Export-Led Decay: The Trade Channel in the Gold Standard Era

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[1]The views expressed here are solely those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Cleveland or the Board of Governors of the Federal Reserve System

Motivation

- This paper tries to contribute to two important topics in international macroeconomics and economic history
  1. Costs of fixed exchange rate (FiEX) and role of exchange rate changes in the short-run
  2. Explain depth and recovery of the Great Depression
- During the Great Depression the US and others in gold standard
- Gold standard produced a fixed exchange regime (Eichengreen (1995))
- Since August 1931, some countries left the gold standard (US in April 1933)
- Today still relevant: Euro zone and many pegged countries (Ilzetzki, Reinhart and Rogoff (2019))
- Global financial cycles (Miranda-Agrippino and Rey (2020)) increase foreign shocks

Motivation

Fixed Exchange Rates

- Evidence of cost of FiEX and Great Depression mostly relies on low-frequency aggregate data (Eichengreen and Sachs (1986), Obstfeld, Ostry and Qurenshi (2019))
- Changes in exchange rate regime are usually accompanied by other big reforms
- In the Great Depression, many things happening at the same time, hard to assign recovery of 1933 to one single policy
- In this paper we try to address these empirical issues, importance of:
  - Cross-sectional estimates, within the US, cities with different exposure
  - High-frequency data to measure effect when the shock hits
  - Shocks outside the US
- Contribution: use cross-sectional variation and detailed micro data to estimate the effect of changes in regime on economic activity

Motivation: What Produced and Ended the Great Depression

- There are theories and empirical work related with fiscal policy expectations (Temin and Wigmore (1990), Eggertsson (2008)), inflation (Jalil and Rua (2016), Hausman et al (2019)), monetary regime (Romer (1992)), etc
- Eichengreen and Sachs (1985) argue that external sector could have been affected by fixed exchange rate.
- Bouscasse (2023) evaluates aggregates across countries effects of this type of policies.
- This paper evaluates effects within country and infers aggregate effects from them
- It estimates the relative contribution of this mechanism, thanks to time-fixed effects
- Contribution: estimate the effect of the end of the gold standard in the recovery of 1933, and the role of that regime in the deepening of the depression

The Gold Standard and Exchange Rate

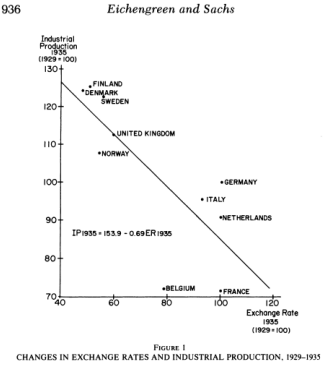


FIGURE 1
CHANGES IN EXCHANGE RATES AND INDUSTRIAL PRODUCTION, 1929–1935

This paper

- Combines rich micro-level data:
  - Economic activity at the city level with monthly frequency
  - Sectoral employment at the city level
  - Exports by destination and sector
  - Bilateral exchange rates by destination with monthly frequency
  - Prices of goods in local currency with monthly frequency
- Creates a measure of exposure at the city level to exchange rate variation depending on the sectoral employment of the city and the destination specific sectoral exposure
- Uses relatively exogenous changes in exchange rate to measure:
  - Prices pass-through
  - Effects on economic activity
- Informs aggregate effects from cross sectional evidence using GE model

Outline

Exchange Rate Measure

- We start by showing variation on the exchange rate between 1928 and 1935
- We build a measure of exchange rate with trade partners for the US
- Obtain bilateral exchange rate for 33 countries (87% of exports in 1928)
- Use exports by destination in 1928
- Normalize exchange rate to 1 in July 1931

$$Exchange\_Rate_t = \sum_{d=1}^{N_d} \frac{Exchange\_Rate_{d,t}}{Exchange\_Rate_{d,1931m7}} \times Share\_Exports_{d,1928}$$

