Do They Add Up?
Using Macro Counterfactuals
to Assess Micro Estimates and Macro Models

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Introduction

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Angrist and Pischke "The Credibility Revolution in Empirical Economics" (JEP 2010).

- ► "Macroeconomists slow to adopt new empirical micro methods."

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Angrist and Pischke "The Credibility Revolution in Empirical Economics" (JEP 2010).

- ▶ "Macroeconomists slow to adopt new empirical micro methods."

- ▶ At that time, the dominant macro methods were time series and quantitative DSGE

- ▶ However, a few macroeconomists were using natural experiments, etc. to estimate parameters or causal effects of interest to macro.

    - ▶ natural experiments such as wars, timing of social security checks.

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Recent renaissance in macro fiscal research includes the widespread use of applied micro methods.

- ▶ Many new natural experiments to estimate household MPCs.

- ▶ Bartik instruments to estimate regional fiscal multipliers in panel data.

- ▶ Two caveats raised in my 2019 JEP paper.

  - ▶ These micro estimates answer macro questions only with the help of macro models — no "applied micro free lunch" for macroeconomists.

  - ▶ The micro estimate/macro model answers are often different from the aggregate data answers.

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▶ We can exploit this micro/macro confluence to take the "credibility revolution" one step further.

▶ In particular, we should use macro counterfactuals implied by micro estimates to assess the plausibility of micro estimates and macro models.

▶ Why this tool is useful

   ▶ Micro estimates and macro aggregates don't always agree.

   ▶ Tool helps determine which estimates and/or models need more scrutiny.

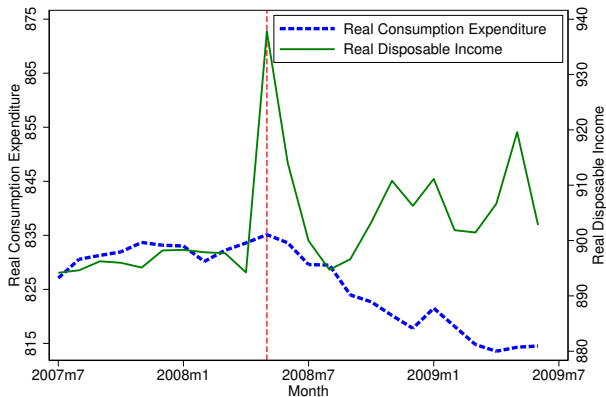   ▶ Search for reconciliation is often illuminating.

Motivation: Micro/Macro Tension Regarding 2008 U.S. Rebates

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▶ Big disposable income spike, no consumption spike.

▶ Concluded that marginal propensity to consume (MPC) from 2008 rebate was low.

Micro/Macro Tension Regarding 2008 U.S. Rebates (cont.)

▶ Parker and co-authors micro MPC estimates

    ▶ Added rebate questions to CEX, Nielsen household data

    ▶ Great natural experiment, applied micro methods.

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    - ▶ Estimated very high MPCs: 0.5 - 0.9 on total consumption.

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- ▶ Policymakers and researchers believed the micro estimates and ignored the simple macro analysis.

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Expenditure on New Motor Vehicles
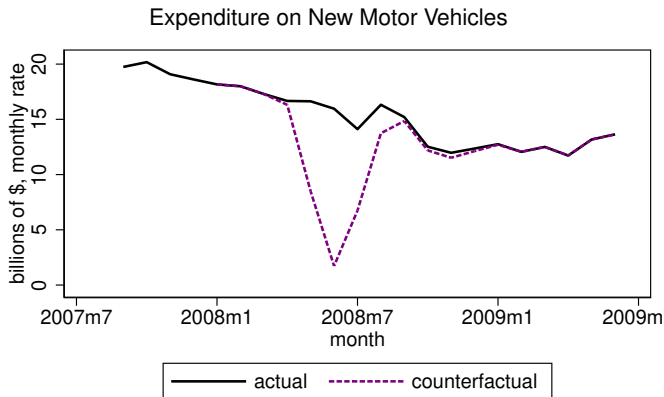
- ▶ Based on Sahm-Shapiro-Slemrod (2012) induced spending calculation for new motor vehicles - no general equilibrium effects.
- ▶ Counterfactual implies 87% drop in expenditures if there were no rebate.

Key Ingredients for a Macro Counterfactual Plausibility Analysis

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▶ A macro model that translates the micro or subregional estimates to dynamic general equilibrium effects (or industry effects in some cases).

▶ A narrative analysis of the time period surrounding the policy or event to assess whether the macro counterfactual is plausible.

    ▶ Often requires auxiliary evidence, forecasting equations, etc.

Illustrations of the Counterfactual Method

- ▶ Macro Implications of Micro MPC Estimates.

    - ▶ The 2001 U.S. Tax Rebate

    - ▶ The 2008 U.S. Tax Rebate

- ▶ Macro Implications of State-Level Multiplier Estimates.

Micro MPC Estimates Illustrations

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▶ Parker, Souleles, Johnson, and McClelland (PSJM) (AER 2013), Broda-Parker (JME 2014) studied the 2008 tax rebate.

▶ Each study relied on a natural experiment and novel data creation:

  ▶ tax rebates distributed to households over several months, with timing randomized by the last two digits of Social Security numbers.

  ▶ the authors added special questions to surveys (CEX for JPS, PSJM; Nielsen Survey for Broda-Parker) that measured the time, amount, and form of the rebate for each household.

JPS and PSJM Estimation Framework

$$(1) \qquad C_{i,t} - C_{i,t-1} = \sum_s \beta_{0s} month_{s,i} + \beta_1' X_{i,t-1} + \beta_2 \mathbf{R}_{i,t} + u_{i,t}$$

- ▶ 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.
- ▶ R is the rebate variable, which can take the form of the dollar amount, an indicator for receipt, or the dollar amount instrumented with the indicator.

Details of the 2001 Rebate

- ▶ Bush 10-year tax cuts passed in early June 2001.

- ▶ Tax rebate checks of \$300 or \$600 mailed to 92 million households.

- ▶ Total rebates = \$38 billion, 6% of monthly disposable income.

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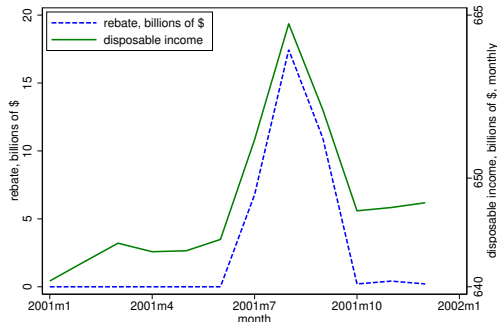
JPS MPC Contemporary Estimates for 2001 Rebate

► Construct a "nondurable" spending category that is a mix of some nondurable goods and services, and even some durable goods.

► Their IV estimates (Table 2) produce an MPC = 0.375 (s.e. = 0.136), based on a quarter-to-quarter difference in spending.

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▶ Their preliminary analysis finds a statistically insignificant MPC on total consumption that is less than the MPC on their "nondurable" subcategory.

  ▶ They attribute that anomaly to noise induced by durable expenditures.
  ▶ Thus, they ignore durables and total consumption.

JPS MPC "Dynamic" Estimates for 2001 Rebate

- ► They also estimate specifications that allow lagged effects of the rebate on spending.

- ► Their IV estimates (Table 4) are:

  - ► Contemporaneous effect of 0.386.

  - ► Lagged effect of 0.273

  - ► Cumulative 6-month effect of MPC = 0.659 (s.e. = 0.262).

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▶ 6-month estimates:
Induced spending$_t$ = $0.386 * (rebate_t + rebate_{t-1} + rebate_{t-2})/3$ + $0.273 * (rebate_{t-3} + rebate_{t-4} + rebate_{t-5})/3$

▶ Counterfactual "nondurable" consumption

= actual aggregate "nondurable" consumption - induced spending.

