Regional Aggregation II & Household Aggregation

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Outline

Outline

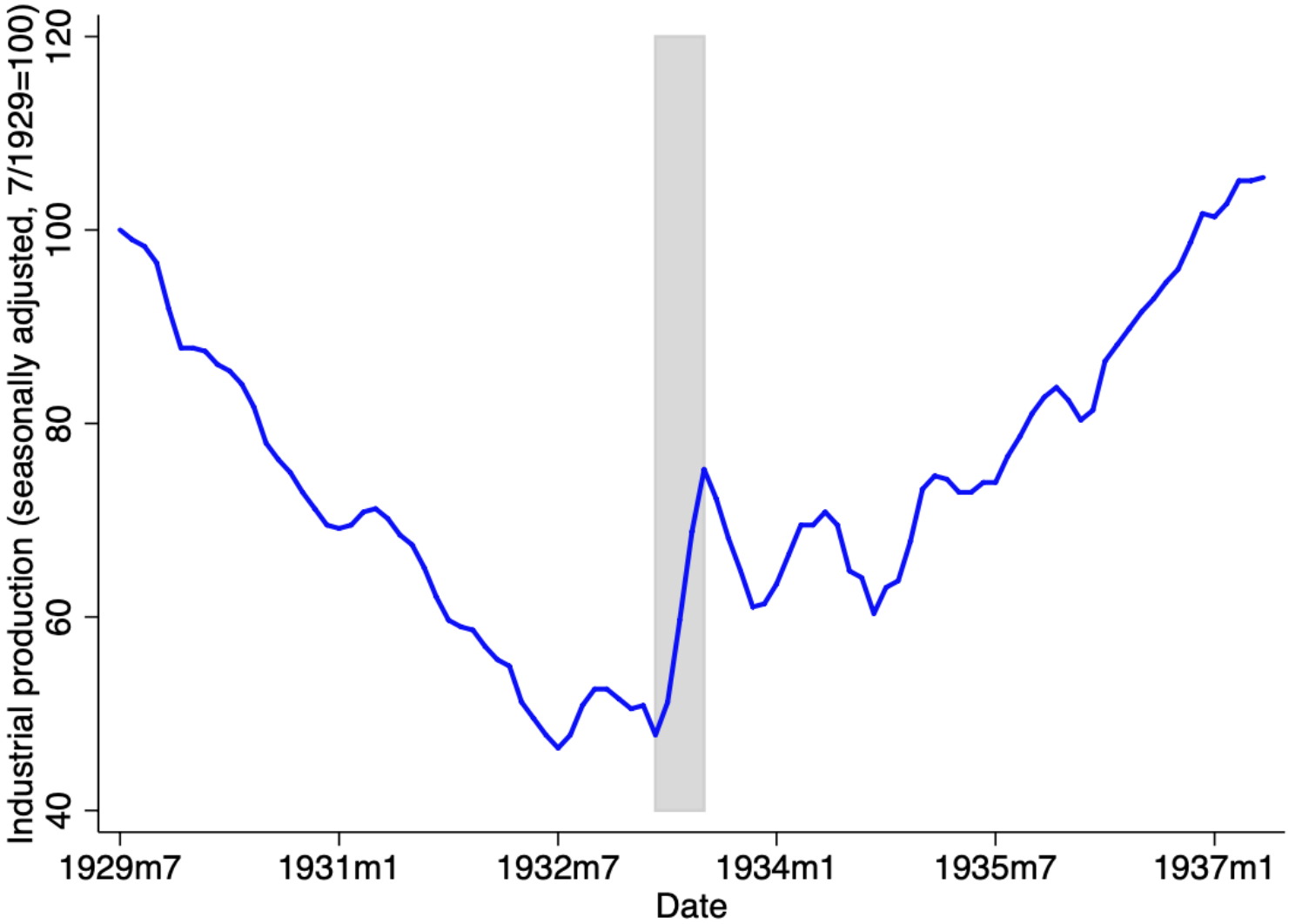
Monetary Transmission Mechanism

- Intertemporal substitution (changes in the real interest rate affect C and I).
- Credit channel: monetary changes affect spreads, ability of banks to make loans, etc. (Jiménez, Ongena, Peydró, and Saurina, AER 2012)
- Relaxing liquidity constraints for some households by raising income (Cloyne, Ferreira, and Surico, ReStud 2020).
- Redistribute income to high MPC consumers (Hausman, Rhode, and Wieland, AER 2019).
- Increases real money balances (Chodorow-Reich, Gopinath, Mishra, Narayanan, QJE 2019).

