that data corresponds to 1977, 1987, and 1997. The index itself was constructed in the exact same way as the natural amenities index — by calculating *z*-scores for each of the sub-indices, assigning them the appropriate sign (all positive, except for per capita property tax), and adding them up. Figure 6 displays the resulting values in (6a) 1980, (6b) 1990, and (6c) 2000 and the three remaining columns of Table 3 list the top and bottom 10 counties in their ordinal ranking for each year. As intended, the highest rated areas of the country are cosmopolitan places known for their abundant cultural, recreational, and other human amenities and the lowest rated areas of the country are more rural places that do not have that same type of appeal. The following paragraph briefly explains the rationale for each of the four sub-indices — for further information on these and other human factors that enhance quality of life see, for example, Mulligan et al (2004).

First, analysts have long recognized the beneficial effects of education on income (Glaeser and Maré, 2001) and on human wellbeing in general (Putnam 2001). These benefits are particularly great in major metropolitan areas, which are commonly sought out by, to name a few groups, college-educated couples (Costa and Kahn 2000) faced with a collocation problem, households and firms in Drennan's (2002) "information economy," and members of Florida's (2002) "creative class." Second, local government expenditure and property taxation have important — and, obviously, closely interrelated — effects on housing values because of the kind of Tiebout (1956) sorting they engender (see Ladd 1998, Fischel 2001, and Oates 2002 for useful summaries). An aggregate measure of public spending, total direct expenditure, is used because its value as a composite amenity is what is really of interest here, but Welch and Waldorf (2006) and Welch et al (2007) have recently explored the various ways in which different kinds of spending are valued by homeowners and renters. Last, density is increasingly recognized a main factor influencing the comparative advantages of regions (Jacobs 1961; Glaeser et al 2001; Glaeser and Gottlieb 2006). For example, the theory behind the "New Economic Geography" framework (Fujita et al. 1999) suggests that the kind of variety found in dense urban

agglomerations has advantages for production and consumption alike. For present purposes, the message is similar: counties that are denser in population not only tend to be more productive but they also tend to provide their residents with a wider variety of high-quality private and public goods and services. Table 4, a matrix of Pearson's *r* statistics, shows that there is little correlation among the sub-indices — except, as indicated, between public spending and property taxes.

The trend surfaces shown in Figures 5 and 6 are analogues of the contemporary plane of living — they jointly depict the spatial distribution of quality of life differentials across the United States. Compared to Goodrich et al's (1935, 1936) original conceptualization, which was based on per capita income and in-home radios and telephones, today's setting is more nuanced, particularly with its orientation toward natural amenities, but it nonetheless bears a certain resemblance. For example, the Northeast Corridor, the Pacific Coast, and parts of the Atlantic Southeast dominate both the older and newer maps. Likewise, the interior of the Atlantic Southeast and some of the more remote parts of the Southwest remain "problem areas" (Hoover 1948, page 204) even today. Then again, there are some big differences. Mainly, the great manufacturing regions of the Midwest — now often pejoratively referred to as the "Rustbelt" — and select agricultural areas as far west as the Great Plains stood out dramatically in the 1930s, but no longer do. Another large, more positive difference between the two eras is the wider "Four Corners" section of the Southwest, which rated poorly in the 1930s, but now rates highly in terms of both natural and human amenities. Although the two indices are kept separate for the sake of exposition, the combination of them is what represents the plane of living — it is the surface that contemporary American households must negotiate as they decide where in the country to live, and at what cost.

3. Econometric Analysis

3.1 A Parallel Plane of Living

The point of departure for the econometric analysis is a simple income capitalization model of housing values suggested by Glaeser et al (2001) and Carruthers and Mulligan (2006):

$$mhv_i^* = \alpha_1 + \alpha_2 \cdot mhi_i^* + \varepsilon_i . \qquad (2)$$

In this equation, mhv_i^* is the natural logarithm of median housing value in county *i;* mhi_i^* is the natural logarithm of median household income; α_1 and α_2 are estimable parameters, giving the equation's intercept and the rate at which the median household income translates into housing value; and ε_i is the stochastic error term. Note that, because the equation is in log-linear form, the

parameter $\alpha_{2\square}$ is an elasticity, meaning that it registers the percent change in median housing value induced by a 1% change in median household income. While many studies have focused on estimating the price and income elasticities of demand for housing, since Muth (1969) a rule of thumb has been that the "correct" income elasticity is somewhere between 1.0 and 1.5 (see also Mayo 1981). In fact, in his numerical simulations, Mills (1972) found that this factor was especially important in influencing both the size and shape of cities because of the tradeoff involving housing and commuting costs that households face.[7] Although $\alpha_{2\square}$ should not be confused with an actual, household-level income elasticity of demand because it is based on aggregated data — and, more to the point, equation (2) is not a demand function — logically, it should still be in the vicinity of 1.0 – 1.5 if it representatively describes the relationship between household income and housing value.

A useful feature of this income capitalization model is that its error term represents an amenity index because it reveals the extent to which median household income over- or under-predicts median housing value. In particular, the error term is positive (negative) when the model underestimates (overestimates) a county's median housing value, based on its median household income. As explained in the background discussion, the compensating differentials framework indicates that people living in attractive (unattractive) places pay more (less) for their homes, as a result of competition in the real estate market. So, based on that framework, the amount of overpayment (underpayment) for housing may be interpreted as a measure of the premium (discount) that people pay for a given county's relative endowment of natural and human amenities. In short, as explained in the background discussion, people live in homes valued higher than their incomes predict in places that are desirable to live in and in homes valued lower than their incomes predict in places that are undesirable to live in — because of this, equation (2) can be also used to construct a parallel analogue of the plane of living.

To illustrate how, Figure 7 provides scatter-plots of median household income (on the *x*-axis) versus median housing value (on the *y*-axis) in (7a) 1980, (7b) 1990, and (7c) 2000. The residuals associated with the ordinary least squares (OLS) regression lines shown in the plots were used to generate the amenity and disamenity maps shown in Figures 8 and 9. These maps, which deal with amenities and disamenities separately only because they are in monochrome, line up almost identically with the maps shown in Figures 5 and 6. Note, too, how the surfaces in the figures shift through time. In Figure 8, the Pacific West and Rocky Mountain West stand out as having high amenity values in all three panels, but, in the middle panel, the effect appears to settle

[7] Further, Brueckner (1982) shows that it is a necessary condition for the traditional negative exponential density gradient to materialize.

somewhat — perhaps as a result of the decline of the real estate market that began in the 1980s — before picking up again in the final panel.[8] On the other side of the country, in the Northeast Corridor, the opposite happened: the amenity value, clearly visible in all three panels, swells in the middle panel before returning to more or less previous levels in the final panel. Meanwhile, in Figure 9, the Great Plains and Midwest consistently register substantial disamenity values but, in central Texas, the effect dissipates in the middle panel before returning again in the final panel. In the Atlantic Southeast, a region that experienced great deal of growth between 1980 and 2000, the disamenity effect steadily declines over the three panels producing corresponding amenity values that take shape year-by-year in Figure 8.

Compared to Figures 5 and 6, which illustrate the natural amenity and human amenity related quality of life differentials of the plane of living, Figures 8 and 9 together represent its value related differentials — that is, the former are analogues of the amenities themselves and the latter are analogues of amenities' economic impacts. The two sets of maps are not so much alternative representations of the same thing as different, parallel dimensions of the greater socioeconomic landscape. As such, the surfaces they display are tightly interwoven: the amenity- and disamenity-related values shown in Figures 8 and 9 are direct outcomes of actions taken by households — and firms — in response to the quality of life differentials pictured in Figures 5 and 6. Given this causal relationship, the logical next step is to connect two representations in a way that helps shed light on how housing values evolved to present levels, through time and across geographic space.

3.2 Income Capitalization Versus Amenity Capitalization

The relative importance of household income versus quality of life in the recent evolution of housing values is weighed by expanding equation (2) to include a spatially lagged dependent variable (Anselin 1988; Arbia 2006), metropolitan and micropolitan area dummy variables, state-level fixed effects (Wooldridge 2000, 2002), and, ultimately, the natural amenity scale and human amenity scale:

$$mhv_{i\square}^{*\square} = \rho \cdot W_{ij\square} \cdot mhv_{j}^{*\square} + \Phi + X_{i\square}^{*} \cdot \Gamma + \upsilon_{i}. \qquad (3)$$

Here, $mhv_{i\square}^{*\square}$ represents the natural logarithm of median housing value on county i; $W_{ij\square} \cdot mhv_{j}^{*}$ represents the endogenous spatial lag of the natural logarithm of median housing value; $X_{i\square}^{*\square}$ represents a vector of exogenous explanatory variables, including $mhi_{i\square}^{*}$ the natural logarithm of

[8] There is much evidence of households migrating out of California to comparatively less expensive locations throughout the West (Henrie and Plane 2007) so an interesting issue for further research is the extent to which western real estate values and amenity consumption have been driven by a wealth effect from that state.

median household income, and metropolitan area and micropolitan area dummy variables, plus the natural logarithms of the natural amenity scale and human amenity scale; ρ represents a spatial autoregressive parameter that describes how median housing value in county i is influenced by median housing value in proximate counties j; Φ represents a vector of state fixed effects, including one for Washington, DC; Γ represents a vector of parameters on the exogenous variables; and υ_i represents the stochastic error term. By convention, W_{ij} is used to denote a 3,103 × 3,103 ($n \times n$) row-standardized weights matrix that describes the spatial connectivity of the dataset. The weights matrix was created using the population weighted center of each county's population — that is, the points shown in Figure 1 — to identify neighbors. In the scheme, each county i is related to all counties j having population centers located within 50 miles of its own population center or, in the 65 cases where the distance is greater than 50 miles, to a single nearest neighbor.

