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

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Abstract

Flexible exchange rates can facilitate price adjustments that buffer macroeconomic shocks. We test this hypothesis using adjustments to the gold standard during the Great Depression. Using prices at the goods level, we estimate exchange rate pass-through. Using novel monthly data on city-level economic activity, combined with sectoral employment and export data, we show that American exporting cities were significantly affected by changes in bilateral exchange rates. We calibrate a general equilibrium model to obtain aggregate effects from cross-sectional estimates. We show that the gold standard deepened the Great Depression, and abandoning it was a key driver of the economic recovery.

JEL: E32, E65, F02, F41, N12

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1 Introduction

Many countries have used some sort of fixed exchange rate in past decades. There is an extensive literature that justifies its use as a way to promote price and financial stability. A fixed exchange rate has been used in the form of unilateral pegs (e.g., Argentina in the 1990s), monetary unions (euro area), or a commitment to international monetary rules (gold standard). But its use can have negative implications in an economic crisis, hindering the adjustment of relative prices and the associated external re-balancing, as Milton Friedman pointed out.[1] This paper shows that this happened in the US during the Great Depression. We show that the gold standard deepened the Great Depression, and leaving it significantly contributed to the economic recovery that started in 1933.

Using monthly data on economic activity at the city level in the 1930s, we show that cities that specialized more in exports were significantly affected by exchange rate appreciations, relative to cities that were less export oriented. We analyze events that occurred outside the US, but affected the US external sector. In particular, we study the large appreciation of the US dollar in 1931, when several countries, mainly the UK and Canada, abandoned the gold standard. Then we show that exporting cities exposed to the depreciation led the economic recovery that started in April 1933, when the US went off the gold standard, depreciating its currency.

We gather several data sets to document these facts. Using nominal and real measures of trade at the monthly level, we first document that US exports were particularly affected between October 1929 and March 1933. Then, using bilateral monthly exchange rates between the US and its trading partners, we construct a measure of an export weighted exchange rate. We show that after a stable exchange rate, the US experienced a large appreciation of its currency in August 1931, when the Mexican peso depreciated. One month later, the UK left the gold standard, followed by several countries whose currencies were tied to the British pound. We also document that the US experienced a significant depreciation relative to its trading partners in April 1933, when President Franklin D. Roosevelt took the United States off the gold standard.

The gold standard limited the adjustment of the US dollar, which had an impact on

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[1] See Friedman (1953).

the competitiveness of the external sector. We first study how changes in the exchange rate affect relative prices. Using prices for tradable goods in local currency for the US, the UK, Germany, and France, we estimate exchange rate pass-through into prices. We find an incomplete price pass-through of about -0.5 percent in foreign prices in the local currency after a 1 percent depreciation of the US dollar. This finding implies an increase in the foreign price relative to the local price of the tradable good: The local good becomes cheaper in the foreign market and the foreign good becomes more expensive in the local market, inducing expenditure switching. We also document a similar pattern for the main events we evaluate: the UK abandoning the gold standard in 1931 and the US in 1933.

We then turn to evaluating the effect on economic activity. We construct a measure of trade exposure at the monthly and city levels, using census data, destination-sector-specific exports from the US in 1928, and the monthly bilateral exchange rate of the US with 33 destinations. We measure exposure to trade at the city level as a weighted sum of sectoral trade exposures, where we weigh by the 1930 share of workers in a city and sector. To compute sectoral trade exposure, we calculate a sector-specific weighted exchange rate, where the weight on each destination's bilateral exchange rate is given by the sector's export share for that country. We aggregate over 45 exporting sectors, obtaining high cross-sectional and time variation across cities.

This measure contains two main components: First, as we consider employment share in the exporting sectors over total employment, the variable shows how specialized a city is in terms of overall exports. The exporting sector was particularly affected in the Great Depression, so it works in the same way as other measures of trade exposure, such as the one used in Autor, Dorn, and Hanson (2013). Second, that component sums over the sector-specific weighted exchange rates, which varies according to country-specific movements, depending on how important they are as a destination of US exports. Therefore, the measure interacts city-level export exposure with monthly variation coming from the exchange rate of countries that are more important sectoral destinations than others. Thanks to these features, we can control for time fixed effects, exploiting the cross-sectional variation and differential exposure to exchange rate shocks. We combine this measure with rich city level weekly economic activity coming from manually transcribed Fed documents. Each week, the Fed reported bank debits (or banks withdraws, including checks) for over 250 cities. We aggregate this variable at the monthly level. We show that, for different levels of aggregation, this variable works as a very good proxy of economic activity. Moreover, we run robustness exercises with other variables of economic activity with lower levels of aggregation to confirm our main results.

Using these measures, we show that cities with full trade exposure increased their economic activity by 0.76 percent after a 1 percent city-specific depreciation.[2] We then evaluate particular events using the measure of trade exposure and also Bartik-type instruments. We start with the events of August and September 1931, when the Mexican peso was devalued and the UK left the gold standard, depreciating the British pound relative to the US dollar. All of these events produced an appreciation of the US dollar of more than 15 percent relative to US trading partners. We show that following a common pre-trend, cities with higher trade exposure exhibited an important drop in economic activity relative to non-exposed cities.

