Canst Thou Beggar Thy Neighbour?

Evidence from the 1930s

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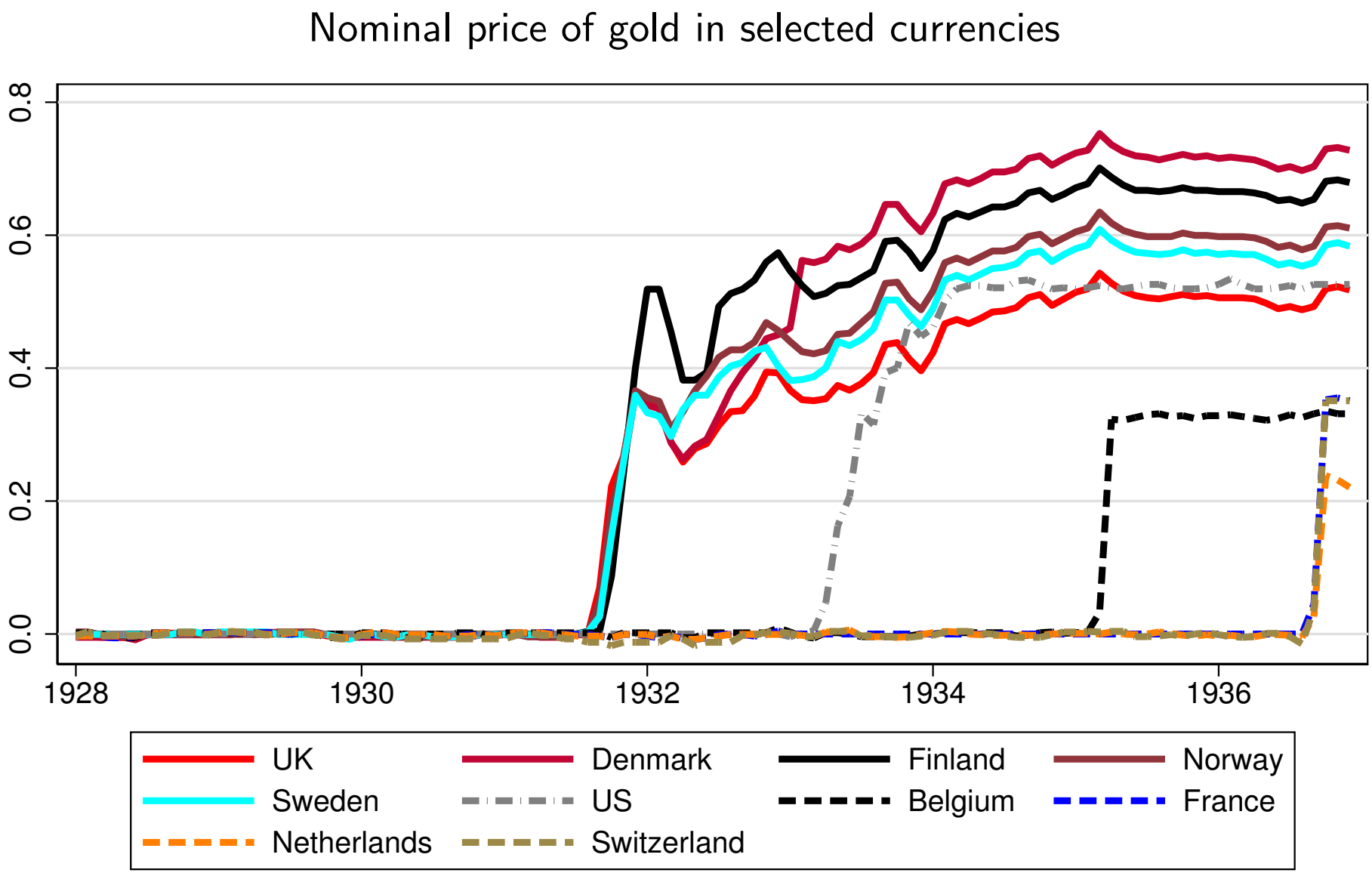
Does Currency Depreciation Depress Foreign Output?

- Classic international macroeconomics question
- Answer is ambiguous:
  - expenditure switching lowers output abroad
  - monetary stimulus might raise it
- Focus on a canonical episode: the currency devaluations of the 1930s
  - Classic example of competitive devaluations
  - Large events: many countries devalued by 30–40%
  - Staggered setting ideal for identification

Staggered Devaluations



Note: logarithm of the price of gold in local currency. 1930 normalized to 0. An increase is a devaluation.

On the Shoulders of..

Eichengreen and Sachs (1985): countries which devalued earlier recovered earlier

- Not causal? Regression of industrial production on the exchange rate
- Relative evidence does not speak to the absolute effect
- Does not have to be about trade: a devaluation is also a monetary expansion

What I Do

- From micro to macro approach:
  - Well-identified cross-sectional moments
  - Estimate a general equilibrium model
  - Run counter-factual experiments
- Two kinds of cross-sectional evidence:
  - Causal inference of the effect of devaluation across countries
  - Parameter values from granular trade data
- Key insight: cross-sectional evidence is informative about certain parameters that determine the answer to the question
- Main result: the effect on non-devaluing countries is small

Literature Review

- Great Depression:

  Friedman and Schwartz (1963), Eichengreen and Sachs (1985, 1986), Bernanke and Carey (1996), Eichengreen (1992), Eggertsson (2008), Cohen-Setton et al. (2017), Albers (2019), Hausman et al. (2019), Candia and Pedemonte (2021)

  $\rightarrow$ Causal evidence of effect of devaluations across countries

  $\rightarrow$ Translation of relative into absolute effect

- Monetary policy in the open economy:

  Obstfeld and Rogoff (1995), Clarida et al. (2002), Corsetti et al. (2011)

  $\rightarrow$ Build a model with realistic cross-sectional implications

  $\rightarrow$ Draw quantitative counter-factual conclusions

- Empirical studies of large depreciation episodes:

  Verhoogen (2008), Burstein et al. (2005, 2007), Rose (2021), Rodnyansky (2019)

  $\rightarrow$ From micro to macro approach to beggar-thy-neighbour question

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Cross-Country Evidence

Difference-in-difference setup:

- Treated group: countries that devalued in 1931
- Control group: countries that had not devalued by 1935
- Years: 1928 to 1935

Specification:

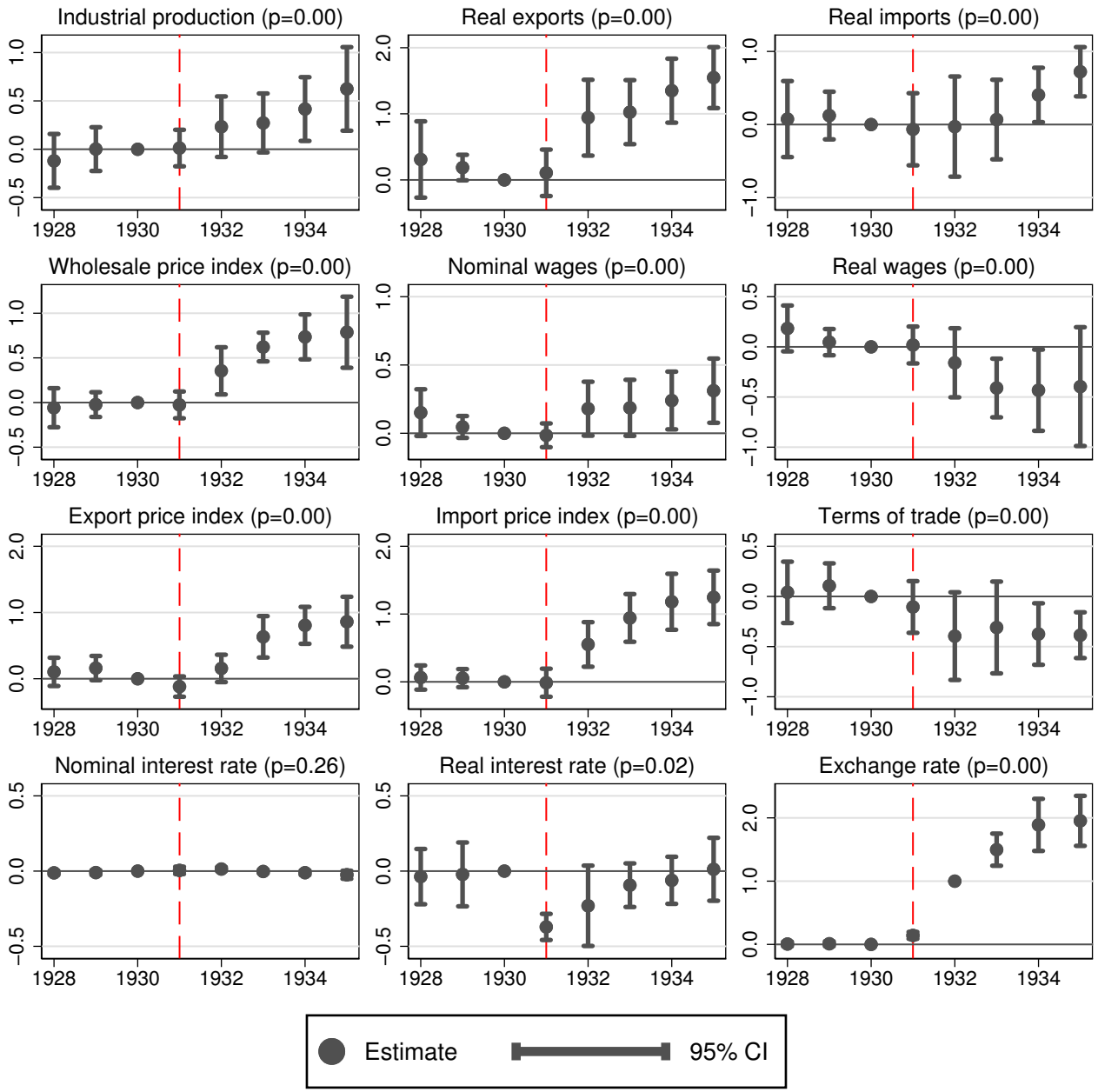
$$\log\left(\frac{Y_t^j}{Y_{1930}^j}\right) = \beta_t \log\left(\frac{XR_{1932}^j}{XR_{1930}^j}\right) \times \mathbb{1}_t + \mu_t + e_t^j$$

where Y_t^j is the variable of interest in country j and year t, and XR_t^j the exchange rate

Exchange rate is instrumented with a devaluation dummy
$\Rightarrow \beta_t$: relative behavior of devaluing countries, scaled by the extent of devaluation

▸ Sample

Difference-in-difference



Endogeneity

Problem: devaluation decision potentially endogenous

- No pre-existing trend
- Contemporaneous shocks could still bias the results down
- Most obvious source of bias would go against results
- Develop another strategy based on high-frequency identification

▸ Policy ▸ Controls ▸ OLS ▸ P-values

To Devalue or Not To Devalue

- Decision will of course be influenced by fundamentals
- But some component is idiosyncratic to each policy maker ▸ FDR
- Idea: that variation is exogenous and can be isolated
- High-frequency data: control for information set of market participants
  - Identify policy announcements
  - Use change in forward exchange rate around the announcement as a shock
  - Conceptually similar to using changes in FFR futures on FOMC days

HFI Strategy: Details

- Shock construction:
  - Go to database of press articles
  - Systematically search for dates where devaluation is mentioned the most
  - Retain dates which correspond to policy announcements
  - Shock: change in forward exchange rate around announcements
- Regress changes in aggregate variables on those shocks
- Assumption: change in forward rate on those dates is exogenous
  - Conceptually similar to using changes in FFR futures on FOMC days
- Valid variation:
  - Surprise devaluations: US 1933
  - Expected devaluations that did not happen: France 1935

▸ Sample ▸ Algorithm ▸ Keywords ▸ Counts ▸ Example ▸ Q&A ▸ HFI method

Specification

Local projection with instrumental variable:

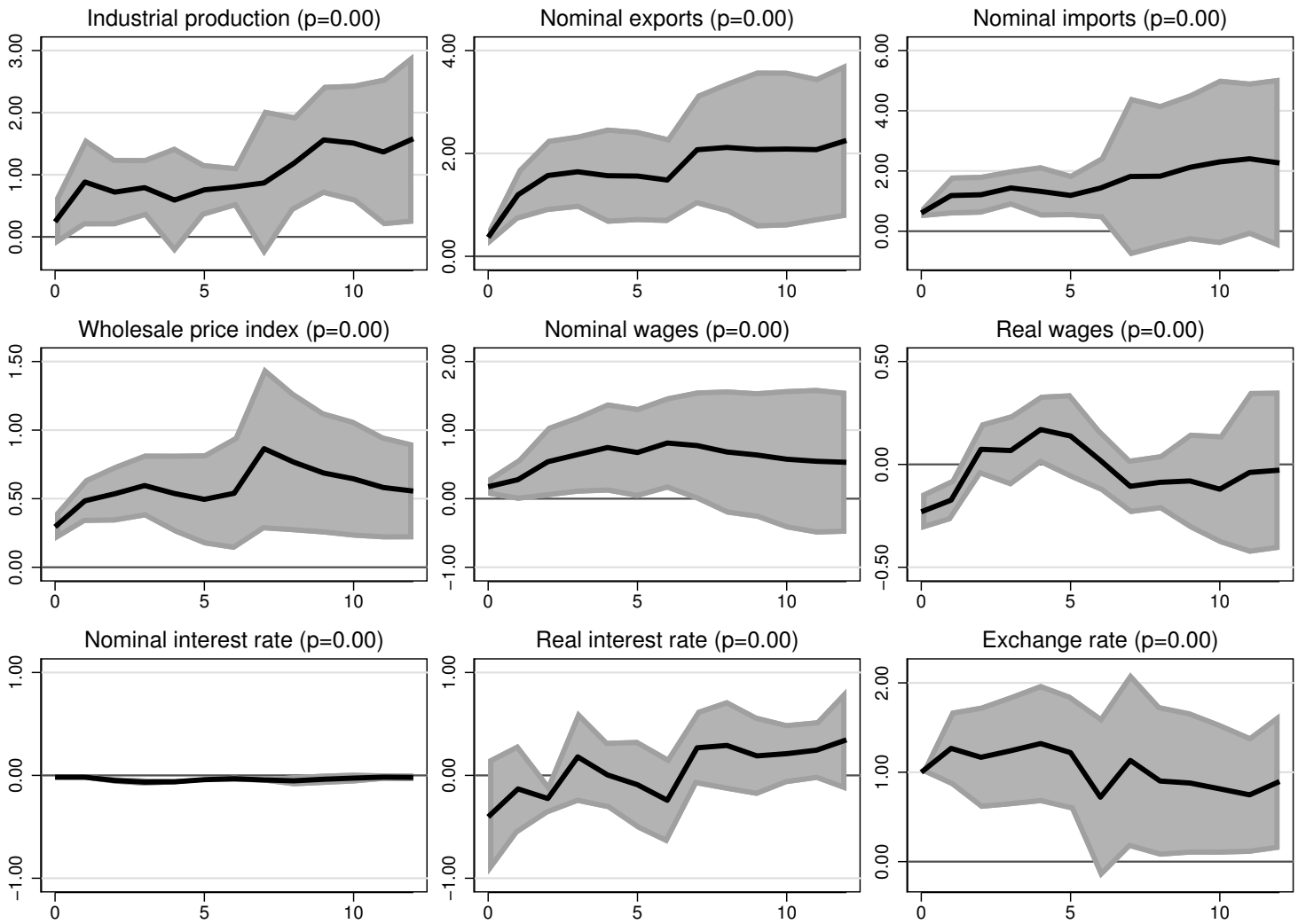
$$y^j_{t+h} - y^j_{t-1} = \beta_k(xr^j_t - xr^j_{t-1}) + \gamma'_k X^j_{t-1} + \delta_{t,h} + \zeta^j_h + e^j_{t,h}$$

where $xr^j_t - xr^j_{t-1}$ is instrumented with the constructed shocks

Notations:

- y^j_t: log-variable of interest in country j
- xr^j_t: log-spot exchange rate of country j against the US — base country does not matter because of time fixed effect
- X^j_t: vector of controls
- $\delta_{t,k}$, ζ^j_k: horizon-time and country-horizon fixed effect

Results



Note: the black line is the point estimate, the grey area the 95% confidence interval with Driscoll-Kraay standard errors.

▶ J-curve

Cross-Country Evidence: Takeaways

- Devaluations stimulate output, trade and nominal quantities
- DD and HFI yield qualitatively similar results though HFI tends to produce larger estimates

  ▸ Comparison
- HFI strategy is cleaner but:
  - Estimates are less precise
  - Requires quarterly data, which is sometimes unavailable or of low quality
- Estimate the model using both sets of IRF:
  - Will show results with DD
  - Using HFI strengthens the main message

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Model: Overview

- Previous evidence is cross-sectional
- Need a model to translate the relative effect into an absolute one
- Multi-country New Keynesian model with:
  - Sticky wages (monetary non-neutrality)
  - Incomplete pass-through of the exchange rate
  - Gold standard (devaluation)
- Model allows for both expenditure switching and monetary stimulus

▶ Details

To the Trade Data

- Main trade ingredients:
  - In each country, there is a continuum of firms
  - Each firm produces a variety of the product
  - Kimball (1995) demand governs aggregation over varieties
    $\rightarrow$ incomplete pass-through of the exchange rate to international prices
- In model, three parameters are important to discipline the response of trade:
  - Elasticity of substitution between imports and domestic goods
  - Elasticity of substitution among imports
  - Pass-through of the exchange rate to international prices
- Turn to US imports data to estimate the last two

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Elasticity: Identification

- Demand function for product r from country k:

$$\Delta \underbrace{c_{rt}^{jk}}_{\text{quantity}} = -\theta \Delta \underbrace{p_{rt}^{jk}}_{\text{price}} + \underbrace{\theta \Delta p_{rt}^{j*} + \Delta c_{rt}^{j*}}_{\text{does not depend on } k} + \underbrace{\Delta \kappa_{rt}^{jk}}_{\text{demand shocks}}$$

- Empirical equivalent:

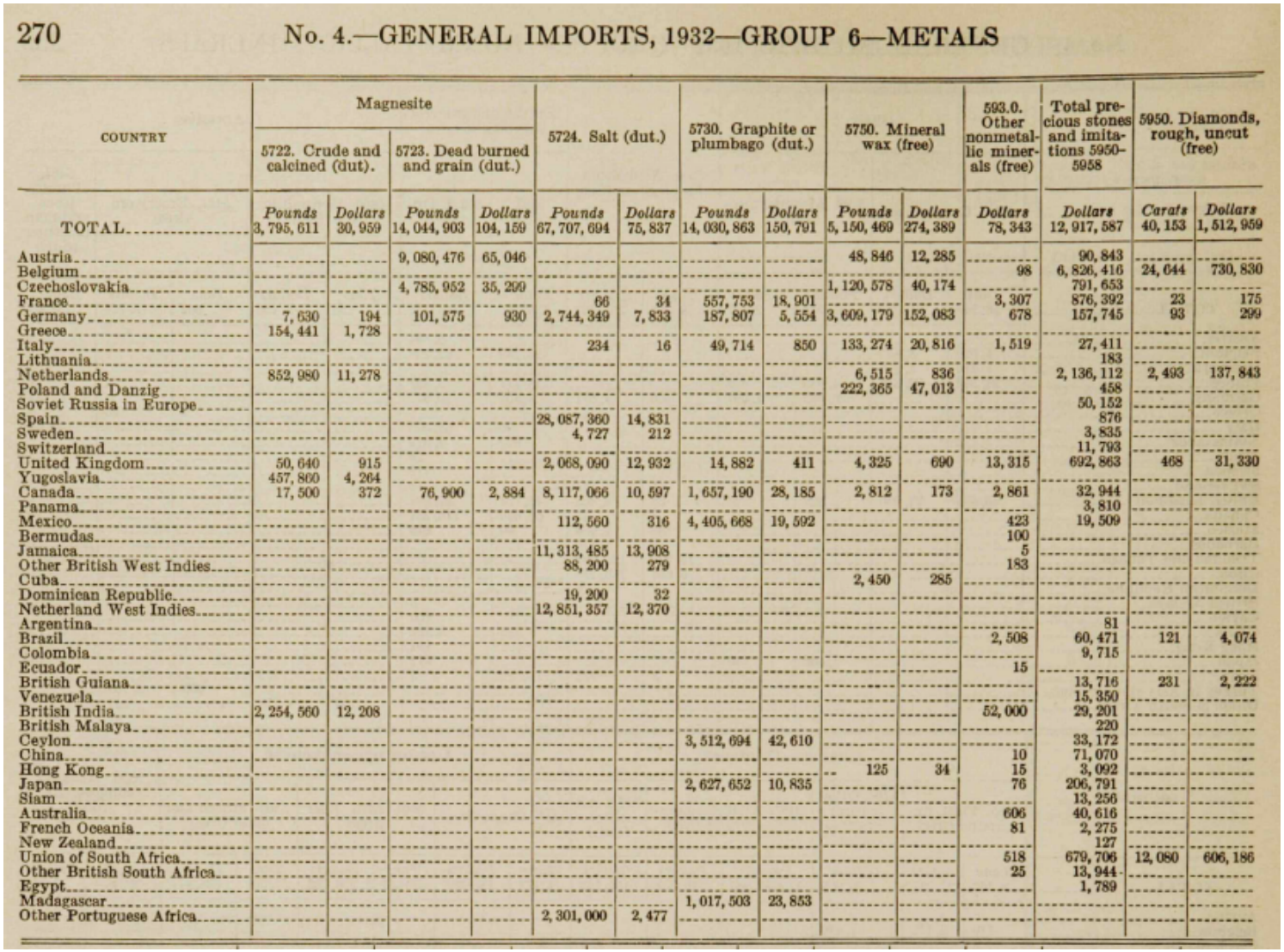
$$\Delta c_{rt}^{jk} = -\theta \Delta p_{rt}^{jk} + \mu_{rt}^{j} + e_{rt}^{jk}$$

- Estimation:
  - Simultaneity bias: regressing quantity on price would be a bad idea
  - Instrument prices with the exchange rate
  - Use data on US imports ($j = us$)

Proposition 1

Provided devaluation is exogenous to within-product relative US demand shocks, instrumenting prices with the exchange rate identifies the within-product elasticity of substitution among foreign varieties, θ.

