

A Spatial Analysis of Housing and Vehicle Affordability in Los Angeles

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Urban spatial structure and affordability

Transportation and housing expenditures vary by neighborhood (1). Lower income households—particularly those without automobiles—are more likely to live in dense urban neighborhoods in close proximity to public transit (2). In these central-city neighborhoods housing costs per square foot tend to be high and transportation costs low.

Cheaper housing (per square foot) is located farther from jobs and other key destinations. Low housing costs tempt families to move to the suburbs, even though moving would likely increase travel costs. Data suggest that many low-income families have made this choice. As of 2005, there were more poor people living in the suburbs of the largest U.S. metropolitan areas than in the cities; and by 2008, the suburban poor was the largest and fastest growing poverty population (3).

This work maps how much people drive and how much they pay for both housing and vehicle transportation in Los Angeles County. We explore whether these patterns appear to represent tradeoffs between driving and housing costs, and what they mean for the housing *and* driving expenditure burdens faced by different groups of people in LA.

A housing and vehicle cost database for LA

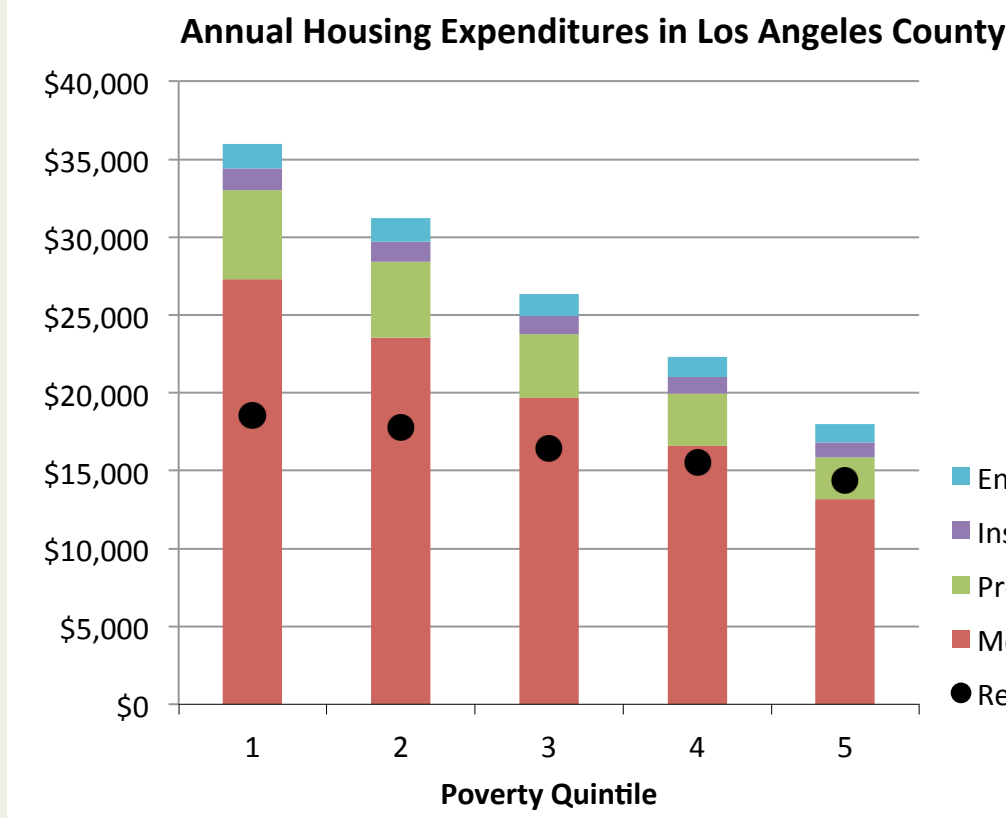
This work uses data at the parcel and census block group levels to directly estimate the each cost component for housing and vehicle transportation. Statistical estimation is used to fill in missing values using multiple imputation. Beyond this, costs are estimated using raw data and simple arithmetic, added together for each household, and then averaged by census tract.

Key data sources that enabled parcel-level estimation were the Los Angeles County assessor records, detailed vehicle registration data (Vehicle Identification Number (VIN) and registration address), and Smog Check inspection records (VIN and odometer readings). The VIN itself tells us the make, model, and model year of each vehicle, which we used to estimate the fixed costs of vehicle ownership. Odometer readings allow us to estimate the annual vehicle miles traveled (VMT) for each vehicle. Using the VIN, we linked these data with each vehicle's registration address. The registration addresses allowed us both to infer which vehicles belonged to the same household, and to link these vehicles at the parcel level with assessor-based owner-occupied housing cost estimates. For renter-occupied housing, vehicle costs were linked to the census median rent for the appropriate block group.

