Tracking Changes in Ride-hailing/Ride-sharing Expenditures

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Research Objectives

- Assess the relationship between “ride-hailing/ride-sharing” and other expenditure categories.
  - How do other confounding factors (relative prices, income and demographic changes) affect the relationship?
  - How may the use of Consumer Expenditure Survey data help inform these issues?
  - What is the “ride-hailing/ride-sharing” expenditure share?
    - How has it changed over time?
    - What type of good is it?

Consumer Expenditure Public Use Microdata Files: 2008 to 2016

- *Consumer Unit (CU) Characteristics and Income File (FMLI)*
  1. *Total Expenditures*
  2. *Transportation Expenditures*
  3. *Demographic Information*
- *Monthly Expenditure File (MTBI)*
  1. *Detailed Public-Transportation Expenditures*

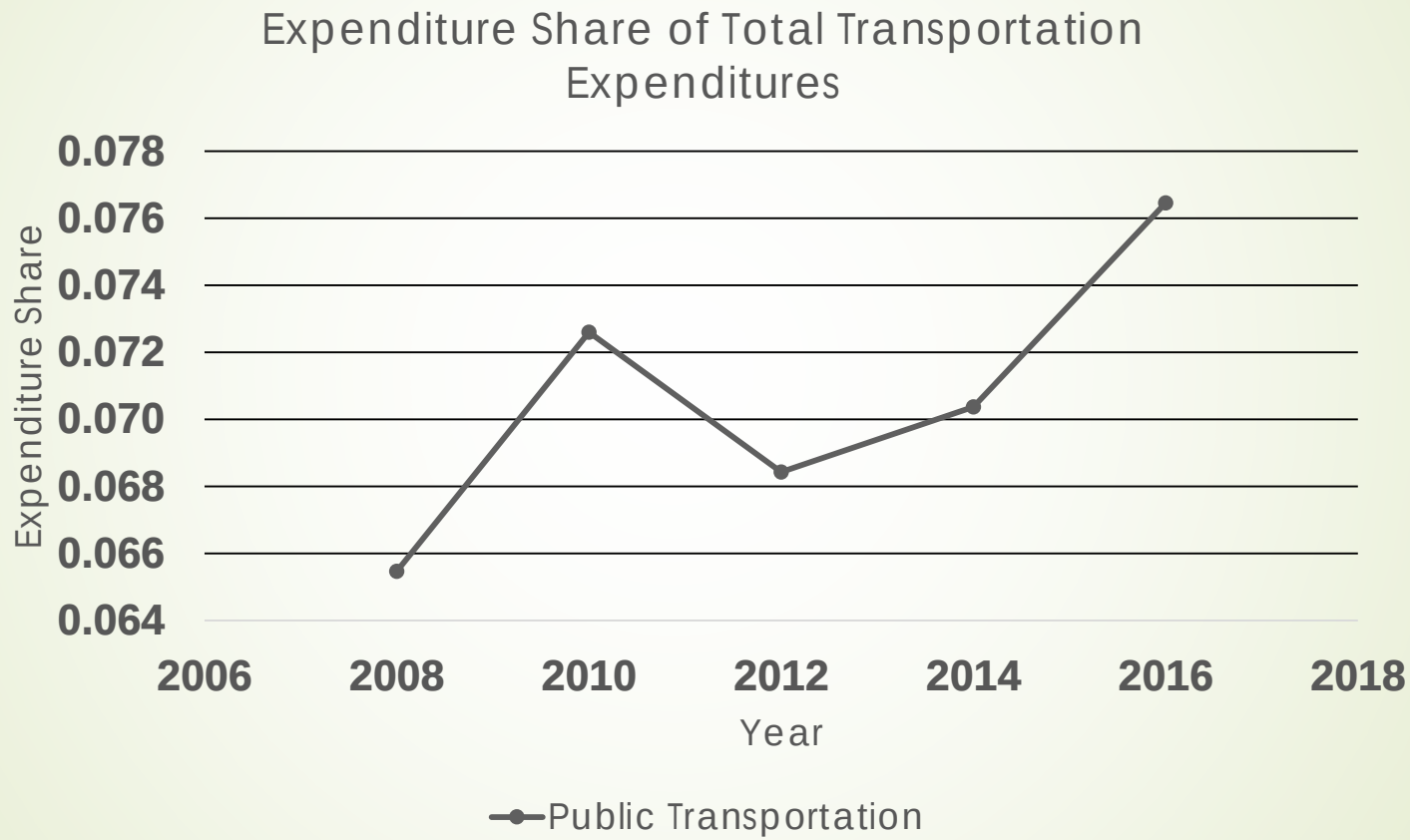
Expenditure Categories/Sub-Categories

- Transportation Expenditures
  1. New Vehicles
  2. Used Vehicles
  3. Other Vehicles
  4. Gasoline and Motor Oil
  5. Vehicle Finance Charges
  6. Maintenance and Repair
  7. Vehicle Insurance
  8. Vehicle Rental
  9. Public and Other Transportation

Public and Other Transportation Expenditures

1. Airline fares
2. Intercity bus fares
3. Intracity mass transit fares
4. Local trans. on out-of-town trips
5. Taxi fares and limousine services on trips
6. **Taxi fares and limousine services (ride-hailing/ride-sharing)**
7. Intercity train fares
8. Ship fares
9. School bus