Data



270 No. 4.—GENERAL IMPORTS, 1932—GROUP 6—METALS

COUNTRY	Magnesite: 5722. Crude and calcined (dut).		Magnesite: 5723. Dead burned and grain (dut.)		5724. Salt (dut.)		5730. Graphite or plumbago (dut.)		5750. Mineral wax (free)		593.0. Other nonmetallic minerals (free)	Total precious stones and imitations 5950-5958	5950. Diamonds, rough, uncut (free)	
	Pounds	*Dollars*	*Pounds*	*Dollars*	*Pounds*	*Dollars*	*Pounds*	*Dollars*	*Pounds*	*Dollars*	*Dollars*	*Dollars*	*Carats*	*Dollars*
TOTAL	3,795,611	30,959	14,044,903	104,159	67,707,694	75,837	14,030,863	150,791	5,150,469	274,389	78,343	12,917,587	40,153	1,512,959
Austria			9,080,476	65,046					48,846	12,285		90,843		
Belgium											98	6,826,416	24,044	730,830
Czechoslovakia			4,785,952	35,299					1,120,578	40,174		791,653		
France					66	34	557,753	18,901			3,307	876,392	23	175
Germany	7,630	194	101,575	930	2,744,349	7,833	187,807	5,554	3,609,179	152,083	678	157,745	93	299
Greece	154,441	1,728												
Italy					234	16	49,714	850	133,274	20,816	1,519	27,411		
Lithuania												183		
Netherlands	852,980	11,278							6,515	836		2,136,112	2,493	137,843
Poland and Danzig									222,365	47,013		458		
Soviet Russia in Europe												50,152		
Spain					28,087,360	14,831						876		
Sweden					4,727	212						3,835		
Switzerland												11,793		
United Kingdom	50,640	915			2,068,090	12,932	14,882	411	4,325	690	13,315	692,863	468	31,330
Yugoslavia	457,860	4,264												
Canada	17,500	372	76,900	2,884	8,117,066	10,597	1,657,190	28,185	2,812	173	2,861	32,944		
Panama												3,810		
Mexico					112,560	316	4,405,668	19,592			423	19,509		
Bermudas											100			
Jamaica					11,313,485	13,908					5			
Other British West Indies					88,200	279					183			
Cuba									2,450	285				
Dominican Republic					19,200	32								
Netherland West Indies					12,851,357	12,370								
Argentina												81		
Brazil											2,508	60,471	121	4,074
Colombia												9,715		
Ecuador											15			
British Guiana												13,716	231	2,222
Venezuela												15,350		
British India	2,254,560	12,208									52,000	29,201		
British Malaya												220		
Ceylon							3,512,694	42,610				33,172		
China											10	71,070		
Hong Kong									125	34	15	3,092		
Japan							2,627,652	10,835			76	206,791		
Siam												13,256		
Australia											606	40,616		
French Oceania											81	2,275		
New Zealand												127		
Union of South Africa											518	679,706	12,080	606,186
Other British South Africa											25	13,944		
Egypt												1,789		
Madagascar							1,017,503	23,853						
Other Portuguese Africa					2,301,000	2,477								

Source: Foreign Commerce and Navigation of the United States

Elasticity Results

	1930-32 change			1930-33 change		
	(1) Quantity	(2) Price	(3) Quantity	(4) Quantity	(5) Price	(6) Quantity
Panel A: Unweighted						
XR	0.910**	−0.443***		1.205***	−0.391***	
	(0.349)	(0.110)		(0.233)	(0.105)	
Elasticity			2.054***			3.084***
			(0.578)			(0.413)
Observations	3742	3742	3742	3446	3446	3446
F-statistic			16.142			13.915
Panel B: Weighted						
XR	0.998***	−0.351**		0.965***	−0.327***	
	(0.348)	(0.136)		(0.264)	(0.088)	
Elasticity			2.843**			2.951***
			(1.207)			(0.853)
Observations	3742	3742	3742	3446	3446	3446
F-statistic			6.643			13.781

▸ Heterogeneity ▸ Tariff ▸ Mechanism ▸ Puzzle

Elasticity: Placebo

	1930-32 change			1930-33 change		
	(1) Quantity	(2) Price	(3) Quantity	(4) Quantity	(5) Price	(6) Quantity
Panel C: Unweighted						
XR	0.027	0.049		0.102	0.024	
	(0.122)	(0.047)		(0.069)	(0.034)	
Elasticity			−0.550			−4.310
			(2.527)			(6.439)
Observations	3755	3755	3755	3579	3579	3579
F-statistic			1.097			0.482
Panel D: Weighted						
XR	−0.135	−0.049		−0.181	−0.061	
	(0.233)	(0.054)		(0.173)	(0.042)	
Elasticity			−2.755			−2.955*
			(3.073)			(1.565)
Observations	3755	3755	3755	3579	3579	3579
F-statistic			0.824			2.141

Pass-Through

- Pass-through literature usually adds a proxy for marginal cost (Burstein and Gopinath, 2014)
- Here, wholesale price index:

$$\Delta p_{rt}^{us,k} = \beta x r_t^{us,k} + \gamma' X_{rt}^k + \mu_{rt}^{us} + e_{rt}^{us,k}$$

	1930-32 change		1930-33 change	
	(1) Unwght.	(2) Wght.	(3) Unwght.	(4) Unwght.
XR	−0.370**	−0.491***	−0.442***	−0.355**
	(0.159)	(0.176)	(0.148)	(0.144)
WPI	−0.279	0.417	0.159	0.091
	(0.286)	(0.353)	(0.300)	(0.357)
Observations	3592	3592	3405	3405

▸ Identification

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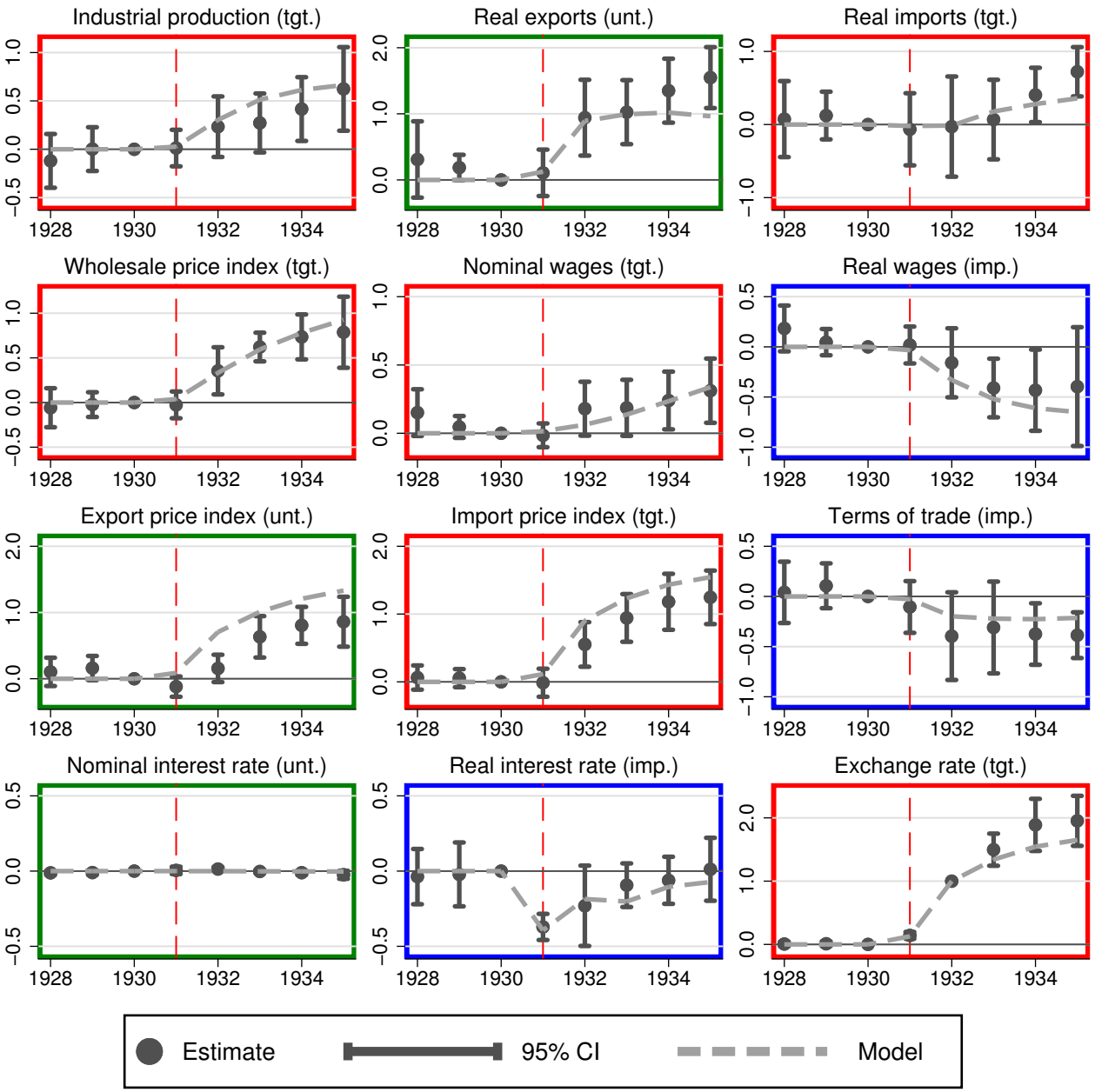
DD: Estimated Parameters

Parameter	Value	Concept	Target or source
		Estimated	
σ^{-1}	0.64	IES	Industrial production
	(0.22)		
α_1	0.55	Curvature of production function	WPI
	(0.26)		
ξ	0.9	Calvo wage parameter	Nominal wages
	(0.03)		
ρ	0.51	Macro trade elasticity	Imports and IPI
	(0.13)		
θ	3	Micro trade elasticity	US imports
	(0.19)		
$\bar{m}$	1.59	Markup elasticity	Pass-through
	(0.29)		

▸ Calibration

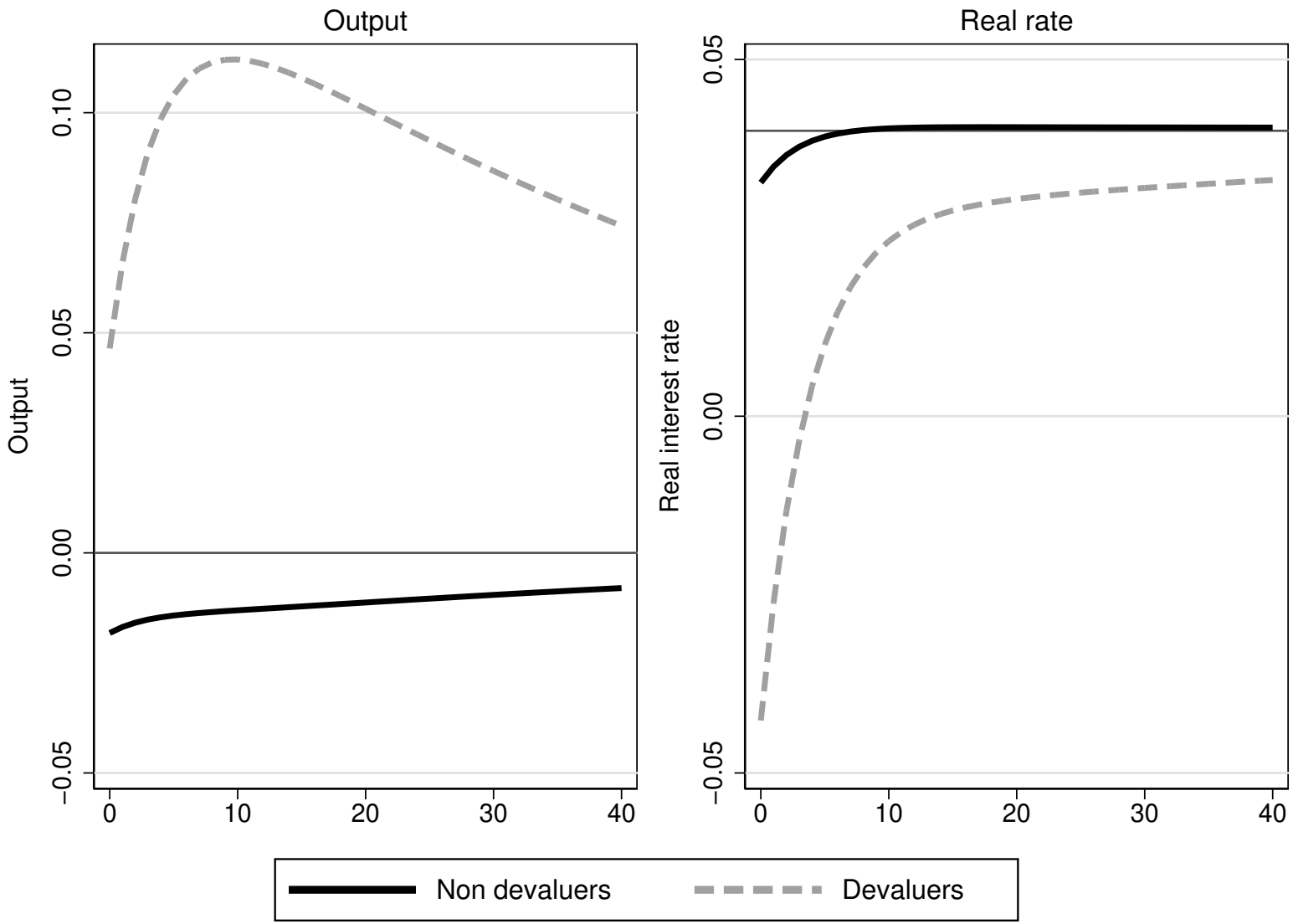
Model Fit


Industrial production (tgt.)
Real exports (unt.)
Real imports (tgt.)
Wholesale price index (tgt.)
Nominal wages (tgt.)
Real wages (imp.)
Export price index (unt.)
Import price index (tgt.)
Terms of trade (imp.)
Nominal interest rate (unt.)
Real interest rate (imp.)
Exchange rate (tgt.)
1928
1930
1932
1934
Estimate
95% CI
Model

Counterfactual Experiment

- Cross-sectional estimates do not answer aggregate counter-factual questions
- In the model, simulate response of the world economy to 30% one-off devaluation by half of the world

Counterfactual Analysis



▸ HFI

Main Result

Main result

Foreign devaluation has a small effect on one's output.

Key intuition:

- Expenditure switching and monetary stimulus offset each other in non-devaluing countries
- They work in the same direction in devaluing countries

▸ Decomposition ▸ CES ▸ Going further

Conclusion

- Identified key moments from aggregated and dis-aggregated data
- Used these to estimate an international New-Keynesian model with incomplete pass-through of the exchange rate
- Takeaway: devaluing countries' recovery was not about beggar-thy-neighbor but about monetary stimulus

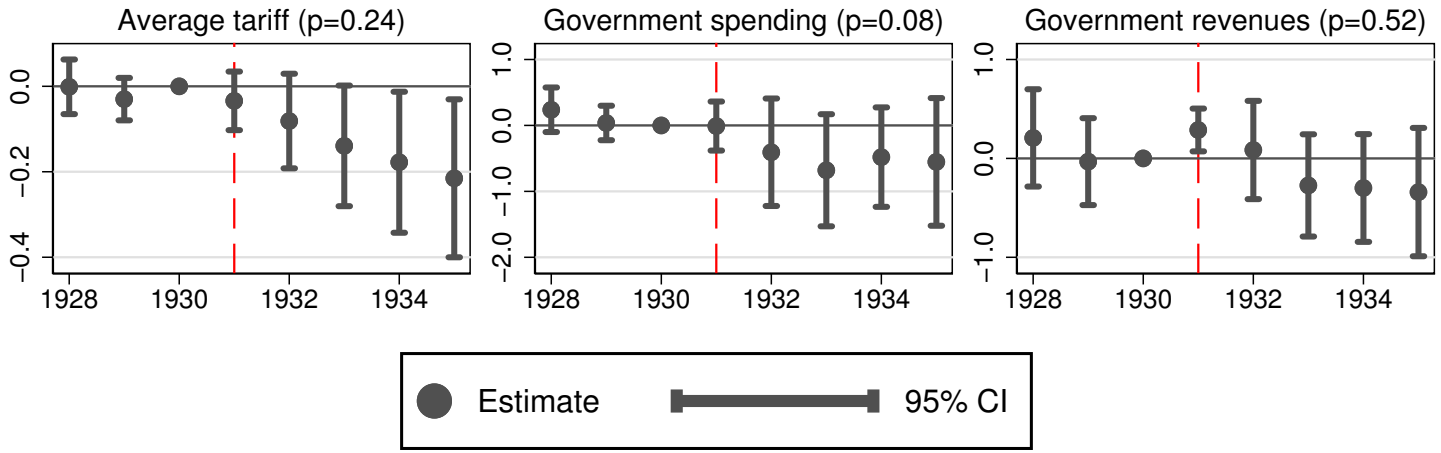
Appendix

Country Samples

Difference-in-difference		
Group	Countries	Comment
Treatment	Austria, Canada, Denmark, Finland, Japan, Mexico, Norway, Salvador, Sweden, United Kingdom	Devaluation in 1931
Control	France, Germany, Hungary, Netherlands, Poland, Switzerland	No devaluation before 1936
High frequency identification		
	Belgium, France, Germany, Italy, Netherlands, United Kingdom, United States, Switzerland	Countries for which forward exchange rate data is available
US imports		
Specification	Countries	Comment
1932, 1933	Austria, British India, British Malaya, Canada, Denmark, Egypt, Finland, Japan, Mexico, Norway, Portugal, Salvador, Sweden, United Kingdom	Devaluation in 1931
1932, 1933	Albania, Belgium, Bulgaria, Czechoslovakia, France, Germany, Hungary, Italy, Latvia, Lithuania, Netherlands, Poland and Danzig, Rumania, Switzerland	No devaluation before 1934
1932	Estonia, South Africa	Devaluation in 1933
none	Argentina, Australia, Bolivia, Brazil, New Zealand, Uruguay, Venezuela	Devaluation before 1931
none	Chile, Costa Rica, Colombia, Ecuador, Greece, Peru, Siam, Yugoslavia	Devaluation in 1932
none	China, Hong Kong, Iran	Silver standard
none	Spain, Turkey	Floating currency
none	Cuba, Philippine Islands	Preferential tariff rates

◂ DD ◂ HFI ◂ Trade

Policy


Average tariff (p=0.24)
Government spending (p=0.08)
Government revenues (p=0.52)
−0.4
−0.2
0.0
−2.0
−1.0
0.0
1.0
−1.0
0.0
1.0
1928
1930
1932
1934
Estimate
95% CI

DD-IV: Controls

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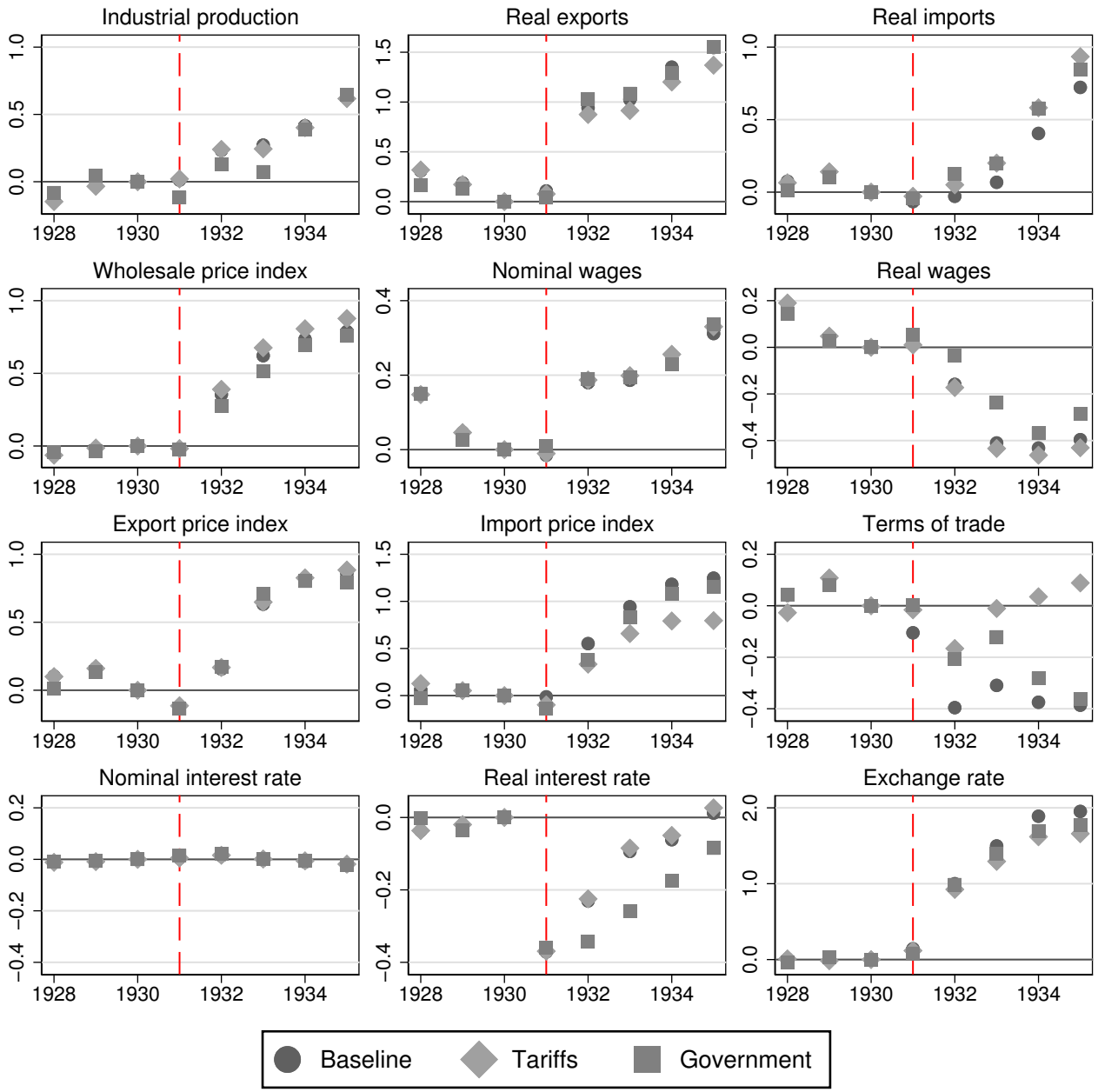