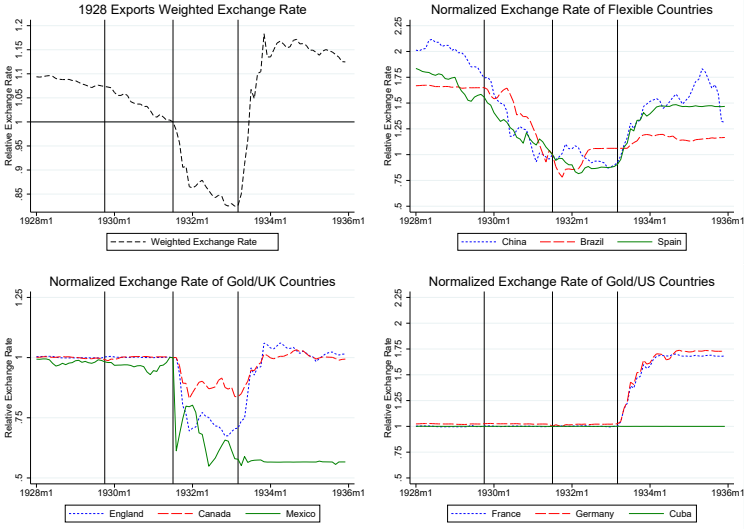
$\uparrow$ is a depreciation of the US dollar relative to the other currency

Exchange Rate Sources of Variation

Three groups of countries that generate exchange rate variation:

- **Never in the gold standard**: China, Spain, Brazil, etc
- **Left before the US**: Mexico, UK and "Pound countries", Japan, etc
- **Stayed in the gold standard after the US**: France

The Gold Standard and Exchange Rate



Vertical lines: October 1929, July 1931, April 1933. ↑ is a depreciation of the US dollar relative to the other currency

Reactions: September 1931

"As an aftermath of the break of approximately $1 in the quotation on the pound sterling since a week ago, as a result of the British suspension of the gold standard, **American shipper of commodities to England during recent weeks whose contracts call for payment in sterling face heavy losses**, now that payments are to be made in the depreciated currency"

The *New York Times*, September 27, 1931. Pg. 27

"As a result if the decline in sterling values, **export trade in cotton goods is practically at a standstill with foreign buyers...The trade is considerably disturbed by the current situation, not knowing when the current price declines in gray cloth are going to end.**"

The *New York Times*, October 4, 1931. Pg. 49

Outline

Trade Exposure Measure

- We build a measure of exposure of a city to bilateral exchange rate shocks
- We three sources of data:
  - Share of sectoral employment in 1930 of the county where the city is located (Census): 45 exporting sectors
  - Share of exports by sector-destination (DoC): 45 exporting sectors and 33 destinations
  - Monthly bilateral exchange rate (Fed): 33 countries
- Create a measure that contains information on:
  - How export oriented a city is
  - Exposure of a city to individual bilateral exchange rate change

Trade Exposure Measure: Details

$$Exposure\_Trade_{c,t} = \sum_{s} Sh\_Workers_{s,c,1930} \sum_{d} Sh\_Exports_{s,d,1928} \times Exchange\_Rate_{d,t}$$

Two main components that depend on time (t), city (c), sector (s) and destination (d):

$\sum_d Sh\_Exports_{s,d,1928} \times Exchange\_Rate_{d,t}$ = Sectoral export-weighted exchange rate

$\sum_s Sh\_Workers_{s,c,1930}$ = Sectoral exposure a la Autor, Dorn and Hanson (2013) (non-tradable sectors not included)

$\rightarrow$ The result is a time varying measure of exposure that combines trade composition of the city, with specific destination time-varying shocks

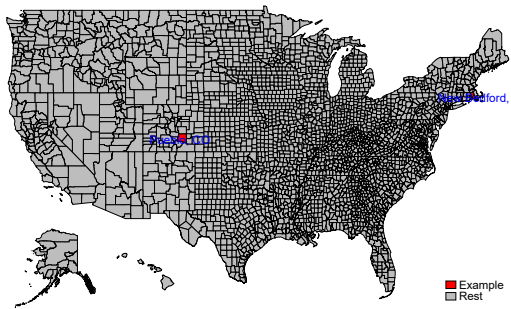
Trade Exposure Measure: Example with two cities

Pueblo, CO

- Inland, trade costly
- Home of Colorado Fuel and Iron Company: 18% of workers in steel
- Steel to Canada (44%) and Japan (18%)