Counterfactual 2001 Consumption - No GE Effects
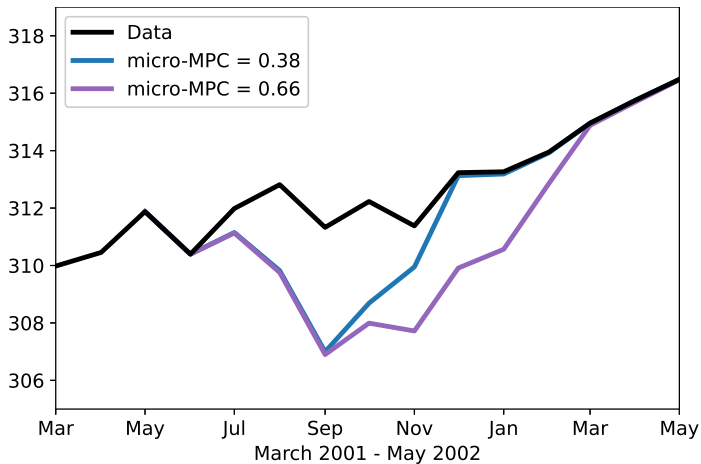
- Uses JPS definition of nondurables.
- Based on micro estimates, no GE effects.

Comments on Counterfactual with No GE

- ▶ Both counterfactuals suggest pronounced V-shapes.

- ▶ However, 9/11 likely dampened spending in September 2001

    - ▶ Most contemporary analyses suggest some negative impact of 9/11.

    - ▶ However, the V-shape starts already in August 2001 and the counterfactual remains depressed even after, despite most analyses suggesting a quick rebound of spending from 9/11.

    - ▶ We will analyze this more after we show the GE counterfactual.

Methodology for Creating Macro (GE) counterfactuals

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▶ Construct a medium-scale two-good, two-agent New Keynesian (TANK) model.

  ▶ Sticky wages/prices, variable utilization of capital, investment adjustment costs.

  ▶ Need two goods because JPS assume that all spending is focused on a category that is 53% of total PCE.

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Optimizing Households ("o"): Utility

▶ $1 - \gamma$ of ex-ante identical HH maximize utility,

$$\sum_{t=0}^{\infty} \beta^t \left[\frac{\left[s_1^{\frac{1}{\iota}} (C_{1t}^o)^{\frac{\iota-1}{\iota}} + (1-s_1)^{\frac{1}{\iota}} (C_{2t}^o)^{\frac{\iota-1}{\iota}} \right]^{\frac{\iota}{\iota-1}(1-\frac{1}{\sigma})}}{1 - \frac{1}{\sigma}} - \nu \frac{(H_t^o)^{1+\phi}}{1+\phi} \right]$$

▶ Variables and parameters

   ▶ C_{1t}^o = nondurable consumption as defined by JPS

   ▶ C_{2t}^o = all other consumption

   ▶ H_t^o = hours worked

   ▶ s_1 = the share of JPS nondurable expenditure in total consumption

   ▶ ι = elasticity of substitution across consumption goods

   ▶ ϕ = Frisch elasticity

▶ Labor supply is not chosen by the household, but instead by a union.

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Optimizing Households ("o"): Constraints

$$A_t^o = \frac{R_{t-1}}{\Pi_t} A_{t-1}^o - C_{1t}^o - C_{2t}^o + W_t H_t^o - T_t^o + \text{Profits}_t$$

- ▶ A_t^o are holdings of the nominal bond

- ▶ R_t is the gross nominal interest rate

- ▶ Π_t is the gross inflation rate

- ▶ W_t is the real wage

- ▶ T_t^o are transfers

- ▶ Profits = real profit income

Hand-to-Mouth Households ("m")

▶ A fraction γ of HH consume follow "hand-to-mouth" rule.

▶ In steady state, hand-to-mouth HH have the same after tax income as optimizing HH.

$$WH^m - T^m = WH^o - T^o$$

▶ Dynamic marginal propensities to consume (MPCs) set to match JPS

$$C_{1t}^m - C_1^m = \sum_{l=0}^{L} mpc_l [W_{t-l} H_{t-l}^m - T_{t-l}^m - (WH^m - T^m)] \prod_{k=1}^{l} \frac{R_{t-k}}{\Pi_{t-k+1}}$$

▶ Follow JPS in assuming MPC on other consumption is 0.

$$C_{2t}^m = C_2^m$$

Calibration

▶ Model calibrated to monthly frequency.

▶ Assume that hand-to-mouth households spread spending equally over three months of the quarter, beginning with current month.

▶ Calibrate micro MPCs (γ) to 0.375 from JPS baseline, and 0.66 for 6-month specification from JPS dynamic estimates.

▶ Value of ι (= elasticity of substitution across consumption goods) is irrelevant because we assume the two goods are perfect substitutes in production so relative prices are constant.

Macro Counterfactual Consumption Expenditures
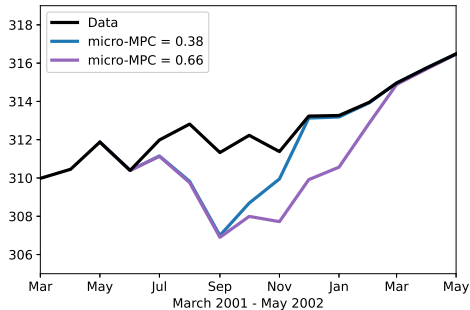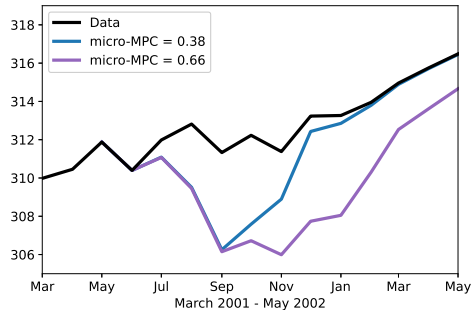
► Based on simulations from TG-TANK model.

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- ▶ The macro counterfactual V-shapes are more pronounced than the micro ones.

- ▶ Define the GE-MPC to be the general equilibrium response of consumption to rebate.

- ▶ GE-MPC $\approx$ multiplier if closed economy and temporary stimulus.

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MPCs	
micro	GE
0.38	0.50
0.66	1.33

▶ GE amplification grows with the MPC value - nonlinear.

Is the Counterfactual Decline Plausible?

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▶ Comparison to other declines in the JPS consumption category.

    ▶ The GE counterfactual implies a 3-month decline of 1.5%.

    ▶ The only bigger declines are during COVID and decline after a prior spike in 1960.

Is the Counterfactual Decline Plausible?

▶ Comparison to other declines in the JPS consumption category.

  ▶ The GE counterfactual implies a 3-month decline of 1.5%.

  ▶ The only bigger declines are during COVID and decline after a prior spike in 1960.

  ▶ 9/11 certainly accounts for some of the spending dip in September 2001.

  ▶ However, observers such as Blue Chip and others made numerous statements before 9/11 about the rebate being a "non-event" because it wasn't showing up in spending in August.

Is the Counterfactual Decline Plausible? (cont.)

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- ▶ Our Forecasting evidence.

    - ▶ We use a monthly times series model to construct forecasts using information through May 2001 (the month before the rebates were enacted).

        - ▶ Variables included are JPS consumption, disposable income, consumption price deflator, gas prices, and the Gilchrist-Zakrajsek excess bond premium.

    - ▶ The "contemporary" model uses contemporary data and assumes that no one realized that the economy was already in recession.

    - ▶ The "pessimistic" model includes the fact that the economy was already in recession and takes gas prices as exogenous.

        - ▶ This significantly reduces the forecast, particularly since the 2001 recession was much more mild than the average recession.

