

Micro MPCs and Macro Counterfactuals: The Case of the 2008 Rebate

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¹Views expressed here do not necessarily reflect those of the Federal Reserve Board or the Federal Reserve System

Introduction

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- ▶ Micro estimates suggest $MPCs \geq 50\%$ out of rebates.
- ▶ Calibration of heterogeneous agent macro models \Rightarrow temporary rebates can be a powerful macro stimulus.

Micro/Macro Tension Regarding 2008 Rebates

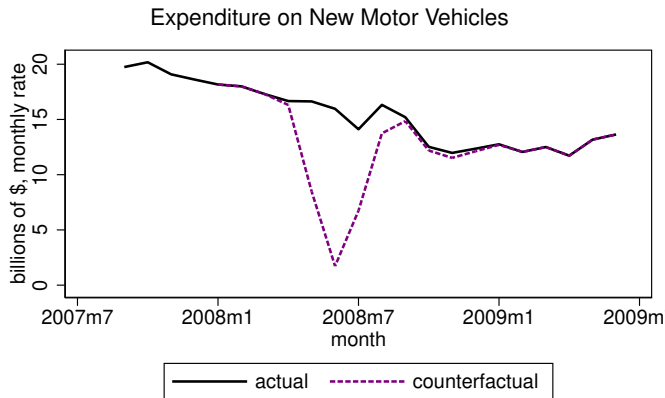
Micro/Macro Tension Regarding 2008 Rebates

- ▶ Feldstein (2008), Taylor (2009)
 - ▶ Simple analysis of [macro data](#)
 - ▶ Big saving rate spike, no consumption spike.
 - ▶ Concluded that MPCs out of the 2008 rebate were low.

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 - ▶ Concluded that MPCs out of the 2008 rebate were low.
- ▶ Parker and co-authors
 - ▶ Added rebate questions to CEX, Nielsen [household data](#)
 - ▶ Great natural experiment, applied micro methods.
 - ▶ Estimated very high MPCs: 0.5 - 0.9 on total consumption.

What are the Macro Implications of Parker et al.'s Estimates?



- ▶ Sahm-Shapiro-Slemrod (2012) calculation for new motor vehicles.
- ▶ Counterfactual implies **90% drop in expenditures if no rebate**

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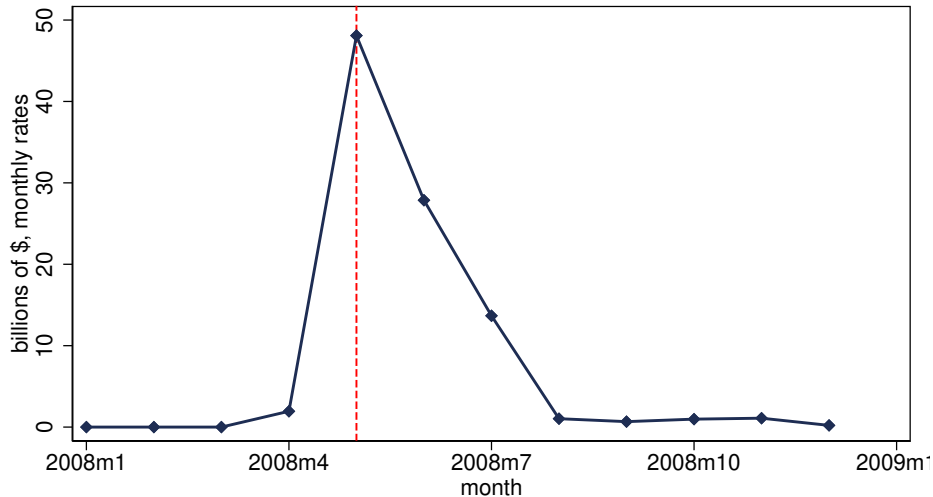
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\Rightarrow Temporary tax rebate give **modest macro stimulus**.

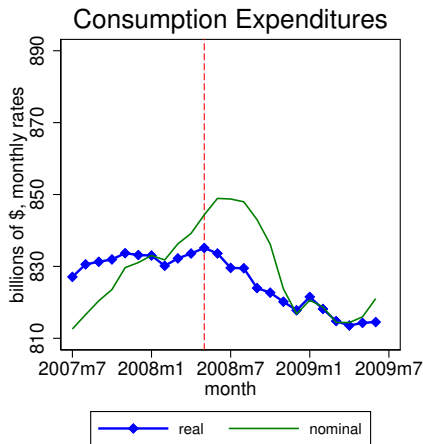
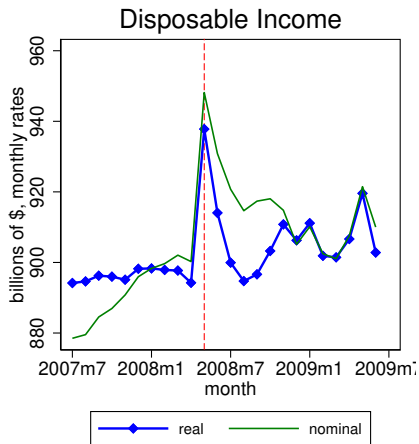
Narrative of 2008

Review of data and major economic events.

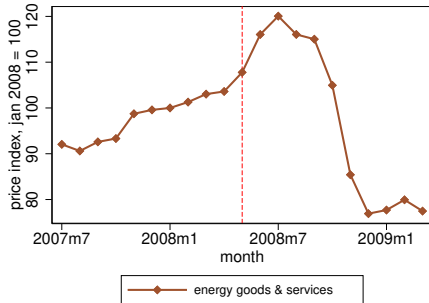
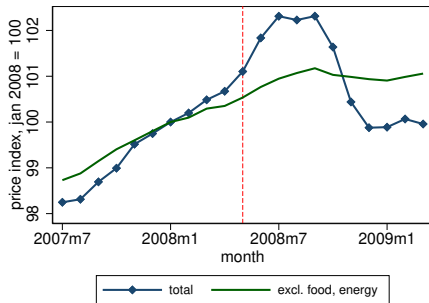
2008 Tax Rebate