After measuring the importance of exchange rate movements for the external sector in the US, we explore the depreciation of 1933. US economic activity started to increase after President Roosevelt's inauguration. We show that starting in April 1933, cities exposed to exports to destinations whose currencies the US dollar depreciated the most in 1933 increased their economic activity more rapidly than cities with lower exposure. These results suggest that a flexible exchange rate plays an important role in buffering macroeconomic shocks.

Then, we use a general equilibrium model to inform the aggregate effects. The model has two regions, each exposed to a different foreign country, so we can simulate a depreciation in one region while the other remains in a fixed regime. The model generates a series of data that allow us to replicate the regressions that we estimate in the empirical part. We calibrate the model to match the empirical findings of the paper. We find that the aggregate effect is smaller than the cross-sectional estimates. A 1 percent depreciation that affects half of the exporting sector of the economy should increase economic activity by 0.32 percent in our sample. Considering the size and

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[2] The average trade exposure is 0.35, implying an average effect of 0.27 for a 1 percent city depreciation, given the level of tradability of the cities.

the importance of the exchange rate movements, this result suggests that the events of 1931 and 1933 had important aggregate consequences for the US economy. This shock can explain about 14.2 percent of the decline in economic activity between 1931 and 1932, and about a third of the increase in economic activity between 1933 and 1934.

Many works have focused on the Smoot-Hawley tariffs and the size of the foreign trade sector (Lucas Jr 1994, Cole, Ohanian et al. 1999).[3] Crucini and Kahn (1996) shows that tariffs significantly affected GDP during the Great Depression, even though the size of the external sector was relatively small. We show that the exchange rate variation was an important driver of the Great Depression. We combine empirical and theoretical evidence to show that the trade channel explained a large share of the recovery in 1933. Industrial Production increased between March 1933 to March 1934, from 48% to 71% of its level in September 1929. Our model suggests that the depreciation explains between 32 percent of that increase, or 7 percent of industrial production growth, which is close to the US external sector size before the Great Depression.

This paper shows that the trade channel was also an important driver of the depression, not just the recovery. We show that the appreciation of 1931 affected the aggregate economy and contributed significantly to the decline in economic activity between 1931 and 1932. This paper is the first to estimate the size of that effect quantitatively.

The gold standard and fixed exchange rates continue to be of interest, both in the US and abroad. Diercks, Rawls, and Sims (2020) show that such a monetary regime in the context of a closed economy would have decreased welfare and produced more instability in the last 20 years due to the volatility of the price of gold. In this paper, we do not focus on the domestic money supply, but on the implications of the exchange rate regime. Along those lines, Obstfeld, Ostry, and Qureshi (2019) find that fixed exchange rate regimes magnify global financial shocks. The implications of the exchange rate regimes can be larger due to countries' increased vulnerability to the global financial cycle, as shown by Miranda-Agrippino and Rey (2020) and in a context where most countries remain somewhat pegged to other currencies, in particular the US dollar, as shown by Ilzetzki, Reinhart, and Rogoff (2019). In this paper, we show that the trade

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[3] We address the effect of tariffs and how this can affect our results when we discuss the empirical findings. In Appendix A.6, we run robustness exercises where we control for time-varying tariff, showing that our results are unaffected by that variation.

sector would also be affected by that vulnerability.

Thanks to the cross-sectional and time variation, we can measure how important the expenditure switching channel is. Once a country depreciates its currency, a monetary easing, and an expenditure switching affect economic activity jointly (Bouscasse 2021). Thanks to the unique panel structure, we can use time-fixed effects to control for the aggregate variation and measure the cross-sectional effect that is dominated by the expenditure switching. The events of the 1930s and the properties of the data are unique, making the exercise of this paper particularly suitable for measuring these effects. First, even today is hard to obtain a panel of high-frequency data on economic activity at the city level with monthly variation and exposure to particular destinations. Secondly, the size and characteristics of the changes in the exchange rate are usually rare today. In March 1933, the US Dollar had a sudden devaluation of almost 30 percent relative to their trade partners, an event that is usually not seen in periods of complete or partial flexible exchange rate. Moreover, as many countries remained in the gold standard, and other tied to the US Dollar, we can explore cross-sectional variation on the expenditure switching, controlling for common monetary easing and price changes. Because of those reasons, these events are unique to estimate these channels and can be used to learn about their implications today.

We find that the expenditure switching channel effect was large. Farhi and Maggiori (2018) show that a motivation to devalue the hegemon's currency, in a Triffin (1961) dilemma fashion, is the size of the expenditure switching channel. While there was likely a multipolar world at the time, with the UK pound and the US dollar as dominant currencies, the expenditure switching channel should be relevant for the exports of the dominant currency country (Gopinath et al. 2020). We also provide narrative evidence on how exporters where affected by the changes in the currency value. We find that the expenditure switching channel is important and explains large changes in economic activity. The relevance of this channel has important implications for optimal exchange rate policy (Itskhoki and Mukhin 2022) and policy coordination in the context of dominant currency (Egorov and Mukhin 2020).