Public Transportation Expenditure Share of Total Transportation Expenditures

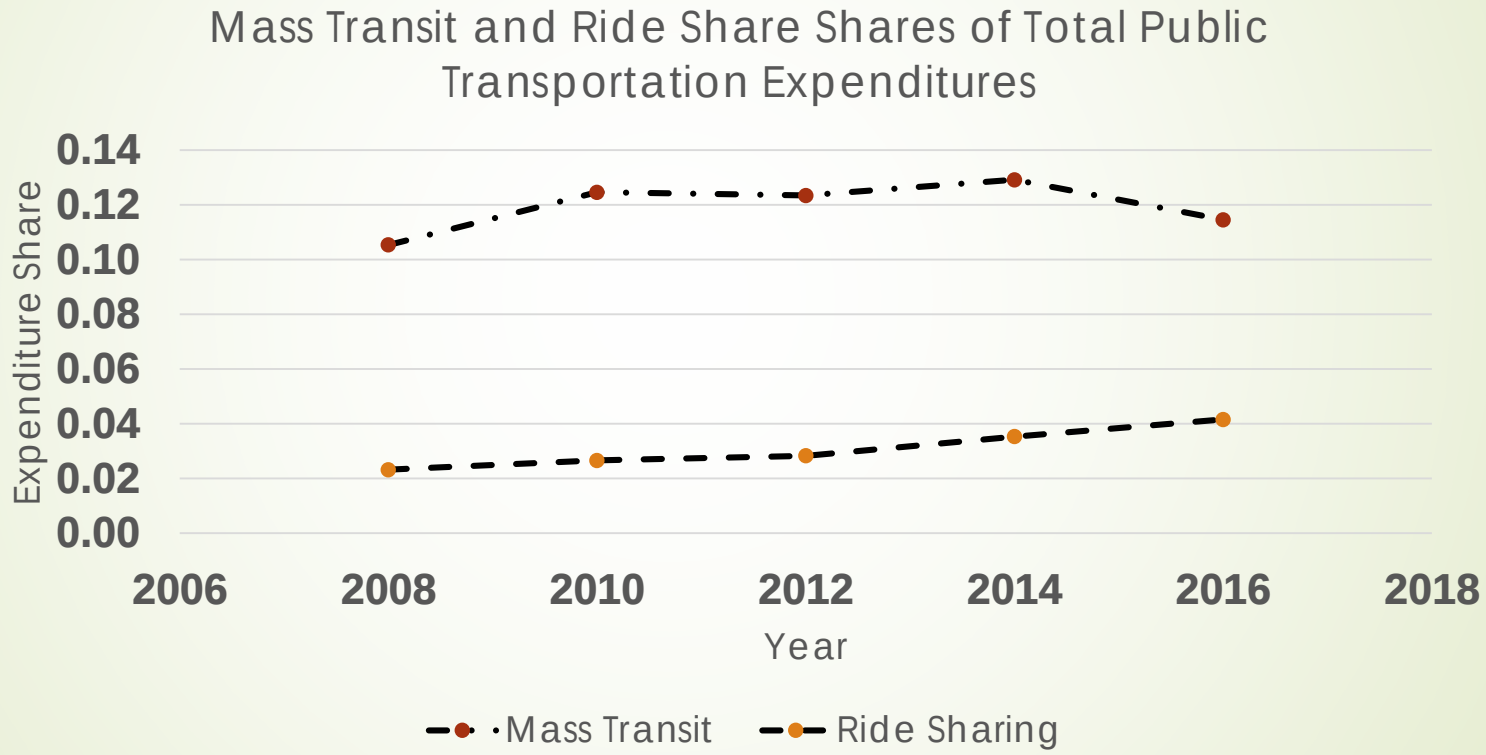


Source: Various CE PUMD files, Bureau of Labor Statistics
(these are unweighted shares for all Consumer Units)

Percent of Consumer Units Reporting “Taxi fares and Limousine services” Expenditures

