

# The Evolution of Market Power in the US Auto Industry

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What are the trends in market power in the auto industry?

How is market power related to trends in

- concentration,
- product proliferation and differentiation,
- import competition,
- product innovations.

# Motivation

Recent interest in long-term trends in market power and concentration.

## Popular approaches to measuring markups

Accounting data:

- Gopinath, Gourinchas, Hsieh, and Li (2011 AER)

Production Functions:

- Hall (1988 JPE),
- De Loecker, Eeckhout, and Unger (2019 wp), etc.

Demand Side:

- Bresnahan (1987 JIndEc), BLP / Petrin, the *Cannon*
- Unusual to have long time series.

# Why No Demand-side Studies?

Data availability: Panels of high quality price and quantity data are typically short.

## Things that might complicate the analysis

- Introduction of new technologies,
- Changes in *distribution of* preferences,
- Changes in conduct.

For a single industry:

1. Construct dataset suitable for estimating markups over four decades;
2. Apply standard demand estimation techniques to recover markups;

## Why US Automobiles?

- Oligopoly with large fixed costs.
- Major durable goods industry:  $\approx 4\%$  of consumer expenditure in 2015.
- Well studied: Berry, Levinsohn, Pakes (1995) and many others.
- Interesting changes from 1980-present.

The Data

# Automobile Sales Data

**Source:** Wards Automotive Yearbooks and other sources.

**Time:** 1982-2017.

**Coverage:** All cars, light trucks, vans sold in US.

**Wards Books (and digital files) contain:**

- **Specifications** and **list price** by trim.
- **Sales** by model.



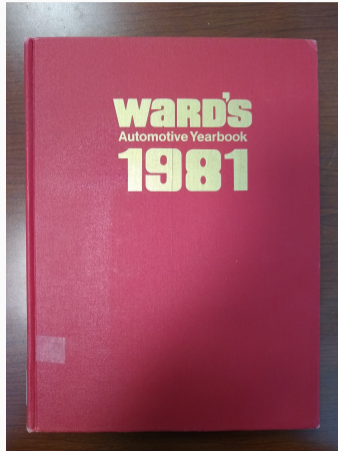
# Consumer-level Sales Data

**Source:** CEX and Mediamark Research (MRI).

**Time:** 1983-2015.

**Information:** We construct “micro-moments” using:

- car purchased and price paid;
- income,
- family size,
- rural?,
- age.



