Housing & Transportation Cost Trade-offs and Burdens of Working Households in 28 Metros

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Abstract

This study examines neighborhood housing and transportation choices available to working households in 28 U.S. metropolitan areas. The purpose is to determine how constraints within the neighborhood and the region—e.g., lack of access to transportation choices, distance from job centers, shortages of affordable housing—affect household costs and how high-cost burdens impact the household, their neighborhoods and the region. Specifically, we examine the relationship between metro areas with the highest housing and transportation costs in relation to working family incomes and whether the highest cost regions for working households tend to be those with the greatest shortages of affordable housing and/or the worse congestion and/or the longest commutes. The results indicate that a number of factors cause high housing and transportation costs, and it is the regions where there are either a few factors at the extreme high end of costs or a number of factors at the medium level—both add up to total high costs for working families. All findings suggest the need for policies that address affordable housing location in concert with: affordable transportation, the location and creation of jobs—particularly in areas with concentrations of working families and existing infrastructure, e.g. inner-ring suburbs and central cities; and mixed-use, well-designed neighborhoods where residents can walk to fulfill some of their daily needs.

Acknowledgements

The National Housing Conference's Center for Housing Policy commissioned this paper with generous support from the MacArthur Foundation. We thank them for their support and guidance in shaping this paper and its important results. Barbara Lipman, the Research Director of the Center for Housing Policy, provided critical feedback through multiple drafts. Kathy Nelson and the other Advisory Committee members also provided important comments. Scott Bernstein has been committed to uncovering the factors that contribute to the total cost of living for working households for many years and provided vision and input on the paper and policy recommendations. Robert Lang, Ph.D., and Arthur C. Nelson, Ph.D. gave feedback throughout the study. Kara Heffernan edited several drafts and by assisting with the clarification of key findings and messages helped to shape the report. Zoe Heller created countless maps and assisted with data collection and analysis. Mingxuan Wang was instrumental in gathering and cleaning the bus system data for each of the regions in the study and in the development of the transportation cost model. Rachel Scheu and Shoshana Cohen provided additional assistance with data collection and summarization.

Report Contents

This report is organized into six sections with three appendices. The main text of the report explains the approach, data, findings, and recommendations. Three appendices provide: supporting and background tables (Appendix A), separate profiles for each of the 28 metro areas (Appendix B), and a detailed explanation of the methods used in the study (Appendix C).

1. Introduction: A brief overview of the background and purpose of the study.

2. Approach & Methods: A brief summary of the methodology for estimating the incomes, housing costs, transportation costs, employment centers, job accessibility, and commuting characteristics used to study each of 29,607 neighborhoods (census tracts) in the 28 metro regions. This section is meant to aid the reader in understanding the data and terminology used in the study, but it is not an exhaustive explanation. More detailed methods are in Appendix C.

3. What are households paying to live in their neighborhood: Housing and Transportation Expenditures by Income and Place: A descriptive overview of the study's classification of metro areas according to their average household housing and transportation costs. The classification is based on the number and size of neighborhoods of each neighborhood type, in which the neighborhood type is based on the average housing and transportation expenditures of the (weighted) average income household in the neighborhood. The housing and transportation burden is summarized for all households in each region by six income categories (ranging from less than $20,000 annually to $250,000 annually) for each neighborhood type within the region.

4. What determines the burden? This section contains three parts: the association between housing and transportation costs and the conditions contributing to these costs, such as concentrations of affordable units and job accessibility; the impact on households and regions from commuting and congestion; and the trends in six to eight metro areas from 1990 to 2000 by Housing + Transportation Neighborhood Type.

5. Everyone Pays: Impacts on Households, Neighborhoods and Regions from high costs to working households

6. Summary of Findings

7. Recommendations

Appendix A. Summary and Background Tables: These tables provide additional reference and support for the major findings in the paper, including the 1990 and 2000 Consumer

Expenditure Survey results, the distribution of households by Area Median Income for each region, and other metro rankings of measures used or created in this study.

Appendix B. Metro Area Profiles: A 4-page profile for each of the 28 metros in the study including: a characterization of the region by housing and transportation costs and choices; a map of the region by neighborhood housing/transportation cost type with the location of the major employment centers (job clusters of 5,000 or more jobs in contiguous census tracts above seven jobs per acre); the distribution of households by income for each neighborhood type; the results of the regression analysis on the association between housing and transportation costs and neighborhood and region conditions; and a description of the commuting characteristics by neighborhood type. An additional set of maps of congestion and traffic levels in comparison to the housing/transportation expenditure patterns is also included for nine of the 28 regions.

Appendix C. **Technical Appendix:** A detailed explanation for the major data elements used in the study, including the household income distribution by neighborhood, the percentage of income spent on housing and transportation, the model used to predict total household transportation costs, the methods to define job density/accessibility, the location and size of regional employment centers, and the commute time, distance, and speed for workers by census tract.

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1. Introduction

Affordable and good quality housing for working families is increasingly becoming scarce throughout the nation. Many working families are spending more than one-half of their budgets for housing alone. While housing is often the largest household expense, it is but one of the many significant expenses facing working families. Transportation is a close second for most households in the U.S. and it is an even higher or equal percentage of income for lower income households. As gasoline prices and interest rates rise and regions expand further out into undeveloped areas away from established communities and job centers, housing and transportation costs are only getting higher. Rising costs and households in financially difficult situations also impact neighborhoods, regions, and communities. Sprawling development causes higher infrastructure costs for cities, congestion causes greater levels of pollution, and long commutes affect businesses through lost productivity, greater levels of absenteeism and tardiness, and ultimately turnover when a worker leaves in search of a better commute.

A recent study by the Center for Housing Policy, *Something's Gotta Give: Working Families and the Cost of Housing*, using the microsample from the Bureau of Labor Statistics Consumer Expenditure Survey (CES), documented the excessive housing and transportation cost burdens on working households[1]. The study found that 44.3% of all working families spend more than half their total expenditures on just these two costs. The Surface Transportation Policy Project and Center for Neighborhood Technology have also reported on these two combined costs in the three *Driven to Spend* reports since 2000. Based on the 2003 CES, the 2005 *Driven to Spend* report showed that the median income households in the 28 areas covered in the study spent $21,213, or 52%, of expenditures on housing and transportation[2].

Yet, there has not been enough analysis of the combined housing and transportation costs for working families at a specific and small unit of geography, e.g. a neighborhood or census tract. The CES expenditures that are reported by *specific income levels* are not available below the four major regions in the U.S. and the expenditures at the metropolitan level are only available for the *median income* household. This level of information (region and metropolitan) and frequency of the survey (the CES is reported annually based on quarterly surveys), makes the CES a useful source for identifying conditions and trends over time, but without detailed geographic information tied to these costs it does not lend itself to assessing the specific problems or causes in neighborhoods and/or regions that might be associated with household costs—particularly for lower income households.

For instance, in 1990 the combined housing and transportation costs in the CES survey were as low as 37% in Kansas City and as high as 47% in San Francisco, San Diego, Los Angeles, and Miami. By 2000, the range had jumped from to 48% at the low end, St. Louis, to 58% at the high

[1] Center for Housing Policy. "Something's Gotta Give: Working Families and the Cost of Housing". New Century Housing, Volume 5, Issue 2, 2004.
[2] Center for Neighborhood Technology and Surface Transportation Policy Project. "Driven to Spend: Pumping Dollars from our Households and Communities", June 2005, from www.transact.org.

end, San Diego. While some of this variation can be explained by the variation in the cost of living from region to region, it is not completely clear how much the costs vary within a region, particularly by incomes within a region.

Of the two costs—housing and transportation—uncovering the reasons for transportation cost variation is especially challenging. According to the 2000 CES, transportation was 18% of expenditures for households earning $51,298 in Kansas City, but 20% for households earning roughly the same income, $51,292, in Seattle. Was this difference statistically insignificant since these are regional averages, or is the difference in expenditures due to regional price differences in taxes, gasoline, and autos, or to variations in auto use and the necessity to drive more or less in one region or the other? Some critics have suggested it is simply regional differences in preferences for either higher priced or cheaper autos, but there is no support for this.

An additional comparison of similar incomes but different transportation costs for three regions further illustrates the need for more specific information below the metropolitan area. In the 2002-2003 survey, the surveyed households in Miami, Tampa, Phoenix, and Milwaukee earned between $48,411 and $49,794, a difference of $1,383. Tampa had the highest income and Miami had the lowest. But their transportation expenditures ranged from a low of $6,797 in Milwaukee to a high of $8,659 in Phoenix, a difference of $1,862. Yet, the Milwaukee households—those paying the lowest in absolute terms for transportation—had the highest reported vehicle ownership, 2.0 vehicles per household, and Phoenix had the lowest reported average, 1.8 vehicles. Typically, vehicle ownership is the most expensive portion of total transportation costs, yet Milwaukee households own more vehicles and have the lowest total costs. The differences in costs in this case were in the “other vehicle expenses” and “gasoline and motor oil” line items. How much of the difference in these expenses are from prices of gasoline, tires, oil, and insurance, versus higher maintenance costs due to wear and tear and mileage or weather is not clear. Unfortunately, the survey findings do not provide sufficient information to answer these questions. Without answers, it’s difficult to suggest solutions.

Therefore, this study is an attempt to examine these costs at the neighborhood level in thousands of neighborhoods for millions of households, in order to understand how location affects both housing affordability and transportation affordability. The relative affordability of these two costs in lower and moderate income neighborhoods is then compared to physical characteristics of neighborhoods and regions, such as housing unit density, the location of all jobs, the concentration of employment centers, and the concentrations of affordable housing units, in order to identify links between housing costs and shortages, transportation costs, commuting patterns and traffic congestion.

Using 2000 Census data on: household income, housing costs as a percentage of income, worker and job locations (CTPP 2000), and other demographic variables; and a new model that predicts total household transportation costs, we characterize each of 29,607 census tracts (proxies for neighborhoods) in the 28 metropolitan areas surveyed in the CES in terms of incomes, housing and transportation cost burdens, accessibility to jobs, and location within a region.

The 28 metro areas in this study are the same as those in the CES annual survey. They represent 25 of the largest metros in the U.S. and were home to nearly 47.1 million households, or 45% of all U.S. households, in 2000.[3] Of these 47.1 million households, 27% (12.6 million households) earned between 30% and 80% of their respective region's Area Median Income (AMI) in 2000. Relative to a dollar amount, 14.3 million households earned less than $35,000 a year. (See Table A3 in Appendix A).

We find that costs vary by neighborhood and by region and that lower income households most often have a higher cost burden for *both* housing and transportation in all neighborhoods and regions. For all households earning between $20,000 and less than $50,000 in the 28 metro areas, the study found the combined expenditures range from 54% of income in Seattle to 63% of income in Chicago. However, in instances where neighborhoods had local concentrations of affordable housing, households had lower housing *and* transportation costs. This was true in 23 of the 28 regions.

[3] In 2000, there were 105,480,101 households in the U.S. according to the 2000 Census, SF1.

2. Approach and Methods

In order to characterize the impacts of housing and transportation costs on lower and moderate income households and the communities in which they live, we analyze the range of factors determining a household's transportation costs and how they compare and combine with their housing costs according to the location in the region and the characteristics of that location. We do this separately for each of six income classifications based on the income breaks in the Census. These incomes range from less than $20,000 to less than $250,000.

To do this analysis, we first needed measures of income by census tract, including how many households of each income are in a census tract, the percentage of income spent on housing by each income group within a census tract, and the percentage of income spent on transportation by the same income groups within a census tract. To compare these expenditures by income and neighborhood to location characteristics, we developed measures to represent accessibility to all jobs within a region (job accessibility), distance to major employment centers, and workers commute distance, commute time, and commute speed. With this complete set of measures we were able to look for the associations between costs, incomes, and locations. The following briefly outlines the approach and source for each of these measures.

Neighborhood Data

This study uses the following seven key measures:

- Weighted Average Household Income by Census tract in 2000 for the entire tract and for each of six income bins within the tract.
- Housing Costs by Tenure as a percentage of household income in 2000 (H)
- Total Household Transportation Costs as a percentage of household income in 2000 (T)
- Housing + Transportation cost burden (H+T)
- Job Locations, Concentrations and Accessibility to Jobs- three uses of the Census Transportation Planning Package allow us to create three measures that represent: 1) the location of each job in the region; 2) the accessibility to all jobs in the region from each census tract; and 3) employment centers, which we define as relatively dense clusters of 5,000 or more jobs in contiguous tracts of more than 7 jobs per acre
- Worker Commuting Characteristics: the estimated distance and speed and the reported commute time for each worker in each census tract by transportation mode
- Household socioeconomic characteristics such as educational attainment levels, unemployment rates, and household size
- Availability of Affordable housing

Household Income

Using Census 2000 household income breakout for each tract we summed the number of households within the following six annual income ranges:

- Less than $20,000
- $20,000 to less than $35,000
- $35,000 to less than $50,000
- $50,000 to less than $75,000
- $75,000 to less than $100,000
- $100,000 to less than $250,000

We chose these categories because they represent, roughly, quintiles of national household incomes—i.e., each category contains nearly 20 percent of U.S. households. We did not include households above $250,000 since they are less than 3% of the population and the high incomes in this group would have greatly skewed the highest bin. And as the average median household income is approximately $46,000 in these regions, the first three categories roughly match the 30-50, 80, and 100 percent of area median income measures that are often used in qualifying households for affordable housing. This makes these income categories useful for policy makers that use AMI to operate programs based on incomes. While they are not exactly the same as AMI, we used a small range within each bin, $15,000 to $20,000, and several bins, to help make the comparison between these ranges and the percentage of AMI in each region.

However, in order to use the transportation cost model, which is based on a specific income, we could not use a range. Therefore, for each census tract, we used the Census PUMS 5% data from the PUMA[4] that encompasses each tract to determine the weighted average income of households in each income bin. For instance, to determine what actual income to use in the income bin range of "Less than $20,000", we used the PUMS data which provides a count of households at each income level. By querying the PUMS data for households by income restricted to just households earning an income of $0 to $20,000, and to households not living in group quarters, we could identify that the weighted average income in that bin and in that PUMA was actually, $10,385 for all households, $9,837 for renters, and 11,368 for owner households. We did this query for each PUMA and each income bin in each of the 28 metro areas. We then applied the results to each income bin in each tract in the 28 metro areas. While this method is not exact since PUMA's are 100,000 persons or more and census tracts are typically 3,000 persons, the error is contained within each income bin and is only used to obtain a weighted average in place of a range. The other alternative would have been to take a simple average of the $0 to $20,000 range, e.g. $10,000, but this would be even less precise. For a more detailed explanation on this technique see Appendix C. Table 1 lists the weighted average income results by tenure and for all households for the aggregate of the 28 metro areas.

[4] PUMAs are Public Use Micro Sample Areas defined by the Census in order to provide detailed cross-tabulated information on persons and households from the Census long form survey. The 5% Public Use Micro Sample includes data on PUMAs that are 100,000 persons or more.

Table 1

Weighted Average Household Income in each Income Bracket
(5% PUMA for 28 Metros)

Census Income Bin	Weighted Average Renters	Weighted Average Owners	Weighted Average All HHS	Renter HHS	Owner HHS	All HHS	% of HHS
<$20,000	$9,837	$11,368	$10,385	971,172	3,190,910	5,691,595	12%
$20,000 to <35,000	$26,941	$27,516	$27,221	1,144,763	3,956,933	7,080,693	15%
$35,000 to <50,000	$41,506	$42,175	$41,899	2,834,351	4,321,022	7,369,761	16%
$50,000 to <$75,000	$60,211	$61,599	$61,189	3,048,739	4,546,832	8,138,869	17%
$75,000 to <$99,000	$85,138	$86,059	$85,875	4,181,936	6,109,521	8,932,939	19%
$100,000 to <$250,000	$132,773	$138,051	$137,291	5,742,029	6,713,796	9,548,147	20%
Total Households				**17,922,990**	**28,839,014**	**46,762,004**	**100%**
No. of 5% PUMAs				**963**	**941**		

Housing Costs as a Percent of Income

In a similar manner to the household income measure from the census, we developed the average housing cost as a percent of income by tenure for the same six income bins. This allows us to examine the housing cost burden as a function of income for each income as well as the tract by using the weighted average of the housing costs for all households in the tract. Table 2 shows the percentage of income spent on housing by income level in the 28 metro areas using the PUMS 5% data. Table 3 shows the distribution of percent of income on housing by tenure.

Table 2

Percent of Income on Housing for 28 Metros
(5% PUMA, Census 2000)

Metro Area	<$20,000	$20,000 to <35,000	$35,000 to <50,000	$50,000 to <$75,000	$75,000 to <$99,000	$100,000 to <$250,000	Tracts
Anchorage, AK MSA	65%	35%	26%	22%	18%	14%	55
Atlanta, GA MSA	59%	33%	25%	20%	16%	14%	660
Baltimore, MD PMSA	58%	33%	26%	21%	17%	14%	1070
Boston, MA CMSA	56%	33%	25%	21%	18%	14%	1219
Chicago, IL CMSA	59%	31%	24%	20%	18%	14%	2055
Cincinnati, OH CMSA	51%	26%	21%	18%	15%	12%	476
Cleveland, OH CMSA	52%	27%	21%	18%	15%	12%	872
Dallas, TX CMSA	57%	29%	22%	18%	16%	13%	1050
Denver, CO CMSA	59%	33%	25%	21%	18%	14%	614
Detroit, MI CMSA	55%	27%	21%	18%	15%	12%	1567
Honolulu, HI MSA	61%	35%	27%	22%	20%	16%	210
Houston, TX CMSA	56%	27%	21%	17%	15%	12%	878
Kansas City, MO-KS MSA	51%	26%	20%	17%	14%	12%	493
Los Angeles, CA CMSA	63%	36%	27%	23%	20%	16%	3356
Miami, FL CMSA	63%	35%	27%	21%	18%	14%	623
Milwaukee, WI CMSA	54%	28%	21%	18%	16%	13%	453
Minneapolis, MN MSA	54%	30%	23%	19%	16%	13%	741
New York, NY CMSA	64%	36%	27%	22%	19%	15%	5072
Philadelphia, PA CMSA	57%	31%	24%	19%	17%	13%	1568
Phoenix, AZ MSA	58%	31%	23%	19%	16%	13%	692
Pittsburgh, PA MSA	47%	24%	18%	16%	14%	11%	702
Portland, OR CMSA	59%	32%	25%	20%	17%	14%	484
San Diego, CA MSA	63%	35%	27%	23%	20%	16%	602
San Francisco, CA CMSA	65%	39%	30%	25%	21%	17%	1455
Seatte, WA CMSA	60%	34%	26%	22%	19%	15%	769
St. Louis, MO MSA	51%	25%	19%	16%	14%	12%	524
Tampa, FL MSA	53%	28%	21%	17%	15%	12%	546
Washington, DC PMSA	61%	35%	27%	22%	18%	14%	1025
Average	**58%**	**31%**	**24%**	**20%**	**17%**	**14%**	**1065**
TOTAL TRACTS							**29,831**

Table 3

Percent of Households Paying 35% or more of Income by Income in 28 Metros (Census 2000, SF3, H.97, H.73)			
Income	**Rent**	**Own**	**All**
Less than $10,000	65%	70%	66%
$10,000 to $19,999	70%	54%	65%
$20,000 to $34,999	31%	39%	34%
$35,000 to $49,999	8%	25%	17%
$50,000 to $74,999	3%	12%	9%
$75,000 to $99,999	1%	5%	4%
$100,000 or more	0%	2%	2%
TOTAL	**31%**	**18%**	**23%**

Transportation Costs as a Percent of Income

The transportation cost data is predicted with a unique model developed by Center for Neighborhood Technology and Center for Transit Oriented Development that uses Census, transit system, National Household Travel Survey, and other data sources to estimate a household's auto use, auto ownership, and transit use at the census tract level for a particular household size and income. This model is run on the specific income bins described above. The monthly transportation cost derived from the model is then taken as a percent of each weighted average income for each income bin in each census tract. This is to report on transportation costs by income for each neighborhood. To characterize the entire neighborhood in terms of transportation costs, we calculated a weighted average of the percentage of income of the six income bins. See Appendix C for a more complete discussion of this technique and references to the model's development. The following table lists the estimated percentage of income on transportation for each of the six income bins in each of the 28 metros.

