Unpacking Household Budgeting Strategies through a Transportation Lens

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Abstract

This is where we will put our abstract.

Plain Language Summary

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1 Introduction

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

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

2 Literature Review

Source: Article Notebook

Table 1 summarizes the literature that was reviewed for this study. As seen in the table, there were a total of 35 studies reviewed with 19 studies that use the consumer 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 o17 percent of expenditures, at least part of the consumption expenditure by low income families is financed from savings, loans or other sourCEX 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 substitue 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 childrend 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 Structureal Determinants of Urban Travel Demand	Souche (2010)	IUTP database	urban density and cost of transport mode were statisticalliy significan 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 the 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 factores 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 enfironment 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 tranportation 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 differenCEX, 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 characteris-tics 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 Expendi-tures on Children by Families in Canada, 2014 to 2017	Duncan et al. (2023)	Survey of House-hold Spending (SHS)	The more income, the more spending on kids.
A New Approach to Understand-ing the Impact of Automobile Ownership on Trans-portation Equity	Molloy et al. (2024)	CEX	"Captive Riders" have less spending allocated to transportation than captive drivers.
Transporta-tion 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 INVEST-MENT PATTERNS OF MARRIED COUPLES WITH CHIL-DREN(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 House-hold Longitu-dinal Study	Suggests that households are less likely to qcquire a car in the presence of ridesourcing, but car disposal is mainly driven by household compositions and residential relocation factors.

Source: Lit Review Table

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

2.1 Family Choices and Activity Patterns

There have been many studies done on the choices and activities of families (Rachel B. Copperman & Bhat, 2007b; Leung et al., 2019; Sener et al., 2008; see Sener & Bhat, 2007). These studies often focus on the activities choices of households and children.

Paleti et al. (2011) performed a study where they wanted to characterize the activity patterns of children after school. Their data were gathered from the Child Development Supplement to the Panel Study of Income Dynamics which has household demographics and time-use diaries for children. They looked at travel patterns

using combinations of three activity-travel scenarios: staying at school, going home from school, and going somewhere else after school. They further identified specific after-school activities (e.g. Organized activities at school, recreation at the home of someone else, meals at restaurants, etc.) to use in a multiple discrete-continuous extreme value (MDCEV) model. The MDCEV is a type of discrete choice model that works when multiple options can be chosen, and was used to find predictors of children's participation in the different after school activities. In their analysis, they found that 57.7% of children in the survey participated in at least one out-of-home activity after school. They also found that children's activities were connected to household income, family dynamics, environment, and other things. For example, children in households with higher income were more likely to participate in activities after school. Children with no siblings along with children having a working primary caregiver were more likely to stay at school or go somewhere besides home directly after school. Children living close to a large city were less likely to go somewhere after school, go home, and then go back out. The findings of this study show the variety of factors that might affect a family's activity, and therefore transportation, patterns.

Another study on family choices was done by Bernardo et al. (2015). They used the American Time Use Survey and a Multiple Discrete Continuous Nested Extreme Value (MDCNEV) model to examine the activities of duel-earner households. The variables they used relate to household demographics, respondent demographics, couple characteristics, and day of the week. Findings indicated that women are more likely to participate in out-of-home maintenance, shopping, and social activities than men. They also found that respondents with higher education and with children are more likely to work from home. One key finding of this study is that couples with children are much less likely to participate in out-of-home, non-work activities.

2.2 Family Transportation Choices

Among the studies on family choices is a group of studies that focus on family transportation choices (Amirnazmiafshar & Diana, 2022; Rachel B. Copperman & Bhat, 2007a; Lu et al., 2022; Souche, 2010). These studies look at the connection between family mobility and family decisions.

McCarthy et al. (2017) is a literature review with some good findings, but I don't know if I should site the literature review or if I should find individual papers from the review to talk about.