Outline

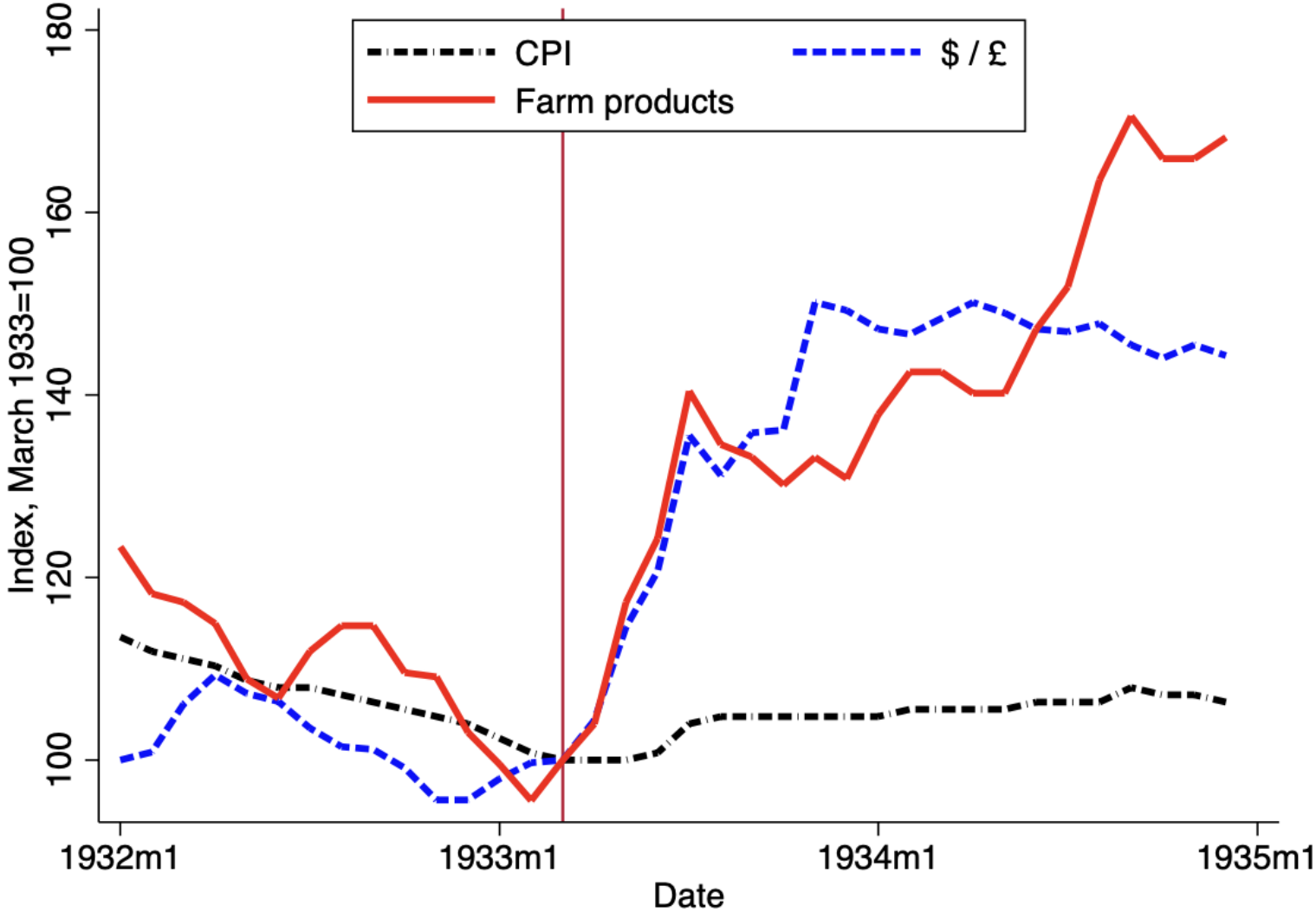
Recovery from the Great Depression

Figure 1 – Industrial production, 1929-1937



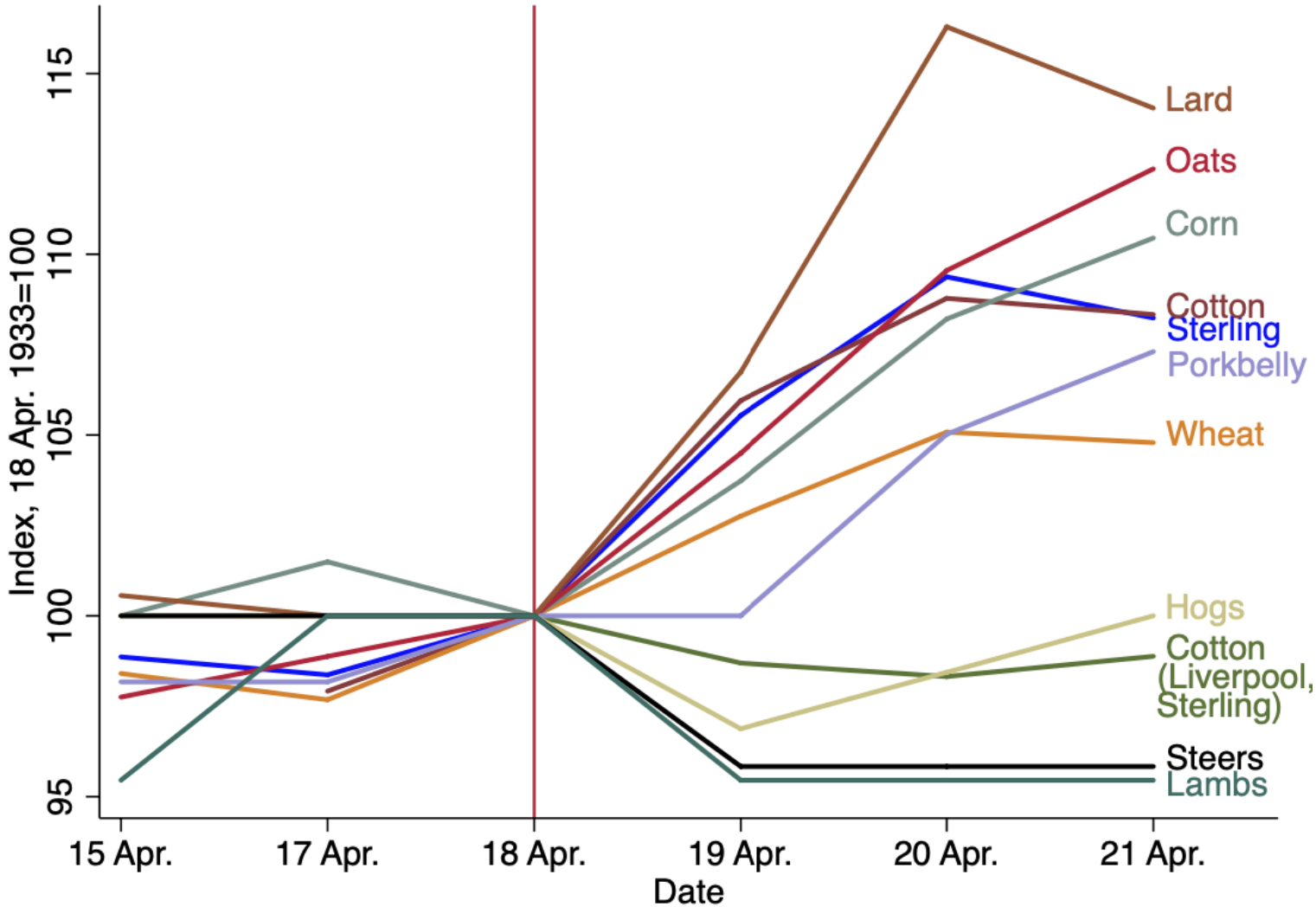
Large Devaluation from Leaving Gold Standard

Figure 2 – The CPI, the exchange rate, and farm prices



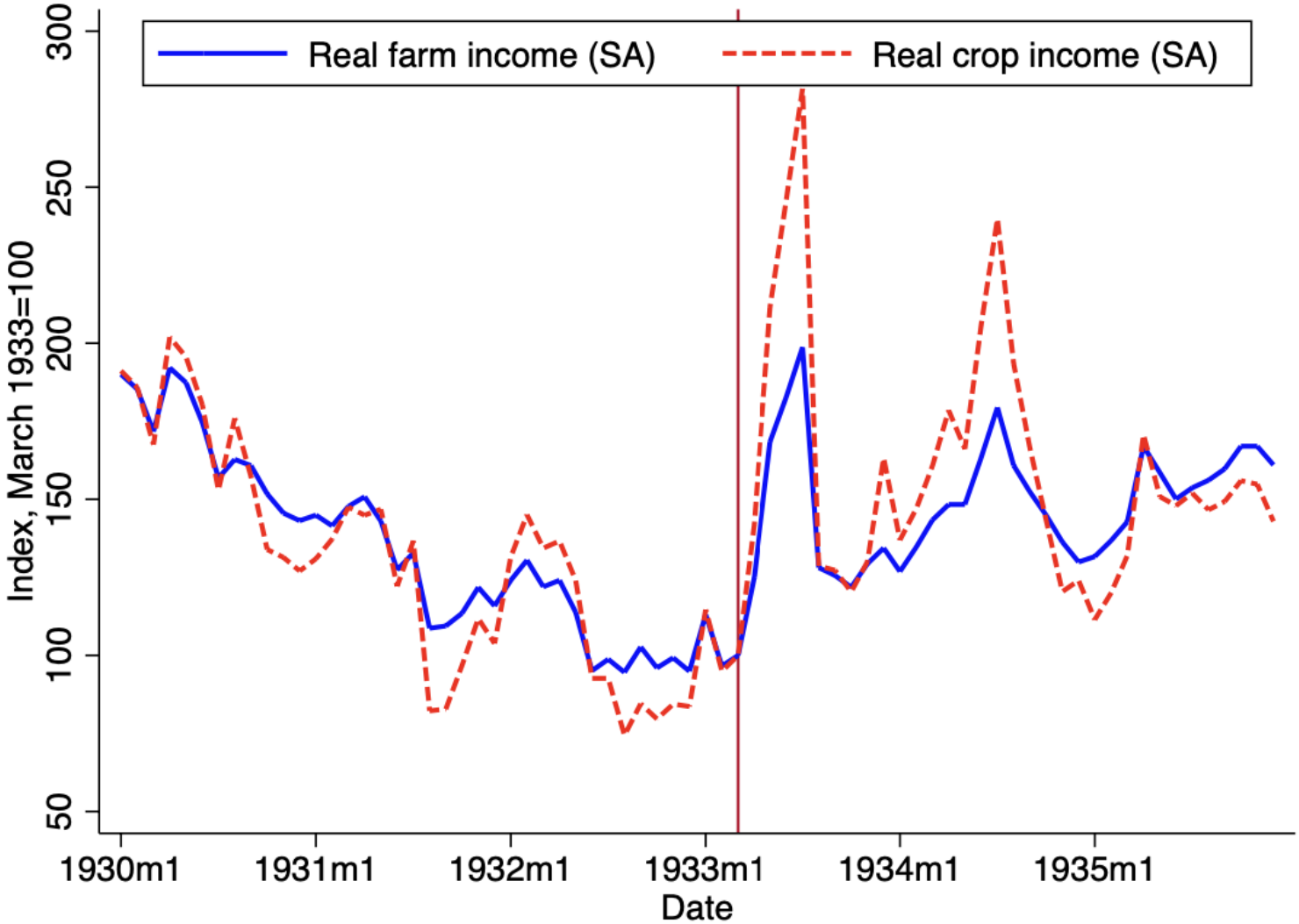
TRADABLE PRICES ROSE

Figure 3 – The exchange rate and farm prices after devaluation



Farm Incomes Rose

Figure 5 – Farm income



Specification

- Cross-sectional regression of the form:

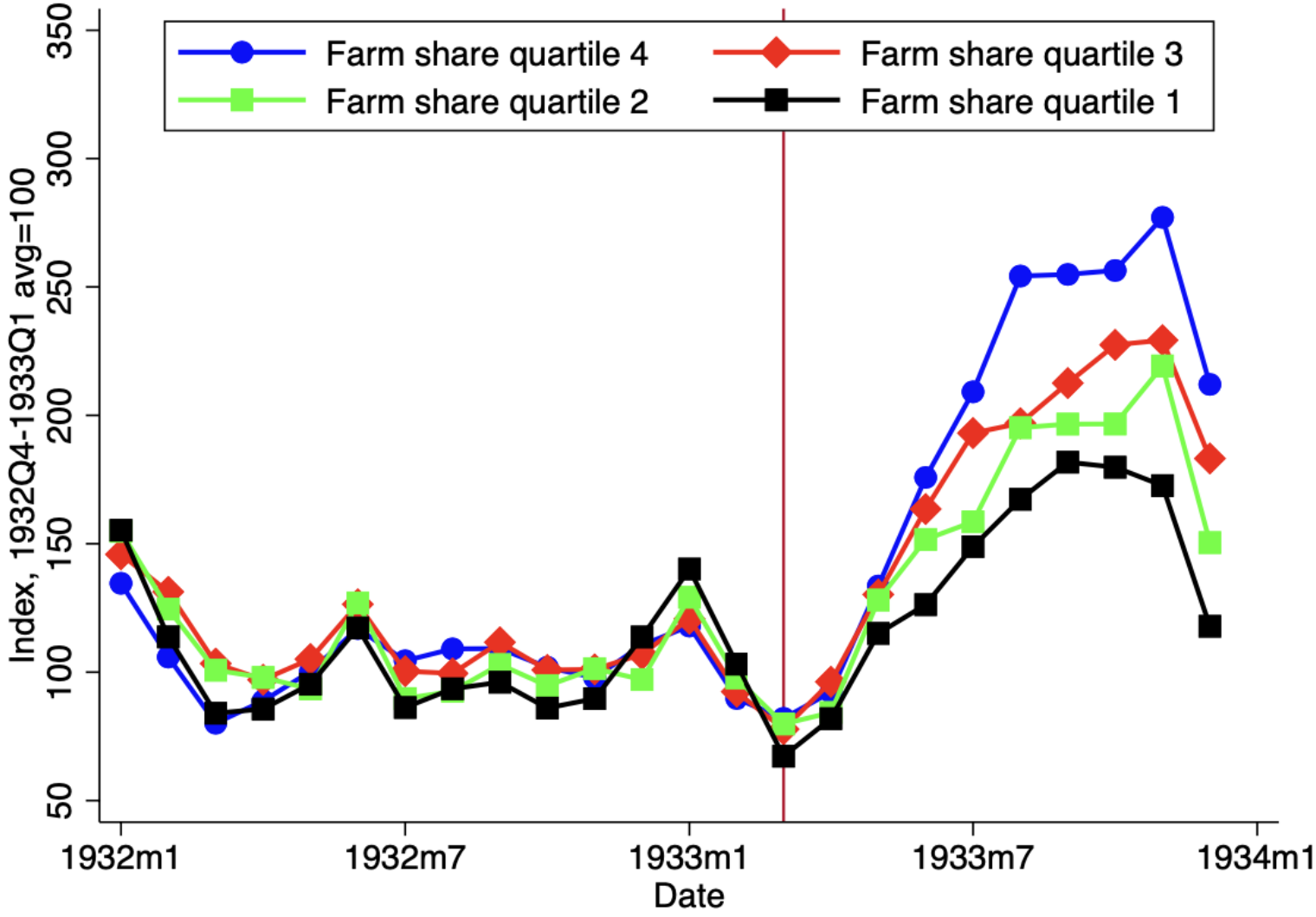
$$\%\Delta\text{Auto sales}_{i,\text{Spring 1933}} = \beta_0 + \beta_1 \text{Agricultural exposure}_i + \gamma' X_i + \varepsilon_i$$