Equation (2) indicates that proximate housing values influence one another. This occurs because, for example, nearby counties have common labor markets and, therefore, have real estate markets that are shaped by the same economic forces. In practice, this means that median housing value in county i depends on median housing values in counties j and the other way around so, as already noted, $W_{ij} \cdot mhv^*_j$ is endogenous to mhv^*_i and the model cannot be properly estimated using ordinary least squares (OLS). A straightforward alternative is a spatial two-stage least squares (S2SLS) strategy developed by Kelejian and Prucha (1998). In the first stage of the S2SLS algorithm, the spatially lagged dependent variable, $W_{ij} \cdot mhv^*_j$, is regressed on X_i and $W_{ij} \cdot X_i$ — the spatial lag of X_i — to produce predicted values. Then, in the second stage of the algorithm, the predicted values, say "$W_{ij} \cdot mhv^*_j$ hat," are used in place of the actual values in equation (2). This approach yields efficient, unbiased parameter estimates, even in the presence of spatial error dependence (Das et al. 2003). In order to carry all of this out, the spatial variables, $W_{ij} \cdot mhv^*_j$ and $W_{ij} \cdot X_i$ were calculated in *GeoDa*, a program specially designed for spatial analysis and computation (Anselin 2003; Anselin et al. 2006), then imported into *EViews*, an econometrics program, with the rest of the data, where the two-stage least squares (2SLS) regressions were run using panel settings to identify the states as cross-sections for fixed effects and as clusters for White-adjusted standard errors.

Table 5 lists the S2SLS estimation results of a baseline model without the natural amenity scale and human amenity scale included — for comparison, OLS estimation results for a variant of the model without a spatial lag are also shown. For both versions of the model and across each

of the three years, all of the explanatory variables except one (the spatial lag in the 1980 S2SLS model) are statistically significant at well over a 99% confidence interval and carry the expected sign. Also, the adjusted R^2 values, which are all 0.75 or greater, indicate that this very simple model does an excellent job of explaining place-to-place variation in median housing value. Focusing first on the S2SLS results in the right-hand panel of the table, the estimates reveal that: (*i*) the spatially lagged dependent variable was insignificant in 1980, but highly significant in 1990 and 2000, indicating that spatial interaction among proximate counties steadily took hold over the 20-year timeframe; (*ii*) as expected, the parameter on median household income is very close to 1.0 in all cases, and it got steadily larger over between years, indicating that housing values capitalized household income at a higher rate in 2000 than they did in 1980; and (*iii*) interestingly, the metropolitan area and micropolitan area dummies are about the same size in all three years, but, if anything, the metropolitan effect declined slightly (from ~0.10 to ~0.08) and the micropolitan effect grew slightly (from ~0.07 to ~0.08). The S2SLS results are very similar to the OLS results listed in the left-hand panel of the table. The main difference is in the parameter on median household income: once the spatial effects take hold in the 1990 and 2000 S2SLS models it is about 10% smaller relative to the OLS models.

Moving on, the left-hand panel of Table 6 lists estimation results for equation (3) with the natural amenities index and human amenities index — together representing the quality of life differentials that make up the plane of living — included. Once again, all of the explanatory variables, including the formerly insignificant spatial lag in the 1980 model, are statistically significant and the adjusted R^2 values are very respectable. (Note here that all parameters associated with continuous variables are elasticities, which are unit free metrics, so they enable reasonably direct comparisons to be made among the different variables.) Adding in the two amenity indices shrinks the income effect by ~10% in 1980 and 1990 and by ~20% in 2000 and the metropolitan area and micropolitan area dummies by ~50% each across all three years. These results are compelling because they illustrate that the ratcheting up of housing values evidenced in Figure 4 is not just a matter of income growth but, also, of increased amenity consumption. The depleted metropolitan area and micropolitan area effects are corroborating evidence of this because, in the preceding results, those variables were serving in part as proxies for any amenities are associated with them. As for the amenity variables themselves, there are two key findings: (*i*) the effect of the natural amenity index grows substantially larger through the years, almost doubling in size (from ~020 to ~0.38) between 1980 and 2000; and (*ii*) the effect of the human amenity index declines through the years, shrinking by over a third (from ~1.35 to ~0.89) between 1980 and 2000. Both shifts seem to be actual transitions, because, in each case, the 1990

values of the parameter estimates are between the 1980 and 2000 values. The decline of the human amenity factor is particularly interesting because it is consistent with the overall process of population deconcentration in the United States (see Frey 1993), which has been responsible for bringing more-and-more of the kind of specialized activity found in major metropolitan areas to both newer areas in the Sunbelt and smaller, less cosmopolitan parts of the country.

In order to examine further spatial relationships in the income capitalization model, equation (3) is expanded again — this time, by adding spatial lags of the two amenity indices into the mix:

$$mhv_i^* = \rho \cdot W_{ij} \cdot mhv_j^* + \Phi + X_i^* \cdot \Gamma + W_{ij} \cdot Z_i^* \cdot \Lambda + \psi_i . \qquad (4)$$

All notation is the same as before except that the vector Z_i^* is a subset of the vector X_i^* — namely, the natural amenity index and the human amenity index — so $W_{ij} \cdot Z_i^*$ represents the spatial lag of those two variables; Λ represents a vector of parameters on the spatially lagged exogenous variables; and ψ_i represents the stochastic error term. This "spatial expansion" variant of the model (see Cassetti 1972) is estimated the exact same way as before except that, because it contains spatially lagged explanatory variables, second order spatial lags, or, in other words, spatial lags of spatial lags, are used as additional instrumental variables in the first stage of the S2SLS algorithm.

The right-hand panel of Table 6 lists the estimation results. Adding in the spatial lags of the two indices renders the spatially lagged dependent variable insignificant again in the 1980 model, and cuts into its effect substantially in the 1990 model; surprisingly, the effect is essentially unchanged in the 2000 model. The spatial lag of the natural amenity index reduces its non-lagged counterpart's overall effect by a steady amount of about 25% in each of the three years — but the effect of the spatial lag grows from ~0.15 in 1980, to ~0.20 in 1990, to ~0.27 in 2000. In the last two years, the effects of the natural amenity index and its spatial lag are more or less equivalent. Meanwhile, adding in the spatial lag of the human amenity index has a minimal effect on its non-lagged counterpart, except in the 1980 model where it has a slight downward effect, but its influence declines from 1980 and 1990 and then becomes insignificant in 2000. This result reinforces the suggestion that, over time, human amenities are becoming less spatially concentrated and, therefore, less influential on nearby areas than they have been in the past. Put differently, the estimates point to a steady evening out of human amenities. All together, the evidence reported in Tables 5 and 6 strongly suggests that the plane of living has played a main role in the recent evolution of housing values — and that this role continues to evolve through time and across geographic space.

4. Observations for Federal Policy

Having explored the plane of living and examined its influence on the recent evolution of housing values, the remainder of the discussion focuses on identifying some of the implications for federal policy in general and the ongoing financial crisis in particular. To recap the findings of the analysis so far: (*i*) the natural amenity and human amenity related quality of life differentials of the plane of living are oriented, respectively, around warm, sunny and cosmopolitan places; (*ii*) these amenity related differentials give rise to corresponding value related differentials that exhibit a parallel topography; (*iii*) over time, housing values have become increasingly connected across geographic space and have also come under greater influence of natural amenities, but lesser influence of human amenities; and (*iv*) the influence of natural amenities has an extensive reach that has grown more powerful with time, while just the opposite appears to be the case for human amenities. As a whole, the evidence suggests that quality of life differentials have played a big part in the nationwide ratcheting up of housing values evidenced in Figure 3 — an interpretation consistent with evidence that quality of life has increased substantially in value over the past several decades (Costa and Kahn 2003; Kahn 2006). These findings hold both general and specific policy implications.

Before discussing these observations, in order to be realistic, it is necessary to be upfront with the fact that, in the United States, virtually all housing is provided via private markets, so the federal government's role is for the most part limited to ensuring that those markets operate equitably via the *Fair Housing Act*, the *Real Estate Settlement Procedures Act*,[9] and other regulation, and to promoting homeownership via income tax deductions. However, beyond these very broad forms of involvement, the Department of Housing and Urban Development also provides focused community development assistance via the *Community Development Block Grant* (CDBG) program and helps build local planning capacity through various initiatives and programs managed by its Office of Policy Development and Research. So, although the government has little direct involvement in delivering housing, there are a number of ways that it could be more responsive to the plane of living.

Foremost, as an overarching observation, it is crystal clear from the various pieces of evidence contained in this paper that housing values are inextricably bound to geography — and are only likely continue growing more so with time. On this front, a relevant consideration for the

[9] A proposed update to the *Real Estate Settlement Procedures Act* is intended to enhance consumer knowledge of the loan and settlement process by reducing information asymmetry in the lending market. Among other things, the regulation requires the use of a standardized good faith estimate (GFE) form on which lenders must spell out the precise terms of their offer.

federal government is that income tax subsidies have almost certainly contributed to the value related differentials shown in Figures 8 and 9. For example, Gyourko and Sinai (2003) find that the spatial distribution of income tax benefits for homeowners is highly skewed, with high-amenity states, like California, registering large positive net transfers and low-amenity states, like West Virginia, registering large negative net transfers. At issue, is the extent to which low-amenity housing markets may actually subsidize high-amenity housing markets via tax write offs. To that point, the study further reveals that regions throughout the Northeast Corridor and along the Pacific coast gain considerably, and at the expense of most other places in the country. Housing related income tax subsidies promote homeownership but, other things being equal, they also enable households to consume "more" housing — particularly high-income households who end up with greater incentives to spend on housing in order to maximize their tax benefit. For example, Voith and Gyourko (2002) show that, with tax benefit capitalization, high-income households consume greater quantities of land, leading to a dispersed pattern of urban form. Although the evidence presented here in no way formally links quality of life differentials and housing related income tax subsidies, it does highlight the need to know more about the relationship.