Disposable Income and Consumption



Consumption Price Indexes (PCE)

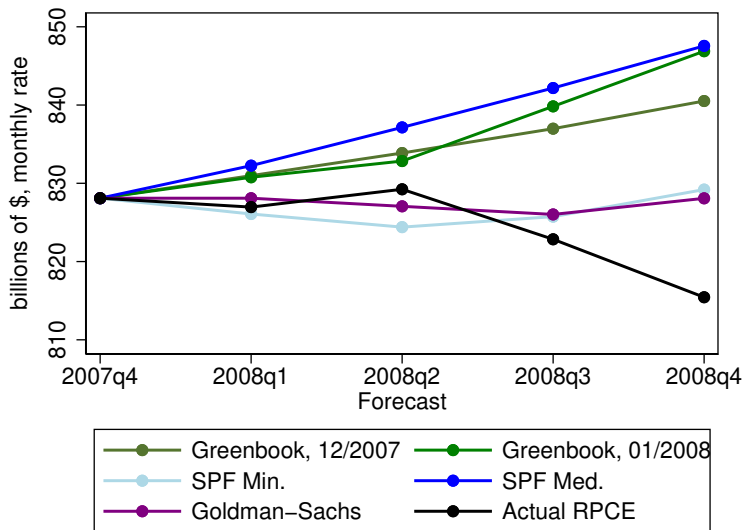


- ▶ Prices rose, peaked in July, then fell.
- ▶ Energy prices were a significant contributor.

Do any forecasts suggest a V-shaped consumption path?

- ▶ Professional forecasters
 - ▶ Forecasts became more pessimistic after release of December 2007 employment report.
 - ▶ Some predicted rebate enacted in second half of the year.
 - ▶ The following graph shows forecasts made just before the rebate was enacted in February 2008.
- ▶ Our forecasts:
 - ▶ Make forecasts pessimistic by allowing perfect foresight of recession, oil prices, and Lehman Brothers.
 - ▶ Similar results.

Professional Forecasters



Methodology for creating macro counterfactuals

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- ▶ Construct a medium-scale **two-good, two-agent** New Keynesian model.
 - ▶ Nondurables and durables (interpreted as motor vehicles).
 - ▶ Optimizing and hand-to-mouth households.
 - ▶ Sticky prices and wages, noncompetitive labor markets, etc.
 - ▶ Combination of Ramey's (2021) extension of Gali et al. (2007) and McKay-Wieland (2021 Econometrica).

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- ▶ Calibrate fraction of **hand-to-mouth households** to match micro MPCs.
- ▶ **Simulate** response of consumption to rebates and subtract from actual consumption data to derive the **counterfactual path** with no rebate.

Durable Goods in the Utility Function

- Utility function of both types of consumers:

$$E_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{(C_t)^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} + \psi \frac{(D_t)^{1-\frac{1}{\sigma^d}}}{1-\frac{1}{\sigma^d}} - \nu \frac{(H_t)^{1+\phi}}{1+\phi} \right]$$

C_t = nondurable consumption, D_t = durable stock, H_t = hours worked.

Durable Goods Accumulation

$$D_t = (1 - \delta^d)D_{t-1} + \frac{X_t}{p_t^d} \left[1 - \frac{\vartheta}{2} \left(\frac{X_t}{p_t^d} - \delta^d D_{t-1} \right)^2 \right]$$

X = durable expenditure denominated in nondurable goods

δ^d = depreciation rate of household durables.

p_t^d = relative price of durable goods.

ϑ = parameter governing adjustment costs

Durable Goods Production

- ▶ Supply curve for consumer durables $p_t^d = \left(\frac{x_t}{\bar{X}}\right)^{\frac{\zeta}{1+\zeta}}$
- ▶ Supply elasticity of real durable goods is given by ζ^{-1} .
- ▶ If $\zeta^{-1} = \infty$ then nondurable and durable goods are perfect substitutes in production.

Household Behavior

- ▶ Fraction $1 - \gamma$ are optimizers, receive all profits.
- ▶ Fraction γ follow hand-to-mouth ("m") rules.
 - ▶ Standard models assume that they neither borrow nor save and simply consume all of their current income,

$$C_t^m + X_t^m = W_t H_t^m - T_t^m$$

- ▶ We [allow for lagged effects](#) of an income shock spread over a few months, calibrated to the micro MPC evidence.

Calibration

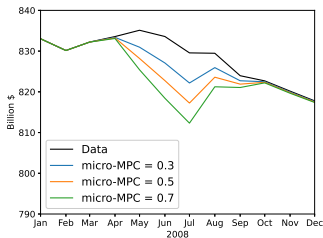
- ▶ Assume that hand-to-mouth households spread spending equally over three months, beginning with current month.
 - ▶ Best estimates: 2/3rds in current month, 1/6th in each of next two months.
 - ▶ Our assumption of 1/3-1/3-1/3 makes our counterfactuals less V-shaped and hence less implausible.
- ▶ Assume households allocate 83% of expenditure to durables - based on our estimates.
- ▶ Calibrate durable adjustment cost and elasticity of substitution to match long-run durable demand elasticity of -1 and short-run durable demand elasticity from Bachmann et al (2021). [Calibration table](#)
- ▶ Baseline $\zeta^{-1} = \infty$, less elastic alternative $\zeta^{-1} = 5$.