On the economic history side, many theories try to explain why March 1933 marks a turning point in economic activity in the US. Among those policies, there are works that study the effect of expectations (Temin and Wigmore 1990; Eggertsson 2008;Jalil and Rua 2016); monetary policy (Romer 1992), and its redistributive effects (Hausman, Rhode, and Wieland 2019); fiscal policy (Fishback, Horrace, and Kantor 2005b), and its interaction with monetary policy (Jacobson, Leeper, and Preston 2019), among others. The amount of competitive (or complement) theories reflect the fact that several policies were implemented at that time,[4] Eichengreen and Sachs (1985), Campa (1990), and Bernanke (1995) have shown that countries that left the gold standard recovered faster than countries that remained on gold. There are many mechanisms linking currency depreciation and recovery. Using adjustments to the gold standard during the Great Depression, Bouscasse (2021) shows that devaluation did not depress trading partners' output since the monetary stimulus to foreign demand offsets the expenditure switching effect. We contribute to this literature by looking at the US cross-sectional effects and, from them, learn about the aggregate effects.

This paper is also closely related to the literature on the role of the exchange rate in economic growth in the short run. In the short run, currency changes can have an effect on economic activity in the presence of market power and other rigidities, as explained by Dornbusch (1987). The conditions discussed in that paper are met in an open economy New Keynesian model, where a key variable in evaluating the effect of exchange rate movements is the price pass-through. Many papers have empirically estimated exchange rate pass-through in different periods of time, such as Feenstra (1989) and Knetter (1989). Goldberg and Knetter (1997) summarized those and other early works. Recent work has considered other variables, such as the currency of invoicing as in Gopinath, Itskhoki, and Rigobon (2010) and Auer, Burstein, and Lein (2021). We add to this discussion by also estimating the exchange rate pass-through in Section 3 using large changes in the exchange rate due to changes in regime. We find results similar to the one discussed in Goldberg and Knetter (1997).

The exchange rate is a flexible price, which implies a quick adjustment in terms of prices, as suggested by Friedman (1953). We find a historical narrative supporting this channel, where local producers reported damages weeks after the shock. Thanks to high-frequency data, this paper shows that large appreciations can quickly and inten-

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[4] That month Roosevelt began his first term. He immediately implemented a battery of policies during a period called the "Hundred Days."

sively damage economic activity. [5]

Finally, we add to the literature on the costs of fixed exchange rates, mainly when local shocks occur. For example, Obstfeld and Rogoff (1995) discuss that when a shock affects demand for local goods (namely, a productivity shock that affects the terms of trade or some shock abroad that reduces the demand for local goods), a fixed exchange rate will damage the local economy, since local producers' prices will not be able to adjust. These arguments have been used to analyze the Latin American crisis in the 1980s and the euro crisis in 2009. In both cases, there have been discussions about the role of the fixed exchange rate in deepening the crisis. Eichengreen et al. (2014) discuss the similarities between both cases and the role of external adjustment (particularly with constrained fiscal instruments).

This paper is organized as follows. In Section 2 we document the trade and exchange rate dynamics during the Great Depression. In Section 3 we examine the connection between trade exposure and price adjustment. In Section 4 we focus on local exposure and economic activity. In Section 5, we show robustness results. In Section 6 we use a model to evaluate the aggregate effects from the cross-sectional estimates and in Section 7 we conclude.

2 The Trade Channel

The US dollar experienced a large depreciation in March 1933. After years on the gold standard, the US abandoned it days after President Roosevelt's inauguration. The gold standard was configured as an international system, where the exchange rate was fixed between the economies that participated (Eichengreen (1996)).

As stated by Bernanke (1995), understanding the Great Depression is the Holy Grail of macroeconomics. Eichengreen and Sachs (1985) argue that the length and depth of the Great Depression and the recovery from it can be explained by the fixed exchange rate regime. Under this type of regime, local shocks have long and profound effects on economic activity due to the lack of adjustment of the external sector. The flexible exchange rate, on the other hand, enables price adjustment, which reduces the de-

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[5] Forbes (2002b) and Forbes (2002a) explode cross-sectional variation on firms to show short-run effects of trade on economic activity. Fajgelbaum et al. (2020) also shows how protectionism can rapidly affect welfare.

cline in competitiveness. In this paper, we evaluate this mechanism empirically using novel micro data. We complement Eichengreen and Sachs (1985) evidence by exploiting cross-sectional variation in the US. This cross-sectional variation comes from novel data on high-frequency economic activity, bilateral international trade indicators, and census data. This variation allows us to control for common shocks across the US in a given period of time and identify the contribution of the mechanism.