# Sample Price Data

## '86 Model U.S. Car Factory List Prices by Makes,

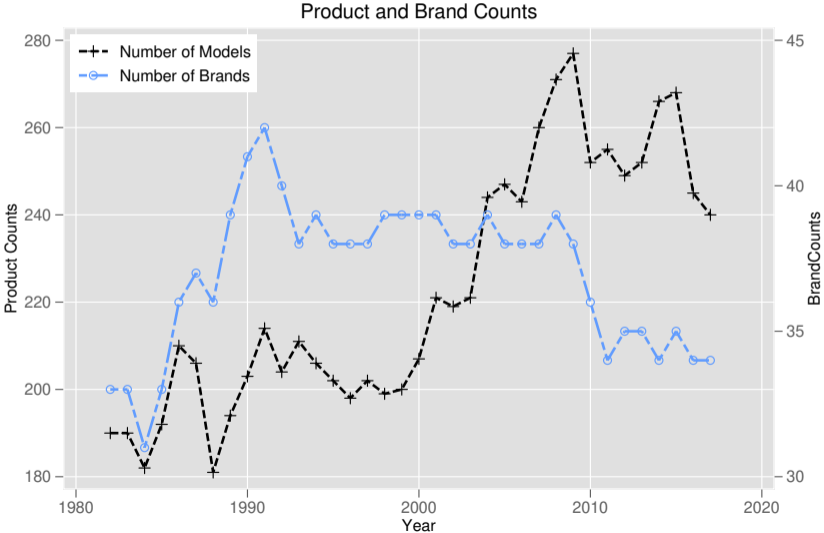
MAKES AND SERIES	SEDANS		HARDTOPS	HATCHBACKS		CONV.	WAGON	SELECTED OPTIONS				
	2-door	4-door	2-door	2-door	4-door	2-door		A-Trans.	R-Air	C-Cruise	T-Tilt	R-Defog
<b>CHEVROLET DIV.</b>												
Chevette CS 4	—	—	—	\$5,935	\$6,249	—	—	\$425	\$645	—	\$115	\$135
Chevette CS 4D	—	—	—	6,442	6,777	—	—	—	—	—	115	135
Cavalier 4	\$7,076	\$7,258	—	—	—	—	\$7,417	465	645	\$175	115	135
Cavalier 6	7,686	7,868	—	—	—	—	8,027	465	645	175	115	135
Cavalier CS 4	—	7,720	—	7,743	—	—	7,895	465	645	175	115	135
Cavalier CS 6	—	8,330	—	8,353	—	—	8,505	465	645	175	115	135
Cavalier RS 4	8,010	8,181	—	8,200	—	\$12,900	8,349	465	645	175	115	135
Cavalier RS 6	8,620	8,791	—	8,810	—	13,510	8,959	465	645	175	115	135
Cavalier Z24 6	9,248	—	—	9,438	—	—	—	465	645	175	115	135
Nova 4	—	7,725	—	—	7,959	—	—	*	*	*	*	*
Camaro Sport Cpe. 4	—	—	—	9,349	—	—	—	465	750	175	115	145
Camaro Sport Cpe. 6	—	—	—	9,699	—	—	—	465	750	175	115	145
Camaro Sport Cpe. 8	—	—	—	10,099	—	—	—	465	750	175	115	145
Camaro Berlinetta 6	—	—	—	12,316	—	—	—	465	750	185	115	145
Camaro Berlinetta 8	—	—	—	12,716	—	—	—	465	750	185	115	145
Camaro Z28 8	—	—	—	12,316	—	—	—	465	750	175	115	145
Celebrity 4	9,149	9,345	—	—	—	—	9,495	490	750	175	115	145
Celebrity 6	9,584	9,780	—	—	—	—	9,930	490	750	175	115	145
Monte Carlo 6	—	—	\$10,655	—	—	—	—	STD	750	175	115	145
Monte Carlo 8	—	—	11,045	—	—	—	—	STD	750	175	115	145
Monte Carlo SS 8	—	—	12,880	—	—	—	—	STD	750	175	115	145
Caprice 6	—	—	10,718	—	—	—	—	STD	750	175	115	145
Caprice 8	—	—	11,108	—	—	—	—	STD	750	175	115	145
Caprice Classic 6	11,110	11,270	—	—	—	—	—	STD	750	175	115	145
Caprice Classic 8	11,500	11,660	—	—	—	—	11,986	STD	750	175	115	145
Caprice Classic Brougham 8	—	11,904	—	—	—	—	—	STD	750	175	115	145