Table 4

Percent of Income on Transportation for 28 Metros
(Transportation Cost Model at Tract Level)

Metro Area	<$20,000	$20,000 to <35,000	$35,000 to <50,000	$50,000 to <$75,000	$75,000 to <$99,000	$100,000 to <$250,000
Anchorage, AK MSA	58%	36%	26%	19%	14%	9%
Atlanta, GA MSA	63%	38%	27%	20%	15%	10%
Baltimore, MD PMSA	55%	33%	24%	18%	13%	9%
Boston, MA CMSA	59%	35%	25%	18%	14%	9%
Chicago, IL CMSA	53%	31%	22%	16%	12%	8%
Cincinnati, OH CMSA	61%	37%	27%	20%	14%	9%
Cleveland, OH CMSA	57%	35%	25%	18%	13%	9%
Dallas, TX CMSA	61%	37%	27%	19%	14%	9%
Denver, CO CMSA	55%	34%	25%	18%	13%	9%
Detroit, MI CMSA	60%	37%	26%	19%	14%	10%
Honolulu, HI MSA	48%	29%	21%	15%	11%	7%
Houston, TX CMSA	62%	37%	27%	19%	14%	9%
Kansas City, MO-KS MSA	60%	37%	27%	20%	14%	9%
Los Angeles, CA CMSA	53%	32%	23%	17%	12%	8%
Miami, FL CMSA	55%	32%	23%	17%	13%	8%
Milwaukee, WI CMSA	55%	34%	25%	18%	13%	9%
Minneapolis, MN MSA	58%	35%	26%	19%	14%	9%
New York, NY CMSA	50%	28%	20%	15%	11%	7%
Philadelphia, PA CMSA	56%	34%	24%	18%	13%	9%
Phoenix, AZ MSA	58%	35%	26%	19%	14%	9%
Pittsburgh, PA MSA	61%	37%	27%	19%	14%	9%
Portland, OR CMSA	60%	37%	27%	20%	14%	10%
San Diego, CA MSA	54%	33%	24%	17%	13%	9%
San Francisco, CA CMSA	54%	32%	23%	17%	13%	8%
Seatte, WA CMSA	59%	36%	26%	19%	14%	9%
St. Louis, MO MSA	60%	37%	26%	19%	14%	9%
Tampa, FL MSA	62%	38%	27%	20%	15%	9%
Washington, DC PMSA	57%	34%	25%	18%	13%	9%
Weighted Average of 28 Metros	**56%**	**34%**	**24%**	**18%**	**13%**	**8%**

Housing + Transportation Cost Burden

By adding the housing and transportation cost burdens for each income bin, and taking a weighted average for each census tract we have an estimate for studying the combined household burden and how it affects households, neighborhoods and regions. The following table lists the combined percentage of income on housing and transportation for each of the six income bins in each of the 28 metropolitan areas.

Table 5

Percent of Income on Housing & Transportation for 28 Metros
(Census Housing Costs + Transportation Cost Model at Tract Level)

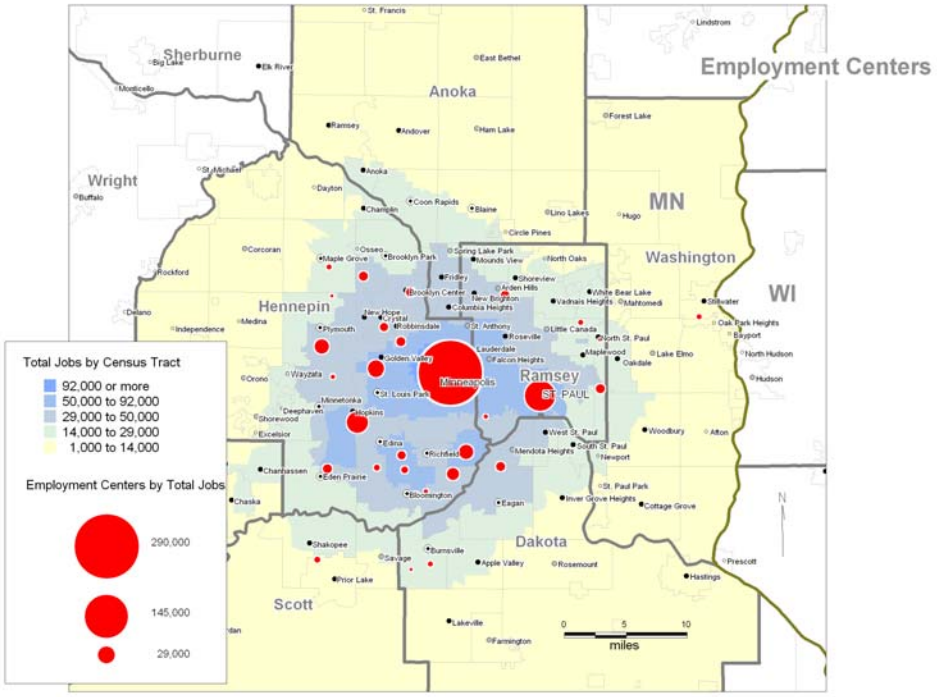
Metro Area	<$20,000	$20,000 to <35,000	$35,000 to <50,000	$50,000 to <$75,000	$75,000 to <$99,000	$100,000 to <$250,000
Anchorage, AK MSA	122%	71%	52%	41%	32%	23%
Atlanta, GA MSA	123%	71%	52%	40%	31%	23%
Baltimore, MD PMSA	113%	66%	50%	38%	30%	22%
Boston, MA CMSA	115%	68%	50%	39%	31%	23%
Chicago, IL CMSA	113%	63%	47%	37%	29%	22%
Cincinnati, OH CMSA	112%	63%	48%	37%	30%	22%
Cleveland, OH CMSA	109%	62%	46%	36%	28%	21%
Dallas, TX CMSA	118%	66%	48%	38%	30%	23%
Denver, CO CMSA	115%	67%	50%	39%	31%	23%
Detroit, MI CMSA	115%	64%	47%	37%	29%	22%
Honolulu, HI MSA	110%	64%	48%	38%	31%	23%
Houston, TX CMSA	118%	64%	47%	36%	29%	22%
Kansas City, MO-KS MSA	111%	63%	47%	36%	28%	21%
Los Angeles, CA CMSA	116%	67%	50%	40%	32%	24%
Miami, FL CMSA	117%	68%	50%	38%	30%	22%
Milwaukee, WI CMSA	110%	62%	46%	36%	29%	21%
Minneapolis, MN MSA	111%	65%	49%	38%	30%	22%
New York, NY CMSA	114%	64%	47%	37%	30%	22%
Philadelphia, PA CMSA	114%	65%	48%	37%	30%	22%
Phoenix, AZ MSA	116%	66%	49%	38%	30%	22%
Pittsburgh, PA MSA	108%	61%	45%	35%	28%	21%
Portland, OR CMSA	119%	69%	51%	40%	32%	23%
San Diego, CA MSA	117%	68%	51%	41%	33%	24%
San Francisco, CA CMSA	119%	71%	53%	42%	34%	25%
Seatte, WA CMSA	119%	69%	52%	41%	33%	24%
St. Louis, MO MSA	111%	61%	46%	36%	28%	21%
Tampa, FL MSA	114%	66%	48%	37%	30%	22%
Washington, DC PMSA	118%	69%	52%	40%	32%	23%
Average of 28 Metros	**115%**	**66%**	**49%**	**38%**	**30%**	**22%**

Job Locations, Concentrations, and Accessibility

In developing the transportation cost model, we developed two primary measures of proximity to work for each census tract. In this study, these measures are built into the transportation costs and are also used separately as location characteristics to compare to housing costs. The first measure of jobs, distance to employment center, is simply the distance from the geographic center of the census tract where a household lives to the geographic center of the nearest cluster of adjacent tracts that all have more than 7 jobs per acre, and that total at least 5,000 jobs. The second measure is of job accessibility based on total job density and distribution within a region in relation to a household's location. To obtain this measure, we add the number of jobs in all tracts in each region divided by the square of the distance to those tracts. This quantity, estimated with a gravity model, allows us to look at the relationship of jobs to housing and transportation

cost burden. The map below (figure 1) shows this job density measure in relation to the employment center measure in the Minneapolis-St. Paul area.

Figure 1



Source: The Census Transportation Planning Package (CTPP) 2000

Worker Commuting Characteristics

The Census Transportation Planning Package (CTPP), allows us to examine the commute patterns of workers in each census tract. In part three of CTPP the home and work place census tracts are provided for each worker. Using a GIS, we assigned the distance between the center of the home tract and work tract to estimate a commute distance. We then used this distance with the time to commute reported by each worker in the Census to calculate an average speed (distance / time = speed). These calculations gave us an average speed, time, and distance for the average worker in each tract by mode to work. However, this measure is not perfect since the distance is "as the Crow Flies", e.g. a straight line between two points, and therefore is generally an underestimate of the commute distance since workers are generally not able to travel from home to work in a straight line. Yet, it provides a consistent statistic by which to compare the journey to work for all workers for all tracts. Breaking the measure of distance, speed and time by mode allows us to compare public transit users to auto users.

In addition to using this measure to judge the quality and cost of the commute for the commuter, we also found it to be a reliable indicator of congestion faced by the workers within a census tract. The slower the speed, the more likely the worker is traveling in a congested area. Even with our underestimate of distance, we found the average speed to be approximately 24 miles per

hour across all 28 metros. According to The Nationwide Personal Transportation Survey (NPTS), "the average commuting speed, including trips by all modes, went from 28 mph in 1983 to 34 mph in 1995."[5]

Household Socioeconomic Characteristics

Household characteristics have been obtained from Census 2000. Variables analyzed include educational attainment, unemployment rates, household size, vehicle ownership, commute time, average household size, race, housing unit density, tenure, occupants per room, workers place of work, travel means to work, time leaving for work, year structure built, and housing unit structure type.

Availability of Affordable Housing

The Department of Housing and Urban Development (HUD) along with the Census creates a special tabulation of housing data using the housing and income data in the census to calculate the number of affordable units in each tract that are available to households of each AMI level. The National Low Income Housing Coalition, with Kathy Nelson, classified these data into shortages by region and percentages of households with a housing burden by region. We used the available unit data at the tract level to study the association with household and transportation costs in neighborhoods and summarized the shortage data to the 28 metro areas to aid in characterizing the housing market of that region. The shortages are categorized as low, medium and high. For instance, San Francisco is a hot housing market- it has a large shortage of affordable units, and 27% of families earning 30-50% of the area family median income have a severe housing cost burden.

[5] Federal Highway Administration. "Status of the Nation's Highways, Bridges, and Transit: 2002 Conditions and Performance Report", Chapter 4: Operational Performance. http://www.fhwa.dot.gov/policy/2002cpr/ch4b.htm.

Housing / Transportation Neighborhood Types

To further compare and quantify housing and transportation variations across and within regions we created a neighborhood typology that represents the proportion of income spent on housing and transportation by the weighted average household income in that neighborhood using the income, housing, and transportation measures described above. This typology is based on housing costs plus transportation costs and results in one of four combinations; high or low expenditures on housing as a percentage of income plus high or low expenditures on transportation as a percentage of income. The four categories are illustrated in figures 2 and 3 and are described below.

Note the matrix does not have values on either the vertical or horizontal axis. This is because the average percent of income spent on H and T is relative to each region. What constitutes above average in one region might not be above average in another. We used the regional average expenditure on H and T as the best measure for what a typical household might spend on housing and transportation rather than using a fixed percentage such as 30% of income on housing. While 30% on housing is an industry standard for lending and public subsidies, it is not the typical amount spent by most households. In the U.S., the average expenditure is closer to 21% on housing. Therefore, we used the average of all households as a fair measure of whether households were taking on a housing and/or transportation burden. Using the average of all households as the threshold was also necessary since there is no analogous standard percentage of income recommended for transportation. Table 5 lists the average expenditures on housing and transportation as a percentage of all incomes in each region. The combined percentage ranges from 42% in Washington D.C. to 54% in Miami. The average of all metros is 48%.

Figure 2

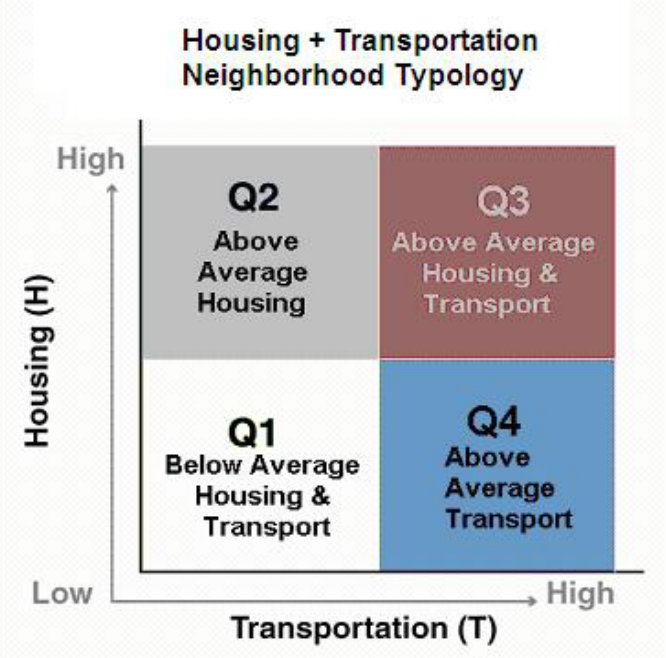


Table 6

Regional Average Expenditures on Housing & Transportation
(Based on Census Housing Costs & Modeled Transportation Costs)

Region	H%	T%	H+T%
Anchorage, AK MSA	28%	18%	46%
Atlanta, GA MSA	27%	21%	48%
Baltimore, MD PMSA	27%	19%	46%
Boston, MA CMSA	28%	19%	47%
Chicago, IL CMSA	28%	18%	46%
Cincinnati, OH CMSA	25%	23%	48%
Cleveland, OH CMSA	26%	22%	49%
Dallas, TX CMSA	26%	21%	47%
Denver, CO CMSA	27%	19%	46%
Detroit, MI CMSA	25%	21%	46%
Honolulu, HI MSA	30%	16%	45%
Houston, TX CMSA	26%	22%	48%
Kansas City, MO-KS MSA	24%	23%	47%
Los Angeles, CA CMSA	32%	19%	51%
Miami, FL CMSA	33%	21%	54%
Milwaukee, WI CMSA	26%	22%	48%
Minneapolis, MN MSA	25%	19%	44%
New York, NY CMSA	31%	16%	47%
Philadelphia, PA CMSA	28%	20%	47%
Phoenix, AZ MSA	27%	21%	48%
Pittsburgh, PA MSA	25%	25%	50%
Portland, OR CMSA	28%	22%	50%
San Diego, CA MSA	31%	19%	50%
San Francisco, CA CMSA	30%	15%	45%
Seatte, WA CMSA	29%	19%	48%
St. Louis, MO MSA	24%	23%	47%
Tampa, FL MSA	27%	25%	52%
Washington, DC PMSA	26%	17%	42%
Average of 28 Metros	**27%**	**20%**	**48%**

To understand the neighborhood categorizations, it is important to understand that the high or low expenditure categorizations of neighborhoods (tracts) are relative to the weighted average incomes in the neighborhood, ***not the absolute costs in neighborhood***. Therefore a low income household living in a tract categorized as Q1: Below Avg. H&T is not necessarily experiencing a "below average" burden by living in that tract, unless their income is similar to the weighted average income in that tract or their costs are uniquely lower than the average costs in the tracts. In fact, most households living in tracts characterized as Q1, Below Avg. H&T tracts were high income households and as such the low burden was a factor of income not of the costs associated with the location. Specifically, the average income of these types of neighborhoods in the 28

metro areas was $76,444 and 67% of the households living in this type of neighborhood earned at least $50,000. This is illustrated in figure 3 below for Below Avg. H&T neighborhoods residents and the residents of the other three H+T Neighborhood Types.

The burden characterization in the Q2 and Q4 neighborhood types, Above Avg. H and Above Avg. T, respectively, are a factor of moderate incomes and higher housing or higher transportation costs. The burdens in Q3—neighborhoods in which both costs are high—are the opposite of Q1. Absolute costs may be lower in these neighborhoods, since they're typically in the central city or inner-ring suburbs where both housing prices and transportation costs can be lower, but the high burden from housing is a factor of low incomes and the high burden from transportation is often due to low incomes as well as factors contributing to higher transportation costs, including a lack of nearby jobs and neighborhood amenities and lower quality public transit.

Figure 3

Neighborhood Types by Housing and Transportation Expenditures as a Percent of the Weighted Average Household Income in Each Neighborhood

High % on H	**Q2. Above Average H** (16% of HHS) **Mixed Income Urban Community**: Neighborhoods with high housing prices, but low transportation costs, and a mix of incomes with a slightly higher percentage of higher incomes. These places tend to be urban, near jobs, and near alternative transportation options and are the most diverse. *41% earn $50,000 or more* *Avg. Income: $52,184*	**Q3. Above Average H&T** (26% of HHS) **Lower Income Urban/Inner-Suburban Community:** Neighborhoods with low incomes and therefore above average expenditures on both housing and transportation relative to incomes. These places tend to be urban areas segregated by race and income, inner-suburbs with fewer jobs, and in some regions, outer suburbs or satellite cities away from jobs and services and close to rural areas. *(30% earn $50,000 or more* *Avg. Income: $41,387*
Low % on H	**Q1. Below Average H&T** (38% of HHS) **Wealthy Suburban Community:** Neighborhoods with higher incomes and therefore below average expenditures on both housing and transportation. These places tend to be suburban. *67% earn $50,000 or more* *Avg. Income: $76,444*	**Q4. Above Average T** (20% of HHS) **Moderate Income Exurb:** Neighborhoods with moderate incomes and moderate housing prices but exceptionally high transportation costs due to long distances to services and employment. These places are primarily in exurban areas. *52% earn $50,000 or more* *Avg. Income: $58,529*
	Low % on T	**High % on T**

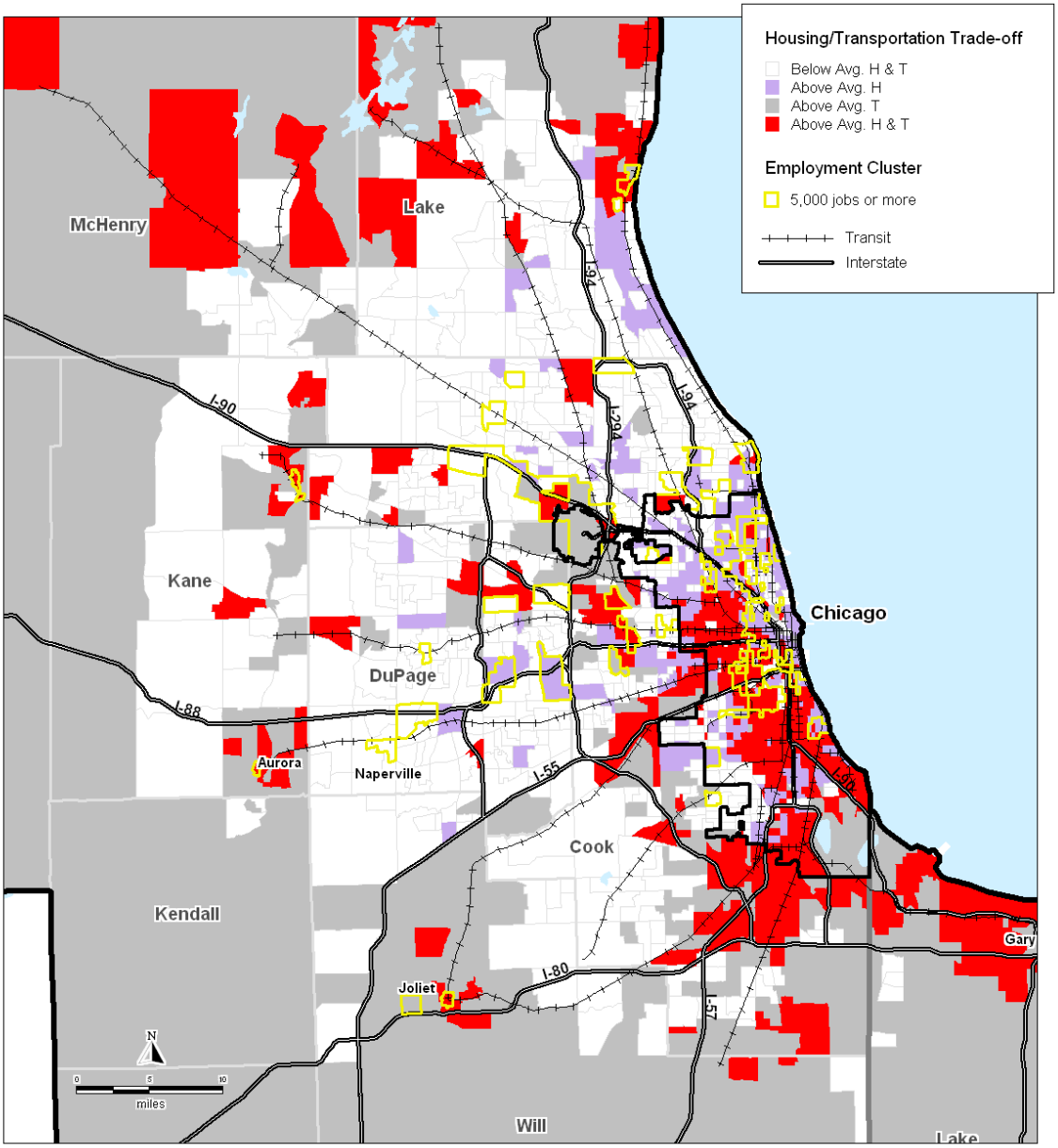
Using this typology we mapped the pattern of housing and transportation burdens in each region, which allowed us to see how these costs varied in relation to transportation infrastructure, the central city, inner suburbs, outer suburbs, exurbs, major centers of employment, and affordable housing shortages or availability. The numerical value of the quadrant type, e.g. 1, 2, 3, and 4, could also be used in statistical analysis to: identify associations between a household's expenditures on housing and transportation and household characteristics or impacts, such as commute time and mode to work, incomes, number of workers in a family, unemployment rates, educational attainment levels, vehicle ownership, etc.; and associations between burdens by neighborhood and regional impacts, such as congestion and density.