Macro Counterfactuals and Forecasts for Contemporaneous Case
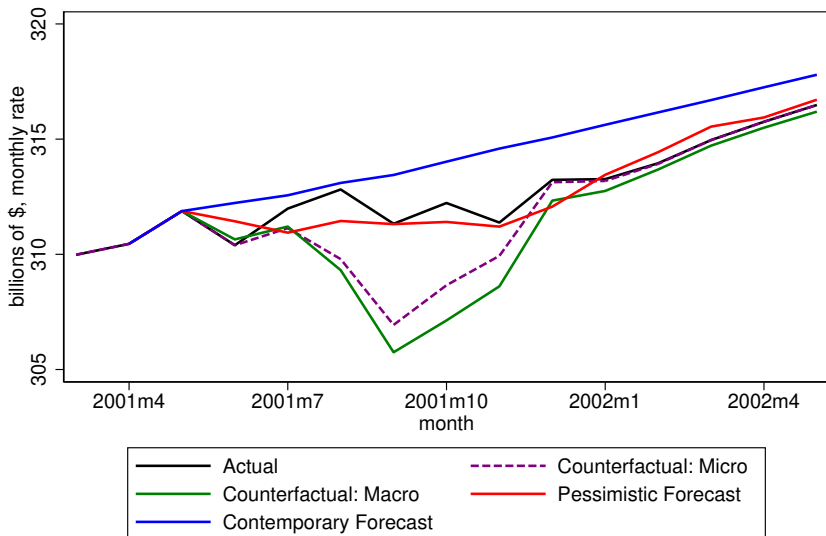
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- ▶ Reconciliation requires smaller micro MPCs and/or GE dampening rather than GE amplification.

- ▶ Re-examine the micro MPCs based on CEX data.

- ▶ Possible modifications to the TANK Model:

  - ▶ Make monetary policy less accommodative.

  - ▶ Make supply less elastic - don't allow variable utilization of capital, less sticky prices/wages, etc.

Re-examination of CEX Estimates for 2001 Rebate

► JPS "Non-Durables" category includes many nondurables, services and some durables, but is only 61% of BEA nondurables + services.

► Let's compare MPC for JPS vs. BEA categories.

Re-examination of CEX Estimates for 2001 Rebate

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	JPS Definitions		BEA Definitions	
	Strict Non-Durables (1)	Non-Durables (2)	Non-Durable Goods (3)	Services (4)
Rebate Amount	0.12 (0.13)	0.32** (0.15)	0.06 (0.06)	0.03 (0.22)
Observations	12,018	12,018	12,018	12,018

▶ BEA category and total PCE estimates imply MPCs ≈ 0.

Comments on CEX Estimates and Interpretation

- ► The JPS estimates are not robust to different categorizations.

    - ► Many categories they omitted have negative MPCs.

    - ► Estimates with BEA aggregates imply MPCs near 0.

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▶ The JPS estimates are not robust to different categorizations.

  ▶ Many categories they omitted have negative MPCs.

  ▶ Estimates with BEA aggregates imply MPCs near 0.

▶ And, the 2001 tax rebate wasn't a temporary stimulus!

  ▶ The rebates were an initial payment on a 10-year tax cut.

  ▶ Permanent income households should have MPC ≈ 0.33 if not Ricardian.

  ▶ With Ricardian equivalence, predicted MPC ≈ 0.

▶ Experiment and micro estimates are too imprecise to shed light on macro model, so we do not revisit the model.

Lessons Learned from 2001 Rebates Counterfactual Exercise

▶ The headline JPS estimates imply implausible macro counterfactuals.

▶ Factoring in GE forces amplifies the problem.

▶ Re-examining the micro estimates reveals nonrobustness of estimates.

   ▶ The BEA categories give quantitative and statistical 0 MPCs.

▶ Re-examining the natural experiment reveals that it is not a temporary stimulus experiment.

The 2008 Rebates Counterfactual

The 2008 Rebates Counterfactual

- ▶ 2008 rebates were even bigger - $100 billion, 11% of disposable income.

- ▶ Among recipients, average rebate was $1,000.

- ▶ Passed February 2008, distributed May - August 2008

- ▶ These rebates were temporary.

- ▶ The following is based on Orchard, Ramey, Wieland "Micro MPCs and Macro Counterfactuals: The Case of the 2008 Rebates" (2023)

Parker et al. (PSJM) Estimates from the 2008 Rebate

- ▶ PSJM estimated very high MPCs: 0.5 - 0.9 for total consumption.

- ▶ Majority of spending on motor vehicles.

- ▶ Motor Vehicle counterfactual (with no GE) is implausible.

Expenditure on New Motor Vehicles
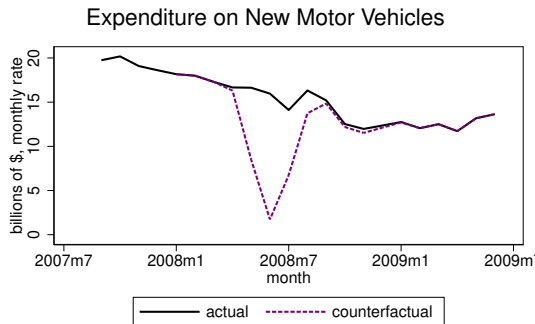
Our GE Counterfactual Analysis of 2008 Rebate

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- ▶ Use a two-good, two-agent NK (TG-TANK) model to compute general equilibrium counterfactuals.

    - ▶ Nondurable and durable goods.

    - ▶ Durable good interpreted as motor vehicles.

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- ▶ Use a two-good, two-agent NK (TG-TANK) model to compute general equilibrium counterfactuals.

  - ▶ Nondurable and durable goods.

  - ▶ Durable good interpreted as motor vehicles.

- ▶ Argue that high micro MPCs imply implausible macro counterfactuals.

  - ▶ Offer detailed narrative of events in spring/summer 2008.

  - ▶ Compare counterfactual path to professional forecasts and our own forecasting model.

A Few Details of the Calibration of TG-TANK Model

► Match micro estimates of durable demand elasticity.

► Set fraction of hand-to-mouth households to match PSJM range for total consumption, 0.5 and 0.9; set motor vehicle MPC at 0.4.

► Baseline model - relative supply curve of durables (in terms of nondurables) is infinitely elastic.

► Match size and timing of the actual rebate.

Counterfactual Total Consumption: Baseline Model
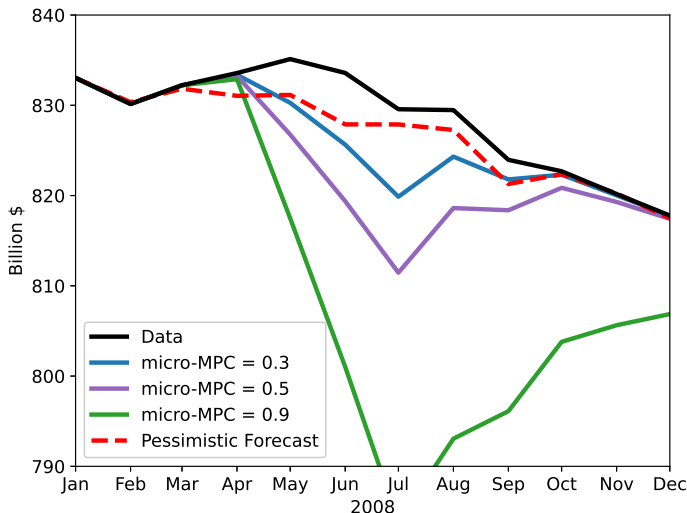
▶ Counterfactuals have pronounced V-shapes.

Reconciliation of Micro Estimates with Macro Counterfactuals

1. We re-examine the micro MPC estimates in light of the new econometrics of diff-in-diff estimators.

    ▶ We identify three sources of upward bias.

    ▶ Correcting for those biases $\Rightarrow \downarrow$ MPC estimates by 40% or more.

    ▶ MPC on nondurables = 0.

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   ▶ MPC on nondurables = 0.

2. We modify the macro model to allow for general / partial equilibrium dampening.

   ▶ Upward-sloping relative supply curve for motor vehicles $\Rightarrow$ crowding out.

