

<sup>1</sup> **Unpacking Household Budgeting Strategies through a  
2 Transportation Lens**

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6      **Abstract**

7      This is where we will put our abstract.

8      **Plain Language Summary**

9      This is a plain language summary

10     **1 Introduction**

11     Statistics I can point out

- 12       • The amount of budget allocated to transportation is more than it used to be  
13       (**johson\_century\_2001?**) (but in recent years it might be going down. I  
14       want to double check that)
- 15       • How much does the average household spend on transportaiton? I can probably  
16       get some good data from Bureau of Transportation Statistics (2024)
- 17       • Do people with more kids spend more on transportation?
- 18       • Do people with more cars spend more on transportation?
- 19       • Lower income households spend m a bigger percent of their budget on trans-  
20       portation (transportaiton burdened) (Molloy et al., 2024)

21     Households juggle how to allocate their budgets: whether to invest in a reliable car,  
22     pay for quality childcare, secure housing in a good school district, or set money aside  
23     for leisure. These everyday choices shape how families live and move, reflecting the  
24     trade-offs they make to balance competing priorities. Transportation often sits at  
25     the center of these decisions, not only because it can be a significant expense, but  
26     also because choosing to buy and maintain a car versus relying on public transit  
27     represents a long-term commitment and a broader lifestyle choice. Its relative weight  
28     compared to housing, childcare, and other spending varies widely across families.  
29     The relationship between household budgeting and mobility is shaped not only by  
30     causal direction but also by how families prioritize and weight different needs. On  
31     one hand, mobility resources such as car ownership can structure the household  
32     budget: households with no or only one vehicle may spend far less on transportation,  
33     freeing up income for other essential or discretionary categories. On the other hand,  
34     underlying family structures and preferences can drive budget allocation choipces  
35     that, in turn, shape transportation behavior. Larger families may prioritize child-  
36     care or invest in higher-quality housing in areas with better schools, limiting what  
37     remains for transportation. Others may emphasize frugality across all categories or  
38     deliberately substitute toward lower-cost transit options. Understanding both the  
39     direction of influence and the weight assigned to different budget categories is critical  
40     for transportation planning and policy, as these dynamics reveal how families navigate  
41     competing priorities under varying demographic and mobility contexts.

42     The purpose of this research is to explore how household budgets are structured  
43     around transportation decisions and how this impacts other spending categories.  
44     Using the Consumer Expenditure Survey (CEX), we will perform a Latent Class  
45     Analysis (LCA) to find groupings based on a household's transportation expenses.  
46     These groupings can help us find groups of spenders with similar patterns to help us  
47     predict transportation expenses based on the household's characteristics.

48     **2 Literature Review**

49     Source: [Article Notebook](#)

50     Table 1 summarizes the literature that was reviewed for this study. As seen in the  
51     table, there were a total of 35 studies reviewed with 19 studies that use the consumer  
52     expenditure survey.

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
A family expenditure perspective on transport planning: Australian evidence in context	Morris & Wigan (1979)	Australian Expenditure Survey	transport takes about 017 percent of expenditures, at least part of the consumption expenditure by low income families is financed from savings, loans or other sources besides “income”.
Variable Lifespan and the Intertemporal Elasticity of Consumption	Skinner (1985)	CEX	Changes in inflation will prompt changes in consumer expenditures
A sample selection model for prepared food expenditures	Nayga (1998)	CEX	Most of the variables analysed significantly affect prepared food expenditures. For example, results suggest that frozen meals expenditures are higher for households without children, for smaller households, and for households headed by a non-white individual
Transportation Costs and Economic Opportunity Among the Poor	Blumenberg (2003)	CEX	Cost comparisons fall short of finding if transportation costs are a barrier for economic opportunity among the poor
Analysis of Variations in Vehicle Ownership Expenditures	Thakuriah & Liao (2005)	CEX	For vehicle-owning households, of every additional dollar that households spend, 18 cents is spent on vehicles after controlling for socioeconomic, demographic, life cycle, and other factors relating to households.