The map below is an example of how these neighborhood types (quadrants), and their respective burdens, are distributed in the Chicago region. Keep in mind that these maps represent housing and transportation costs as a percentage of *income*, and therefore they are depicting both the costs associated with the place as well as the predominant incomes in a neighborhood. Therefore, by simply looking at the map, without having an understanding of the distribution of incomes within a region it may not be clear in every instance whether the red areas, "Above Average H&T" are above average due primarily to high costs in that area, because the incomes are low in those areas, or from a combination of both high costs and low incomes. However, we found most households with moderate economic choice, e.g. those earning more than $35,000; tend to locate in places in which housing is close to 30% of income (See Table 2 for households earning $35,000 or more). Therefore, if an area is indicated as a place with both high housing and high transportation costs it is likely an area in which the majority of incomes are low because these households do not typically have economic choice and typically spend more than 30% on housing. To verify the incomes of the neighborhood types on each region's map, we provide detailed tables and explanations for each quadrant and each region in the next section and in Appendix B which provides more detail for each metro. The reader can reference the H+T type on the map with the type on the table to see both the income breakout by type and the expenditures on housing and transportation by type.

The maps also depict the employment center boundaries as well as the region's transportation infrastructure. Note in the Chicago map on the following page there are few employment centers (depicted by yellow outlines) within the red (Above Avg. H&T) or gray (Above Avg. T) areas. Most of the centers are surrounded or within the Below Avg. H&T or Above Avg. H areas, which we found contributes to the higher transportation costs of households in Above Avg. T and Above Avg. H&T neighborhoods. To access jobs, households in these two neighborhood types typically have to travel to the other two neighborhood types.

Figure 4

Chicago: Average Household Expenditures on Housing and Transportation as a Percentage of Average Tract Income, 2000



Source: Income and housing costs from 2000 Census of Population and Housing, Summary File 3 and PUMS 5%, P76 and P97. Retrieved 2006, from http://www.census.gov: http://factfinder.census.gov/servlet/BasicFactsServlet. PUMS 5% from PDQ Software, from http://www.pdq.com. Transportation costs based on 2000 data from a variety of national public sources and modeled by Center for Neighborhood Technology. Cities over 100,000 persons labeled.

3. What are households paying to live in their neighborhood: Housing and Transportation Expenditures by Income and Place

For several decades, households of all incomes- but higher incomes in particular- have been moving from central city neighborhoods to newer neighborhoods in surrounding and farther out suburban areas. As households have moved, jobs have followed. In search of better schools, more space, and less crime, households have also tended to move to neighborhoods of similar socioeconomic and demographic characteristics, e.g. places with other households of similar incomes, educational levels, family structures, and race. The concentration of jobs, e.g. "employment centers", has followed these higher income households and increasingly regions are becoming multi-centered, with the central city being only one of several employment centers.

This pattern of movement by both households and employers has resulted in many regions in which the job centers are increasingly within moderate to high income neighborhoods with housing prices to match. They are also mostly lower density communities with high percentages of single-family homes, low percentages of rental units and multi-family buildings, more segregated land uses, and very little public transit—factors which contribute to high transportation costs. (The white areas on the map of Chicago in Section 2 typify these higher income suburban areas.)

If high income low density suburbs are one type of area, the remaining areas are the central cities, inner suburbs, and outer suburbs. These three other areas each have lower incomes than the middle ring suburbs, and the inner and especially the outer suburbs have lower job concentrations. In all regions we studied, however, the central city is still an employment center although it may not always be the largest. Unlike many of the employment centers in the middle-ring suburbs the central city employment centers are generally surrounded by both high and low income neighborhoods and they also have lower transportation costs than the middle-ring suburbs. The number of high or low income neighborhoods near the central city employment center, and the values of the housing units, especially closest to the downtown business district, varies depending on the strength of the central city relative to the region.

Given these characteristics, the location and density of jobs, housing unit density, tenure, location in region, land uses, availability of transit, and incomes, there are clear differences in the expenditures on housing and transportation by different incomes in each of the four H+T Neighborhood Types. The chart below (Figure 5) shows the average expenditures for households of each income bin when they live in each neighborhood type.

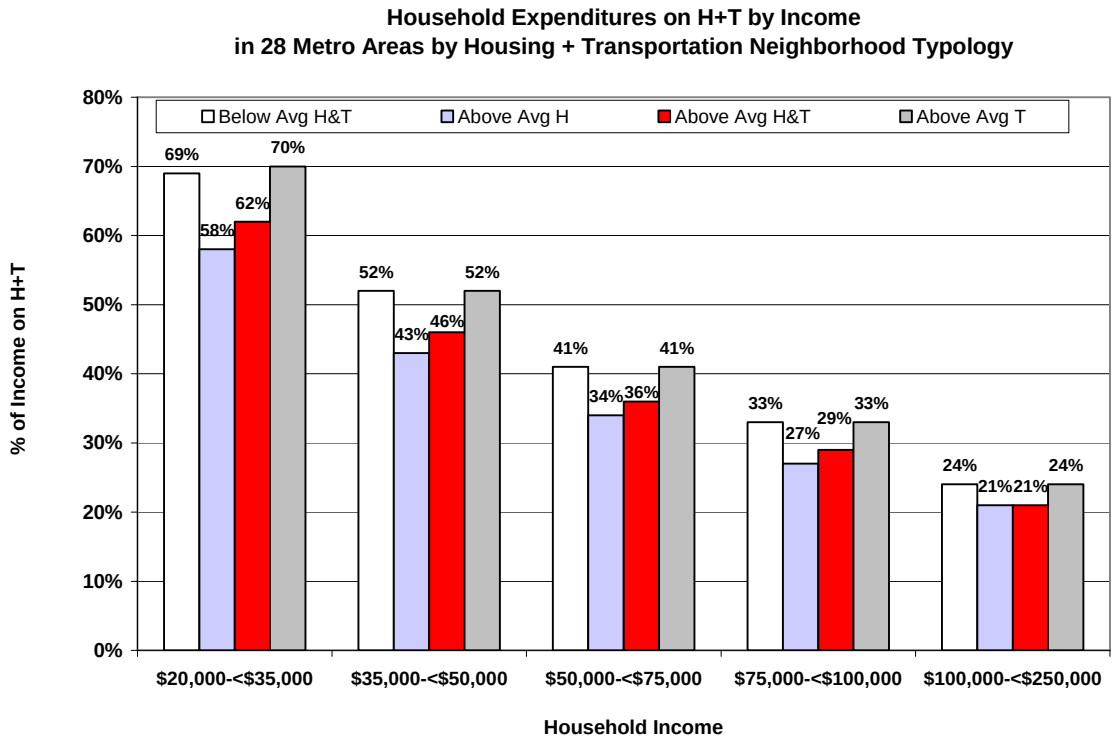
- For households earning $20,000 to less than $35,000, their average combined expenditures on housing and transportation range from 58% when they live in Above Avg. H neighborhoods to 70% when they live in Above Average T neighborhoods.

- Households in the highest income category, $100,000 to <$250,000, have the lowest combined housing and transportation expenditures from 21% of income in the Above Avg. H and Above Avg. H&T neighborhoods to 24% in the other two neighborhoods.

- At all income levels, at the 28 metro aggregate, the lowest combined housing and transportation expenditures are in the Above Avg. H neighborhoods. These neighborhoods provide the greatest mix of housing units and prices, as well as incomes, and the lowest transportation costs in absolute terms. The greater mix of housing types allows more households of various incomes to find housing that is nearby affordable transportation. However, for lower incomes, these neighborhoods often present a trade-off of higher housing prices for units that are often older, and therefore possibly in poor condition, and smaller in exchange for low transportation costs. Housing ownership by lower income households in these neighborhoods is often out of reach but renting in these neighborhoods can be the most affordable in terms of combined housing and transportation expenditures.

Note the costs are not the lowest in the "Below Avg. H&T" neighborhoods as a percentage of income even for the highest income bins. This is because these are mostly high income suburban areas (average income is $76,444) and housing and transportation costs are also high. However, at 24% of income, higher income households in these area spend well below the average combined housing and transportation expenditure for the region. Whereas, if a higher income household lives in another neighborhood type, their low combined expenditures are not typical of those neighborhoods and because they have higher incomes the lower costs in these areas afford them lower expenditures. This is why the higher income households have the lowest expenditures in the "Above Average H&T" neighborhoods.

Figure 5



Distribution of Households by Neighborhoods

As indicated in Figure 3, the neighborhood type "Below Avg. H&T" is the most common of the four neighborhood types, based on the percentage of households. However, at 38% of all households it is not the majority. The remaining share of households, 62%, live in neighborhoods where the average income household in the neighborhood has either an above average housing burden, an above average transportation burden, or above average housing and transportation burdens. Whereas the average combined percentage of income on housing and transportation for the average household in the Below Avg. H&T neighborhoods is 41%, the combined housing and transportation expenditures in the other three neighborhood types is 48% to 57%. The highest expenditure, 57%, is in the Above Avg. H&T neighborhoods where average incomes are the lowest, $41,387, and 53% of households earn less than$35,000. These neighborhoods house the second largest percentage of households of the four neighborhood types, 26%.

Table 7 displays the distribution of households by the four types and by the six income brackets for the 28 metro-aggregate. The percentages for each income bin can be added vertically to identify the percentage of households in a neighborhood type of a particular income (% in Neighb. column), e.g. 33% of households in Below Avg. H&T neighborhoods earn less than $50,000. Adding the figures in the % in income bin column horizontally shows the distribution of households of a particular income across neighborhood types, e.g. 19% of households earning less than $20,000 live in Below Avg. H&T neighborhoods.

Table 7

Distribution of Households by Income and Housing + Transportation Neighborhood Types

	Below Avg H & T			Above Avg. H			Above Avg. H & T			Above Avg T		
Income	% on H+T	% in Neighb.	% of income bin	% on H+T	% in Neighb.	% of income bin	% on H+T	% in Neighb.	% of income bin	% on H+T	% in Neighb.	% of income bin
<$50,000		**33%**	**26%**		**59%**	**19%**		**70%**	**36%**		**48%**	**19%**
$0-<$20,000	116%	8%	19%	106%	23%	21%	111%	30%	44%	119%	14%	16%
$20,000-<$35,000	69%	12%	26%	58%	20%	19%	62%	23%	35%	70%	17%	20%
$35,000-<$50,000	52%	13%	33%	43%	16%	17%	46%	17%	28%	52%	17.0%	22%
$50,000-<$75,000		**22%**	**41%**		**18%**	**15%**		**17%**	**21%**		**24%**	**23%**
$50,000-<$75,000	41%	22%	41%	34%	18%	15%	36%	17%	21%	41%	24%	23%
$75,000 or more		**45%**	**58%**		**23%**	**13%**		**14%**	**12%**		**28%**	**18%**
$75,000-<$100,000	33%	16%	50%	27%	10%	13%	29%	7%	15%	32%	14%	22%
$100,000-<$250,000	24%	29%	64%	21%	13%	12%	21%	6%	9%	24%	14%	15%
	% on H+T	% of HHS in 28 Metros		% on H+T	% of HHS in 28 Metros		% on H+T	% of HHS in 28 Metros		% on H+T	% of HHS in 28 Metros	
All Households	**41%**	**38%**		**48%**	**16%**		**57%**	**26%**		**48%**	**20%**	

From this analysis we found households earning less than $50,000 are paying from 43% (in Above Avg. H for households earning $35,000 to $50,000) to 119% (Above Avg. T for households earning less than $20,000) of their incomes on housing and transportation. The percentage above 100% of income by households earning less than $20,000 in each of the neighborhood types can be explained in part by households living in subsidized housing or sharing household costs with others that have not reported their income as part of the household's total income on the Census form. (The Census reports several instances where the housing costs alone are greater than 100% of household incomes in a given census tract). In other cases, the percentage greater than 100% may also be a factor of "under spending" on transportation relative to what our transportation model would predict a household would need to spend on transportation given the characteristics of the tract and typical household needs for transportation. The transportation model also applies the average auto cost for the average make and model vehicle on the road to the predicted number of autos per household whereas households of this income may be driving autos that have lower or no payments and/or may be sharing autos with other households. In this case, the predicted absolute transportation costs is higher than what the household may actually spend on vehicle purchase and ownership.

By Tenure

When we break this same distribution apart by tenure, it reveals that renter households have higher housing burdens in all four neighborhood types. However, renter households in each income bin (see Table 1), and each neighborhood type (see Table 8) have lower incomes which explains some of the higher burden as a percentage of income.

Of the total households that rent, the Above Avg. H&T neighborhoods are home to the greatest share, 6.3 million households and 37%. The Above Avg. T neighborhoods have the smallest share, 2.3 million and 13%. Within neighborhood type, renters are the majority of households in

the two neighborhood types that are primarily in cities and inner-suburbs in most regions, the Above Avg. H and Above Avg. H&T neighborhoods. These two neighborhood types are also where the median incomes of renters, when compared to all renter households, are the lowest at $33,578 and $24,198, respectively.

Table 8

Distribution of Households by Tenure and Neighborhood Type

	Below Avg H & T	Above Avg. H	Above Avg H & T	Above Avg. T
Median Income				
Owners	$79,671	$61,041	$43,783	$55,897
Renters	$47,767	$33,578	$24,198	$34,699
All Households	$71,930	$43,824	$31,718	$50,119
Households by Neighborhood				
Total Owners	11,972,149	2,225,590	4,453,270	5,973,487
% Owners	75%	33%	42%	73%
Total Renters	4,017,270	4,601,492	6,267,595	2,250,452
% Renters	25%	67%	58%	27%
Households across Metros				
% of all owners in 28 metros	49%	9%	18%	24%
% of all renters in 28 metros	23%	27%	37%	13%

The breakout above shows a trend, but even as a weighted average it hides some variation. While incomes within suburban neighborhoods, census tracts in this case, are typically within a narrow range, or there is at least a clear majority of an income level, more urban areas, such as the Above Avg. H neighborhoods, are the exception. Because of this income clustering (or segregation), the weighted average expenditure on H+T shown above is generally representative of at least 40% of households in each neighborhood type. However, the weighted average does not show the full range, especially at the ends of the distribution.

When the distribution is shown by income (See Table 9), for moderate income households ($20,000 to <$50,000) **housing costs** as a percentage of income:

- are *highest* in the Below Avg. H&T and the Above Avg. H neighborhoods for both owner and renter households;

- are *lowest* in the Above Avg. T neighborhoods for owners and for renters earning less than $20,000, and the Above Avg. H&T neighborhoods for renters earning $20,000 to <$50,000.

But, as this and other studies have shown, housing is only part of the picture. Combined housing and transportation costs as a percentage of income:

- are *lowest* for renters of all income categories, in the Above Avg. H neighborhood type;

- and for owners in the Above Avg. H neighborhoods for households earning less than $35,000 and the Above Avg. H&T neighborhoods for owners earning more than $35,000

Table 9

Percentage of Income on H and T Compared to % on H+T by Tenure, Income, and Neighborhood Type

	% of All HHS	Below Avg H&T				Above Avg. H				Above Avg. H&T				Above Avg. T			
		% H	% T	% H+T	% of HHS	% H	% T	% H+T	% of HHS	% H	% T	% H+T	% of HHS	% H	% T	% H+T	% of HHS
Owners	**59%**				**75%**				**33%**				**42%**				**73%**
<$20,000	5%	59%	57%	116%	**4%**	60%	48%	*109%*	**3%**	55%	56%	111%	**7%**	51%	65%	116%	**7%**
$20,000:<35,000	7%	35%	35%	71%	**7%**	37%	30%	*66.2%*	**4%**	32%	34%	*66.2%*	**8%**	31%	40%	71%	**10%**
$35,000:<50,000	8%	28%	26%	54%	**8%**	29%	22%	50.3%	**5%**	25%	25%	*49.6%*	**8%**	25%	29%	54%	**12%**
$50,000:<$75,000	14%	24%	19%	43%	**16%**	23%	16%	39%	**7%**	20%	18%	*38%*	**10%**	21%	21%	42%	**19%**
$75,000:<$99,000	10%	20%	14%	34%	**14%**	19%	12%	31%	**5%**	16%	14%	*30%*	**5%**	17%	16%	33%	**12%**
$100,000:<$250,000	15%	15%	9%	25%	**26%**	15%	8%	23%	**8%**	13%	9%	*22%*	**5%**	14%	11%	24%	**12%**
Renters	**41%**				**25%**				**67%**				**58%**				**27%**
<$20,000	12%	64%	53%	117%	**4%**	65%	41%	*105%*	**19%**	58%	52%	110%	**24%**	57%	64%	121%	**7%**
$20,000:<35,000	10%	35%	32%	66%	**5%**	33%	23%	*56%*	**16%**	29%	31%	60%	**15%**	30%	39%	69%	**7%**
$35,000:<50,000	7%	25%	23%	48%	**5%**	23%	17%	*40%*	**12%**	20%	23%	43%	**9%**	21%	28%	49%	**5%**
$50,000:<$75,000	7%	19%	17%	36%	**5%**	18%	12%	*30%*	**11%**	15%	17%	32%	**7%**	16%	21%	36%	**5%**
$75,000:<$99,000	3%	15%	12%	27%	**3%**	14%	9%	*23%*	**5%**	12%	12%	25%	**2%**	12%	15%	27%	**2%**
$100,000:<$250,000	3%	12%	8%	20%	**3%**	11%	6%	*17%*	**5%**	9%	8%	18%	**2%**	9%	10%	20%	**1%**
% in 28 metros	**100%**				**38%**				**16%**				**26%**				**20%**
Total HHS	**41,761,305**				**15,989,419**				**6,827,082**				**10,720,865**				**8,223,939**

Indicates lowest H+T neighborhood for respective income bin

Indicates lowest H neighborhood for respective income bin

The housing expenditure for moderate income households in Above Avg. H, Above Avg. H&T, and Above Avg. T neighborhoods compared to the combined H+T expenditure illustrates the trade-offs and constraints facing these households. Households of this income category can afford either good housing or good transportation, but rarely are they able to afford both to the quality or convenience desired.

- For **renters** of nearly all incomes, (except for those earning <$20,000 which may be corrected by taking into account household age or type), they have the lowest housing expenditure in the Above Avg. H&T neighborhoods. However, because these neighborhoods are primarily lower income, and because they also have higher transportation costs, the general situation of most households in these neighborhood types is above average housing and transportation expenditures. Lower income households would have a slightly lower combined burden in the Above Avg. H neighborhoods where they could reduce their transportation expenditures. However, finding affordable units in those higher priced "hot" neighborhoods next to jobs and amenities is becoming more and more difficult. The supply of rental units in major cities is shrinking and vacancies are low, especially for units that are affordable and in good condition.

- For **owners** earning less than $50,000, the difference in expenditures on H alone and H+T across neighborhood types is different from renters because of the location and supply of rental units and affordable ownership units. Owner households in these three income brackets

have the lowest H expenditure in the Above Average T neighborhoods, which demonstrates the reason more households in this income group are moving to outer suburban and exurban areas to purchase a lower-priced home. Yet, the housing burden is only slightly higher in the Above Avg. H&T neighborhoods for owner households earning $20,000 to $50,000, than it is in the Above Avg. T neighborhoods. However, the transportation costs in the Above Avg. H&T neighborhoods are much lower than the Above Avg. T neighborhoods thereby making these neighborhoods the most affordable in terms of combined H+T for owners of all incomes, except those earning <$20,000. The name of this neighborhood does not indicate this affordability because the majority of households in these neighborhoods are lower income renters and their costs are high as a percentage of income.

By Metro Area

For each metro area, the distribution of households by H+T Type is similar to the 28-metro average. In all regions, the Below Average H&T neighborhoods are the greatest share of neighborhoods, but not the majority. Within this neighborhood type households earning greater than $50,000 are the majority, however, ranging from 54% of households in Pittsburgh to 78% of households in Washington D.C. These households are paying from 22% of income to 45% of income on combined housing and transportation costs.

The neighborhood type with the second highest share of all neighborhoods varies somewhat across metros but in 25 of the 28 it is the Above Avg. H&T neighborhoods, ranging from 23% of neighborhoods in Chicago to 41% in Anchorage. Households earning less than $50,000 are the majority in this type and their expenditures on housing and transportation range from 42% of income to 119% of income. The three exceptions are Honolulu, where the second common type of neighborhood is Above Avg. H, and Boston and New York where the second type is Above Avg. T. In Boston and New York, households earning less than $50,000 living in Above Avg. T neighborhoods are 46% and 41% of households in these areas and are paying 55% to 124% of income on the combined expenses.