Counterfactual Simulations Procedure

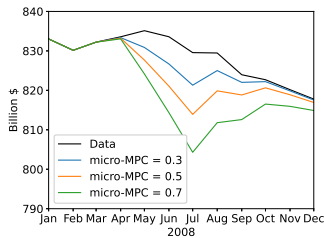
- ▶ We use our TG-TANK model to **simulate the dynamic general equilibrium** consumer spending response to a rebate.
 - ▶ Match anticipation lag, size, and timing of the actual rebate.
- ▶ Run experiment for **micro MPCs equal to**
 - ▶ **0.3** — Shapiro-Slemrod (2009) and our estimates.
 - ▶ **0.5 and 0.7** — Low and mid-point of Parker, Souleles, Johnson, McClelland (AER 2013)

Counterfactual Consumption Expenditure: Baseline Model

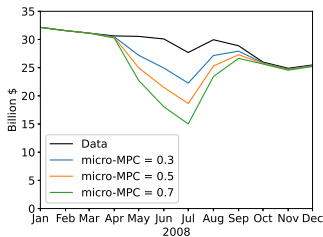
Real PCE: Micro MPCs



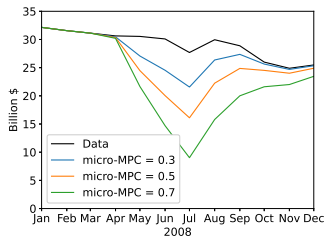
Real PCE: GE Baseline



Motor Vehicles: Micro MPCs



Motor Vehicles: GE Baseline



Baseline Model: GE Forces Amplify Micro MPCs

Table: General Equilibrium Marginal Propensity to Consume: Baseline Model

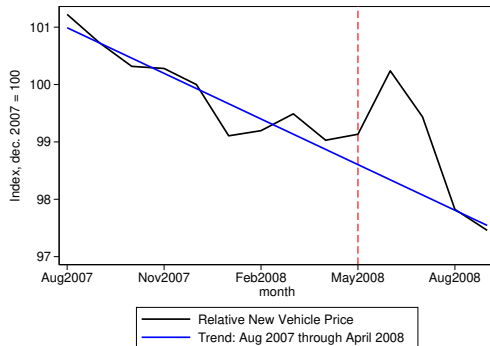
PCE		Motor vehicles		Nondurable goods	
micro	GE	micro	GE	micro	GE
0.3	0.36	0.25	0.29	0.05	0.06
0.5	0.74	0.41	0.61	0.08	0.12
0.7	1.35	0.58	1.13	0.12	0.22

Reconciling micro MPCs with Macro Counterfactuals

- ▶ Significant GE dampening forces.

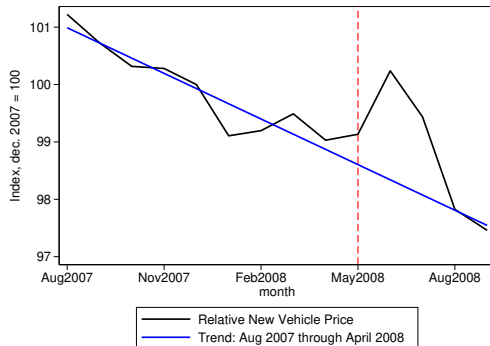
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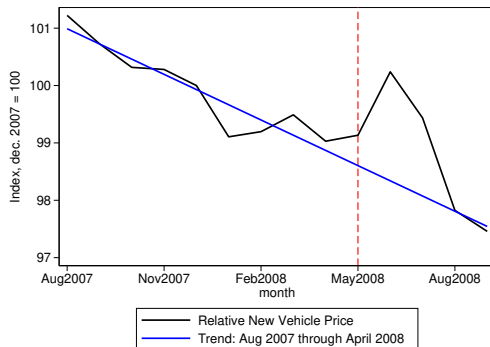
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- Less elastic durable goods supply - we change elasticity from ∞ to 5.

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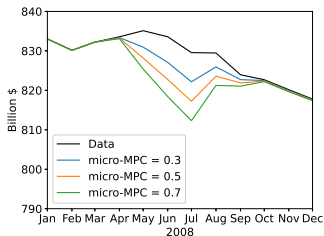
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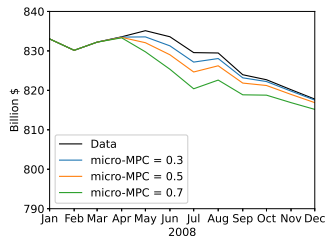
- Less elastic durable goods supply - we change elasticity from ∞ to 5.
- Re-examination of the micro MPC estimates.

Counterfactual: Less Elastic Durable Supply Model

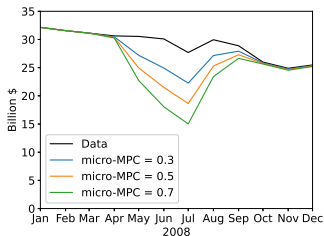
Real PCE: Micro MPCs



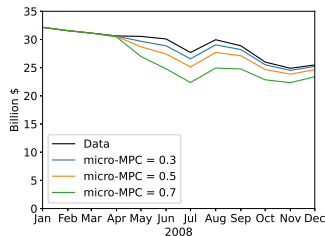
Real PCE: GE Less Elastic



Motor Vehicles: Micro MPCs



Motor Vehicles: GE Less Elastic



Less Elastic Durable Supply: GE Forces Dampen Micro MPC

Table: General Equilibrium Marginal Propensity to Consume: Model with less elastic Durable Supply

PCE		Motor vehicles		Nondurable goods	
micro	GE	micro	GE	micro	GE
0.3	0.12	0.25	0.08	0.05	0.03
0.5	0.28	0.41	0.21	0.08	0.07
0.7	0.62	0.58	0.49	0.12	0.13

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- ▶ Relatively elastic demand for durables important for dampening.
- ▶ With only nondurables micro MPC = 0.3 becomes GE MPC = 0.41.

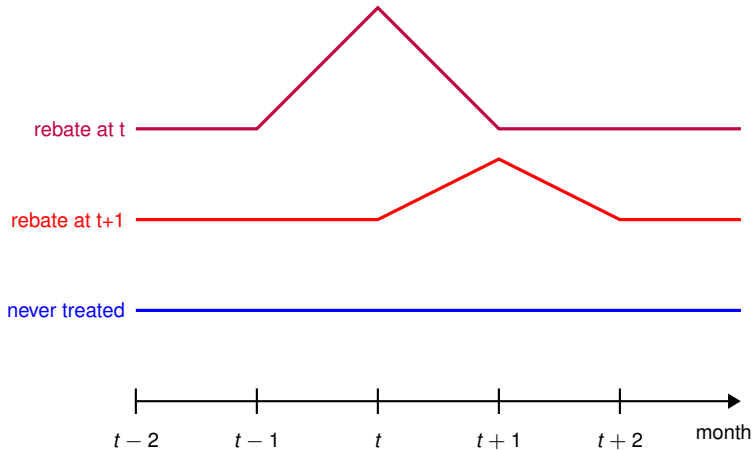
Estimation Framework

We focus on the indicator specification of Parker et al. 2013

$$C_{i,t+1} - C_{i,t} = \sum_s \beta_{0s} month_{s,i} + \beta'_1 \mathbf{X}_{i,t} + \beta_2 I(\text{Rebate}_{i,t+1}) + u_{i,t+1}$$

- ▶ C is consumer expenditures.
- ▶ i indexes the household.
- ▶ t indexes the interview (performed once every three months).
- ▶ $month_{s,i}$ are fixed effects for each month.
- ▶ $X_{i,t}$ includes household controls for age and change in household size.
- ▶ $I(\text{Rebate}) = 1$ if the household received a rebate.