- What is the identifying assumption?

- Comments? Concerns?

Test for Pre-Trends

Figure 7 – Auto sales by farm share quartile



County-level Analysis

Table 3 – County New Auto Sales 1932-1933

Dependent variable:	New auto sales growth (%)								
Geography:	State		County						
Frequency:	Q41-Q3	1932-33	1932-33						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Right hand side variables ($ p.c.):									
Change farm product value	1.49**	1.99**	1.54***	1.49***	1.20***	0.84**	1.05***	0.92***	
	(0.62)	(0.93)	(0.57)	(0.42)	(0.34)	(0.38)	(0.38)	(0.34)	
Farm product value 1932	−0.55	−0.40**	−0.26**	−0.33***	−0.25***	−0.023	−0.16**	−0.16***	
	(0.42)	(0.16)	(0.098)	(0.081)	(0.058)	(0.034)	(0.061)	(0.058)	
AAA Transfers 1933					3.26**			2.66	
					(1.61)			(1.89)	
Cotton, tobacco, and wool value 1932									2.33***
									(0.23)
Corn, oats, and wheat value 1932									0.35**
									(0.13)
Hay, potato, and fruit value 1932									0.14
									(0.18)
Livestock value 1932									−0.11
									(0.17)
Milk and egg value 1932									−0.42***
									(0.10)
Control Variables	No	No	No	Yes	Yes	No	Yes	Yes	No
State Fixed Effects	No	No	No	No	No	Yes	Yes	Yes	No
Drought Interactions	No	No	No	Yes	Yes	No	Yes	Yes	No
R^2	0.27	0.19	0.09	0.31	0.36	0.31	0.40	0.43	0.26

Convincing?

Aggregation Effects?

- Evidence is about *relative* changes in consumption expenditure.
- Three mechanisms by which it can be expansionary overall:
  1. Redistribution to higher-MPC households.
  2. Improves bank health.
  3. Raises inflation expectations.

Testing for Differential MPCs

- Cross-sectional regression of the form:

$$\begin{aligned}
&\%\Delta\text{Auto sales}_{i,\text{Spring 1933}} = \\
&\quad \beta_0 + \beta_1 \Delta\text{farm product value}_i \times \%\text{farms mortgaged} + \\
&\quad + \beta_2 \text{farm product value}_i \times \%\text{farms mortgaged} \\
&\quad + \beta_3 \Delta\text{farm product value}_i + \beta_4 \%\text{farms mortgaged} \\
&\quad + \beta_5 \Delta\text{farm product value}_i + \gamma' X_i + \varepsilon_i
\end{aligned}$$

- What is the identifying assumption?

- Comments? Concerns?

Debt-Interaction Positiv

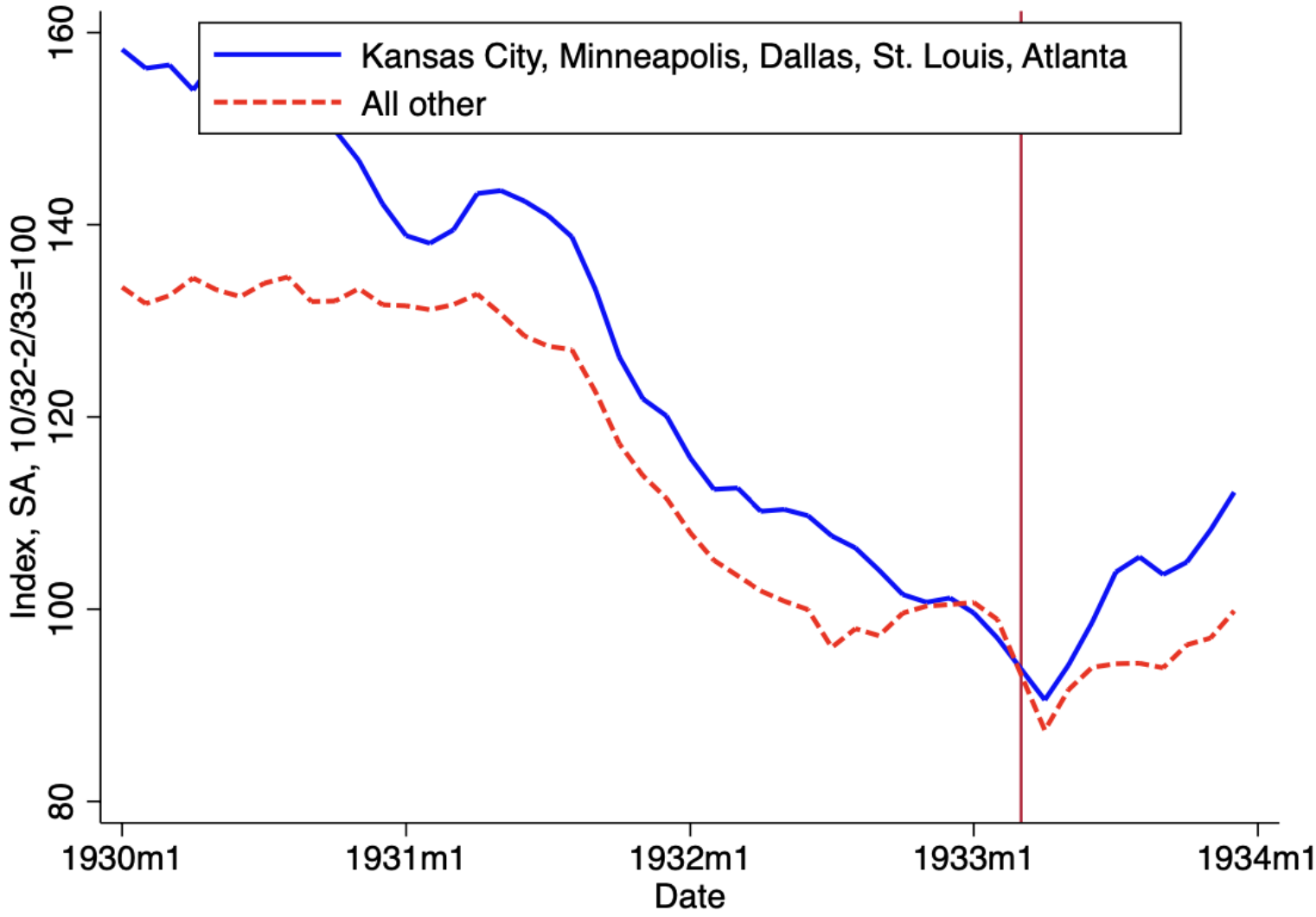
Table 5 – Auto sales growth in spring 1933 (% changes) and farm debt

Panel A: Linear interaction with % farms mortgaged

	(1)	(2)	(3)	(4)
Linear Interaction	0.37*	0.77***	0.57**	0.72***
	(0.19)	(0.24)	(0.23)	(0.24)
Change farm product value p.c. ($)	1.39**	0.089	0.49	0.018
	(0.61)	(0.50)	(0.52)	(0.51)
State Fixed Effects	No	Yes	No	Yes
Control Variables	No	No	Yes	Yes
Drought Interactions	Yes	Yes	Yes	Yes
R^2	0.23	0.40	0.37	0.44
Observations	2,094	2,094	2,073	2,073

Differential Deposit Growth

Figure 12 – Net demand deposits, 1930-33



INFLATION EXPECTATIONS?