   ▶ Consistent with $\uparrow$ relative price of motor vehicles during the period.

Counterfactual: Less Elastic Durable Supply Model
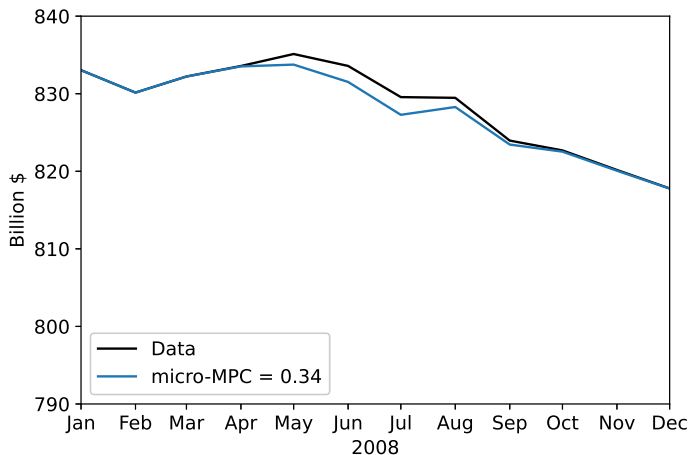
▶ Micro-MPC = 0.3 on total consumption is our estimate.
▶ Less elastic supply ⇒ GE-MPC < 0.2.

Lessons from the Rexamination of the 2008 Rebate

▶ The addition of durable goods is crucial for our dampening result because durables have much more elastic demand than nondurables.

▶ Both overall MPC and the distribution of spending across durables vs. nondurables matter for the GE outcome.

▶ If we calibrate the MPC to 0.3 in a one-good nondurable model, we still get implausible counterfactuals because GE forces amplify.

▶ Heterogeneity of goods is as important as heterogeneity of households.

▶ The reconciliation implies that the multiplier on temporary rebates is below 0.2.

3rd Illustration: State-Level ARRA Multiplier Estimates

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▶ Chodorow-Reich's (2019) synthesized cross-sectional state-level estimates of jobs multipliers for the ARRA (Obama Stimulus), passed in February 2009.

▶ He estimated that 2.01 jobs (s.e. 0.59) were created for every $100,000 federal dollars spent in a state.

▶ Using theoretical insights from Farhi-Werning (2016), he argued that the state level multipliers were a lower bound on the aggregate multipliers, due to ZLB in 2009.

Creating the Macro Counterfactual

Creating the Macro Counterfactual

We refined a macro counterfactual I created in a 2017 discussion published in 2019.

▶ We used Chodorow-Reich's estimated impulse responses of employment and his estimates of how much of the ARRA was spent by Dec. 2010.

▶ We created a counterfactual unemployment rate by adding the induced employment to the actual number unemployed.

Counterfactual U.S. Unemployment Rate for the ARRA
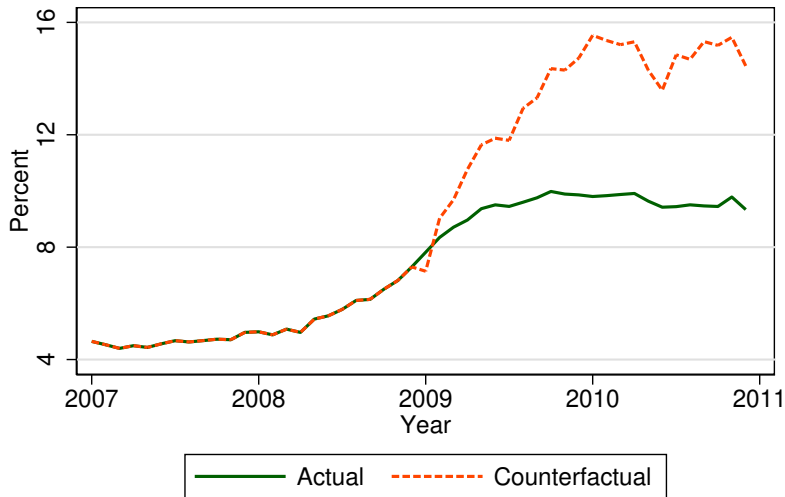
Assessing Plausibility

Assessing Plausibility

▶ Compare the counterfactual rise in unemployment to the first two years of the Great Depression.

▶ Match up the signature financial crises at the start of both periods

▶ Stock market crash of October 1929
▶ Failure of Lehmann Brothers in September 2008.

▶ The following graph shows the change in the unemployment rate relative the month of the crisis – Month 0.

Comparison to Unemployment Rise in the Great Depression
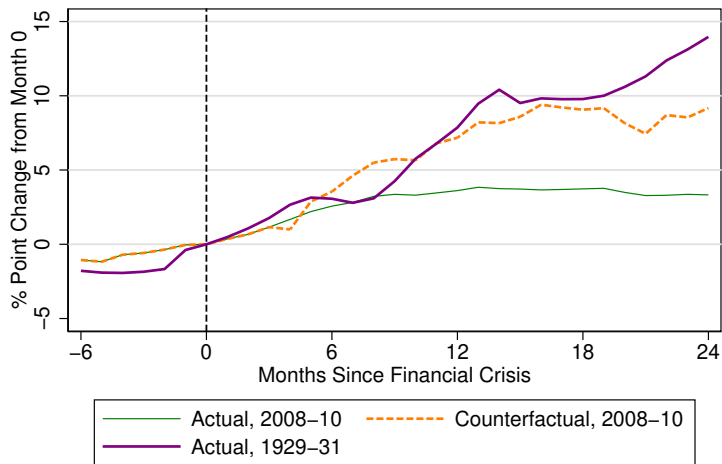
Comparison to Unemployment Rise in the Great Depression
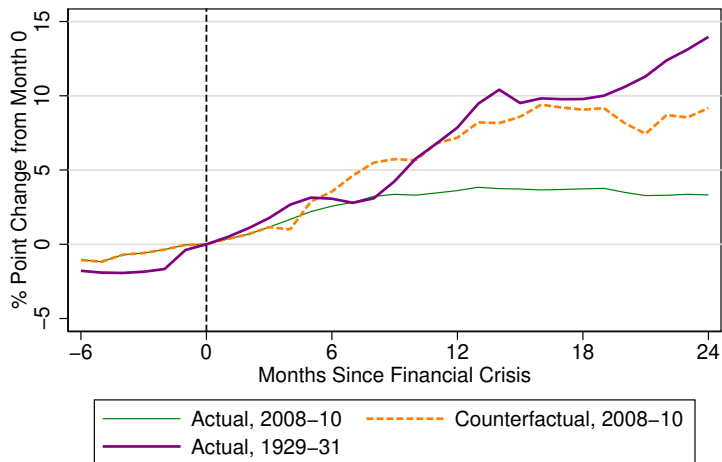
► Counterfactual implies with no ARRA, unemployment would have risen as much as in first two years of Great Depression.

Policy Comparison to Great Depression

Policy Comparison to Great Depression

- ► Besides the ARRA, the responses of policy were very different across the two periods.

- ► Great Depression

  - ► The Fed began raising the discount rate in 1928.

  - ► The Fed lowered the discount rate after the 1929 crash, but started raising it again in Fall 1930.

  - ► The Fed allowed the nominal money supply to fall.

Policy Comparison to Great Depression (cont.)

- ► Great Recession

    - ► The Fed lowered the federal funds rate starting a year before Lehmann.

    - ► The Fed drove the funds rate to 0 and then implemented new methods to provide liquidity and stimulus to the economy.

    - ► The Fed raised the money supply dramatically.

    - ► TARP provided additional liquidity, etc.

- ► The belief that without the ARRA the Great Recession unemployment rate would have risen as much as the first two years of the Great Depression requires that one also believe that monetary policy doesn't matter.

Reconciliation of State Estimates with Macro Counterfactual

Reconciliation of State Estimates with Macro Counterfactual

▶ State-level estimates not nationally representative (Ramey 2019 JEP)

    ▶ Studies use per capita variables, so each state is weighted equally.