Source: Various CE PUMD files, Bureau of Labor Statistics
(these are unweighted shares for all Consumer Units)

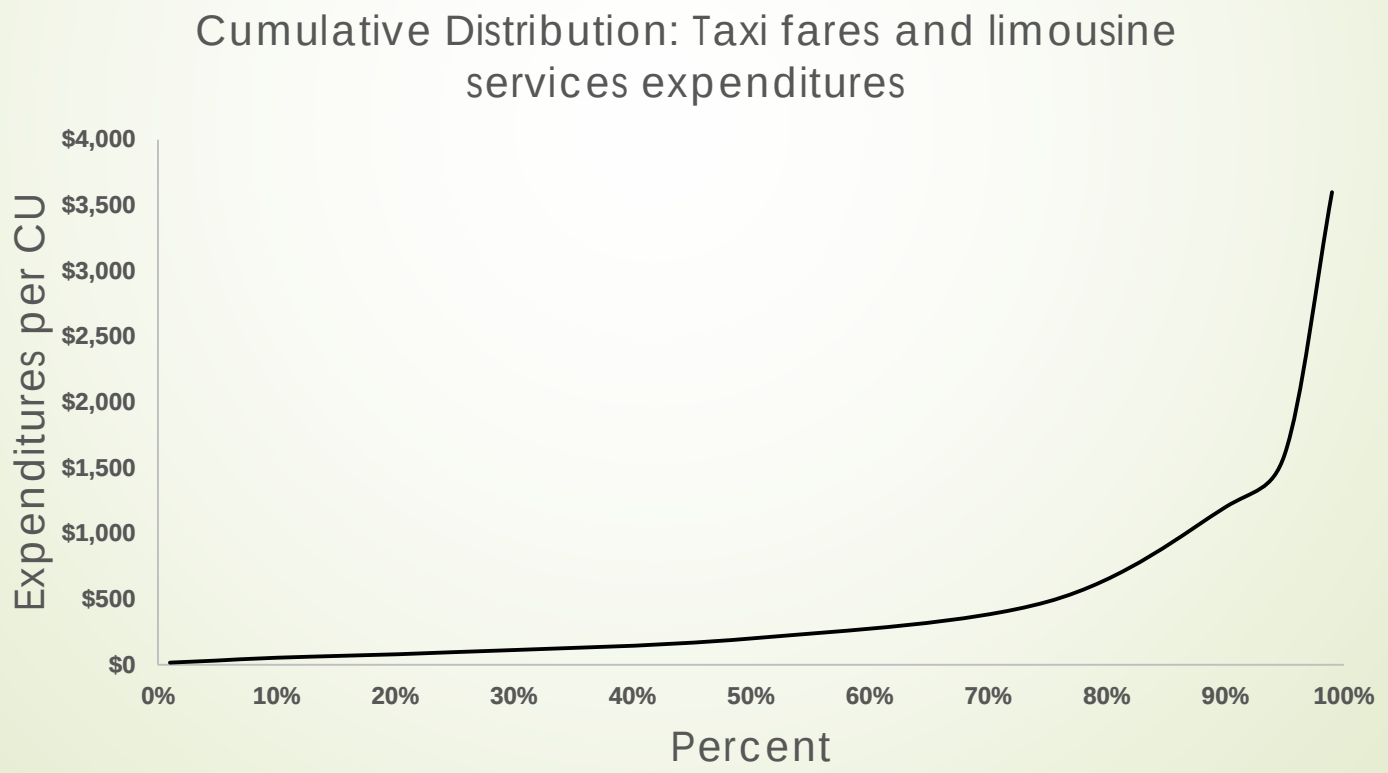
“Intracity Mass Transit Fares,” and “Taxi Fares and Limousine Services” Shares of Total Public Transportation Expenditure