(b) Tires

Aggregation

- Simple framework to examine how cross-sectional estimates map to the aggregate economy.
- Model has heterogeneity on the following three dimensions:
  - Income from farming, labor, or pricing power.
  - Permanent income vs hand-to-mouth.
  - Farm vs urban area.
- Simplifications:
  - Model essentially static.
  - Exogenous relative price movements.
- Who looked at the appendix?

KEY RESULT

$$\%\Delta \text{Cars} = \underbrace{\beta \times \phi^f}_{\substack{\text{“naive”} \\ \text{extrapolation}}} \times \underbrace{\frac{\text{Farm area income per capita}}{\text{National income per capita}}}_{\text{Relative income p.c.}}$$

$$\times \underbrace{\left(1 - \xi \frac{\theta^w}{\theta^f}\right)}_{\substack{\text{Redistribution from} \\ \text{high-MPC consumers}}} \times \underbrace{\mu_t}_{\substack{\text{Aggregate} \\ \text{spending} \\ \text{multiplier}}}$$

$$+ \underbrace{-\sigma d \ln(1 + r_t)}_{\text{Intertemporal Substitution}}$$

- Comments? Concerns?

Aggregate Effect of Farm Channel

Table 7 – Implied aggregate effect

Redistribution from high MPC consumers, $\xi\frac{\theta^w}{\theta^f}$	Predicted %ΔCars: Aggregate Multiplier $\mu=1$	$\mu=2$	$\mu=3$	Fraction of actual %ΔCars: Aggregate Multiplier $\mu=1$	$\mu=2$	$\mu=3$
0.7	8.0	15.9	23.9	9.2	18.4	27.6
0.6	10.6	21.2	31.9	12.3	24.6	36.8
0.5	13.3	26.6	39.8	15.4	30.7	46.1
0.4	15.9	31.9	47.8	18.4	36.8	55.3
0.3	18.6	37.2	55.8	21.5	43.0	64.5

Notes: Columns 2-4 display the implied new car sales growth rate from equation (8) given the indicated parameter values, and $\beta = 1.7$, $\phi^f = 0.248$, $\frac{Y_{p.c.,a}}{Y_{p.c.}} = 0.63$. Columns 5-7 show the fraction of actual new car sales growth (86.5%) explained.

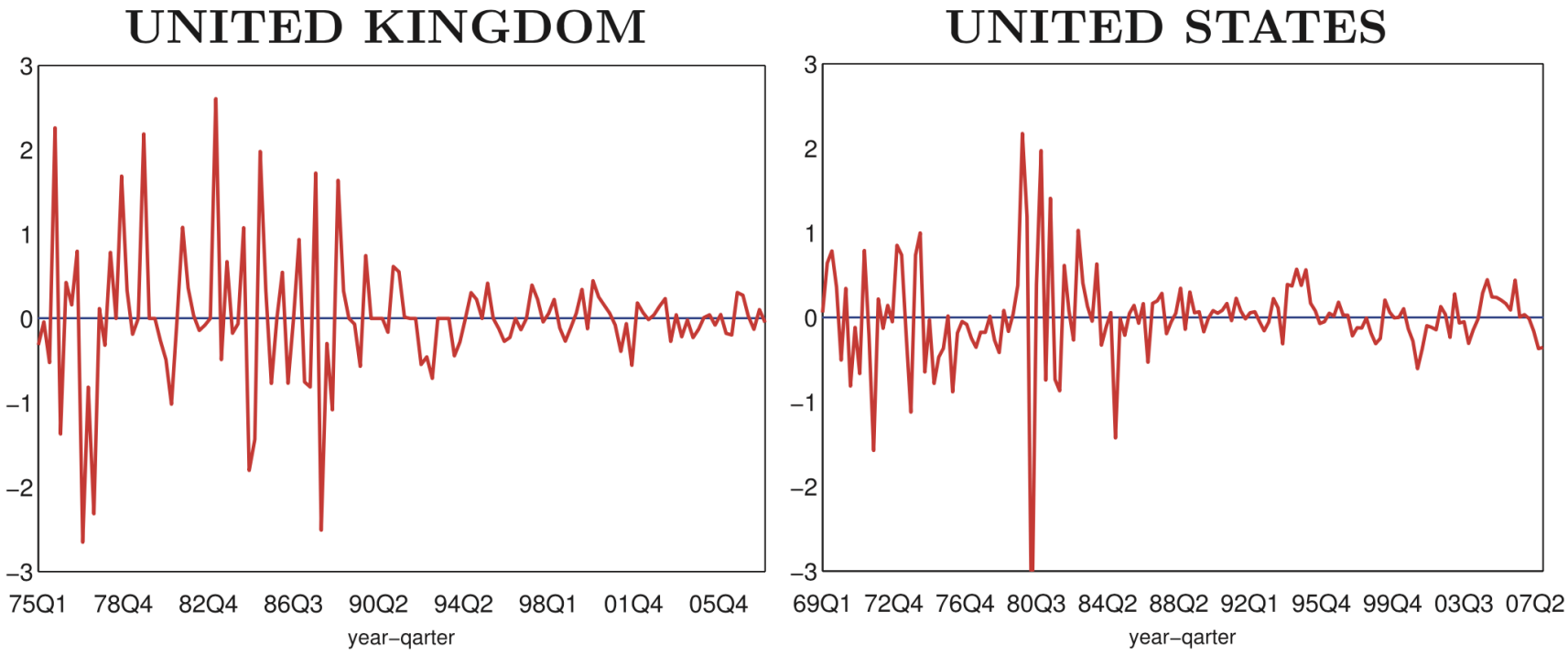
- Thoughts? Comments?

Outline

Data

- Monetary shocks for U.S., U.K.
- Consumer expenditure data.
  - Detailed data on consumption.
  - More rudimentary data on income and especially wealth.
  - Contains information on housing tenure and housing debt status.

Aggregate Monetary Shock



- Thoughts? Comments?

Specification

$$X_{i,t} = \alpha_0^i + \alpha_1^i trend + B^i(L)X_{i,t-1} + C^i(L)S_{t-1} + \sum_{q=2}^{4} D_q^i Z_q + u_{i,t}$$

- $i \in$ [Mortgagor, Outright-Owner, Renter]
- Identification assumption?
- Comments? Concerns?

NONDURABLE EXPENDITURE

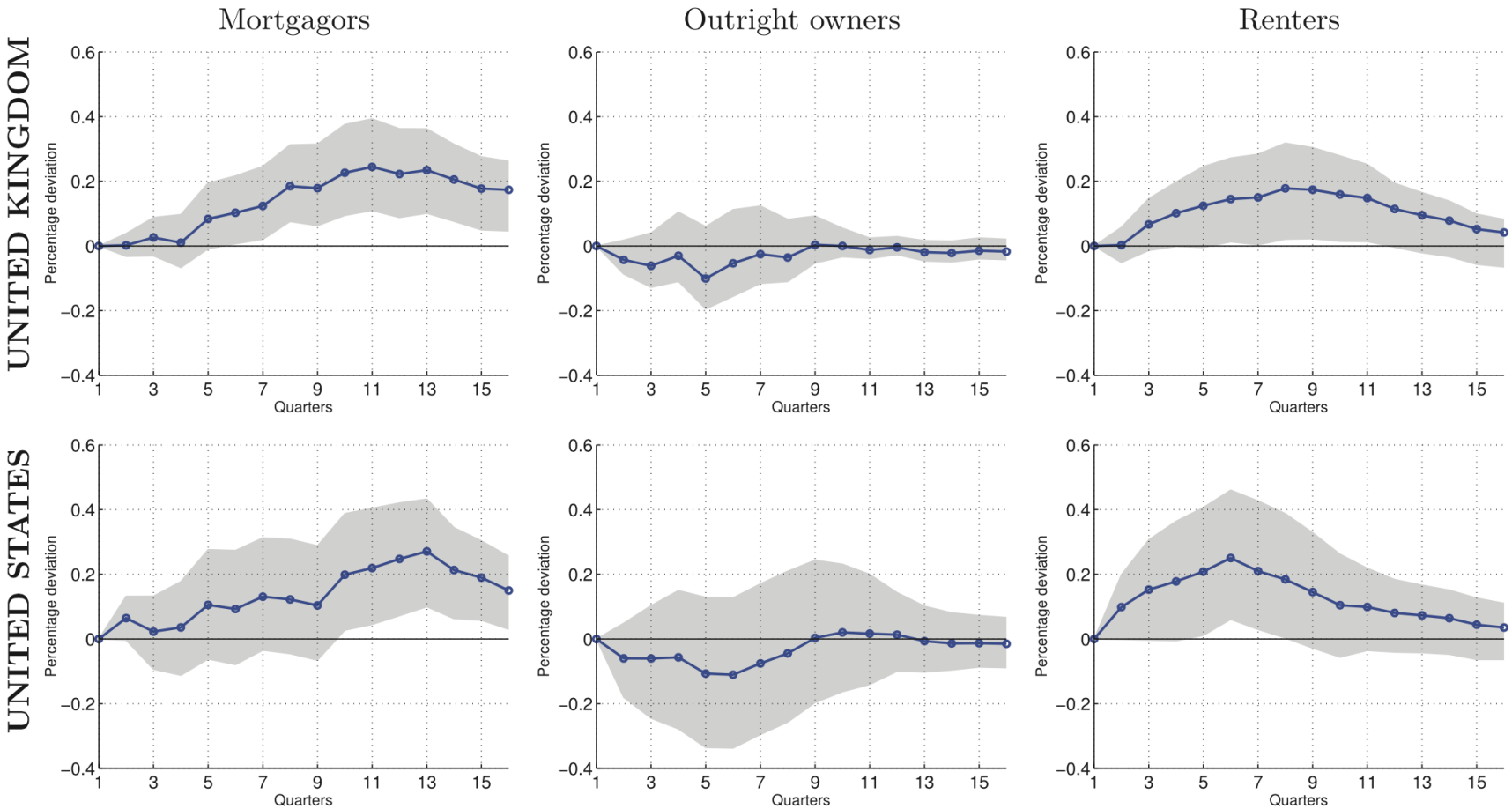


FIGURE 3

Dynamic effects of a 25 bp unanticipated interest rate cut on the consumption of non-durable goods and services by housing tenure group. Gray areas are bootstrapped 90% confidence bands. Top row: U.K. (FES/LCFS data). Bottom row: U.S. (CEX data).