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
Leisure Travel Expenditure Patterns by Family Life Cycle Stages	Hong et al. (2005)	CEX	Marrieds without children are more likely to spend on leisure travel than singles, whereas single parents and solitary survivors are less likely to spend on leisure travel than singles.
Transportation Expenditures and Ability to Pay: Evidence from Consumer Expenditure Survey	Thakuriah (Vonu) & Liao (2006)	CEX	Transportation expenditures made by households are better explained by permanent income levels of households than by annual incomes.
The Effects of Ethnic Identity on Household Budget Allocation to Status Conveying Goods	Fontes & Fan (2006)	CEX	Asian Americans allocate more of their budget to housing, African Americans allocate more of their budget to apparel, and Hispanics allocate more of their budget to both housing and apparel, but to a lesser extent than Asian Americans with respect to housing and African Americans with respect to apparel.
Do Transportation and Communications Tend to be Substitutes, Complements, or Neither?: U.S. Consumer Expenditures Perspective, 1984–2002	Choo et al. (2007)	CEX	New tech doesn't substitute Personal Vehicle travel probably

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
An analysis of the determinants of children's weekend physical activity participation	Rachel B. Copperman & Bhat (2007a)	San Francisco Bay Area Travel Survey	The "number of children" variable suggests an overall higher likelihood of participation in utilitarian active travel among households with many children relative to households with few children
An analysis of the social context of children's weekend discretionary activity participation	Sener & Bhat (2007)	Panel Study of Income Dynamics (PSID)	male children more likely to participate with their fathers than female children, African-American children less likely to participate in health-enhancing active recreation pursuits
An Exploratory Analysis of Children's Daily Time-Use and Activity Patterns Using the Child Development Supplement (CDS) to the US Panel Study of Income Dynamics (PSID)	Rachel B. Copperman & Bhat (2007b)	Panel Study of Income Dynamics (PSID)	The age of chilrend has an effect on the types of activities they pursue
Estimating Transportation Costs by Characteristics of Neighborhood and Household	Haas et al. (2008)	CEX and others	Their model can help in travel demand modeling

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
An analysis of children's leisure activity engagement: Examining the day of week, location, physical activity level, and fixity dimensions	Sener et al. (2008)	Panel Study of Income Dynamics (PSID)	Children in households with parents who are employed, higher income, or higher education were found to participate in structured outdoor activities at higher rates.
A comprehensive analysis of household transportation expenditures relative to other goods and serviCEX: An application to United States consumer expenditure data	Ferdous et al. (2010)	CEX	Adjustments are made with increased fuel priCEX
Measuring the Structural Determinants of Urban Travel Demand	Souche (2010)	IUTP database	urban density and cost of transport mode were statistically significant in their model
An empirical analysis of children's after school out-of-home activity-location engagement patterns and time allocation	Paleti et al. (2011)	Panel Study of Income Dynamics (PSID)	The results show that a wide variety of demographic, attitudinal, environmental, and others' activity-travel pattern characteristics impact children's after school activity engagement patterns.

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
Is the Consumer Expenditure Survey Representative by Income?	Sabelhaus et al. (2013)	CEX	the highest income thresholds are underrepresented in the survey
Relationship between Households' Housing and Transportation Expenditures: Examination from Lifestyle Perspective	Deka (2015)	CEX	More housing costs = more transportation costs, people who take transit spend less on transportation
An empirical investigation into the time-use and activity patterns of dual-earner couples with and without young children	Bernardo et al. (2015)	ATUS	the presence of a child in dual-earner households not only leads to a reduction in in-home non-work activity participation (excluding child care activities) but also a substantially larger decrease in out-of-home non-work activity participation (excluding child care and shopping activities),
Expenditures on Children by Families, 2015	Lino et al. (2017)	CEX	Many observations on the expenditures of children
Factors influencing travel mode choice among families with young children (aged 0–4): A review of the literature	McCarthy et al. (2017)	Lit Review	many factors influence decisions about mode choice when traveling with young children.