DD-OLS: Controls

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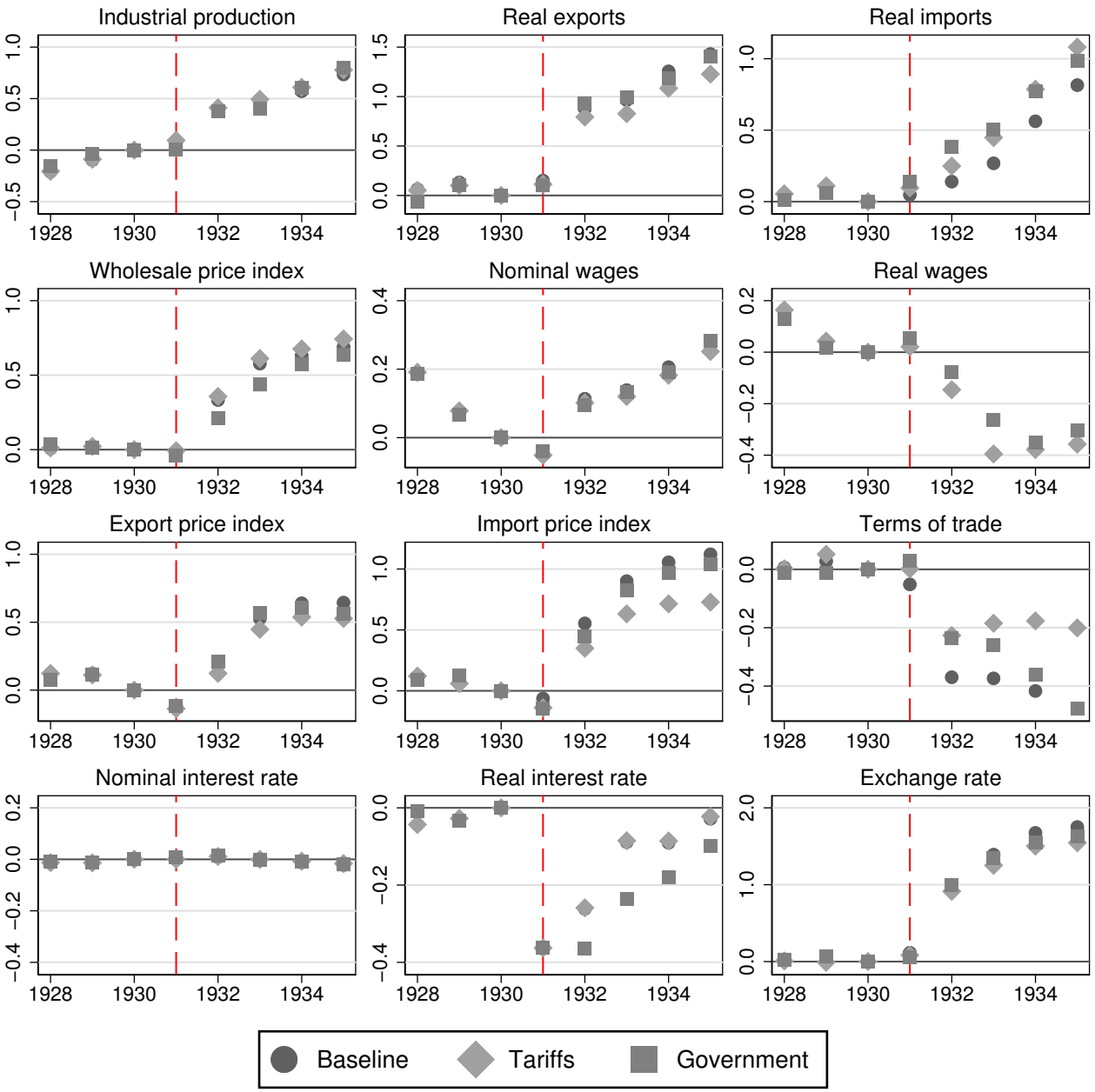

P-values for DD Exercise

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	IV			OLS		
	Baseline	Tariffs	Government	Baseline	Tariffs	Government
Industrial production	0.07	0.03	0.00	0.00	0.00	0.00
Real exports	0.00	0.19	0.00	0.00	0.00	0.00
Real imports	0.00	0.07	0.00	0.02	0.00	0.00
Wholesale price index	0.00	0.00	0.00	0.00	0.00	0.00
Consumer price index	0.04	0.04	0.00	0.00	0.00	0.00
Export price index	0.00	0.30	0.00	0.00	0.03	0.00
Import price index	0.00	0.00	0.00	0.00	0.00	0.00
Nominal wages	0.10	0.12	0.00	0.01	0.16	0.00
Real wages	0.03	0.73	0.00	0.20	0.00	0.00
Terms of trade	0.26	0.27	0.00	0.04	0.89	0.00
Nominal interest rate	0.13	0.27	0.26	0.17	0.27	0.25
Real interest rate	0.03	0.16	0.02	0.00	0.04	0.00

Example: US

On the night of April 18, the president met with his close advisers to discuss issues related to the impending visit of British Prime Minister Ramsay MacDonald. [...] Only [Assistant Secretary of State] Moley knew that Roosevelt had been negotiating a new initiative for "controlled inflation" with a group of key senators, including Elmer Thomas from Oklahoma. When FDR told them, with a chuckle, that the next day he would announce his support for the Thomas Amendment, [adviser] Feis, [Budget Director] Douglas, and [Secretary of State] Warburg became livid; they couldn't believe what they were hearing and interrupted each other in their efforts to convince the president that this was a mistake of historical proportions. In 1934, Warburg wrote that as late as April 18, those who were in daily contact with FDR had no "idea that he was seriously considering such a move." [...] After leaving the White House late that night, Lew Douglas told the rest of the group that without a doubt this was "the end of Western civilization."

Edwards (2018, pp. 57–58)

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High Frequency Identification Methodology

HFI is a well-established method to infer the causal effect of monetary policy (Ramey, 2016)

- Use changes in federal funds rate futures on FOMC days
- Assumption: endogenous component of monetary policy is anticipated
- Use these shocks in regressions of lower-frequency macroeconomic variables

What I am doing:

- Adapting this method to exchange rates
- Implementing it in the 1930s

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Policy Announcements

Procedure (for each country):

1. Search in ProQuest Historical Newspapers for articles featuring appropriate keywords during gold standard period
2. Retain dates whose number of articles is 6 standard deviations above the mean
3. Read press to identify nature and exact timing of the news: retain if policy announcement (e.g. devaluation), reject if conveys news about economic situation (e.g. strike)
4. Use variation in 3-month forward rate around announcement as shock

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Keywords

Two requirements:

1. Name of the country or currency, name has to be in the title for countries other than US
2. Mentions of (i) exchange controls, (ii) leaving the gold standard, or (iii) devaluation in the article

Example for France:

```
ti(France OR French OR franc) AND ((exchange control) OR ((off OR suspension OR leave OR quit) AND "gold standard") OR devaluation)
```

Example for US:

```
("United States" OR US OR dollar) AND ((exchange control) OR ((off OR suspension OR leave OR quit) AND "gold standard") OR devaluation)
```

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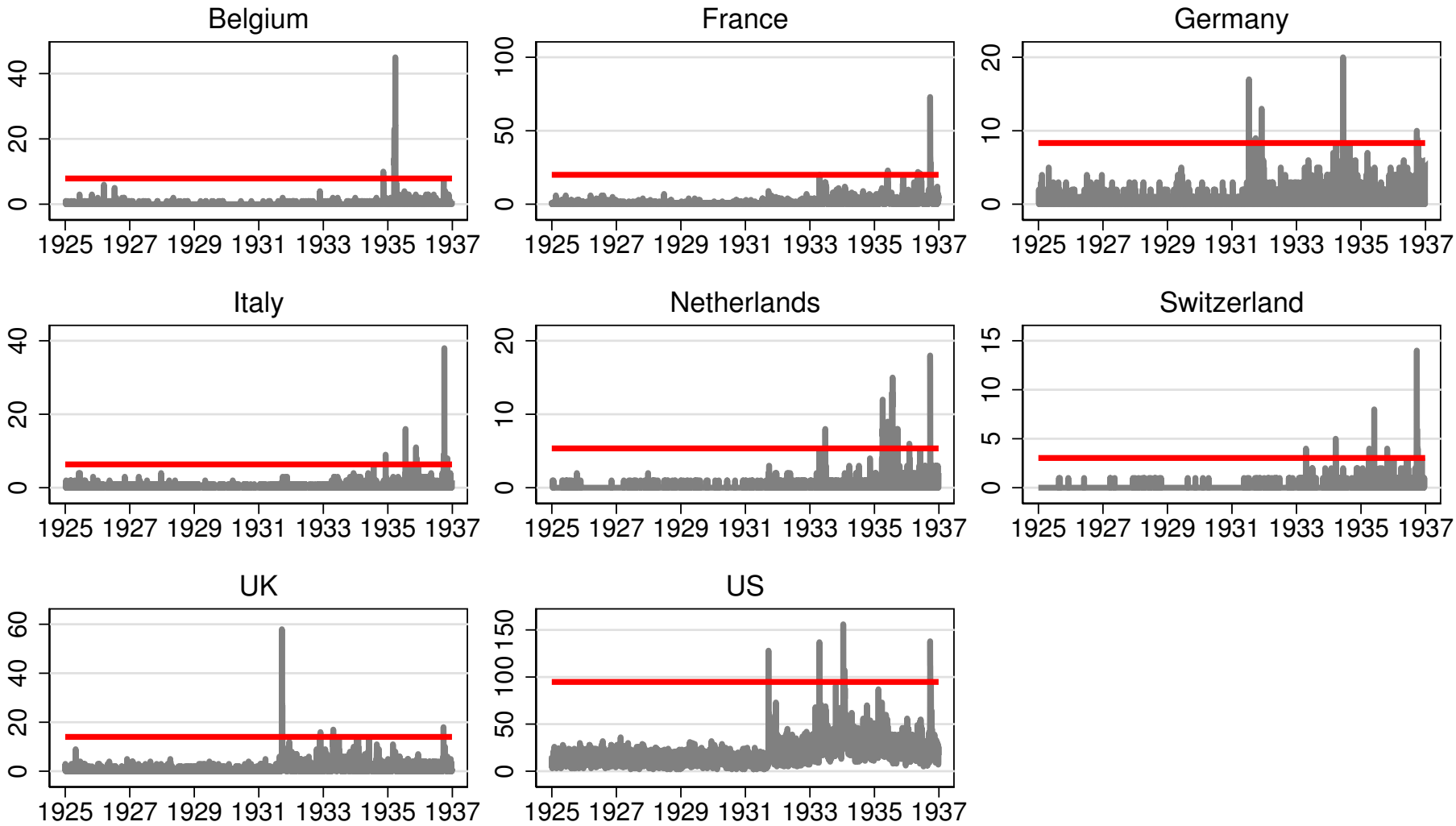
Daily Count of Articles



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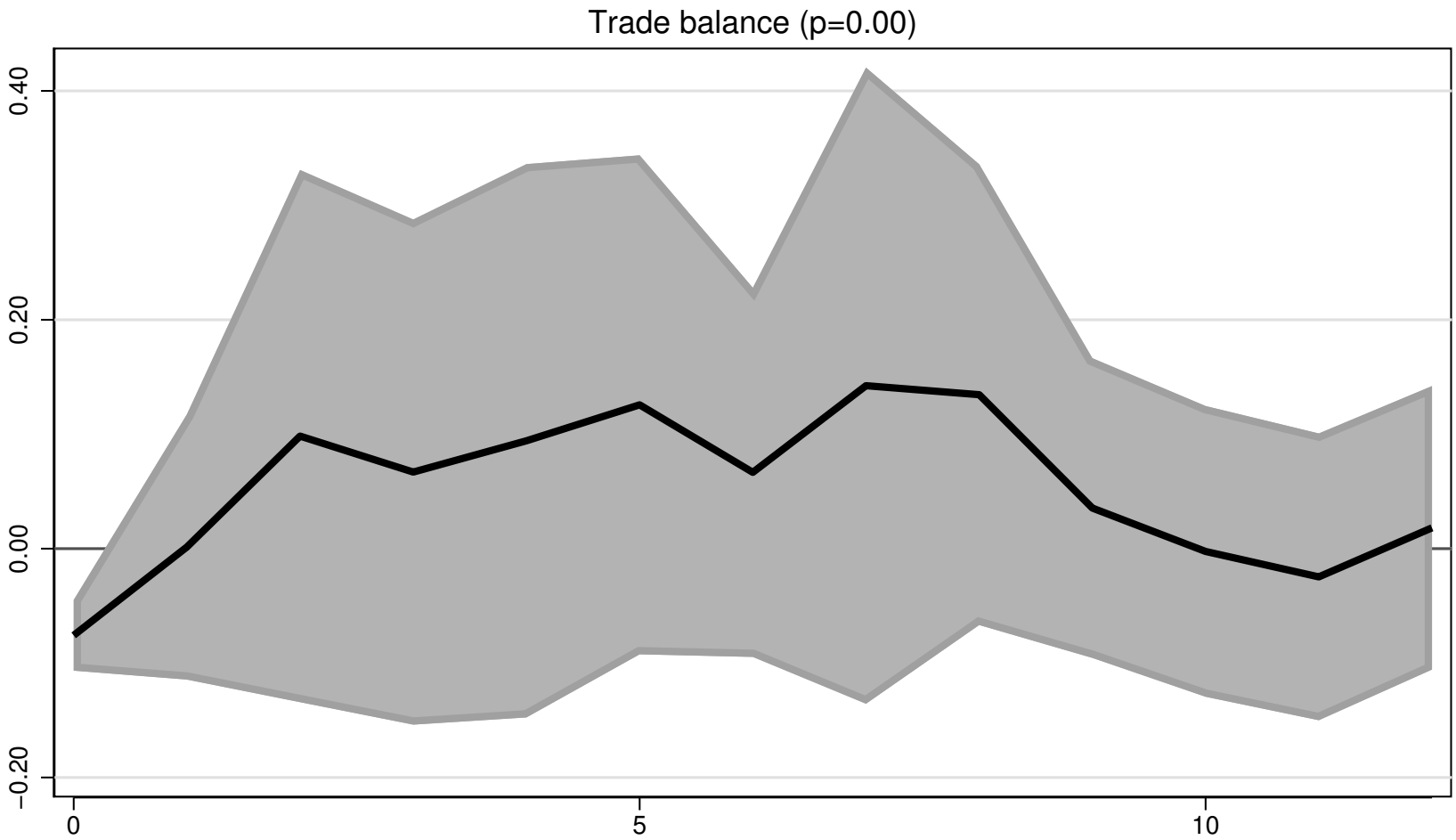
Dates: France

Date	# articles	Event	Shock
27may1935	21		
31may1935	21		
04jun1935	21	Fall of Flandin's cabinet	-0.046
05jun1935	23		
11may1936	22	Blum's devaluation speech	-0.013
05jun1936	21	Strikes	×
25sep1936	30		
26sep1936	60		
27sep1936	73		
28sep1936	59		
29sep1936	33		
30sep1936	31	Devaluation	+0.234
01oct1936	25		
02oct1936	28		
03oct1936	28		
04oct1936	27		
05oct1936	24		

Notes: The mean and standard deviations of the daily number of articles are 1.3 and 3.1 respectively.

▸ Belgium ▸ Germany ▸ Italy ▸ Netherlands ▸ Switzerland ▸ UK ▸ US ◂ Back

J-Curve



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Dates: Belgium

Date	# articles	Event	Shock
14nov1934	10	Catholics and liberals against devaluation	-0.007
17mar1935	14		
18mar1935	12		
19mar1935	22		
20mar1935	23		
21mar1935	8		
23mar1935	10		
25mar1935	11		
26mar1935	10		
27mar1935	12	Devaluation	+0.116
28mar1935	12		
29mar1935	25		
30mar1935	45		
31mar1935	24		
01apr1935	24		
02apr1935	14		
08apr1935	8		

Notes: The mean and standard deviations of the daily number of articles are 0.2 and 1.3 respectively.

◀ France

Dates: Germany

Date	# articles	Event	Shock
13jul1931	9		
15jul1931	17		
16jul1931	10	Exchange controls	-0.067
21jul1931	9		
22jul1931	9		
29sep1931	9	Stock exchange closed indefinitely	n.a.
05dec1931	13		
13jun1934	10	Devaluation rumors	×
15jun1934	20		
27sep1936	9		
28sep1936	10	Gold bloc demise	×
01oct1936	9		

Notes: The mean and standard deviations of the daily number of articles are 0.7 and 1.3 respectively.

◂ France

Dates: Italy

Date	# articles	Event	Shock
10dec1934	9	Exchange controls	-0.018
11dec1934	7		
23jul1935	8	Gold coverage ratio suspended	+0.042
24jul1935	16		
25jul1935	9		
20nov1935	11	Gold-buying monopoly	-0.002
29nov1935	8	International tensions	×
27sep1936	7	Gold bloc demise	×
28sep1936	9		
04oct1936	8	Devaluation	n.a.
06oct1936	38		
07oct1936	12		
09oct1936	8		
10nov1936	8	Austro-Italian trade pact	×

Notes: The mean and standard deviations of the daily number of articles are 0.3 and 1.0 respectively.

◂ France

Dates: Netherlands

Date	# articles	Event	Shock
27jun1933	8	Devaluation rumors	×
06apr1935	8		
07apr1935	7	Gold bloc reaffirms commitment	-0.023
08apr1935	12		
04jun1935	9	Pro-devaluation minister resigns	-.009
24jul1935	8		
25jul1935	13		
26jul1935	8	New government	-0.014
27jul1935	13		
28jul1935	11		
29jul1935	15		
17sep1935	7	Bank rate hike	-0.003
18sep1935	8	Deflationary budget	-0.009
26sep1935	8	Devaluation rumors	×
04feb1936	6	Pro-devaluation speech by former minister	×
27sep1936	18		
28sep1936	16	Devaluation	+0.175
29sep1936	7		

Notes: The mean and standard deviations of the daily number of articles are 0.2 and 0.9 respectively.

◀ France

Dates: Switzerland

Date	# articles	Event	Shock
21apr1933	4	US gold embargo	$\times$
23mar1934	5	Pro-gold minister resigns	+0.003
24mar1934	4		
08apr1935	4	Gold bloc reaffirms commitment	-0.020
03jun1935	8	Devaluation proposal rejected	-0.011
04jun1935	4		
28oct1935	4	General elections	-0.003
27sep1936	14	Devaluation	+0.321
28sep1936	14		
30sep1936	6		
01oct1936	4		
09oct1936	4		

Notes: The mean and standard deviations of the daily number of articles are 0.1 and 0.5 respectively.

◀ France

Dates: Britain

Date	# articles	Event	Shock
21sep1931	40	Pound devaluation	+0.175
22sep1931	58		
23sep1931	26		
27sep1931	18		
28sep1931	27		
26nov1932	15	War debt discussions	×
02dec1932	16		
22apr1933	15	Dollar devaluation	×
26apr1933	17	Exchange equalisation fund increased	+0.018
26sep1936	18	Gold bloc demise	×
27sep1936	15		

Notes: The mean and standard deviations of the daily number of articles are 1.2 and 2.1 respectively.

◂ France

Dates: US

Date	# articles	Event	Shock
22sep1931	128	Pound devaluation	×
21apr1933	137	Gold embargo	+0.095
23apr1933	96		
16jan1934	156	Dollar devaluation	+0.022
02feb1934	107		
26sep1936	106	Gold bloc demise	×
27sep1936	138		
28sep1936	113		
29sep1936	111		

Notes: The mean and standard deviations of the daily number of articles are 18.3 and 12.7 respectively.

◀ France

Potential Objections (and Answers)

- "Information effect": shock may reflect policy makers' superior information (Nakamura and Steinsson, 2018)
  - Less of a concern than in modern settings: central banks and governments did not have the same staff resources
- Timing of the policy announcements is endogenous:
  - Not a problem as long as that endogeneity is reflected in the forward rate before the announcement
- Background noise that correlates with fundamentals:
  - Unavoidable without intraday data
  - More good variation than bad one
- Forward exchange rate is a poor forecast for spot (Fama, 1984)
  - Not true under fixed exchange rates in general (Flood and Rose, 1996, Colacito and Croce, 2013)
  - No carry trade return under fixed exchange rates during that period (Accominotti et al., 2019)

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DD vs. HFI: Comparison

- Best way to compare the two is to compute the integral:

$$\mathcal{I}^y = \frac{1}{S} \sum_{s=1}^{S} \beta^y_{t+s}$$

- Since the path of the nominal exchange rate is different, will also compute the ratio:

$$\mathcal{R}^y = \frac{\mathcal{I}^y}{\mathcal{I}^{xr}}$$

Back

DD vs. HFI: Comparison

	DD-IV		DD-OLS		HFI	
Industrial production						
Numerator	0.39	[0.11,0.66]	0.54	[0.31,0.77]	1.05	[0.47,1.63]
Denominator	1.58	[1.32,1.85]	1.45	[1.22,1.69]	1.03	[0.42,1.64]
Ratio	0.24	[0.06,0.43]	0.37	[0.19,0.56]	1.03	[0.79,1.26]
Wholesale price index						
Numerator	0.62	[0.38,0.87]	0.56	[0.36,0.76]	0.61	[0.30,0.92]
Denominator	1.44	[1.24,1.64]	1.38	[1.19,1.57]	1.19	[0.52,1.85]
Ratio	0.43	[0.25,0.62]	0.40	[0.25,0.56]	0.51	[0.47,0.56]

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Model: Detailed Overview

- Continuum of symmetric countries
- Static consumption problem:
  - Single product with many varieties
  - All production is consumed
  - Preferences over varieties are defined by a Kimball aggregator
- Trade:
  - In each country, there is a continuum of firms
  - Each firm produces a variety of the product
  - Those varieties are traded internationally
  - Distinguish macro and micro trade elasticities (Feenstra et al., 2018)

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Static Consumption Problem

Consumers minimize expenditures:

$$\underbrace{\int_f P_t^{jj}(f) C_t^{jj}(f)\,\mathrm{d}f}_{\text{domestic}} + \underbrace{\int_k \int_f P_t^{jk}(f) C_t^{jk}(f)\,\mathrm{d}f\,\mathrm{d}k}_{\text{foreign}}$$

subject to a Kimball aggregator:

$$\begin{aligned} C_t^j =& (1-\bar{\Gamma}) C_t^j \times g\left(\int_f g^*\left(\frac{C_t^{jj}(f)}{(1-\bar{\Gamma})C_t^j}\right)\mathrm{d}f\right) \\ &+ \bar{\Gamma} C_t^j \times g\left(\int_k \int_f g^*\left(\frac{C_t^{jk}(f)}{\bar{\Gamma} C_t^j}\right)\mathrm{d}f\right)\mathrm{d}k \end{aligned}$$

where:

- C_t^j: total consumption in country j
- $C_t^{jk}(f)$: consumption of the variety of firm f of country k in country j
- $P_t^{jk}(f)$: price of the variety of firm f of country k in country j

Functional Forms

- As functional forms, I assume:

$$\text{imports/domestic varieties:} \quad g(x) = 1 + \frac{1}{1-\tilde{\rho}}\left(x^{1-\tilde{\rho}} - 1\right)$$

$$\text{among imported varieties:} \quad (g^{*'})^{-1}(x) = \left[1 - (\theta - 1)\bar{m}\log x\right]^{\frac{\theta/(\theta-1)}{\bar{m}}}$$

- Up to a first order:
  - $\rho \equiv \theta/(1+\theta\tilde{\rho})$ is the elasticity of substitution between domestic and imported varieties
  - θ is the elasticity of substitution among foreign varieties
  - $\bar{m}$ is the elasticity of the markup charged by firms