Durable Expenditure

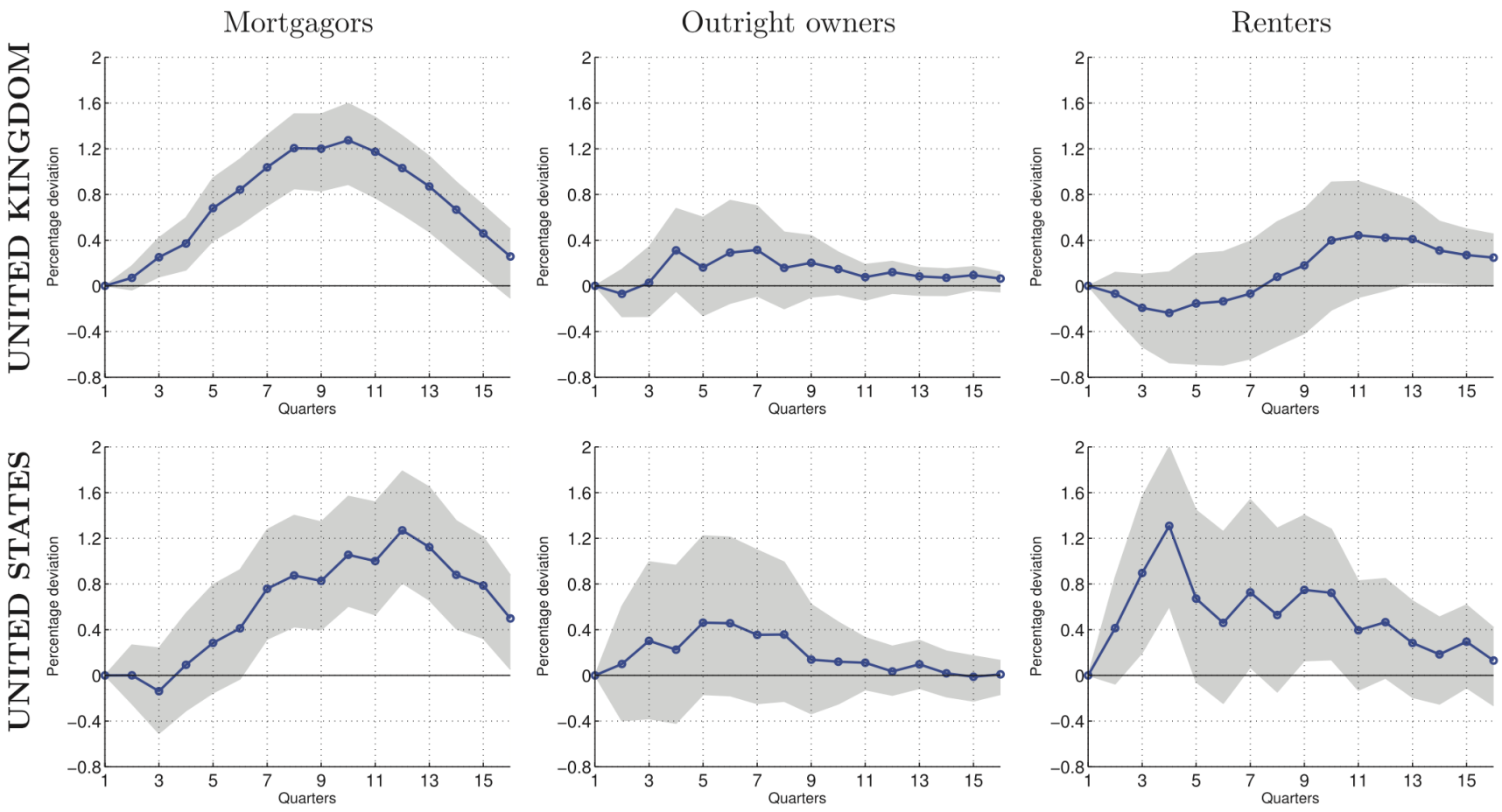


Figure 4

Dynamic effects of a 25 bp unanticipated interest rate cut on the expenditure of durable goods by housing tenure group. Gray areas are bootstrapped 90% confidence bands. Top row: U.K. (FES/LCFS data). Bottom row: U.S. (CEX data).

Comparison to Income

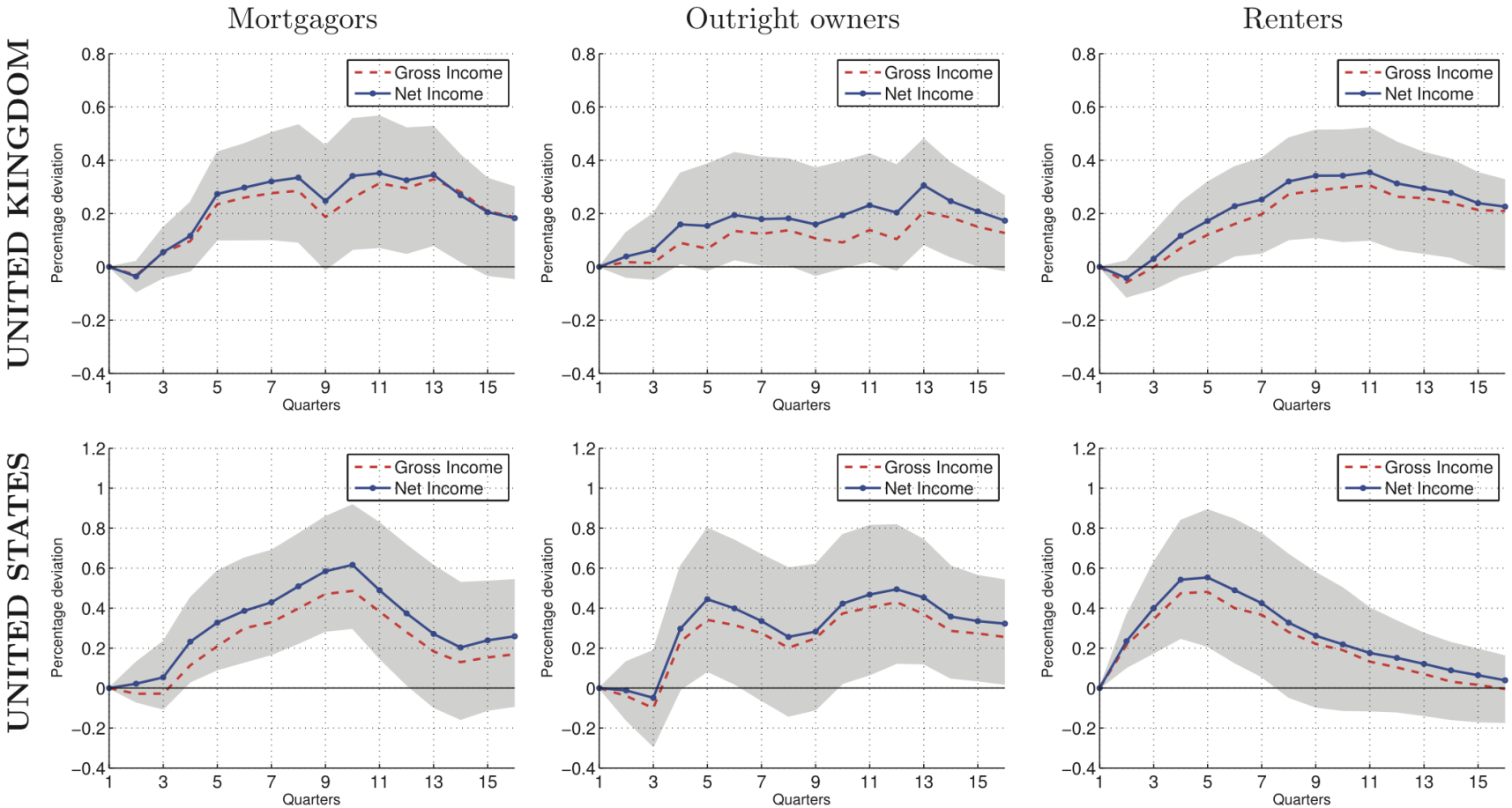


Figure 9

Dynamic effects of a 25 bp unanticipated interest rate cut on net income (blue) and gross income (red). Mortgagors (left), outright owners (centre), and renters (right). Gray areas are bootstrapped 90\% confidence bands for net income. Top row: U.K. (FES/LCFS data). Bottom row: U.S. (CEX data).