The following table (Table 10) shows the distribution of households for each metro across H+T Type, as well as the weighted average H+T expenditures of all households in the region compared to the H+T expenditures for the subset of households earning $20,000 to less than $50,000. The percentage of income on H+T for all households is on average across all 28 metros 48% of income, from a low of 42% in Washington D.C., reflecting the high incomes in that region, to a high of 54% in Miami. But for households earning $20,000 to less than $50,000, the average H+T expenditure is 57% of income, from a low of 54% in Pittsburgh to a high of 63% in San Francisco. These two extremes are due to the housing prices in those areas; Pittsburgh households in this income category have the lowest housing expenditure, 22%, and San Francisco households of this income have the highest, 35%. The Atlanta and Seattle regions are close seconds, each at 61% of income but in Atlanta the high H+T is due to high transportation costs, 32%, and moderately high housing costs, 29%, and the Seattle costs are due to high housing, 31%, and high transportation costs, 30%.

Table 10

Distribution by Metro of Household Housing & Transportation Burdens by Income

	% of All Households by H+T Type				% of Households earning <$50,000 by H+T Type				Expenditures of All Households in Metro			Expenditures of Households earning $20,000 to <$50,000		
Region	Below Avg H&T	Above Avg. H	Above Avg H & T	Above Avg T	Below Avg H&T	Above Avg. H	Above Avg H & T	Above Avg T	H%	T%	H+T%	H%	T%	H+T%
Anchorage, AK MSA	50%	0%	41%	10%	32%	0%	60%	9%	28%	18%	46%	31%	30%	60%
Atlanta, GA MSA	37%	17%	27%	19%	23%	18%	40%	20%	27%	21%	48%	29%	32%	61%
Baltimore, MD PMSA	42%	12%	27%	19%	27%	15%	40%	18%	27%	19%	46%	27%	29%	56%
Boston, MA CMSA	35%	18%	21%	26%	23%	22%	30%	25%	28%	19%	47%	29%	30%	59%
Chicago, IL CMSA	38%	18%	23%	20%	24%	23%	30%	23%	28%	18%	46%	28%	27%	55%
Cincinnati, OH CMSA	45%	8%	30%	17%	32%	9%	42%	17%	25%	23%	48%	24%	32%	56%
Cleveland, OH CMSA	43%	12%	25%	20%	33%	13%	34%	20%	26%	22%	49%	24%	30%	55%
Dallas, TX CMSA	41%	15%	26%	18%	26%	18%	37%	20%	26%	21%	47%	26%	31%	57%
Denver, CO CMSA	42%	15%	29%	14%	25%	19%	41%	14%	27%	19%	46%	29%	29%	59%
Detroit, MI CMSA	44%	11%	28%	17%	31%	10%	41%	18%	25%	21%	46%	24%	31%	56%
Honolulu, HI MSA	39%	24%	23%	13%	25%	32%	30%	13%	30%	16%	45%	31%	25%	56%
Houston, TX CMSA	37%	19%	30%	15%	22%	20%	41%	16%	26%	22%	48%	24%	31%	56%
Kansas City, MO-KS MSA	38%	12%	27%	23%	25%	12%	38%	25%	24%	23%	47%	23%	33%	56%
Los Angeles, CA CMSA	40%	17%	28%	16%	26%	18%	39%	16%	32%	19%	51%	32%	27%	59%
Miami, FL CMSA	43%	11%	34%	11%	30%	13%	45%	12%	33%	21%	54%	31%	28%	59%
Milwaukee, WI CMSA	43%	9%	26%	22%	31%	11%	37%	21%	26%	22%	48%	25%	30%	55%
Minneapolis, MN MSA	42%	12%	26%	20%	28%	15%	38%	19%	25%	19%	44%	27%	30%	56%
New York, NY CMSA	31%	23%	20%	26%	19%	31%	28%	22%	31%	16%	47%	32%	24%	55%
Philadelphia, PA CMSA	40%	15%	26%	18%	29%	18%	36%	17%	28%	20%	47%	27%	29%	56%
Phoenix, AZ MSA	39%	17%	29%	16%	25%	17%	40%	18%	27%	21%	48%	27%	30%	57%
Pittsburgh, PA MSA	35%	19%	20%	26%	26%	21%	25%	28%	25%	25%	50%	22%	33%	54%
Portland, OR CMSA	38%	13%	34%	15%	28%	14%	43%	15%	28%	22%	50%	28%	31%	60%
San Diego, CA MSA	40%	13%	30%	17%	26%	14%	42%	18%	31%	19%	50%	31%	28%	59%
San Francisco, CA CMSA	41%	15%	26%	18%	27%	18%	38%	17%	30%	15%	45%	35%	27%	63%
Seatte, WA CMSA	37%	16%	27%	20%	26%	19%	37%	19%	29%	19%	48%	31%	30%	61%
St. Louis, MO MSA	41%	10%	27%	21%	30%	11%	37%	22%	24%	23%	47%	23%	32%	55%
Tampa, FL MSA	37%	16%	26%	20%	27%	17%	33%	23%	27%	25%	52%	25%	33%	58%
Washington, DC PMSA	40%	16%	27%	17%	23%	19%	41%	17%	26%	17%	42%	32%	28%	60%
Average of Metros	38%	16%	26%	20%	27%	17%	38%	19%	27%	20%	48%	28%	30%	57%

Characteristics of Neighborhoods

To further define the neighborhood types, beyond what households were paying as a share of income on housing and transportation, we used a cluster analysis to identify whether other neighborhood characteristics were also related to place or to households expenditures. These other characteristics are: incomes, educational attainment (percent with a bachelor degree), unemployment rates, household density, household size, vehicle ownership, distance to work, tenure, and the daily number of household trips. Using these characteristics, the tracts clustered into four categories, with income as a significant discriminate variable. The clusters range from 30% of households in tracts with an average (weighted) income of $35,007 to 10% of households in tracts with an average (weighted) income of $100,128. The clustering also reveals a spatial dimension through the housing unit density variable ranging from urban for the lowest income category through suburban for the upper-income category. This spatial dimension is further analyzed in the next sub-section, Location of Neighborhood Types. Table 11 shows the average characteristics in each of the resulting four clusters.

Table 11

Neighborhoods Clustered by Socioeconomic and Place Characteristics

	Cluster				
Variables in Cluster Analysis	**1**	**2**	**3**	**4**	
T as a % of Income (all households)	20%	16%	25%	13%	
H as a % of income (all households)	28%	26%	34%	25%	
H + T as a % of income (all households)	48%	42%	58%	38%	
% unemployed	5%	4%	12%	3%	
% bachelor degree	16%	24%	8%	33%	
Avg. Distance to Work by Auto	9.6	10.5	7.7	10.7	
Avg. Number of vehicles per household	1.7	2.0	1.2	2.2	
Avg. Household Size	2.7	2.8	2.9	2.9	
Housing Unit Density (Units per square mile)	1,212	812	2,697	602	
Estimated Daily Trips per Household	10.2	10.6	10.1	11.0	
Tenure (% Owner)	63%	77%	39%	88%	
Weighted Average Income	$54,490	$74,818	$35,007	$100,128	
Number of Neighborhoods (tracts)	**10,252**	**7,200**	**8,815**	**2,967**	**29,234**
% of Neighborhoods (tracts)	**35%**	**25%**	**30%**	**10%**	**100%**

Across these neighborhood clusters, the characteristics are distinct but reflect the incomes of the respective cluster. The neighborhoods with the lowest incomes have the highest average unemployment rate (12%) and the lowest percentage of households with college degrees (8%). In terms of transportation-related characteristics, the households in the low income cluster own 1.2 vehicles compared with 1.7 to 2.2 in the other three clusters, make the fewest household trips per day (10.1), and have the shortest average distances to work, 7.7 miles. The two high income clusters make the most daily household trips (10.6 and 11), have the highest vehicle ownership (2 and 2.2), the longest distances to work (10.5 and 10.7 miles). Household sizes are largest for the highest and lowest income groups but in the middle for the second highest income group (2.8 for the cluster income of $74,818). Transportation and housing costs as a percentage of income

are more related to density, number of daily trips, distance to work, and the housing stock and location, in addition to income and household size.

Simply comparing the income of each cluster with the percentage of income spent on H+T makes it appear that expenditures—as a share of income—are just a matter of income. As incomes go up, expenditures go down. While this is true, it is not the complete story, especially since the average in a cluster represents at least 2,967 neighborhoods and each of those neighborhoods could vary from the average H+T expenditure of the cluster. For instance, a household earning $20,000 to $35,000 could have combined expenditures ranging from 66% in Above Avg. H neighborhoods to 71% in Above Avg. T neighborhoods and both neighborhoods might fall in the same cluster (see Table 10 above).

By matching the demographic neighborhood classification to the H+T neighborhood classification, we get a sense of whether all neighborhoods of a particular cluster do have the same H+T expenditures, and conversely whether all neighborhoods of a particular H+T expenditure share similar demographic characteristics. (See Table 12 below).

Table 12

Comparison of Neighborhoods and Households by Clusters and H+T Neighborhood Type

Median Incomes of Clusters	**Below Avg. H&T** % in Neighborhood	**Above Avg. H** % in Neighborhood	**Above Avg. H&T** % in Neighborhood	**Above Avg. T** % in Neighborhood	
$54,490	25%	48%	25%	59%	
$74,818	47%	15%	3%	26%	
$35,007	2%	35%	72%	14%	
$100,128	27%	3%	0%	1%	
TOTAL in H+T Type	100.0%	100.0%	100.0%	100.0%	
Median Incomes of Clusters	**Below Avg. H&T** % of Cluster	**Above Avg. H** % of Cluster	**Above Avg. H&T** % of Cluster	**Above Avg. T** % of Cluster	**Total in Cluster**
$54,490	25%	22%	20%	33%	100%
$74,818	67%	10%	3%	20%	100%
$35,007	2%	22%	66%	10%	100%
$100,128	93%	4%	0%	3%	100%

We found that the low income cluster neighborhoods (Cluster 3, $35,007), are primarily Above Avg. H&T neighborhoods which means this H+T Type is primarily neighborhoods with high unemployment rates (12%), low educational attainment (8% with a college degree), and low rates of home ownership (39%). Above Avg. T neighborhoods primarily consist of the moderate and high income clusters; the $54,490 and $74,818 clusters make up 85% of this H+T Type. Therefore, these neighborhoods have lower unemployment rates, 4-5%, higher rates of college degrees, 16-24%, and higher rates of home ownership, 63% to 77%. Below Average H&T neighborhoods are almost exclusively moderate and high income cluster neighborhoods with only 2% of the low income cluster neighborhoods falling into this H+T Type.

The lower half of Table 12, which shows the distribution of the demographic clusters across the H+T Types shows the segregation by income in neighborhood types for low and very high

incomes. While the moderate income cluster neighborhoods ($54,490) are nearly equally distributed across the four H+T Types (at 25%, 22%, 20%, and 33%), 88% of the low income cluster neighborhoods are in Above Avg. H or Above Avg. H&T, nearly the converse of the high income cluster neighborhoods ($74,818) of which 87% fall into the other two H+T types. The very high income cluster ($100,128) neighborhoods are almost exclusively (93%) in the Below Avg. H&T neighborhoods.

The significance of classifying the same set of 29,608 neighborhoods by a number of characteristics and not just the housing and transportation costs indicates that expenditures are largely a factor of place and where households live is largely a factor of income. Households do not have equal access to the same places and therefore shoulder additional burdens associated with the places they are able to access. The level of access is examined below.

Because of the similar distribution between the H+T Types and the cluster analysis, we summarized the remaining characteristics by the H+T Types.

Neighborhood Type Summary

The following descriptions and table of each H+T Type summarize the above findings.

Below Average H&T Neighborhoods: These neighborhoods contain 38% of households in the 28 metro areas. They spend an average of 39% of their income for housing and transportation. The neighborhoods are on average the second furthest away from the closest central city (16.8 miles), after Above Avg. T neighborhoods. Households in these areas are mostly homeowners (75%) with the highest median incomes of the four types, approximately $70,428. The households are predominantly white (81%), have the second largest household size, are majority family households, have the highest median age, and the highest percentage of the two household types: married with kids and married without kids. They also have the lowest percentage of male or female single-parent households. Members of these households have the highest percentage of graduate and bachelor's degrees and live in households with the highest average workers per household (1.55). As expected, this neighborhood type has the lowest unemployment rate (4%) and the lowest poverty rate (5%).

Above Average H Neighborhoods: These neighborhoods contain 16% of households in the 28 metro areas. They spend an average of 47% of their income for housing and transportation. The neighborhoods on average are the closest to the central city, 9.5 miles. Households in these areas are mostly renters (67%), with the third highest median income of the four types, $43,824. However, owner households in these neighborhoods have the second highest incomes among owners, $61,041, after the owners in the Below Average H&T neighborhoods ($78,007). These neighborhoods are in the middle for percentage of white households, 58%, have the smallest household size (2.6), lowest percentage of family households (58%), and the highest percentage of single person households (33%). The

second highest family type in these neighborhoods is married without children. Single parent households are also more common at 10% of households, after the Above Avg. H&T neighborhoods (16%). Members of these households have the second highest percentage of graduate and bachelors degrees. Yet, only the Above Average H&T neighborhoods have a higher unemployment rate (11% versus 7%) and poverty rate (23% versus 15%). These neighborhood types are the most diverse in terms of the range of incomes, tenure mix, and race.

Above Average H&T Neighborhoods: These neighborhoods contain 26% of households in the 28 metro areas. They spend an average of 59% of their income for housing and transportation. The neighborhoods on average are the second closest to the central city, 15.7 miles from the center, after the Above Avg. H neighborhoods. Households in these areas are mostly renters, 58%, second after Above Avg. H neighborhoods. These households have the lowest median incomes of the four neighborhood types, regardless of tenure. The median income is $31,718 for all households, $24,198 for renter households, and $43,783 for owner households. These neighborhoods have the lowest percentage of white households, 47%, the second smallest household size (3.21), second lowest percentage of family households (66%), and the second highest percentage of single person households (28%). After single person households, the second highest family types are married with or without children at 19% and 18%, respectively, followed by 16% single parent households, which is the highest percentage of this type of household among the four neighborhoods. Members of these households have the lowest educational attainment levels, 14% with a graduate or bachelor degree, compared to 20% in the next highest, Above Avg. T neighborhoods, and 41% in the Below Avg. H&T neighborhoods. This H+T Type also has the highest unemployment rate, 11%, and the highest poverty rate, 23%.

Above Avg. T Neighborhoods: These neighborhoods contain 21% of households in the 28 metro areas. They spend an average of 49% of their income for housing and transportation. The neighborhoods on average are by far the greatest distance to the nearest central city, 31 miles. Households in these areas are mostly owners, 73%, second only to the Below Avg. H&T neighborhoods at 75%. They have the second highest renter median incomes ($34,699) of the four neighborhood types. Owner incomes are only higher than the Above Avg. H&T neighborhoods, $55,897. These neighborhoods are tied with the Below Avg. H&T households for the highest percentage of white households, but they have a higher Hispanic population than the Below Avg. H&T neighborhoods, 13% compared to 9%. They have the largest household size, 4.35 persons, and are tied with the Below Avg. H&T neighborhoods for the percentage of family households (73%). Yet, despite the higher percentage of family households, there are not as many children (percentage of population under 18 years), as the Above Avg. H&T neighborhoods, 26% compared to 28%. The most common household type

is married households without children, 30%, followed by married households with children, 27%. Members of these neighborhoods have lower educational attainment levels than Below Avg. H&T and Above Avg. H, 20% with a graduate or bachelor degree, after the Above Avg. T neighborhoods. These neighborhoods have the second lowest unemployment rate (5%) and the second lowest poverty rate, 8%.

Table 13

Profiles of Households by Neighborhood Types in 28 Metro Areas				
Characteristic	**Below Avg H&T**	**Above Avg. H**	**Above Avg. H&T**	**Above Avg T**
Average Median Household Income (owners)	$78,007	$61,041	$43,783	$55,897
Average Median Household Income (renters)	$46,769	$33,578	$24,198	$34,699
Average Median Household Income (all)	$70,428	$43,824	$31,718	$50,119
Total Renter Households	4,017,270	4,601,492	6,267,595	2,250,452
Renters as % of all Households in 28 Metros	10%	11%	15%	5%
% of all Renters in 28 Metros	23%	27%	37%	13%
Renters as % of Households in the Neighborhood Type	25%	67%	58%	27%
Total Owner Households	11,972,149	2,225,590	4,453,270	5,973,487
Owners as % of all Households	29%	5%	11%	14%
% of all Owners	49%	9%	18%	24%
Owners as % of Households in the Neighborhood Type	75%	33%	42%	73%
Total Households in 28 Metros	15,989,419	6,827,082	10,720,865	8,223,939
% of all Households	38%	16%	26%	20%
Total Population in 28 Metros	48,558,067	19,850,410	35,428,365	27,056,943
% of Population	37%	15%	27%	21%
Average H as % of Income (owners)	23%	26%	28%	24%
Average H as % of Income (renters)	28%	35%	37%	30%
Average H as % of Income (all)	24%	32%	34%	26%
Average T as % of Income (owners)	14%	12%	20%	21%
Average T as % of Income (renters)	21%	19%	30%	31%
Average T as % of Income (all)	15%	15%	25%	23%
Average Job Density (Jobs/sq.mi. gravity model)	48,055	116,086	56,403	19,931
Average Distance to an Employment Center	6.3	3.9	6.7	15.3
Average Distance to the closest Central City	16.8	9.5	15.7	31.0
Unemployment Rate	4%	7%	11%	5%
Avg. % Poverty	5%	15%	23%	8%
% of All Workers in 28 metros	34%	19%	29%	18%
Average Workers per household	1.55	1.20	1.16	1.54
% of Workers commuting by auto to Work	92%	73%	84%	97%
Avg. Vehicles per household	1.99	1.24	1.34	1.96
% High School Degree	21%	22%	29%	32%
% Bachelors Degree	25%	20%	9%	13%
% Graduate Degrees	16%	13%	5%	7%
% White	81%	58%	47%	81%
% Black or African American	6%	20%	32%	7%
% Hispanic	9%	18%	25%	13%
Average Household Size	3.96	2.60	3.21	4.35
Avg. Family Size	3.1	3.1	3.4	3.2
Avg. Non-Family Household Size	2.7	2.5	2.8	2.8
% Family HouseholdS	73%	58%	66%	73%
Median Age	38	35	32	37
% under 5 years	6%	6%	8%	7%
% under 18 years	24%	21%	28%	26%
% over 65	12%	12%	11%	13%
% 1-person Households	22%	33%	28%	22%
% Married Household w/ Children	29%	18%	19%	27%
% Married Household no Children	31%	21%	18%	30%
% Male Single Parents	1%	2%	3%	2%
% Female Single Parents	4%	8%	13%	6%

Locations of Neighborhood Types

This section further analyzes the location of the H+T neighborhood types. Location matters for both housing and transportation costs since proximity to and availability of jobs is a factor that contributes to both transportation costs and household incomes, as well as housing prices, as does the density, mix of housing units types and tenure, availability of neighborhood services and amenities, and transportation choice.

To identify the general location of the neighborhood types within the region, we use the proximity to types of Employment Centers (EC) as a way to characterize whether the neighborhood is in the central city (Central City EC), an inner or middle-ring suburb (Other EC), or an outer-ring suburb or exurban area (Away from EC). Recall from Section One that employment centers are contiguous areas of at least 5,000 jobs or more in which the job density is at least 7 jobs per acre in the contiguous area.

This characterization is a first step in identifying the location of the H+T neighborhood types. It is not perfect however due to the varying nature of employment centers in each metro area. In total, there are more than 57 million jobs in these 28 regions and 37% of these jobs are contained within 466 employment centers. The number and percentage of jobs that fall within employment centers in regions varies from just 18% of all jobs in Miami to 51% of all jobs in New York. The total number of employment centers in a region also varies, from one and seven ECs in Anchorage and Atlanta, respectively, to 68 and 76 ECs in Los Angeles and New York, respectively.

The following table (Table 14) presents the number of jobs and employment centers within each region.

