A Consumption Measure for Motor Vehicles From 1996-2019 CE Survey

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Consumption Measure of Motor Vehicles

- Measuring living standards for households
- Frequent and expensive long-lived goods
- Consumption vs. spending
 - o zero spending ≠ zero consumption



Key Concept: Depreciation of Motor Vehicles

- An effort towards a full user cost approach
 - 1) Value of service received during the reference period
 - 2) Smooth out consumption
 - 3) Measures at consumer unit level



Consumption of Motor Vehicles

$$S_{ii} = \sum_{j=1}^{J} \left(\delta_{a(j)} * (1 - \delta_{a(j)})^{y_j} * P_{jo} \right)$$

where

 S_{it} : service flow from all vehicles at time t of CU i $\delta_{a(j)}$: **age specific** depreciation rate P_{jo} : purchase price for vehicle j y_j : owned years since purchasing J: number of vehicles owned by CU i



CE Interview Survey, 1996-2019

- Over 1 million motor vehicles
 - Include cars, SUVs, trucks (85%)
 - Exclude boats, kayaks, aircrafts, RVs, other unknowns, etc. (15%)
- 40% purchased as new vs. 60% purchased as used
- 23% price reported (11% news cars, 12% used cars)



Regression Model

Regression model

 $Log (P_{jt}) = \theta_0 + \theta_a^* age_t + make + model + year + u_{jt}$

Constant geometric depreciation include vehicles of all ages
Non-parametric depreciation include only new vehicles and vehicles of specific ages from 1 through 20.



Construction of Subsamples for Depreciation Estimation

- Purchase prices are reported and >\$300 in 1983 dollars
- Variables *make, model, modelyear* are all available

Purchase condition and age	Composition of estimation sample	# of obs	Percent share of full sample (obs=1071468)
used car	used cars of all ages	147290	13.75%
new car	new cars (age=0) and used cars of all ages	212619	19.84%
new car & age 1	new cars (age=0) and used cars of age 1	118828	11.09%
new car & age 2	new cars (age=0) and used cars of age 2	118516	11.06%
new car & age 3	new cars (age=0) and used cars of age 3	118001	11.01%
new car & age 4	new cars (age=0) and used cars of age 4	111531	10.41%
••••			
new car & age 20	new car (age=0) and used car of age 20 & over	99444	9.28%



Annual Depreciation Rates (δ_a)

• Age specific depreciation rate $\delta_a = 1 - \exp(\theta_a)$

Current market value

 $CMV_{jt} = P_{j0} * (1 - \delta_a)^y$

Consumption in the reference period $S_{jt} = \delta_a * CMV_{jt}$



Depreciation Rate (δ_a)



Notes: The new vehicle depreciation rate by age (solid line) shows how much vehicles' market value have decreased over the past year as a percentage of their purchase prices. The average depreciation rates of new and used vehicles are average value change across all ages.



Motor Vehicle Consumption vs. Spending

Quarterly Average of All Consumer Units



Consumption and Spending at Consumer Unit Level



BLS

Consumption and Spending at Consumer Unit Level

2019Q4 (>\$0) Percent Percent 2 -Spending Consumption



Consumption and Spending at Consumer Unit Level



Conclusion

- Depreciation based approach
 - Correlated with spending measure
 - Reliable and smoothed estimates at CU level

Next step: adding in spending on maintenance and repairs

- Important for full user cost approach
- Same for spending and consumption

Next step: Finish OER approach



Appendix (1)

Annual average CU consumption of matched vehicles





Appendix (2)

Coefficient of simple regression: NADA price = CE predicted price (no intercept)

2018	Non-parametric depreciation	Constant geometric depreciation	Difference
Average	0.93	0.89	0.04

- Ratio of CE predicted price to NADA value for given make/model/age
- Non-parametric prices more similar to NADA prices than constant geometric prices



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