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
Relationships between Land Use, Transportation, Household Expenditures, and Municipal Spending in Small Urban Areas	Mattson & Peterson (2019)	CEX, Ammerican Community Survey	denser areas are more likely to use transit to commute. People in single-family homes tend to spend more money on transportation
An environment-people interactions framework for analysing children's extra-curricular activities and active transport	Leung et al. (2019)	Survey in Hong Kong Schools	childrens activities can differ a lot based on neighborhood environment and family sociodemographic background.
Relationships between density, transit, and household expenditures in small urban areas	Mattson (2020)	CEX, Ammerican Community Survey	single family homes spend more on transportation, higher income is correlated with higher transportation costs.
An Updated Estimation Model of the Cost of Raising Children in Texas	Osborne et al. (2021)	NHTS, CEX	Regardless of the method of calculation, we find that it is nearly impossible for two minimum wage earners to meet the basic costs of raising children in Texas, especially when child care is included

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
Parental Investments of Money for White, Black, and Hispanic Children in the United States	Hastings (2022)	CEX	. Both sociodemographic and economic factors play a substantial role in these differences, and the racial and ethnic gaps in parental investments of money are nearly eliminated when both are accounted for
The role of household modality style in first and last mile travel mode choice	Lu et al. (2022)	South-east Queens-land Travel Survey (SEQTS)	joint travel contributes least to modal shift from car to active transport when there is improved infrastructure of trains and things
A review of the socio-demographic characteristics affecting the demand for different car-sharing operational schemes	Amirnazmiafshar & Diana (2022)	NA	There are lots of factors that might affect people's willingness to use car sharing
Estimating Expenditures on Children by Families in Canada, 2014 to 2017	Duncan et al. (2023)	Survey of Household Spending (SHS)	The more income, the more spending on kids.
A New Approach to Understanding the Impact of Automobile Ownership on Transportation Equity	Molloy et al. (2024)	CEX	“Captive Riders” have less spending allocated to transportation than captive drivers.
Transportation Statistics Annual Report 2024	Bureau of Transportation Statistics (2024)	CEX and others	Lots of summaries

Table 1: Summary of the Literature

Title	Citation	Dataset	Findings
A STUDY OF SPENDING, SAVING AND INVESTMENT PATTERNS OF MARRIED COUPLES WITH CHILDREN(NON-DINK) IN MUMBAI	Hargunani et al. (2024)	Data from Mumbai	The data analysis reveals distinct spending, saving, and investment patterns among married couples, with a clear prioritization towards ensuring the well-being and future security of their families.”
Subsidizing Car Ownership for Low-Income Individuals and Households	Klein (2024)	Personal Survey Created by Dr. Klein	Having a car gave people more opportunities than before, and they usually had more time to spend with the family. At the beginning and end of the day.
Investigating the effects of ridesourcing on the dynamics of household car ownership	Bilgin et al. (2025)	United Kingdom Household Longitudinal Study	Suggests that households are less likely to acquire a car in the presence of ridesourcing, but car disposal is mainly driven by household compositions and residential relocation factors.

53      Source: [Lit Review Table](#)

54      The literature relating to this study has been classified into four groups: (1) Family  
 55      Choices and Activity Patterns, (2) Family Transportation Choices, (3) Family Spend-  
 56      ing and Budgets, and (4) Family Transportation Budgets. The following sections  
 57      describe the relevant findings from literature in each of these groups.

## 58      **2.1 Household Activities and Transportation Choices**

59      The literature shows that household dynamics affect the activity patterns of those in  
 60      the household, and many studies focus on the role children play in these household  
 61      activities. Some studies aim to find how the presence of children affect the activities  
 62      of the household (Bernardo et al., 2015), and many studies focus on how children's ac-  
 63      tivities are affected by household demographics (Rachel B. Copperman & Bhat, 2007b;  
 64      Leung et al., 2019; Paleti et al., 2011; Sener et al., 2008; see Sener & Bhat, 2007). A  
 65      common finding in these studies is that child activity participation is associated with

66 the environment the child lives in along with household income, parent activities, and  
 67 other household demographics.