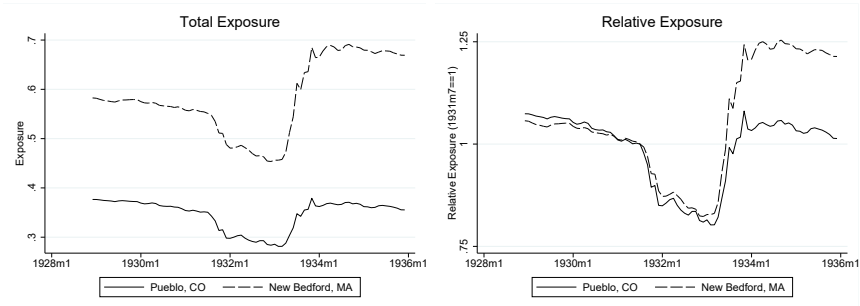
New Bedford, MA

- Coastal, open to trade
- Many cotton mills: 42 % of workers in semi-manufacturing cotton
- Cotton to Germany (25%) and UK (24%)



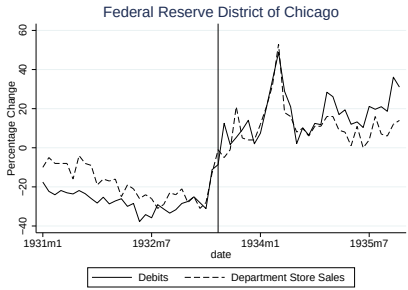
Trade Exposure Measure: Example

Figure 1: Exposure Measure for Selected cities



Measure of Economic Activity

- Bank debits at the city level with monthly variation
- Bank debits are withdrawals from bank accounts (including checks)
- High correlation with many measures of economic activity



Regressions with other aggregates

Properties of the Data

Importance of high time and cross-sectional variation for this exercise

- Cross-sectional variation: Importance to have good variation in the measure of exposure (255 cities)
- Long time series: get variation from different events
- Time variation: Importance to identify in high frequency, specially in 1933
- This exercise can use exposure to different destinations and right after the changes in exchange rate, which seems to be important given historical narrative

Effects on Economic Activity

$$\ln D_{c,t} = \gamma_c + \gamma_t + \beta \times Exposure\_Trade_{c,t} + \varepsilon_{c,t},$$

Effects on Economic Activity

$$\ln D_{c,t} = \gamma_c + \gamma_t + \beta \times Exposure\_Trade_{c,t} + \varepsilon_{c,t},$$

	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Trade	1.193***	0.836***	0.758***	2.176***	1.965***	1.564***
	(0.253)	(0.260)	(0.216)	(0.449)	(0.453)	(0.529)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	-	-	Yes	-	-
Fed-Time FE	No	Yes	No	No	Yes	No
State-Time FE	No	No	Yes	No	No	Yes
Sample	All	All	All	$\leq$1933m3	$\leq$1933m3	$\leq$1933m3
Observations	21,807	21,807	21,164	13,269	13,269	12,899
R-squared	0.990	0.992	0.993	0.994	0.994	0.995

Effects on Economic Activity

Discussion of results

- Large and significant effect in all specifications
- Considering the median exposure of a city (35 percent), a one percent city specific depreciation increases bank debits in between 0.27 and 0.42 depending on the specification
- A big part of the (rural) population excluded here. In order to account for that, we perform the same exercise, but with state level data (Hausman et al. (2019)) Cars
- We also get results for a more direct measure of economic activity, but with less time variation, using retail sales per capita at the county level (Fishback, Horrace, and Kantor (2005)), finding strong economic results. Retail

Tariffs

Aggregate policies are controlled by the time fixed effect, but some could be specific, such as the Smoot-Hawley tariff:

- This could be problematic as it can affect exchange rate
  - Exchange rate should partially offset the effect of the tariff (Jeanne and Son (2020))
- Only affects flexible exchange rate countries
- Effect of tariffs on exchange rate should go in the opposite direction, reducing the size of the effect
- Main source of variation comes from big changes in exchange rate, coming from countries exiting the gold parity

We show some robustness checks that show that tariff don't explain our results

- We exclude 1930 Less 1930
- We control by tariff at the sector level Controling for Tariffs