Another pertinent and, unhappily, obvious general observation is that the implosion of the housing bubble has left many, many Americans holding homes valued less than they paid for them. But, as the experience leading up to the present financial crises illustrates, many of these are embedded in markets with excellent intermediate-run – long-run prospects: California, to name just one state, is well acquainted boom and bust cycles, and has a demonstrated record of recovering from wild upheaval in its housing markets. That is to say, in net, places having an enduring appeal for their high quality of life are likely to weather the storm comparatively well. On the other hand, places that do not have the same kind of prospects — whether because of weak labor demand, low environmental appeal, or, worse still, a combination of the two — are sliding down a very slippery slope. Indeed, the kind of place-based policy frameworks that some analysts (like Partridge and Rickman 2006) have advocated as an approach to endemic poverty may eventually be needed for housing markets with particularly grim outlooks. Power (1996) and Power and Barrett (2001) have suggested a plausible way forward for formerly resource-dependent areas of the Rocky Mountain West, but the same kind of path is simply not open to areas forsaken for both their deteriorating economies and the character of their environments. As unjust as it is, regions that fail to grow, along with those that remain stranded in perpetual decline, may end up being permanent casualties of the financial crisis if great innovation and effort is not taken in the formation of housing and development policy, federal or otherwise, going forward.

A deeper look at the variegated nature of the problem is provided in Figure 10, which displays the Case-Shiller housing price indices[10] for the 106-month-long period between January 2000 and October 2008 for four groupings of the 20 metropolitan areas that the data is available for: (*i*) Las Vegas, New York City, Phoenix, San Francisco, and Tampa Bay; (*ii*) Los Angeles, Miami, San Diego, and Washington; (*iii*) Atlanta, Charlotte, Cleveland, Dallas, Denver, and Detroit; and (*iv*) Boston, Chicago, Minneapolis, Portland, and Seattle. The groupings were assembled using a Ward-type cluster analysis of the monthly patterns exhibited by the price indices — 2000 is set to 100 for all cases — such that regions having similar rise-and-fall patterns are grouped together. Those exhibiting the highest month-to-month volatility in their housing price indices, by their coefficients variation, are Miami (CV = 0.33), Los Angeles (CV = 0.32) and Las Vegas (CV= 0.31); those exhibiting the lowest month-to-month volatility in their housing price indices are Dallas (CV = 0.06), Denver (CV = 0.08) and Cleveland (CV = 0.06). The graphs in Figure 10 reveal clear differences among the groupings: Group (*i*) began its climb early on and peaked higher than any of the other groups; Group (*ii*) began its climb somewhat later and peaked at a lower level; Group (*iii*) began its climb at around the same time as Group (*i*) but peaked substantially below Group (*ii*); and Group (*iv*) remained essentially flat from 2000 – 2007, before falling off in 2008.

The impacts of natural amenities and human amenities on this volatility — as stabilizing and/or destabilizing factors — are queried by first regressing the natural logarithm of the 20 region-specific coefficients of variation on the natural logarithms of the natural amenity index and the human amenity index and then doing the same, but with natural logarithm of the change in the housing price index as the dependent variable. The results of the first step, given in the upper panel of Table 7, suggest that human amenities, but not natural amenities, have a statistically significant impact on the volatility of house prices. The results of the second step, displayed in the lower panel of Table 7, indicate that the human amenity index, but (again) not the natural amenity index, has a positive and statistically significant influence on the housing price index. Though each of these findings needs to be tempered by the fact that the sample size is very small, in the context of a hypothesis test, the sample size is large enough ($df = 17$) to draw at least general conclusions about statistical significance. The evidence presented in Table 7 is encouraging in the sense that it suggests that regions with high levels of human amenities have experienced more volatility, but also greater gains. The reason that this is encouraging is that, unlike natural amenities, like temperature, human amenities can readily be enhanced via public

[10] Available from Standard and Poor's on line, here: *http://www2.standardandpoors.com/portal/site/sp/en/us/page.topic/indices_csmahp/0,0,0,0,0,0,0,0,0,0,1,1,0,0,0,0,0.html*.

policy: investments in higher education, other pubic goods and services, and economic development, though often expensive, may pay off.

In terms of particular federal policy frameworks, the newly arrived Obama administration has pledged to pursue both metropolitan and nonmetropolitan initiatives aimed at producing sweeping enhancements to the plane of living.[11] On the metropolitan front, the administration intends to: (*i*) pursue a general commitment to cities by creating a White House Office of Urban Policy; (*ii*) fully fund the CDBG program; (*iii*) strengthen the human capital base through public education and workforce training; (*iv*) invest in core infrastructure; and (*v*) and promote livable and sustainable communities. With respect to housing itself the White House says that, "President Obama and Vice President Biden will … restore cuts to public housing operating subsidies, and ensure that all Department of Housing and Urban Development (HUD) programs are restored to their original purpose." On the nonmetropolitan front, the administration specifically cites the need to "improve rural quality of life," through: (*i*) methamphetamine control; (*ii*) better access to heath care; (*iii*) education initiatives; and (*iv*) infrastructure investments. These are all bold steps and, if they are taken, they will amount to the single greatest effort to enhance quality of life across the United States since at least the Johnson administration's *Great Society* movement. But, as noted in the introduction, the nation's economic circumstances are at a low not witnessed since the 1930s, so some commentators (see, for example, Krugman 2009) argue that the Obama administration's initiatives need to be implemented on a scale more in line with the Roosevelt administration's *New Deal*.

The analysis contained in this paper was not designed as a specific evaluation of the Obama administration's policies — most of it was, in fact, conducted more than a year prior to the presidential election — but it nonetheless speaks directly to their efficacy. The successive waves of qualitative and quantitative evidence presented here demonstrate that the plane of living is a vital dimension of the American space economy and, as such, should be of acute interest to federal policymakers who, after all, are the only stewards of the national scene. While many quality of life improvements are probably best implemented at the local level, the federal government can provide critical capacity building and guidance by way of financial resources and technical support. The Obama administration initiatives promise significant enhancements to a broad spectrum of human amenities nationwide. And, though not even the federal government can generate more January sunshine or remove July humidity from the air, as a general indicator, the natural amenities index reveals the great value that Americans place on environmental quality. So, by extension, the results associated with it reinforce many of the administration's "green"

[11] See: *http://www.whitehouse.gov/agenda*.

policy proposals, including reduced greenhouse gas emissions, and a greater emphasis on environmental sustainability. As the results show, both natural and human amenities matter to households, and natural amenities matter more now than they ever have before. So, the investigation closes how it should: with independent analysis and objective policy formation reinforcing one another.

5. Summary and Conclusion

This paper began by setting out three specific objectives: (*i*) to illustrate how housing values vary from place-to-place and explain why quality of life differentials cause them to vary so dramatically; (*ii*) to estimate a series of simple income capitalization models aimed at weighing the relative importance of household income versus quality of life in the recent evolution of housing values; and (*iii*) to evaluate the implications for federal policy with a particular eye toward the ongoing crisis. Having met those objectives, the remaining comments briefly refocus on the nature of the challenge the nation now faces.

As noted in the introduction, in 2008 alone, American homes lost an estimated $2 trillion in value. Between October 2007 and October 2008, the last complete year for which they are available, the 20 Case-Shiller housing price indices fell by an average of 16.41% — an aggregate figure that, while bad, includes even worse region-specific news: greater than 30% single-year declines in Phoenix (32.65%), Las Vegas (31.68%), and San Francisco; and greater than 20% single-year declines in Miami (29.03%), Los Angeles (27.93%), San Diego (20.39%), and Detroit (20.39%). For most regions, the overall setback, while dramatic, is essentially a matter of a few years, with the price indices back at their 2004 – 2005 levels. For others, however, the setback appears to be far more insurmountable, at least in the foreseeable future: Cleveland and Detroit, two of the regions shown in the bottommost panel of Figure 10, experienced almost none of the boom between 2000 and 2009, and are now back at their 2002, and pre-2000 levels, respectively. In Miami, San Diego, Phoenix, and other high natural amenity regions it is reasonable to expect that supply-induced growth mechanisms will eventually drive housing values back up. Likewise, in Chicago, New York City, the District of Columbia, and other high human amenity regions, it is equally reasonable to expect that demand-induced growth mechanisms will eventually drive housing values back up. But what about regions like Cleveland, Detroit, and many others that have suffered from years of economic decline and even neglect? Although the human tragedy of the financial crisis extends nationwide, at present, with no recovery in sight, these parts of the country appear particularly vulnerable. They rest on the downside of the plane of living and will

almost certainly present special policy challenges, even when the long-gathering storm finally begins to let up.

