

The Flow of Services from Owned Vehicles in Consumer Expenditure Interview Surveys

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Consumption Measure of Motor Vehicles

- Measuring living standards for households
- Frequent and expensive long-lived goods
- Consumption vs. spending
 - zero spending \neq 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



Service Flow From Owned Vehicles

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

where

S_{it} : service flow from all vehicles at time t of CU i

r_t : inflation adjusted annual yield on long-term security at time t

$\delta_{a(j)}$: **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, 1996Q1-2019Q4

- 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)

CE Interview Survey, 1996Q1-2019Q4

CE Variables	Description
FAMID, NEWID	Consumer unit ID
SEQNO	Sequence number
ALCNO	Allocation number
QINTRVYR, QINTRVMO	Interview year, Month
VEHICYR	Vehicle model year
VEHPURYR, VEHPURMO	Purchase year and month
NETPURX	Net purchase price after discount, trade-in, or rebate including destination fee
TRADEX	Amount of trade-in allowance
MKMDLY	Vehicle Make and Model code (4 digit #)
MKMODEL	Vehicle Make and Model
MKMDESC	Vehicle make and model description
VEHNEWU	Was it new or used when acquired?
FINLWT21	Calibration final weight for the full sample



Regression Model

- Regression model

$$\text{Log}(P_{jt}) = \beta_0 + \beta_a * \text{age}_t + \text{make} + \text{model} + \text{year} + u_{jt}$$