Other Results

- Use time fixed effect to evaluate empirically contribution of exchange rate: Time FE
  - Trade explains 16% of drop in economic activity by end of 1932
  - Trade explains 50% of increase in economic activity by end of 1934
- Robustness using Autor, Dorn and Hanson (2013) style measure: Robustness
  - Rely only on fixed shares and time FE
  - Show no pre-trend and similar results in 1931 and 1933
- Estimate price pass-through: Prices
  - Find incomplete pass-through
  - Consistent with improving terms of trade

Outline

Aggregate Effect

Simple NK model

- We got cross sectional estimates in the US for economic activity
- Between country estimates of price changes after changes in exchange rate
- From those estimates we can't know what happened with the aggregate economy: control region could expand or contract, increasing or decreasing the aggregate effect
- In this section, we try to obtain an idea of the aggregate effect
- We also try to obtain a measure of the contribution of the changes in exchange rate on output during the Great Depression

Aggregate Effect

Simple NK model

- Simple open economy NK model:
  - 1 home country with 2 symmetric regions
  - 2 foreign countries
  - Each region trades with one of those countries
  - Home country and foreign region 2 in FiEX regime

$$C_{i,t} = \left[\phi_H^{\frac{1}{\sigma}} C_{H,i,t}^{\frac{\sigma-1}{\sigma}} + \phi_C^{\frac{1}{\sigma}} C_{C,i,t}^{\frac{\sigma-1}{\sigma}} + \phi_F^{\frac{1}{\sigma}} C_{F,i,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

$$C_{i,t}^* = \left[(\phi_H + \phi_C)^{\frac{1}{\sigma}} C_{H,i,t}^{*\frac{\sigma-1}{\sigma}} + \phi_F^{\frac{1}{\sigma}} C_{F,i,t}^{*\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

Aggregate Effect

Model Equations

We derive aggregate equations related with the model. Defining the terms of trade $q_t = p_t^* + e_t - p_t$:

$$y_t = y_t^* + \left[2\sigma(1-\phi_F)\phi_F + \frac{1}{2\gamma}\left(1-2(1-\phi_F)\right)^2\right] q_t$$

$$\pi_{H,t} = \kappa \sum_{j=0}^{\infty} \beta^j \left(\alpha y_{t+j} + \gamma c_{t+j}^* + q_{t+j} + \phi_f \rho^j e_t\right)$$

$$nx_t = \phi_F \left((\phi_H + \phi_C)\left(\sigma - \frac{1}{\gamma}\right) - \frac{\gamma - 1}{2\gamma}\right) q_t$$

Aggregate Effect

Parameters

- We use parameters from Nakamura and Steinson (2014) to characterize the monetary union ($\sigma = 2$)
- We use monthly variation $\beta = 0.996$, as interest rate was relatively higher at the time
- Labor supply elasticity $\alpha = 1$
- From Nakamura and Steinsson (2014), we take the share of the local economy relative to the rest of the monetary union, using the share of non-tradable workers from Census, we set $\phi_H = 0.69 \times (1 - \phi_F)$

Aggregate Effect

Exercise

- Generate series of output, prices and shock exchange rate with foreign country 1, while in gold standard with country 2
- Find parameters ρ and ϕ_F that match empirical findings

Aggregate Effect

Exercise

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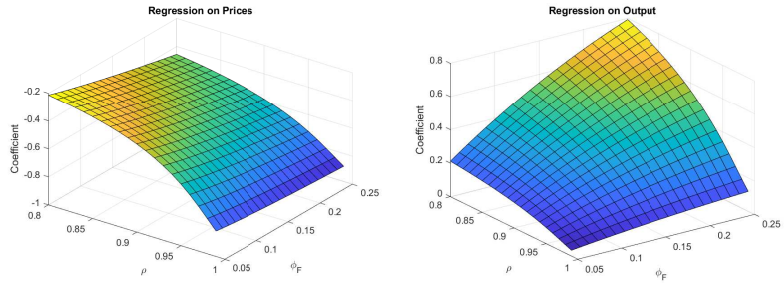
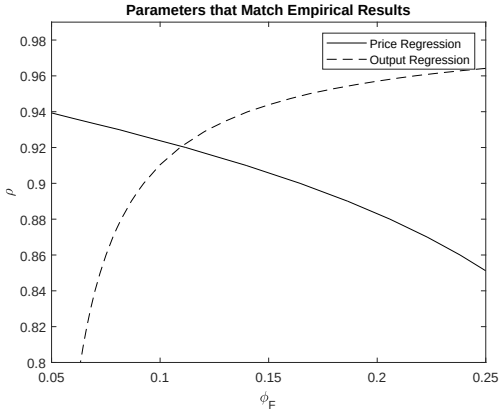
Figure 2: Regressions under Different Parameters