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Table 1. Median Value of Owner–occupied Homes ($2005) by State in 1980 and 2005

	1980		2005		Difference			1980		2005		Difference	
	Median value	Percent of US median	Median value	Percent of US median	Value	Percent		Median value	Percent of US median	Median value	Percent of US median	Value	Percent
US	$110,900	100.00%	$167,500	100.00%	$56,600	51.04%	MT	$108,800	98.11%	$131,600	78.57%	$22,800	20.96%
AL	$79,500	71.69%	$97,500	58.21%	$18,000	22.64%	NE	$89,100	80.34%	$113,200	67.58%	$24,100	27.05%
AZ	$132,700	119.66%	$185,400	110.69%	$52,700	39.71%	NV	$162,300	146.35%	$283,400	169.19%	$121,100	74.61%
AR	$72,900	65.73%	$87,400	52.18%	$14,500	19.89%	NH	$112,600	101.53%	$240,100	143.34%	$127,500	113.23%
CA	$198,600	179.08%	$477,700	285.19%	$279,100	140.53%	NJ	$144,000	129.85%	$333,900	199.34%	$189,900	131.88%
CO	$151,500	136.61%	$223,300	133.31%	$71,800	47.39%	NM	$106,500	96.03%	$125,500	74.93%	$19,000	17.84%
CT	$158,100	142.56%	$271,500	162.09%	$113,400	71.73%	NY	$107,600	97.02%	$258,900	154.57%	$151,300	140.61%
DE	$104,600	94.32%	$203,800	121.67%	$99,200	94.84%	NC	$84,400	76.10%	$127,600	76.18%	$43,200	51.18%
DC	$165,800	149.50%	$384,400	229.49%	$218,600	131.85%	ND	$102,700	92.61%	$88,600	52.90%	–$14,100	-13.73%
FL	$106,200	95.76%	$189,500	113.13%	$83,300	78.44%	OH	$105,800	95.40%	$129,600	77.37%	$23,800	22.50%
GA	$86,500	78.00%	$147,500	88.06%	$61,000	70.52%	OK	$83,500	75.29%	$89,100	53.19%	$5,600	6.71%
ID	$107,600	97.02%	$134,900	80.54%	$27,300	25.37%	OR	$138,400	124.80%	$201,200	120.12%	$62,800	45.38%
IL	$126,400	113.98%	$183,900	109.79%	$57,500	45.49%	PA	$91,700	82.69%	$131,900	78.75%	$40,200	43.84%
IN	$87,200	78.63%	$114,400	68.30%	$27,200	31.19%	RI	$110,200	99.37%	$281,300	167.94%	$171,100	155.26%
IA	$95,200	85.84%	$106,600	63.64%	$11,400	11.97%	SC	$82,300	74.21%	$113,100	67.52%	$30,800	37.42%
KS	$88,600	79.89%	$107,800	64.36%	$19,200	21.67%	SD	$85,800	77.37%	$101,700	60.72%	$15,900	18.53%
KY	$80,200	72.32%	$103,900	62.03%	$23,700	29.55%	TN	$83,500	75.29%	$114,000	68.06%	$30,500	36.53%
LA	$100,800	90.89%	$101,700	60.72%	$900	0.89%	TX	$91,700	82.69%	$106,000	63.28%	$14,300	15.59%
ME	$88,900	80.16%	$155,300	92.72%	$66,400	74.69%	UT	$140,700	126.87%	$167,200	99.82%	$26,500	18.83%
MD	$138,800	125.16%	$280,200	167.28%	$141,400	101.87%	VT	$99,200	89.45%	$173,400	103.52%	$74,200	74.80%
MA	$113,700	102.52%	$361,500	215.82%	$247,800	217.94%	VA	$112,800	101.71%	$212,300	126.75%	$99,500	88.21%
MI	$91,500	82.51%	$149,300	89.13%	$57,800	63.17%	WA	$142,300	128.31%	$227,700	135.94%	$85,400	60.01%
MN	$127,300	114.79%	$198,800	118.69%	$71,500	56.17%	WV	$90,300	81.42%	$84,400	50.39%	–$5,900	-6.53%
MS	$73,600	66.37%	$82,700	49.37%	$9,100	12.36%	WI	$114,000	102.80%	$152,600	91.10%	$38,600	33.86%
MO	$86,100	77.64%	$123,100	73.49%	$37,000	42.97%	WY	$141,600	127.68%	$135,000	80.60%	–$6,600	-4.66%

Source: United States Census Bureau.

Table 2. Median Housing Value — Top 25 Counties in 1980, 1990, and 2000

	1980			1990			2000		
1.	Pitkin County	CO	$474,031	Pitkin County	CO	$676,602	Pitkin County	CO	$850,610
2.	Marin County	CA	$357,892	Marin County	CA	$529,267	Nantucket County	MA	$654,970
3.	San Mateo County	CA	$294,846	San Mateo County	CA	$513,877	Marin County	CA	$583,632
4.	Santa Clara County	CA	$259,294	Nantucket County	MA	$447,382	San Mateo County	CA	$532,141
5.	Orange County	CA	$256,213	San Francisco County	CA	$446,635	Santa Clara County	CA	$506,283
6.	Mono County	CA	$251,235	Santa Clara County	CA	$432,439	San Francisco County	CA	$449,576
7.	San Francisco County	CA	$247,917	Westchester County	NY	$423,623	Santa Cruz County	CA	$428,140
8.	Santa Barbara County	CA	$246,495	Santa Cruz County	CA	$382,680	Eagle County	CO	$418,613
9.	Eagle County	CO	$240,570	Orange County	CA	$377,600	New York City	NY	$416,504
10.	Summit County	CO	$239,385	Santa Barbara County	CA	$373,565	Teton County	WY	$414,417
11.	Montgomery County	MD	$230,852	Fairfield County	CT	$373,267	San Miguel County	CO	$406,251
12.	Teton County	WY	$227,771	New York City	NY	$368,963	Westchester County	NY	$369,505
13.	Fairfax County	VA	$225,638	Ventura County	CA	$366,542	Summit County	CO	$360,091
14.	Contra Costa County	CA	$224,216	Arlington County	VA	$345,174	Dukes County	MA	$344,780
15.	Santa Cruz County	CA	$223,031	Alexandria city	VA	$341,588	Alameda County	CA	$343,760
16.	Douglas County	CO	$221,846	Bergen County	NJ	$340,243	Summit County	UT	$335,707
17.	Ventura County	CA	$221,135	Alameda County	CA	$339,496	Santa Barbara County	CA	$332,305
18.	Arlington County	VA	$220,187	Los Angeles County	CA	$338,301	San Juan County	WA	$330,944
19.	Alexandria city	VA	$219,950	Falls Church city	VA	$337,703	Fairfield County	CT	$327,655
20.	Fairfield County	CT	$218,764	Contra Costa County	CA	$327,841	Blaine County	ID	$327,541
21.	San Diego County	CA	$215,683	Morris County	NJ	$324,703	San Benito County	CA	$322,098
22.	Douglas County	NV	$213,313	Rockland County	NY	$324,404	Falls Church city	VA	$314,272
23.	Falls Church city	VA	$211,891	San Luis Obispo County	CA	$321,715	Sonoma County	CA	$309,849
24.	Sonoma County	CA	$209,521	Fairfax County	VA	$319,473	Orange County	CA	$306,220
25.	Los Angeles County	CA	$208,573	Hunterdon County	NJ	$313,646	Routt County	CO	$304,518

Note: All dollar values are expressed in 2005 constant dollars.

Table 3. Median Household Income — Top 25 Counties in 1980, 1990, and 2000

	1980			1990			2000		
1.	Fairfax County	VA	$80,732	Fairfax County	VA	$93,372	Douglas County	CO	$97,215
2.	Montgomery County	MD	$77,977	Morris County	NJ	$88,630	Fairfax County	VA	$95,012
3.	Buena Vista city	VA	$76,936	Somerset County	NJ	$87,442	Loudoun County	VA	$94,541
4.	Douglas County	CO	$76,345	Los Alamos County	NM	$86,312	Hunterdon County	NJ	$93,650
5.	Los Alamos County	NM	$75,056	Hunterdon County	NJ	$86,039	Los Alamos County	NM	$92,601
6.	Howard County	MD	$74,279	Howard County	MD	$85,598	Morris County	NJ	$90,663
7.	DuPage County	IL	$74,001	Nassau County	NY	$85,496	Somerset County	NJ	$90,186
8.	Morris County	NJ	$71,626	Montgomery County	MD	$85,190	Falls Church city	VA	$87,831
9.	Somerset County	NJ	$70,574	Putnam County	NY	$84,474	Santa Clara County	CA	$87,141
10.	Nassau County	NY	$70,184	Rockland County	NY	$83,051	Howard County	MD	$86,944
11.	Campbell County	WY	$70,104	Loudoun County	VA	$82,001	Putnam County	NY	$84,730
12.	Waukesha County	WI	$69,477	Douglas County	CO	$81,456	Nassau County	NY	$84,439
13.	Fairfax city	VA	$69,431	Falls Church city	VA	$80,342	Montgomery County	MD	$83,877
14.	Rockland County	NY	$68,995	Fairfax city	VA	$80,188	Marin County	CA	$83,590
15.	Fort Bend County	TX	$68,842	Fayette County	GA	$79,013	Fayette County	GA	$83,497
16.	Fayette County	GA	$68,828	Fairfield County	CT	$78,578	Hamilton County	IN	$83,262
17.	Ozaukee County	WI	$68,742	Prince William County	VA	$77,758	Collin County	TX	$83,038
18.	Prince William County	VA	$68,422	Bergen County	NJ	$77,567	San Mateo County	CA	$83,019
19.	Oakland County	MI	$68,121	Suffolk County	NY	$77,377	Williamson County	TN	$81,008
20.	Lake County	IL	$67,817	DuPage County	IL	$76,980	Forsyth County	GA	$80,758
21.	Johnson County	KS	$67,717	Sussex County	NJ	$76,896	Rockland County	NY	$79,680
22.	Manassas city	VA	$66,453	Marin County	CA	$76,457	DuPage County	IL	$79,582
23.	Marin County	CA	$66,052	Westchester County	NY	$76,238	Fairfax city	VA	$79,295
24.	Livingston County	MI	$66,025	Santa Clara County	CA	$75,781	Livingston County	MI	$79,011
25.	Falls Church city	VA	$65,953	Calvert County	MD	$74,983	Delaware County	OH	$78,844

Note: All dollar values are expressed in 2005 constant dollars.