- ▶ 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

$$\delta_a = 1 - \exp(\beta_a)$$

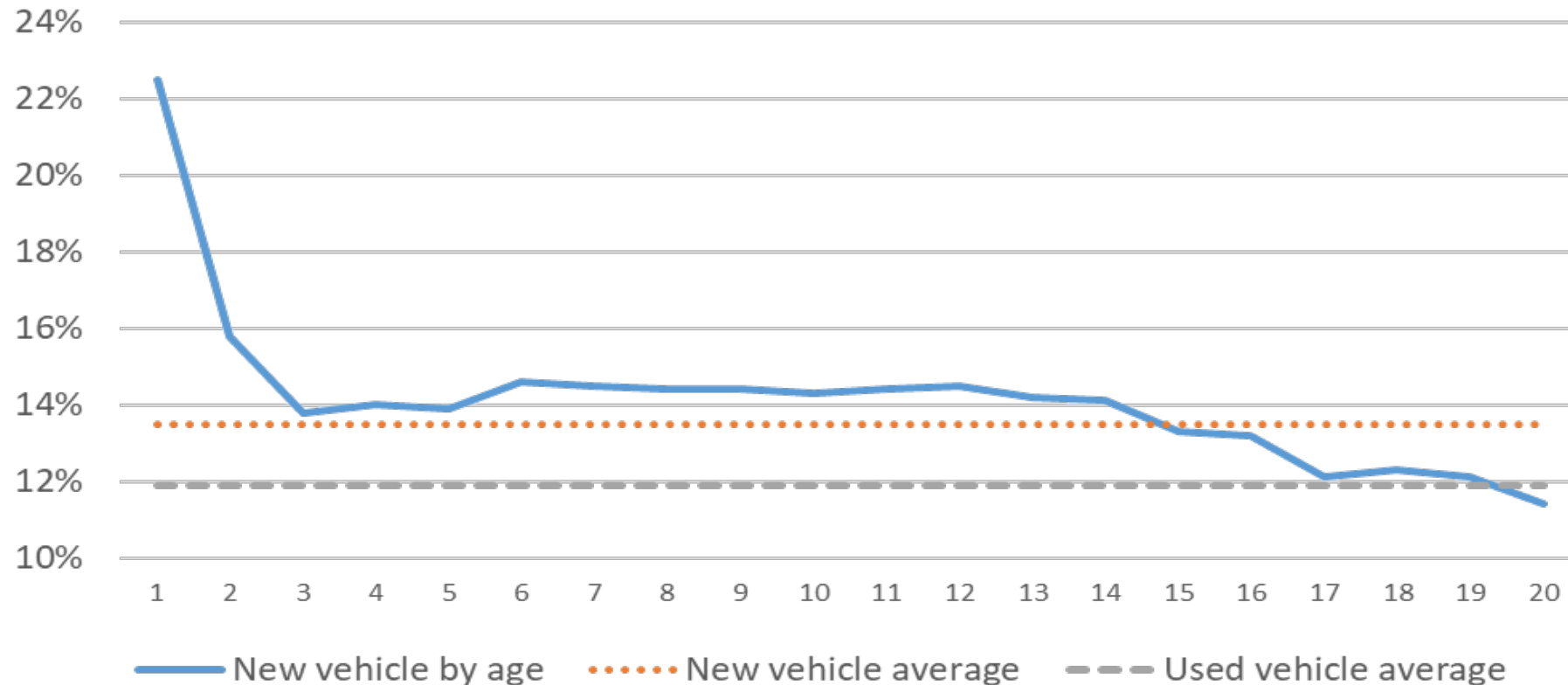
- Current market value

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

- Service flow received during the reference period

$$S_{jt} = (r_t + \delta_a) * CMV_{jt}$$

Depreciation Rate (δ_a)