Kimball Demand: Remark

- Kimball demand is a standard way of generating incomplete pass-through of the exchange rate to international prices (Klenow and Willis, 2016, Gopinath and Itskhoki, 2010, Itskhoki and Mukhin, 2023)
- Compared to these papers, I introduce the nesting of aggregators that allows me to distinguish the two elasticities
  - Two-country case of Itskhoki and Mukhin (2023): $\tilde{\rho} = 0$
- Will be useful to match the divergent behaviors of exports and imports
- Formulation nests the CES case with: $\tilde{\rho} = 0$ and $\bar{m} \to 0$

▸ Demand functions

Pricing to Market

- A firm sets its price while taking into account the demand function that comes out of the consumption problem

- The price of country j's varieties in country k is:

$$p_t^{kj} = (1 - \zeta_1 - \zeta_2)(mc_t^j - xr_t^{jk}) + \zeta_1 p_t^{k*} + \zeta_2 p_t^k$$

  where:
  - mc_t^k: average marginal cost in country j
  - p_t^{k*}: import price index in country k
  - p_t^k: price index in country k
  - ζ_1, ζ_2 depends on ρ, θ and $\bar{m}$

- The pass-through of the exchange rate is:

$$1 - \zeta_1 - \zeta_2 = \frac{1}{1 + \bar{m}} < 1$$

- CES case:

$$\bar{m} \to 0 \quad \Rightarrow \quad \frac{1}{1 + \bar{m}} \to 1$$

Important parameters

Output in country j is:

$$y_t^j = \underbrace{\psi \left(\int_k \left(mc_t^k - xr_t^{kj} \right) \, dk - mc_t^j \right)}_{\text{substitution}} + \underbrace{(1-\bar{\Gamma})\hat{c}_t^j}_{\text{domestic consumption}} + \underbrace{\bar{\Gamma} \int_k \hat{c}_t^k}_{\text{foreign consumption}}$$

$$\psi \equiv \bar{\Gamma} \left(\frac{1}{1+\bar{m}\rho/\theta}(1-\bar{\Gamma})\rho + \frac{1}{1+\bar{m}}\theta \right)$$

3 parameters determine the strength of the substitution term:

- ρ: elasticity of substitution between imported and domestic varieties
- θ: elasticity of substitution among foreign varieties
- $\bar{m}$: markup elasticity which determines the exchange rate pass-through

Demand System

Generalizing Kimball demand system:

$$C_{rt}^{j} = \underbrace{(1-\Gamma_{rt}^{j})C_{rt}^{j} \times g\left(\int_{f} g^{*}\left(\frac{C_{rt}^{jj}(f)}{(1-\Gamma_{rt}^{j})C_{rt}^{j}}\right)\mathrm{d}f\right)}_{\text{domestic varieties}} + \underbrace{\Gamma_{rt}^{j}C_{rt}^{j} \times g\left(\sum_{\substack{k\in\mathcal{J}\\k\neq j}}\mathcal{K}_{rt}^{jk}\int_{f} g^{*}\left(\frac{C_{rt}^{jk}(f)}{\Gamma_{rt}^{j}\mathcal{K}_{rt}^{jk}C_{rt}^{j}}\right)\mathrm{d}f\right)}_{\text{foreign varieties}}$$

where:

- C_{rt}^{j}: demand in country j for product r
- $C_{rt}^{jk}(f)$: demand in country j for the variety of product r from firm f of country k
- Γ_{rt}^{j}: share of imports when relative prices are 1
- $\mathcal{K}_{rt}^{jk}$: share of country k among imports when relative prices are 1

Elasticity: Identification

- Demand function for product r from country k:

$$\Delta c_{rt}^{jk} = -\theta \Delta p_{rt}^{jk} + \underbrace{\theta \Delta p_{rt}^{j*} + \Delta c_{rt}^{j*}}_{\text{fixed effect}} + \underbrace{\Delta \kappa_{rt}^{jk}}_{\text{error term}}$$

- Empirical equivalent:

$$\Delta c_{rt}^{jk} = -\theta \Delta p_{rt}^{jk} + \mu_{rt}^{j} + e_{rt}^{jk}$$

- Estimation:
  - Simultaneity bias: regressing quantity on price would be a bad idea
  - Instrument prices with the exchange rate
  - Use data on US imports ($j = us$)

Proposition 1

Provided devaluation is exogenous to within-product relative US demand shocks, instrumenting prices with the exchange rate identifies the within-product elasticity of substitution among foreign varieties, θ.

Heterogeneity

	(1)	(2)
Animal products	6.079*	(3.485)
Vegetable edible	2.460**	(0.889)
Vegetable inedible	1.486*	(0.855)
Textiles	2.564***	(0.606)
Wood and paper	0.688	(0.639)
Nonmetallic minerals	1.545	(0.934)
Metals and manufactures	4.656**	(1.824)
Machinery and vehicles	2.659	(3.148)
Chemicals	4.358**	(1.916)
Miscellaneous	1.941**	(0.912)
Observations	7042	
P-value	0.004	

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An International Elasticity Puzzle?

- The puzzle:
  - Macroeconomics literature: the international elasticity is around 1 (Goldstein and Khan, 1985)
  - Trade data: international elasticities are 4 on average, above 10 for some sectors (Head and Ries, 2001, Feenstra, 1994, Romalis, 2007, Broda and Weinstein, 2006, Caliendo and Parro, 2015)
- Leading explanations:
  - Ruhl (2008): there is a fixed cost of entering the export market
  - Broda and Weinstein (2006), Imbs and Méjean (2015): the more aggregated the goods, the lower the elasticity estimate
  - Feenstra et al. (2018): for a given good, the elasticity between foreign and domestic varieties (the macro elasticity) is not the same as the elasticity between foreign varieties from different countries (the micro elasticity)
- My results are consistent with the trade literature

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Mechanism

- Relative increase in exports not necessarily driven by the exchange rate:
  1. Looser monetary policy could ease the financial constraint of firms
  2. Devaluations could correlate with less banking problems, or more slack
  3. Size of devaluations is endogenous
  4. Exchange controls: true exchange rate may not be properly measured
- In the next table, I:
  1. Add money supply indicators as controls
  2. Add banking panics and unemployment rate as controls
  3. Instrument change in the exchange rate with devaluation dummy
  4. Interact the exchange rate with exchange controls dummy
- Overall, exchange rate coefficient survives well
- Remark: none of these stories is a threat to the identification of the elasticity, but they change the interpretation of the quantity response

Mechanism

	1930-32 change				1930-33 change			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
XR	0.844***	0.759**	0.504**		0.901***	1.298***	0.788***	
	(0.254)	(0.353)	(0.223)		(0.199)	(0.316)	(0.168)	
DR	−27.144***	−18.616			−9.130	−8.001		
	(9.136)	(14.214)			(6.705)	(14.822)		
M0	−0.825**	−1.703**			0.192	−0.927		
	(0.371)	(0.825)			(0.371)	(0.739)		
DCR	−0.051	−0.582			0.356	−1.452***		
	(0.280)	(0.396)			(0.253)	(0.489)		
Panics		−0.019				−1.298***		
		(0.013)				(0.319)		
UR		−0.010*				−0.032***		
		(0.006)				(0.010)		
XC=0 × XR				0.505**				0.758***
				(0.249)				(0.215)
XC=1 × XR				1.375***				1.554***
				(0.280)				(0.187)
XC				−0.049				−0.180*
				(0.094)				(0.099)
Observations	2976	2349	3742	3742	2819	2267	3446	3446

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Elasticity: Tariff

- Previous discussion ignored tariffs
- In practice, observe the before-tariff unit value, $\tilde{P}_{rt}^{jk}$
- Not an issue if tariffs are ad-valorem and are not correlated with devaluation:

$$\Delta c_{rt}^{jk} = -\theta \Delta \tilde{p}_{rt}^{jk} + \underbrace{\theta \Delta \left(\tau_{rt}^{j*} + \tilde{p}_{rt}^{j*} \right) + \Delta c_{rt}^{j*}}_{\text{fixed effect}} + \underbrace{\Delta \left(\xi_{rt}^{jk} - \tau_{rt}^{jk} \right)}_{\text{error term}}$$

- Tariffs were changed in 1930, before the devaluations happened
- A lot of goods had fixed nominal duties:
  - Effective tariff rate is inversely proportional to the before-tariff price:

$$\tau_{rt}^{jk} \left(\tilde{P}_{rt}^{jk} \right) \propto \frac{1}{\tilde{P}_{rt}^{jk}}$$

  - Then the regression identifies:

$$\theta \left(1 + \tau_{rt}^{jk\prime} \left(\tilde{P}_{rt}^{jk} \right) \right) < \theta$$

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Elasticity: *Ad valorem* tariffs

	Unweighted		Weighted	
	(1) All	(2) Ad-valorem	(3) All	(4) Ad-valorem
	Panel A: Instrument			
Elasticity	2.731***	3.784***	2.964***	4.020**
	(0.379)	(0.763)	(0.938)	(1.689)
Observations	7042	2912	7042	2912
F-statistic	17.170	5.890	13.890	8.970
	Panel B: OLS			
Elasticity	1.150***	1.013***	0.878***	0.629*
	(0.065)	(0.080)	(0.174)	(0.334)
Observations	7042	2912	7042	2912

Mechanism

	1930-32 change				1930-33 change			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
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DR	−27.144***	−18.616			−9.130	−8.001		
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UR		−0.010*				−0.032***		
		(0.006)				(0.010)		
XC=0 × XR				0.505**				0.758***
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XC=1 × XR				1.375***				1.554***
				(0.280)				(0.187)
XC				−0.049				−0.180*
				(0.094)				(0.099)
Observations	2976	2349	3742	3742	2819	2267	3446	3446

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Pass-Through: Identification

What does the pass-through regression identify?

- In model, dollar prices are:

$$p_{rt}^{us,k} = \frac{1}{1+\bar{m}} \left(mc_{rt}^{k} - xr_{t}^{k,us} \right) + \text{other terms}$$

- Want to control for mc_{rt}^{k} as it is correlated with exchange rate
- But domestic prices are an imperfect control:

$$p_{rt}^{kk} = (1 - \delta \bar{\Gamma}_{r}^{j}) mc_{t}^{k} + \delta \bar{\Gamma}_{r}^{j} xr_{t}^{kj} + \text{other terms}$$

- Can still make a statement under some assumptions

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Pass-Through: Identification

Proposition 2

With a single product and symmetric countries, the pass-through regression identifies:

$$\hat{\beta} = -\frac{1}{1+\bar{m}} \times \frac{1+\bar{m}\rho/\theta}{1+(1-\bar{\Gamma})\bar{m}\rho/\theta}$$

- Imperfect controlling for marginal cost introduces a bias:
  - True pass-through: $1/(1+\bar{m})$
  - Bias: $(1+\bar{m}\rho/\theta)/(1+(1-\bar{\Gamma})\bar{m}\rho/\theta)$
- Bias is small as $\bar{\Gamma}$, the coefficient of openness, is close to 0

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Tariff

- Proposition 2 is robust to the introduction of tariff provided one controls for tariff rates in the pass-through regression
- Relevant equations become:

$$\tilde{p}_{rt}^{jk} = \frac{1}{1+\bar{m}}(mc_{rt}^{k} - xr_{t}^{kj}) + \text{other terms}$$
$$p_{t}^{kk} = (1-\delta\bar{\Gamma}_{r}^{k})mc_{rt}^{k} + \delta\bar{\Gamma}_{r}^{k}xr^{kj} + \delta\bar{\Gamma}_{r}^{k}\tau_{rt}^{k}$$

where $\tilde{p}_{t}^{jk}$ is the before-tariff price

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Monetary Policy: Gold Standard

- Central banks buy and sell gold at local-currency price $\mathcal{E}_t^j$
- They issue money in proportion to the value of their gold reserves:

$$\Lambda^j M_t^j = \mathcal{E}_t^j G_t^j$$

- Nominal exchange rate pinned down by relative prices of gold:

$$\mathcal{E}_t^j / \mathcal{E}_t^k$$

- Nominal price of gold is expected to be constant:

$$E_t \mathcal{E}_{t+1}^j = \mathcal{E}_t^j$$

- Devaluation is a one-off unexpected increase in the price of gold:

$$\Delta \mathcal{E}_t^j > 0$$

Rest of the Model

- Euler equation with internal habits:

$$\hat{\mu}_t^j = E_t \hat{\mu}_{t+1}^j + \sigma^{-1} \left(i_t^j - E_t \pi_{ct+1}^j \right)$$

$$\hat{\mu}_t^j = \frac{1}{(1-\iota)(1-\beta\iota)} \left(\beta\iota (E_t \hat{c}_{t+1}^j - \iota \hat{c}_t^j) - (\hat{c}_t^j - \iota \hat{c}_{t-1}^j) \right)$$

- Money demand:

$$\hat{\tau}_t^j = \eta_p (p_t^j - m_t^j) - \eta_c \hat{\mu}_t^j$$

- Uncovered interest rate parity:

$$\hat{\tau}_t^j = \hat{\tau}_t^k$$

- Marginal cost:

$$mc_t^j = w_t^j + \frac{\alpha_1}{1-\alpha_2} \hat{y}_t^j$$

- Wage Phillips curve:

$$\pi_{wt}^j = \beta E_t \pi_{wt+1}^j + \psi_y \hat{y}_t^j - \psi_\mu \hat{\mu}_t^j + \psi_{tt} \hat{tt}_t^j$$

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Calibrated Parameters

Parameter	Value	Concept	Target or source
		Calibrated	
β	0.99	Discount rate	Annual interest rate of 4%
ι	0.8	Habit	Eggertsson (2008)
χ	1	Concavity of utility for money	Standard
γ	0.1	Openness	British export-to-GDP ratio
α_2	0.37	Profit share	Labor share of 2/3
η	21	Elasticity of labor demand	Christiano et al. (2005)
υ	0.0007	Stationarity-inducing device	Schmitt-Grohé and Uribe (2003)
g^*	0.14	Gold to output ratio	British gold-reserves-to-GDP ratio

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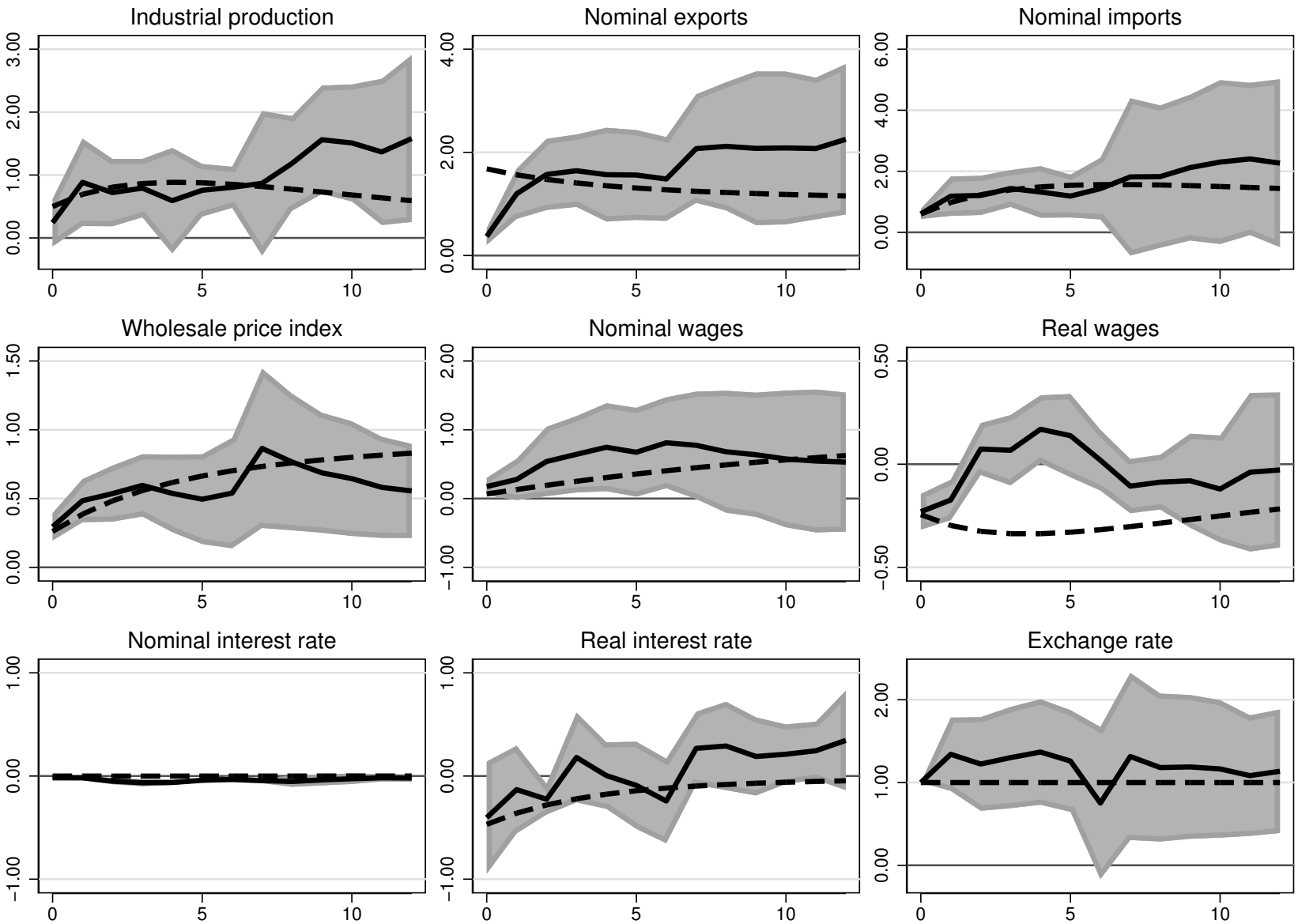
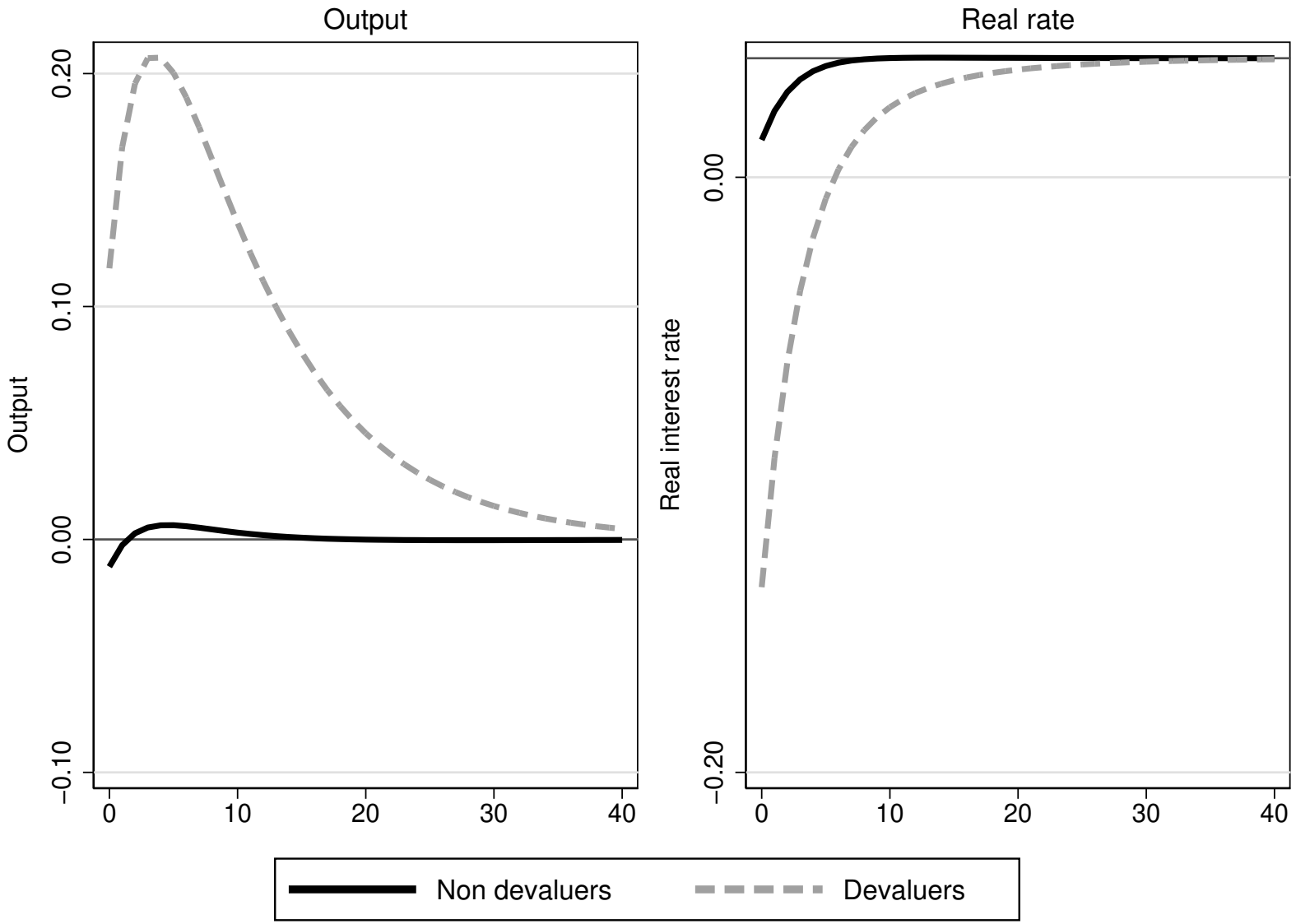
HFI: Model Fit



HFI: Estimated Parameters

Parameter	Value	Concept	Target or source
		Estimated	
σ^{-1}	4.19	IES	Industrial production
	(0.83)		
α_1	0.28	Curvature of production function	WPI
	(0.27)		
ξ	0.7	Calvo wage parameter	Nominal wages
	(0.04)		
ρ	1.2	Macro trade elasticity	Imports and IPI
	(0.07)		
θ	3.08	Micro trade elasticity	US imports
	(0.12)		
$\bar{m}$	1.36	Markup elasticity	Pass-through
	(0.16)		

HFI: Counterfactual Analysis



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Main Intuition

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Output in country j is given by:

$$y_t^j = \underbrace{\psi\left(\int_k \left(mc_t^k - xr_t^{kj}\right) dk - mc_t^j\right)}_{\text{expenditure switching}} + \underbrace{(1-\bar{\Gamma})\hat{c}_t^j}_{\text{domestic consumption}} + \underbrace{\bar{\Gamma}\int_k \hat{c}_t^k}_{\text{foreign consumption}}$$

Effect of devaluation:

- Expenditure switching term falls
- Foreign consumption term increases
- Domestic consumption term is ambiguous