68 Among the studies on household choices is a group of literature with a specific focus  
 69 on a household's transportation decisions. A common finding in this group of liter-  
 70 ature is that household composition plays a role in its transportation choices. Some  
 71 studies in this group are concerned with the way households use cars or the effect of  
 72 car ownership on transportation decisions (Amirnaziafshar & Diana, 2022; Bilgin et  
 73 al., 2025; Klein, 2024; Lu et al., 2022). These studies show there is a major connection  
 74 between car ownership and transportation decisions. Other studies are focused on  
 75 travel choices more generally (Rachel B. Copperman & Bhat, 2007a; Souche, 2010).  
 76 For an extensive literature review on the transportation choices of households with  
 77 young children, see the study done by McCarthy et al. (2017).

## 78 **2.2 Household Spending and Budgets**

79 Another set of studies focuses on household budgets and household spending patterns  
 80 (Fontes & Fan, 2006; Nayga, 1998; Sabelhaus et al., 2013; Skinner, 1985). Many of  
 81 the studies reviewed had an emphasis on the budgets related to raising children.  
 82 Hargunani et al. (2024) analyzed family spending patterns in Mumbai and concluded  
 83 that many families focus their expenditures on the current and future wellbeing of  
 84 their children. This is evidenced by money spent on basic necessities and setting aside  
 85 money for the future.

86 The United States Department of Agriculture (USDA) has produced reports that use  
 87 the CEX to specifically analyze the costs of raising a child in the United States. The  
 88 most recent report (Lino et al., 2017) found the top expenditure for married-couple  
 89 families with two children to be housing. The rankings of other expenditures were  
 90 different depending on the age of children, but food, child care/education, and trans-  
 91 portation were always the next highest expenditures on children. Similar to the USDA  
 92 report on the cost of raising children, Osborne et al. (2021) modeled the cost of  
 93 raising children in Texas by following similar methodologies but using Texas-specific  
 94 data for housing and childcare costs. They looked not only at married-couple families,  
 95 but also at single-parent households and duel households where children spend time  
 96 with both parents in different locations. They found differing expenditures on children  
 97 among the different family make-ups and among different incomes.

98 Duncan et al. (2023) performed a study in Canada using the country's Survey of  
 99 Household Spending (SHS) to analyze family expenditures. They found similar results  
 100 as previously mentioned studies. Different income groups had different amounts  
 101 allocated to children, but housing was always the highest expenditure with food, child  
 102 care/education, and transportation being the next highest expenditures.

103 Other studies with similar analyses have had similar findings. Hastings (2022) used  
 104 the CEX to compare expenditures between different racial and ethnic groups. When  
 105 controlling for both family characteristics and income, he found that there was not  
 106 a significant difference in total expenditures on children among racial and ethnic  
 107 groups. This suggests that income and family characteristics play a larger role in  
 108 family budgeting than race and ethnicity.

## 109 **2.3 Household Transportation Expenses and Budgets**

110 There have been many studies on family budgets and transportation expenses (Blu-  
 111 menberg, 2003; Choo et al., 2007; Ferdous et al., 2010; Haas et al., 2008; Hong et al.,  
 112 2005; Morris & Wigan, 1979; Thakuriah (Vonu) & Liao, 2006).

113 One study focused on transportation budgets was done by Thakuriah & Liao (2005).  
 114 Using CEX data, they made multiple models to analyze the expenditures related  
 115 to vehicle ownership of households in the United States. In each model, they used  
 116 a variety of variables (income, household demographics, spatial factors, economic  
 117 factors, and family condition factors) to predict the amount of money a household

118 spends on vehicles. Their model results indicate 18 percent of additional household  
 119 expenditures is a vehicle expense. They results also indicate many factors influence  
 120 household vehicle expenses. The models showed that homeowners spend more on  
 121 vehicle expenses. They also showed that vehicle expenses are connected with the sex  
 122 of the head of household and the number of people in the household.

