HOUSING AND TRANSPORTATION AFFORDABILITY INITIATIVE

UNDERSTANDING THE COMBINED COST OF HOUSING AND TRANSPORTATION

The Impact of Transportation on Affordability:

LAI Auto Cost Research Synthesized

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Contents

As reported by the Consumer Expenditure Survey (CES), transportation costs are the second largest household expenditure after housing. HUD's Location Affordability Index (LAI) estimates household transportation costs, comprised of auto ownership, auto use, and transit use, based on a home's location. The largest single transportation expense is the cost of auto ownership. During development of the LAI, research was conducted to capture the most accurate and appropriate cost factors of auto ownership to use in the Index.

Auto Ownership Cost Sources

Several private companies, including the American Automobile Association (AAA), Edmunds.com, Kelly Blue Book, and Consumer Reports, release estimates of the annual cost of owning and operating a vehicle. Typically these estimates focus on how costs vary for different types of vehicles, rather than how household characteristics affect ownership costs.

Your Driving Costs, produced by AAA, is one of the most widely used measures of costs for owning and operating a vehicle. It is employed by government agencies, industry experts, and transportation consultants. It is based on amortized purchase costs for the first five years of a newly purchased auto and includes per mile costs for maintenance, repairs, and fuel. In 2012, AAA's *Your Driving Costs* put average auto costs at 59.6 cents per mile or, based on annual vehicle miles traveled (VMT) of 15,000, $8,946 per year.[1]

Edmunds.com's *True Cost to Own*® (TCO®) is a proprietary model that helps to approximate the total cost of buying and owning a vehicle over a five year time period based on the vehicle's make, model, year, and style. Similar to AAA, costs are based on an annual VMT of 15,000. TCO's estimate includes: depreciation, interest on financing, taxes and fees, insurance premiums, fuel, maintenance, repairs and any federal tax credit that may be available.[2]

The Internal Revenue Service (IRS) and the Bureau of Labor Statistics (BLS) are two frequently cited government sources for information on household transportation costs. IRS standards for deductions related to transportation include the standard mileage rate, vehicle depreciation limits, and allowable living expenses. The standard mileage rate is provided for taxpayers to use when computing the deductible costs of operating an automobile for business, charitable, medical, or moving purposes. An independent contractor is hired annually by the IRS to study the fixed and variable costs of operating a vehicle to determine the standard mileage rate. In 2012 the standard mileage rate for business use was 56.5 cents per mile, 23 cents of which is treated as depreciation.[3]

Allowable living expense standards, also known as collection financial standards, are used to determine the ability of a taxpayer to pay a delinquent tax liability. With respect to

[1] http://newsroom.aaa.com/2012/04/cost-of-owning-and-operating-vehicle-in-u-s-increased-1-9-percent-according-to-aaa%E2%80%99s-2012-%E2%80%98your-driving-costs%E2%80%99-study/

[2] http://www.edmunds.com/tco.html

[3] http://www.irs.gov/pub/irs-drop/n-12-01.pdf

transportation, there are three components: monthly ownership costs (nationwide figures for monthly loan and lease payments), monthly operating costs (which vary by region), and public transportation costs. Ownership costs are the lesser of the monthly payment on the lease or car loan, or $517.[4] Operating costs are the lesser of actual spending or a regionally-defined amount. Auto use costs include maintenance, repairs, insurance, fuel, registrations, licenses, inspections, parking, and tolls.[5]

The BLS Consumer Expenditure Survey (CES) collects information on the buying habits of US consumers and consists of two different types of surveys: the Quarterly Interview Survey and the Diary Survey. It includes data on expenditures, income, and household characteristics. Information is collected on all spending including food, housing, apparel and services, transportation, entertainment, and out-of-pocket health care costs including insurance premiums. The BLS CES also provides household expenditures for auto ownership and use, aggregated to household incomes and sizes. However, to obtain the per auto cost measures required for use in the LAI further research of the micro data is required.

The CES helps inform the Consumer Price Index (CPI), which measures the change in the price level of consumer goods and services, and is another government source for information on the cost of household transportation.

An additional federal resource related to household spending and finances is the Federal Reserve's Survey of Consumer Finances (SCF), a triennial cross-sectional survey that includes information on families' balance sheets, pensions, income, and demographic characteristics. However, data collected on autos is focused more on valuing assets as opposed to assessing the full cost of ownership.