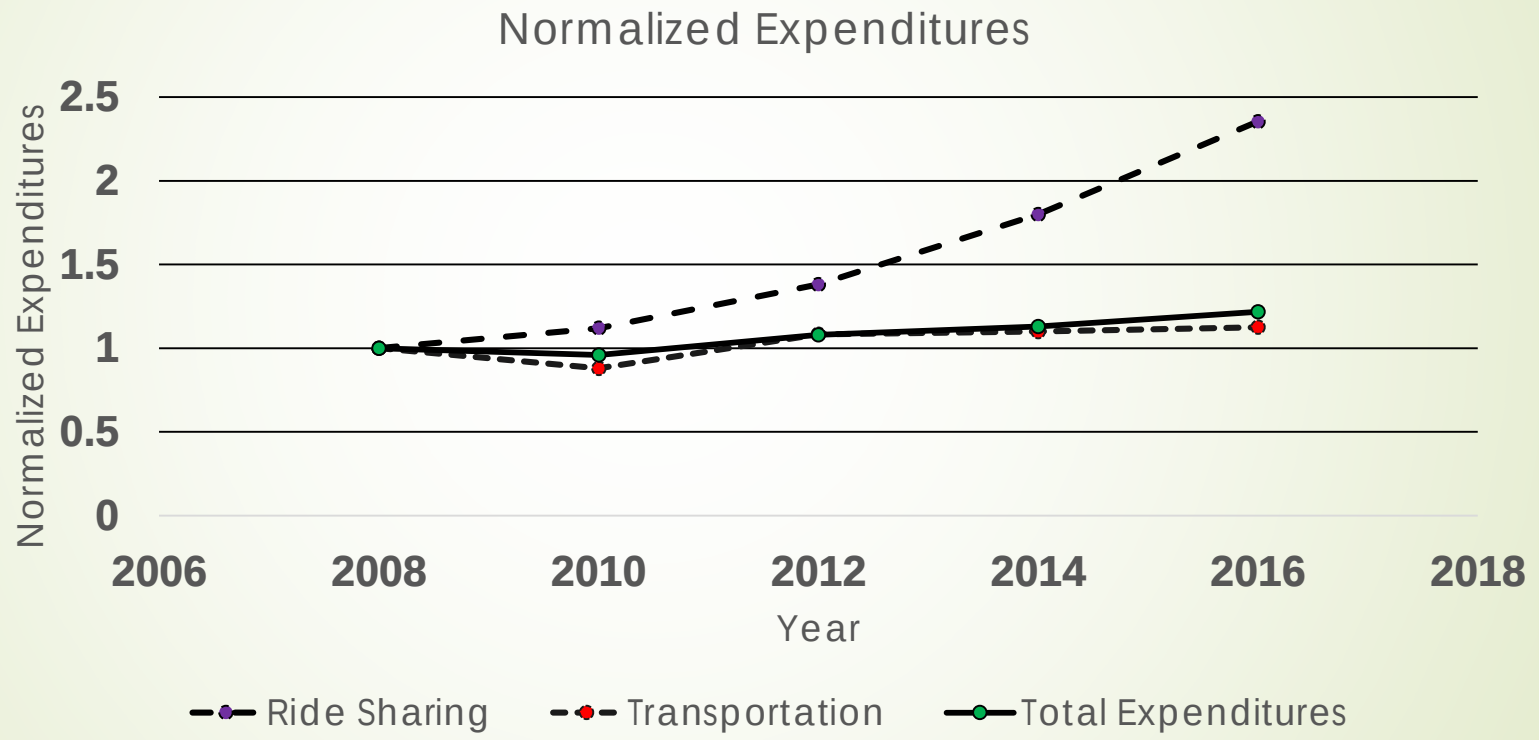
Source: Various CE PUMD files, Bureau of Labor Statistics
(these are unweighted shares for all Consumer Units)