A unique study to understand the effects car ownership has on household decisions was done by Nicholas Klein (2024). In order to understand how access to a car can effect a family in the United States, he interviewed 30 people in Maryland and Virginia who received a subsidized car. Two main findings of this study relate to travel behavior changes and access to opportunities. The people interviewed generally changed their travel behavior in similar ways after receiving a car. Before receiving the car, they would rely on public transit and others for transportation, but after receiving a car, they made many trips in their own cars, including some trips that they had to forgo before having a car. Another general conclusion Klein makes is that people had more access to opportunities after receiving a car. They had easier access to more potential jobs, but some also mentioned the ability to get more hours at the their current jobs. With less reliance on public transit, many respondents spent more time with their families at the beginning and end of the day.

Another study interested in car ownership was done by @bilgin_investigating_2025. They analyzed car ownership across multiple years using the United Kingdom Household Longitudinal Study dataset to see if ridesourcing availability affects car ownership. They used two fixed effects logit models: one to model the effect of ridesourcing on the decision to increase the number of cars in the household and the other to model the effect of ridesourcing on the decision to decrease the number of cars in the household. Their results suggested that households with more than one car

are more likely to get rid of a car and less likely to add a car compared to households with one car. Even with this tendency, their models did not show a strong connection between the presence of ride sourcing and changes in car ownership. They concluded that changes in household composition have a stronger impact on the change in number of cars of a household.

2.3 Family Spending and Budgets

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

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

Other studies with similar analyses have had similar findings. @hastings_parental_2022 used the CEX to compare expenditures between different racial and ethnic groups. When controlling for both family characteristics and income, he found that there was not a significant difference in total expenditures on children among racial and ethnic groups. This suggests that income and family characteristics play a larger role in family budgeting than race and ethnicity. Duncan et al. (2023) performed a study in Canada using the country's Survey of Household Spending (SHS) to analyze family expenditures. They found similar results as previously mentioned studies. Different income groups had different amounts allocated to children, but housing was always the highest expenditure with food, child care/education, and transportation being the next highest expenditures.

2.4 Family Transportation Expenses and Budgets

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

One study focused on transportation budgets was done by Thakuriah & Liao (2005). Using CEX data, they made multiple models to analyze the expenditures related to vehicle ownership of households in the United States. In each model, they used a variety of variables (income, household demographics, spatial factors, economic factors, and family condition factors) to predict the amount of money a household spends on vehicles. Their model results indicate 18 percent of additional household expenditures is a vehicle expense. They results also indicate many factors influence household vehicle expenses. The models showed that homeowners spend more on vehicle expenses. They also showed that vehicle expenses are connected with the sex of the head of household and the number of people in the household.

In a study by Deka (2015), they used two years of the CEX to see the connection between housing expenses and transportation expenses. They created three least

squares models: one to describe expenditures in dollar amounts, one to describe expenditures as percentages of income, and one to describe expenditures as shares of total household expenditures. They found a positive association between transportation expenses and housing expenses. Similarly, share of income on transportation was positively affected by share of income on housing, but there was no significant evidence showing the share of income on housing being affected by share of income on transportation. Both housing and transportation expenditures were found to be higher for those living in single-family detached homes and lower for those living in older homes.

Mattson (2020) Mattson & Peterson (2019) - single family homes spend more on transportation, higher income is correlated with higher transportation costs. - denser areas are more likely to use transit to commute. People in single-family homes tend to spend more money on transportation

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

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

Molloy et al. (2024) - "Captive Riders" have less spending allocated to transportation than captive drivers.

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

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

3 Data

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

- **The Interview Survey** tracks a household's major and recurring expenditures by reviewing their expenses from the past three months. Approximatedly 6000 usable interviews are collected each quarter. After interviewing a household for 4 consecutive quarters, they are removed from the sample and replaced by a new household.

- **The Diary Survey** tracks a household's weekly expenditures by having them fill out a detailed expenditure diary across a two-week span. Approximately 3000 usable responses are collected each quarter. After the two consecutive weeks of reporting expenditures, the household is removed from the sample and replaced by a new household.

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