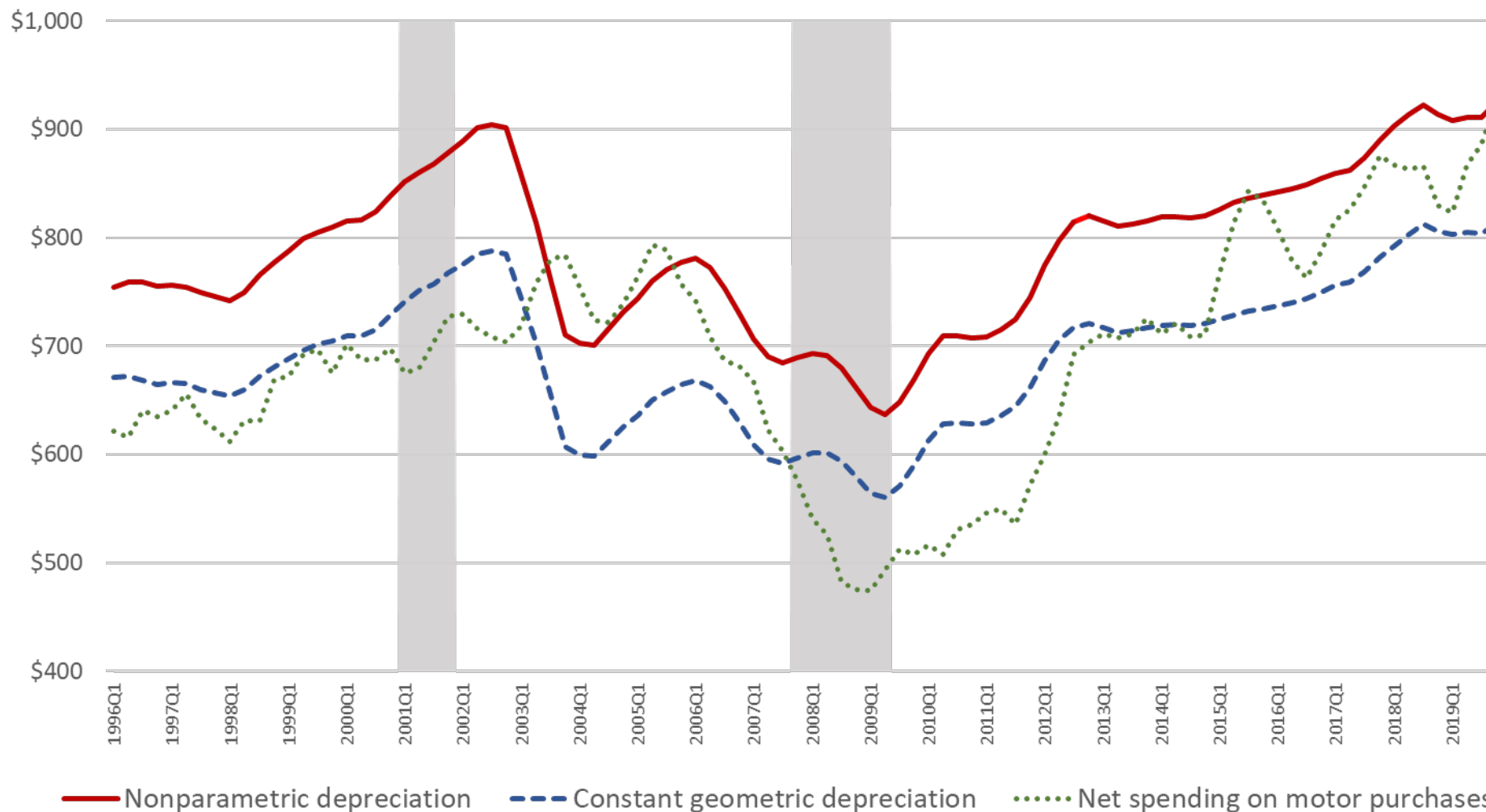


Notes: The new vehicle depreciation rate by age (solid line) shows how much vehicles' market value have decreased over the past year as a percentage of their purchase prices. The