Table 14

Metro Area Jobs and Employment Centers

Metro Area	Total Jobs	Jobs in Employment Centers	% of Jobs in Employment Centers	Employment Centers in Region
Anchorage, AK MSA	135,997	41,074	30%	1
Atlanta, GA MSA	2,080,327	580,690	28%	7
Baltimore, MD PMSA	1,143,425	331,629	29%	9
Boston, MA CMSA	2,928,326	949,458	32%	22
Chicago, IL CMSA	4,189,946	1,429,970	34%	35
Cincinnati, OH CMSA	939,716	232,461	25%	8
Cleveland, OH CMSA	1,384,765	281,958	20%	12
Dallas, TX CMSA	2,544,920	867,795	34%	10
Denver, CO CMSA	1,347,391	442,980	33%	12
Detroit, MI CMSA	2,440,788	686,857	28%	25
Honolulu, HI MSA	403,983	234,546	58%	6
Houston, TX CMSA	2,052,949	705,336	34%	12
Kansas City, MO-KS MSA	896,319	215,170	24%	10
Los Angeles, CA CMSA	6,587,361	3,085,900	47%	68
Miami, FL CMSA	1,610,493	580,329	36%	9
Milwaukee, WI CMSA	826,523	188,218	23%	8
Minneapolis, MN MSA	1,614,633	542,483	34%	11
New York, NY CMSA	9,201,516	4,695,264	51%	76
Philadelphia, PA CMSA	2,733,936	684,550	25%	27
Phoenix, AZ MSA	1,448,838	468,745	32%	12
Pittsburgh, PA MSA	1,062,092	280,051	26%	6
Portland, OR CMSA	1,097,236	348,397	32%	9
San Diego, CA MSA	1,274,267	581,467	46%	12
San Francisco, CA CMSA	3,469,424	1,717,324	49%	25
Seatte, WA CMSA	1,770,097	781,072	44%	17
St. Louis, MO MSA	1,246,155	339,360	27%	9
Tampa, FL MSA	1,051,222	194,239	18%	8
Washington, DC PMSA	2,605,839	1,262,707	48%	18
TOTAL	**57,482,645**	**21,487,323**	**37%**	**466**
AVERAGE	**2,146,017**		**34%**	**17**

To compare the above list of employment centers to the H+T Types, we identified neighborhoods that were within or intersecting a Central City EC or Other EC. The limit to this method however, is in the “Away from ECs” category. A neighborhood that is “Away from ECs” because it’s not directly intersecting or within an EC could be a mile away from an EC cluster or 20 miles away. To compensate for this limitation, we also calculated the average distance from each neighborhood (tract centroid) to the center of the nearest central city. In multi-centered regions, such as the Bay Area, San Francisco, Oakland and San Jose were all identified as central cities. Across the 28-metro average, we see the following distribution of H+T neighborhood types to Central City ECs and Other ECs.

Table 15

Distribution of Neighborhoods by Housing & Transportation Costs by Location in Region based on Adjacency to Employment Centers (EC)

Below Avg H&T				Above Avg H				Above Avg H&T				Above Avg T			
Central City EC	Other EC	Away from ECs	Miles to CC	Central City EC	Other EC	Away from ECs	Miles to CC	Central City EC	Other EC	Away from ECs	Miles to CC	Central City EC	Other EC	Away from ECs	Miles to CC
8%	18%	74%	16.8	31%	26%	43%	9.5	17%	20%	64%	16.0	2%	8%	90%	31.0

- The Above Avg. T neighborhood type has by far the greatest share of neighborhoods away from major centers of employment, 90%, and they are 31 miles on average from the center of the nearest central city. With only 2% of these neighborhoods located near the Central City EC, it is safe to say these neighborhoods are mainly suburban and largely in outer or exurban communities.

- The Below Avg. H&T neighborhood is the other predominantly suburban type, with 74% away from ECs and 18% near Other ECs. Only 8% of these are proximate to Central City ECs. The lower distance from the central city, 16.8 miles, compared to 31 miles in the Above Avg. T neighborhoods, indicate these are mostly inner and middle ring suburbs, not exurbs.

- The Above Avg. H neighborhoods are the most likely to be near jobs--57% are within or adjacent to either the Central City EC or Other ECs. They are also mainly in the central cities or inner-ring suburbs, based on the average distance to the center of the central city, 9.5 miles. This proximity is often what makes the housing prices higher and the transportation costs lower in these neighborhoods.

- The Above Avg. H&T neighborhood type has a greater number of neighborhoods that are adjacent to employment centers (37%) than the Above Avg. T and Below Avg. H&T neighborhoods, however, the majority of these neighborhoods are away from employment centers, 64%. Gauging from the distance to the central city, 16 miles, which is similar to the Below Avg. H&T neighborhoods, and knowing that these neighborhoods had the highest share of the low income cluster, which also had the greatest household density, and that these areas are primarily lower income renter households, this is an instance where the Away from EC measure does not indicate the neighborhoods are in exurbs but rather they are in central city or inner-ring suburbs without major employment centers.

The following table shows this same distribution for each of the 28 metro areas. The Above Avg. H&T neighborhoods in all regions are always closer to the central city than the Above Avg. T neighborhoods. In all but three regions, the Above Avg. H&T neighborhoods are further from the central city than the Above Avg. H neighborhoods. The three exceptions are Phoenix, Detroit, and Kansas City. Detroit and Kansas have weaker housing markets and all three have weaker central cities and are overall low density regions.

In 20 regions, the Above Avg. H&T neighborhoods are also further from the central city than the Below Avg. H&T neighborhoods; the exceptions are New York, Boston, San Francisco, Seattle, Philadelphia, Denver, Washington D.C., Pittsburgh, and Portland. Except for Pittsburgh and Philadelphia, the places where the Below Avg. H&T neighborhoods are closer to the central city are hot housing markets, making many of the closer in suburbs just as desirable and expensive as the city neighborhoods and outer suburbs.

This comparison of distance to Central City and ECs for the Above Avg. H&T neighborhoods—H+T Type with the lowest incomes—is evidence that lower income households are more isolated from the central business district and the institutions, services, jobs, transportation assets, and amenities, that are often associated with these places in nearly all regions.

Table 16

Distribution of Neighborhoods by Housing & Transportation Costs by Location in Region

	Below Avg H&T				Above Avg H				Above Avg H&T				Above Avg T			
Metro Areas	Central City EC	Other EC	Away from ECs	Miles to CC	Central City EC	Other EC	Away from ECs	Miles to CC	Central City EC	Other EC	Away from ECs	Miles to CC	Central City EC	Other EC	Away from ECs	Miles to CC
New York, NY CMSA	21%	25%	54%	17.7	86%	7%	8%	8.2	30%	36%	35%	18.1	1%	16%	83%	38.9
Los Angeles, CA CMSA	5%	38%	58%	25.1	26%	46%	28%	17.0	15%	34%	50%	21.3	2%	20%	78%	48.0
Boston, MA CMSA	4%	17%	79%	18.0	61%	14%	25%	4.7	7%	37%	55%	24.5	0%	10%	90%	32.6
Anchorage, AK MSA	14%	0%	86%	14.4	n/a	n/a	n/a	n/a	44%	n/a	56%	11.5	10%	0%	90%	14.9
Miami, FL CMSA	7%	19%	74%	20.0	37%	21%	42%	12.8	30%	13%	57%	12.9	4%	5%	91%	20.9
San Francisco, CA CMSA	11%	38%	51%	9.9	22%	43%	35%	7.5	2%	38%	61%	16.7	0%	15%	85%	25.5
Phoenix, AZ MSA	5%	12%	82%	14.8	22%	27%	51%	11.7	18%	20%	61%	10.7	1%	9%	90%	24.5
Seatte, WA CMSA	9%	24%	68%	14.5	26%	31%	43%	8.3	6%	33%	61%	24.0	0%	5%	95%	30.7
San Diego, CA MSA	11%	24%	65%	14.9	33%	25%	42%	10.6	15%	23%	62%	13.4	2%	15%	82%	20.9
Cincinnati, OH CMSA	0%	7%	92%	13.0	16%	16%	68%	7.1	18%	17%	65%	10.6	2%	1%	97%	20.0
Milwaukee, WI CMSA	6%	9%	85%	11.8	37%	21%	42%	4.4	21%	13%	66%	5.4	1%	13%	86%	17.2
St. Louis, MO MSA	1%	14%	85%	16.4	20%	37%	44%	8.0	6%	27%	67%	9.5	0%	2%	98%	26.0
Philadelphia, PA CMSA	1%	17%	82%	16.3	23%	28%	49%	9.3	15%	18%	67%	18.8	0%	7%	93%	27.0
Honolulu, HI MSA	15%	18%	67%	10.7	64%	7%	29%	4.2	19%	13%	67%	10.5	4%	16%	80%	11.1
Denver, CO CMSA	1%	20%	79%	12.9	22%	43%	35%	8.3	14%	17%	69%	13.2	1%	6%	94%	18.9
Minneapolis, MN MSA	3%	18%	78%	10.9	23%	43%	34%	6.9	18%	11%	71%	7.9	0%	2%	97%	20.3
Tampa, FL MSA	2%	4%	94%	14.8	1%	30%	69%	14.0	5%	23%	72%	14.6	0%	1%	99%	23.3
Washington, DC PMSA	10%	31%	59%	12.6	31%	37%	31%	7.9	12%	14%	73%	13.4	1%	6%	93%	34.0
Chicago, IL CMSA	5%	25%	70%	19.0	37%	23%	39%	8.2	6%	20%	75%	14.7	0%	10%	90%	31.4
Pittsburgh, PA MSA	3%	5%	92%	11.2	29%	2%	69%	5.0	14%	11%	75%	15.3	0%	5%	95%	23.7
Detroit, MI CMSA	0%	23%	77%	21.7	4%	29%	68%	18.2	6%	19%	75%	17.7	0%	8%	91%	36.4
Baltimore, MD PMSA	2%	14%	84%	13.2	31%	18%	51%	4.9	13%	11%	75%	6.7	1%	5%	94%	15.1
Portland, OR CMSA	7%	21%	72%	11.4	25%	23%	52%	6.9	6%	18%	76%	16.2	1%	7%	92%	25.2
Kansas City, MO-KS MSA	1%	15%	83%	12.8	21%	33%	46%	8.4	6%	17%	77%	7.0	0%	0%	100%	19.6
Cleveland, OH CMSA	0%	9%	91%	14.3	1%	26%	73%	8.6	3%	19%	78%	12.8	0%	6%	94%	29.8
Houston, TX CMSA	5%	16%	79%	18.5	33%	20%	48%	11.8	6%	16%	78%	14.6	0%	3%	97%	26.0
Dallas, TX CMSA	4%	12%	83%	13.8	14%	34%	52%	10.0	8%	13%	79%	11.8	1%	4%	95%	19.3
Atlanta, GA MSA	5%	7%	88%	18.6	25%	26%	50%	9.8	5%	13%	81%	12.5	0%	0%	100%	28.6
Weighted Average	**8%**	**18%**	**74%**	**16.8**	**31%**	**26%**	**43%**	**9.5**	**17%**	**20%**	**64%**	**16.0**	**2%**	**8%**	**90%**	**31.0**

The locations of H+T Types can be used to target places for housing and transportation policies for working households and to identify causal effects between expenditures and neighborhood characteristics, such as the lack of services, public transit and affordable housing, and the distance to jobs.

It makes sense, and has been shown through the Location Efficiency study[6] and the development of the transportation cost model used here, that lower transportation costs are associated with proximity to jobs and services—households do not have to drive as far to commute or to access services and retail. However, it's not always clear how much lower, or whether the lower transportation costs are low enough to offset the higher housing costs that are generally associated with access. This question is explored in the next section.

[6] John Holtzclaw, Robert Clear, Hank Dittmar, David Goldstein, and Peter Haas, "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use—Studies in Chicago, Los Angeles, and San Francisco," Transportation Planning and Technology 25(1) (2002): 1-27.

4. What Determines the Burden?

This section seeks to answer the question raised in the previous section: How do savings on either housing or transportation costs vary from place to place?

To answer this question we first look at trends for all the neighborhoods within the 28 metro areas, without accounting for metro area differences, and then we breakout the differences by metro area.

Trends for All Metros

Location in Region compared to H+T Expenditures

Using the Employment Center proximity to define location in region, our analysis indicates that the lower transportation costs in central cities and inner-ring suburbs can offset the higher housing costs for moderate income households. We also found the combined housing and transportation costs substantially rises as one gets further from the central city and the rise is not due to rising housing costs as a percentage of income, but rising transportation costs. This is shown in Table 16 below. As distance from the central city increases, the housing costs as a percentage of income are only rising a few percentage points for each income category as they move from the Central City EC locations to Away from ECs whereas the transportation costs which are rising by 4% to 19%.

A household earning $20,000 to $35,000 living near the Central City EC is paying 54% combined for the two costs, with 32% for housing and 22% for transportation, but moving to a location Away from ECs, even when only increasing housing by one percent, increases the combined costs by 16 percent to a combined total of 70%. This is due to the extra 15% on transportation. The higher amount on transportation is due to higher vehicle ownership and more miles driven each day.

Table 17

Percent of Household Expenditures on Housing and Transportation

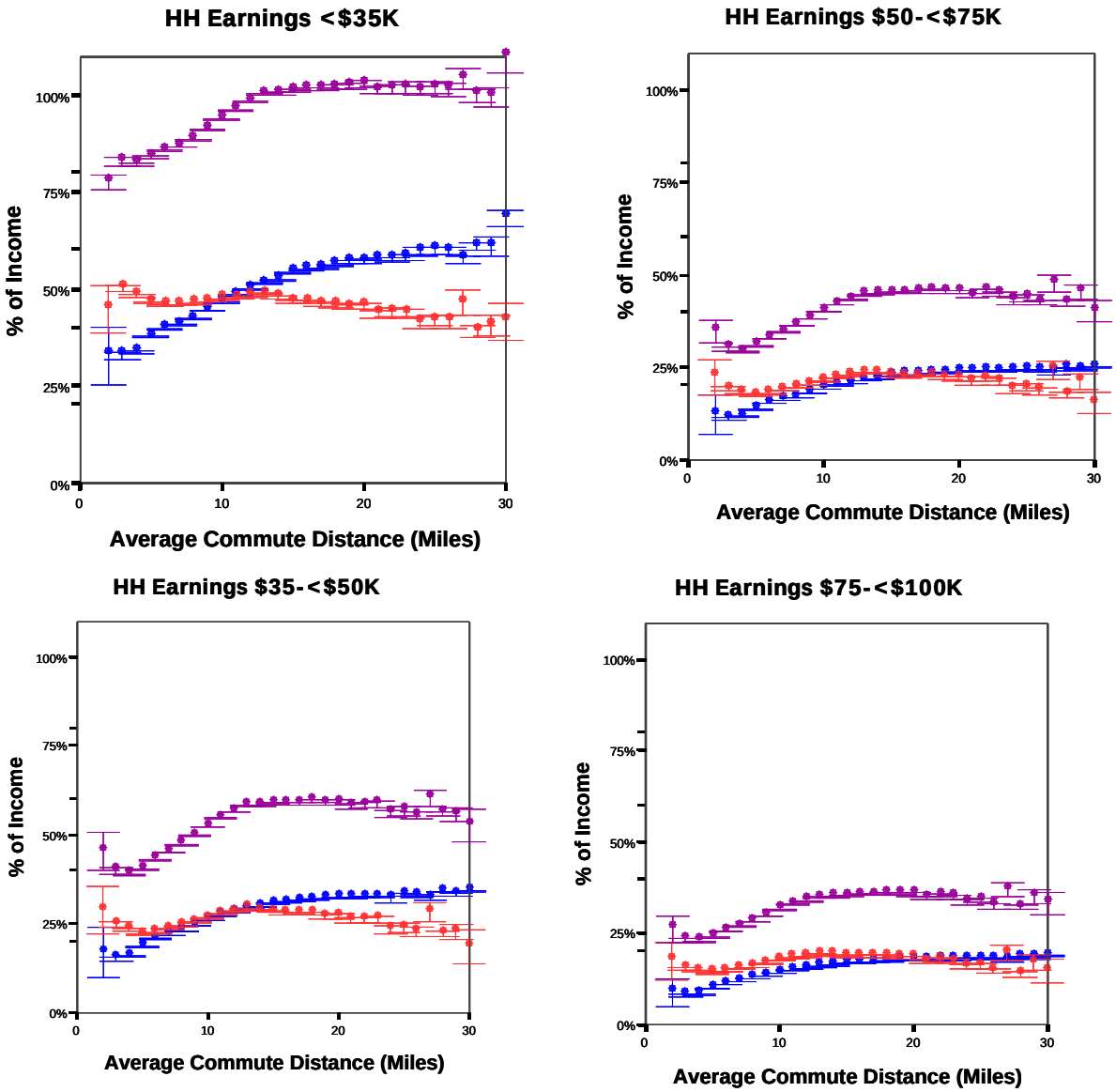
% of Expenditures by Income	Intersecting Central City Employment Center	Intersecting Other Employment Centers	Away from an Employment Center
$0-<$20,000			
% Income on Housing	63%	63%	60%
% Income on Transport.	41%	52%	60%
% Income on H+T	*104%*	*116%*	*120%*
$20,000 - <$35,000			
% Income on Housing	32%	35%	33%
% Income on Transport.	22%	31%	37%
% Income on H+T	*54%*	*66%*	*70%*
$35,000 - <$50,000			
% Income on Housing	23%	26%	25%
% Income on Transport.	16%	23%	26%
% Income on H+T	*39%*	*48%*	*52%*
$50,000 - <$75,000			
% Income on Housing	18%	21%	20%
% Income on Transport.	11%	17%	19%
% Income on H+T	*29%*	*37%*	*40%*
$75,000 - <$100,000			
% Income on Housing	15%	17%	17%
% Income on Transport.	8%	12%	14%
% Income on H+T	*23%*	*29%*	*31%*
$100,000 - <$250,000			
% Income on Housing	11%	13%	12%
% Income on Transport.	5%	8%	9%
% Income on H+T	*16%*	*21%*	*22%*
Owner Median Income	$56,074	$63,058	$61,530
Renter Median Income	$30,807	$37,741	$36,316
Median Income	$38,170	$51,387	$53,987

Commute Distance compared to H+T Expenditures

As regions become more multi-centered and an increasing number of households commute to secondary cities for employment, the Employment Center analysis is not sufficient for every region. For instance, the Central City EC in Detroit does not have the same pull as the Central City EC in Chicago. Therefore, we also looked at the commute distance of every worker in each neighborhood in comparison to the household housing and transportation expenditures in each neighborhood. This analysis compares the actual commute for a neighborhood with costs, which accounts for the dispersion of jobs away from central city and other employment centers in many regions.

The following plots represent all households in four income bins in the 28 metros. They compare housing and transportation expenditures within a neighborhood to the typical commute distance for workers of a particular income within a neighborhood. The red lines represent housing costs as a percentage of income, the blue lines represent transportation costs, and the purple lines are the combined housing and transportation costs[7]. These plots illustrate the strong relationship we found between the percent of income a household spends on each cost separately as well as the combined costs and their commute distance. By plotting these two costs separately along with the combined costs, we're able to see at what distance the increase in transportation costs outweigh the savings on housing costs, resulting in a higher total combined cost.

Figure 6



[7] In a black and white printout, the housing line begins in the middle of the three lines at the vertical axis, greater than the transportation line and less than the combined cost line.

The trends above for each income level for all households in the 28 metro areas are also consistent with the expenditures and commute distances by H+T Neighborhood Type. Comparing the housing and transportation expenditures for the three income bins from $35,000 to $75,000 in each of the H+T Neighborhood Types with the average commute distance of each neighborhood type, we found the following pattern of housing and transportation expenditures:

- The percentage of income spent on housing is higher in areas with the shortest distance (Above Avg. H), than it is in areas with longer distances, the Above Avg. H&T and Above Avg. T neighborhoods, but less than the housing percentage in the middle distance, Below Avg. H&T neighborhoods. In relation to the commute distance plots above; housing prices start high in the neighborhoods with the shortest distances which are typically in the central cities, drop with a slight increase in distance to the inner ring suburbs, then increase in price with the next increase in distance to the middle ring suburbs, and then drop again in the neighborhoods with the greatest distances in the exurban areas.

- Unlike the housing costs which rise and fall with distance to employment, transportation costs continue to increase with commute distance. At different distances for each income, transportation costs eventually rise above housing costs as a percentage of income.

The net effect is that total combined housing and transportation costs increase with commute distance even though housing prices ultimately decrease at the greatest distance.

Table 18

H+T Expenditures by Income & Neighborhood Compared to Average Commute Distance

	Above Avg. H	Above Avg. H&T	Below Avg H&T	Above Avg. T
Mean Distance	**7.4**	**8.3**	**9.6**	**12.1**
<$35,000				
% H	49.8%	45.7%	46.2%	41.0%
% T	33.9%	43.9%	42.8%	50.9%
% H+T	33.9%	43.9%	42.8%	50.9%
$35,000 to <$50,000				
% H	24.8%	22.2%	27.2%	23.7%
% T	18.3%	23.7%	24.8%	28.7%
% H+T	18.3%	23.7%	24.8%	28.7%
$50,000 to <$75,000				
% H	19.9%	18.1%	22.4%	19.7%
% T	13.8%	17.8%	18.5%	21.2%
% H+T	13.8%	17.8%	18.5%	21.2%
$75,000 to <$99,000				
% H	16.8%	15.1%	19.0%	16.7%
% T	10.6%	13.4%	14.0%	15.9%
% H+T	10.6%	13.4%	14.0%	15.9%

The trend is slightly different, however, for households earning less than $35,000. Housing and transportation are not the highest for these households living in the Below Avg. H&T neighborhoods as they are in the other three income groups. This trend needs more exploration but the lower housing costs could represent households who purchased homes in these areas before they developed and therefore have lower mortgage payments, and the lower transportation costs could be due to smaller household sizes at this income in these neighborhood types.

Regional Differences

The trends across all metro areas are useful for identifying general patterns and relationships, many of which can be used to interpret the reason for costs in specific neighborhoods within a region, but differences in metro areas, such as concentration of employment in employment centers, the availability and quality of mass transit, the strength of the housing market, etc., also make it necessary to look at each metro area separately.