Table 4. Natural Amenity Index and Human Amenity Index – Top 10 and Bottom 10 Counties

	Top 10 Counties							
			Human Amenity Index					
	Natural Amenity Index		1980		1990		2000	
1.	Ventura County	CA	New York County	NY	New York County	NY	New York County	NY
2.	Humboldt County	CA	District of Columbia	DC	San Francisco County	CA	San Francisco County	CA
3.	Santa Barbara County	CA	San Francisco County	CA	District of Columbia	DC	District of Columbia	DC
4.	Mendocino County	CA	Philadelphia County	PA	Suffolk County	MA	Suffolk County	MA
5.	Del Norte County	CA	Baltimore City	MD	Philadelphia County	PA	Philadelphia County	PA
6.	San Francisco County	CA	Suffolk County	MA	Hudson County	NJ	Hudson County	NJ
7.	Los Angeles County	CA	Hudson County	NJ	Alexandria City	VA	Arlington County	VA
8.	San Diego County	CA	Alexandria City	VA	Arlington County	VA	Alexandria City	VA
9.	Monterey County	CA	Essex County	NJ	Baltimore City	MD	Falls Church City	VA
10.	Orange County	CA	Arlington County	VA	Falls Church City	VA	Baltimore City	MD
.	Bottom 10 Counties							
.			Human Amenity Index					
.	Natural Amenity Index		1980		1990		2000	
3094.	Pennington County	MN	Phillips County	MT	Irion County	TX	Kearny County	KS
3095.	Grand Forks County	ND	Powder River County	MT	Upton County	TX	Upton County	TX
3096.	Dodge County	MN	Duval County	TX	Kennedy County	TX	Loving County	TX
3097.	Trail County	ND	Kent County	TX	Crane County	TX	Borden County	TX
3098.	Mower County	MN	Fallon County	MT	Sheridan County	MT	Yoakum County	TX
3099.	Pembina County	ND	Burt County	NE	McMullen County	TX	McMullen County	TX
3100.	Norman County	MN	Carter County	MT	Wibaux County	MT	King County	TX
3101.	Tipton County	IN	Wibaux County	MT	Kent County	TX	Crane County	TX
3102.	Wilkin County	MN	King County	TX	Glasscock County	TX	Kennedy County	TX
3103.	Red Lake County	MN	Loving County	TX	King County	TX	Kent County	TX

Table 5. Correlation Matrix — Components of Human Amenity Index

	Percent w/ College Degree			Per Capita Total Direct Expenditure			Per Capita Property Tax Revenue		
	1980	1990	2000	1980	1990	2000	1980	1990	2000
Percent w/ College Degree	-	-	-	-	-	-	-	-	-
Per Capita Total Direct Expenditure	0.28	0.23	0.25	-	-	-	-	-	-
Per Capita Property Tax Revenue	–0.28	–0.25	–0.31	–0.71	–0.68	–0.54	-	-	-
Territorial Density	0.23	0.29	0.26	0.19	0.13	–0.57	–0.08	–0.05	–0.07

Table 6. OLS and S2SLS Estimates of the Income Capitalization Model

	OLS — Baseline Model						STSLS — Baseline Model					
	1980		1990		2000		1980		1990		2000	
	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value
Constant	1.15 ***	4.44	–0.24 n/s	–0.83	–1.45 ***	–4.75	0.79 ***	2.37	–0.10***	–3.58	–2.16 ***	–7.75
ln Spatial Lag	-	-	-	-	-	-	0.05 n/s	1.72	0.15 ***	6.30	0.16 ***	5.10
ln Median Household Income	0.96 ***	38.29	1.08 ***	38.53	1.20 ***	41.16	0.93 ***	33.74	0.10 ***	31.79	1.10 ***	29.88
Metropolitan Area	0.10***	9.82	0.09 ***	7.56	0.08 ***	7.23	0.10 ***	9.51	0.08 ***	7.54	0.08 ***	7.22
Micropolitan Area	0.07 ***	6.77	0.07 ***	6.33	0.08 ***	8.44	0.07 ***	6.82	0.07 ***	6.70	0.08 ***	8.84
n	3,103		3,103		3,103		3,103		3,103		3,103	
Adjusted R^2	0.75		0.82		0.80		0.75		0.83		0.83	

Notes: all state fixed effects have been suppressed in order to conserve space; all models were estimated using White-adjusted standard errors clustered by state; OLS is ordinary least squares; S2SLS is Kelejian and Prucha's (1998) spatial two-stage least squares estimator; all hypothesis tests are two-tailed; *** denotes significant at $p < 0.01$; ** denotes significant at $p < 0.05$; * denotes significant at $p < 0.10$; n/s denotes not significant.

Table 7. S2SLS Estimates of the Income Capitalization Model with Amenities

	S2SLS — Basic Amenity Model						S2SLS — Spatial Expansion Model					
	1980		1990		2000		1980		1990		2000	
	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value	Estimated parameter	t-value
Constant	–3.56 ***	–8.52	–5.23 ***	–15.73	–5.06 ***	–14.87	–4.56 ***	–9.54	–6.58 ***	–15.34	–5.10 ***	–10.72
ln Spatial Lag	0.09 ***	3.50	0.18 ***	8.89	0.16 ***	7.21	–0.01 n/s	–0.37	0.10 ***	3.38	0.14 ***	5.35
ln Median Household Income	0.85 ***	30.41	0.90 ***	33.08	1.02 ***	30.46	0.88 ***	29.98	0.92 ***	31.81	1.04 ***	30.49
ln Natural Amenity Index	0.20 ***	8.04	0.31 ***	12.27	0.38 ***	13.76	0.14 ***	4.22	0.23 ***	7.10	0.26 ***	7.69
ln Spatial Lag of Natural Amenity Index	-	-	-	-	-	-	0.15 ***	3.02	0.20 ***	4.23	0.27 ***	5.02
ln Human Amenity Index	1.35 ***	11.13	1.32 ***	15.35	0.89 ***	9.06	1.18 ***	11.42	1.28 ***	15.08	0.90 ***	9.18
ln Spatial Lag of Human Amenity Index	-	-	-	-	-	-	0.71 ***	3.68	0.59 ***	3.54	–0.13 n/s	–0.76
Metropolitan Area	0.06 ***	5.86	0.04 ***	4.42	0.05 ***	5.35	0.06 ***	6.39	0.043 ***	4.36	0.05 ***	5.15
Micropolitan Area	0.05 ***	5.55	0.05 ***	5.34	0.07 ***	8.25	0.06 ***	6.03	0.05 ***	5.55	0.07 ***	8.22
n	3,103		3,103		3,103		31,03		3,103		3103	
Adjusted R^2	0.80		0.87		0.85		0.80		0.87		0.85	

Table 8. OLS Estimates of the Income Capitalization Model with Amenities

	Case-Shiller Housing Price Index			
	ln CV		Ln Change, Jan. 2000 – Oct. 2008	
	Estimated parameter	t-value	Estimated parameter	t-value
Constant	–6.28 $^{n/s}$	–0.72	–2.88 $^{n/s}$	–0.72
ln Natural Amenity Index	0.43$^{n/s}$	0.95	0.93 $^{n/s}$	0.95
ln Human Amenity Index	1.91 ***	2.03	1.42 ***	2.03
n	20		20	
Adjusted R^2		0.29		0.12

Notes: both models were estimated using ordinary least squares (OLS); all hypothesis tests are two-tailed; *** denotes significant at $p < 0.01$; ** denotes significant at $p < 0.05$; * denotes significant at $p < 0.10$; $^{n/s}$ denotes not significant.