All of the vehicle cost estimates reported here use 2009 as a reference year. Owner-occupied housing costs are based on 2008 data. Renter-occupied housing costs are based on the 2005-2009 5-year average from the American Community Survey.

Main Variables of Interest	Source
Automobiles	California DMV Administrative Records
Vehicle Miles Traveled (VMT)	Estimates based on odometer readings recorded by the California Bureau of Automotive Repair and the California Department of Motor Vehicles (DMV)
Fuel Efficiency	U.S. EPA Fuel Economy Database
Fuel Prices	Energy Information Administration, U.S. DOE
Vehicle Maintenance Costs	American Automobile Association
Vehicle Insurance Costs	www.carinsurance.com
Vehicle Depreciation	Kelley Blue Book-based vehicle depreciation schedules
Vehicle Purchase Finance Costs	Consumer Expenditure Survey
Homeowner Housing Cost	LA County Assessor, Freddie Mac, (4)
Renter Housing Cost	2005-2009 American Community Survey
Poverty Quintiles	2005-2009 American Community Survey

Housing cost components

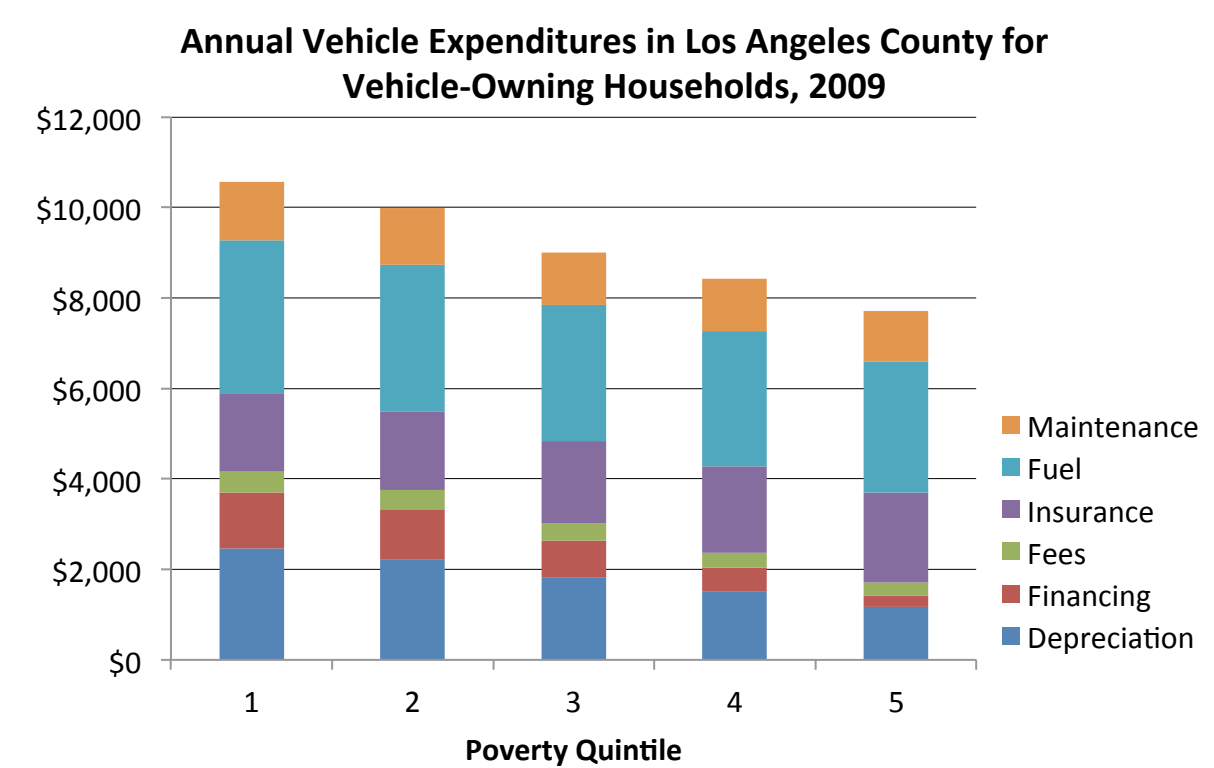


The chart at left illustrates the breakdown of our estimates of housing costs for homeowners with a mortgage, and includes dots that indicate census-based cost estimates for renters. Three points emerge:

- 1) Housing costs for homeowners are more correlated to poverty quintile than are vehicle ownership costs.
- 2) The majority of the cost is the mortgage itself – homeowners without a mortgage clearly have much lower housing costs.
- 3) Rental housing costs vary much less than do homeowner costs in Los Angeles.