Decomposition

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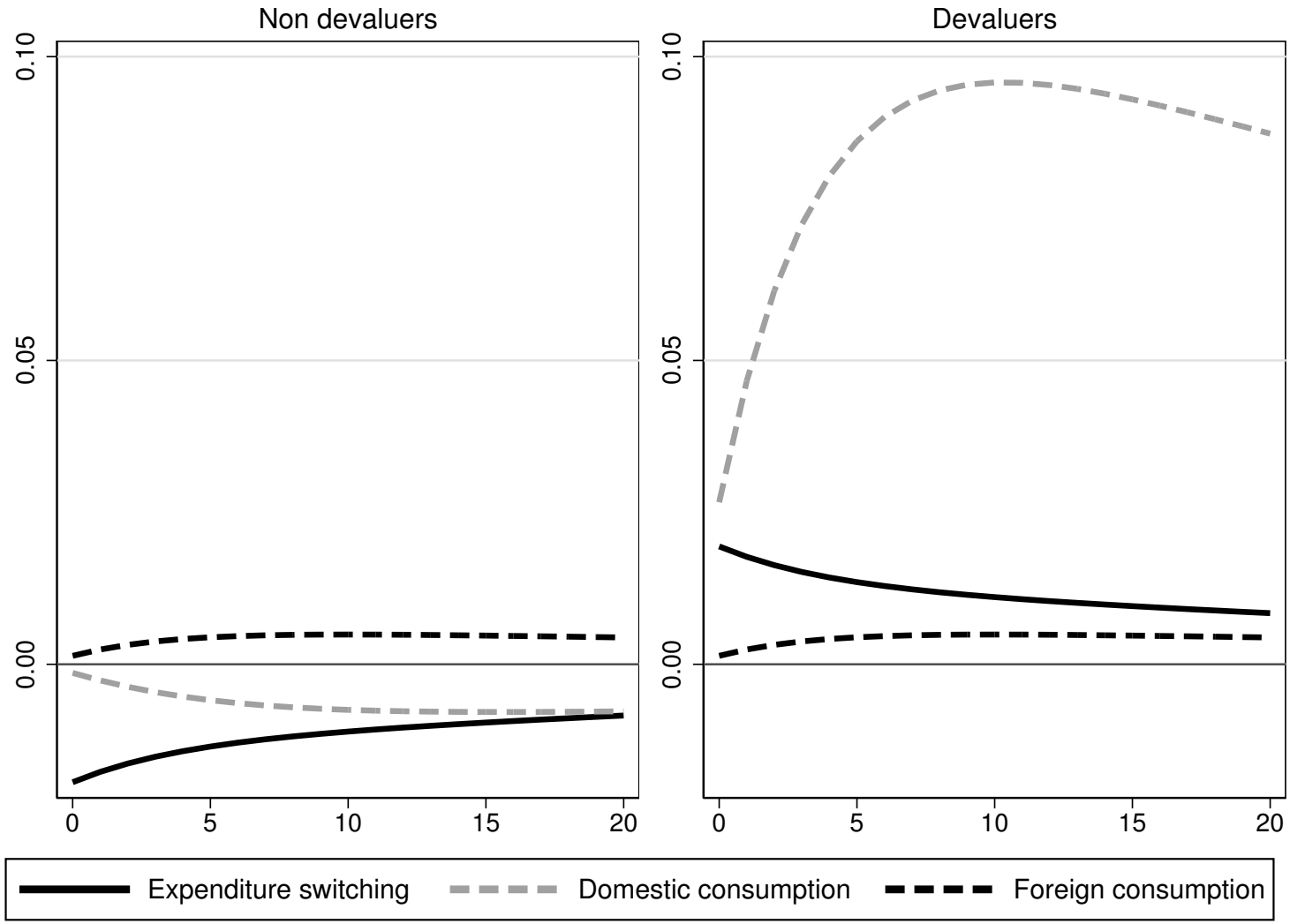

CES Case

- Can model imply large negative effect on foreign output?
- Yes! Low pass-through of the exchange rate is important for the result
- In baseline, use Kimball (1995) demand to generate incomplete pass-through
- What happens with a constant elasticity of substitution (CES)?

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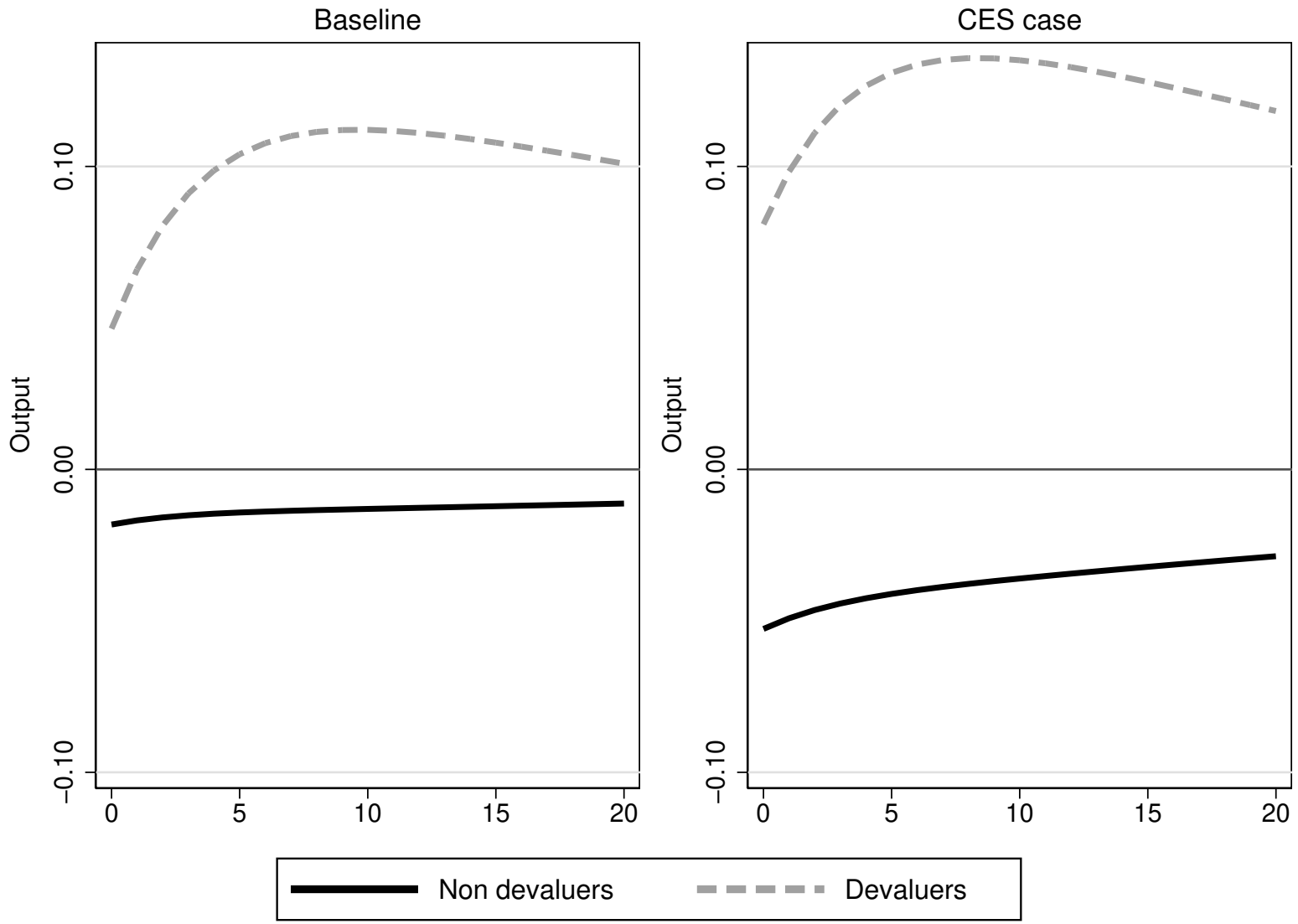
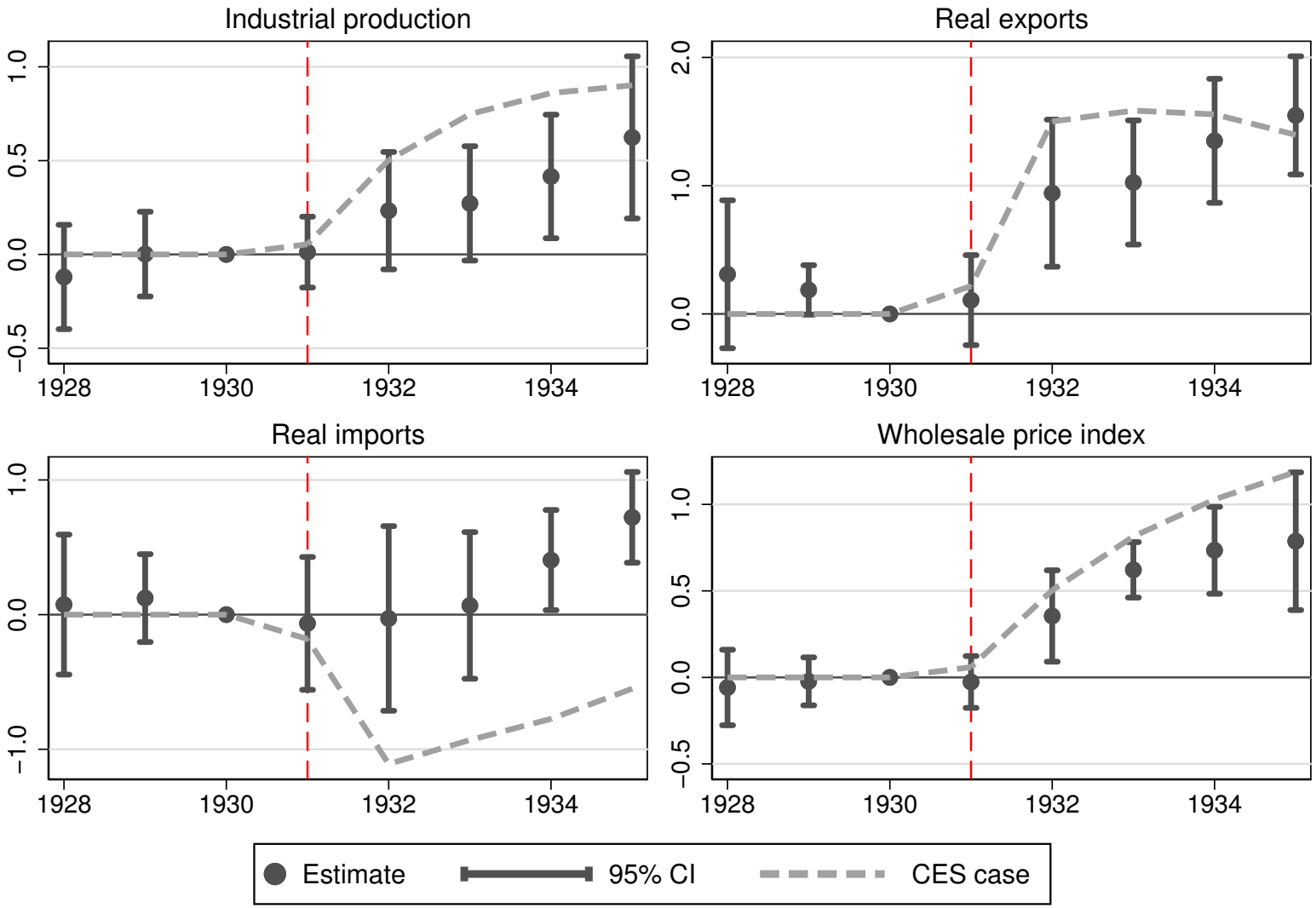
CES Case


Baseline
CES case
Output
0.10
0.00
−0.10
0
5
10
15
20
Non devaluers
Devaluers

CES Case: Fit



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Going Further

- Identification
  - Details
- Sufficient statistics approach
  - Details
- Robustness
  - s.e.
  - TANK
  - Elasticity
- Modern applicability
  - Pricing
  - Intermediate goods
- GE decomposition
  - Quantitative
  - Definition
  - Proposition
  - Identification
- More supporting evidence
  - Details

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Identification

- Denote:
  - Devaluers: superscript D
  - Non devaluers: superscript N
  - World: superscript W
- In any model with symmetric countries, absolute effect is:

$$\hat{y}_t^D = (1 - S^D)(\underbrace{\hat{y}^D - \hat{y}^N}_{\text{relative}}) + \underbrace{\hat{y}^W}_{\text{time f.e.}}$$

$$\hat{y}_t^N = -S^D(\underbrace{\hat{y}^D - \hat{y}^N}_{\text{relative}}) + \underbrace{\hat{y}^W}_{\text{time f.e.}}$$

  where S^D is the mass of countries that devalue
- Since I hit the cross-section $(\hat{y}^D - \hat{y}^N)$, question is how $\hat{y}^W$ is pinned down

Back

Identification: Parameters

- In the model, estimate 6 parameters:
  - σ^{-1}: IES
  - α_1: curvature of production function
  - ξ: wage stickiness
  - ρ: elasticity of substitution between imports and domestic varieties
  - θ: elasticity of substitution among imports
  - $\bar{m}$: pass-through
- Can show (analytically): ρ, θ, and $\bar{m}$ don't matter to $\hat{y}_t^W$
- Other 3 parameters are about how powerful monetary policy is:
  - Identified in the cross-section in an intuitive way
  - How do they influence the world response ($\hat{y}_t^W$)?

Back

Identification: IES

- Euler equation (without habits):

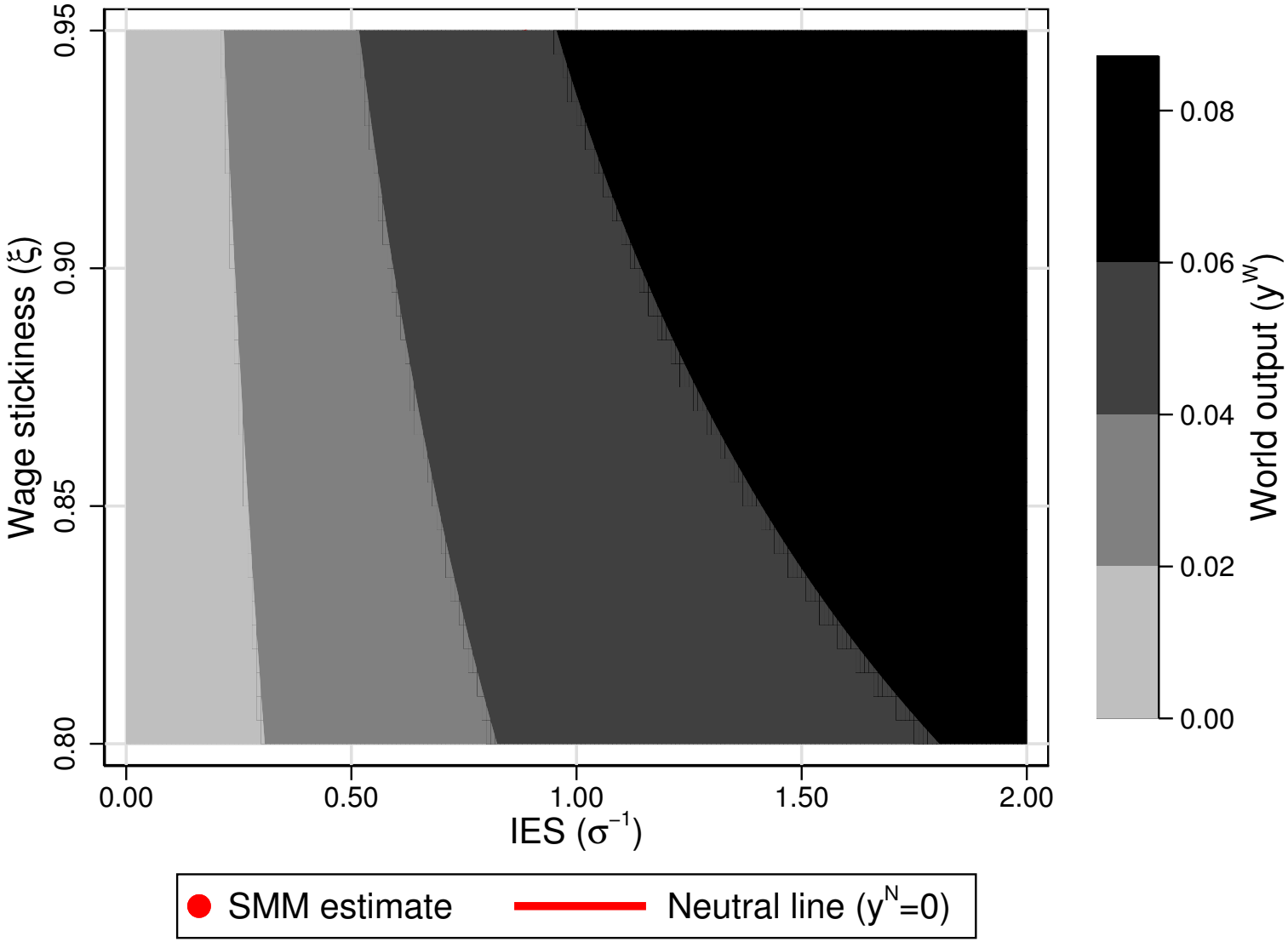
$$\hat{c}_t^j = E_t \hat{c}_{t+1}^j - \sigma^{-1} E_t \hat{r}_t^j$$

- Can show:

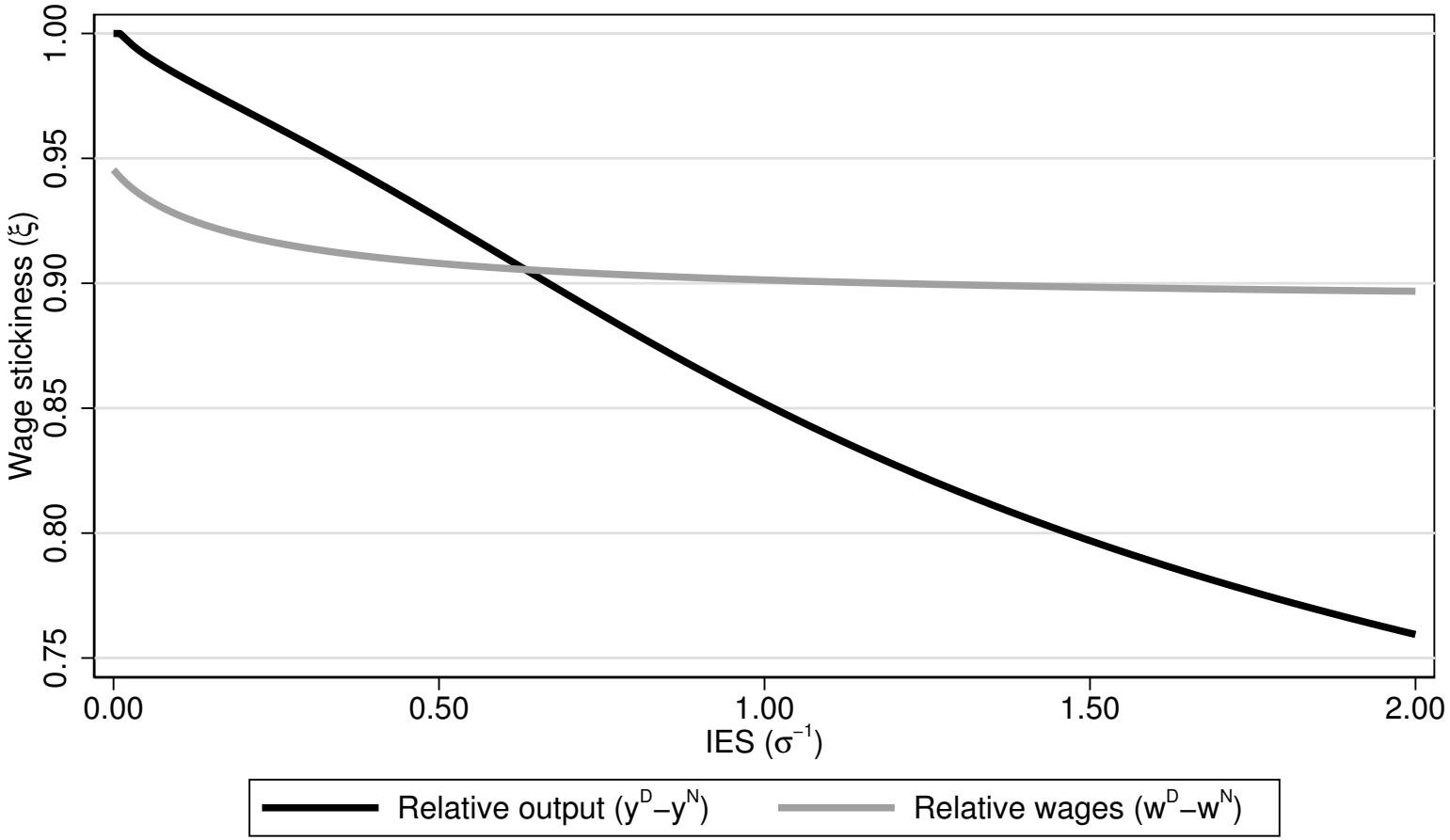
$$\sigma^{-1} = -\frac{\hat{c}_t^D - \hat{c}_t^N}{\sum_s \left(\hat{r}_{t+s}^D - \hat{r}_{t+s}^D\right)}$$