average depreciation rates of new and used vehicles are average value change across all ages.



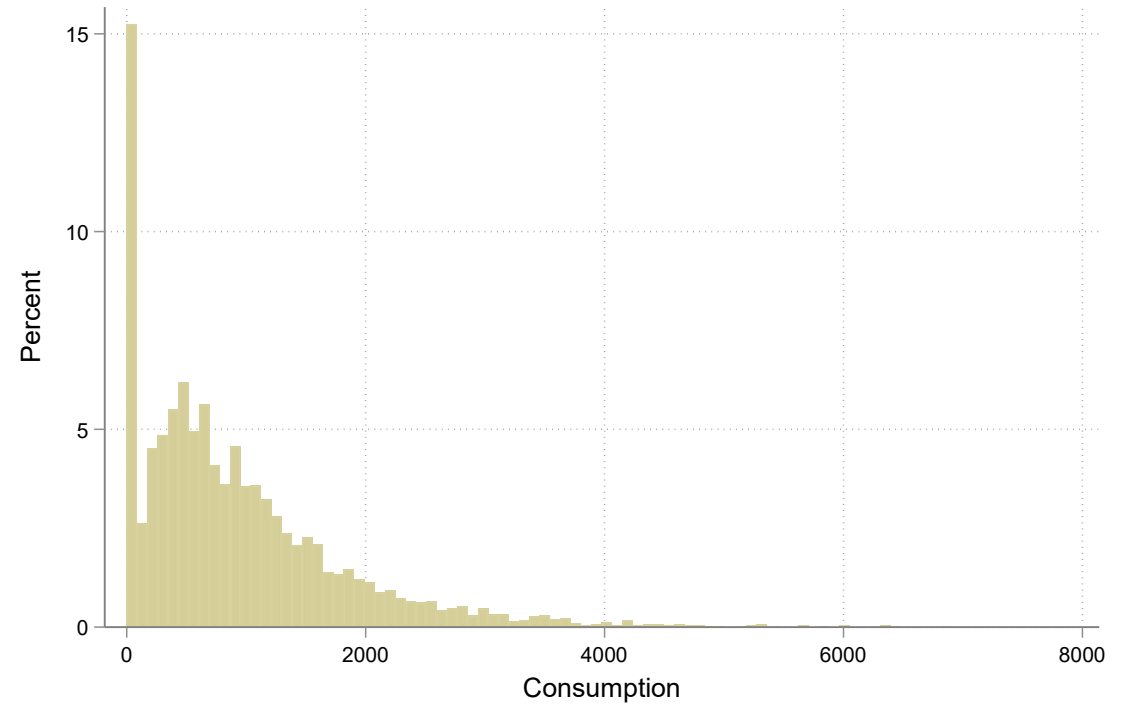
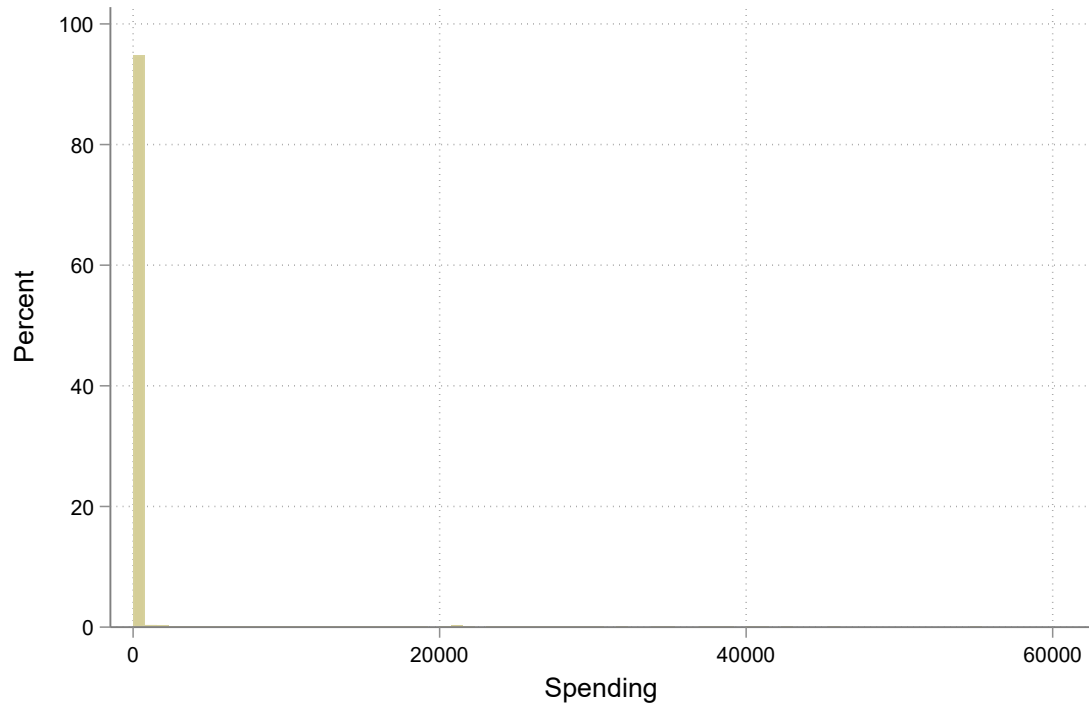
Motor Vehicle Consumption vs. Spending