OLS TWFE Leverages “Forbidden Comparisons”



Steps of Borusyak, Jaravel, Spiess Method

1. Estimate regression on never- and not-yet treated observations

$$\Delta C_{i,t+1} = \sum_s \beta_{0s} month_{s,i} + \beta_1' \mathbf{X}_{i,t} + \tilde{u}_{i,t+1}$$

2. Impute ΔC for all observations as though no rebate received.

$$\Delta C_{i,t+1}(0) = \sum_s \hat{\beta}_{0s} month_{s,i} + \hat{\beta}_1' \mathbf{X}_{i,t}$$

3. Create $\tau_{i,t+1} = \Delta C_{i,t+1} - \Delta C_{i,t+1}(0)$ for households treated in $t+1$.
4. Take average of τ using CEX sample weights, ω .

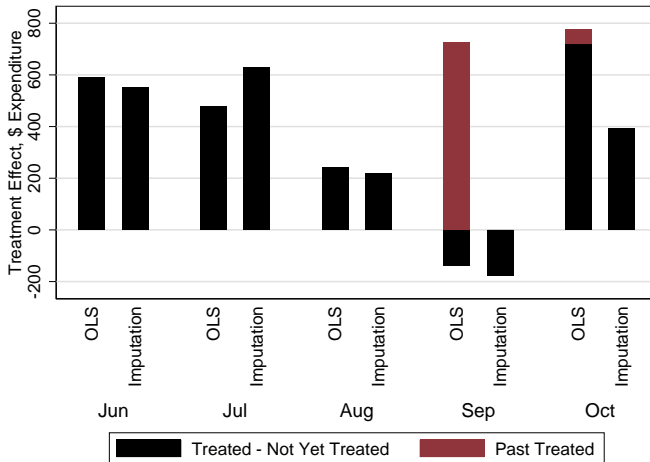
$$\tau = \sum_{i,t+1 \in I(ESP_{i,t+1})=1} \omega_{i,t+1} \tau_{i,t+1}$$

Table: Contemporaneous Household Expenditure Response to Rebate

Panel A: OLS				
	Full Sample		Rebate Only Sample	
	(1)	(2)	(3)	(4)
Rebate Indicator	483.2** (209.9)	325.7* (178.2)	779.2** (310.2)	593.6** (238.8)
Implied MPC	0.52	0.35	0.86	0.65
Extra Controls	No	Yes	No	Yes
Observations	17,229	17,229	10,343	10,343

Panel B: DID Imputation				
	(1)	(2)	(3)	(4)
Rebate Indicator	287.0 (216.0)	116.2 (191.4)	984.4 (665.6)	-64.3 (579.0)
Implied MPC	0.30	0.12	1.03	-0.07
Extra Controls	No	Yes	No	Yes
Observations	12,499	12,499	5,585	5,585

Decomposing OLS and DID Imputation



Summary of Estimation Results

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- ▶ For total consumption expenditures and the full sample, OLS implies an MPC of 0.52 while DID imputation implies an MPC of 0.3.
- ▶ Most of the change comes from nondurables expenditures.
- ▶ According to our TG-TANK model with less elastic durable good supply, a micro MPC of 0.3 corresponds to a GE-MPC of 0.12.
- ▶ Since there is negligible investment response to the temporary tax rebate, and our model is a closed-economy model, the GE-MPC is approximately equal to the Keynesian multiplier.

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 - ▶ Both imply **small multipliers**.

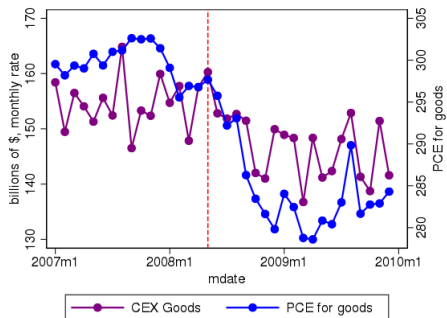
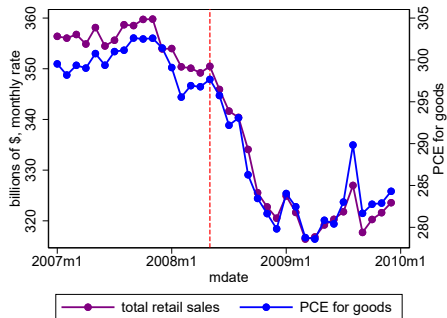
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- ▶ Two possible reconciliations: GE forces severely dampen the stimulus effects of high micro MPCs and/or there may be upward bias in the micro MPC estimates. We provide evidence for both.
 - ▶ Both imply **small multipliers**.
- ▶ More broadly, we propose this new method for evaluating micro estimates: combine theory and historical evidence to construct and assess the implied counterfactuals.