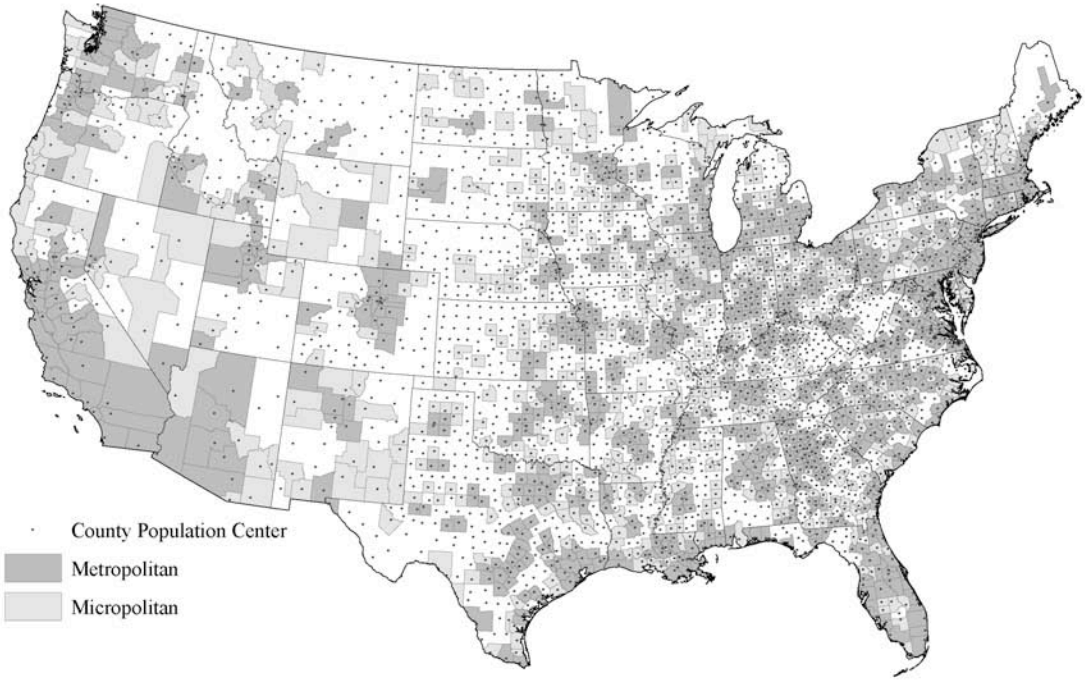
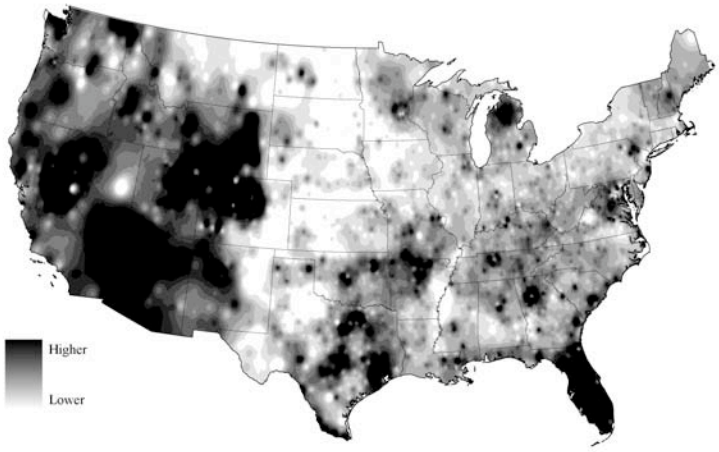
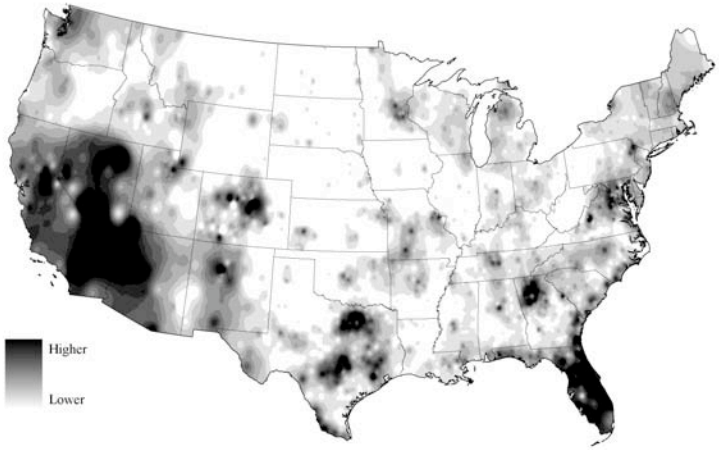


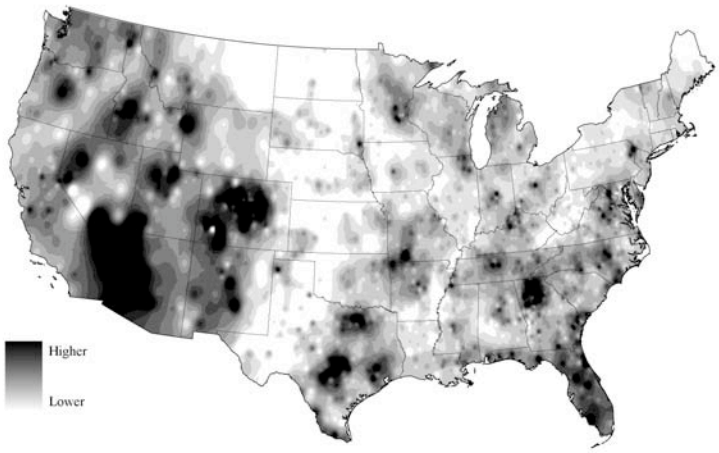
Figure 1. United States Population Centers and Core Based Statistical Areas (CBSAs)



(a)

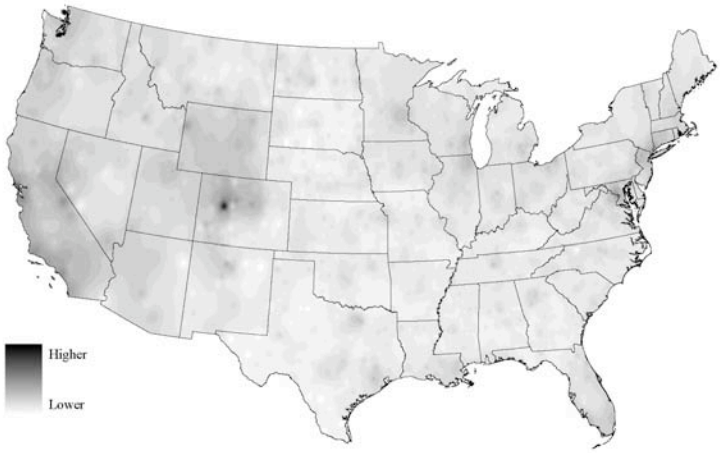


(b)

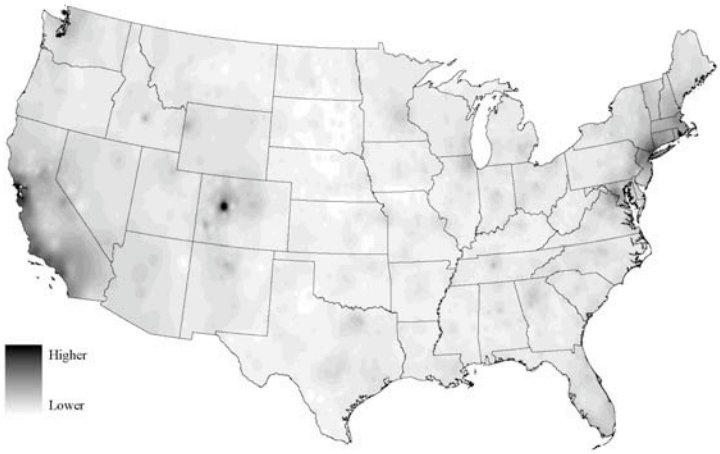


(c)

Figure 2. Rate of Population Change in (a) 1980, (b) 1990, and (c) 2000



(a)



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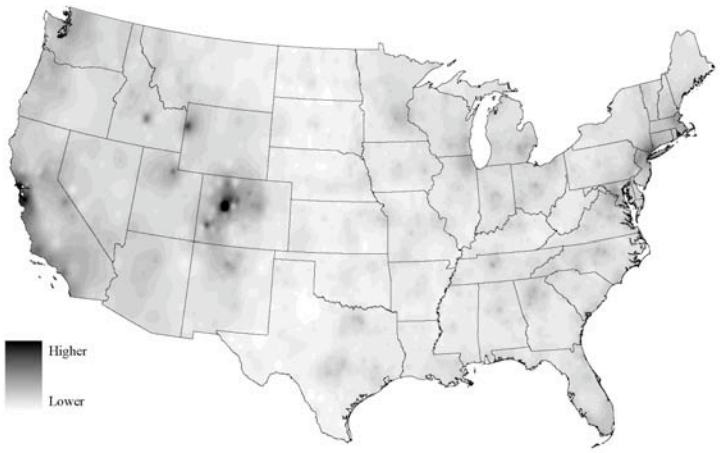
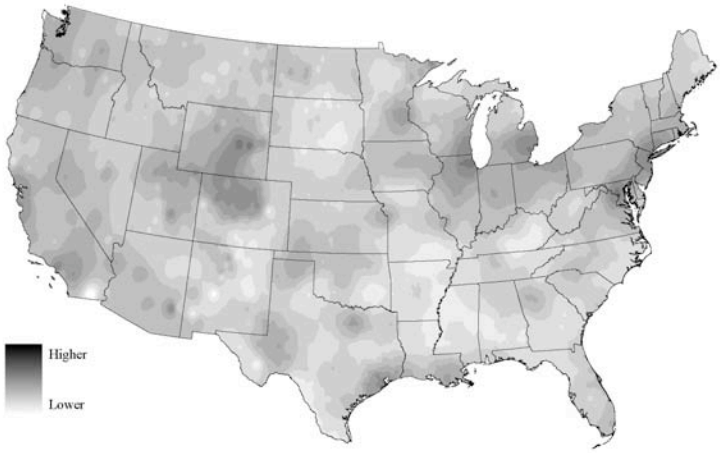
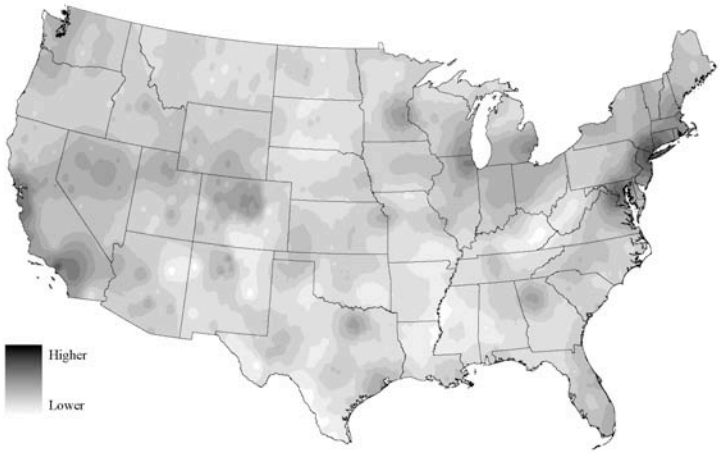