Comparison to Income

TABLE 1
Cumulative changes over four years in US$

Panel A: U.K.

	Non-durable consumption	*Durable expenditure*	*Mortgage or rental payments*	*After-tax income*
Mortgagors	308.3	292.3	−166.4	695.9
	[112.8, 516.1]	[189.2 , 369.0]	[−272.2 , −41.7]	[186.5 , 1105.1]
Outright	−62.6	46.5		451.7
owners	[−148.2 , 77.4]	[−24.6 , 107.6]		[122.5 , 797.2]
Renters	155.3	19.0	64.7	397.3
	[17.9 , 261.8]	[−36.5 , 62.9]	[4.4 , 118.7]	[94.2 , 596.1]

Panel B: U.S.

	Non-durable consumption	*Durable expenditure*	*Mortgage or rental payments*	*After-tax income*
Mortgagors	305.8	229.3	−56.3	757.3
	[58.3 , 554.3]	[122.0 , 350.8]	[−112.8 , −4.3]	[196.8 , 1302.0]
Outright	−72.3	54.8		585.3
owners	[−324.8 , 186.0]	[−10.5 , 127.8]		[83.3 , 1012.8]
Renters	223.3	123.5	64.8	439.3
	[32.3 , 412.3]	[30.3 , 213.8]	[9.8 , 121.5]	[112.8 , 699.8]

Demographic Sub-groups

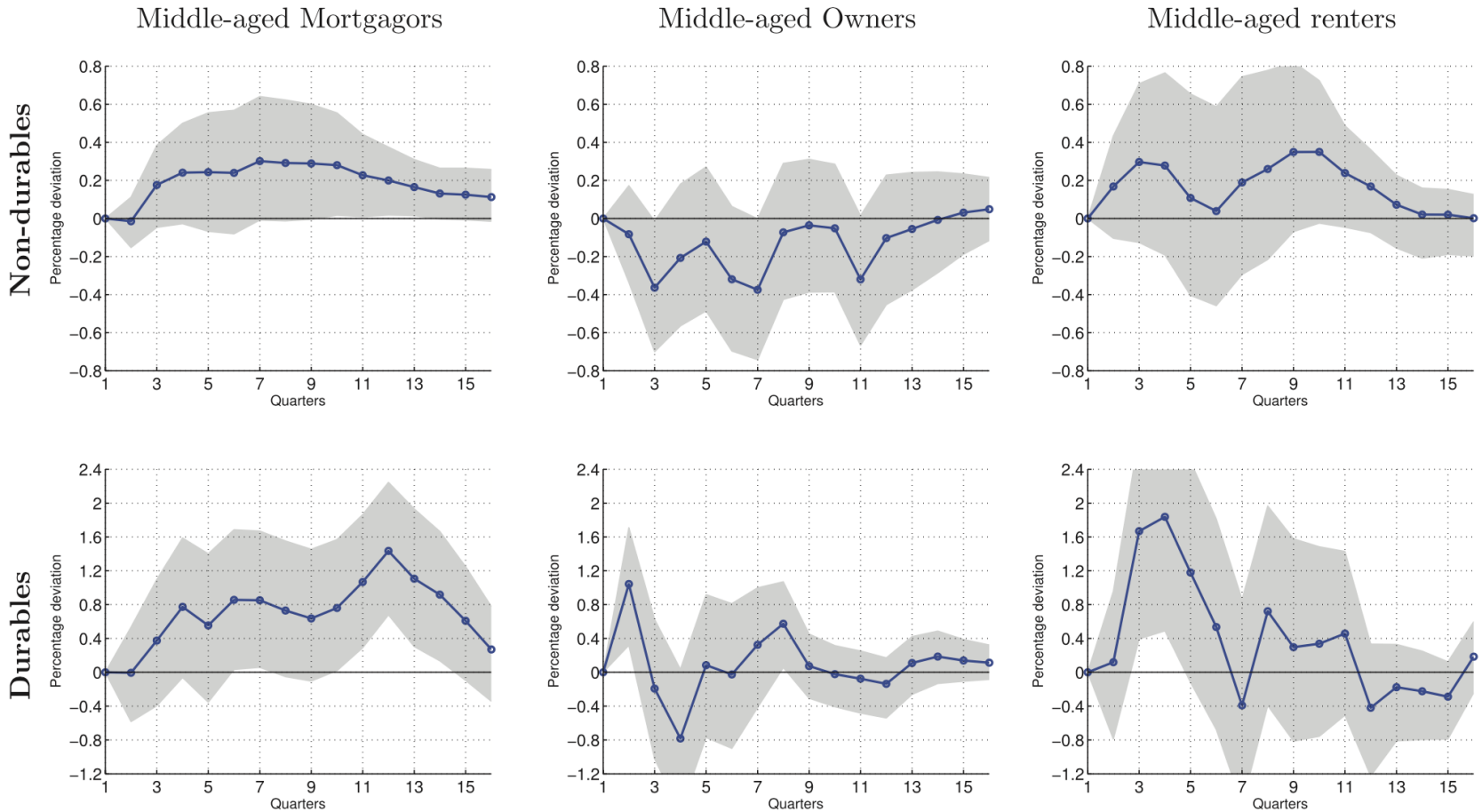


Figure 6

Convincing?

Questions

- What is their preferred interpretation?
- What is causing the rise in income?
- What are the aggregate implications?
- How is it different from Hausman, Rhode, Wieland?

Outline

What is the MPC?

- MPC = marginal propensity to consume.
- Very important parameter in old Keynesian models.
- In standard New Keynesian models ≈ 0.
  - Euler equation $\Rightarrow$ Permanent income consumer.
- TANK and HANK models.

Identification Problem

$$c_{it} = \alpha + \beta y_{it} + \varepsilon_{it}$$

- What could go wrong?

Jonathan Parker Oeuvre

- Johnson, Parker, Souleles, AER 2003: 20-40% of 2001 Rebate spent on nondurable goods within 3 months.
- Parker, Souleles, Johnson, McClelland, AER 2008: 50-90% of 2008 Rebate spent on nondurable and durable goods within 3 months.
- Broda, Parker, JME 2014: 2008 rebate caused 10% increase in spending in first week.
- Parker, Schild, Erhard, Johnson, WP 2022: 10% of 2020 stimulus was spent within 3 months.

THE 2008 EXPERIMENT

TABLE 1—THE TIMING OF THE ECONOMIC STIMULUS PAYMENTS OF 2008

Payments by electronic funds transfer		*Payments by mailed check*	
Last two digits of taxpayer SSN	Date ESP funds transferred to account by	Last two digits of taxpayer SSN	Date check to be received by
00–20	May 2	00–09	May 16
21–75	May 9	10–18	May 23
76–99	May 16	19–25	May 30
		26–38	June 6
		39–51	June 13
		52–63	June 20
		64–75	June 27
		76–87	July 4
		88–99	July 11

Source: Internal Revenue Service (http://www.irs.gov/newsroom/article/0,,id=180247,00.html).

SPECIFICATION

$$C_{i,t+1} - C_{i,t} = \sum_s \beta_{0s} \times month_{s,i} + \beta_1' X_{i,t} + \beta_2 ESP_{i,t+1} + u_{i,t+1}$$

- Comments? Concerns?

Effects on Expenditure

Table 2—The Contemporaneous Response of Expenditures to ESP Receipt among All Households

	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS
Panel A. Dollar change in spending								
ESP	0.016	0.079	0.121	0.516				
	(0.027)	(0.046)	(0.055)	(0.179)				
I(*ESP*)					10.9	74.8	121.5	494.5
					(31.7)	(56.6)	(67.2)	(207.2)
	Food OLS	Strictly nondurables OLS	Nondurable spending OLS	All CE goods and services OLS	Food 2SLS	Strictly nondurables 2SLS	Nondurable spending 2SLS	All CE goods and services 2SLS
Panel B. Percent change in spending					*Panel C. Dollar change in spending*			
ESP					0.012	0.079	0.128	0.523
					(0.033)	(0.060)	(0.071)	(0.219)
I(*ESP*)	0.69	1.74	2.09	3.24				
	(1.27)	(0.96)	(0.94)	(1.17)				

Notes: All regressions also include a full set of month dummies, age, change in the number of adults, and change in the number of children following equation (1). Reported standard errors are adjusted for arbitrary within-household correlations and heteroskedasticity. The coefficients in panel B are multiplied by 100 so as to report a percent change. The last four columns report results from 2SLS regressions where the indicator variable for ESP receipt and the other regressors are used as instruments for the amount of the ESP. All regressions use 17,478 observations except for the first two columns of panel B which have only 17,427 and 17,475, respectively.