To begin our comparison of burdens by region, we first compared our housing and transportation costs to the CES costs in 2000 as one benchmark for our hybrid of housing and transportation expenditures. We found a significant positive correlation between the CES housing and transportation expenditures for the median income in each metro area and the housing and modeled transportation costs for comparable incomes in this study (See Table A4 in Appendix A)[8]. With this validation for our average expenditures at the regional level, we used these averages to determine whether metro types could be classified into a combination of housing and transportation costs. A cluster analysis resulted in four different types of metro areas:

- 10 metros with Low Housing/High Transportation costs,
- 4 metros with High Housing/Low Transportation Costs;
- 3 metros with High Housing/Medium Transportation Costs; and
- 11 metros with Medium Housing/Medium Transportation costs.

These metro categories are listed in the table below. The category with the strongest relationship among regions is Low Housing/High Transportation. Regardless of the different clustering methods we tried, these 10 regions always clustered together.

Table 19

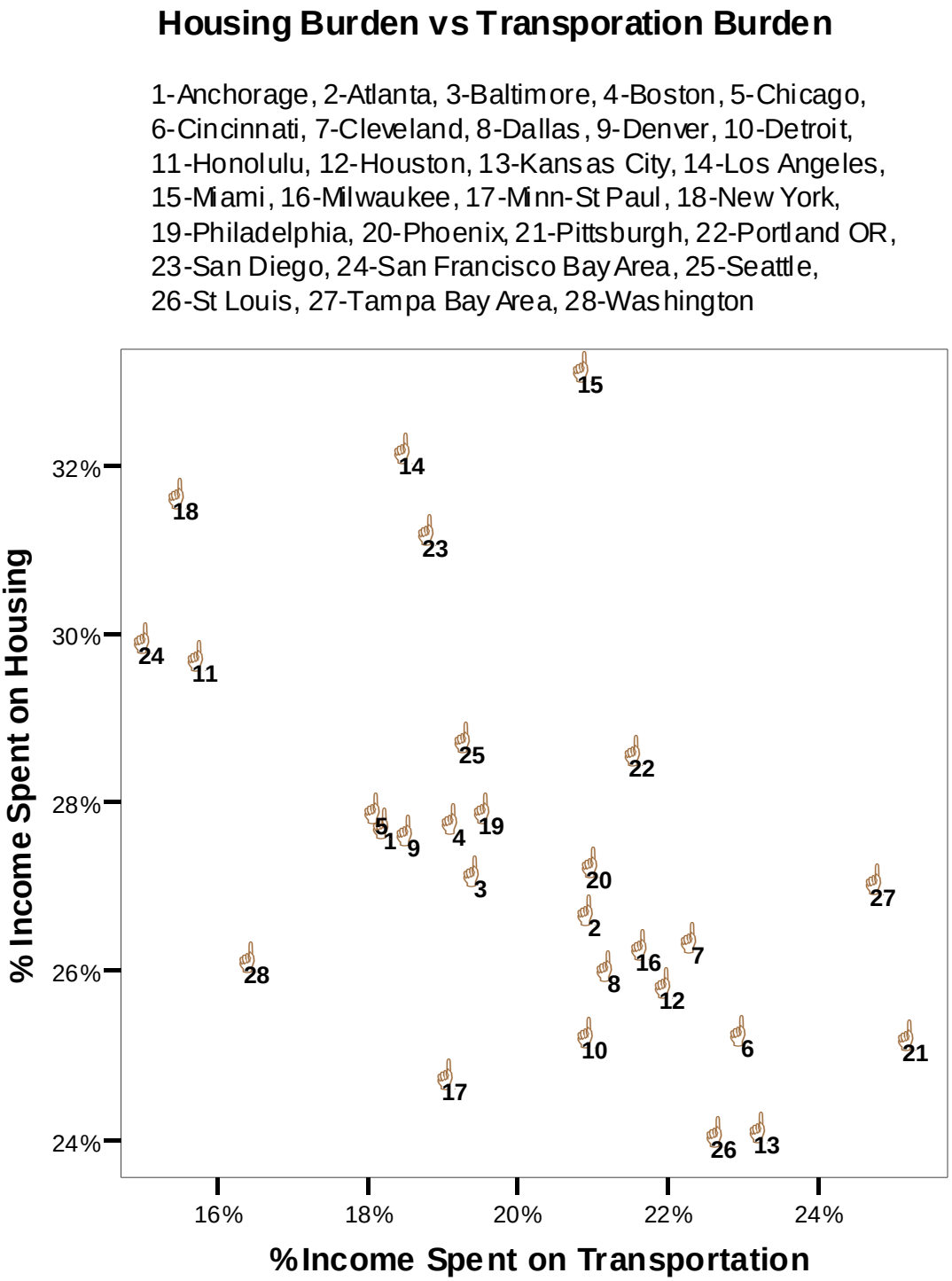
Metro Area Categorizations by Reported Housing and Modeled Transportation Expenditures as a Share of Income (2000)

Low Housing (25.4%) High Transportation (22.8%)	High Housing (29.2%) Low Transportation (15.8%)	High Housing (32.0%) Med Transportation (19.5%)	Med Housing (27.3%) Med Transportation (19.6%)
Cincinnati, OH CMSA	Honolulu, HI MSA	Los Angeles, CA CMSA	Anchorage, AK MSA
Cleveland, OH CMSA	New York, NY CMSA	Miami, FL CMSA	Atlanta, GA MSA
Dallas, TX CMSA	San Francisco, CA CMSA	San Diego, CA MSA	Baltimore, MD PMSA
Detroit, MI CMSA	Washington, DC PMSA		Boston, MA CMSA
Houston, TX CMSA			Chicago, IL CMSA
Kansas City, MO-KS MSA			Denver, CO CMSA
Milwaukee, WI CMSA			Minneapolis, MN MSA
Pittsburgh, PA MSA			Philadelphia, PA CMSA
St. Louis, MO MSA			Phoenix, AZ MSA
Tampa, FL MSA			Portland, OR CMSA
			Seattle, WA CMSA

[8] To obtain an income from our six income bins that could be compared to the median income surveyed for a metro area in the CES, we either used a single income bin that encompassed the CES median income, or took a weighted average of two income bins if the CES income was at the low or high end of an income bin.

The next figure, which plots each metro area along the housing and transportation expenditure axis shows the above categories but specifies where each region falls within the cluster.

Figure 7



On the whole, without considering the different burdens by income, the top five most expensive metro areas for households based on the combined housing and transportation costs relative to income are: Miami (54%), Tampa (52%), Los Angeles (51%), Pittsburgh (50%), and Portland (50%). These five areas are a mix of types: Miami and Los Angeles are High Housing/Medium Transportation regions, Tampa and Pittsburgh are Low Housing/High Transportation regions, and Portland is the only Medium Housing/Medium Transportation region. The region type, High Housing/Low Transportation, e.g. San Francisco, Honolulu, Washington D.C., and New York does not make the top five list when ranking regions according to the average of all households. Because these regions are known for their very high housing cost burdens on working families, we realized it was important to also rank each region according to income categories.

These additional rankings by income category show that certain "H/T region types" might be more expensive for working families than higher income families. When the 28 regions are ranked separately for the second through fifth income bins, there are 11 regions that were within the top five most expensive for either one of the income categories or for the region as a whole. The following table lists the 11 regions, their region type, and where they rank in terms of the Top 5 list for each income category. The combined housing and transportation expenditure for that income is shown in parenthesis along side the rank. The area median income of the region is also provided for additional reference. (The table is sorted by region type and the rank order for households earning $35,000 to <$50,000).

Table 20

Rank Among Top 5 Most Expensive by Income Category

Region Type	Region	$20K - <$35K	$35K - <$50K	$50K - <$75K	$75K - $100K	Avg. of All Incomes	2000 Area Median Income
High H-Low T	San Francisco	1 (71.7%)	1 (53.9%)	1 (42.7%)	1 (35.0%)		$62,024
High H-Low T	Washington, D.C.	4 (69.0%)	2 (52.5%)	3 (41.2%)	5 (33.2%)		$62,216
High H-Med T	Miami					1 (54.0%)	$38,632
High H-Med T	Los Angeles				4 (32.6%)	3 (50.6%)	$45,903
High H-Med T	San Diego			4 (40.8%)	3 (33.4%)		$47,067
Low H High T	Tampa					2 (51.8%)	$37,406
Low H-High T	Pittsburgh					4 (50.4%)	$37,467
Med H-Med T	Seattle	5 (68.8%)	3 (52.4%)	2 (41.9%)	2 (33.9%)		$50,733
Med H-Med T	Atlanta	2 (70.4%)	4 (50.7%)				$51,948
Med H-Med T	Portland		5 (51.0%)			5 (50.1%)	$46,090
Med H-Med T	Anchorage	3 (69.5%)		5 (40.7%)			$55,546

This approach results in a number of findings. First, two of the most expensive housing markets, New York and Honolulu do not appear in any of the lists. It may be that their Low Transportation costs off-set their higher housing costs for low to moderate income households and that they have greater housing choice than the other High Housing markets, San Francisco and Washington D.C.. It's not necessarily due to having higher area median incomes in these regions since the 2000 median incomes in New York and Honolulu were $50,795 and $51,914, respectively, which are much lower than median incomes of San Francisco and Washington.

Second, a region from each of the four H/T region types ranks among the five most expensive in at least one of the lists, however, the Low Housing/High Transportation only appears in the Average of All Incomes ranking. The two regions that make this list, Tampa and Pittsburgh, also have low median incomes.

Third, regions categorized as Medium Housing/Medium Transportation appear most often. It's possible in these regions, there are not enough instances to make a trade-off between housing and transportation for low to moderate incomes and therefore they are most often saddled with both costs in the medium range making the combined costs high, e.g. **(Med. H + Med. T = High H+T).**

Regardless of region type, the rankings illustrate the importance of addressing both household costs for low and moderate income households. The cities with the highest expenditures are not just those with either very high housing costs, although this is the issue with San Francisco because of *extreme* costs, or just the places with affordable housing shortages or with very high transportation costs. The high cost regions are a combination of regions with medium to high costs in both household necessities and a mixture of places with varying levels of affordable housing shortages and transportation options. In places with low levels of affordable housing shortages, high transportation costs outweigh the greater availability of affordable housing. In places with transportation choice, lower income households do not have equal access to the transportation assets and in places without transportation choice, lower income households bear a higher transportation burden from the lack of choice than do higher income households.

To illustrate this mix of factors that may contribute to the housing and transportation expenditures by working households in each region, Table 21 summarizes these housing and transportation characteristics: the H/T region type; the state of the housing market, e.g. hot, weak, sprawling, expanding; the availability of affordable housing; the level of transportation choice; the concentration of employment centers; the level of congestion, and the housing and transportation expenditures of households earning from $20,000 to <$50,000. The table is ranked by H/T region type and then by the expenditure on housing and transportation by households from $20,000 to <$50,000. (Note the regions that rank high in their respective region type, are not on the above ranking lists by smaller income bins because this table takes a weighted average of two income bins--$20,000 to <$35,000 and $35,000 to <$50,000.) Initial observations from the table include: the most expensive places for this combined income category are not always regions with high affordable housing shortages, e.g. Kansas City; places with high transportation costs have lower concentrations of jobs within employment centers, e.g. Tampa; congestion levels vary between and within region types, but tend to be highest within medium and high housing expenditure metros, e.g. Los Angeles; and regions with rail systems have higher shares of households commuting without autos to work, e.g. New York. The next analysis uses many of these factors listed in table 21 but at the neighborhood level in order to find a statistical relationship with these factors and affordable housing and employment access within each region.

Table 21

Metro Area Characterization by Housing and Transportation Choices and Burdens

MSA	H+T Type	Housing Market (Price and Construction Density)	Housing Burden (% of 30-50% HAMFII with Severe Burden)	Affordable Housing Shortage	Transportation Choice (% non-auto commuters, Rail Transit System Size)	Employment Centers (Pop. near ECs, Jobs in ECs)	TTI Congestion 2003, Change '93-'02		Expenditures of Households Earning $20,000 to <$50,000 % H	%T	% H+T
New York, NY CMSA	High H, Low T	Hot Densifying Mkt.	22%	high	31%, Extensive Rail	54%, 51%	49	16	29%	32%	61%
San Francisco, CA CMSA	High H, Low T	Warm Sprawling Mkt.	27%	high	14%, Extensive Rail	42%, 49%	72	13	31%	30%	60%
Honolulu, HI MSA	High H, Low T	Hot Single Family Mkt.	23%	medium	15%, No Rail	39%, 58%	20	-10	29%	30%	59%
Washington, DC PMSA	High H, Low T	Hot Single Family Mkt.	13%	medium	13%, Large Rail	35%, 48%	69	15	27%	29%	56%
Los Angeles, CA CMSA	High H, Med T	Hot Single Family Mkt.	28%	high	8%, Large Rail	45%, 47%	93	-15	24%	32%	56%
Miami, FL CMSA	High H, Med T	Hot Single Family Mkt.	42%	high	6%, Medium Rail	34%, 36%	51	14	28%	27%	55%
San Diego, CA MSA	High H, Med T	Hot Single Family Mkt.	31%	high	7%, Medium Rail	35%, 46%	52	22	24%	30%	55%
Kansas City, MO-KS MSA	Low H, High T	Cool Single Family Mkt.	15%	low	3%, New Start Rail	18%, 24%	17	2	31%	28%	59%
Tampa, FL MSA	Low H, High T	Hot Single Family Mkt.	31%	medium	4%, Small Expanding Rail	14%, 18%	46	0	29%	29%	59%
Cleveland, OH CMSA	Low H, High T	Cool Single Family Mkt.	16%	low	6%, Medium Rail	14%, 20%	10	1	32%	27%	59%
Detroit, MI CMSA	Low H, High T	Cool	14%	low	4%, No Rail	22%, 28%	57	-23	26%	31%	57%
Milwaukee, WI CMSA	Low H, High T	Warm L/Med Density Mkt.	15%	low	7%, No Rail	23%, 23%	23	5	27%	30%	56%
Pittsburgh, PA MSA	Low H, High T	Cool Single Family Mkt.	16%	low	10%, Medium Rail	14%, 26%	14	-1	23%	33%	56%
Houston, TX CMSA	Low H, High T	Cool Single Family Mkt.	16%	medium	5%, Small Expanding Rail	23%, 34%	63	27	24%	31%	56%
Dallas, TX CMSA	Low H, High T	Cool	17%	medium	3%, Medium Rail	19%, 34%	60	14	24%	31%	56%
Cincinnati, OH CMSA	Low H, High T	Cool Sprawling Mkt.	11%	low	5%, No Rail	16%, 25%	30	12	31%	25%	56%
St. Louis, MO MSA	Low H, High T	Cool Single Family Mkt.	12%	low	4%, Small Expanding Rail	21%, 27%	35	7	25%	30%	55%
Chicago, IL CMSA	Med H, Med T	Warm Sprawling Mkt.	16%	medium	15%, Extensive Rail	30%, 34%	58	13	35%	27%	63%
Phoenix, AZ MSA	Med H, Med T	Hot Single Family Mkt.	26%	medium	5%, New Start Rail	28%, 32%	49	7	31%	30%	61%
Minneapolis, MN MSA	Med H, Med T	Warm Single Family Mkt.	13%	medium	7%, New Start Rail	24%, 34%	43	13	32%	28%	60%
Anchorage, AK MSA	Med H, Med T	Warm Sprawling Mkt.	n/av	n/av	5%, No Rail	25%, 30%	5	2	28%	31%	60%
Philadelphia, PA CMSA	Med H, Med T	Hot Single Family Mkt.	18%	medium	13%, Extensive Rail	25%, 25%	38	15	31%	28%	59%
Denver, CO CMSA	Med H, Med T	Cool Single Family Mkt.	20%	medium	7%, Small Expanding Rail	27%, 33%	51	14	25%	33%	58%
Portland, OR CMSA	Med H, Med T	Warm Densifying Mkt.	24%	medium	9%, Large Rail	25%, 32%	39	8	27%	30%	57%
Boston, MA CMSA	Med H, Med T	Warm Sprawling Mkt.	17%	medium	14%, Extensive Rail	33%, 32%	51	10	27%	29%	56%
Atlanta, GA MSA	Med H, Med T	Cool Sprawling Mkt.	22%	medium	5%, Medium Rail	17%, 28%	67	26	32%	24%	55%
Baltimore, MD PMSA	Med H, Med T	TBD	15%	low	11%, Medium Rail	20%, 29%	50	17	23%	32%	55%
Seatte, WA CMSA	Med H, Med T	Warm Single Family Mkt.	22%	medium	11%, Small Expanding Rail	31%, 44%	46	-8	22%	33%	54%
High H, Low T Avg.			21%		18%	43%, 52%	53	9	29%	30%	59%
High H, Med T Avg.			34%		7%	38%, 43%	65	7	25%	30%	55%
Low H, High T Avg.			16%		5%	18%, 26%	36	4	27%	30%	57%
Med H, Med T. Avg.			19%		9%	26%, 32%	45	11	28%	29%	58%
Average of 28 Metros			**20%**		**9%**	**27%, 34%**	**45**	**8**	**28%**	**30%**	**57%**

Does the presence of affordable housing and employment access affect H+T and does it vary by region?

The table above suggests relationships among some of the characteristics and housing and transportation costs. This analysis further examines how various spatial features of the housing market, including the spatial distribution of affordable housing, are associated with average household expenditures on housing and transportation costs. To examine this issue, we estimated two linear regression models with housing as a percentage of income (H) and transportation as a percentage of income (T) as dependent variables and the following as independent variables: *measures of urban form and spatial location relative to employment* (natural log of housing unit density, distance from nearest employment center, census tract job accessibility using a gravity model, median commute time), *local supply of affordable housing* (percent of units in tract that are "affordable" to working families from CHAS), and *household income* (natural log of the median household income for the tract). Each model, estimated for the pooled sample of census tracts in all 28 metropolitan areas, also includes dummy variables ("fixed effects") indicating the metropolitan area in which the tract was located. The following summarizes the statistically significant results from these regression analyses for the average of all metro areas. Following the aggregate results, is a list of the variations in these results by metro area:

- *Expenditures on housing are higher in more densely-developed areas that are within close proximity to jobs, while expenditures on transportation are lower.* As suggested above, households make tradeoffs between housing costs and accessibility to jobs. In the models, increases in housing unit and employment density are associated with higher H and lower T and households in tracts closer to employment centers spend more on H and less on T.

- *Expenditures on housing are lower in areas with a larger supply of affordable housing units.* We find that increases in the percent of units affordable to working families locally are associated with large reductions in housing costs. Among all factors influencing housing costs, affordable housing supply has an impact that is second in magnitude only to the median household income of the census tract.

- *The results suggest that expenditures on housing are higher in areas with higher degrees of traffic congestion, while expenditures on transportation are lower.* The median commuting time is positively associated with housing costs and negatively associated with transportation costs. Since the models control for the factors influencing average commute distances for households within the tract, we interpret this finding to imply that increases in commute time signal increases in local roadway congestion, which tends to be higher in locations that are within a close distance to employment centers. The negative influence of commuting time on transportation costs may possibly indicate modal shifts that occur in areas experiencing high levels of auto congestion. Such shifts would lower transportation costs since commuting by transit is generally more affordable than commuting by auto.

When we studied the regression model results for each of the metro areas separately, we found similar trends with some exceptions.

- *In 20 of the 28 metro areas, local concentrations of affordable housing are associated with declining transportation **and** housing cost burdens.* The exceptions are five west coast cities in terms of lowering both costs: Anchorage, San Diego, San Francisco, Portland, Seattle, and San Francisco; Honolulu in terms of increasing housing costs; and Miami and Tampa in terms of increasing transportation costs. The five west coast exceptions may be due to State-supported affordable housing planning in Oregon and California, or because in San Francisco and San Diego affordable housing is in such scarce supply, that no one tract has a large enough share to exert influence on housing or transportation costs. The increases in affordable housing concentration and increased transportation costs in Miami and Tampa may be due to the tourism industry and the extensive Gulf coast and ocean coastlines in these cities, affordable housing is likely further inland and away from employment centers rather than in the downtown areas which would mean locations with affordable housing have high transportation costs.
- *Job Density and housing costs are positively associated in 19 of the 28 regions.* In seven regions, however, there is no association. In some cases, the lack of association may be due to the ubiquity of employment centers and high job density, such as New York, San Francisco, and Los Angeles. In these three regions, the percent of jobs in employment centers is 47% to 51%. In the other four regions where these two measures are not associated, it may be due to the exact opposite--there may be too few instances of sufficient job densities to exert significant pressure on housing costs. In St. Louis and Detroit, job density and housing costs are unexpectedly negatively associated. These two regions have weaker central city housing markets and therefore the employment centers in their central cities have high job density but are not exerting price pressures on the nearby housing.
- *Transportation Costs are positively associated with distance to employment centers in 21 regions, negatively associated in Detroit and St. Louis and are not associated in five other regions; Cleveland, Dallas, Miami, Milwaukee, and Phoenix* This again could be due to the nature of employment centers in these regions. These regions have relatively lower concentrations of jobs in employment centers. St. Louis, Detroit, Milwaukee and Cleveland each have less than 30% of jobs concentrated in centers and Dallas and Miami have less than 37% of jobs in employment centers.
- *Housing Costs are negatively associated with distance to employment centers in 19 regions and positively associated in Honolulu.* In eight other regions; Pittsburgh, Portland, San Diego, Seattle, Boston, Cleveland, Kansas City, Miami, and Milwaukee, housing costs are not associated with distance to employment centers.
- *Housing Unit Density is associated with housing costs in 23 of the metros, negatively associated in San Francisco and Denver, and not associated in Washington D.C., Chicago, and Phoenix*. In San Francisco and Washington D.C. the negative or neutral association may be due to the overall hot housing market, e.g. housing prices are high everywhere regardless of higher densities. In Denver and Phoenix, household preferences may be stronger for lower density communities than the downtown higher density areas. Additionally, or conversely, there may not be enough high density housing areas to show up in our models.