Alternative measures of Aggregate Consumption

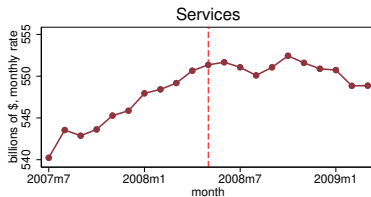
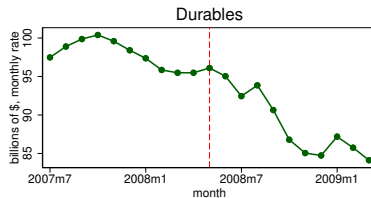
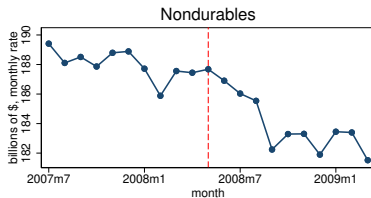
- ▶ NIPA monthly PCE is based on combining and smoothing various data sources.
- ▶ We use detailed data to make sure NIPA PCE captures the path of consumer purchases in summer 2008.
- ▶ Supplementary data: retail sales, Wards Automotive Reports, and our own CEX aggregates.

Comparison of PCE to Retail Sales and CEX

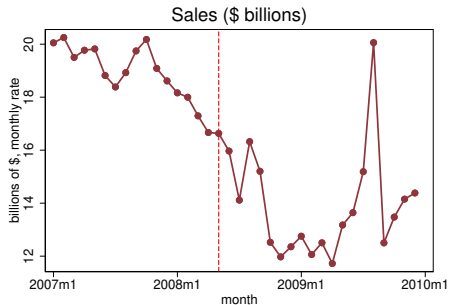
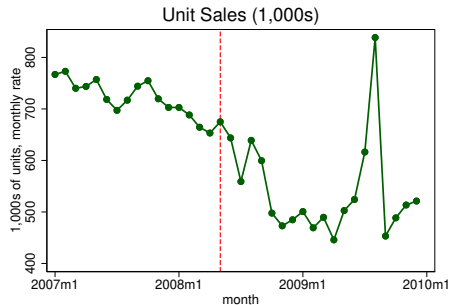


Difference in CEX and PCE Over Time

Real Consumption Expenditures by Type of Product



New Motor Vehicle Sales to Consumers

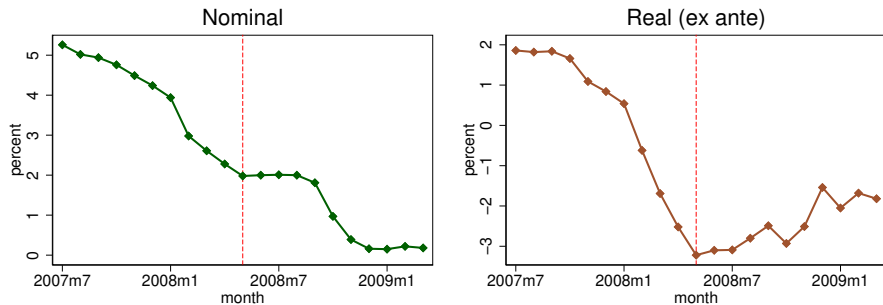


[Sales and prices by segment](#)

[Fixed Weight Price Index](#)

[Return](#)

Behavior of Monetary Policy: Federal Funds Rate



Note: Ex ante real interest rate constructed using the University of Michigan Consumer Survey median inflation expectations.

Table: Counterfactual Real PCE Declines between April and July 2008

MPC	Decline
0.3	1.7 %
0.5	2.8 %
0.7	4.5 %

Table: Largest Actual Three-Month Real PCE Declines

Date	Episode	Decline
Jan-Apr 2020	COVID lockdowns	20 %
Jan-Apr 1980	Credit controls, Volcker	2.9 %
Aug-Nov 1974	prior spike up	2.3 %
Apr-Jul 1960	prior spike up	1.8 %

Description of our forecasting equations

Included Variables

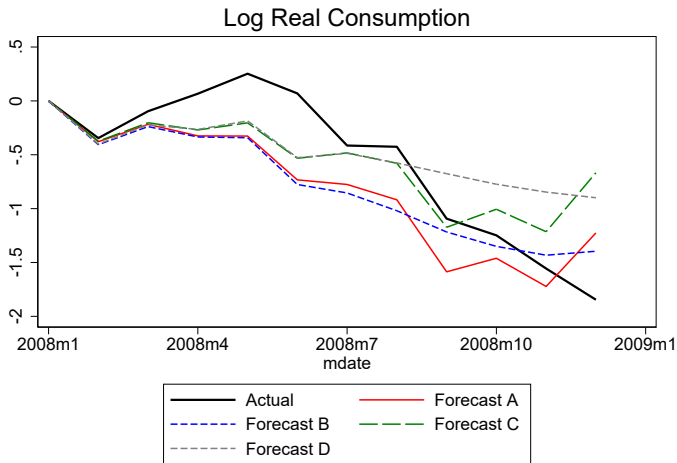
Endogenous variables	Endogenous or exogenous depending on specification
Log real consumption	Recession dummy
Log real disposable income	Log real oil prices
Log consumption deflator	Lehman bankruptcy dummy
Gilchrist-Zakrajek spread	

Notes: The sample is monthly, 1984m1 - 2019m12. 6 lags of all variables except the Lehman dummy are included. Current values of spread, recession, and oil are included. When the Lehman dummy is used, current and 2 lags are included.

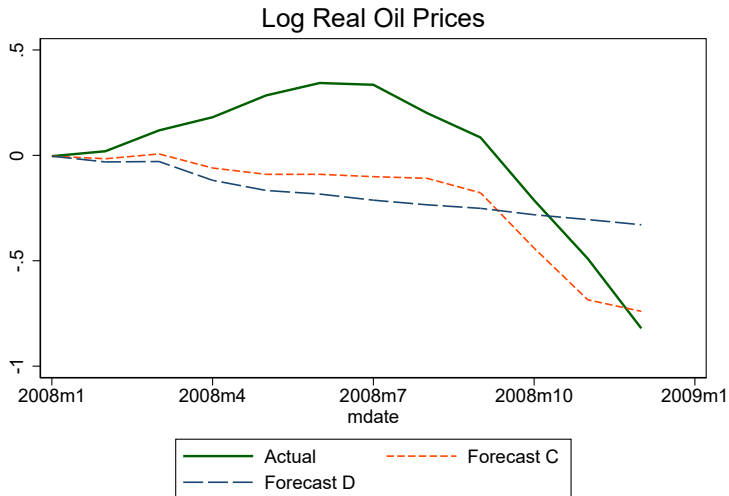
Forecast Model Specifications

Forecast Model	Lehman dummies included?	Real Oil Prices
Model A	Yes	exogenous
Model B	No	exogenous
Model C	Yes	endogenous
Model D	No	endogenous