SUB-SAMPLES

TABLE 3—THE RESPONSE TO ESP RECEIPT AMONG HOUSEHOLDS RECEIVING PAYMENTS

	Dollar change in		Percent change in		Dollar change in	
	Nondurable spending	All CE goods and services	Nondurable spending	All CE goods and services	Nondurable spending	All CE goods and services
	OLS	OLS	OLS	OLS	2SLS	2SLS
Panel A. Sample of all households ($N = 17{,}478$)						
ESP	0.117	0.507			0.123	0.509
	(0.060)	(0.196)			(0.081)	(0.253)
$I(ESP)$			2.63	3.97		
			(1.07)	(1.34)		
$I(ESP_{i,t} > 0 \text{ for any } t)_i$	9.58	21.21	−0.88	−1.17	8.23	20.77
	(36.07)	(104.00)	(0.50)	(0.63)	(38.79)	(112.18)
Panel B. Sample of households receiving ESPs ($N = 11{,}239$)						
ESP	0.185	0.683			0.252	0.866
	(0.066)	(0.219)			(0.103)	(0.329)
$I(ESP)$			3.91	5.63		
			(1.33)	(1.69)		
Panel C. Sample of households receiving only on-time ESPs ($N = 10{,}488$)						
ESP	0.214	0.590			0.308	0.911
	(0.070)	(0.217)			(0.112)	(0.342)
$I(ESP)$			4.52	6.05		
			(1.50)	(1.89)		

PERSISTENCE

TABLE 5—THE LONGER-RUN RESPONSE OF EXPENDITURES TO ESP RECEIPT

	Dollar change in		Percent change in		Dollar change in	
	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending OLS	All CE goods and services OLS	Nondurable spending 2SLS	All CE goods and services 2SLS
ESP_{t+1} or $I(ESP_{t+1})$	0.201	0.517	3.92	4.96	0.254	0.757
	(0.067)	(0.211)	(1.55)	(1.96)	(0.110)	(0.360)
ESP_t or $I(ESP_t)$	−0.054	−0.288	−1.23	−2.22	−0.097	−0.278
	(0.080)	(0.214)	(1.50)	(1.92)	(0.113)	(0.330)
Implied spending effect in second three-month period	0.146	0.230	NA	NA	0.156	0.479
	(0.104)	(0.303)			(0.177)	(0.568)
Implied cumulative fraction of rebate spent over both three-month periods	0.347	0.747	NA	NA	0.410	1.235
	(0.155)	(0.477)			(0.273)	(0.892)

Notes: All regressions also include the change in the number of adults, the change in the number of children, the age of the household, and a full set of month dummies. The sample includes only households receiving only on-time ESPs. Standard errors are adjusted for arbitrary within-household correlations and heteroskedasticity. The coefficients in the second triplet of columns are multiplied by 100 so as to report a percent change. The final triplet of columns reports results from 2SLS regressions where $I(ESP)$ and the other regressors are used as instruments for ESP. The number of observations for all regressions is 10,488.

HETEROGENEOUS TREATMENT EFFECTS

TABLE 6—THE PROPENSITY TO SPEND ACROSS DIFFERENT HOUSEHOLDS

Interaction:	*Panel A. By age*		*Panel B. By income*		*Panel C. By liquid assets*		*Panel D. By housing status*	
Dependent variable:	Dollar change in		Dollar change in		Dollar change in		Dollar change in	
	Non-durable spending	All CE goods and services	Non-durable spending	All CE goods and services	Non-durable spending	All CE goods and services	Non-durable spending	All CE goods and services
	Age Low: ≤ 40 High: > 58		Income Low: $\leq 32{,}000$ High: $> 74{,}677$		Liquid assets Low: ≤ 500 High: $> 7{,}000$		Housing status Low: own with mortgage High: own without	
ESP	0.345	0.952	0.215	0.568	0.275	0.851	0.213	0.431
	(0.133)	(0.398)	(0.124)	(0.442)	(0.164)	(0.558)	(0.153)	(0.455)
ESP × *Low*	−0.150	−0.461	0.024	0.715	−0.253	−0.844	0.043	0.543
(group difference)	(0.124)	(0.399)	(0.155)	(0.500)	(0.184)	(0.527)	(0.131)	(0.394)
ESP × *High*	0.044	0.414	−0.009	0.205	−0.075	0.083	0.260	0.800
(group difference)	(0.151)	(0.472)	(0.139)	(0.466)	(0.186)	(0.631)	(0.169)	(0.514)
Observations	10,488	10,488	8,592	8,592	5,071	5,071	10,380	10,380
Implied total spending								
Low group	0.195	0.491	0.239	1.283	0.022	0.007	0.256	0.974
	(0.114)	(0.394)	(0.180)	(0.564)	(0.205)	(0.566)	(0.112)	(0.364)
High group	0.389	1.366	0.206	0.773	0.200	0.934	0.473	1.231
	(0.168)	(0.498)	(0.133)	(0.463)	(0.202)	(0.677)	(0.175)	(0.508)

Convincing?

More MPCs

- Shapiro and Slemrod (AER 2003, AER, 2009): self-reported MPC of 25-30% out of rebates in 2001 / 2008.

- Japielli and Pistaferri (AEJ-Macro, 2014): self-reported MPC of 48% out of hypothetical transitory income shock.

- Faegereng, Holmn, and Natvick (AEJ-Macro, 2021): 50% MPC within one year of large lottery winnings in Norway. Consumption is resiaul from budget constraint: $C = Y - \Delta A$.

Outline

de Chaisemartin and D'Haultfœuille, AER 2020

- Panel, binned into cells g, t (g=group).
- $Y_{i,g,t}$ outcome of unit i in cell g, t.
- $D_{g,t}$ treatment indicator.
- Expectation of OLS 2-way FE estimator:

$$\beta_{fe} = E\left(\sum_{(g,t):D_{g,t}=1} W_{g,t} \Delta_{g,t} \right)$$

  - $W_{g,t}$ are weights, $\sum_{(g,t):D_{g,t}=1} W_{g,t} = 1$.
  - $\Delta_{g,t}$ is the group-specific ATE.

What is the Problem?

- With homogeneous treatment effects, no problem:

$$\Delta_{g,t} = \Delta \Rightarrow \beta_{fe} = \Delta$$

- With heterogenous treatment effects β_{fe} may be poor guide to average ATE since weights $W_{g,t}$ may be negative.

Outline

Borusyak, Jaravel, and Spiess, WP 2022

Table 1: Two-Unit, Three-Period Example

$\mathbb{E}[Y_{it}]$	$i = A$	$i = B$
$t = 1$	α_A	α_B
$t = 2$	$\alpha_A + \beta_2 + \tau_{A2}$	$\alpha_B + \beta_2$
$t = 3$	$\alpha_A + \beta_3 + \tau_{A3}$	$\alpha_B + \beta_3 + \tau_{B3}$
Event date	$E_i = 2$	$E_i = 3$

Notes: without loss of generality, we normalize $\beta_1 = 0$.

- 2-way FE OLS population coefficient is:

$$\beta_{fe} = \tau_{A2} + \frac{1}{2}\tau_{B3} - \frac{1}{2}\tau_{A3}$$

- Not an ATE!
- What is OLS doing here?

Test for Pre-Trends

Table 1: Two-Unit, Three-Period Example

$\mathbb{E}[Y_{it}]$	$i = A$	$i = B$
$t = 1$	α_A	α_B
$t = 2$	$\alpha_A + \beta_2 + \tau_{A2}$	$\alpha_B + \beta_2$
$t = 3$	$\alpha_A + \beta_3 + \tau_{A3}$	$\alpha_B + \beta_3 + \tau_{B3}$
Event date	$E_i = 2$	$E_i = 3$

Notes: without loss of generality, we normalize $\beta_1 = 0$.

- Pre-trend coefficient for lag 2:

$$\beta_{fe,-2} = \tau_{A3} - \tau_{B3}$$

- What is OLS doing here?
- Identified?

Notation

- Binary treatment D_{it}, outcome Y_{it}
- Event date E_{it} where D_{it} switches from 0 to 1.
- Observations $\Omega_1 = \{it \in \Omega : \ D_{it} = 1\}$ and not-yet-treated Ω_0 (includes never treated).
  - Treated: $\Omega_1 = \{it \in \Omega : \ D_{it} = 1\}$, $|\Omega_1| = N_1$
  - Not-yet-treated: $\Omega_0 = \{it \in \Omega : \ D_{it} = 0\}$, $|\Omega_0| = N_0$
- $Y_{it}(0)$ potential outcome if never treated.
- Causal effect $\tau_{it} = E[Y_{it} - Y_{it}(0)]$.

Start from First Principles

- Estimation target:

$$\tau_w = \sum_{it \in \Omega_1} w_{it} \tau_{it} = w' \tau$$

- Assumption 1: Parallel trends

$$E[Y_{it}(0)] = \alpha_i + \beta_t \qquad \forall it \in \Omega$$

- Assumption 2: No anticipation

$$Y_{it} = Y_{it}(0) \qquad \forall it \in \Omega_0$$

- Assumption 3': Restricted causal effects

$$\tau = \Gamma \theta$$

  - θ is unknown $N_1 - M \times 1$, Γ is known $N_1 \times (N_1 - M)$
  - M restrictions on treatment effect. $M = N_1 - 1 =$ homogenous effects.