Specific Research Needs for the LAI

In determining the most favorable source to use for the LAI, several factors were considered, including the following:

1. The use of federally sourced data was prioritized by HUD and DOT;
2. As the LAI is intended to provide information on the predictive costs of housing and transportation in a given location for eight representative household of widely varying incomes, a single cost measure would not be practical for use for all household types; and
3. Auto costs needed to reflect costs likely to be encountered by a wide range of household types since one of the major purposes of the LAI is to provide useful information for budgeting purposes.

Given these parameters, the CES was selected for use in the LAI. It is the only publicly available source of auto cost data that varies by household income and is federally sourced. Additionally, the CES includes a large dataset of autos purchased, with the year purchased, and price paid.

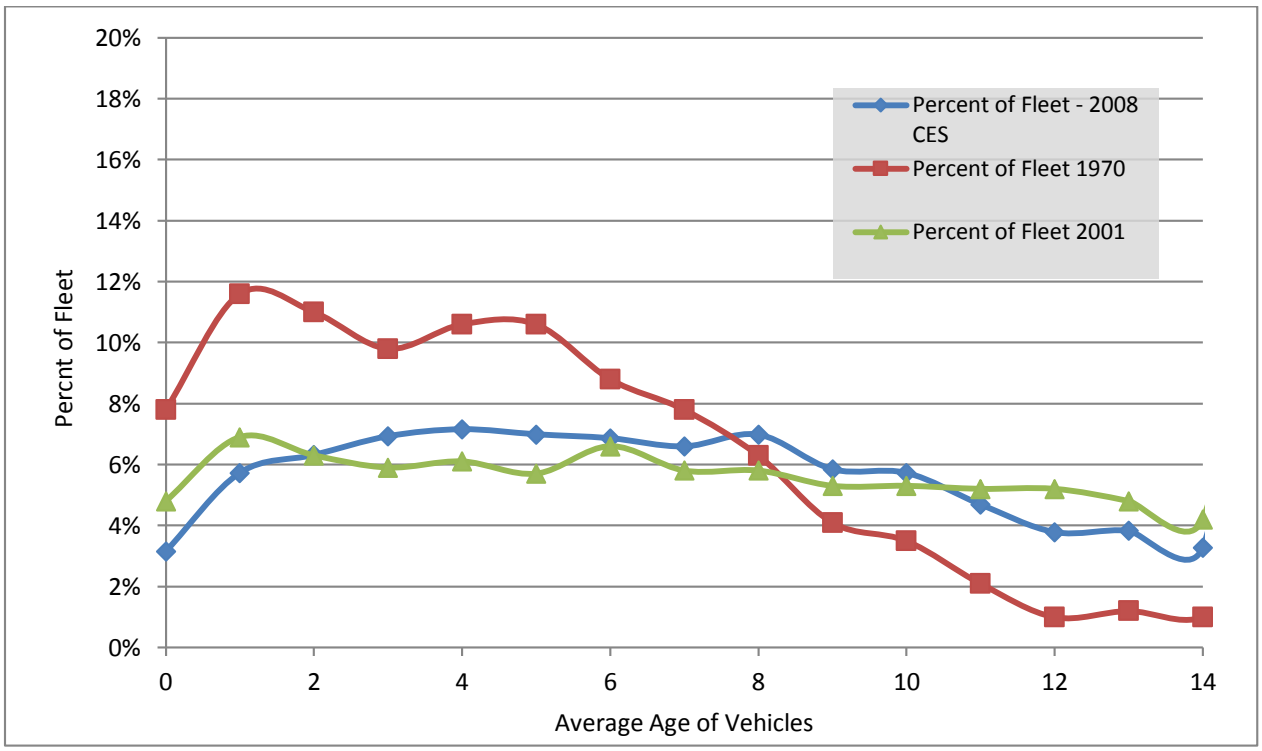
The set of purchased autos in the CES was compared to the U.S. auto fleet as whole to determine if it reflected current autos on the road. The following graph demonstrates the compatibility

[4] $1034 for two cars, though a single taxpayer is normally allowed one automobile

[5] http://www.irs.gov/Businesses/Small-Businesses-&-Self-Employed/Local-Standards:-Transportation

between the CES 2008 auto fleet mix and the U.S. auto fleet mix from 2001 and 1970, which indicates it is appropriate to draw conclusions about costs from the dataset of autos in the CES.