Back

Identification: World



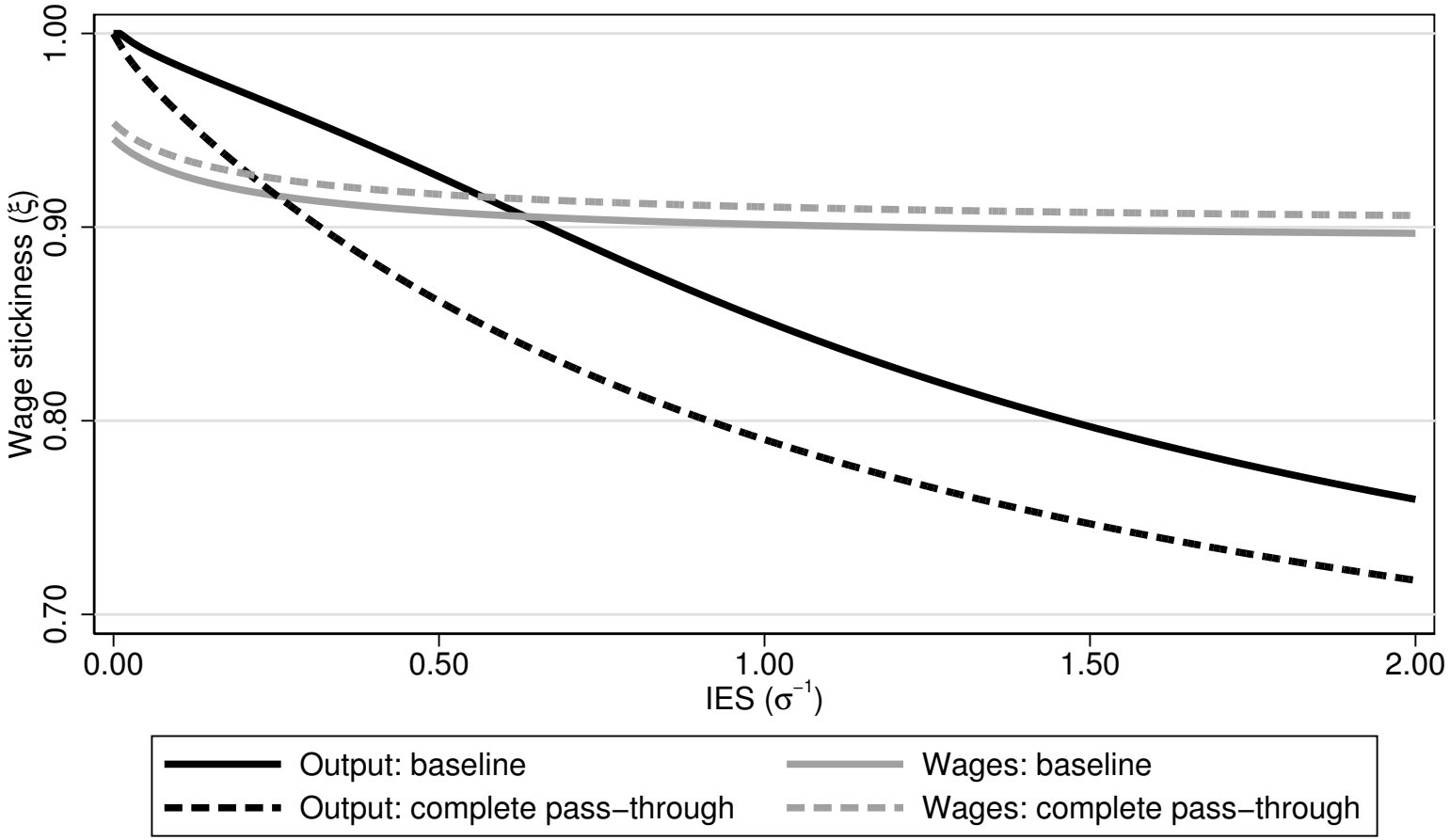
Moments: Baseline



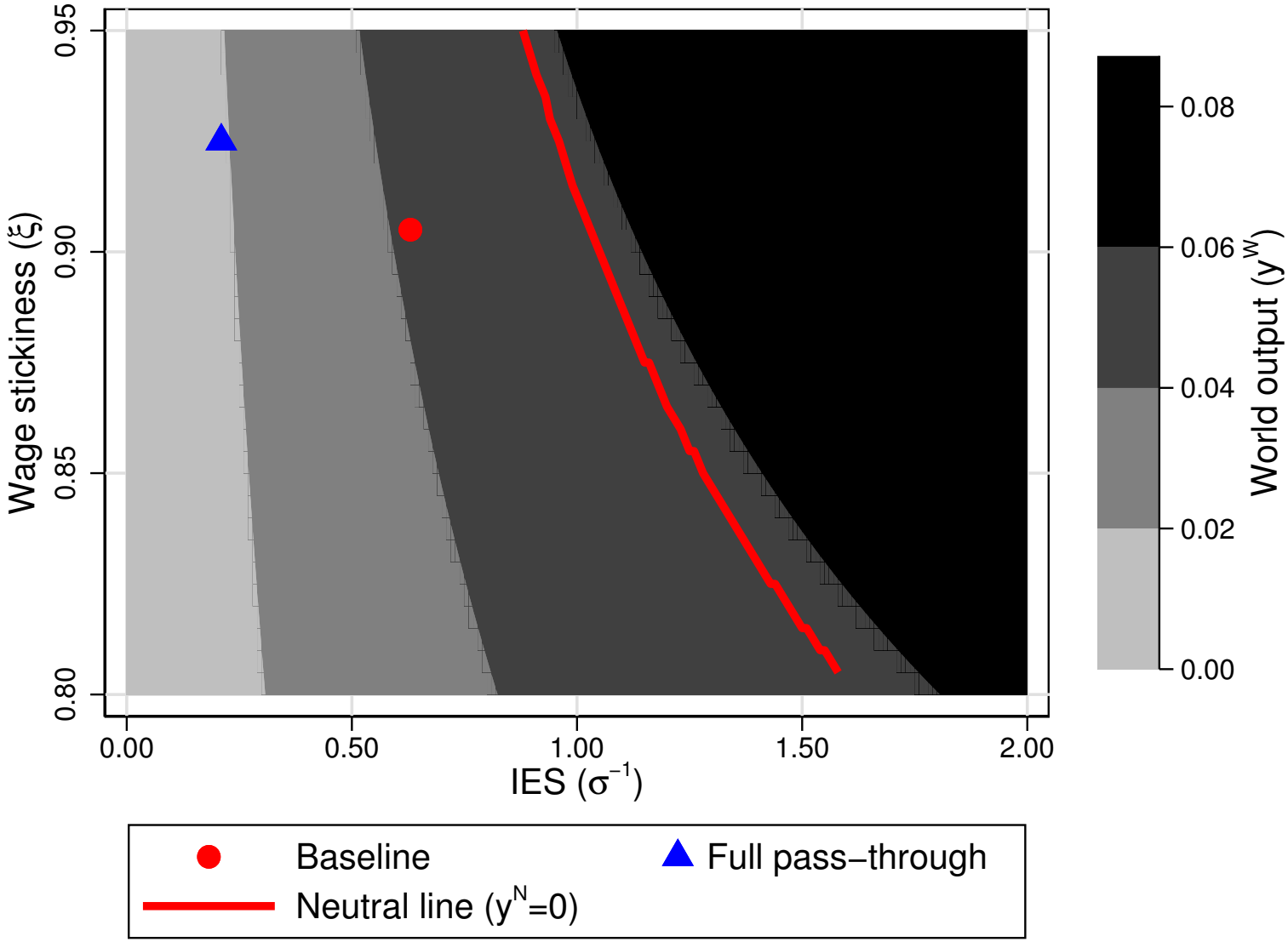
Moments: Baseline

- Where does the estimation with trade data come in?
- Answer: different values for the elasticity or the pass-through move the output line
- Illustration with the case of full pass-through

Moments: Complete Pass-Through



Identification: Complete Pass-Through



GE Decomposition: Motivation

Consider general equilibrium decomposition:

- Monetary policy is a path for the nominal price of gold: $\{\mathcal{E}_t^j\}_{j\in\mathcal{J}}$
- $\mathcal{E}_t^j$ enters model in two ways:
  1. To determine the quantity of money:

$$\Lambda^j M_t^j = \mathcal{E}_t^j G_t^j$$

  2. To determine the exchange rate:

$$XR_t^{jk} = \frac{\mathcal{E}_t^j}{\mathcal{E}_t^k}$$

Back

GE Decomposition: Informal Definition

Equations:

$$\text{money supply:} \qquad \Lambda_t^j M_t^j = \mathcal{E}_t^j G_t^j$$

$$\text{exchange rate:} \qquad XR_t^{jk} = \frac{\mathcal{E}_t^j}{\mathcal{E}_t^k}$$

1. Monetary channel:

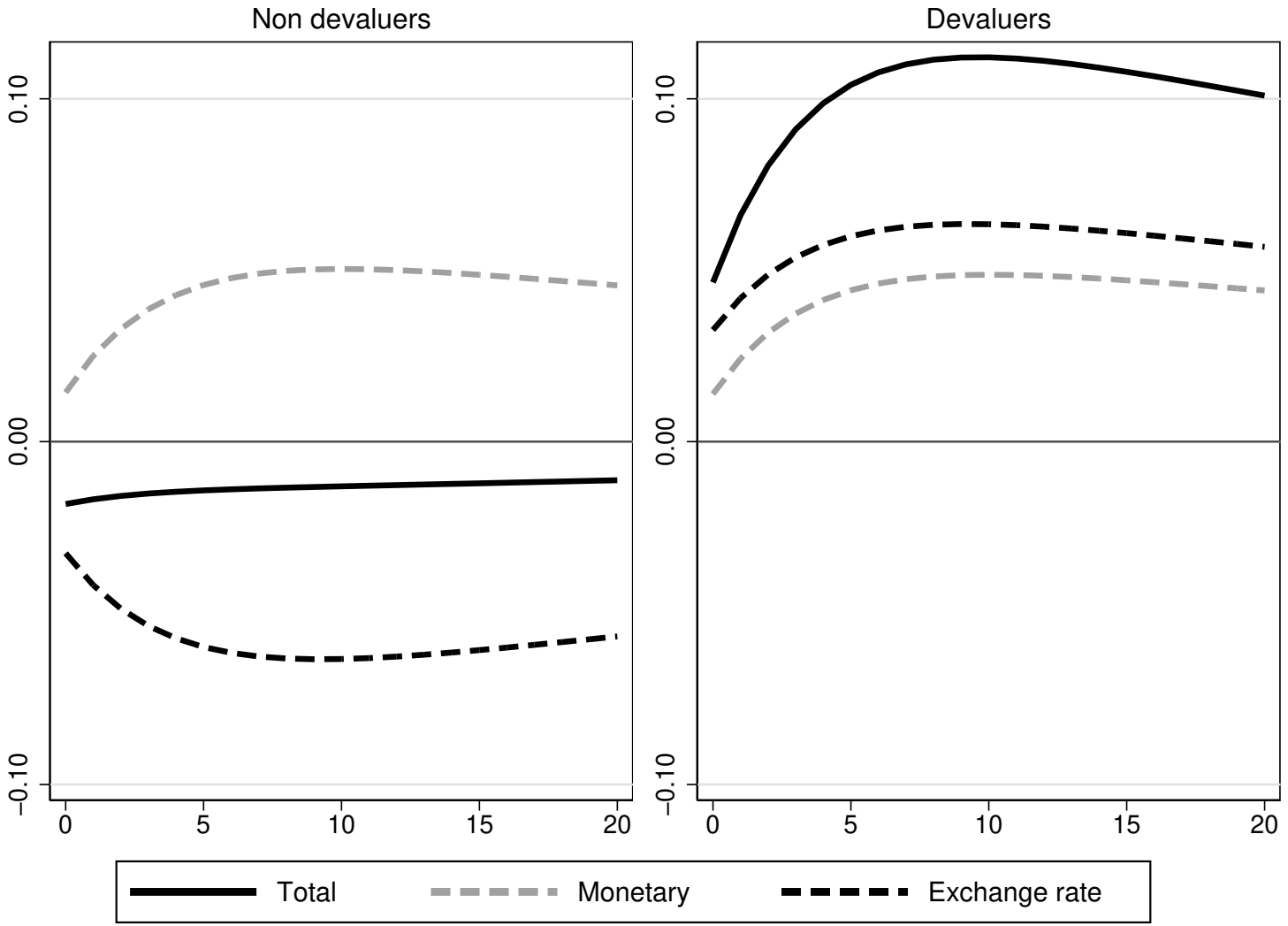
$$\begin{cases} \Lambda_t^j \downarrow \\ \mathcal{E}_t^j \text{ constant} \end{cases} \Rightarrow \begin{array}{l} M_t^j \uparrow \text{ (given } G_t^j\text{)} \\ XR_t^{jk} \text{ constant} \end{array}$$

2. Exchange rate channel:

$$\begin{cases} \mathcal{E}_t^j / \Lambda_t^j \text{ constant} \\ \mathcal{E}_t^j \uparrow \end{cases} \Rightarrow \begin{array}{l} M_t^j \text{ constant (given } G_t^j\text{)} \\ XR_t^{jk} \uparrow \end{array}$$

Back

GE Decomposition: Output



Back

GE Decomposition: Formal Definition

Definition

Consider a one-off devaluation: $\mathcal{E}_0^j/\mathcal{E}_{-1}^j = \bar{D} > 1$. It can be decomposed as the sum of two policies:

1. Monetary channel. A permanent decrease in the gold cover ratio which holds the price of gold constant:

$$\frac{\Lambda_0^j}{\Lambda_{-1}^j} = \frac{1}{\bar{D}} \qquad \frac{\mathcal{E}_0^j}{\mathcal{E}_{-1}^j} = 1$$

2. Exchange rate channel. A permanent increase in the price of gold whose immediate effect on the money supply is offset by a corresponding permanent increase in the gold cover ratio:

$$\frac{\Lambda_0^j}{\Lambda_{-1}^j} = \bar{D} \qquad \frac{\mathcal{E}_0^j}{\mathcal{E}_{-1}^j} = \bar{D}$$

Back

GE Decomposition: Notations

For output y, denote the first-order solutions:

- full model: $\{\hat{y}_t^{jF}\}_{t\geq 0}^{j\in\mathcal{J}}$
- monetary channel: $\{\hat{y}_t^{jM}\}_{t\geq 0}^{j\in\mathcal{J}}$
- exchange rate channel: $\{\hat{y}_t^{jX}\}_{t\geq 0}^{j\in\mathcal{J}}$

Remark

The decomposition is additive:

$$\hat{y}_t^{jF} = \hat{y}_t^{jM} + \hat{y}_t^{jX}$$

Back

GE Decomposition: Proposition

Proposition 3: GE decomposition

3. World-level variables are fully determined by the monetary channel:

$$\int_{j\in\mathcal{J}} \hat{y}_t^{jM}\, dj = \int_{j\in\mathcal{J}} \hat{y}_t^{jF}\, dj \qquad \int_{j\in\mathcal{J}} \hat{y}_t^{jX}\, dj = 0$$

4. Monetary policy leaks. Suppose that:

$$\forall j \in \mathcal{J}, \quad \mathcal{E}^j G^j / \left(P^j Y^j\right) \to 0$$

The monetary channel affects all countries symmetrically:

$$\forall (j,k) \in \mathcal{J}^2, \qquad \hat{y}_t^{jM} = \hat{y}_t^{kM}$$

Morever, the exchange rate channel pins down the relative effect:

$$\forall (j,k) \in \mathcal{J}^2, \qquad \hat{y}_t^{jX} - \hat{y}_t^{kX} = \hat{y}_t^{jF} - \hat{y}_t^{kF}$$

Back

GE Decomposition: Intuition

- Consider money supply equation:

$$\Lambda_t^j M_t^j = \mathcal{E}_t^j G_t^j$$

- Monetary channel:

$$\begin{cases} \Lambda_t^j \downarrow \\ \mathcal{E}_t^j \text{ constant} \end{cases} \Rightarrow \begin{array}{l} M_t^j \uparrow \text{ (given } G_t^j\text{)} \\ XR_t^{jk} \text{ constant} \end{array}$$

- What's the catch? G_t^j is endogenous:
  - XR does not move, so there is no pressure on relative prices or output
  - UIP implies that nominal interest rates are equal across countries:

$$i_t^j = i_t^W$$

  - Money demand is the same across countries:

$$\left(M_t^j / P_t^j\right)^{-\chi} / \left(C_t^j\right)^{-\sigma} = i_t^W / (1 + i_t^W)$$

  - Gold flows to equalize money supplies across countries

Back

GE Decomposition: Identification

- Implication of proposition 3:
  - Monetary channel is the aggregate effect
  - Exchange rate channel is the relative effect

- Model estimated on cross-sectional data

  $\Longrightarrow$ Identification driven by the exchange rate channel

- Yet, exchange rate channel is not clueless about aggregate effect
  - Monetary channel works primarily through the real interest rate:

$$E_t \hat{\mu}_t^{jM} = \sigma^{-1} \sum_{s=0}^{\infty} E_t \hat{r}_{t+s}^{wF}$$

  - Exchange rate affects *relative* interest rates:

$$\sigma^{-1} = \frac{dE_t \left(\hat{\mu}_t^{jF} - \hat{\mu}_t^{kF} \right)}{d \sum_{s=0}^{\infty} E_t \left(\hat{r}_{t+s}^{jF} - \hat{r}_{t+s}^{kF} \right)}$$

Back

Sufficient Statistics

Back

- Denote:
  - Devaluers: superscript D
  - Non devaluers: superscript N
  - World: superscript W
- In any model with symmetric countries, absolute effect is:

$$\hat{y}_t^N = -S^D(\hat{y}_t^D - \hat{y}_t^N) + \hat{y}_t^W$$

where S^D is the mass of countries that devalue

- In model:

$$\hat{y}_t^W = -\sigma^{-1}\frac{(1-\iota)(1-\beta\iota)}{(1-\iota L)(1-\beta\iota L^{-1})}\sum_{s=0}^{\infty}\hat{r}_{t+s}^W$$

where L is the lag operator

Sufficient Statistics: Theoretical Results

Back

Proposition

Sufficient statistics for absolute effects are:

$$\hat{y}^D - \hat{y}^N \qquad \sigma^{-1}, \iota \qquad \left\{\hat{r}^W_{t+s}\right\}_{s=0}^{\infty}$$

- Result only requires (i) symmetric countries, (ii) RANK with habits
- Can be extended to TANK

Sufficient Statistics: Comments

Back

- Three objects:
  - $\hat{y}^D - \hat{y}^N$: estimated reduced-form exercise
  - σ^{-1}, ι: estimated in structural estimation
  - $\left\{\hat{r}^W_{t+s}\right\}_{s=0}^{\infty}$: determined by model for money supply/demand
- Does the model have realistic implications for $\left\{\hat{r}^W_{t+s}\right\}_{s=0}^{\infty}$?
- Estimate it empirically

World Real Rate: Construction

Back

- Gather data on real rate for as many countries as possible
- Retain country if complete quarterly time series from 1925 to 1936
- Weight countries by share in 1929 world GDP/trade

$\Rightarrow$ Resulting country sample accounts for 60% of world GDP/trade

World Real Rate: Identification

Back

- HFI shocks are valid for *time series* identification
- Can estimate:

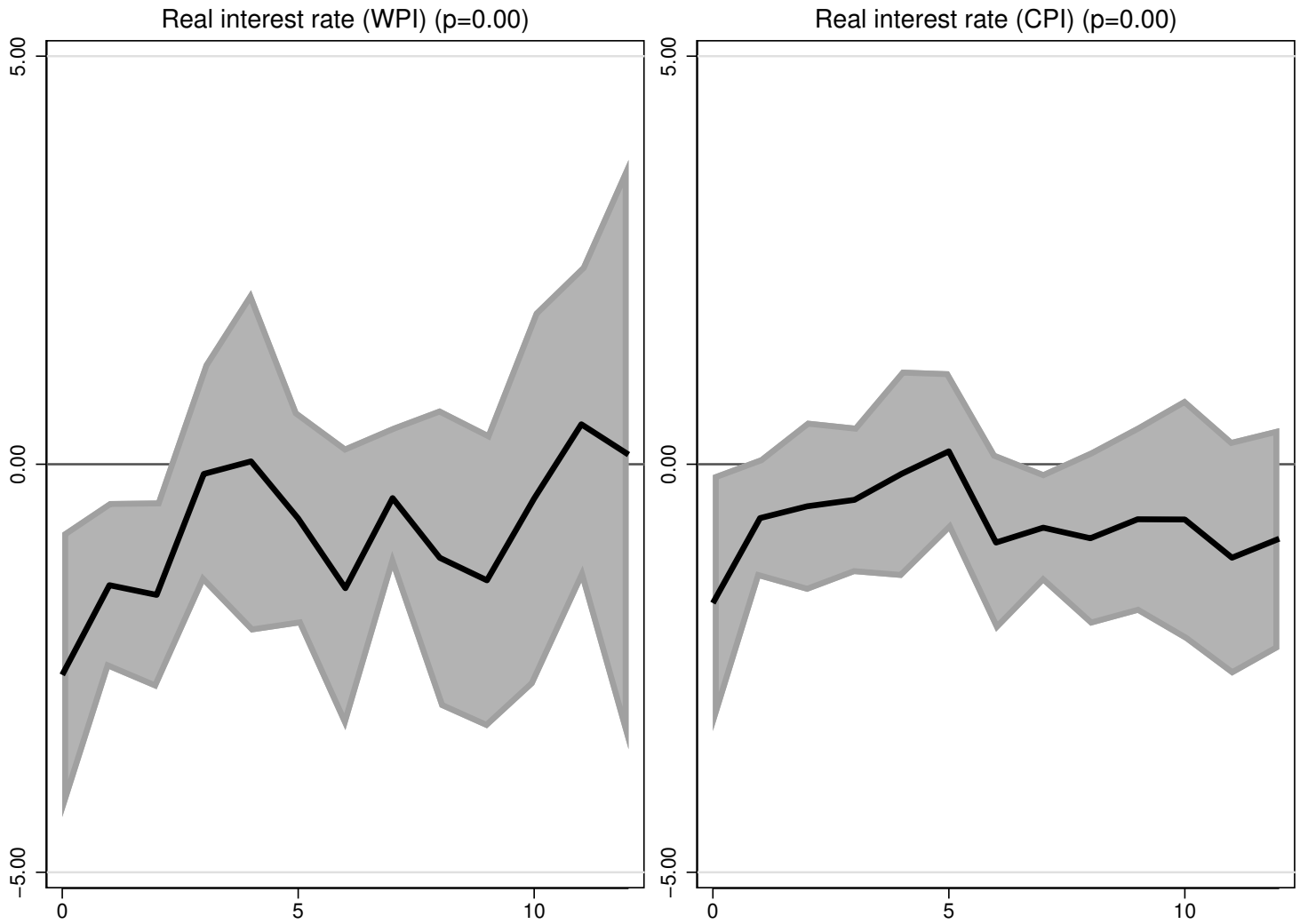
$$r^W_{t+h} - r^W_{t-2} = \beta_k(\epsilon^W_t - \epsilon^W_{t-1}) + \gamma'_k X^j_{t-1} + \zeta_h + e_{t,h}$$

  where ϵ^W_t is the world nominal price of gold

- Instrument: weighted sum of HFI shocks
- Remark: in principle, could do the same for output, but not enough power

World Real Rate: IRF

Back



World Real Rate: Sum

Back

- What matters is the sum of present and future real interest rates
- Compute the sum of coefficients:

$$\mathcal{I}^y = \frac{1}{S} \sum_{q=0}^{12} \hat{\beta}_q$$

- Do it for real rate, gold price, and ratio of the two

	(1) Real rate	(2) Gold price	(3) Ratio
Real rate (CPI)	-0.717^{***}	1.865^{***}	-0.385^{***}
	(0.235)	(0.330)	(0.110)
Real rate (WPI)	-0.825^{***}	2.459^{***}	-0.336^{***}
	(0.284)	(0.485)	(0.091)