Parameters

Figure 3: Parameters that Match Empirical Results

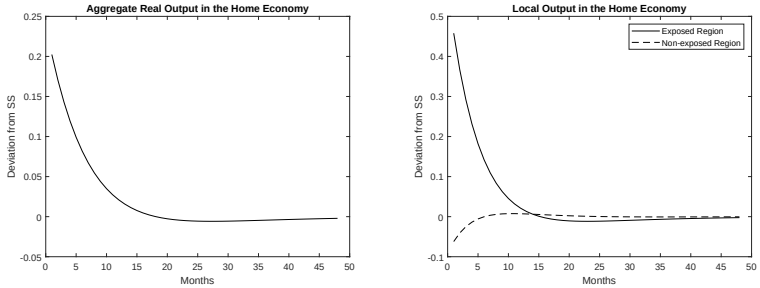


Very Persistent shock, reasonable size of the external sector

Aggregate Effects

With those parameters we can generate a shock to see aggregate effects

Figure 4: Aggregate Output after Depreciation



Region non exposed is marginally affected in at the beginning, but aggregate positive effects

Aggregate Effect

Contribution to the Great Depression

- We estimate the effect over many periods, to match the empirical findings
- 1 pp depreciation in foreign country 1 increases aggregate output by 0.32 pp
- Contribution to decay and recovery (reg results of debit on IP between 0.592 and 0.346 Table):
  - July 1931-June 1932: $\approx$ 15.7% of total decrease in economic activity ($\Delta y = -4.6\%$ over $\Delta IP = -29\%$)
  - March 1933-February 1934: $\approx$ 32% of increase in economic activity ($\Delta y = 12.5\%$ over $\Delta IP = 39\%$)

Outline

Conclusions

- Exploiting cross sectional variation at the city level in the US, we show that changes in exchange rate affect economic activity
- We estimate prices pass-through using novel natural experiment
- We use economic theory to inform aggregate effect from cross-sectional estimate
- We show that this mechanism was key to understand the decay in economic activity between 1931 and 1932 in the US and important for the recovery of 1933
- Important for today's context with more global shocks and big currency unions

Thank you!

A little heavy in the stern!

Cleveland Plain Dealer. September 22, 1931. Page 6.

Robustness: Income fixed variable

We add another variable to evaluate the effect a la Autor, Dorn and Hanson (2013)

$$Trade\_Exposure_{c,33-32} = \sum_{s} \frac{L_{c,s,1930}}{L_{c,1930}} \times \frac{Exports_{s,1933} - Exports_{s,1932}}{Exports_{s,1932}}$$

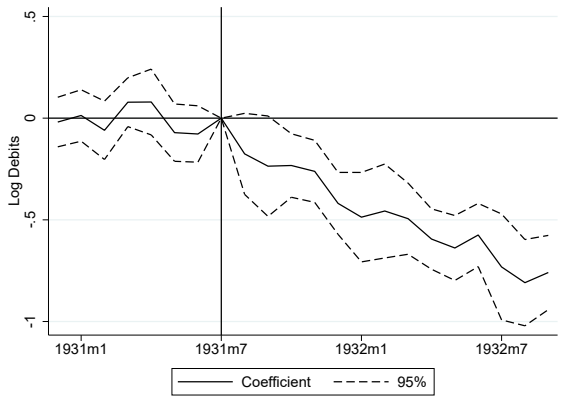
- This measure don't varies across time, so we rely on interactions with time fixed effects
- We can test for pre-trends around main events
- The measure indicates how much income received each reason in 1933

What Happened when the UK Abandoned?