## Trends in US Auto Market

## Main Take-aways

1. Concentration decreasing over time.
2. Prices rising.
3. Car characteristics getting better.

# Brands and Models over Time



# Major Firms over Time

1985



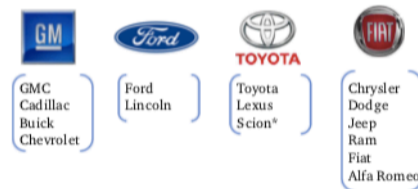
1995



2005

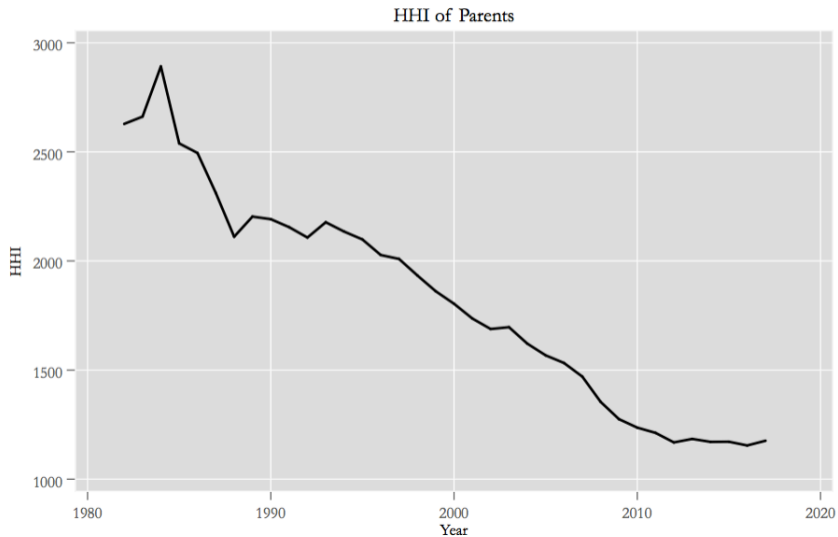


2015



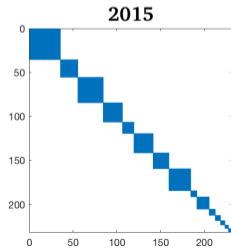
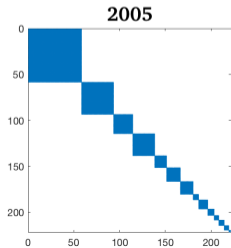
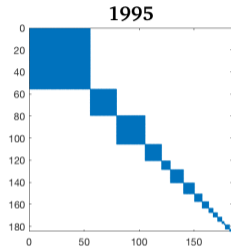
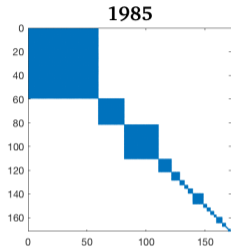
\* Retired brand as of 2017