Expansionary Devaluations

Back

- World real rate falls because of the devaluations
- Ratio means that a 30% devaluation by half of the world leads to an average drop in the real interest rate of:

$$-0.405 \times 0.30 \times \frac{1}{2} \approx -6\%$$

- Implies that 1930s devaluations were *not* a zero-sum game
- Theoretical results of Caballero et al. (2021) do not apply

Sufficient Statistics: Solution Method

Back

- Same model as before, with relaxed assumptions about monetary policy
  - Assume one-off devaluation and UIP
  - No assumption on money supply or demand
  - Nests ZLB, change of regime...
- Solve model in relative terms so that do not have to make assumptions about monetary policy

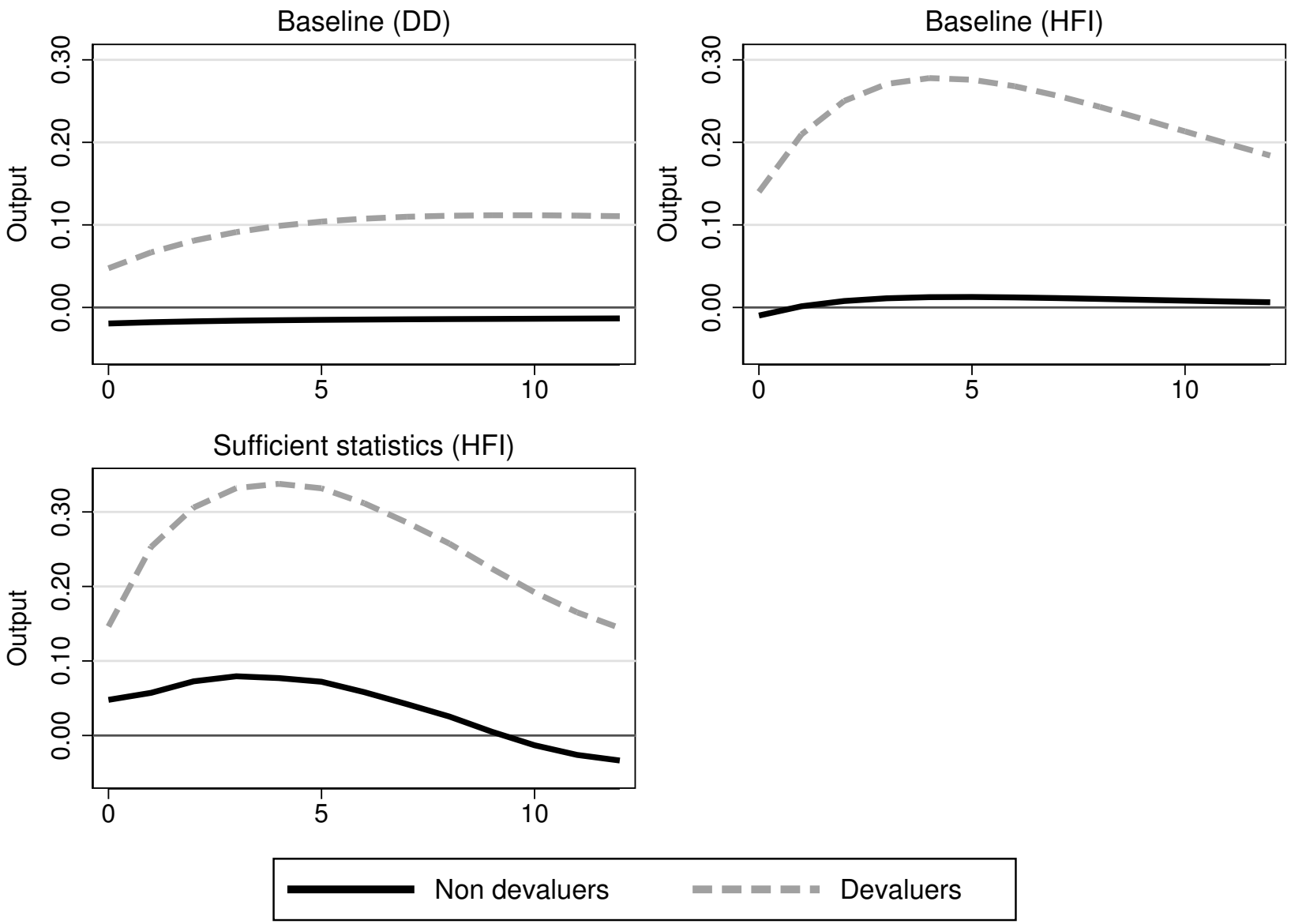
$$x_t^R = x_t^D - x_t^N$$

- Estimate out of cross-sectional moments like before
- Feed path of world real rate into:

$$\hat{y}_t^N = -S^D(\hat{y}^D - \hat{y}^N) - \sigma^{-1}\frac{(1-\iota)(1-\beta\iota)}{(1-\iota L)(1-\beta\iota L^{-1})}\sum_{s=0}^{\infty} E_t \hat{r}_{t+s}^W$$

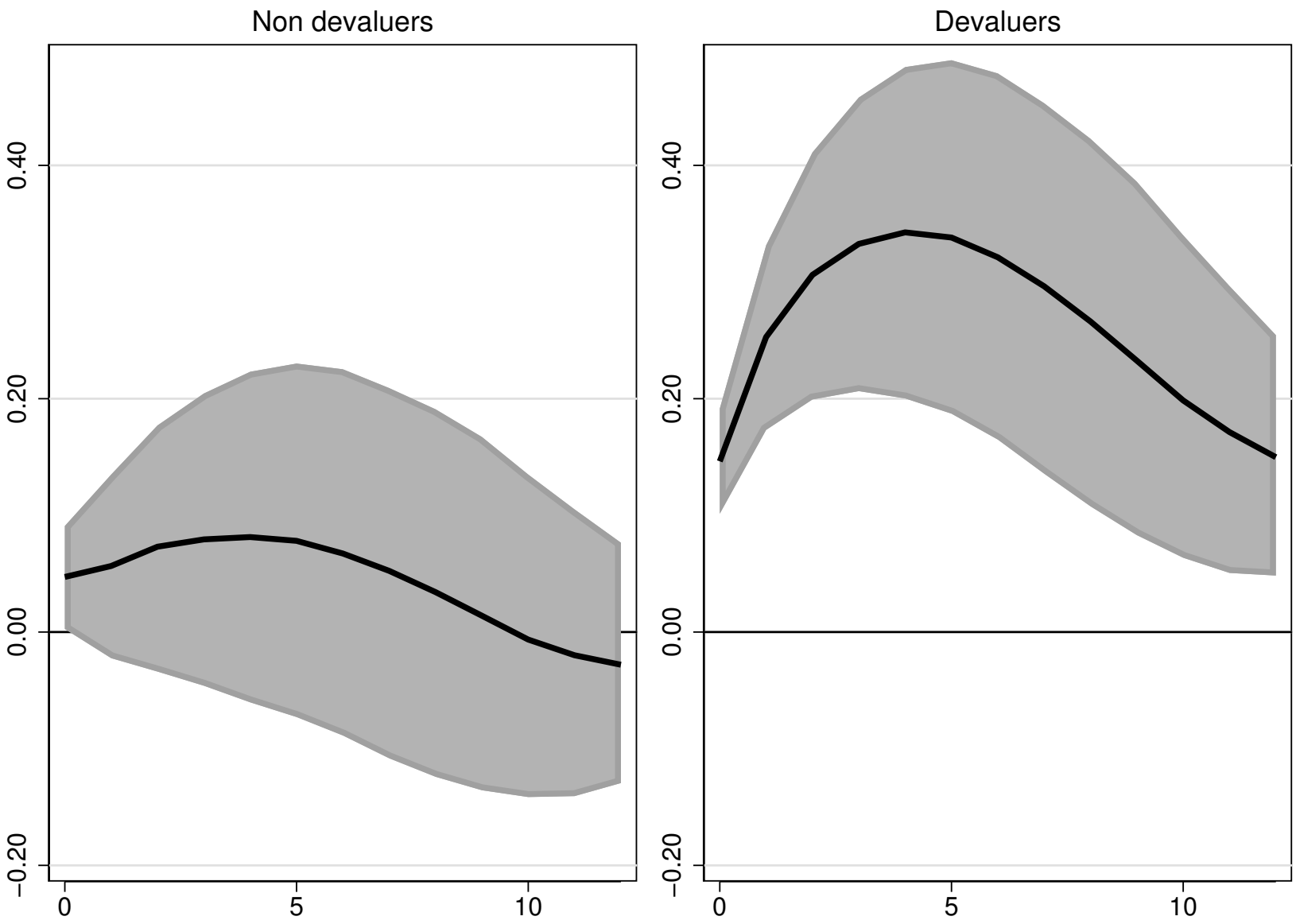
Sufficient Statistics: Result

Back



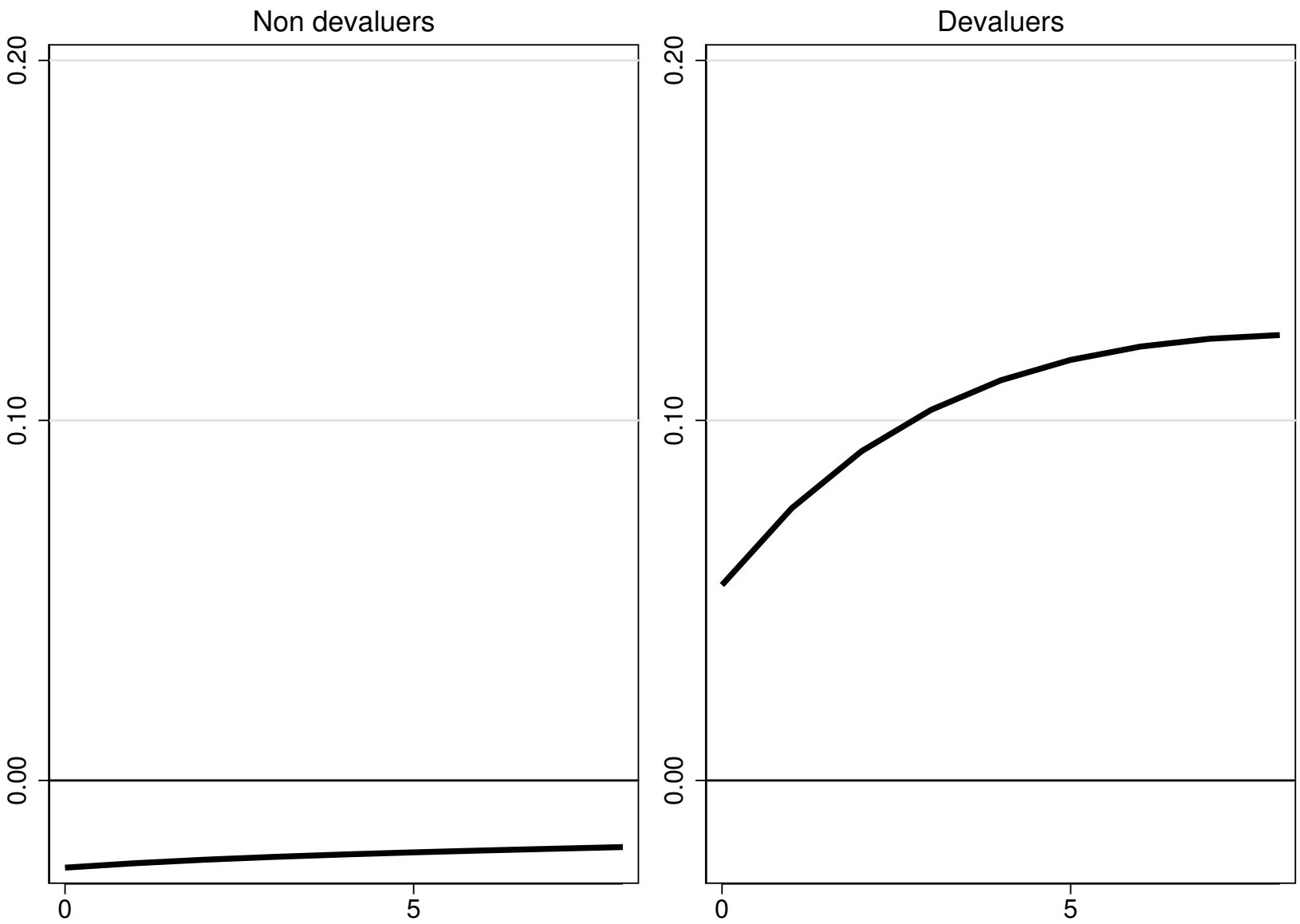
Sufficient Statistics

Back



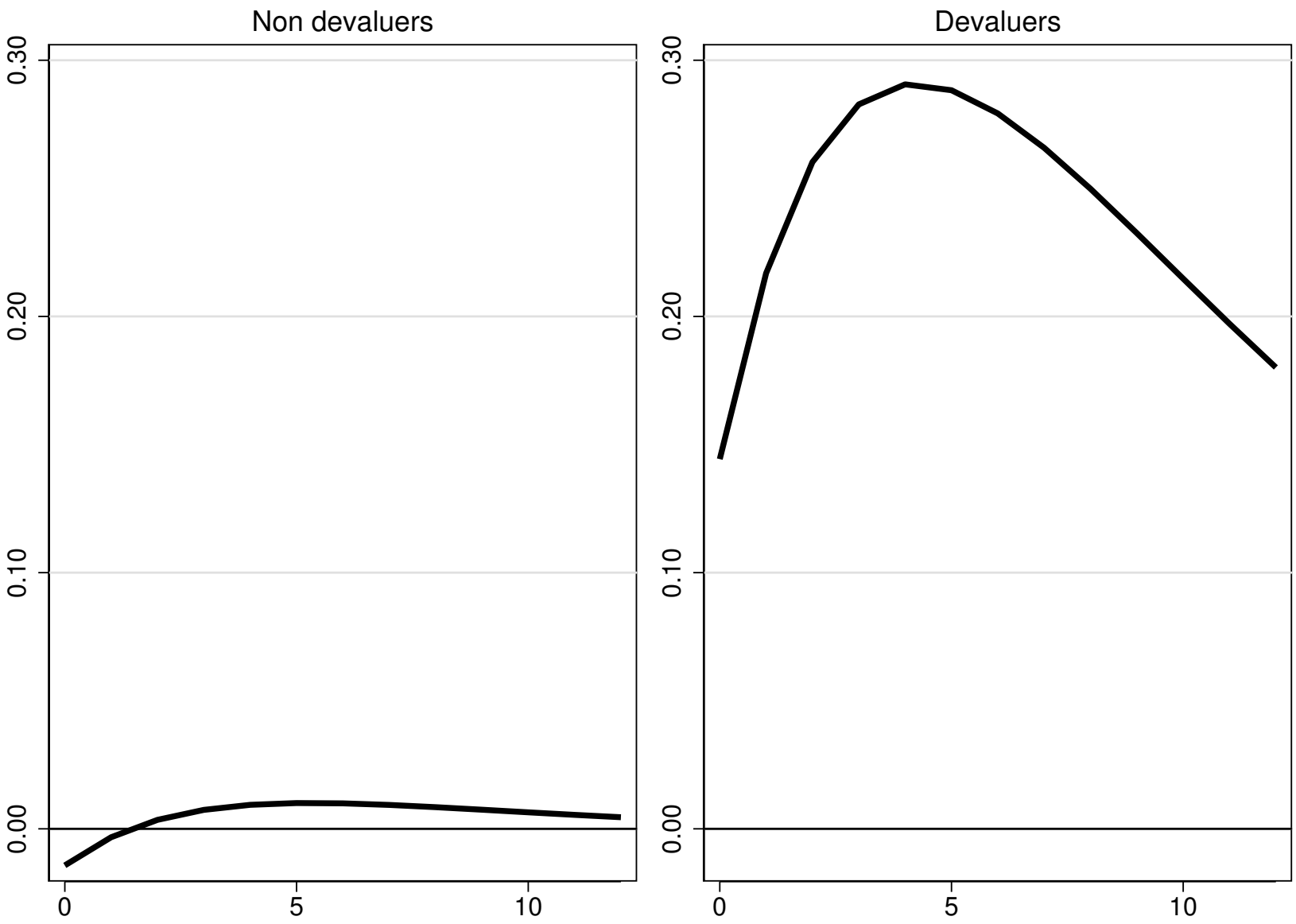
Counter-Factual with Confidence Intervals (DD)

Back



Counter-Factual with Confidence Intervals (HFI)

Back



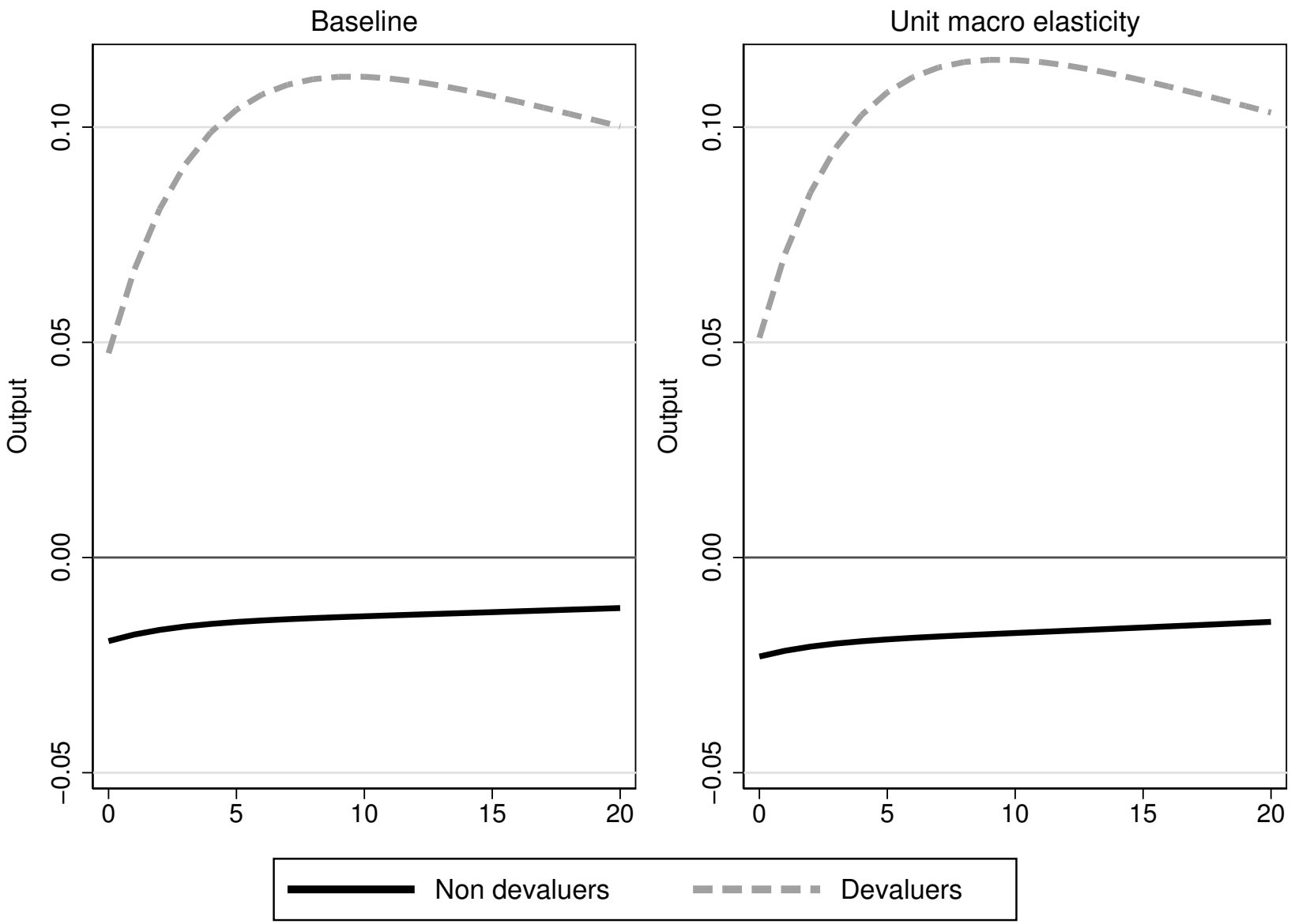
Macro Elasticity

Back

- Estimate for macro trade elasticity is low in DD case (0.51), but reasonable in HFI case (1.2)
- Independent estimate by Irwin (1998): 0.8
- DD estimated parameters with $\rho = 1$

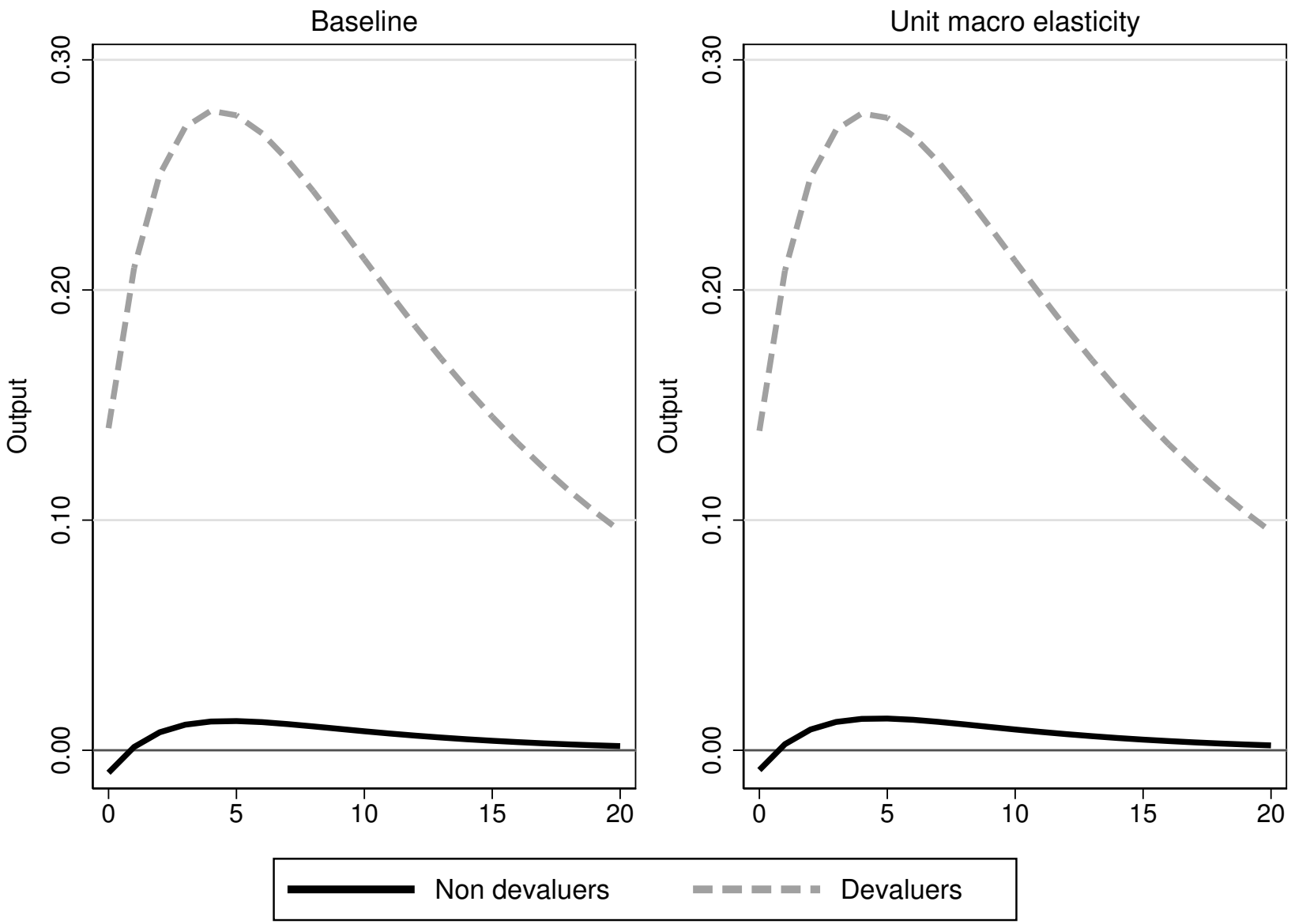
Unit Macro Elasticity (DD)