$$D_{c,t} = \alpha_c + \gamma_{s(c),t} + \beta^t \times Trade\_Exposure_{c,31-30} \times \gamma_t + \varepsilon_{i,t}$$

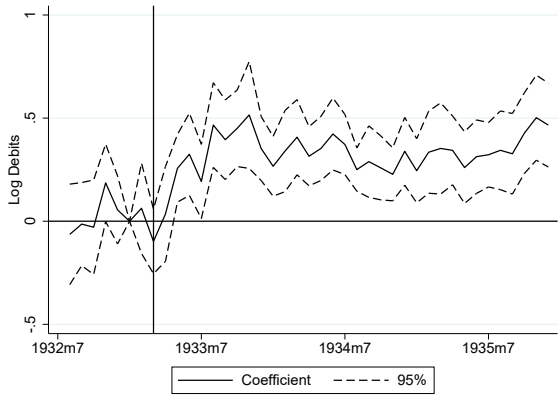
What Happened when the UK Abandoned?

$$D_{c,t} = \alpha_c + \gamma_{s(c),t} + \beta^t \times Trade\_Exposure_{c,31-30} \times \gamma_t + \varepsilon_{i,t}$$



What happened when the US Abandoned?

$$D_{c,t} = \alpha_c + \gamma_{s(c),t} + \beta^t \times Trade\_Exposure_{c,33-32} \times \gamma_t + \varepsilon_{i,t}$$



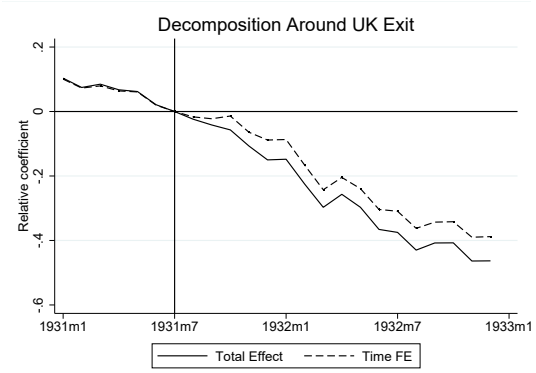
Back

Effects on Economic Activity: Results

- Significant and economically relevant results at the city level
- 1 % city specific depreciation increases economic activity by around 1 percent as well.
- Appreciation in 1931 was 15 percent and depreciation in 1933 was 35 percent
- To analyze effect, average exposure also relevant
- We then analyze around the main events comparing the average effect with the time fixed effect:
  - Time fixed effect: γ_t
  - Average exposure effect: $\beta \times \overline{Exposure\_Trade}_{.,t}$
  - Total average effect: $\gamma_t + \beta \times \overline{Exposure\_Trade}_{.,t}$

Decomposition around 1931 Event

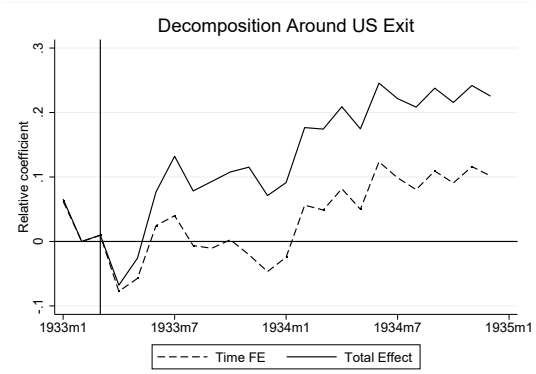
Figure 5: Effect of Exchange Rate Appreciation on Trade Exposed Cities



→ Economic activity ↓ 16 % by the end of 1931 → 40 % due to the trade channel
→ Economic activity ↓ 42 % by the end of 1932 → 16 % due to the trade channel

Decomposition around 1933 Event

Figure 6: Effect of Exchange Rate Appreciation on Trade Exposed Cities



→ Economic activity ↑ 10 % by the end of 1933 → 100 % due to the trade channel

→ Economic activity ↑ 22 % by the end of 1934 → 50 % due to the trade channel Back