Figure 1: Plot of CES 2008 Fleet mix by Age of Vehicle Compared to 2001 and 1970



Although Although shows that the fleet make up has changed quite a bit from 1970, the 2008 CES Fleet looks very similar to that of 2001 – the latest data of fleet mix identified.[6]

Another consideration for using the CES data in the LAI is the need and expectation that a household should budget for reliable transportation to travel to jobs. As such, the analysis was limited to autos ten years old or newer, which is close to the age in which autos fully depreciate. This assumption is supported by programs which help low income households purchase autos. For budgeting purposes, it was also necessary to estimate an annual cost of purchase over the number of years an auto was owned using a kinked depreciation schedule.

Method and Approach

In light of the established parameters, Diane Schanzenbach, PhD and Leslie McGranahan, PhD were commissioned to conduct analysis of the 2005-10 Consumer Expenditure Survey (CES) to help determine how the CES data could be utilized for auto ownership costs in the LAI. The CES micro data provide expenditures in relation to household income for various auto ownership expenses. Expenditures from the 2005-2010 waves of the CES were analyzed and converted to inflation-adjusted 2010 dollars using the Consumer Price Index for Urban Consumers (CPI-U).

[6] From Transportation Energy Data Book, Oak Ridge National Laboratory, US-DOE
See: http://cta.ornl.gov/data/tedb32/Spreadsheets/Table3_08.xls

Their analysis produced estimates for auto ownership expenditures for five household income profiles categorized as purchase costs, fixed costs, drivability costs, and a ratio of repairs/maintenance to fuel costs.

The method for applying the auto cost figures to the LAI can be found on page 16 of the LAI Methods available on the Location Affordability Portal (LAP).[7]

While these costs in the LAI represent averages, the LAI's companion tool, My Transportation Cost Calculator (MTCC), allows individuals to input their own transportation expenditures to estimate costs for various locations.

The following selected excerpts from the CES analysis[8] provides insight on the final auto cost measures applied to the LAI.

Expected Spending

Expenditures are broken into four main categories: purchasing, ownership (i.e., insurance, registration and taxes), drivability (i.e., maintenance and repairs), and fuel costs. When average spending on these categories is calculated, the average includes zeroes for any individuals who fail to purchase items in any given category. Using insurance as an example: only 86 percent of households that own a vehicle report any annual spending on insurance. Including the 14 percent of households that report zero spending, the average amount spent per vehicle is $573. Conditional on some positive spending on insurance, however, the average amount spent annually is $667 per vehicle. When a household considers the expected cost of owning and operating a car, it should plan on purchasing insurance.

Expected spending is predicted for each category. For ownership costs, this includes actual average spending on registration, taxes, audio and video equipment plus the average cost of insurance conditional on its purchase. For drivability cost, this includes average spending on inspection, licensing, maintenance and repairs conditional on some positive spending in this category. Note that over 95 percent of households report some positive spending for drivability costs. Finally, fuel costs are presented overall and conditional on positive spending. Almost all households report some positive spending on fuel.

Income group number	Income Range (2010 dollars) (1)	Percent of Total Households (2)	Average Income in Range (3)	Percent of All Vehicle Owners (4)
1	<$20,000	20.7	$10,846	15.3
2	$20,000 - $39,999	22.2	$29,600	22.0
3	$40,000 - $59,999	16.7	$49,374	17.9
4	$50,000 - $99,999	21.0	$77,463	23.2
5	>=$100,000	19.4	$167,997	21.7

[7] Available at http://locationaffordability.info/LAPMethods.pdf.

[8] **Additional Analysis of Auto Costs.** Diane Whitmore Schanzenbach, Ph.D., Northwestern University; Leslie McGranahan, Ph.D. July 25, 2013.

Table 1: Actual and Expected Spending by Income Group (includes all households with at least one vehicle)

	Ownership Costs			Drivability Costs			Fuel Costs			
Income group number	Actual Expenses (1)	Expected Expenses (2)	% with positive spending (3)	Actual Expenses (4)	Expected Expenses (5)	% with positive spending (6)	Actual Expenses (7)	Expected Expenses (8)	% with positive spending (9)	Number of vehicles (10)
1	$513.8	$657.3	76.7%	$360.1	$400.8	89.7%	$1,168.4	$1,182.0	98.8%	1.4
2	$625.3	$732.0	83.7%	$395.9	$421.1	94.0%	$1,365.3	$1,369.5	99.7%	1.6
3	$668.8	$755.6	87.2%	$440.3	$458.8	95.8%	$1,491.7	$1,494.2	99.8%	1.9
4	$691.0	$758.6	89.7%	$464.6	$477.6	97.3%	$1,551.1	$1,552.8	99.9%	2.2
5	$761.2	$836.6	89.4%	$582.4	$593.1	98.2%	$1,634.8	$1,635.6	99.9%	2.5
Overall average	$659.2	$752.5	86.0%	$452.8	$474.5	95.4%	$1,456.5	$1,460.9	99.7%	1.9

