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# Green pastures: Do US real estate prices respond to population health?

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ABSTRACT

We investigate whether communities with improving population health will subsequently experience rising real estate prices. Home price indices (HPIs) for 371 MSAs from 1990 to 2010 are regressed against life-expectancy five years prior. HPIs come from the Federal Housing Finance Agency. Life expectancy estimates come from the Institute of Health Metrics. Our analysis uses random and fixed effect models with a comprehensive set of controls. Life expectancy predicted increases in the HPI controlling for potential confounders. We found that, this effect varied spatially. Communities that invest their revenue from property taxes in public health infrastructure could benefit from a virtuous cycle of better health leading to higher property values. Communities that do not invest in health could enter vicious cycles and this could widen geospatial health and wealth disparities.

## 1. Introduction

The link between community prosperity and longevity is well established (Chetty et al., 2016). There are few studies, however, that assess whether improvements in community health raise housing prices by increasing buyers' competition for a chance to live in healthier neighborhoods. We review the dynamics that shape community resources and health by combining the main tenets of the socio-ecological framework with that of the New School of Urban Sociology. Hedonic pricing theory provides us the conceptual umbrella and methodological approach to do so. There are many facets that make a location attractive to home buyers. We test whether the factors that attract people to bid up real estate values might also coincide with factors that make populations healthy.

The socio-ecological framework has been widely used in medical sociology and posits that, in addition to individual socioeconomic factors, the broader contexts in which our lives unfold affect our health and longevity (Stokols and Daniel, 1992). The community physical and social environment are such contexts that shape exposure to risks and access to health furthering resources (Glass and McAtee, 2006; Phelan et al., 2010; Stokols and Daniel, 1992). Studies have shown that for example, neighborhood income, wealth, home ownership and crime all had an effect on a wide range of health outcomes including longevity (Ashe et al., 2003; Kaplan and Geling, 1998; Kawachi et al., 1999; LaVeist and Wallace, 2000; Murray et al., 2006; Pereira et al., 2013).

While social ecology provides a theoretical framework that explains the spatial variation in health with spatial variation in community socioeconomic resources, a part of urban sociological theory focuses on explaining how spatial variation in community resources and features are created by the dynamics that unfold between urban dwellers with different socioeconomic resources (Logan and Molotch, 2007). The Chicago School of urban ecology, the earliest theory of urban sociology, proposes that residents compete for urban space and amenities much like species compete within an ecological system (Park et al., 1984). While the Chicago School sees competition as a way to assure optimal allocation of resources across the urban landscape, the New School of Urban Sociology highlights that competition is regulated mainly by real estate prices and thus leads to the exclusion of non-solvable demand and unequal access to urban amenities and investments into community development over time (Gottdiener and Hutchison, 2011; Logan and Molotch, 2007).

We use hedonic pricing theory as an umbrella to integrate both the medical and urban sociological schools of thoughts. Factors that affect health, such as crime, walkability, healthy food access, alcohol and tobacco outlets and social capital (Kaplan and Geling, 1998; Kawachi et al., 1999; LaVeist and Wallace, 2000; Pereira et al., 2013) can be observed by home buyers and can attract or repel them based on the degree to which buyers perceive their attractiveness. We do not suppose that home buyers commonly consult epidemiological data on health in their home purchasing choices. Rather, we ask whether places with features that further population health attract higher bids for property. Hedonic pricing theory provides an econometric approach for

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assessing residents' competition for community resources (Harrison and Rubinfeld, 1978; Rosen, 1974). Sherwin Rosen advanced hedonic pricing theory and suggested that "goods are valued for their utility-bearing attributes" (Rosen, 1974, p.34) even in the absence of a market for some of these attributes (Hite et al., 2001). Accordingly, home buyers who bid on property are attracted to various amenities of the property and its environment, creating spatial differences in prices of otherwise identical goods (Rosen, 1974). We hypothesize that a residential property and the neighborhood it is located in present an unspecified set of visible markers that buyers find valuable. Since safety and health are universally valued, we hypothesize that home prices reflect health furthering amenities and population health.

We assume that the effect of observable and desirable health promoting features of communities can be proxied by community level life expectancy. We use a hedonic pricing model to gauge the urban ecologic premise that home buyers compete for access to health promoting communities. We hypothesize that increases in community life expectancy lead to subsequent increases in real estate prices. Housing prices influence the tax base of a community and the community's potential for future spending on amenities and health. A health-housing price link would have significant socioeconomic and public health implications by allowing communities to improve property values and tax revenue by public spending on public health and health promoting infrastructure. This could create a virtuous cycle of improvements of community fiscal solvency, public health spending, and better population health. However, this mechanism would tend to exacerbate health and wealth disparities between "have" and "have-not" communities. On a global scale, the last 200 years have shown divergence between countries in GDP and life expectancy based on mutually reinforcing links between population health and wealth (Riley, 2001). This analysis will explore whether a similar phenomenon could be leading to divergence in health and wealth across place on a sub-national scale.