    ▶ This could be a problem if there are hetergeneous treatment effects.

    ▶ Most studies do not take into account induced state government spending.

ARRA Estimates with Different Weighting and Spending Measure

Table: Alternative Estimates (Ramey JEP)

	Chodorow-Reich estimate	Population-weighted	All govt spending, pop-weighted
Jobs created per $100K	2.01	1.15	0.89
Robust s.e.	(0.59)	(0.72)	(0.45)

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- ► The estimate drops by half in the third column.

- ► The 0.9 estimate implies that the unemployment rate would have risen to around 12.4% with no ARRA.

- ► We are currently re-estimating the full path with this alternative econometric framework.

Summary and Conclusions

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Summary and Conclusions

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▶ We have illustrated this method using three examples from our work.

▶ The search for reconciliation between micro estimates and macro counterfactuals has led to new insights about better ways to model the macro effects and better estimates of the micro parameters.

▶ This method can be used for natural experiments in other countries as well as for other questions, including partial equilibrium questions.

Thank you!

Narrative of 2008

Review of data and major economic events.

Details of the 2008 Rebate

- ► Passed in February 2008, most funds distributed April - July.

- ► $100 billion, equal to 11% of January disposable income (monthly basis).

- ► 85% of "tax units" received a payment; phased out at higher income.

- ► Among households receiving a payment, the average check was $1,000.

2008 Tax Rebate
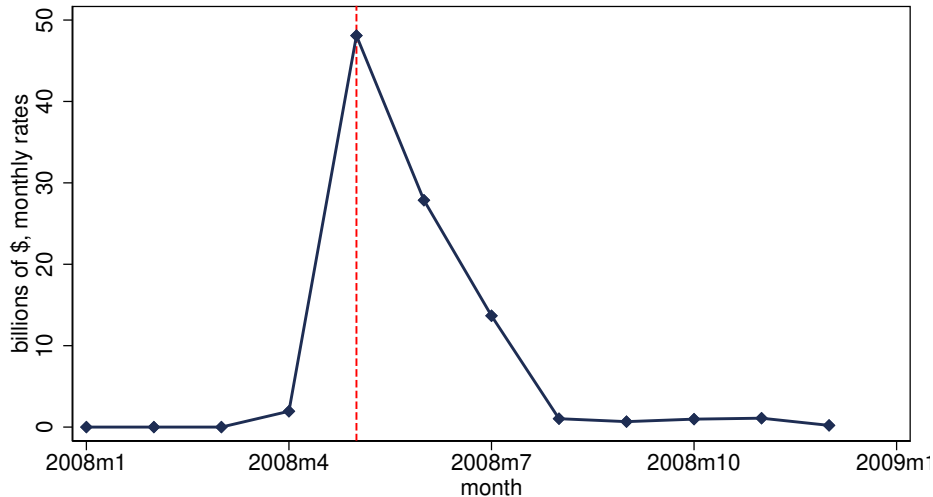
Disposable Income and Consumption

PCE by Product   Motor Vehicles
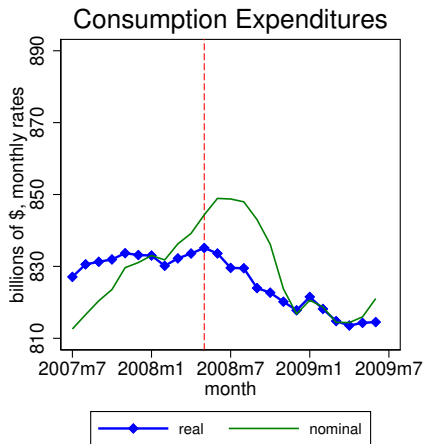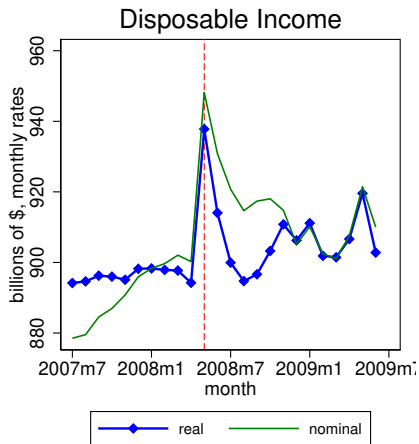
Consumption Price Indexes (PCE)
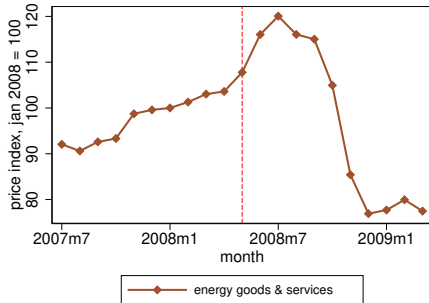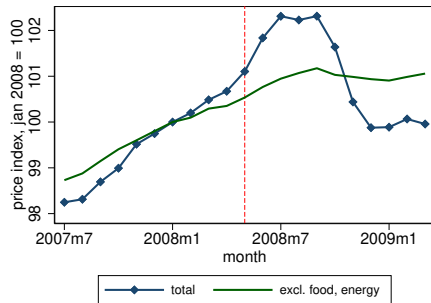
▶ Prices rose, peaked in July, then fell.

▶ Energy prices were a significant contributor.

Behavior of Monetary Policy: Federal Funds Rate
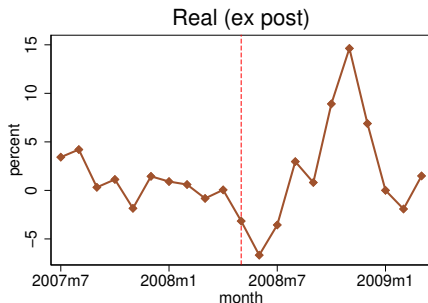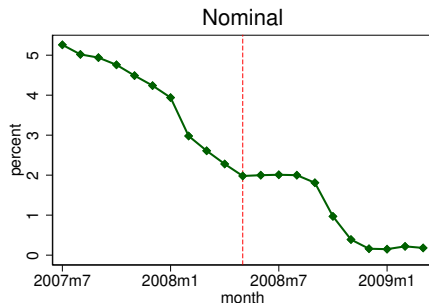
Note: Ex ante real interest rate constructed using the University of Michigan Consumer Survey median inflation expectations.

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.

Own Forecasts

Professional Forecasters
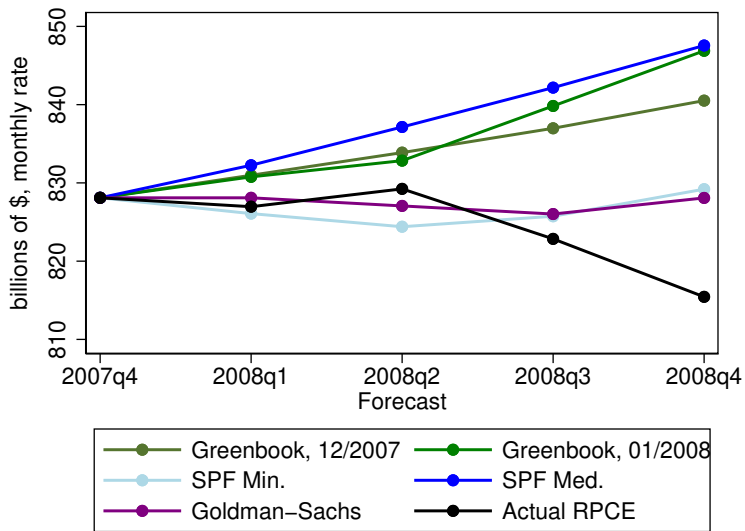
Alternative measures of Aggregate Consumption