# Herfindahl-Hirschman Index (HHI) Over Time

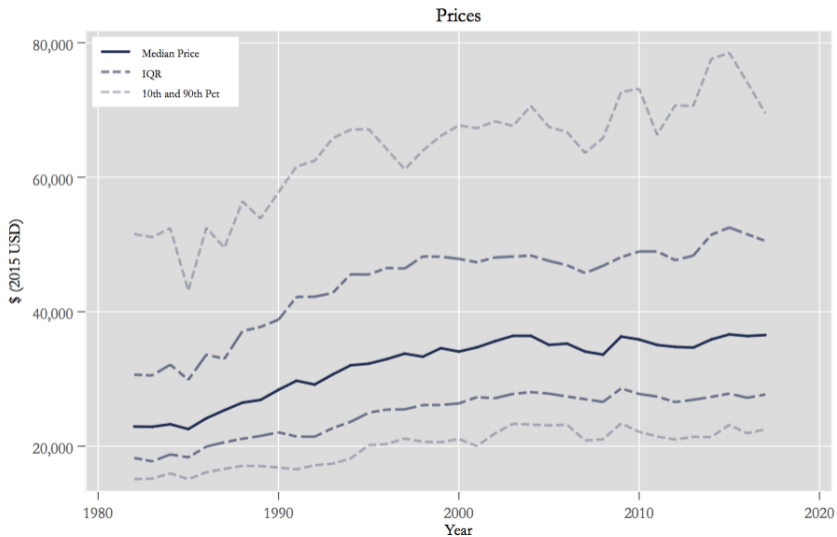




# Product Offerings over Time: Ownership Matrix



# Distribution of Prices (2015 US\$)

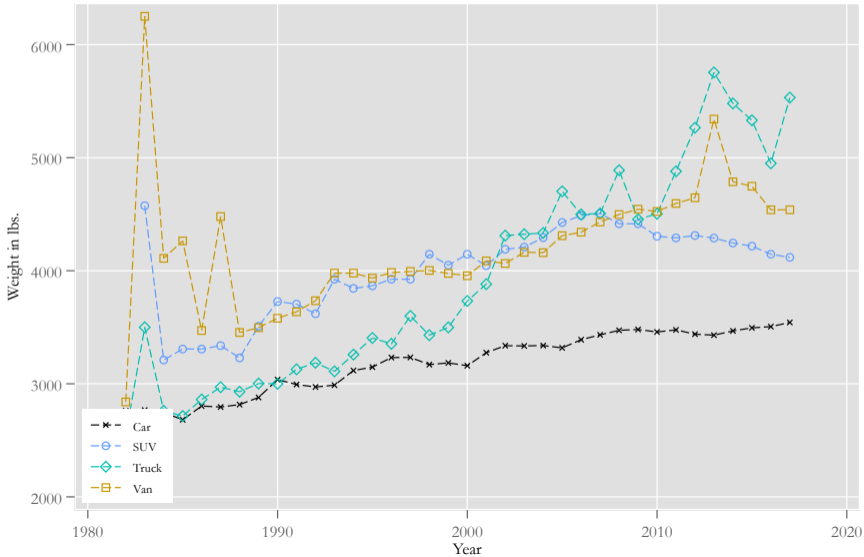


## Why would Prices Rise as HHI Falls?

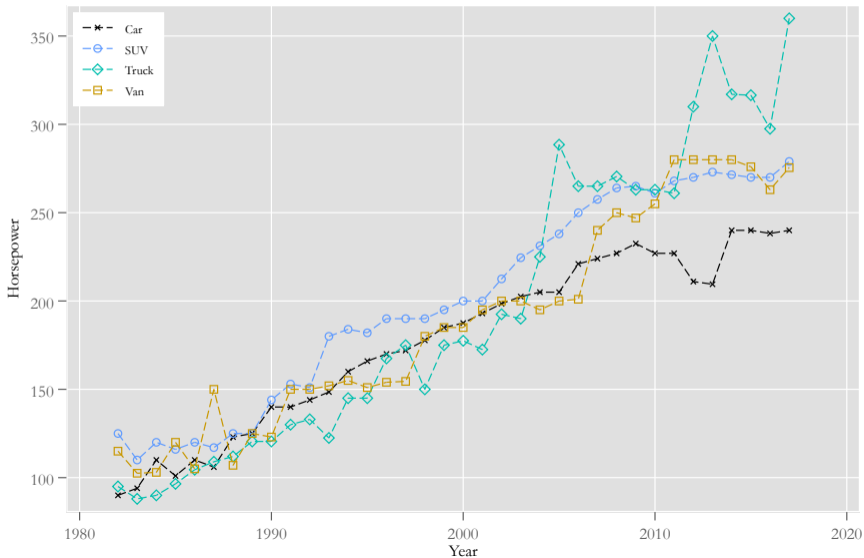
Several possible explanations:

1. Marginal costs have increased.
  - Higher quality
  - Lower efficiency
2. Products are more differentiated.
3. Consumers are less elastic.

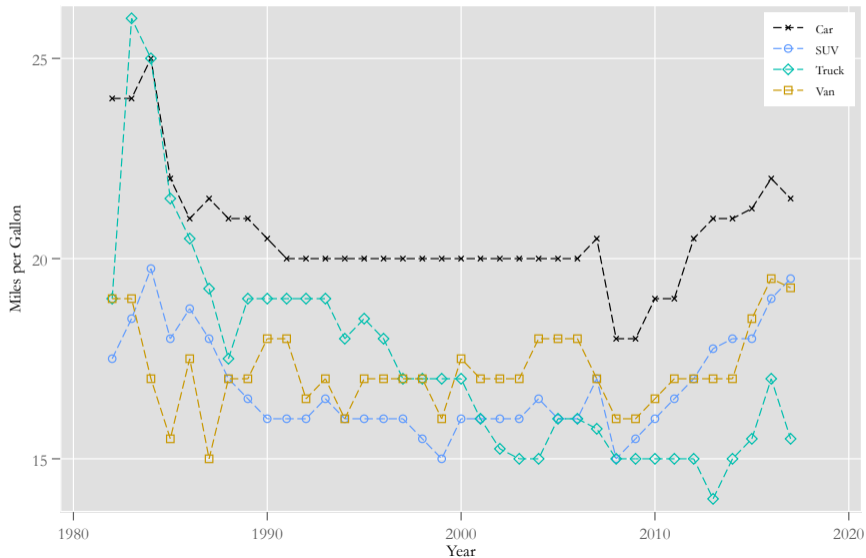
# Costs: Autos are getting heavier, trucks by a lot