Vehicle cost components

This chart illustrates the breakdown of our estimates of vehicle ownership and use costs for households that own vehicles. Fuel costs are the largest component, and represent a much larger percentage of the total cost for households in higher poverty areas than for those in lower poverty areas.



Expenditure burden

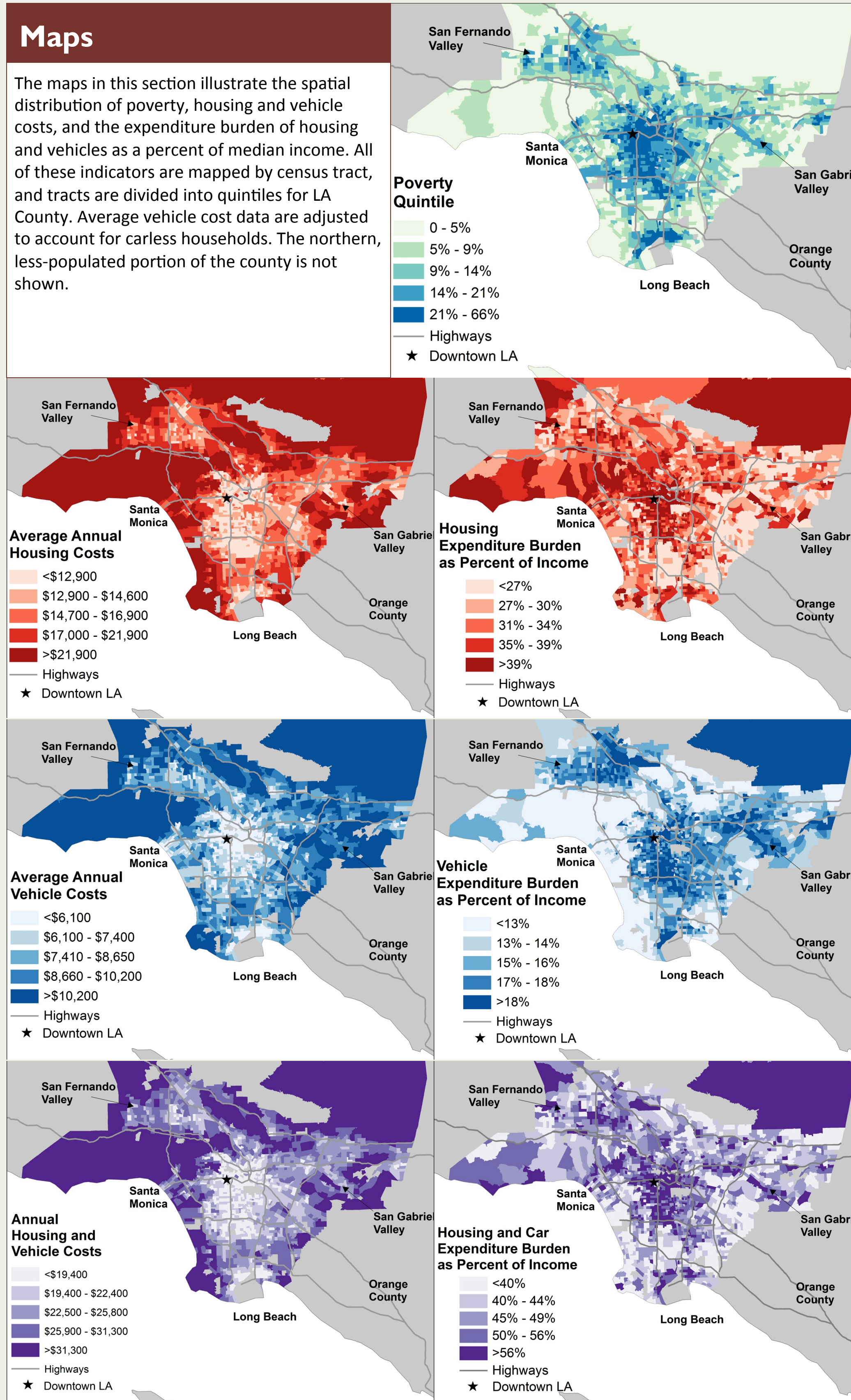
We find that absolute transportation and housing costs are *lowest* in the poorest neighborhoods in Los Angeles, but the burden of these costs measured as a percent of household income is *highest* in these same neighborhoods. The table below provides an overview of this burden by census tract poverty quintile. Average vehicle cost data are adjusted to account for carless households.