Back



Unit Macro Elasticity (HFI)

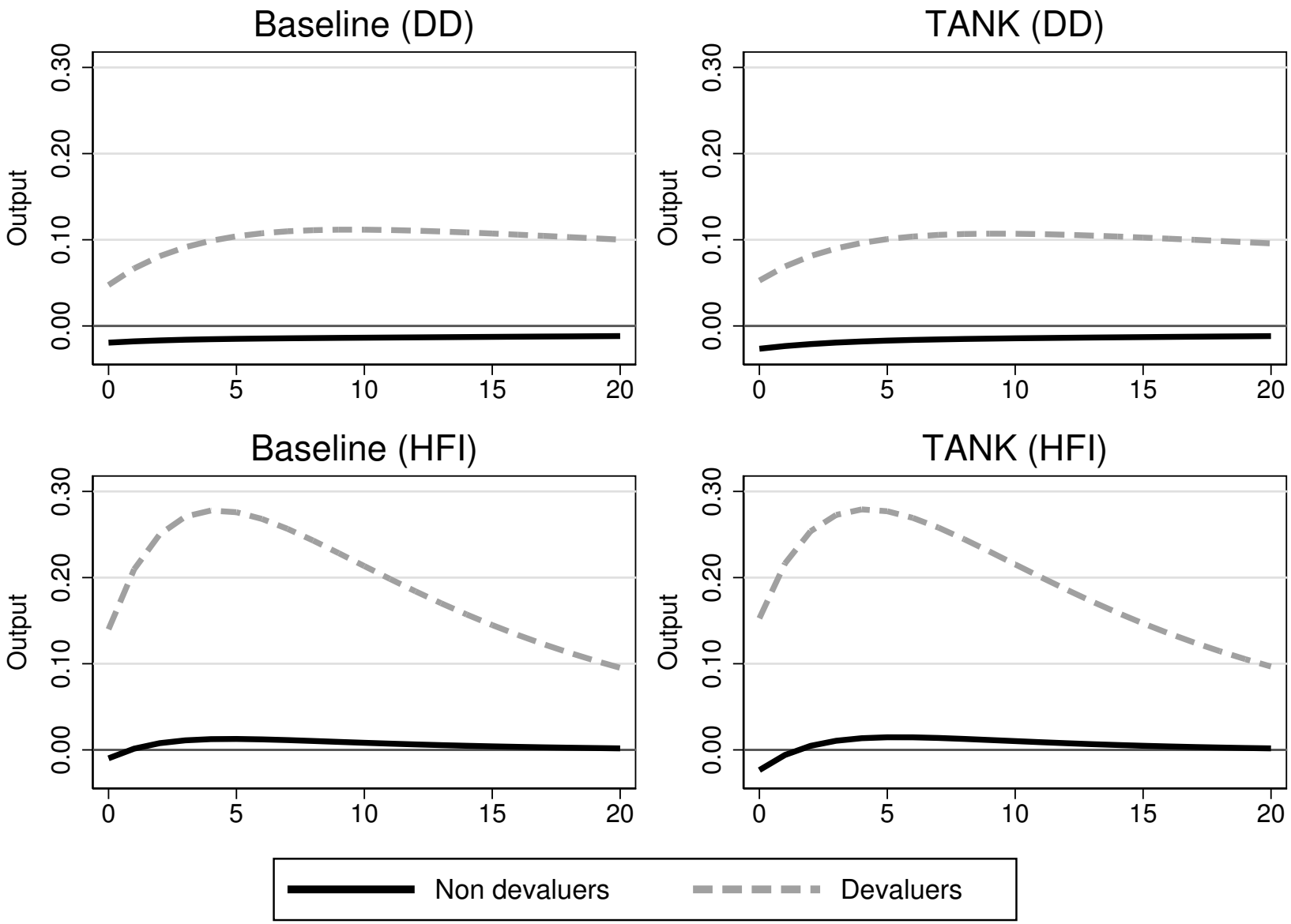
Back



TANK

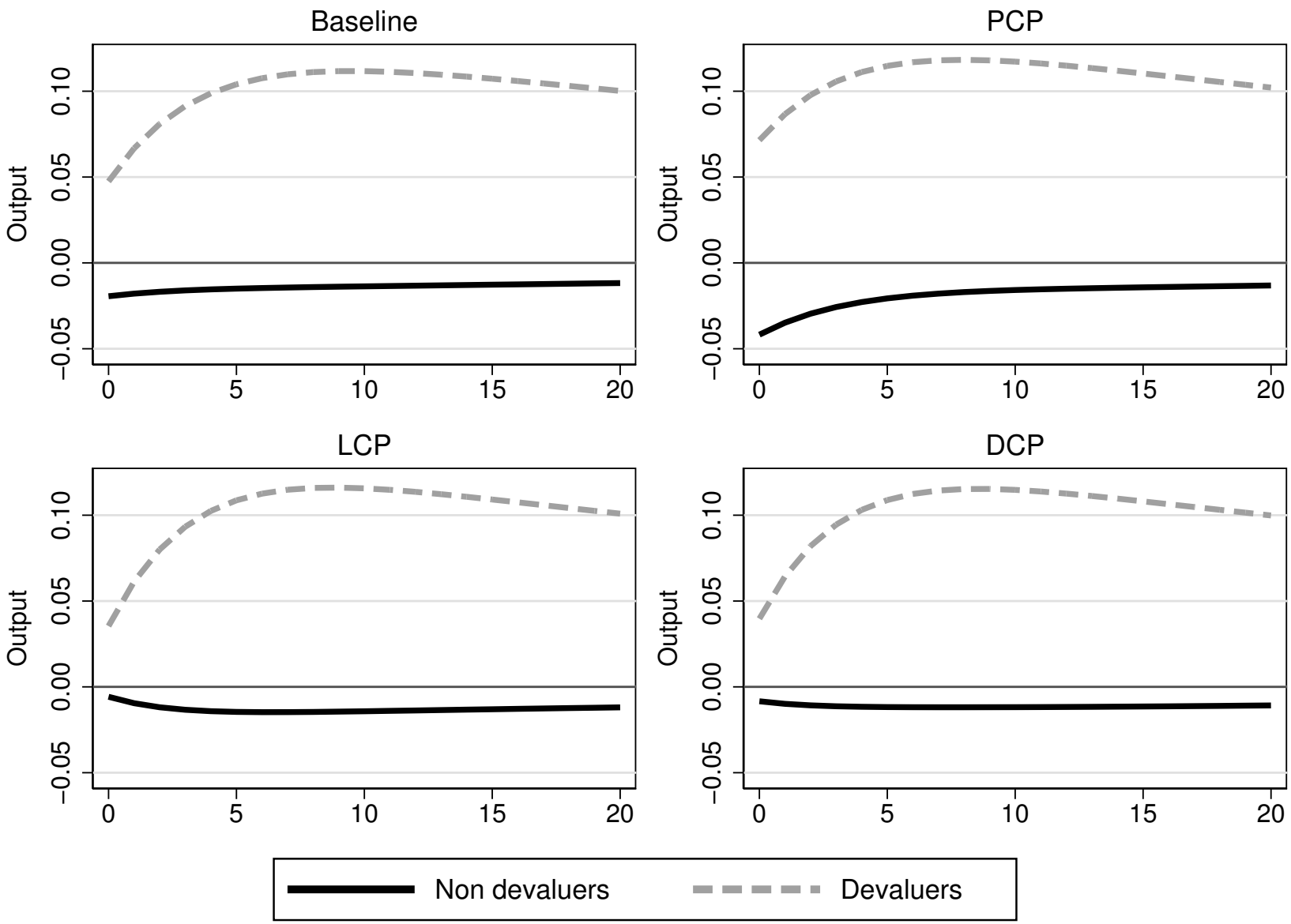
- Does result come from representative agent logic?
- Introduce a fraction λ of hand-to-mouth (HTM) agents who receive and consume a constant fraction of their country's nominal output
- Calibrate $\lambda = 0.6$ to match the MPC estimate of Hausman (2016)

TANK


Baseline (DD)
TANK (DD)
Baseline (HFI)
TANK (HFI)
Output
0.00
0.10
0.20
0.30
0
5
10
15
20
Non devaluers
Devaluers

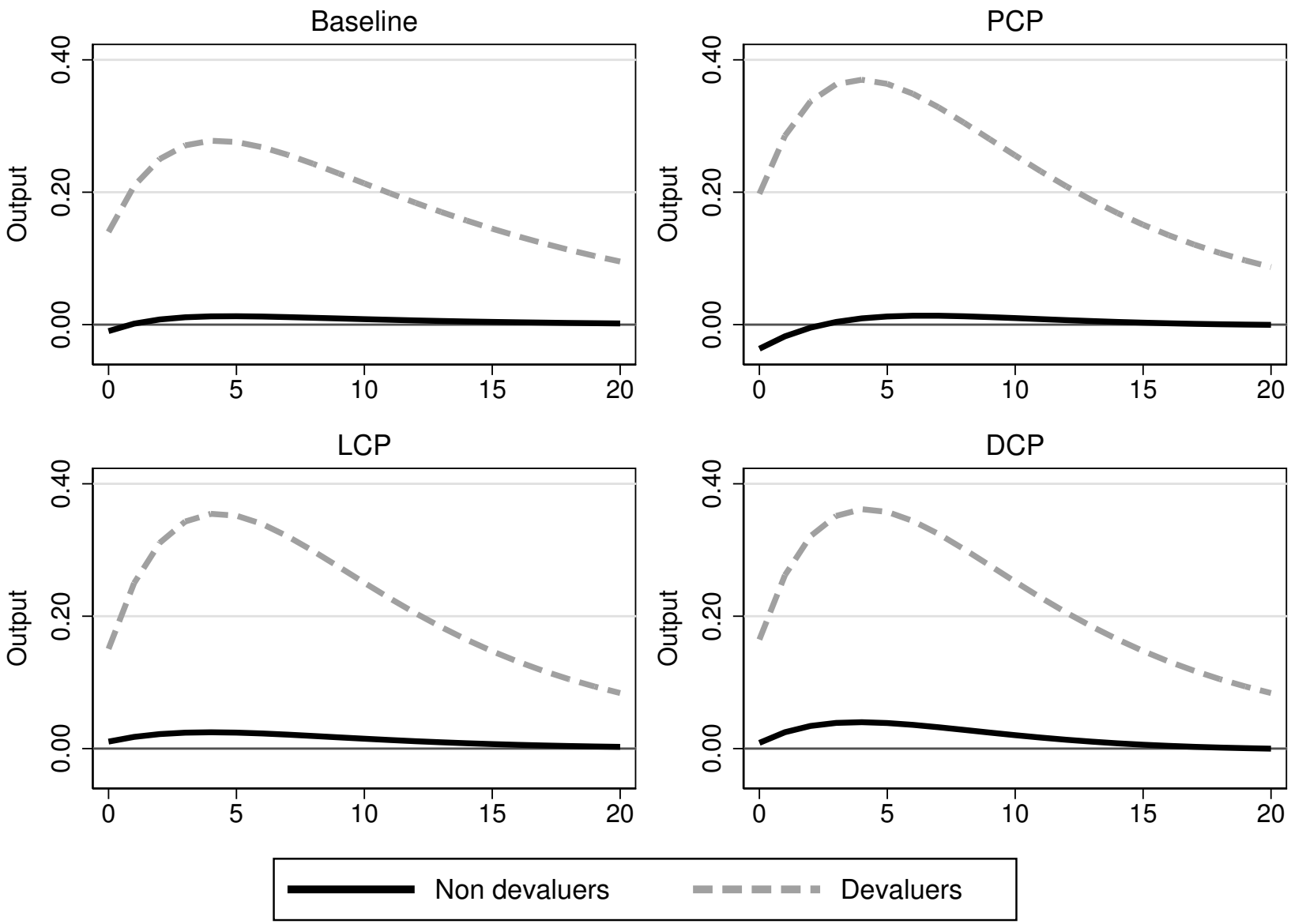
Sticky Prices (DD)

Back



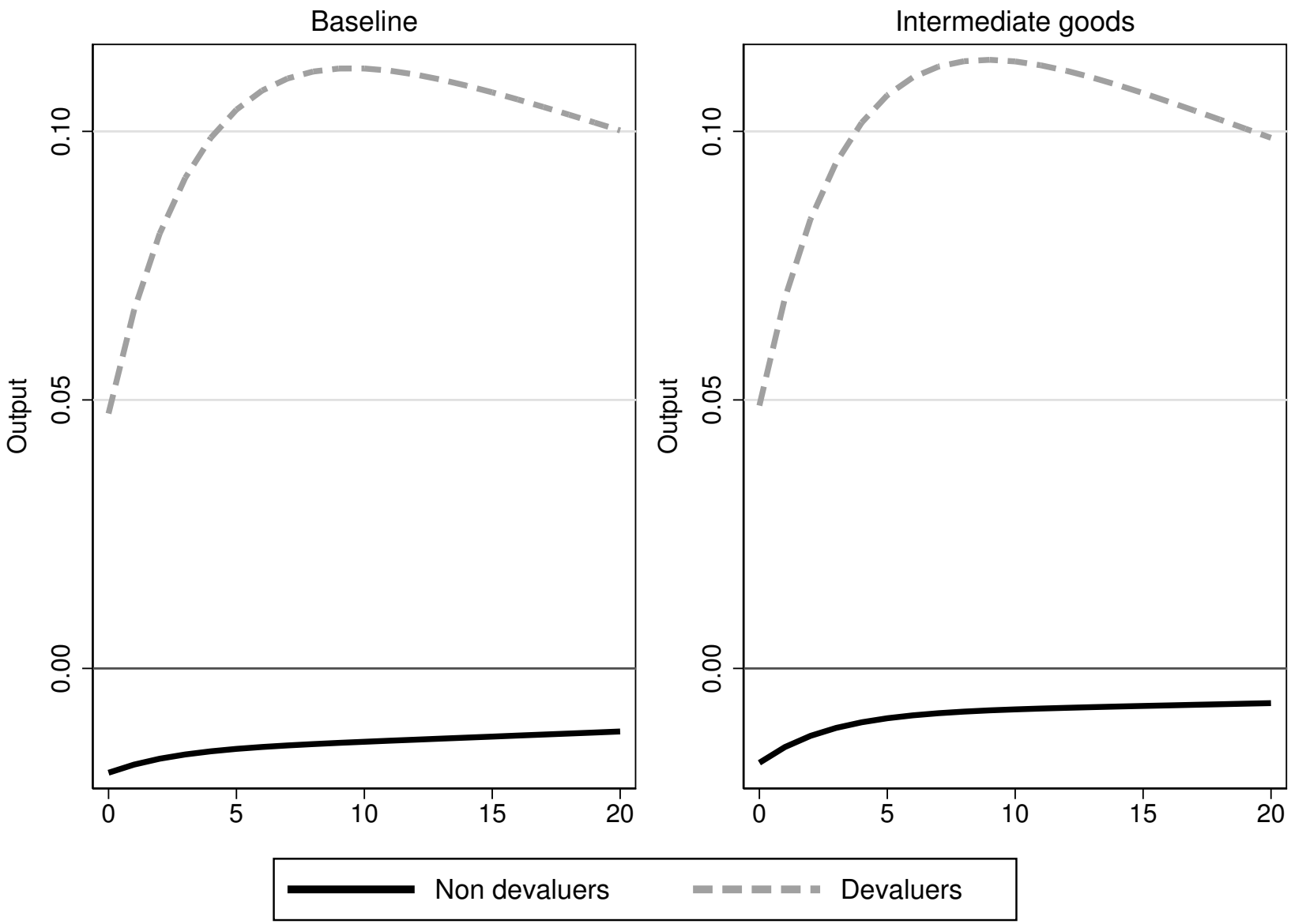
Sticky Prices (HFI)

Back



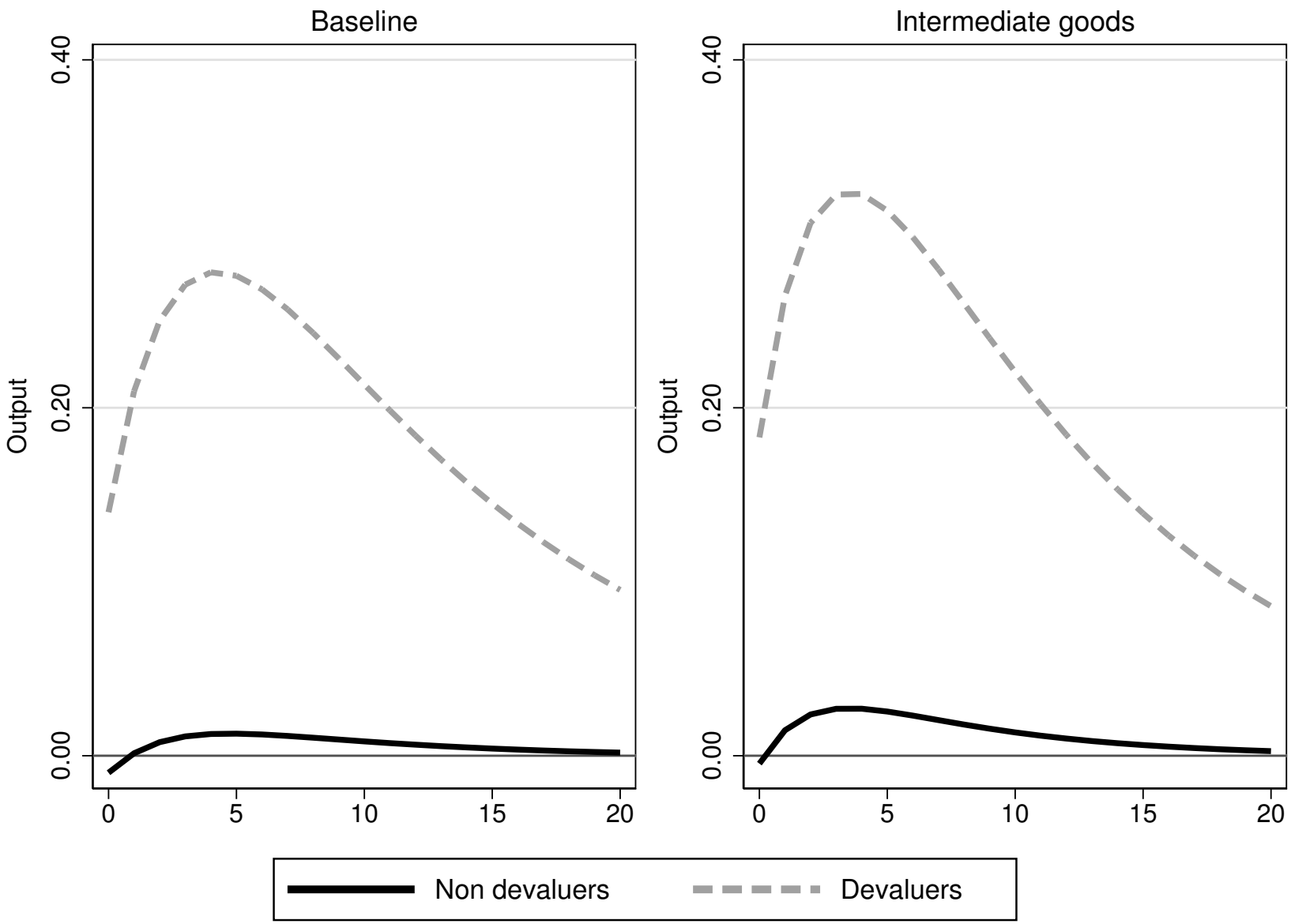
Intermediate Goods (DD)

Back



Intermediate Goods (HFI)

Back



Intermediate Goods

Back

- Until now:

$$Y_t^j = F(L_t^j)$$

- Now, assume that production is:

$$Y_t^j = (F(L_t^j))^{(1-\nu)} X_t^\nu$$

where X_t is the consumption of intermediate inputs

- Use calibration of Itskhoki and Mukhin (2023):

$$\bar{\Gamma} = 0.07 \qquad \nu = 50\%$$

Supporting Empirical Evidence

Back

- Compute trade-weighted exposure to foreign devaluation:

$$XP_t^j = \sum w^{jk} XR_t^k$$

where w^{jk} is the share of country k in country j's imports/exports

- Estimate:

$$\log\left(\frac{IP_t^j}{IP_{1930}^j}\right) = \beta \log\left(\frac{XR_t^j}{XR_{1930}^j}\right) + \gamma \log\left(\frac{XP_t^j}{XP_{1930}^j}\right) + \mu_t + e_t^j$$

Supporting Empirical Evidence

Back

	(1)	(2)	(3)	(4)
XR	0.305***	0.280***	0.339***	0.309***
	(0.084)	(0.106)	(0.094)	(0.111)
Export XP		0.196		0.440
		(0.457)		(0.508)
Import XP			-0.225	-0.413
			(0.353)	(0.375)
Observations	128	128	128	128

Candia and Pedemonte (2021)

Back

In contemporaneous work (last April), they come to a different conclusion:

> *Between August and September of 1931, the [US] export-weighted exchange rate decreases [by] 14 percent, [...] that implies a drop in economic activity of 9.4 percent, this effect would account [for] almost a third of the drop in industrial production between July 1931 and August 1932.*

What they do:

1. Regress economic activity on measure of exposure to exports to devaluing countries in a cross-section of US cities
2. Use cross-sectional estimates to discipline a general equilibrium model

Differences with what I do:

- Exporting cities being hurt would require that devaluing countries import less
  $\rightarrow$ I show it is not the case
- Monetary channel not discussed
  $\rightarrow$ Important for my results