► 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
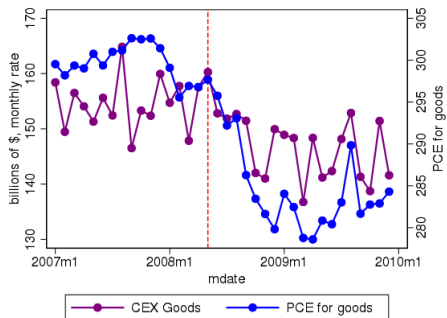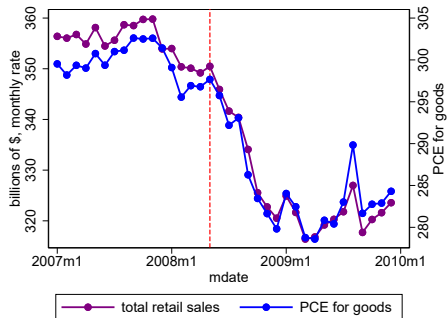
Real Consumption Expenditures by Type of Product
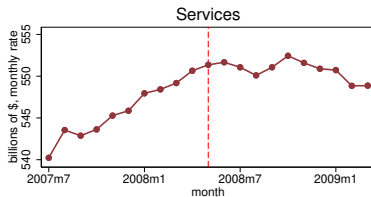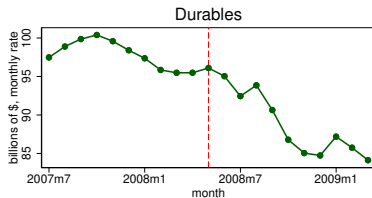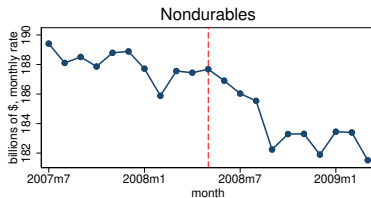
New Motor Vehicle Sales to Consumers

Unit Sales (1,000s)

Sales ($ billions)
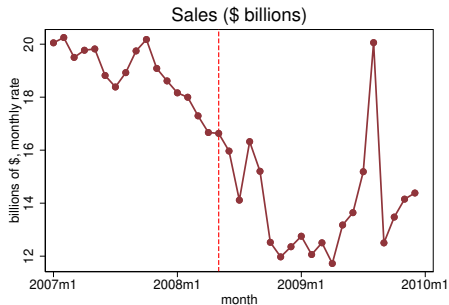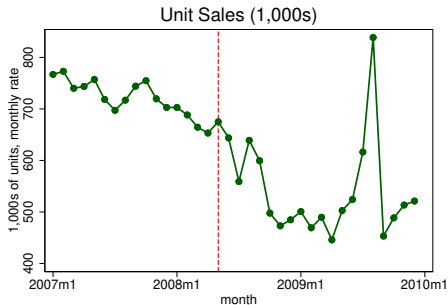
Sales and prices by segment   Fixed Weight Price Index   Return

Table: Counterfactual Real PCE Declines between April and July 2008

MPC	Decline
0.52	2.8 %
0.86	5.5 %

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

Real Consumption

Legend: Actual, Forecast A, Forecast B, Forecast C, Forecast D
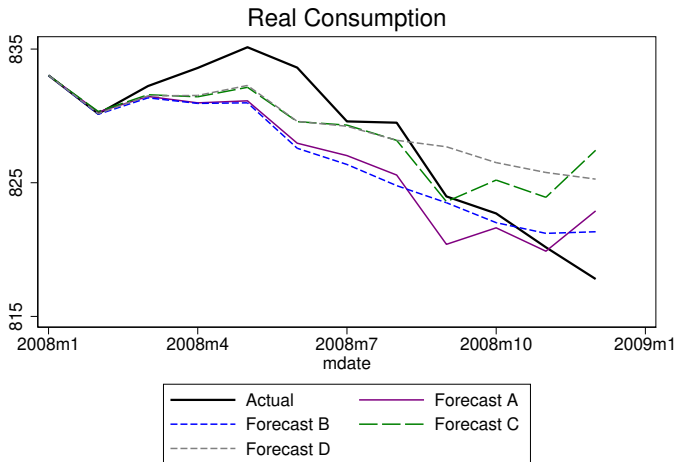
Return

Forecasts of Log Oil Prices

Log Real Oil Prices
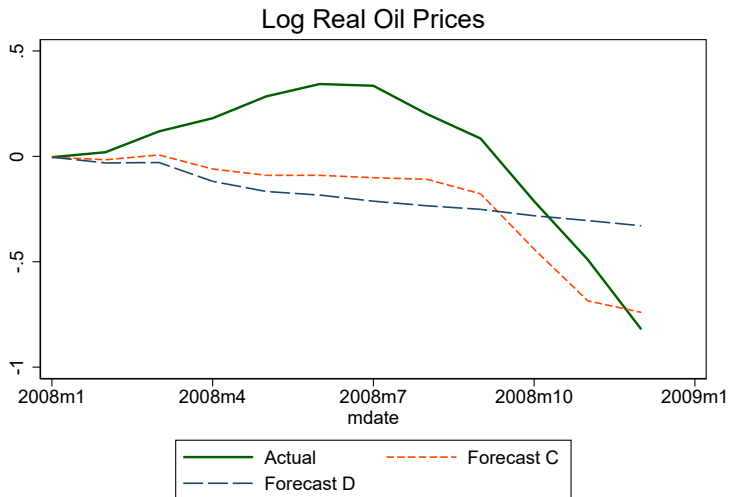
Difference CEX and PCE Over Time

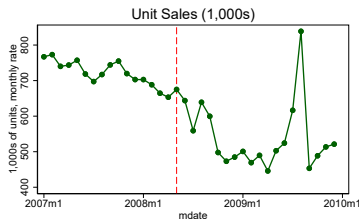PERSONAL CONSUMPTION EXPENDITURES

Legend: PCE, CEX, CEX Seasonally Adjusted
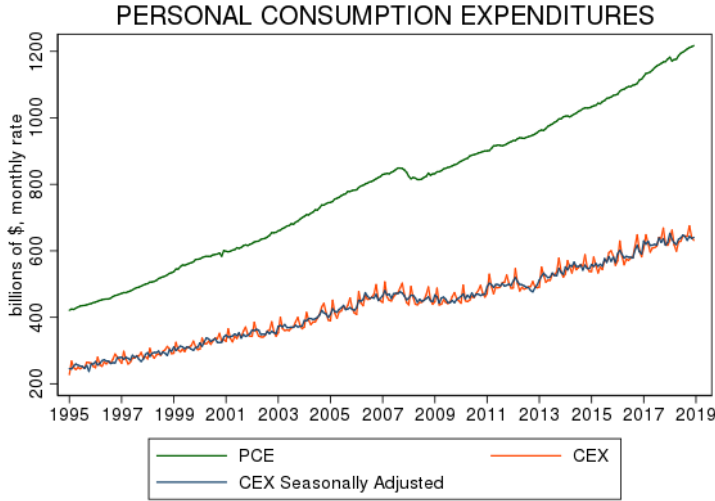
Return