2016 Distribution of Ride-Sharing Expenditures

Variable	Obs	Mean	Std. Dev.	Min	Max
Ride Sharing	1,413	$450.26	$715.43	$6.67	$8,000.00



Normalized Real Expenditures per CU: Total Expenditures, Transportation Expenditures, and Taxi Fares and Limousine Services (Ride Sharing)



Source: Derived from Various CE PUMD files, Bureau of Labor Statistics (unweighted values for all Consumer Units)

The Engle Curve

Properties

1. Satisfies the adding-up constraint (shares add up to one)
2. Individual share equations can be estimated using simple least squares

$$\widehat{w}_i = \hat{\alpha}_i + \hat{\beta}_i lny$$

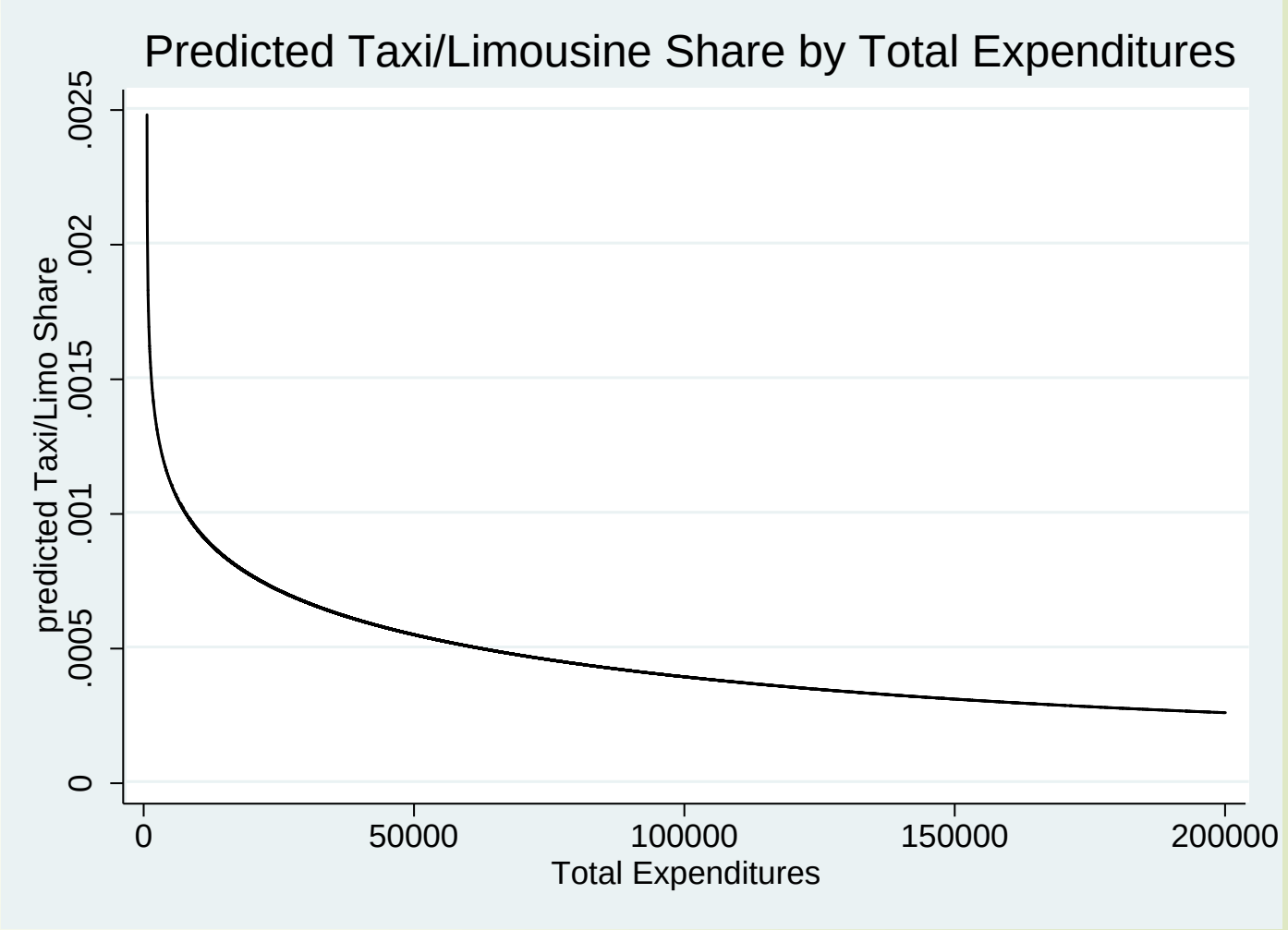
Where $\widehat{w}_i$ is the estimated share of the i^{th} good; lny the natural log of total expenditures; where $\sum \hat{\alpha}_i = 1$ and $\sum \hat{\beta}_i = 0$.