Data: Prices

- We estimate the effect of changes in exchange rate on prices to account for terms of trade change $ToT_t = \frac{p_{FF,t}}{p_{HH,t}}\mathcal{E}_t$
- Incomplete pass-through implies gain in competitiveness:
  - 1% increase in exchange rate that translates to only 0.5% decrease in foreign currency prices implies that local producer receives 0.5% higher price
- We obtain monthly prices for the US, UK, France and Germany for 14 goods (commodities and food) in local currency
- We run regression over between 1929-1935, and run event studies in 1931 and 1933 to estimate effect of exchange rate variation

Price Data

- Monthly data of prices in local currency
- Differences in units: importance of country-product FE.
- We collect 14 prices for all the pairs of goods that we found:
  - Tradable: Copper, Cotton Yarn, Hides, Oats, Pig Iron, Potatoes, Wheat
  - Non-tradable: Bread, Butter, Cattle, Eggs, Hogs, Milk, Poultry
- Each price associated with an exchange rate local/US (a depreciation of local currency is an increase of the rate, a depreciation in the US is a reduction of the rate)
- Estimates will be related to foreign prices relative to the US over exchange rate

Effect on Prices

$$\Delta Prices_{c,j,t} = \beta \Delta Exchange\_Rate_{c,t} + \gamma_{j,c} + \theta_{j,t} + \varepsilon_{c,j,t},$$

Effect on Prices

$$\Delta Prices_{c,j,t} = \beta \Delta Exchange\_Rate_{c,t} + \gamma_{j,c} + \theta_{j,t} + \varepsilon_{c,j,t},$$

Table 1: Effect of Exchange Rate Changes on Prices

	(1)	(2)	(3)	(4)
Exchange Rate (log changes)	-0.500***	-0.522***	-0.507***	-0.232**
	(0.104)	(0.119)	(0.127)	(0.105)
Exchange Rate*Tradable		0.044		-0.543**
		(0.116)		(0.236)
Country-Product FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	-	-
Product-Time FE	No	No	Yes	Yes
Observations	2,719	2,719	2,719	2,719
R-squared	0.071	0.071	0.590	0.592

Effect on Prices: Discussion

- We find incomplete pass-through
- Values similar to early works in the field (Goldberg and Knetter (1997))
- Also, evidence that more tradable goods have a higher pass-through as in Burstein, Eichenbaum and Rebelo (2005)
- Smaller than numbers found in the dominant currency paradigm literature (Gopinath et al (2020))
- No clear dominant currency at the time, UK a little more dominant than the US according to Eichengreen and Flandreau (2009) and Nurkse (1944)
- Big part of the period with no change, so we estimate effect around main events

Effect on Prices: Event study

$$Prices_{c,j,t} = \beta^t US_c \times \gamma_t + \gamma_{j,c} + \varepsilon_{c,j,t}$$

Effect on Prices: Event study

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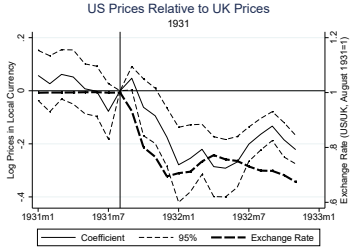

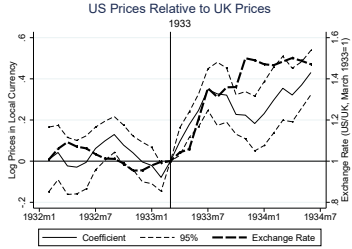

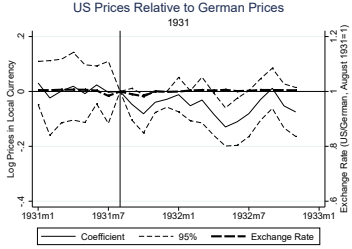

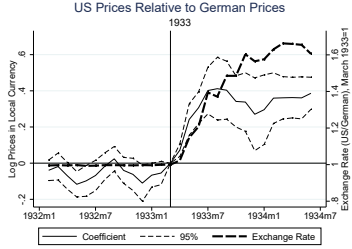

Effect on Prices: Event study

- We see changes in the relevant prices around the main events
- Changes in prices occur immediately after the changes in exchange rate
- This exercise is for a small sample of prices
- Shows incomplete pass-through in relevant pairs
- Next, see with a bigger sample what happened in terms of economic activity