(c)

Figure 3. Median Housing Value ($ 2005) in (a) 1980, (b) 1990, and (c) 2000



(a)



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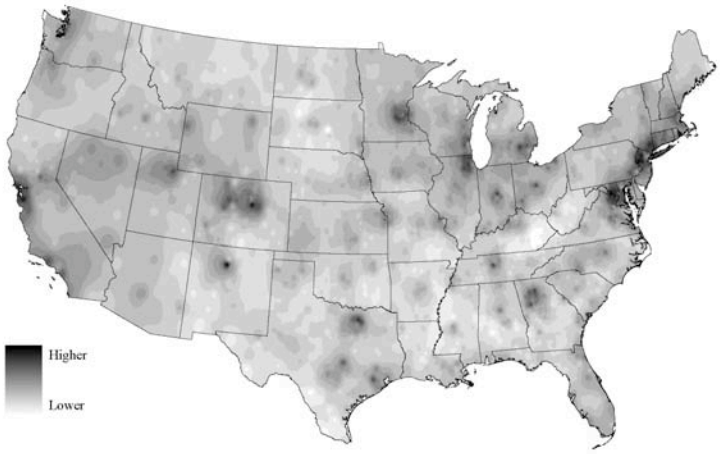


(c)

Figure 4. Median Household Income ($ 2005) in (a) 1980, (b) 1990, and (c) 2000

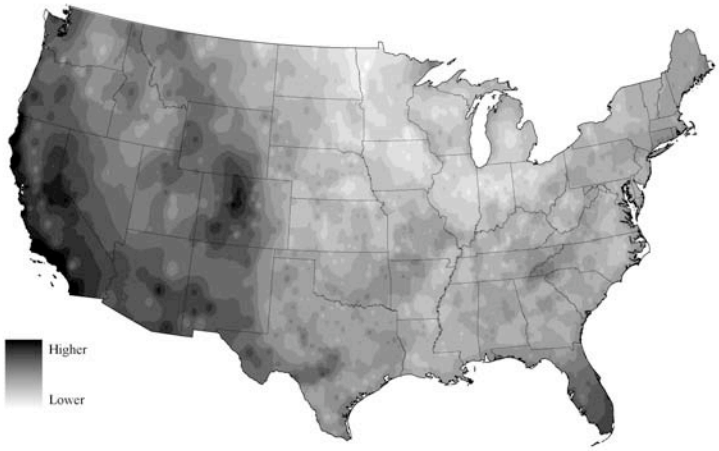
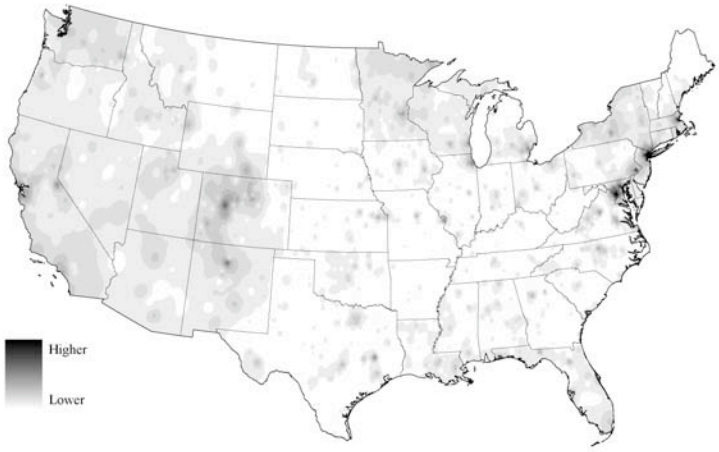
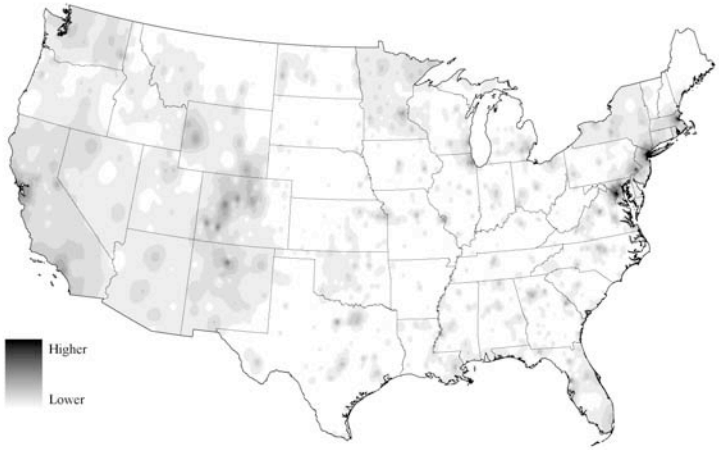


Figure 5. Value of Natural Amenity Index



(a)



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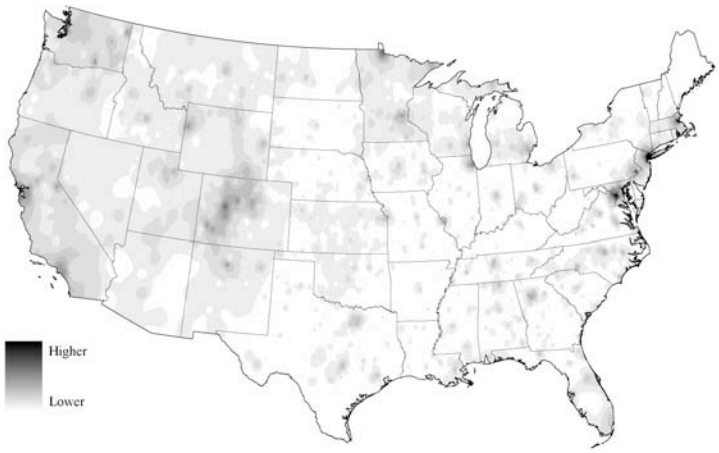
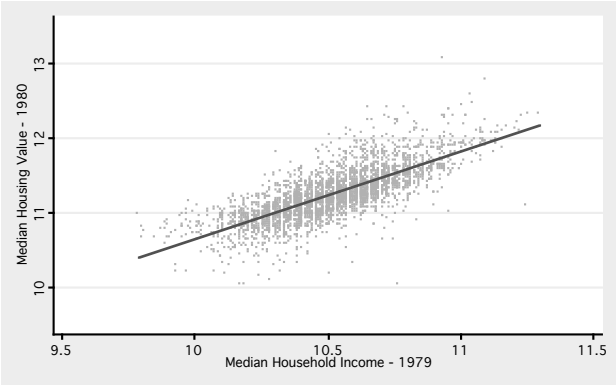
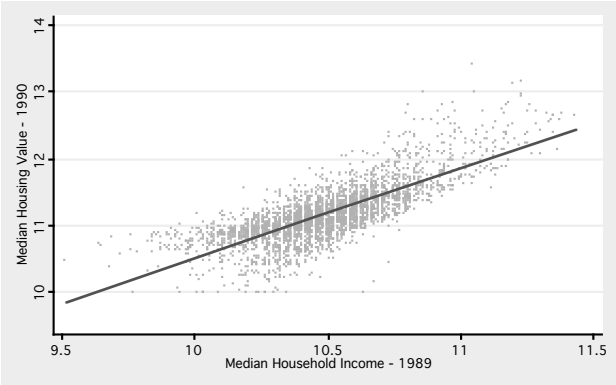


(c)

Figure 6. Value of Human Amenity Index in (a) 1980, (b) 1990, and (c) 2000



(a)



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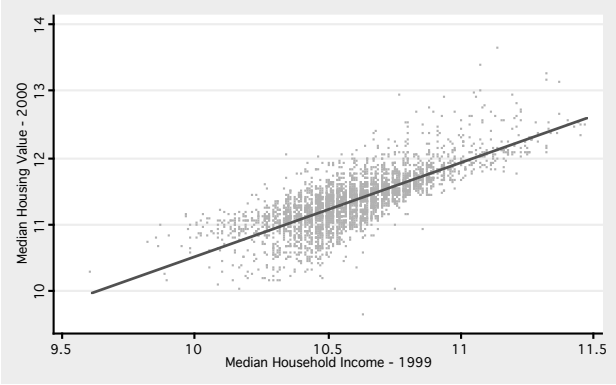
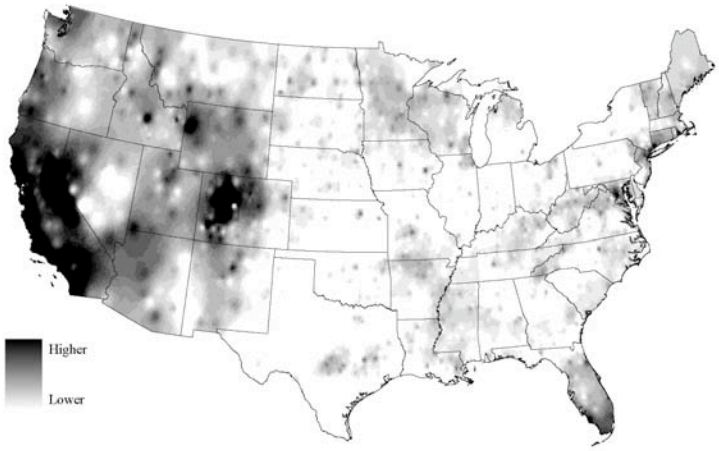
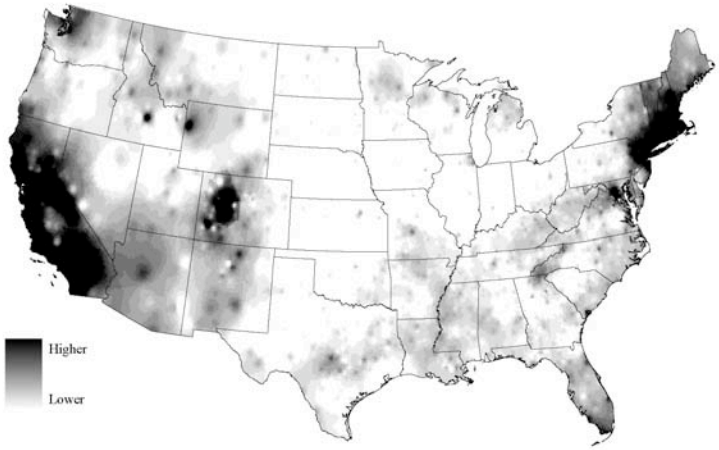