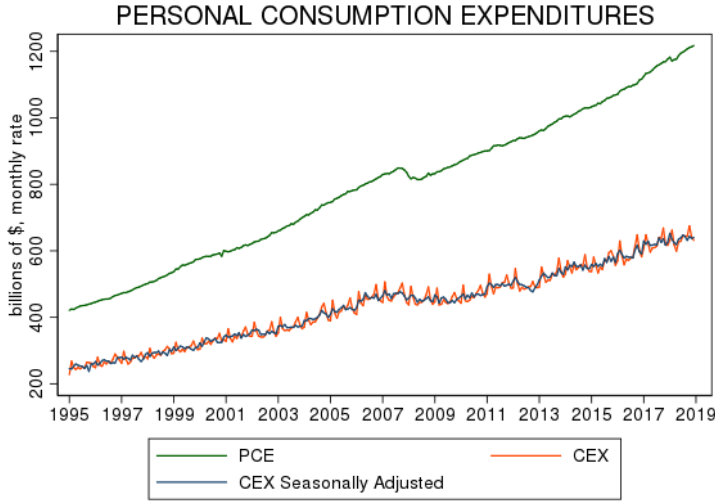
Forecasts from four models using information through 2008m1



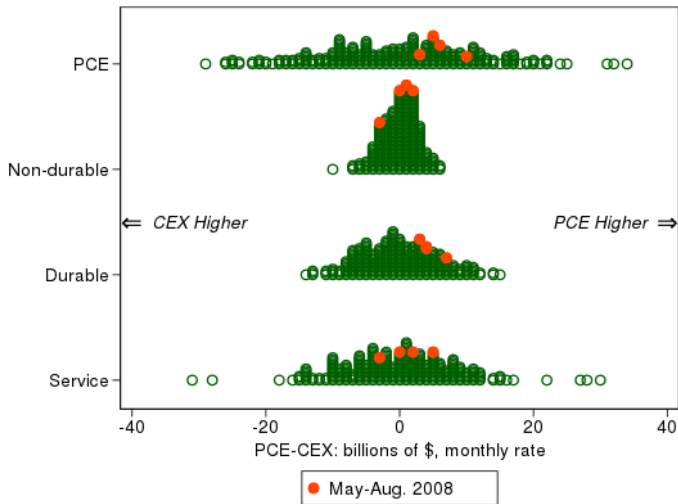
Forecasts of Log Oil Prices



Difference CEX and PCE Over Time

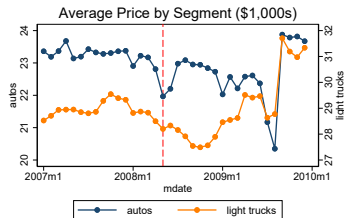
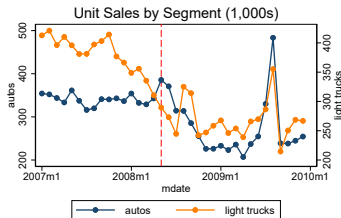
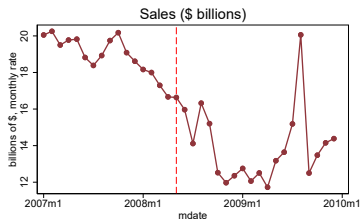
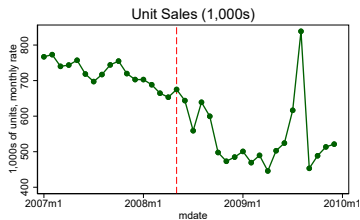


CEX v PCE Gap is Normal in Summer of 2008



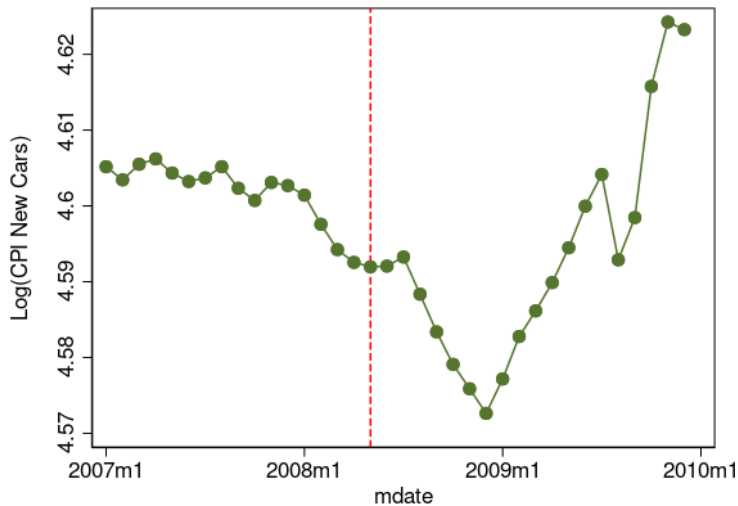
Note: Difference is demeaned and conditional on linear time-trend.