Table 22 lists the model results for each of the metro areas.

Table 22

Results of H and T Models of Affordability and Accessibility by Metro Area

Metro Area	Job Density and Housing Costs	Increase in HU Density and Housing Costs	Distance to Employment Centers and Housing Costs	Distance to Employment Centers and Transportation Costs	Local Concentration of Affordable units and Housing & Transportation Costs
Anchorage, AK MSA	Positive	Positive	Negative	Positive	
Atlanta, GA MSA	Positive	Positive	Negative	Positive	Negative
Baltimore, MD PMSA	Positive	Positive	Negative	Positive	Negative
Boston, MA CMSA	Positive	Positive		Positive	Negative
Chicago, IL CMSA	Positive		Negative	Positive	Negative
Cincinnati, OH CMSA	Positive	Positive	Negative	Positive	Negative
Cleveland, OH CMSA		Positive			Negative
Dallas, TX CMSA		Positive	Negative		Negative
Denver, CO CMSA	Positive	***Negative with H&T***	Negative	Positive	Negative
Detroit, MI CMSA	***Negative***	Positive	Negative	***Negative***	Negative
Honolulu, HI MSA	Positive	Positive	***Positive***	Positive	***H costs rise***
Houston, TX CMSA	Positive	Positive	Negative	Positive	Negative
Kansas City, MO-KS MSA	Positive	Positive		Positive	Negative
Los Angeles, CA CMSA		Positive	Negative	Positive	Negative
Miami, FL CMSA		Positive			***Positive T***
Milwaukee, WI CMSA		Positive	Negative		Negative
Minneapolis, MN MSA	Positive	Positive	Negative	Positive	Negative
New York, NY CMSA		Positive	Negative	Positive	Negative
Philadelphia, PA CMSA	Positive	Positive	Negative	Positive	Negative
Phoenix, AZ MSA	Positive		Negative		Negative
Pittsburgh, PA MSA	Positive	Positive		Positive	Negative
Portland, OR CMSA	Positive	Positive		Positive	
San Diego, CA MSA	Positive	Positive		Positive	
San Francisco, CA CMSA		***Negative with H&T***	Negative	Positive	
Seatte, WA CMSA	Positive	Positive		Positive	
St. Louis, MO MSA	Positive	Positive	Negative	***Negative***	Negative
Tampa, FL MSA	***Negative***	Positive	Negative	Positive	***Positive T***
Washington, DC PMSA	Positive		Negative	Positive	Negative

Exceptions in bold and italics, blanks indicate no correlation

5. Everyone Pays: Impacts on households, neighborhoods and regions from high costs to working households

In this section we assess the burdens on households, neighborhoods, and regions associated with the household costs in locations where working households live. Burdens are discussed in three categories:

1. Burdens on Working Households:
   - housing burdens, including overcrowding and the approximate quality of units
   - transportation burdens, including commute time and distance, availability of transportation choice, and the necessity to own and operate multiple vehicles
2. Burdens on Neighborhoods and Regions:
   - Levels of congestion and traffic
   - Neighborhoods with high rates of poverty and unemployment and residents straddled with high costs and little means to get ahead
   - All households and the region as a whole experience more congestion and traffic levels on roads from the jobs-housing mis-match. Government costs increase from a growing share of households with little remaining income for additional education, savings, or healthcare. Environmental problems of air and water quality, water availability, and brownfield abandonment increase when regions expand beyond existing developed areas.

Burdens on Working Households

Housing Burdens

As we've shown throughout, working households are likely to have the lowest combined H+T costs in Above Avg. H and Above Avg. H&T neighborhoods. But we recognize that the quality of housing stock –affordable to working households--was not incorporated into this analysis, and that the availability of affordable ownership units, particularly in the Above Avg. H neighborhoods was not fully addressed. Here, we look at four housing characteristics in six regions by H+T Type: overcrowding, age of housing stock, units built since 1990, and diversity of housing types. While these measures do not fully explore quality, since an older unit can be in better condition than some newer units, they can indicate average quality. They also indicate the availability of housing choices in each neighborhood type, both in terms of type of unit and size of unit.

Overcrowding

To measure overcrowding we used the Census variable which compares number of occupants in a housing unit to the number of rooms in a unit. Kitchens, bathrooms and closets are not included

in the room count, but common areas, such as living rooms, are included in the count in addition to bedrooms. We considered more than one person per room an overcrowded situation since the average number of occupants per room is 0.12 occupants.

In the six regions, the instance of overcrowding is greatest in the two neighborhood types that are most affordable to working households and have the highest percentages of working households, the Above Avg. H&T and Above Avg. H neighborhoods. Los Angeles was the exception with high overcrowding in the Above Avg. T neighborhoods as well. Based on the number of tracts with overcrowding in each region, the average number of households with more than one person per room in the Above Avg. H&T neighborhoods ranges from 1.7% in Pittsburgh to 35.6% in Los Angeles. Pittsburgh is the one region of the six that does not have a high rate of overcrowding in any of the four neighborhood types. Los Angeles, on the other hand, is notable in its high rate of overcrowding in all four neighborhood types. The lowest rates of overcrowding in all regions are in the Below Avg. H&T neighborhoods.

Table 23

Overcrowding by H+T Neighborhood Type in Six Regions
(Housing Units with greater than 1 person per room)

	Below Avg. H&T	Above Avg. H	Above Avg. H&T	Above Avg. T
Region	**2000**	**2000**	**2000**	**2000**
Atlanta	2.4%	5.6%	11.1%	3.5%
Chicago	3.1%	8.9%	13.1%	4.6%
Denver	1.6%	4.9%	11.6%	4.9%
Los Angeles	9.9%	19.0%	35.6%	20.5%
Pittsburgh	0.6%	1.7%	1.7%	1.1%
Portland	2.6%	4.2%	8.0%	4.3%
Wtd. Average	**5.9%**	**10.7%**	**18.6%**	**7.8%**

Age of Units and Recent Construction

The average age of units as well as the number of units constructed since 1990 can indicate whether the construction of newer homes, or even the rehab of existing homes is occurring within a neighborhood. Newer homes being built within an existing neighborhood, signals reinvestment in a neighborhood and could mean that the existing units are also being rehabbed or maintained. The lack of construction of new units in existing neighborhoods could be from the lack of space for new development but also from the lack of market interest. Even in developed neighborhoods there is often room for new construction through replacement and the adaptation of other uses.

When we compared the age of the housing stock across neighborhoods in the same six regions, we found the same trend as the overcrowding comparison; the neighborhoods types with the lowest incomes are also the types with the oldest housing stock, the Above Avg. H&T and Above Avg. H neighborhoods. This is also true of the percentage of units constructed since 1990. However, the greater percentage of units constructed in the Above Avg. H neighborhoods, which are the highest density of the four types, than the Above Avg. H&T neighborhoods, illustrates

our point that even in developed areas there is still room for new construction. The lower rate of newer construction in the Above Avg. H&T neighborhoods indicates lack of recent investment and probably units that are not only older but possibly in worse condition. Lower home prices in these areas could also indicate the condition.

Table 24

Age of Housing Stock by H+T Neighborhood Type

Region	Below Avg. H&T	Above Avg. H	Above Avg. H&T	Above Avg. T
Atlanta	1983	1973	1970	1983
Chicago	1964	1950	1952	1965
Denver	1979	1971	1965	1971
Los Angeles	1967	1965	1962	1971
Pittsburgh	1960	1947	1944	1956
Portland	1974	1965	1964	1973
Wtd. Average	**1968**	**1958**	**1958**	**1967**

Table 25

Percentage of Housing Units Constructed since 1990

Region	Below Avg. H&T	Above Avg. H	Above Avg. H&T	Above Avg. T
Atlanta	33%	22%	14%	34%
Chicago	14%	6%	6%	15%
Denver	27%	17%	12%	19%
Los Angeles	11%	9%	8%	14%
Pittsburgh	10%	3%	3%	8%
Portland	28%	19%	17%	24%
Wtd. Average	**24%**	**16%**	**10%**	**21%**

Housing Choice

The percentage of all housing units in each neighborhood type that are single family detached also indicates the number of housing options available to a working household. We found the four neighborhood types each have a disproportionate mix in all six regions with some regions having less choice by neighborhood type than others. If each neighborhood type is to accommodate households of all sizes and incomes, some neighborhoods may need a greater variety of multi-family buildings and other communities need to find a way to provide affordable single family housing in compact urban and inner suburban areas served by frequent transit. If larger households are to look for an affordable housing/transportation trade-off in Above Avg. H&T and Above Avg. H neighborhoods, there needs to be a greater availability of larger units. For instance, in Chicago, only 33% of the units in the Above Avg. H&T neighborhoods are single family. Conversely, households looking for smaller units in Below Avg. H&T neighborhoods in Atlanta would have a difficult time since 83% of units in these neighborhoods are single family detached.

Table 26

Percent of Single Family Detached Units by H+T Neighborhood Type

Region	Below Avg. H&T	Above Avg. H	Above Avg. H&T	Above Avg. T
Atlanta	83%	39%	51%	79%
Chicago	65%	25%	33%	70%
Denver	79%	32%	50%	75%
Los Angeles	70%	34%	42%	68%
Pittsburgh	79%	48%	55%	75%
Portland	75%	46%	55%	72%
Wtg. Average	**75%**	**33%**	**45%**	**69%**

In sum, the trade-off made by working households to live near work or have affordable transportation likely comes with a trade-off in housing quality. They are paying more for housing units that are older, and possibly in poor condition, and have less space. They also have fewer choices for single family units. While mild overcrowding may not be a problem for many households, it is serious in situations where overcrowding makes it difficult for workers, care givers, students or other occupants to sleep or where overcrowding causes safety or other health hazards. Older units can also have health and safety issues, such as exposure to lead paint, asbestos, and pests, and inadequate or unsafe heating and cooling systems. These hazards may be higher in areas that have seen little recent investment, e.g. the Above Avg. H&T neighborhoods.

Transportation Burdens

To see how the commutes of workers varied across neighborhood type, which would indicate whether households of lower incomes are taking on an additional burden in the form of a longer commute, *in both time and distance,* we compared the weighted average one-way commute speed, commute time, and commute distance of workers in each neighborhood by mode to work.

Table 27

Worker Average Commute Time, Speed, and Distance by Neighborhood Type in 28 Metro Areas

Neighborhood Type	Weighted Avg. Time	Weighted Avg. Distance	Weighted Avg. Speed	Mode Share	% H	% T	% H+T
Below Avg. H & T (all modes)	**28.8**	**9.9**	**20.3**		**24%**	**15%**	**39%**
by Auto	27.1	9.8	20.8	93%			
by Public Transit	51.6	11.5	12.7	7%			
Above Avg. H (all modes)	**31.1**	**7.6**	**15.7**		**32%**	**15%**	**47%**
by Auto	26.7	8.0	17.9	77%			
by Public Transit	45.9	6.2	8.5	23%			
Above Avg. H & T (all modes)	**29.4**	**8.9**	**18.7**		**34%**	**25%**	**59%**
by Auto	26.8	9.0	19.8	89%			
by Public Transit	50.4	7.7	10.0	11%			
Above Avg. T (all modes)	**29.4**	**12.3**	**24.0**		**26%**	**23%**	**49%**
by Auto	28.4	12.1	24.1	97%			
by Public Transit	64.4	18.9	17.4	3%			
All Neighborhoods (all modes)	**29.4**	**9.8**	**20.0**				
by Auto	27.3	9.9	21.0	91%			
by Public Transit	49.9	9.0	10.7	9%			

- On average, the Below Avg. H&T neighborhoods have the lowest *commute time*, but not the fastest speeds or the shortest distances. In comparison to household transportation costs, we found that these households are paying more for ***total*** transportation costs, despite the shorter commute **time**. This is due to the physical characteristics of these neighborhoods. Even though these households have a shorter time to work, they are located in areas where they likely need to use an auto for most of their other trips besides their commute. As such, these other trips add to their total household transportation costs, e.g. through multiple vehicles, more daily trips, and more miles each year, as shown in the cluster results for higher income households in Table 6—these household made the greatest number of trips and owned more vehicles. The shorter commute time does not save them money, except for the value of their time. Yet, relative to their higher incomes, households in these neighborhoods still spend a lower share on transportation than the households in the other neighborhood types.

- In contrast, the Above Avg. T neighborhoods have the longest commute *times* and *distances* by both auto and public transit. They also have the lowest share of public transit users. The longer distances and the lack of public transit options contribute to the high transportation costs in these areas. As a share of income, these households spend 23% on just transportation. The lower priced housing trade-off in these neighborhoods comes at a price as longer distances contribute to much higher transportation costs in these areas. Longer distances require more gas and add to the wear and tear on a car. A very low percentage of households are using transit in these neighborhoods, and to do so they spend an average of 64 minutes one way.

- The lower income households in the Above Avg. H&T neighborhoods have relatively short distances to travel, but their times are not significantly shorter than the two suburban

neighborhood types with longer distances. This is probably due to the higher percentage of public transit users, and the slower speed of some transit compared to auto travel. It's also an indication of congestion as well as slower speed limits and more stops and intersections on surface streets in urban and most inner-suburban areas. In terms of burdens, the commute is one of the few areas in which these neighborhoods are not the worse off. However, 11% of households in these neighborhoods do commute by public transit for an average of 50.4 minutes to go 7.7 miles. This is better slower than the rate of public transit travel in the Above Avg. T and Below Avg. H&T neighborhoods and there are more households in the Above Avg. H&T neighborhoods taking transit. Given the higher rate of public transit users in these neighborhoods, and the lower incomes, steps should be taken to improve the quality of the transit service.

- Households in Above Avg. H neighborhoods may have the best commute situation in terms of costs, distance, and time. By auto, they are nearly tied for the shortest commute times and they have the shortest distances. By transit, they have both the shortest commute times and the shortest distances. The shorter distances means a higher percentage of workers in these neighborhoods can also bike or walk. In these six regions, 5.6% of workers commuted by walking or biking in this neighborhood type, the highest percentage of all three types. The other types ranged from 1.7% in Below Avg. H&T to 4.8% in Above Avg. H&T. This neighborhood type also has the lowest combined housing and transportation costs, 47%. Costs are lower due to shorter distances, and therefore fewer miles and lower gasoline use, and because trips can be made by transit, walking, or biking instead of auto.

We also looked at the time workers leave for work as another possible indication of commute burden. In each of the six regions, the Above Avg. T and Above Avg. H&T neighborhoods had the greatest share of workers leaving before 6:00 am Despite there being some workers who may enjoy getting an early start, there are probably many more who are not able to maintain a daily schedule of rising by 4:00 am or 5:00 am in order to be on the road by 6:00 am while also getting enough sleep, especially workers with children or aging parents to care for.

Table 28

Percentage of Workers Leaving Home before 6 a.m. by H+T Neighborhood Type

Region	Below Avg. H&T	Above Avg. H	Above Avg. H&T	Above Avg. T
Atlanta	26%	20%	32%	35%
Chicago	29%	27%	34%	36%
Denver	28%	26%	36%	36%
Los Angeles	27%	25%	37%	39%
Pittsburgh	27%	23%	29%	34%
Portland	27%	24%	33%	35%
Wtd. Average	**26%**	**22%**	**31%**	**33%**

In sum, we found commute characteristics are highly associated with neighborhood type which also means they're associated with income. The households with the shortest commute times are those in the higher income neighborhood types, Below Avg. H&T and Above Avg. H plus the neighborhood type with the lowest incomes, Above Avg. H&T. On this measure—commute burden—lower income households in Above Avg. H&T do not take on a higher burden in terms of time or distance when commuting by auto, but they do have a high commute time by transit experienced by 11% of workers. The households with the worst commute burden are the predominantly moderate income households in Above Avg. T neighborhoods. They have the longest commute times and greatest distances by both auto and transit resulting very high transportation costs, whether measured by time or price. They also have the least amount of transportation choice.

The following table shows the commute time, distance and speed by mode for each metro area.

Table 29

Commuting Characteristics by Metro Area
(Interpretation of CTPP 2000)

	Auto Commuters				Public Transit Commuters			
Region	**% of Workers**	**Avg. Distance** (Miles)	**Avg. Time** (Minutes)	**Avg. Speed** (Miles/Hr)	**% of Workers**	**Avg. Distance** (Miles)	**Avg. Time** (Minutes)	**Avg. Speed** (Miles/Hr)
Anchorage, AK MSA	95%	6.4	17.9	20.4	5%	4.2	34.1	8.8
Atlanta, GA MSA	95%	11.5	30.7	22.0	5%	8.9	52.6	12.1
Baltimore, MD PMSA	89%	10.8	28.7	21.7	11%	9.2	52.9	10.7
Boston, MA CMSA	86%	9.8	26.7	20.5	14%	7.9	44.5	10.0
Chicago, IL CMSA	85%	9.8	29.2	19.5	15%	11.3	50.8	13.0
Cincinnati, OH CMSA	95%	9.0	24.0	21.4	5%	6.3	39.0	10.9
Cleveland, OH CMSA	94%	8.7	23.4	21.2	6%	6.8	43.7	10.7
Dallas, TX CMSA	97%	10.5	27.3	22.3	3%	8.6	50.3	12.3
Denver, CO CMSA	93%	8.7	25.1	20.1	7%	8.1	42.8	11.7
Detroit, MI CMSA	96%	10.3	26.1	22.7	4%	6.9	48.5	10.7
Honolulu, HI MSA	85%	7.8	26.8	17.3	15%	7.1	45.8	9.7
Houston, TX CMSA	95%	10.9	28.4	22.3	5%	10.6	51.3	13.8
Kansas City, MO-KS MSA	97%	9.5	22.8	23.8	3%	5.6	40.6	10.0
Los Angeles, CA CMSA	92%	10.7	28.7	21.4	8%	8.7	51.1	11.1
Miami, FL CMSA	94%	8.8	28.3	18.4	6%	7.6	52.0	10.4
Milwaukee, WI CMSA	93%	8.4	21.6	22.0	7%	5.5	40.7	9.1
Minneapolis, MN MSA	93%	9.8	23.4	23.8	7%	6.7	36.4	11.3
New York, NY CMSA	69%	9.9	28.9	19.8	31%	9.2	53.2	9.9
Philadelphia, PA CMSA	87%	9.2	26.4	20.0	13%	8.7	47.8	10.7
Phoenix, AZ MSA	95%	9.5	26.1	21.7	5%	7.0	47.0	10.6
Pittsburgh, PA MSA	90%	8.4	24.8	19.7	10%	5.9	39.1	9.3
Portland, OR CMSA	91%	8.4	23.3	20.4	9%	6.1	40.8	9.5
San Diego, CA MSA	93%	9.9	24.7	23.0	7%	9.2	51.9	11.8
San Francisco, CA CMSA	86%	10.1	28.1	20.5	14%	9.3	46.3	11.4
Seatte, WA CMSA	89%	9.6	26.7	20.7	11%	8.6	45.2	11.4
St. Louis, MO MSA	96%	10.1	25.3	22.8	4%	7.2	45.5	11.2
Tampa, FL MSA	96%	8.9	25.5	20.5	4%	6.1	43.7	10.9
Washington, DC PMSA	87%	11.0	31.7	19.9	13%	8.4	46.6	10.6
28-Metro Average	**91%**	**9.5**	**26.1**	**21.1**	**9%**	**7.7**	**45.9**	**10.8**
Minimum	**69%**	**6.4**	**17.9**	**17.3**	**3%**	**4.2**	**34.1**	**8.8**
Maximum	**97%**	**11.5**	**31.7**	**23.8**	**31%**	**11.3**	**53.2**	**13.8**

Burdens on Neighborhoods and Regions

Congestion

One hypothesis of this study was whether regions with the greatest shortages of affordable housing or with the highest transportation costs or highest housing costs had higher levels of congestion. To address this question, we mapped the commute speeds by neighborhood for ten regions in comparison to average daily traffic levels on major roads. Placing these maps along side the Housing/Transportation trade-off map created for each of the ten regions shows a strong relationship between congestion and the presence or absence of jobs and affordable housing.

The San Francisco region maps are shown below and the remaining nine regions are at the end of Appendix B.