We start by showing some stylized facts in this section. We construct a measure of the export-weighted exchange rate for the US. The US was not the first country to abandon the gold standard. Mexico abandoned it in August 1931 after the monetary reforms called "Plan Calles," the UK left in September 1931,[6] and other countries had had flexible regimes since the beginning of the Great Depression. This variation generates many exchange rate shocks depending on the exposure of exporting sectors to those countries. The objective of this measure is to have a general idea of the main changes in the exchange rate that the US experienced during the Great Depression. To construct this measure, we obtain bilateral exchange rates at the monthly level for 33 countries representing 86.6 percent of total US trade with foreign countries in 1928.[7] We define the exchange rate as the US dollar over the foreign currency, so an increase in the indicator represents a depreciation of the US dollar. We normalize the exchange rate of each country to July 1931 (equal to 1). Then, we construct a weighted exchange rate, where the weight of each bilateral exchange rate is the fraction of total exports that goes to that country in 1928.[8] Figure 1 shows the evolution of this export-weighted exchange rate and the normalized bilateral exchange rate for some particular countries.

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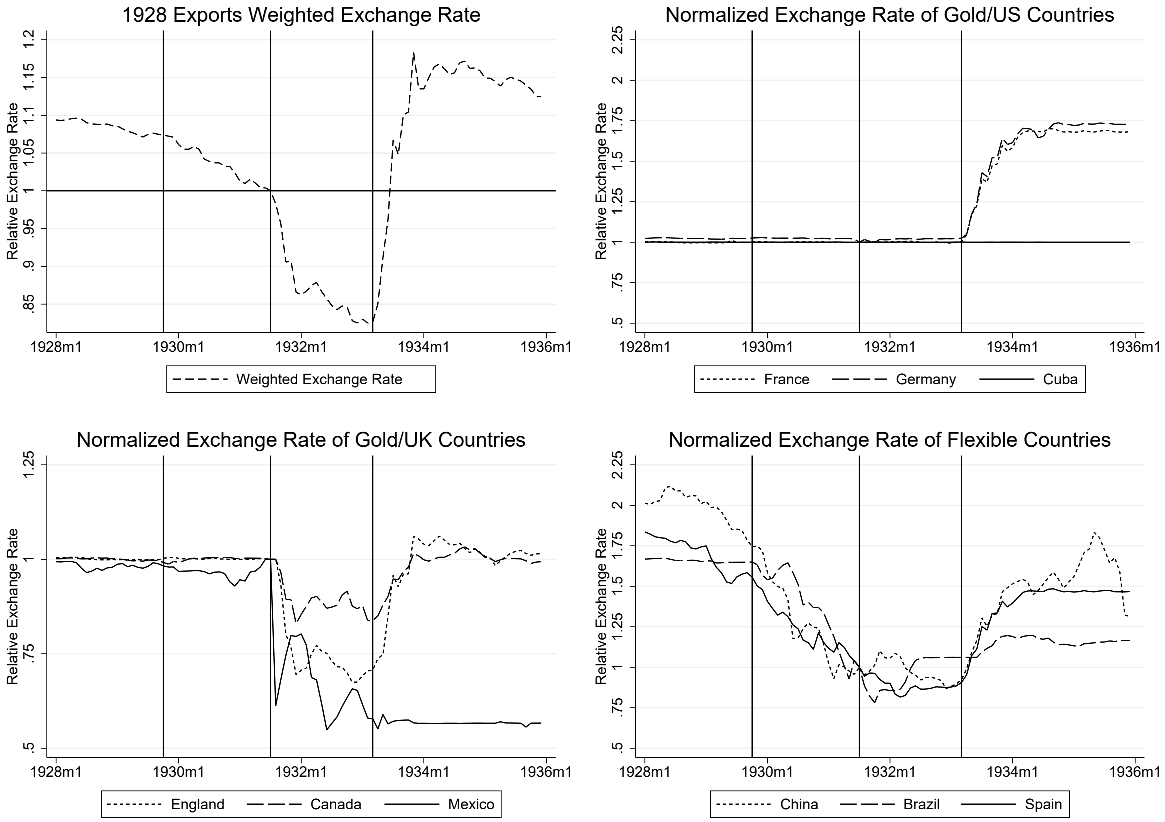
[6] Farhi and Maggiori (2018) argue that the exit of the UK and the subsequent devaluation of the sterling were due to stabilizing needs in line with the Triffin dilemma (Triffin (1961)). This need was explained by the high fiscal imbalances and the banking losses that followed the German financial crisis.

[7] From the Federal Reserve Bulletins. We obtain data for Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, the UK, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, Yugoslavia, Canada, Cuba, Mexico, Argentina, Brazil, Chile, Colombia, Uruguay, China, Hong Kong, India, and Japan

[8] Solomou and Vartis (2005) use a similar strategy for the UK. Our data for the exports comes from the Monthly Summary of Foreign Commerce of the United States from the U.S. Department of Commerce, Bureau of Foreign and Domestic Commerce

Figure 1: End of Gold Standard and Exchange Rates



Notes: The upper left panel shows the weighted nominal exchange rate for the US. This measure is constructed by calculating the share of US exports in 1928 to 33 economies that represent 86.6 percent of total exports that year. Each bilateral exchange rate is normalized to one in July 1931 and we construct a weighted average, where the weights are export shares. The upper right, lower left and lower right panel represent the bilateral nominal exchange rate between the US and selected countries as indicated in each panel. Each bilateral exchange rate is normalized to 1 in July 1931. Vertical lines indicate October 1929, August 1931, and March 1933. The exchange rate is defined as the US dollar over the foreign currency.