Motor Vehicle Sales by Segment

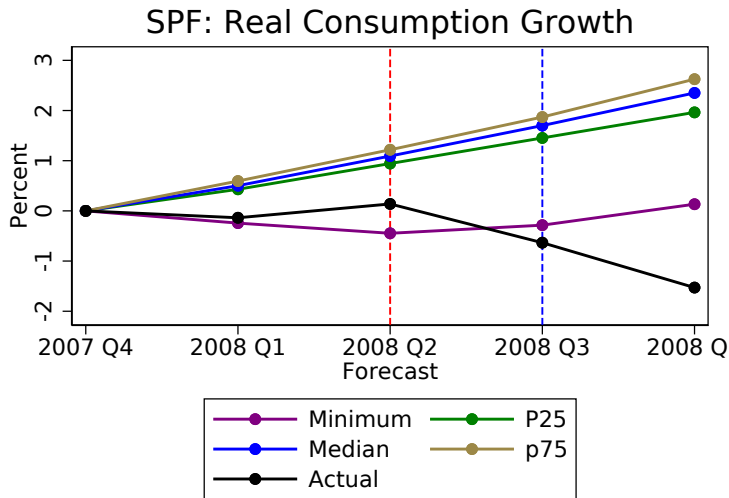


[Return](#)

CPI New Vehicles



Survey of Professional Forecasters: 2007q4 Forecast and Actual



Rebate Receipt Correlated with Interview Schedule

Table: Distribution of CEX Interview Schedule

Panel A: EFT and Check Recipients				
	Overall CEX	May Cohort	June Cohort	July Cohort
Interview Schedule				
Jan-Apr-Jul-Oct	33%	32%	35%	26%
Feb-May-Aug-Nov	33%	29%	37%	39%
Mar-Jun-Sep-Dec	33%	39%	28%	34%

Panel B: Check Recipients Only			
	May Cohort	June Cohort	July Cohort
Interview Schedule			
Jan-Apr-Jul-Oct	30%	36%	28%

Baseline Calibration of Model

Parameter	Value	Description
σ	0.5	Utility curvature on nondurable consumption
ϕ	1	Inverse of the Frisch elasticity of labor supply
γ	varies	Fraction of Hand-to-Mouth consumers
mpx	0.83	Hand-to-Mouth MPC on durables
ψ	0.724	Weight on durable service flow
δ_d	0.015	Depreciation of durable consumption goods
θ_p	0.917	Calvo parameter on price adjustment
θ_W	0.917	Calvo parameter on wage adjustment
δ_2	0.017	Parameter on quadratic term of capital utilization cost
ϕ_b	0.1	Debt feedback coefficient in fiscal rule
ρ_r	0.947	Monetary policy interest rate smoothing
ϕ_π	1.5	Monetary policy response to inflation
ϕ_{gap}	0.083	Monetary policy response to the output gap

Could the rise in oil prices have reduced consumption?

776

P. Edelstein, L. Kilian / *Journal of Monetary Economics* 56 (2009) 766–779

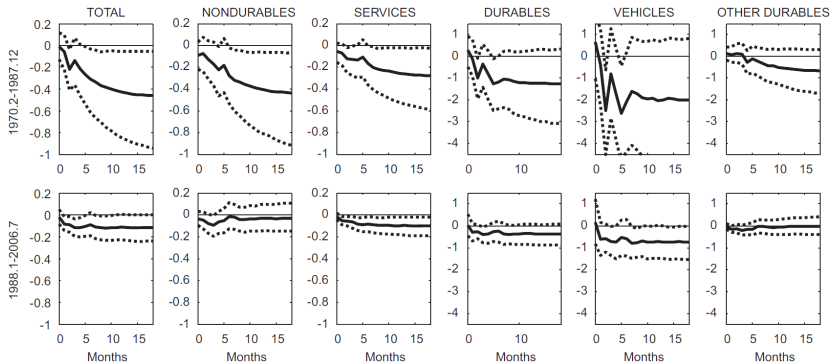


Fig. 4. Selected responses by sample period. Notes: Split-sample VAR estimates for U.S. data based on the purchasing power loss associated with an unanticipated change in weighted retail energy prices.

Table: Contemporaneous Household Non-Durable Expenditure Response to Rebate

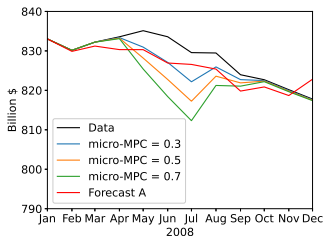
Panel A: OLS				
	Full Sample		Rebate Only Sample	
	(1)	(2)	(3)	(4)
Rebate Indicator	126.4*	116.2*	262.9***	241.5***
	(67.2)	(66.8)	(94.8)	(91.2)
Implied MPC	0.14	0.13	0.29	0.27
Extra Controls	No	Yes	No	Yes
Observations	17,229	17,229	10,343	10,343
Panel B: DID Imputation				
	(1)	(2)	(3)	(4)
Rebate Indicator	57.0	44.8	175.2	42.8
	(68.9)	(70.5)	(212.5)	(203.2)
Implied MPC	0.06	0.05	0.18	0.04
Extra Controls	No	Yes	No	Yes
Observations	12,499	12,499	5,585	5,585

Table: Contemporaneous Household Vehicles (Used + New) Expenditure Response to Rebate

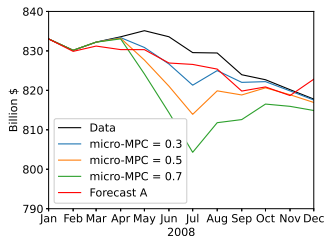
Panel A: OLS				
	Full Sample		Rebate Only Sample	
	(1)	(2)	(3)	(4)
Rebate Indicator	375.6** (159.2)	278.3* (148.8)	370.5 (238.3)	261.1 (214.9)
Implied MPC	0.40	0.30	0.41	0.29
Extra Controls	No	Yes	No	Yes
Observations	17,229	17,229	10,343	10,343
Panel B: DID Imputation				
	(1)	(2)	(3)	(4)
Rebate Indicator	288.7* (150.6)	206.9 (144.7)	341.3 (375.5)	-286.0 (414.6)
Implied MPC	0.30	0.22	0.36	-0.30
Extra Controls	No	Yes	No	Yes
Observations	12,499	12,499	5,585	5,585