Back

Measure of Economic Activity: Correlation with other measures

Table 2: Relationship of Debits with Regional Measures of Economic Activity

	Log Car Registration (State)				% Change in Department Store Sales (Fed)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debits	0.610***	1.032***	0.588***	0.349***	0.376***	0.375***	0.248***	0.226***
	(0.008)	(0.037)	(0.006)	(0.053)	(0.023)	(0.023)	(0.037)	(0.037)
Region FE	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	No	No	Yes	Yes	No	No	Yes	Yes
Obs	3,480	3,480	3,480	3,480	792	792	792	792
R-squared	0.681	0.786	0.839	0.929	0.438	0.441	0.896	0.900

Measure of Economic Activity: Correlation with other measures

Table 3: Relationship of Debits with National Measures of Economic Activity

	Industrial Production			Business Activity		
	(1)	(2)	(3)	(4)	(5)	(6)
Log Debits	0.346***	0.514***	0.592***	0.496***	0.613***	0.470***
	(0.032)	(0.029)	(0.066)	(0.026)	(0.035)	(0.051)
Sample	All	$< 1933m3$	$\geq 1933m3$	All	$< 1933m3$	$\geq 1933m3$
Observations	117	51	66	117	51	66
R-squared	0.359	0.823	0.492	0.668	0.817	0.457

Back

Measure of Economic Activity: Correlation with other measures

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Log Debits	0.346***	0.514***	0.592***	0.496***	0.613***	0.470***
	(0.032)	(0.029)	(0.066)	(0.026)	(0.035)	(0.051)
Sample	All	$< 1933m3$	$\geq 1933m3$	All	$< 1933m3$	$\geq 1933m3$
Observations	117	51	66	117	51	66
R-squared	0.359	0.823	0.492	0.668	0.817	0.457

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State Level Regressions

$$\ln C_{s,t} = \gamma_s + \gamma_t + \beta \times Exposure\_Trade_{s,t} + \varepsilon_{s,t},$$

Table 5: Log New Cars by State

	(1)	(2)	(3)	(4)	(5)	(6)
Export Trade	6.049***	3.681***	3.952***	13.358***	5.236***	6.566***
	(0.276)	(0.388)	(0.409)	(0.499)	(1.451)	(1.207)
State FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	-	No	Yes	-
Fed-Time FE	No	No	Yes	No	No	Yes
Sample	All	All	All	$\leq$1933m3	$\leq$1933m3	$\leq$1933m3
Observations	3,528	3,528	3,528	2,499	2,499	2,499
R-squared	0.758	0.929	0.961	0.846	0.925	0.960

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Exclusing 1930

	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Trade	1.194***	0.836***	0.759***	1.068***	0.764***	0.645***
	(0.253)	(0.216)	(0.260)	(0.231)	(0.203)	(0.244)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Fed-Time FE	No	Yes	No	No	Yes	No
State-Time FE	No	No	Yes	No	No	Yes
Sample	All	All	All	No 1930	No 1930	No 1930
Observations	21,807	21,807	21,164	18,747	18,747	18,188
R-squared	0.990	0.992	0.993	0.991	0.992	0.993

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Control for Tariffs

$$Exposure\_Tariff_{c,t} = \sum_{s} Sh\_W_{s,c,1930} \times Tariff_{s,y(t)}, \tag{1}$$

	(1)	(2)	(3)	(4)
Exposure Trade		1.190***	0.799***	0.737***
		(0.259)	(0.232)	(0.276)
Exposure Tariff	-0.025***	-0.174	-0.531	-0.269
	(0.004)	(0.522)	(0.502)	(0.591)
City FE	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes
Fed-Time FE	No	No	Yes	No
State-Time FE	No	No	No	Yes
Observations	21,807	21,807	21,807	21,164
R-squared	0.951	0.990	0.992	0.993

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Retail Sales per Capita

	(1)	(2)	(3)	(4)
Exposure Trade (Level)	47.465***	40.115***		
	(7.303)	(8.389)		
Exposure Trade (Change)			620.963***	575.689***
			(21.301)	(26.152)
County FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
State-Time FE	No	Yes	No	Yes
Observations	9,104	9,104	9,104	9,104
R-squared	0.925	0.937	0.932	0.941

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