The upper left panel of Figure 1 shows that the weighted exchange rate of the US had been slowly appreciating since 1928. This is mainly due to countries that did not have a fixed exchange rate with the US, such as China (2.7 percent of total exports in 1928), Brazil (2 percent), and Spain (1.7 percent), as shown in the lower right panel. In August 1931 we can see a large appreciation of the US dollar relative to its trading partners. Mexico (2.6 percent) had a large depreciation of its currency that year as seen in the lower left panel. Then, the most important trade partners of the US -Canada (17.1 percent of total exports in 1928), the UK (16.6 percent), and the countries tied to the British pound- also depreciated their currencies. Other countries remained tied to gold, such as Germany (9.1 percent), France (4.7 percent), and Cuba (2.5 percent), so the exchange rate with these countries was not affected in 1931, as seen in the upper right panel. Then, when the US abandoned the gold standard, the US dollar experienced a large depreciation. This was produced by a depreciation relative to the countries that were not tied to gold, such as Canada and the UK, but also relative to the countries that remained on the gold standard, such as France and Germany. A few countries such as Cuba, remained tied to the US dollar.

Figure 2 shows that following these main events, measures of trade also reacted. Exports and quantities of exports decreased sharply during the Great Depression. Panels 1, 2, and 4, show that after the depreciation, exports experienced an increase as measured by value and volume. This trend coincided with the evolution of industrial production, which also strongly increased starting in April 1933, as shown in panel 3 of Figure 2.

These figures also show that the Great Depression was characterized by a large drop in exports. The US was not able to gain competitiveness using its currency. This situation was exacerbated when the UK and other economies tied to the British pound depreciated their currencies in 1931. Before October 1929, exports were slowly growing according to many measures, as well as economic activity. The gold standard worked in a cooperative way until 1928 (Eichengreen (1996)), but as October 1929 approached, that cooperation ended, producing a tightening of the money supply that increased the effects of the great crash.[9] During the years of the depression, real exports dropped almost 70 percent while industrial production dropped by a similar magnitude.

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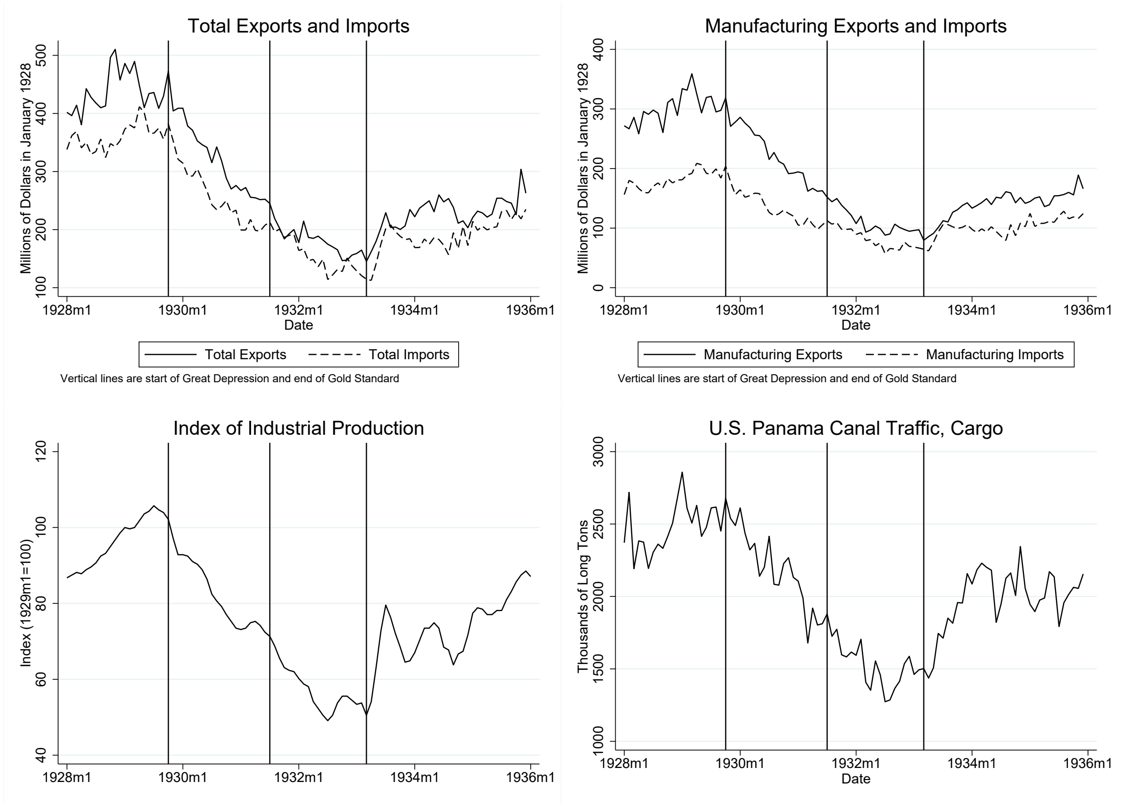
[9] Bernanke (1995) argues that the largest factor behind the monetary contraction in the US was the instability of the banking sector, while the collapse of the gold standard dominated outside the US.