Counterfactual Consumption Expenditure: Baseline Model

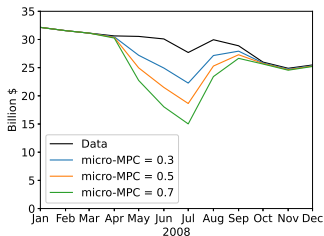
Real PCE: Micro MPCs



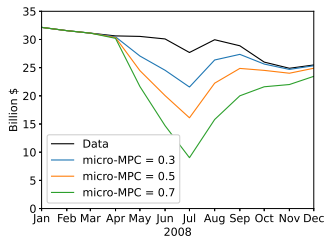
Real PCE GE: Baseline



Motor Vehicles: Micro MPCs

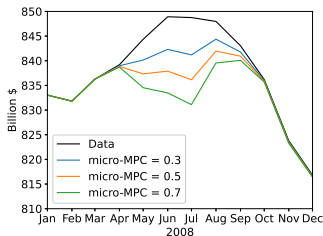


Motor Vehicles: GE Baseline

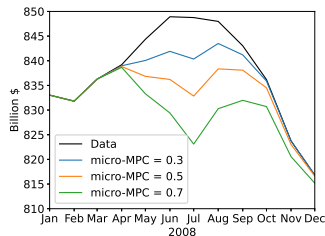


Counterfactual Consumption Expenditure: Baseline Model

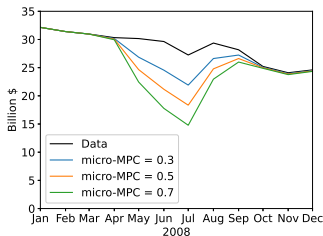
Nominal PCE: Micro MPCs



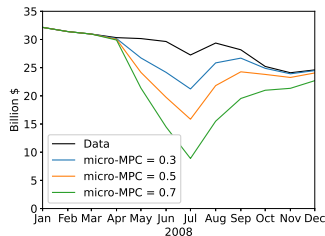
Nominal PCE GE: Baseline



Motor Vehicles: Micro MPCs

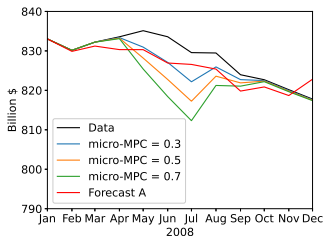


Motor Vehicles: GE Baseline

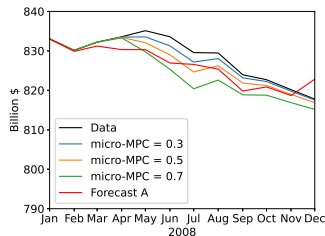


Counterfactual: Less Elastic Durable Supply Model

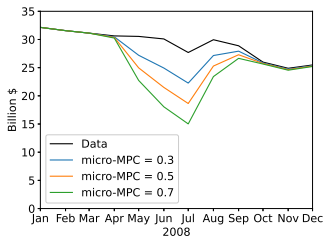
Real PCE: Micro MPCs



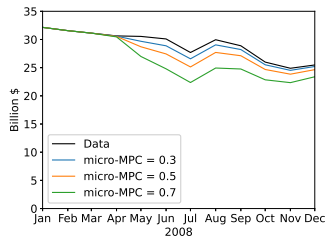
Real PCE: GE Less Elastic



Motor Vehicles: Micro MPCs

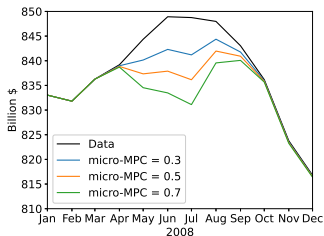


Motor Vehicles: GE Less Elastic

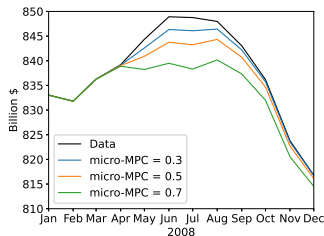


Counterfactual: Less Elastic Durable Supply Model

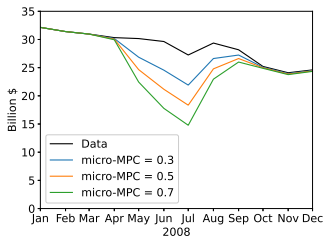
Nominal PCE: Micro MPCs



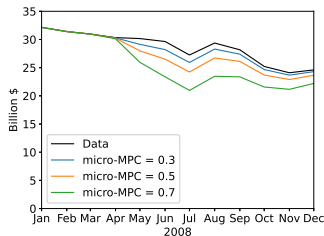
Nominal PCE: GE Less Elastic



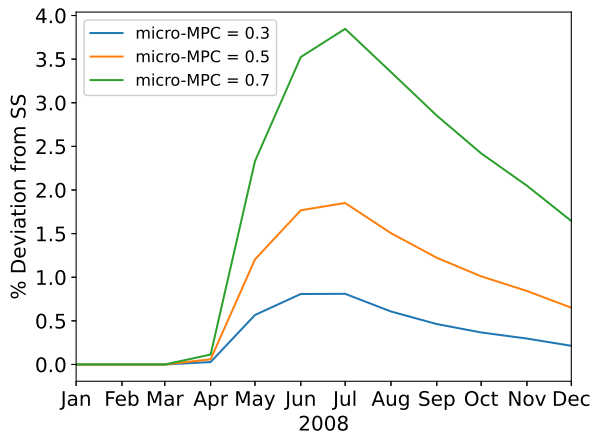
Motor Vehicles: Micro MPCs



Motor Vehicles: GE Less Elastic

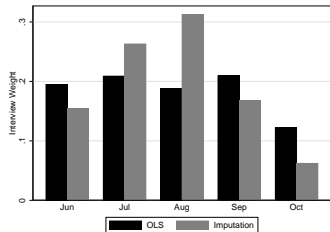


IRF of Relative Durable Price

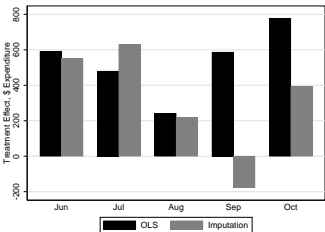


Decomposing OLS v.DID Imputation

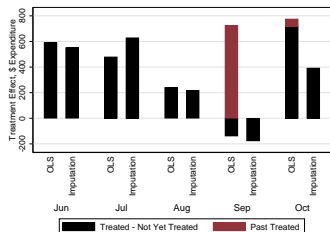
Period Weights



Period Coefficients



Decomposed Coefficient



Relative Contributions