123 In a study by Deka (2015), they used two years of the CEX to see the connection  
 124 between housing expenses and transportation expenses. They created three least  
 125 squares models: one to describe expenditures in dollar amounts, one to describe  
 126 expenditures as percentages of income, and one to describe expenditures as shares  
 127 of total household expenditures. They found a positive association between trans-  
 128 portation expenses and housing expenses. Similarly, share of income on transportation  
 129 was positively affected by share of income on housing, but there was no significant  
 130 evidence showing the share of income on housing being affected by share of income  
 131 on transportation. Both housing and transportation expenditures were found to be  
 132 higher for those living in single-family detached homes and lower for those living in  
 133 older homes.

134 Mattson & Peterson (2019) looked at how density, land use, transportation, and  
 135 household expenditures are related. They developed a regression model using CEX  
 136 data where transportation expenditures were estimated using type of housing, popu-  
 137 lation, family characteristics, and other factors. Similar to other studies, they found  
 138 that income is positively associated with transportation expenditures. Their model  
 139 showed single-family homes to have higher transportation expenditures than other  
 140 types of dwellings. Using data from the U.S. Census Bureau's Annual Survey of State  
 141 and Local Government Finances, they also created models to explore how land use  
 142 might affect municipal spending. In these models, increase in density was associated  
 143 with a decrease in many per capita operational costs, including fire protection, streets  
 144 and highways, parks and recreation, and others.

145 A similar study was published by Mattson (2020) where he modeled transportation  
 146 expenditures using CEX data. The results showed, like the previous publication,  
 147 that single-family dwellings spend more on transportation compared to other types.  
 148 He also found that larger household sizes and newer homes contribute to higher  
 149 transportation spending.

150 In their study, Molloy et al. (2024) look at CEX data after proposing a new frame-  
 151 work to look at transit users and vehicle users. In past studies, three categories have  
 152 been used to analyze transportation users: "drivers" are those who own a car, "cap-  
 153 tive riders" are those who use transit because they ca not afford a car, and "choice  
 154 riders" are those who can afford a car but do not. Instead of having one grouping for  
 155 those that own cars, Molloy et al. (2024) propose splitting that category into "captive  
 156 drivers" and "choice drivers". Captive drivers would be those in the population that  
 157 are low income but have a car representing people with less transportation freedom.  
 158 They analyzed the CEX with this new way of classifying transportation users and  
 159 found that captive drivers carry the most transportation burden. The transportation  
 160 expenditures of captive drivers average more than 16% of total household expendi-  
 161 tures while the transportation expenditures of captive riders was only around 7% of  
 162 total expenditures.

163 Bureau of Transportation Statistics (2024) - Chapter 2 has a whole section where they  
 164 analyze household expenditures gettting much of their data from the CEX.

#### 165 **2.4 The Current Study**

166 This study has never been done and will add to the current literature in the following  
 167 ways.

- 168 • Data: Many studies on household transportation patterns focus on time diaries  
169 and other things. This study uses consumer expenditure data to understand  
170 patterns in household transportation budgets.
- 171 • Methodology: LCA to find groupings that organize households using different  
172 transportation expense patterns. What variables do we want to look at, and  
173 how is that different from other studies?
- 174 • Purpose: Have there been any studies that share a similar end goal as our  
175 study? If so, is ours unique?

### 176 3 Data

177 Data for the following analysis were attained from the 2024 Consumer Expenditure  
178 Survey (CEX) Public Use Microdata (PUMD). The CEX is deployed continuously by  
179 the Bureau of Labor Statistics (BLS). The data are organized by quarter published  
180 each year. The CEX consists of two surveys as described below.

- 181 • **The Interview Survey** tracks a household's major and recurring expenditures  
182 by reviewing their expenses from the past three months. Approximately 6000  
183 usable interviews are collected each quarter. After interviewing a household for  
184 4 consecutive quarters, they are removed from the sample and replaced by a  
185 new household.
- 186 • **The Diary Survey** tracks a household's weekly expenditures by having them  
187 fill out a detailed expenditure diary across a two-week span. Approximately  
188 3000 usable responses are collected each quarter. After the two consecutive  
189 weeks of reporting expenditures, the household is removed from the sample and  
190 replaced by a new household.

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