Quarterly Average of All Consumer Units



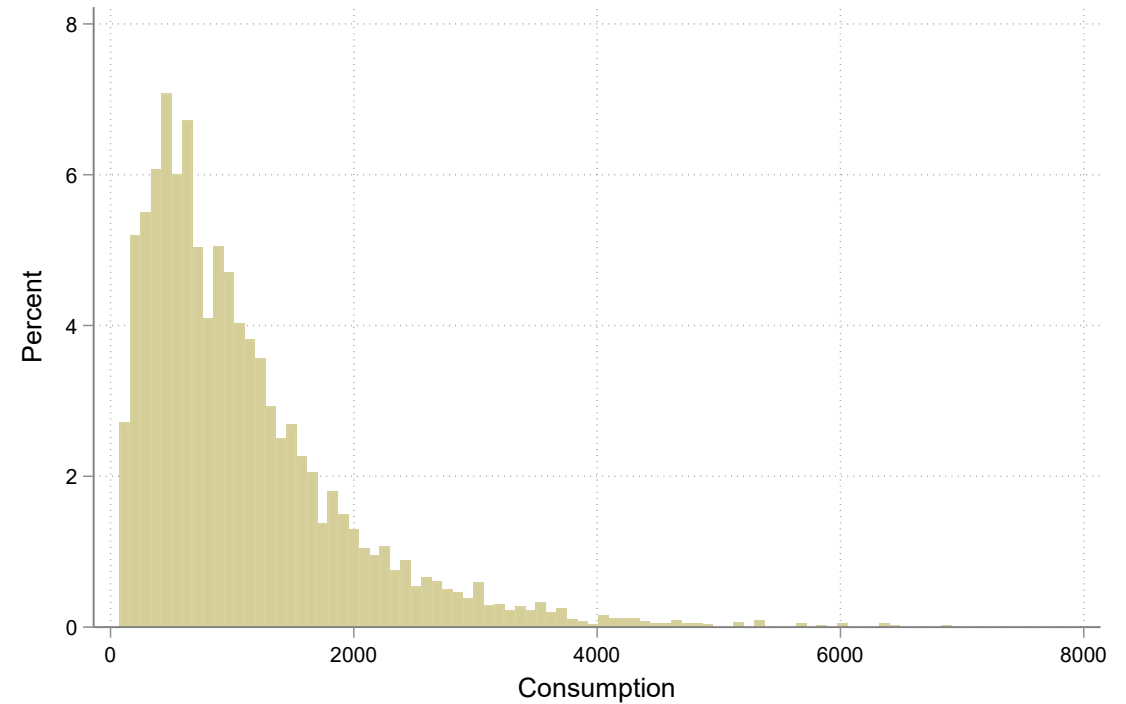
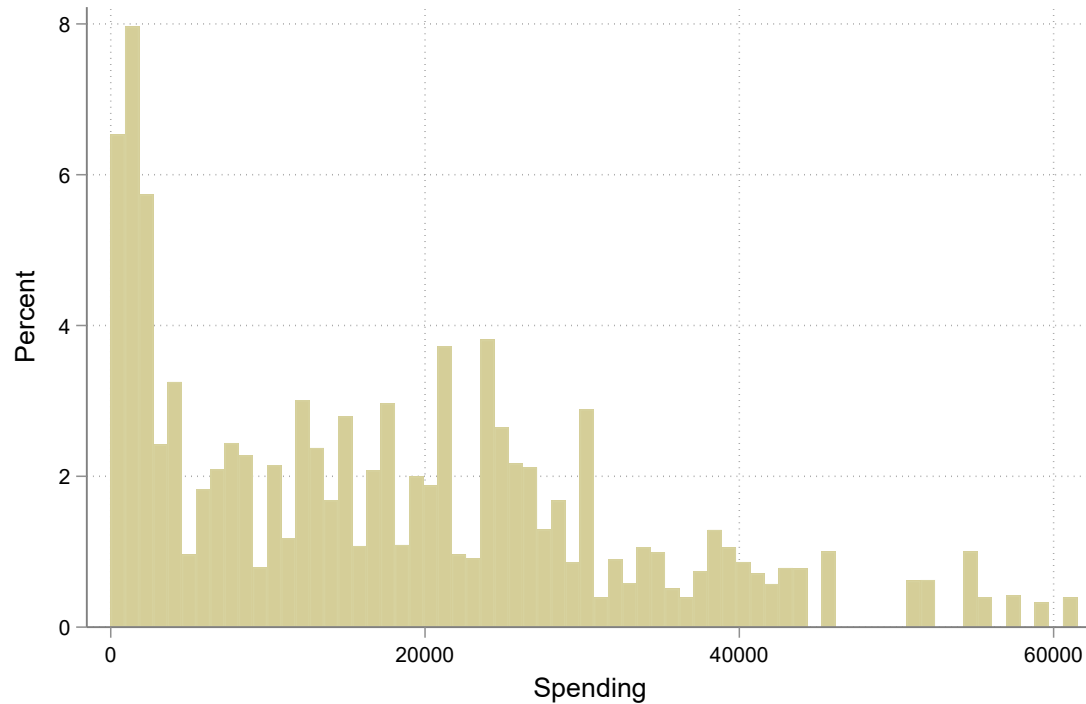
Consumption and Spending at Consumer Unit Level