By our calculations, tracts with the highest percentage of households living in poverty spend an average of more than 60 percent of their incomes on housing and vehicle transportation, while households living in the least poverty-stricken tracts spend an average of 40 percent of their incomes on these needs. This is true despite the fact that the households in the lowest poverty areas spend more than double the amount on housing and vehicle transportation compared with households in the highest poverty areas.

Poverty Quintiles	All Housing		Vehicle Transport		Transport + Housing	
	Cost	Cost Burden	Cost	Cost Burden	Cost	Cost Burden
1 (< 5.1%)	28%	\$27,917	12%	\$10,767	40%	\$38,567
2 (5.1-9.2%)	30%	\$21,334	13%	\$9,118	43%	\$30,457
3 (9.2-15%)	31%	\$18,050	15%	\$8,114	46%	\$26,190
4 (15-23%)	35%	\$14,461	17%	\$6,922	51%	\$21,397
5 (24%+)	42%	\$12,386	19%	\$5,622	60%	\$18,156
All	33%	\$19,040	15%	\$8,229	47%	\$27,331

Maps

The maps in this section illustrate the spatial distribution of poverty, housing and vehicle costs, and the expenditure burden of housing and vehicles as a percent of median income. All of these indicators are mapped by census tract, and tracts are divided into quintiles for LA County. Average vehicle cost data are adjusted to account for carless households. The northern, less-populated portion of the county is not shown.



Comparison to Location Affordability Index

The analysis we have done is similar to that completed by the Center for Neighborhood Technology in their H+T Index work (5), as well as to the related Location Affordability Index (6). Both these indices and our results of this project are estimates of the cost of both transportation and housing at a fine geographic scale. The data sources are only partly overlapping, however, and the methodologies are separate. We directly estimated the components of cost and added them up, whereas the LAI uses a regression formula to estimate costs.

The table below provides a direct comparison. The total average cost estimates are close, but some of the underlying components of those estimates on the vehicle side diverge. The most dramatic of these are the household VMT estimates. Our work using odometer readings from Los Angeles resulted in much higher average household VMT estimates – after adjusting for carless households – than the LAI estimation formula produced. The total vehicle cost estimates are similar because the LAI estimates of vehicle depreciation are much higher than ours.

NOTE ON THE LOCATION AFFORDABILITY INDEX WEB MAPS: In the LAI maps, the estimated costs in each tract are divided by the median income for the entire region, and therefore provide an indicator of affordability of the area *for a household that earns the regional median income*. Our maps at left indicate the affordability of an area *for the people who live there*.

	Our estimates (2009)	Estimates based on the Location Affordability Index cost formula (2010)
Housing + car transportation cost	\$27,331	\$28,391
Housing cost	\$19,100	\$19,567
Car transportation cost	\$8,230	\$8,824
Autos per household	1.77	1.77
Variable vehicle costs		
Household VMT	20,113	15,349
Average fuel economy	19.6	20.7
Gas price assumed	\$2.69	\$2.69
Maintenance/Fuel cost ratio	0.39	0.42
Total	\$3,849	\$2,615
Fixed vehicle costs		
Per vehicle depreciation	\$1,045	\$2,576
Per vehicle finance charges	\$415	\$163
Per vehicle other fixed costs (reg fees, ins.)	\$1,417	\$745
Total	\$4,381	\$6,200

Works cited

- (1) Alonso, William. *Location and Land Use: Toward a General Theory of Land Rent*. Harvard University Press Cambridge, MA, 1964.
- (2) Glaeser, Edward L., Matthew Kahn, and Jordan Rappaport. Why do the poor live in cities? The role of public transportation. *Journal of Urban Economics*, 63(1), 2008, pp. 1–24.
- (3) Kneebone, Elizabeth and Emily Garr. *The Suburbanization of Poverty: Trends in Metropolitan America, 2000 to 2008*. Metropolitan Policy Program, The Brookings Institution, Washington, DC, 2010.
- (4) Circella, Giovanni, Robert Johnston, Andrew Holguin, Eric Lehmer, Yang Wang, and Michael McCoy. *Updating the PECAS Modeling Framework to Include Energy Use Data for Buildings*. ITS-Davis Research Report – UCD-ITS-RR-13-04, 2013.
- (5) Center for Neighborhood Technology (2012). H+T Affordability Index Methods. Available at <http://htaindex.cnt.org/downloads/HTMethods.2011.pdf>. Accessed 11/2014.
- (6) U.S. Departments of Housing and Urban Development and Transportation (2013). Data and Methodology: Location Affordability Index and My Transportation Cost Calculator. Housing and Transportation Affordability Initiative. <http://locationaffordability.info/LAPMethods.pdf>