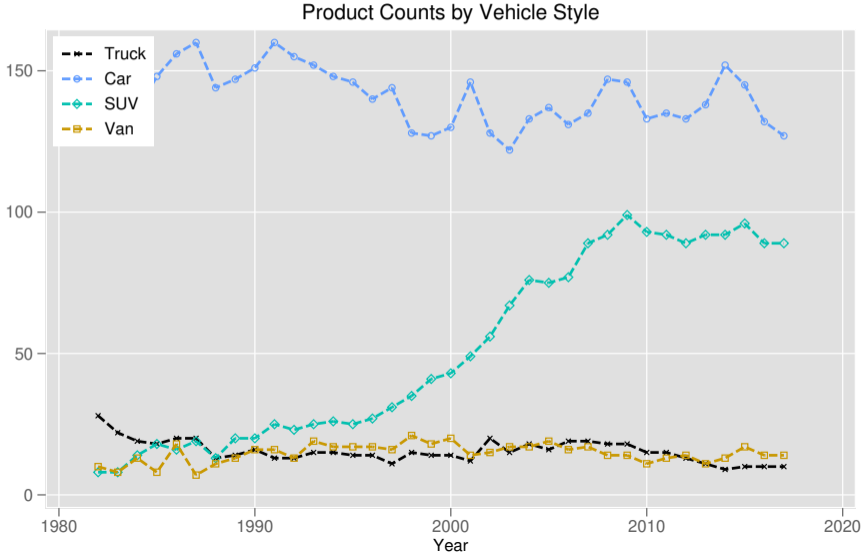
# Costs: Horsepower increases steadily



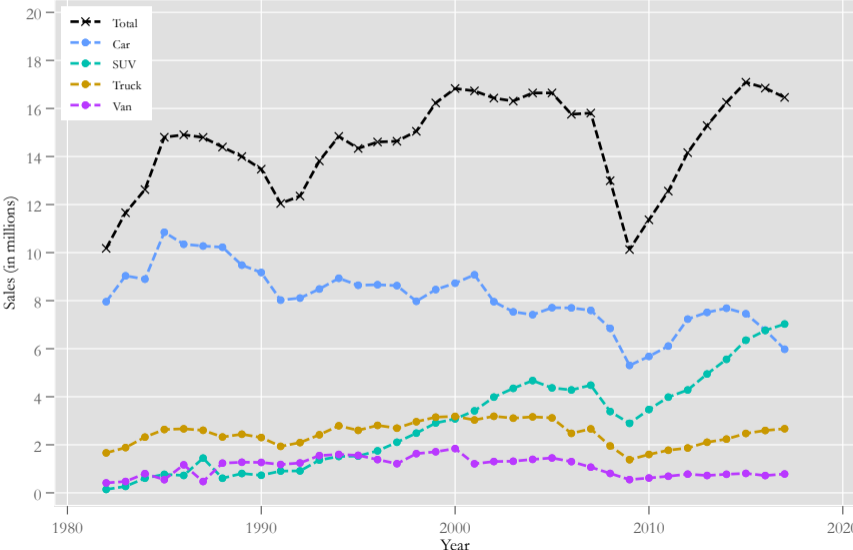
## Costs: Fuel efficiency stable, despite size increase