CEX v PCE Gap is Normal in Summer of 2008
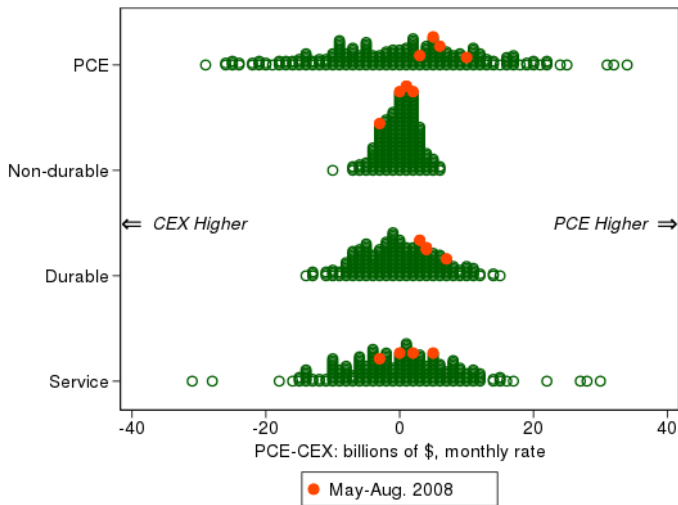
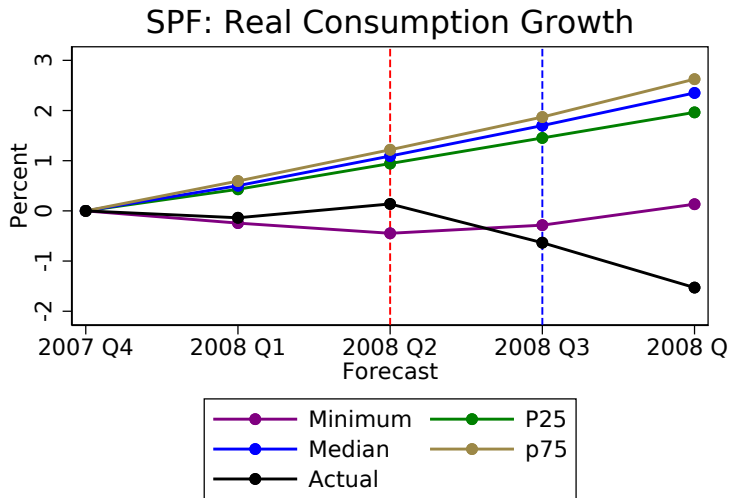Note: Difference is demeaned and conditional on linear time-trend.

Motor Vehicle Sales by Segment
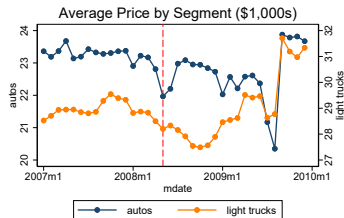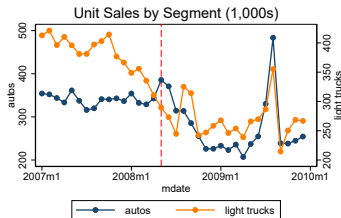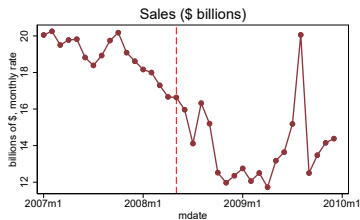
CPI New Vehicles
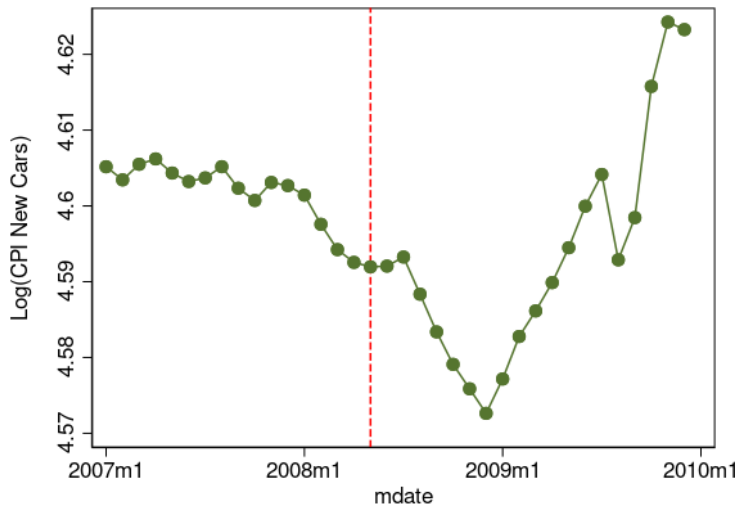
Survey of Professional Forecasters: 2007q4 Forecast and Actual

SPF: Real Consumption Growth

5

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%
Feb-May-Aug-Nov	34%	35%	40%
Mar-Jun-Sep-Dec	36%	28%	32%

Notes: Data in column 1 come from the entire CEX Sample 2007-2009. Data in columns 2-4 come from our subsample.

Return

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
θ^d	varies	Calvo parameter on durable adjustment
σ^d	1	Utility curvature on durable service flow
mpx	varies	Hand-to-Mouth MPC on durables
ψ	0.189	Weight on durable service flow
δ^d	0.015	Depreciation of durable consumption goods
ϕ_b	0.1	Debt feedback coefficient in fiscal rule

Notes: The model is calibrated at a monthly frequency. The parameter γ is calibrated to either 0.34, 0.52, or 0.86, which corresponds to the aggregate MPC in the model. The parameter θ^d is calibrated such that for each value of γ to model replicates our empirical targets for the short-term interest elasticity of durable demand. For example, when $\gamma = 0.34$, then $\theta^d = 0.844$. See the text for details.

Return

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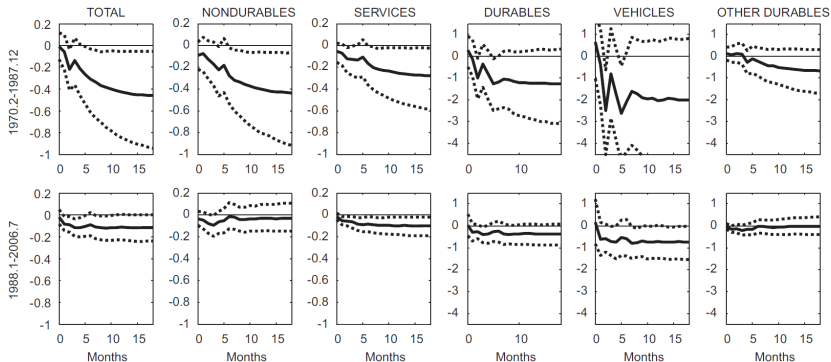
Fig. 4. Selected responses by sample period. *Notes*: Split-sample VAR estimates for U.S. data based on the purchasing power loss associated with an unanticipated change in weighted retail energy prices.

First Stage: Rebate Amount Conditional on Rebate Receipt

Table: First Stage: Rebate Amount Conditional on Rebate Receipt

Full Sample

	Homogeneous Treatment		Heterogeneous Treatment	
	(1)	(2)	(3)	(4)
Rebate Indicator	948.60***	951.10***	950.54***	945.95***
	(10.37)	(10.29)	(10.19)	(10.07)
Lag Rebate Indicator		11.97***	0.59	−2.94**
		(3.17)	(0.54)	(1.20)
Lag Total Expenditure				0.00***
				(0.00)
Lag Motor Vehicle				−0.00
				(0.00)
Income Decile FE	No	No	No	Yes
Observations	16,962	16,962	16,962	16,962

First Stage: Rebate Amount Conditional on Rebate Receipt

Rebate Only Sample

	Homogeneous Treatment		Heterogeneous Treatment	
	(1)	(2)	(3)	(4)
Rebate Indicator	931.69***	945.06***	939.42***	946.84***
	(13.11)	(12.73)	(12.53)	(13.25)
Lag Rebate Indicator		24.14***	−2.23	6.43
		(7.73)	(1.92)	(4.30)
Lag Total Expenditure				0.00***
				(0.00)
Lag Motor Vehicle				−0.00***
				(0.00)
Income Decile FE	No	No	No	Yes
Observations	10,076	10,076	10,076	10,076

Return

Household Motor Vehicle and Parts Response to Rebate

Table: Household Motor Vehicle and Parts Spending Response to Rebate

Full Sample

	Homogeneous Treatment		Heterogeneous Treatment	
	(1)	(2)	(3)	(4)
Rebate Indicator	197.65	185.13	166.99	283.64***
	(157.70)	(150.40)	(152.97)	(107.33)
Lag Rebate Indicator		−59.86	−49.01	121.65
		(159.03)	(133.94)	(93.37)
Lag Total Expenditure				0.02***
				(0.01)
Lag Motor Vehicle				−1.04***
				(0.01)
Implied 3-month MPC	0.21	0.19	0.18	0.30
Implied 6-month MPC		0.32	0.30	0.42
6-Month MPC S.E.		(0.34)	(0.35)	(0.17)