(c)

Figure 7. Natural Logarithm of Median Household Income Versus Natural Logarithm of Median Housing Value in (a) 1980, (b) 1990, and (c) 2000



(a)



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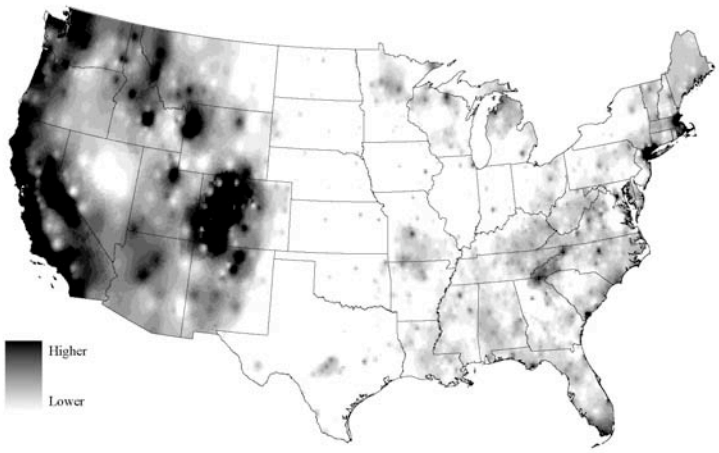
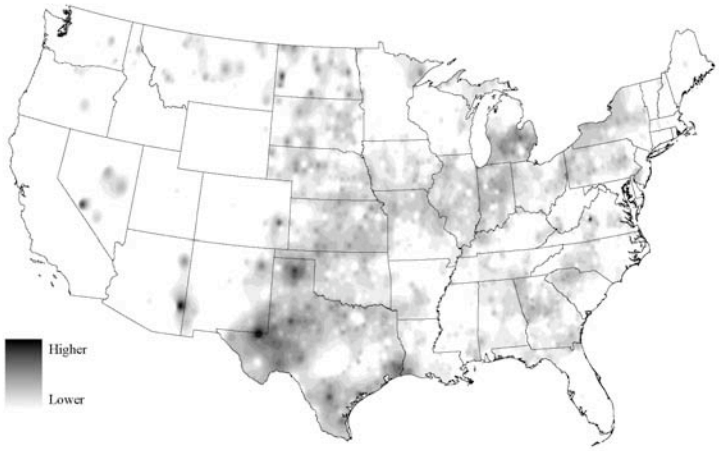
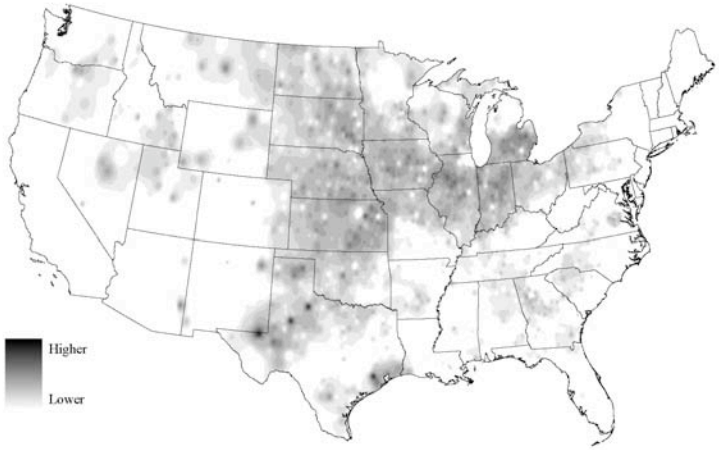


(c)

Figure 8. Estimated Amenity Values ($ 2005) in (a) 1980, (b) 1990, and (c) 2000



(a)



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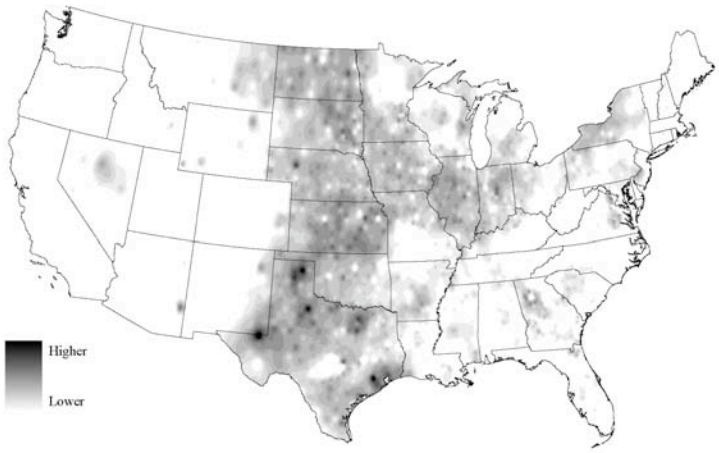
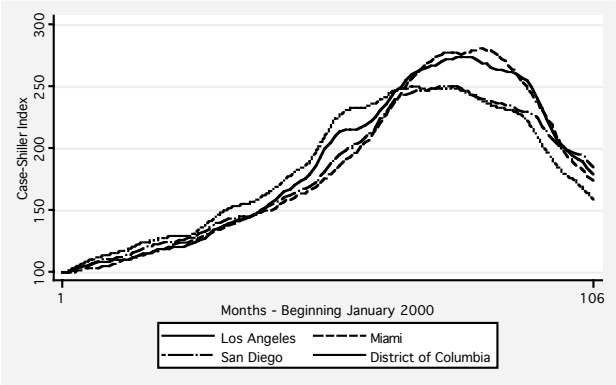
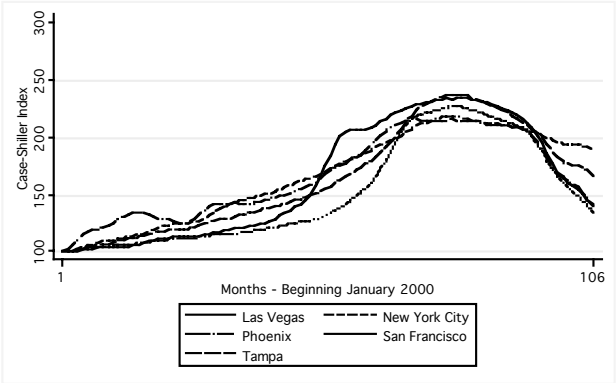


(c)

Figure 9. Estimated Disamenity Values ($ 2005) in (a) 1980, (b) 1990, and (c) 2000



(a)



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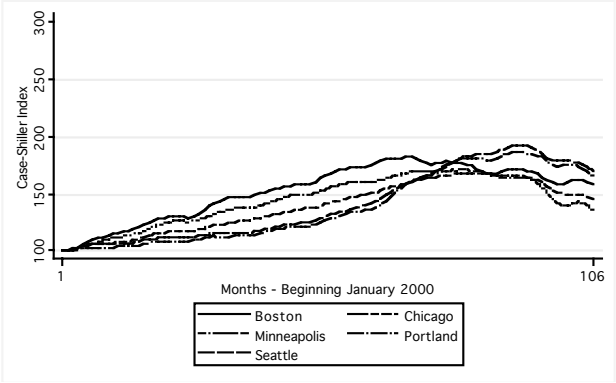
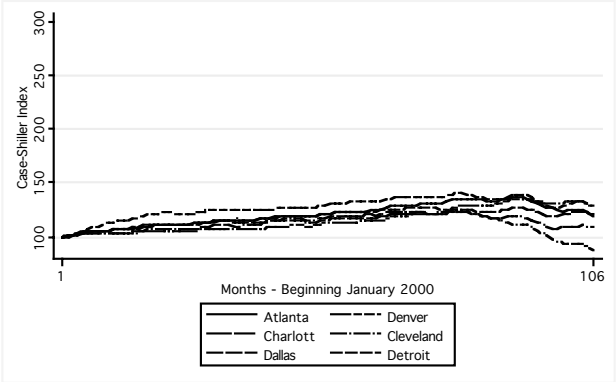


(c)



(d)

Figure 10. Case-Shiller Housing Price Indices for Groups *i* (a), *ii* (b) *iii* (c) and *iv* (d)