# Differentiation: Rise of SUVs

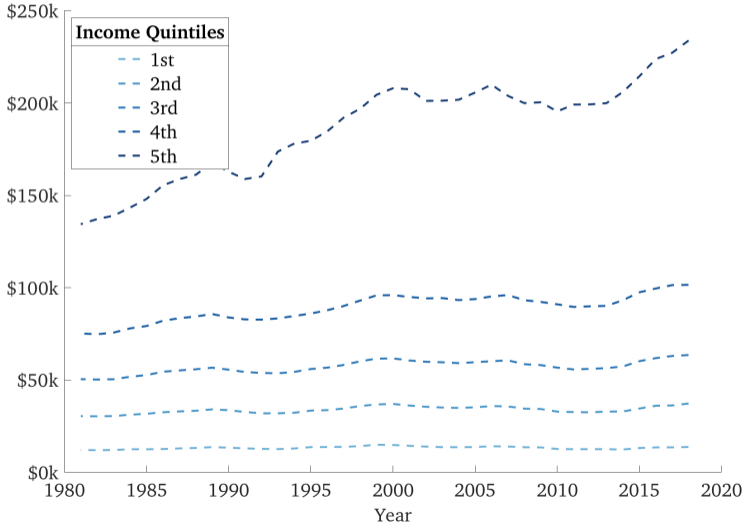


# Differentiation: Sales by Body Type

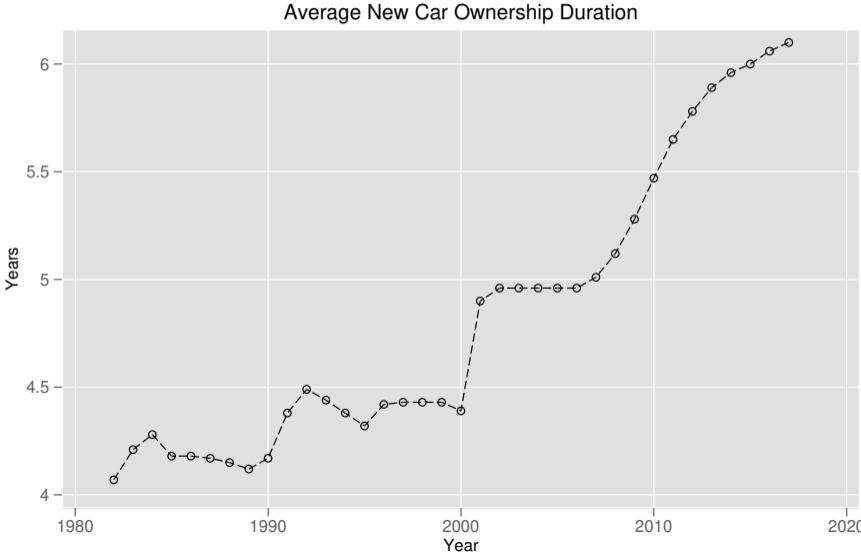




# Consumers: Household Income Inequality



# Car Durability



- Not all households are in the market for a car every year.
- Car durability has improved dramatically over time, shrinking the potential market-size for new cars.

- We define:

$$MktSize_t = \frac{\text{Num. of Households}_t}{\text{Avg. New Car Duration}_t}$$

- Data on new car tenure from Nat. Highway Traffic Safety Admin. (NHTSA).<sup>1</sup>

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<sup>1</sup>Need to refine this.

Model

## Demand

Each year, households make a discrete choice over the available vehicle models.

$$u_{ij} = \beta_i x_{jt} + \alpha_i p_{jt} + \xi_{jt} + \epsilon_{ijt}.$$

## Supply

Each year: static, simultaneous, Nash Eq. in prices.

$$\text{Price FOC: } q_j + \sum_{k \in \mathcal{J}_t^m} (p_j - c_j) \frac{\partial q_j}{\partial p_k} = 0$$

## Car Characteristics

Horsepower, miles per \$, weight, width, height, style (“car,” truck, SUV, van), new design (refresh), make dummy.

## Observed Heterogeneity

- Price: Income.
- Constant: Income.

## In the future

More observed heterogeneity + unobserved heterogeneity.

## Estimation and Results

## Price Instrument: Real Exchange Rates (RER)

Proxy for cost of production in assembly country:

$$\text{Real Exchange Rate} = \frac{PPP_{it}}{XR_{it}}$$

- $PPP_{it}$  - Purchasing Power Parity  
Local prices/wages rise  $\rightarrow$  PPP rises  $\rightarrow$  RER rises.
- $XR_{it}$  - Market Exchange Rate  
Local Depreciation  $\rightarrow$  XR rises  $\rightarrow$  RER falls.
- Feenstra, Inklaar and Timmer (2015, *AER*) refer to RER as “Price Level”.
- 1 = US in base year (2005).