2019Q4

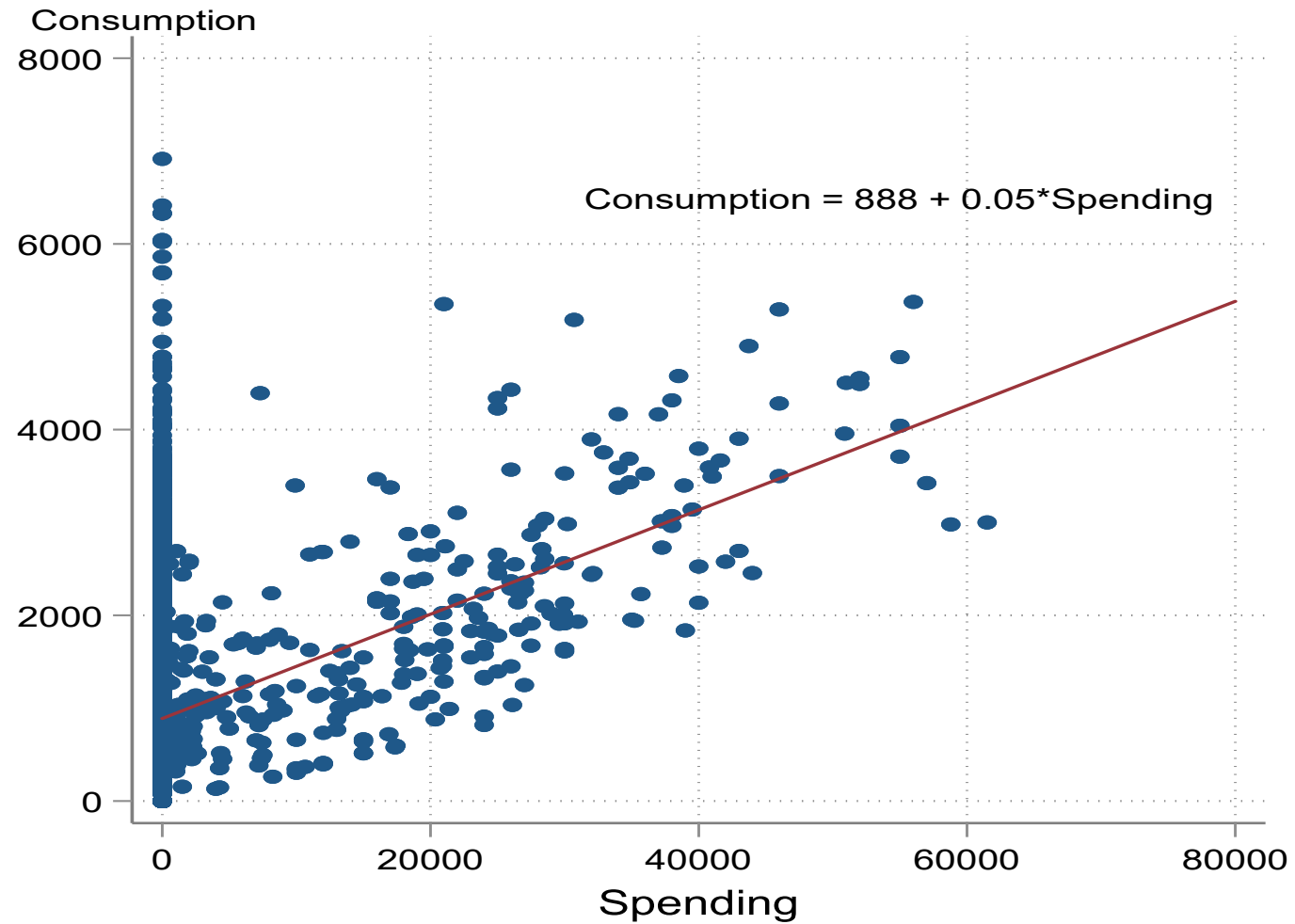


Consumption and Spending at Consumer Unit Level

2019Q4 (>\$0)



Consumption and Spending at Consumer Unit Level



2019Q4



Conclusion

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

- Next step: adding in other expenditures
 - ▶ Maintenance & repairs
 - ▶ Operating expense
 - ▶ Gas & fluids
 - ▶ Vehicle insurance

Appendix

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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