BSJ Theorem 1 [Simplified]

- Suppose Assumptions 1, 2, 3', and 4 [homoscedastic errors] hold. Then among linear unbiased estimators of τ_w, the (unique) efficient estimator $\hat{\tau}_w^*$ can be obtained with the following steps:

1. Estimate θ by $\hat{\theta}$ from the linear regression

$$Y_{it} = \alpha_i + \beta_t + D_{it}\Gamma_{it}'\theta + \varepsilon_{it}.$$

2. Estimate the vector of treatment effects τ by $\hat{\tau} = \Gamma\hat{\theta}$.

3. Estimate the target τ_t by $\hat{\tau}_w^* = w'\hat{\tau}$

BSJ Theorem 2 [Simplified]

- With unrestricted treatment effects ($M = 0$), the unique efficient linear unbiased estimator $\hat{\tau}_w^*$ of τ_w from Theorem 1 can be obtained via an imputation procedure:

  1. Within the untreated observations only ($it \in \Omega_0$), estimate by OLS:

  $$Y_{it} = \alpha_i + \beta_t + \varepsilon_{it}.$$

  2. For each treated observations ($it \in \Omega_1$) with $w_{it} \neq 0$, set $\hat{Y}_{it}(0) = \hat{\alpha}_i + \hat{\beta}_t$ and $\hat{\tau}_{it} = \hat{Y}_{it} - \hat{Y}_{it}(0)$.

  3. Estimate the target τ_w by a weighted sum $\hat{\tau}_w^* = w'\hat{\tau}$

Inference

- Inference problem for treated units:

$$Y_{it} = \alpha_i + \beta_t + \tau_{it} + \varepsilon_{it}.$$

- How to distinguish between unrestricted τ_{it} and ε_{it}?

- "Conservative" standard errors: impose some homogeneity, so attribute some variance to ε_{it} that belongs to τ_{it}.

- Yields asymptotically weakly conservative standard errors.

Pre-trends

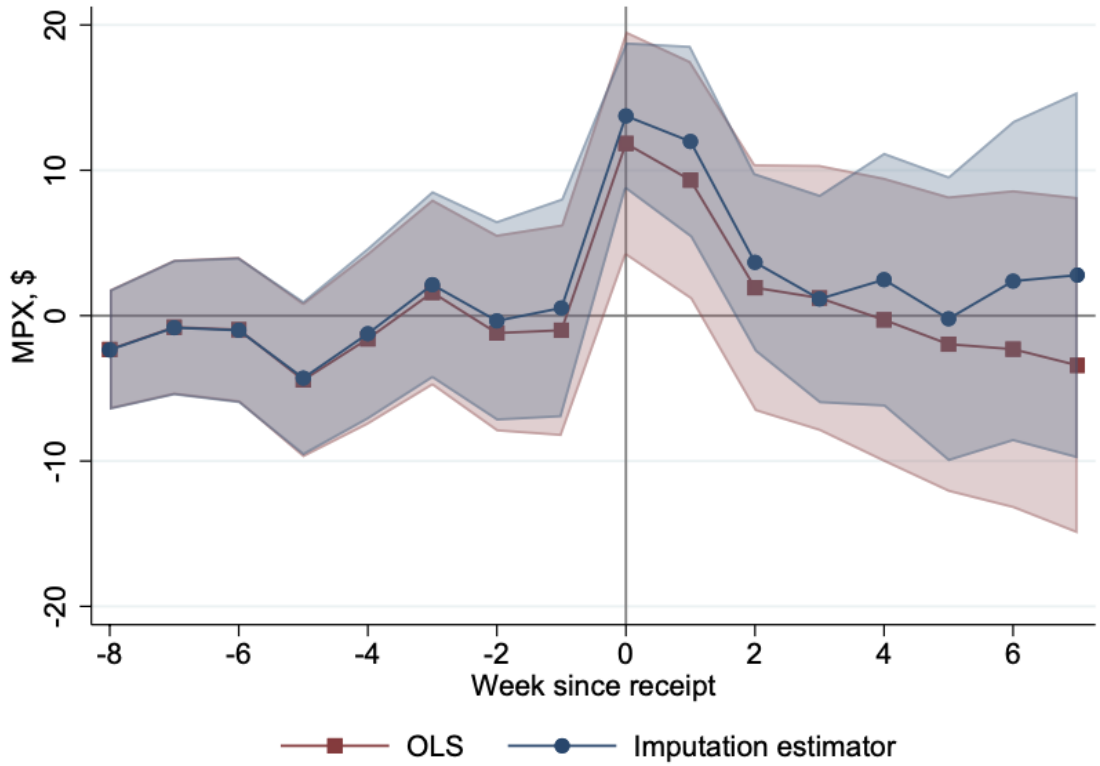
- To test for pre-trends augment model for untreated observations with additional pre-determined variables and test that the coefficients are zero.
- Does not distort inference conditional on test passing.
- What happens if we then include these variables in the regression model? Do we satisfy parallel trends?

Application to Broda and Parker, JME 2014

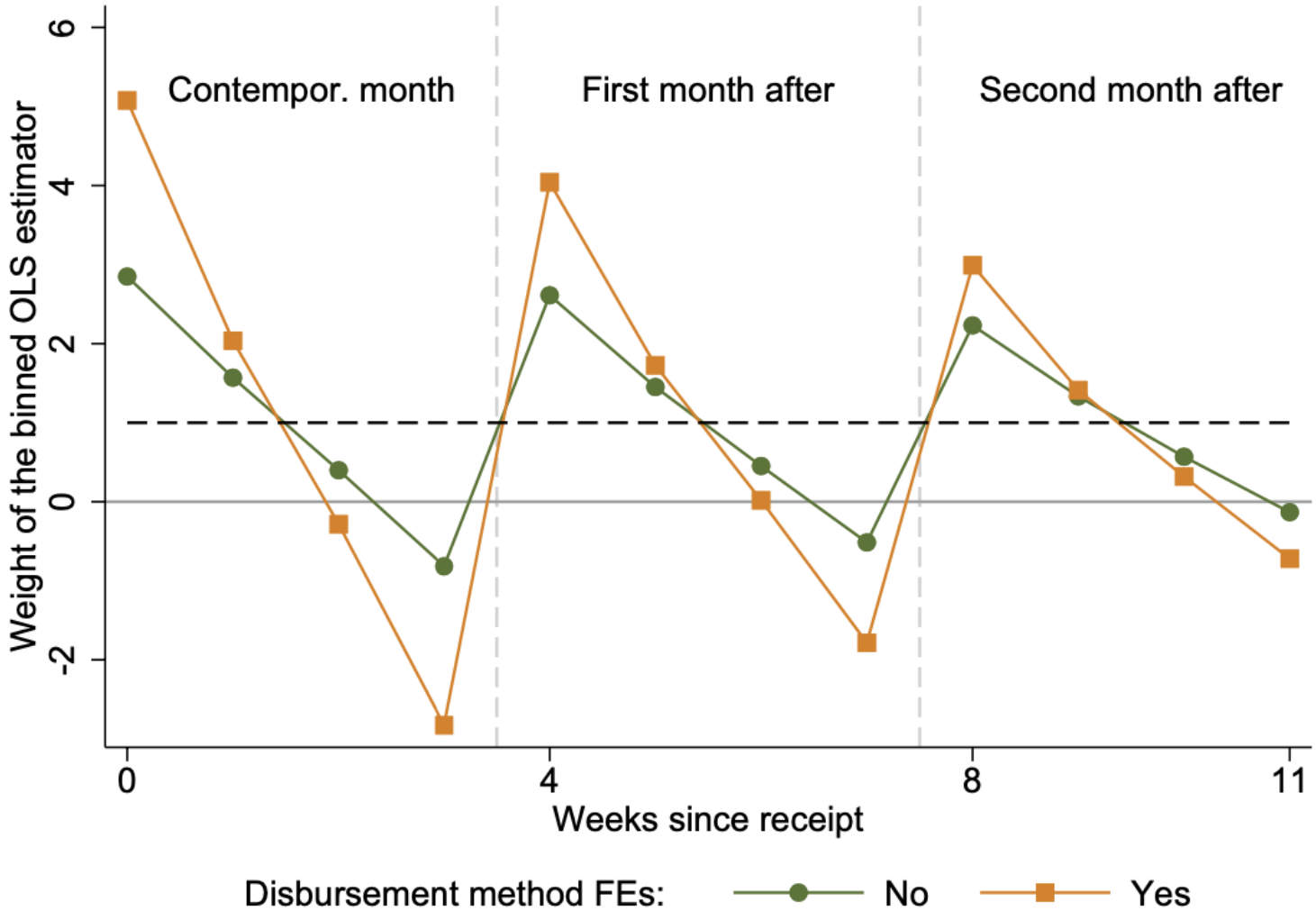
Panel B: With disbursement method fixed effects

	Dollars spent after tax rebate receipt		
	OLS Monthly binned (1)	OLS No binning (2)	Imputation Estimator (3)
Contemporaneous month	47.57	27.88	30.54
	(9.15)	(7.75)	(9.08)
First month after	26.26	−4.48	7.43
	(11.95)	(12.48)	(16.17)
Second month after	20.52	−13.82	4.01
	(14.57)	(16.38)	(29.89)
Three-month total	94.35	9.58	41.97
	(33.54)	(34.42)	(46.56)
N observations	1,127,880	1,127,880	536,553
N households	21,690	21,690	21,690

Dynamic Treatment Effects



WEIGHTS


Contempor. month
First month after
Second month after
Weight of the binned OLS estimator
6
4
2
0
-2
0
4
8
11
Weeks since receipt
Disbursement method FEs:
No
Yes

Outline