Figure 2: End of Gold Standard and Trade



Notes: The upper left panel (panel 1) is seasonally adjusted total exports in millions of dollars normalized by the CPI (base January 2008). The data come from the NBER Macrohistory Database. The upper right panel (2) is the seasonally adjusted total exports in manufacturing in millions of dollars normalized by the CPI (base January 2008). The data come from the NBER Macrohistory Database. The lower left panel (3) shows monthly industrial production, normalized to January 1929 (100). The data come from the Fed's G.17 Industrial Production and Capacity Utilization. The lower right panel (4) is the seasonally adjusted long tons of US cargo in the Panama Canal from the Panama Canal Record, available in the NBER Macrohistory Database. Each bilateral exchange rate is normalized to 1 in July 1931. Vertical lines indicate October 1929, August 1931, and March 1933.

Depreciation lowers the price of American goods in terms of foreign currency, enhancing the competitiveness of exports. By March 1933, US exports reached their lowest value since 1929. The manufacturing sector (66 percent of total exports in September 1929) was particularly hit. In March 1933, manufacturing exports in real terms were 73 percent lower than in September 1929. Exports of crude materials (32.5 percent of exports in September 1929) decreased 50 percent. By March 1934, manufacturing exports were 85 percent higher, while exports of crude materials was 50 percent higher than one year before. After that low point in March 1933, the value of exports grew by 75.21 percent over the next six months. This effect was not only caused by rising prices. By April 1934, the weight of US cargo in the Panama Canal was 53.3 percent higher than in April 1933.

Relevant economic stakeholders at the time suggested that the volume of trade could have been even much greater after the United States went off the gold standard. The expansion of exports was hindered by the instability of the dollar. With the dollar falling in value, it was convenient for foreign importers to delay purchases of American goods in anticipation of further depreciation. Patch (1934), quoting a speech made in December 1933 by the head of the Foreign Credit Interchange Bureau of the National Association of Credit Men, William S. Swingle, reveals the thinking of the time:

> *An imposing backlog of orders is piling up abroad while customers for American products wait for the dollar to settle to a permanent level. They refuse to make advance commitments for fear competitors will be able to buy similar goods at a more favorable price later. A desire to profit by exchange is also having an effect upon collections in many foreign markets. Payments for shipments are being delayed in the hope that the dollar will be lower when the final settlement for goods purchased is made.*

According to him, foreign purchasers avoided making long-term commitments in the hope of receiving more American goods for the same amount of money. Patch (1934), now quoting the secretary of the Export Managers Club of New York, said: "Foreigners are buying more goods, but their purchases are made up of small orders placed at frequent intervals and represent no long-time commitments."

Depreciation also increases the price of imports of the depreciated currency, which would discourage the demand for foreign goods. However, after the United States abandoned the gold standard in the spring of 1933, the value of imports (seasonally adjusted) grew without interruption until August 1933, accumulating a growth of 84.6 percent as shown in Figure 2. The initial increase in imports is consistent with the empirical evidence provided in Blaum (2019), who shows that large devaluations are characterized by an increase in the aggregate share of imported inputs and by the reallocation of resources toward import-intensive firms, because large exporters are also large importers (Amiti, Itskhoki, and Konings (2014), Bernard et al. (2007), and Albornoz and García-Lembergman (2020)).[10] The effect on net exports is ambiguous.[11] This narrative and the quantitative evidence show that the external sector expanded starting in April 1933.

The opposite mechanism occurred when other countries abandoned the gold standard. When the UK left the gold standard in September 1931, newspapers at the time warned about the consequences for the US export sector. The *New York Times*, for example, highlighted the potential gains for the UK, expecting an increase in England's exports while increasing American imports. The Times considered that the US would experience "a temporary reduction in the standard of living." The article was optimistic about an increase in the UK's demand for US raw materials, which can explain why crude material exports did not decline as much as manufacturing exports during the Great Depression. This optimism did not last long: On October 4, the same newspaper documented that American cotton exports were stagnant. The paper attributed this situation to the "decline in sterling values," describing a "steady decline in prices." The article highlighted that it did not know when the price decline was going to stop.