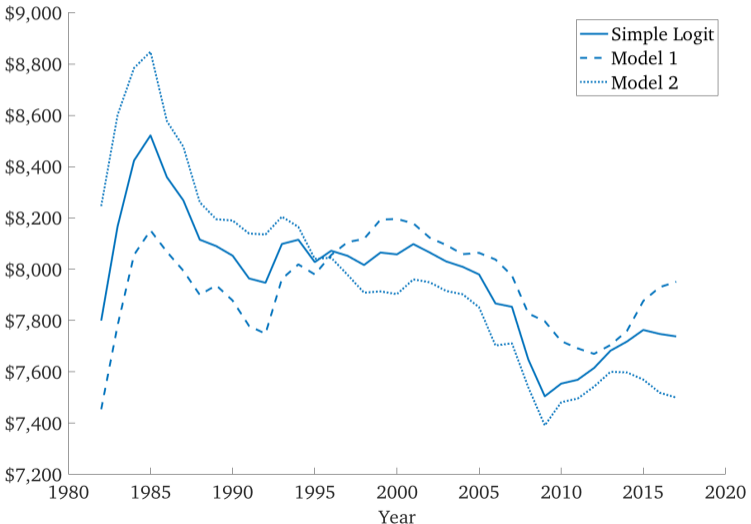
# Multinomial Logit Results

	First Stage	Reduced Form	OLS	IV
Real XR*	4.816 (0.774)	-0.675 (0.338)		
Price			-0.053 (0.008)	-0.140 (0.060)
Characteristics	yes	yes	yes	yes
Make Dummies	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes
N	7115	7115	7115	7115
R-sq	0.826	0.436	0.471	0.360
Mean Own Price Elas.	–	–	-1.75	-4.66
First Stage F-Stat:	38.69			

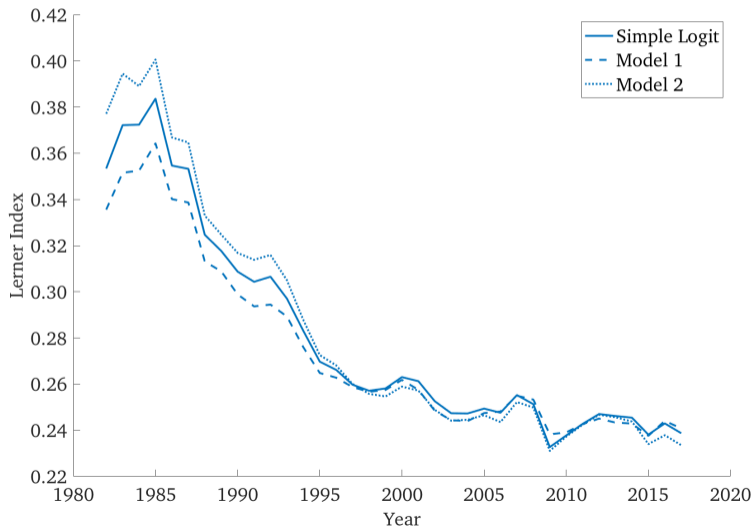
## Three Specifications

- Multinomial Logit.
- Model 1: Price X Income.
- Model 2: Price X Income *and* Constant X Income.