Household Motor Vehicle and Parts Response to Rebate

Rebate Only Sample

	Homogeneous Treatment		Heterogeneous Treatment	
	(1)	(2)	(3)	(4)
Rebate Indicator	97.66	−18.23	402.47	249.55
	(247.44)	(260.96)	(377.75)	(165.03)
Lag Rebate Indicator		−209.24	299.60	129.64
		(272.89)	(319.47)	(119.15)
Lag Total Expenditure				0.02***
				(0.01)
Lag Motor Vehicle				−1.04***
				(0.01)
Implied 3-month MPC	0.10	-0.02	0.43	0.26
Implied 6-month MPC		-0.25	1.18	0.39
6-Month MPC S.E.		(0.69)	(1.06)	(0.23)
Income Decile FE	No	No	No	Yes
Observations	10,076	10,076	10,076	10,076

Return

Other PCE

Table: Household Other Spending Response to Rebate

Full Sample

	Homogeneous Treatment		Heterogeneous Treatment	
	(1)	(2)	(3)	(4)
Rebate Indicator	272.48*	248.71*	180.41	−21.65
	(148.68)	(146.90)	(150.83)	(145.54)
Lag Rebate Indicator		−113.75	−33.51	−182.57
		(145.95)	(145.91)	(133.83)
Lag Total Expenditure				−0.28***
				(0.03)
Lag Motor Vehicle				0.30***
				(0.03)
Implied 3-month MPC	0.29	0.26	0.19	-0.02
Implied 6-month MPC		0.40	0.34	-0.23
6-Month MPC S.E.		(0.35)	(0.36)	(0.32)

Other PCE

Rebate Only Sample

	Homogeneous Treatment		Heterogeneous Treatment	
	(1)	(2)	(3)	(4)
Rebate Indicator	666.80***	545.57**	198.79	71.17
	(211.38)	(238.26)	(393.52)	(459.45)
Lag Rebate Indicator		−218.85	−478.25*	−481.50
		(202.68)	(271.52)	(343.01)
Lag Total Expenditure				−0.32***
				(0.02)
Lag Motor Vehicle				0.33***
				(0.03)
Implied 3-month MPC	0.72	0.58	0.21	0.08
Implied 6-month MPC		0.90	-0.09	-0.38
6-Month MPC S.E.		(0.62)	(1.07)	(1.14)
Income Decile FE	No	No	No	Yes
Observations	10,076	10,076	10,076	10,076

Return

14

Future Rebate Predicts Low Current Expenditure

	Full Sample (1)	Rebate Recipients Only (2)
Lead Rebate Indicator	−866.5***	−562.0*
	(289.5)	(335.9)
Rebate Indicator	−383.4	246.1
	(303.8)	(377.8)
Observations	16,962	10,076

Return

Counterfactual Consumption Expenditure: Baseline Model

Counterfactual Consumption Expenditure: Baseline Model

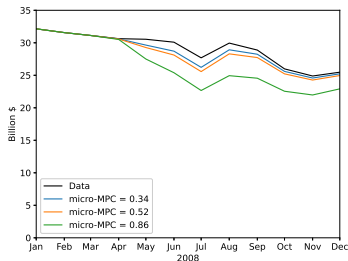# Counterfactual: Less Elastic Durable Supply Model

Real PCE: Micro MPCs
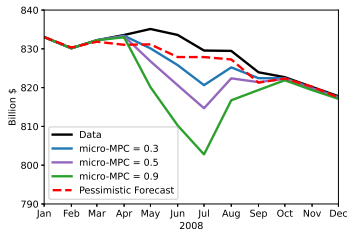
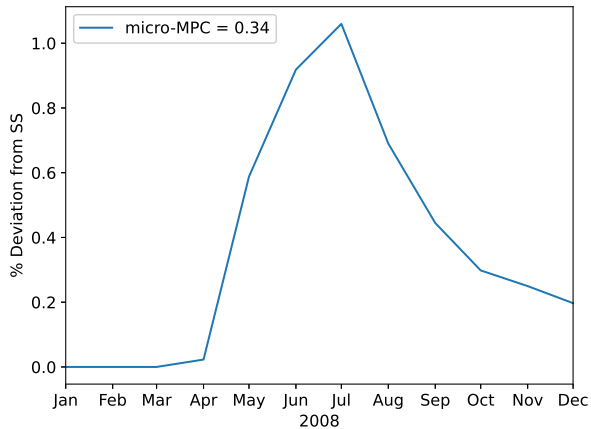Real PCE: GE Less Elastic
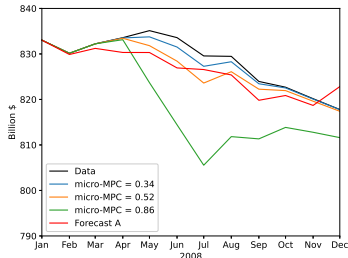
Motor Vehicles: Micro MPCs
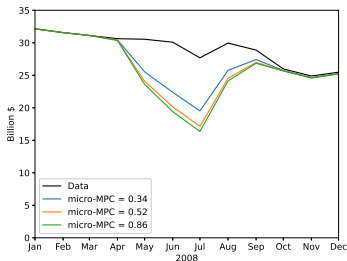
Motor Vehicles: GE Less Elastic

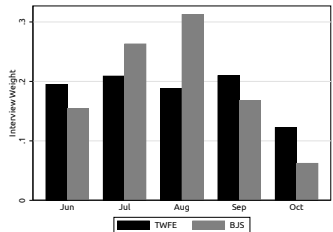# Counterfactual: Less Elastic Durable Supply Model
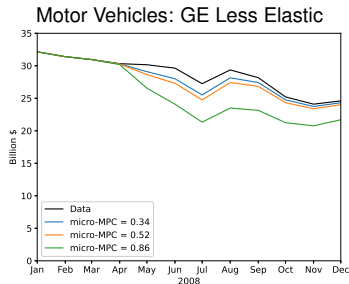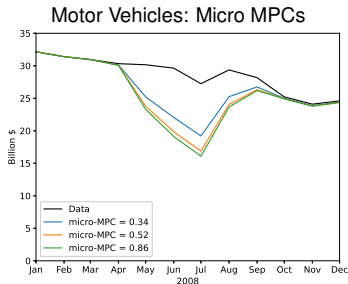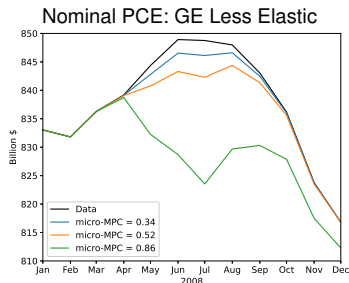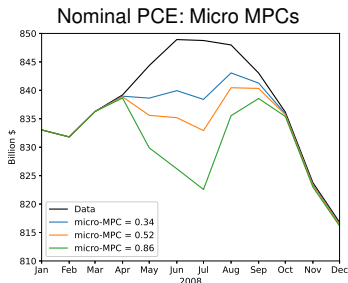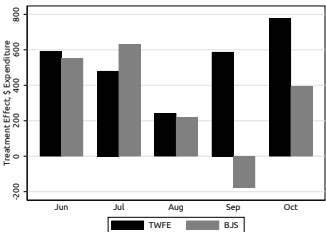
IRF of Relative Durable Price

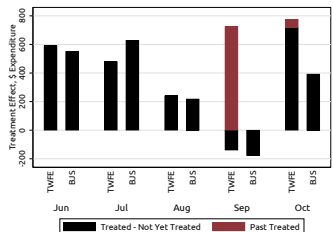# Decomposing OLS v.DID Imputation

Period Weights

Period Coefficients

Decomposed Coefficient

Relative Contributions