The changes in exchange rate produced quick and unexpected effects. When contracts were in foreign currency, a depreciation of that currency created immediate effect in terms of income to the exporters, which could have been transmitted directly to the local economy. In September 27, 1931, The *New York Times*, page 27 posted: "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." This article shows how fast prices adjusted. That is why, in this paper we focus on short term variables, to evaluate those immediate effects. The *New York Times*,

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[10] Patch (1934) argues that the initial growth in imports was due to the sharp increase in industrial activity and the need for replenishing stocks of raw materials. With the dollar falling in value, it was convenient for importers to accumulate large stocks of foreign products in anticipation of further depreciation of the dollar. According to this author, the loss of purchasing power of the US dollar became an obstacle for importers by July 1933, as reflected in the decline of the year-over-year growth rate of imports, while the export growth rate increased progressively after August 1933.

[11] The increase in net exports is related to the elasticity of substitution between the local and foreign variety. We address this point in Section 6. In addition, see Gali and Monacelli (2005)

August 30, page N15, described similar problems when Mexico depreciated, saying that "many of the companies have been forced to pocket a loss as high as 25 per cent." These two articles highlight how important and fast the effect of foreign currency depreciation were.

We turn now to estimating the exchange rate mechanism empirically. In the next section, we evaluate changes in competitiveness due to changes in the exchange rate during the Great Depression. With this we can account for changes in the terms of trade for certain goods to see if we should expect benefits for the external sector. Then, we measure the effect on economic activity, comparing the economic performance of more export-oriented cities relative to less export-oriented cities.

3 Competitiveness Effect of Changes in Exchange Rate

We start by studying whether changes in exchange rates had an effect on prices. The amount of pass-through is relevant for understanding the gain in competitiveness for local producers. For example, if the US dollar depreciates by 1 percent, and at the same time the prices of American products in the UK decrease by 1 percent, US producers will receive the same revenue from any foreign sales. This measure is directly related to changes in the terms of trade.

In order to have incomplete pass-through in economic models, many works, such as Atkeson and Burstein (2008), have focused on variable markups. Incomplete pass-through can also be achieved in a New Keynesian model with sticky prices and some level of substitution between varieties as in Monacelli (2005).[12] After a negative local shock, the external sector of the domestic country loses competitiveness through an increase in the price of the tradable good produced domestically relative to the price of the same good produced abroad. On the other hand, under the flexible regime, the exchange rate buffers the loss of competitiveness, mitigating the negative impact of the shock. Consequently, under a fixed exchange rate, the recession is deeper and longer lasting.

For this reason, we estimate exchange rate pass-through to evaluate the extent of the changes in the terms of trade. We gather prices for 14 products for the US, the

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[12] The market conditions to achieve that result were proposed in Dornbusch (1987).

UK, France, and Germany. We do not have data for all of the goods and all of these countries, but we do have data for all of the products at least in the US and another country.[13] We use monthly data from 1928 to 1934 for most products.[14] Source and details of the data source is shown in Table A.5. Most prices come from wholesale prices in local markets and some retail prices. We run the following regression to see the effect of the exchange rate on prices:

$$\Delta Log(Prices)_{c,j,t} = \beta \Delta Exchange\_Rate_{c,t} + \gamma_{j,c} + \theta_{j,t} + \varepsilon_{c,j,t}, \tag{1}$$

where $\Delta Log(Prices)_{c,j,t}$ is the monthly change in log of the price of the good j in country c at time t. $Exchange\_Rate_{c,t}$ is the log bilateral exchange rate (US/c) with respect to country c at time t. We also add a country-product fixed effect ($\gamma_{j,c}$) to control for specific country-product trends in some prices, and a product-time fixed effect ($\theta_{j,t}$) that controls for any general effect on prices and also for any product-specific shock or seasonality. Standard errors are clustered at the product-country level and at the time level. We also run regressions up to March 1933, when changes in exchange rate were coming from outside of the US. Table 1 shows the results.

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[13] The products are bread (France and US), butter (UK and US), cattle (UK and US), copper (Germany and US), cotton yarn (Germany and US), eggs (UK and US), hides (Germany and US), hogs (Germany, UK and US), milk (UK and US), oats (UK and US), pig iron (France, Germany, UK, and US), potatoes (UK and US), poultry (UK and US), and wheat (France, Germany, UK, and US).

[14] Data for pig iron are not available for the UK in 1934, and data for wheat are available until November 1934 for the UK and June 1934 for France.

Table 1: Effect of Exchange Rate Changes on Prices

	(1)	(2)	(3)	(4)
Exchange Rate (log changes)	-0.500***	-0.358***	-0.507***	-0.344***
	(0.104)	(0.119)	(0.127)	(0.105)
Country-Product FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Product-Time FE	No	No	Yes	Yes
Sample	1928-1935	≤1933m3	1928-1935	≤1933m3
Observations	2,719	2,013	2,719	2,013
R-squared	0.071	0.050	0.590	0.584

Notes: The table shows the results of specification 1. The dependent variable is the change in log of prices. The exchange rate is the change in logs of the exchange rate, measured as US dollars over one unit of local currency (1 for the US). Clusters are at the product-country level and at the time level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

We can see that the pass-through is not complete. After a 1 percent depreciation of the British pound, prices in the UK are around 0.5 percent more expensive in pounds, meaning that those prices, when converted to US dollars, are 0.5 percent cheaper for American consumers. This effect is consistent over all the specifications. We find that the effect is similar, but slightly lower when we exclude the period when the US left the gold standard. The average coefficient is in line with those found in Goldberg and Knetter (1997) and Burstein and Gopinath (2014).