5

Flow Costs of Auto Ownership

A consumption-based approach to expenditures on car purchases only captures outlays when they originally occur. For example, if a family were to purchase a $20,000 car in the year 2010 and finance it at a 5 percent interest rate over five years, this measure would capture a $20,000 expense in the year 2010, and only the interest charges on the loan in the subsequent years. This method of accounting for expenditures fails to capture the flow cost of auto ownership. In particular, the flow cost of auto ownership should reflect the fact that a car's value depreciates over time, i.e., a car is worth less and less over time as it ages. Conceptually, it may also be appropriate to include the opportunity cost of holding a physical asset instead of having an equivalent amount of cash in an interest-bearing account. The tabulations below omit this opportunity cost because it is small when the risk-free interest rate is low, as was the case in the time period covered in the analysis conducted by Schanzenbach and McGranahan.

Three approaches to depreciating the value of an auto are taken: straight line, constant rate, and kinked. Straight-line depreciation assumes that the car loses 10 percent of its new-car value every year, and has no further value after 10 years. Constant rate depreciation assumes that a car loses a specified percentage of its current value every year. The depreciation rate assumed is 15.35 percent. After 10 years, approximately 20 percent of the car's initial value is retained and can considered "scrap value." Finally, the kinked-line depreciation approach which calculates the average sales price of a given make and model year car both when new and when sold on the used car market at different ages. When a line is fit to the average depreciation amount, what best fits the data is a 19 percent decline in value in the first year, an 8 percent decline off of initial price from years two through eight, and a 4 percent decline in years nine through twelve. The flow value is the loss in value of the vehicle in a given year.

There are 240,623 vehicles in the CES data sample covering 2006-2010. The flow cost of ownership is only calculated for cars owned that are 10 years old or newer in these years. This restriction reduces the sample size to 143,572. To estimate these flow cost models using the CES, the value of the car when it was new must be estimated with the data however this information is not directly available for many cars. To assign the value when new, the average value when new is calculated for every make and model year for all cars from 1996 to 2010. This average is assigned to all cars of that make and model year, regardless of whether the purchase price is directly observed for the particular automobile. The vast majority (86 percent) of cars can be assigned to a purchase price in this manner. Almost all of the remaining cases are missing information on the model of the car. One half of one percent of cases overall include data on the make and year of the car, but no value when new for a car of the same make and year is observed in the data.

The table below presents the average annual flow cost of vehicle ownership over the duration that the vehicle has been owned by the current owner. This means, if a vehicle was purchased used in year five and the car is now seven years old, the average flow cost is calculated only over years five, six and seven. The sample sizes using this approach

decline somewhat because the calculation requires information on the timing of purchase to be non-missing. This calculation includes payments for leased vehicles.

Table 2: Average Annual Per-Vehicle Flow Value of Auto Costs Since Vehicle was Purchased*

	Owned Plus Leased Vehicles		
Income Group	Constant Rate Depreciation (1)	Kinked Line Depreciation (2)	Number of Vehicles (3)
1	$2,374	$2,396	1.1
2	$2,431	$2,478	1.2
3	$2,524	$2,586	1.3
4	$2,637	$2,717	1.5
5	$3,038	$3,139	1.8
Total	$2,648	$2,717	1.5

* Households with at least one vehicle.

Table 3: Per-Vehicle Annual Average Financing Costs

Income Group	Households with at Least One Vehicle (1)
1	$73
2	$133
3	$182
4	$211
5	$201
Total	$165

To assess characteristics of the fleet of vehicles held in the CES data, the Table 4 provides information on the average age of owned cars and the average length of time the car has been owned. Columns (1) and (2) present this information for the overall sample, and columns (3) and (4) are limited to the sample of cars that is 10 years old or newer (that are used to calculate the flow value of ownership in Tables 1 through 3).

Table 4: Average Age and Duration of Auto Ownership

	Overall Sample		Cars < =10 years old	
Income Group	Age of Car (1)	Years Owned (2)	Age of Car (3)	Years Owned (4)
1	9.9	4.7	6.0	3.6
2	9.0	4.6	5.7	3.5
3	8.3	4.3	5.4	3.4
4	7.6	4.3	5.2	3.5
5	6.5	4.3	4.7	3.6
Total	8.0	4.4	5.2	3.5

** Households with at least one vehicle.*