We also hypothesize that there could be spatial variation in the strength of the population health housing price relationship across the country. Buyers in some markets might be imperfectly appreciative of how healthy and safe a location is or, they may have their home purchasing decisions influenced by cultural/ethnic preferences or practical issues such as commuting time. These factors might impede the ability of buyers to bid up the prices of the most health promoting communities and, depending on the spatial distribution of such exogenous factors, weaken the health-housing price relationship locally.

Income levels of the municipal government as well as the average home buyer are important confounders in a relationship between population health and housing prices. People with higher incomes have better health and they are also able to pay higher prices for real estate. Simply including measures of population income would be insufficient to fully control for unobservable aspects of affluence that might not be captured by median income or government expenditure in an area. Therefore, we use fixed and random effects models of panel data for the US between 1990 and 2010. Data availability forces us to assess the health-HPI relationship at the MSA level. We grant that there can be substantial variability in property values in small area geographies like census tracts and counties. However, it would be extremely challenging to measure the health-producing properties of a very small geography or a single residence prior to sale. Therefore, we are forced to use HPIs and small area health measures like life expectancy to measure the average healthiness and housing values of an MSA even though the MSA will encompass disparities in both health and property values. We discuss strength and limitations of our approach in detail in the discussion.

We also control for potential confounding factors such as the racial and ethnic composition of the community, the prevalence of college completion, unemployment, changes in the occupation of the local workforce, and domestic, and international net migration. Racial and ethnic discrimination has been a feature of US real estate markets and is also correlated with population health. College completion similarly affects real estate buyers' preferences as well as affecting health and health behaviors. Unemployment and the occupational composition of the work force can affect both the demand for housing and life expectancy.

We focus on the urban real estate market using publicly available data on housing prices at the level of Metropolitan Statistical Areas (MSA) from the Federal Housing Finance Agency (2016). This choice deliberately leaves out data from rural areas where transactions are less frequent, and measures of both area-specific real estate prices and life expectancy are less precise.

**Table 1**
Descriptive statistics of dependent and independent variables for 1990 and 2010 (first and last year of main analysis).

| | 1990 | | 2010 | |
|---|---|---|---|---|
| | **Mean/ Percentage** | **SD** | **Mean/ Percentage** | **SD** |
| Housing Price Index (HPI) | 86.270 | 11.724 | 170.578 | 23.539 |
| Life Expectancy | 75.238 | 1.443 | 77.933 | 1.785 |
| Race/Ethnic Diversity HHI[a] | 45.897 | 9.233 | 41.453 | 9.799 |
| Percent in poverty | 9.898 | 5.501 | 9.9714 | 4.848 |
| Log Income | 10.964 | 0.161 | 11.041 | 0.160 |
| Percent Unemployed | 6.444 | 2.000 | 9.445 | 2.858 |
| Percent with at least Bachelors | 18.530 | 6.196 | 24.595 | 7.501 |
| Percent African-American | 9.444 | 10.206 | 10.297 | 10.698 |
| Percent Other Races | 2.716 | 5.056 | 7.162 | 6.139 |
| Percent Hispanic | 6.375 | 12.461 | 11.975 | 15.267 |
| Population (10k) | 37.258 | 51.082 | 48.619 | 71.632 |
| Percent population living in urban areas | 68.546 | 16.239 | 78.665 | 13.453 |
| Percent living in own homes | 66.304 | 5.974 | 66.705 | 5.575 |
| *Occupation (percent of workforce)* | | | | |
| Service Occupations | 14.133 | 2.092 | 13.105 | 1.672 |
| Manual Occupations | 15.913 | 4.462 | 13.696 | 2.921 |
| Agriculture Occupations | 3.031 | 2.347 | 2.553 | 1.412 |
| Other Occupations | 66.923 | 4.794 | 70.645 | 3.276 |
| *Net Migration (10k)* | | | | |
| International Net Migration | 0.118 | 0.386 | 0.600 | 1.594 |
| Domestic Net Migration | 0.643 | 3.754 | 0.240 | 1.977 |

[a] HHI stands for Herfindahl-Hirschman Index of diversity of MSA population of whites, non-Hispanic African American, and Hispanics.

## 2. Data

Real estate price indices for this study come from the Federal Housing Finance Agency (FHFA) which provides quarterly housing price indices (HPI) based on all housing transactions for all Metropolitan Statistical Areas (MSAs) from 1975 to 2015. An MSA is an area that consists of an urban core with a population of at least 50,000 and includes adjacent counties that are economically and socially integrated with the urban core (U.S. Census Bureau, 2016; US Census Bureau (n.d.)). MSAs change over time. The FHA recalculates HPIs retrospectively using the latest MSA definitions. Quarterly HPIs that were last updated in 2015 were aggregated into yearly measures.

The FHA HPI is based on all repeat transactions of single and attached single family homes including re-sales and appraisals of properties whose mortgages have been acquired or securitized by