The Bay Area has the most expensive housing market in the country. It also stands out in that nearly half of its jobs are concentrated in employment centers and 42% of the population lives near these centers. However, as the Housing/Transportation trade-off map on the right shows, the households near these employment centers are generally higher income—the white areas on the map. Looking at these same areas on the congestion map (map on the left), shows these areas also have the slowest commute speeds and that they line the highways leading to the employment centers. In contrast, the areas that have the highest commute speeds are generally the same areas as the Above Avg. H&T and the Above Avg. T neighborhoods —the red and gray areas on the Housing/Transportation trade-off map. The higher speeds in the low and moderate income areas indicate a worker living in one of these neighborhoods is able to begin the commute at a higher rate of travel, because there are lower levels of traffic since few workers are coming into these areas, but probably encounters congestion on the latter part of their commute once the worker reaches the congested highways and roads near the centers.

The percentage of workers that are commuting out of the place where they live in order to access work is highest for the Above Avg. T neighborhoods and typically lowest for the Above Avg. H neighborhoods. However, across the eight regions, this varies. Atlanta has low percentages of households in all four neighborhood types that can live and work in the same place whereas Chicago, Dallas and Portland have more than half their workers in Above Avg. H and Above Avg. H&T neighborhoods that live and work in the same place.

Table 30

Percent of Workers that Work and Live in Same Place by H+T Neighborhood Type

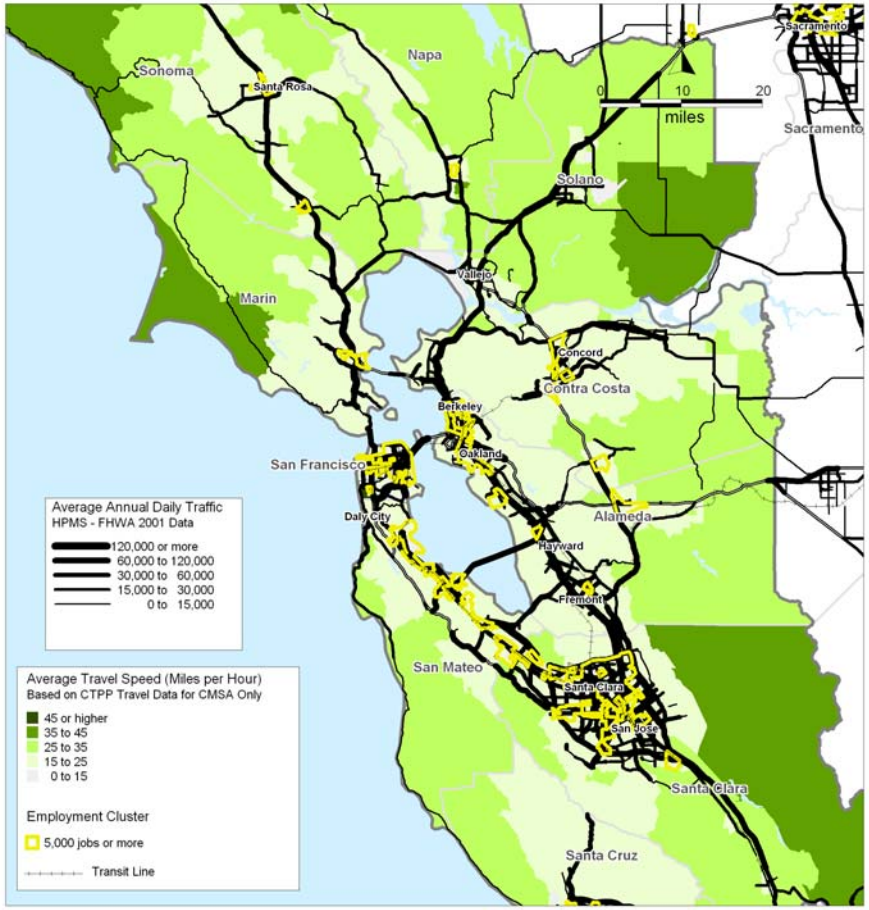
Region	Below Avg. H&T	Above Avg. H	Above Avg. H&T	Above Avg. T
Atlanta	23%	33%	35%	21%
Chicago	31%	61%	55%	25%
Denver	30%	48%	41%	27%
Los Angeles	29%	41%	38%	29%
Pittsburgh	22%	44%	34%	14%
Portland	37%	53%	50%	33%
Dallas	41%	58%	57%	38%
San Francisco	35%	45%	35%	30%
Wtd. Average	**30%**	**48%**	**43%**	**27%**

The impact on the higher income neighborhoods near employment centers is heavy traffic, possibly worse air quality, and longer times to work despite the ability to locate closer to work. The impact on the region as more households either commute to concentrated centers surrounded by higher priced housing, or to places around the region but outside the place they live, is clogged and congested major roads that require higher levels of maintenance, traffic safety and enforcement, and capital improvements.

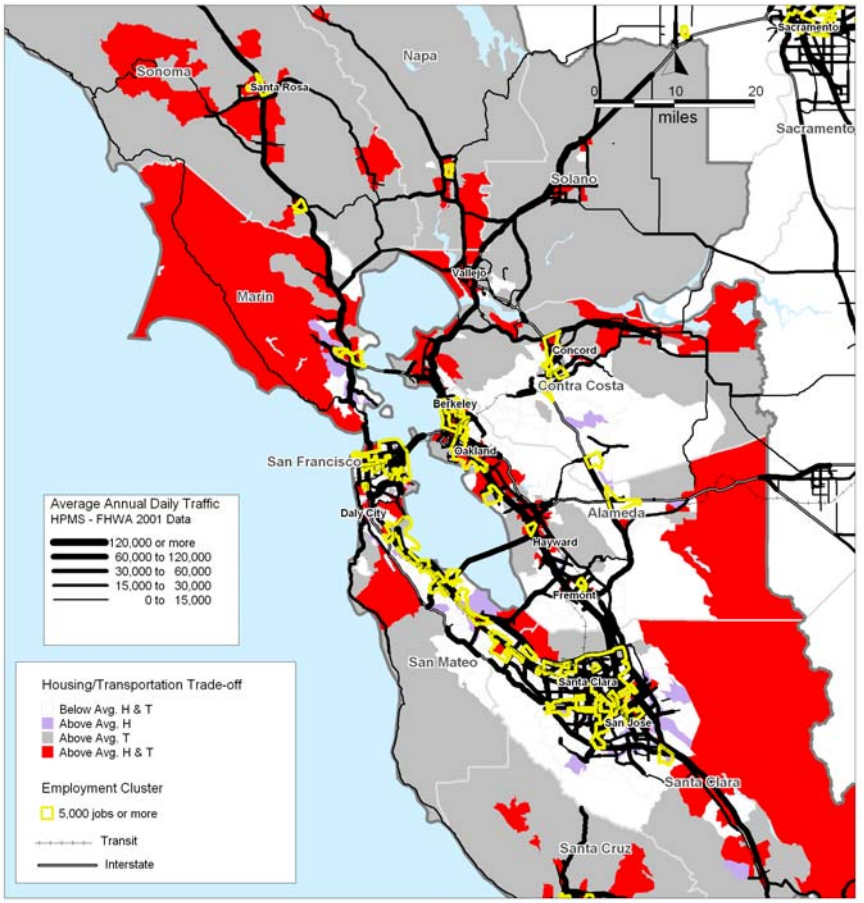
H+T Neighborhood Types compared to highway congestion, commute speeds, and employment centers

Figures 8 and 9 *(Additional comparison maps for 9 other regions are in Appendix B)*

San Francisco: Travel Speed in Relation to Average Annual Daily Traffic



San Francisco: Average Household Expenditures on Housing and Transportation as a Percentage of Average Tract Income, 2000 in Relation to Average Annual Daily Traffic



Trends 1990 to 2000

To obtain a sense of whether the patterns we have identified as of 2000 are different than they were in 1990 and therefore might change again, stay the same, or worsen by 2010, we looked at some of the contributing factors to housing and transportation costs in both 1990 and 2000.

The CES surveys indicate from 1990 to 2000 housing and transportation costs rose for most households in the 28 regions at a faster rate than incomes. From 1990 to 2000 the combined costs rose from 41.7% of median income to 52.4%, a 26% increase, while the percentage change in incomes of the surveyed households was 0.3% (adjusted for inflation). The 26% increase in expenditures was during the same period that median incomes, according to the Census, only rose by 4%, on average for all 28 regions. In eight of the regions real incomes dropped. Four regions experienced median income growth greater than 10%; San Francisco, Minneapolis-St. Paul, Portland, OR, and Denver, CO. (See Table A2, Appendix A for 1990 and 2000 Median Income comparisons from the Census by region). While the Census shows more favorable increases in median income than the income growth that was reported in the CES, a 4% increase in income on average is still much less than a 26% increase in household expenditures. Using either measure of income in comparison to the rise in expenditures, suggests expenditures rose faster than incomes during this time period for most households in the majority of the 28 regions.

For eight regions, we compare census tracts that maintained the same boundaries from 1990 to 2000 in eight of the metro regions; San Francisco, Portland, Los Angeles, Denver, Dallas, Chicago, Pittsburgh, and Atlanta. This limits our cases to mostly urban and non-growing areas since tracts that change boundaries between the decennial census are those tracts in which the population has grown beyond the typical tract population.

With costs rising faster than incomes, working households are in the best situation if they are in neighborhoods where housing and transportation are more affordable. Their costs are also likely to be lower if they work and live in the same place or an adjoining place. However, from 1990 to 2000 the greatest growth by neighborhood type in Atlanta, Chicago, Portland, and San Francisco was in the Above Avg. T neighborhoods, places in which this study has shown lower income households have a higher combined burden since they require higher rates of auto ownership and more auto use on a daily basis. At the same time, these neighborhoods had a decline in the percentage of workers in these areas that worked and lived in the same place. As more workers move to these areas for housing, more of them commute somewhere else for work. Table 30 shows the actual growth in households from 1990 to 2000 in the eight regions by neighborhood type. It's interesting to note that Los Angeles, a region more typically known for sprawl had the greatest growth in Above Avg. H neighborhoods. However, they had drops in all four areas in terms of the percentage of workers working and living in the same place.

In Atlanta, Chicago, Denver, Pittsburgh, and Portland, there was an increase in the percentage of households in Above Avg. H neighborhoods who work and live in the same place. These are all

regions with revitalized downtown and transit systems in their central cities and inner-ring suburbs.

In Dallas and San Francisco, only the Above Avg. T neighborhoods had an increase in workers working and living in the same place. This increase could represent an increase in the number of job opportunities in these types of neighborhoods with higher rates of housing growth.

Table 31

Growth in Households and Jobs 1990 - 2000 for Eight Regions Compared to H+T Neighborhood Types

	Growth in Households								
Neighborhood Type	Atlanta	Chicago	Denver	Los Angeles	Pittsburgh	Portland	San Francisco	Dallas	8 Regions
Below Avg H & T	39%	11%	23%	3%	7%	15%	8%	33%	11%
Above Avg. H	23%	7%	17%	7%	6%	13%	10%	19%	10%
Above Avg H & T	10%	1%	14%	4%	-2%	9%	7%	10%	6%
Above Avg. T	47%	13%	20%	6%	3%	20%	11%	19%	13%
	Change in Percent of Workers Working in Same Place They Live 1990 - 2000								
Below Avg H & T	-10%	-9%	-7%	-14%	-11%	-1%	-4%	-2%	-4%
Above Avg. H	5%	13%	11%	-1%	1%	7%	-4%	-8%	-8%
Above Avg H & T	-11%	-2%	-3%	-8%	-19%	7%	-7%	-11%	-10%
Above Avg. T	-18%	-19%	-13%	-16%	-19%	-15%	9%	1%	-5%

In contrast to the growth in some neighborhoods, the Above Average H&T neighborhoods were the slowest growing in all regions except for Los Angeles. In Pittsburgh, these neighborhoods actually declined by 2%. These numbers seem to represent the continued decline in these neighborhoods of predominantly lower income households and places with declining job bases and high rates of poverty.

Summary of impact on regions

The impact of these trends on regions is that a significant share of low income households, more than 12 million in the 28 regions, are living in places with little new investment, high rates of poverty and unemployment, low educational attainment levels, and little disposable income, after paying for housing and transportation, to put toward education, savings, health care, other necessities, and wealth creating assets.

At the same time a growing share of households are moving to places that are not only away from jobs but that lack existing infrastructure, including roads, sewers, schools, and services. Household growth in these areas, especially targeted to moderate income households that will little income left after paying for the increased transportation costs, cause higher costs for municipalities, regions and states. Local governments attempt to recover their costs through impact fees and new taxes, but the fees are often not enough and their residents do not necessarily have enough income to pay for the added housing and transportation costs, additional taxes, and the wealth creating assets mentioned above; savings for retirement, education, and healthcare. Though poverty and unemployment rates were lower in these neighborhoods, so were educational attainment levels.

6. Summary of Findings

The following points summarize our primary findings. In general, we identified a combination of forces—high income households wanting to live close to suburban job centers; limited affordable units in suburban areas; low transit availability in exurban areas; high income households in urban areas supporting high housing prices in the most accessible locations; moderate income households seeking higher quality and bigger homes being forced to look to places that are 30 miles from the central city; and a lack of employment centers in lower income areas—that combine to leave working households either stretched to afford the housing and/or transportation near jobs; pushed to exurbs in search of higher quality or more spacious housing that they can afford; or left behind in neighborhoods with lower quality housing, concentrated poverty, high unemployment rates, and low accessibility to jobs and daily necessities.

Trade-offs by Income, Place and Tenure

Because households generally live in neighborhoods they are able to afford, neighborhoods are highly segregated by income. In high income neighborhoods, home prices remain high because households have the incomes to afford them and supply matches demand. These neighborhoods are mostly suburban and also have high absolute transportation costs because land uses generally do not support non-auto modes. In low income neighborhoods, low income households have lower costs than if they were to locate in a high income neighborhood, but their costs burdens as a percentage of income are still above regional averages due to lower income levels:

- For households earning $20,000 to less than $50,000, their average combined expenditures on housing and transportation are lowest in Above Avg. H neighborhoods and Above Avg. H&T neighborhoods, the two lower income neighborhood types, but their combined expenditures, from 43% to 62% of income (see Figure 5), are still higher than combined housing and transportation expenditures for households earning $50,000 or more.

Combined costs by neighborhood type vary by tenure:

- As of 2000, combined housing and transportation costs as a percentage of income were *lowest* for **renters** of all income categories, in the Above Avg. H neighborhood type. These neighborhoods provide the greatest mix of housing units and prices, as well as incomes, and the lowest transportation costs in absolute terms. The greater mix of housing types allows more households of various incomes to find housing that is nearby affordable transportation. However, for lower incomes, these neighborhoods often present a trade-off of higher housing prices for units that are often older, and therefore possibly in poor condition, and smaller in exchange for low transportation costs. Housing ownership by lower income households in these neighborhoods is often out of reach but renting in these neighborhoods can be the most affordable in terms of combined housing and transportation expenditures.

- For owners earning less than $50,000, the difference in expenditures on H alone and H+T across neighborhood types is different from renters because of the location and supply of rental units and affordable ownership units. Owner households in the three income brackets below $50,000 have the lowest H expenditure in the Above Avg. T neighborhoods, which demonstrates the reason more households in this income group are moving to outer suburban and exurban areas to purchase a lower-priced home, but these areas do not have the lowest combined costs. Therefore, for owner households earning more than $20,000, the combined H+T costs are most affordable in the Above Avg. H&T neighborhoods. (The name of this neighborhood does not indicate this affordability because the majority of households in these neighborhoods are lower income renters and their costs are high as a percentage of income.)

What Determines the Burden

Identifying the pattern of housing and transportation cost trade-offs for working families at the neighborhood level for entire regions helps to identify the key factors that contribute to these costs. One major factor is the location of a neighborhood in relation to employment centers and all jobs.

- Total combined housing and transportation costs increase with commute distance even though housing prices ultimately decrease at the greatest distance. This is due to high transportation costs. In the Above Avg. T neighborhoods, of which 90% are away from employment centers, and on average are 31 miles from the nearest central city, transportation costs are by far the highest leading to the highest combined H+T costs.

- Expenditures on housing are higher in more densely-developed areas that are within close proximity to jobs, and with higher degrees of traffic congestion while expenditures on transportation are lower.

Expenditures on housing are lower in areas with a larger supply of affordable housing units. We find that increases in the percent of units affordable to working families locally are associated with large reductions in housing costs. Among all factors influencing housing costs, affordable housing supply has an impact that is second in magnitude only to the median household income of the census tract. In 23 of 28 metro areas local concentrations of affordable housing units is associated with declining housing and transportation cost burdens.

Regions categorized as Medium Housing/Medium Transportation, due to moderate to high shortages of affordable housing, and fewer places with affordable transportation options, appear most often in the most expensive rankings for each of the working household income bins. In these regions there are not enough instances to make a trade-off between affordable housing or affordable transportation for low to moderate incomes and therefore they are most often saddled with both costs in the medium range which results in a combined cost that is high, e.g. **(Med. H + Med. T = High H+T).**

Impacts on Regions and Neighborhoods

As home prices increase in Below Avg. H&T and Above Avg. H neighborhoods, and housing choices remain limited in Above Avg. H&T neighborhoods, moderate income households are increasingly moving to Above Avg. T neighborhoods. In eight regions where we studied growth by neighborhood type, Above Avg. T neighborhoods grew by 13% from 1990 to 2000 compared to Above Avg. H&T neighborhoods, which grew by 6% overall and declined in Pittsburgh. As neighborhoods of this type grow in terms of households faster than they grow in number of jobs, the households in these neighborhoods not only take on high combined, but also contribute to congestion within the region since they must drive greater distances to access jobs. Transit is rarely available in these areas.

As jobs and employment centers in many regions cluster primarily near highly educated households in higher income suburbs that are unaffordable to lower income households, congestion is worse in the high income employment center areas and low income neighborhoods are left in decline with little investment or opportunity. Residents in Above Avg. H&T neighborhoods—lower income areas with less access to employment—make up 26% of households in the 28 metros and are more likely to have lower educational attainment levels, lower earnings, higher rates of poverty, and higher rates of unemployment.

7. Recommendations

Our findings suggest four major policies:

I. Policies for workforce housing must be paired with policies that both support and improve workforce transportation and with policies to promote better planning of the location and distribution of employment and job centers within regions. Workforce transportation would mean major improvements to the frequency, extent, and capacity of public transit in all regions. Communities would need to be developed and redeveloped in ways that can support transit to and from the employment centers and within communities; this would go a long way toward ensuring that workforce transportation becomes a reality and so households could save money and congestion in regions would be reduced. Targeting employment to areas that already house a substantial number of working families would also highly benefit working households as well as regions by helping these neighborhoods with high rates of unemployment and low educational attainment levels. This was the intent of the Enterprise Zones and Empowerment Zones in the 1990s, many of which still offer businesses tax credits and sales and income tax exemptions for locating in disinvested areas today. Workforce transportation is important for high transportation cost regions such as Dallas, Houston, Detroit, and Tampa. Workers in these regions are taking on very high transportation costs with little return. But quality and reliable transit is also important for the outer suburbs in all regions. Suburb to suburb public transit is particularly important, as is continued and additional funding for programs that support the reverse commute for low and moderate income workers, e.g. Jobs Access Reverse Commute (JARC). In Chicago, the non-profit car-sharing company, I-Go has received JARC funds to allow cars in lower income neighborhoods to operate as “car-pool cars by day” and “car-share cars by night”.

II. Inclusionary zoning and mixed-income housing in employment center areas with high housing prices would allow lower income households to live near major centers of employment and may help to reduce regional congestion. This is especially important for metro areas with a high concentration of jobs within in employment centers and a high percentage of employment centers surrounded by high income neighborhoods, such as San Francisco. Our findings suggest that congestion is caused in part by dense destinations and origins and a lack of capacity for all income levels to live in these major work destinations. As high income households occupy the majority of neighborhoods near employment centers, lower income households are forced to drive further distances to access the employment clusters because they can’t afford to live near them. This increases their transportation costs and contributes to the congestion on highways and roads serving those centers.

III. Targeted job development in low income neighborhoods in central cities and inner-ring suburbs, the Above Average H&T neighborhoods, would help to raise the incomes of the households living there and eventually attract more households back to these neighborhoods. In the long term it would also help to reduce regional transportation costs and congestion. Without incentives, employers will

likely continue to follow the high income households and abandon or overlook the low income neighborhoods. This policy applies to all metro areas since every region has high concentrations of Above Average H&T neighborhoods. It could be especially helpful for regions with weak central cities, such as Detroit and St. Louis.

IV. Household transportation costs need to be communicated to consumers, policy makers, and planners. Consumers can use the information to make location decisions before they make choices on housing costs alone. Local government planners and policy makers can use the modeled transportation costs to adjust zoning so that commercial and industrial land uses can be proximate to affordable transportation and housing. This will allow some of the many daily household trips to be made on foot or by transit rather than by auto. MPO and State planning staff can use transportation cost maps to plan new transit lines and stations, and compare them to highway options and areas that are targeted for housing growth. Savings to households and communities from reduced congestion could be used as justification for greater expenditures on public transit and community planning. This is another policy that applies to all regions but is especially important to sprawling regions with little or not transit.