- $\hat{\beta}_i > 0$: luxury good
- $\hat{\beta}_i = 0$: necessity good
- $\hat{\beta}_i < 0$: inferior good

Estimated Share Equations for "Taxi Fares and Limousine Services" for 2008 and 2016

2008						
		Robust				
Taxi/Limousine Share	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Log of total Expenditures	**-8.8E-05**	**3.02E-05**	**-2.9**	**0.004**	**-0.00015**	**-2.9E-05**
Rural x Log of total Expenditures	**0.002455**	**0.001652**	**1.49**	**0.137**	**-0.00078**	**0.005693**
Intercept						
Rural	**-0.00022**	**0.000172**	**-1.3**	**0.193**	**-0.00056**	**0.000114**
Constant	**0.001083**	**0.000286**	**3.79**	**0**	**0.000524**	**0.001643**
2016						
		Robust				
Taxi/Limousine Share	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Log of total Expenditures	**-0.0002**	**5.38E-05**	**-3.8**	**0**	**-0.00031**	**-9.9E-05**
Rural x Log of total Expenditures	**0.002158**	**0.002587**	**0.83**	**0.404**	**-0.00291**	**0.007228**
Intercept						
Rural	**-0.00022**	**0.000276**	**-0.78**	**0.435**	**-0.00076**	**0.000326**
Constant	**0.002469**	**0.00052**	**4.75**	**0**	**0.001449**	**0.003488**

Predicted "Taxi Fares and Limousine Services" Shares versus Total Expenditures



Estimated Engle Curves: 2008 to 2016

Year	Airline fares (530110)	Intracity mass transit fares (530311)	Taxi fares and limousine services (530412)
2008	**0.00403**	**-0.00188**	**-0.00009**
	(0.00020)	(0.00042)	(0.00003)
2010	**0.00395**	**-0.00153**	**-0.00019**
	(0.00018)	(0.00018)	(0.00004)
2012	**0.00411**	**-0.00132**	**-0.00021**
	(0.00019)	(0.00015)	(0.00004)
2014	**0.00435**	**-0.00144**	**-0.00014**
	(0.00021)	(0.00016)	(0.00004)
2016	**0.00411**	**-0.00125**	**-0.00020**
	(0.00020)	(0.00025)	(0.00005)

Standard errors are reported in the parenthesis

Findings and Preliminary Thoughts

- From 2008 to 2016, there has been a substantial increase in average "taxi fares and limousine service" expenditures.
  - Driven in part by an increase in use by CUs
- Between 2008 and 2016, the "taxi fares and limousine service" expenditure share has increased substantially.
- The estimated Engle curves for "taxi fares and limousine service" indicate that it is an inferior good.
- Unanswered questions:
  - Do demographic factors affect "taxi fares and limousine service" expenditures and patterns of transportation use in general?
  - To what extent does urbanization, age composition and household debt changes influence ride sharing/ride hailing expenditures?
  - Can we say more on if changes in the use of ride-sharing/ride-hailing services affect the overall pattern/composition in transportation expenditures?

Literature

- Deaton, Angus, and John Muellbauer. *Economics and Consumer Behavior.* Cambridge: Cambridge University Press, 1988.
- Leser, C. E. V. “Forms of Engel functions." *Econometrica*, 1963: 694-703.
- Working, H. “Statistical laws of family expenditures." *Journal of the American Statistical Association*, 1943: 43-56.

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