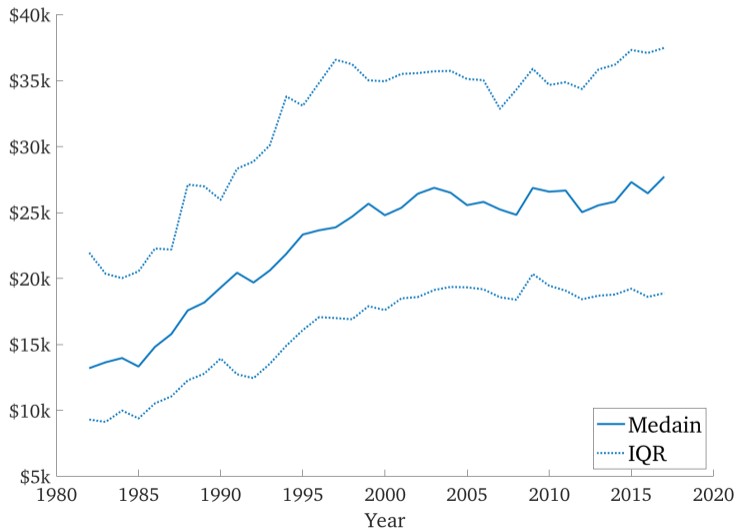
# Average Margin over Time



## Average Markup (Lerner Index) over Time

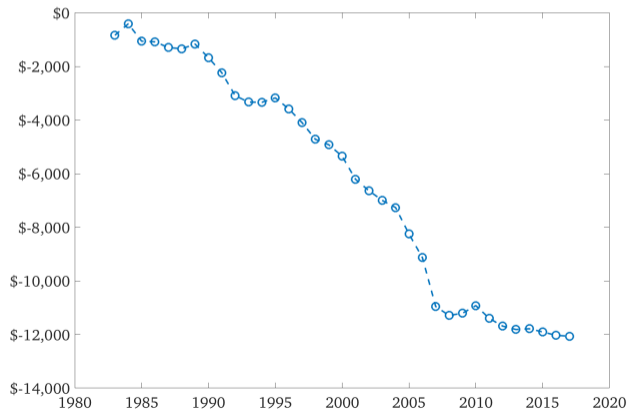


## Price Increase driven by Costs (Model 2)



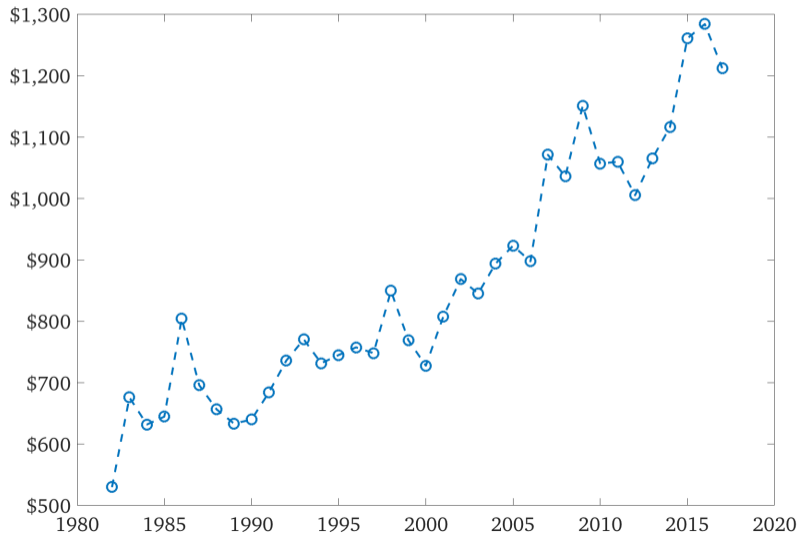
# Costs are Falling after Controlling for Car Characteristics

$$\log(\hat{m}c_{jt}) = \gamma X_{jt} + \tau XR_{jt} + \eta_t + \omega_{jt}$$



- How much would consumers pay for 2017 choice set versus 1982 choice set?
- Issue: Value of outside good is changing over time.
  - Durability of used cars, and
  - Macro shocks change relative value of new versus used cars.
- **Today's Solution: Fix year effects at mean value, compute compensating variation.**
- Nets out:
  - Change in value of outside good.
  - Increase in mean value of unobserved characteristics.

# Compensating Variation Due to Characteristic Change





Initial results, subject to change:

- Price increase is not due to markups, which have declined
- Marginal cost increases are the culprit
- Bigger, better cars, not technological backsliding
- Consumers are better off