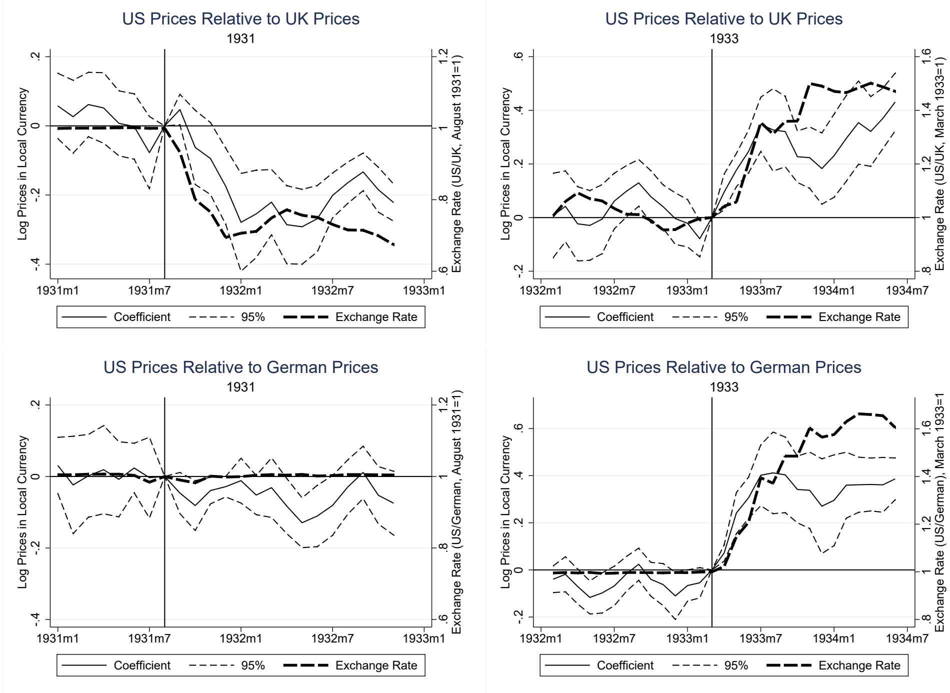
In addition to this result, we explore what happened during two important events during the Great Depression. The first event occurred in September 1931, when the UK left the gold standard, producing an appreciation of the US dollar of more than 25 percent relative to the British pound between September and December 1931, as shown in Figure 1. This shock is relatively exogenous from the US point of view. There is no evidence of changes in price expectations during that time (Binder 2016). So, it is likely that the policy conducted in the UK was not related to prices in the US. This consideration will be more important when we discuss the results in terms of economic activity.

The second event occurred in April 1933, when the US left the gold standard. In this exercise, we only use product prices between a pair of countries and their bilateral exchange rate. We evaluate the effect of these events through the time series, exploring the cross-sectional differences in prices in each period of time. We perform this exercise between the US and the UK. For comparison, we also perform this exercise between the US and Germany. The bilateral exchange rate between the US and Germany did not change in 1931, so we should not see an effect that year. In 1933, the US dollar also depreciated relative to the German mark, so we expect to see an effect around that event of US prices relative to both British and German prices. We run the following regression:

$$Prices_{c,j,t} = \beta^t \times US_c \times \gamma_t + \gamma_{j,c} + \varepsilon_{c,j,t}, \tag{2}$$

where US_c is a dummy equal to 1 if the country is the US and γ_t is a time dummy. The rest of the variables are the same as in the previous equation. We explore the effect for the events of both 1931 and 1933. Figure 3 shows the results.

Figure 3: Exchange Rate and Price Reaction after Gold Standard



Notes: The figure shows results from regression (2). The left panels are results in September 1931 and the right panels are the event in April 1933. The solid line plots the coefficient (β^t). The light-dashed line are confidence intervals at the 95 percent level. Standard errors have two-way clusters at the product-country level and at the time level. The dark-dashed line represents the bilateral exchange rate.

The figure shows a similar pattern compared with the general regression in Table 1. After the UK left the gold standard, US prices declined relative to UK prices at a lower rate than the appreciation of the US dollar. The opposite effect occurred in 1933. After the US went off the gold standard, US prices increased relative to UK prices at a lower rate than the depreciation of the US dollar. These changes are large and suggest changes in the terms of trade. By August 1932, prices in the US were 16 percent lower than in the UK. This effect is the result of a 28 percent appreciation of the US dollar. A similar effect was produced over the same period of time (one year), but in 1933. US prices in March 1934 were 35 percent higher than in March 1933, after a 48 percent depreciation of the US dollar.

Relative prices between the US and Germany were less affected by the UK's departure from the gold standard. The results show only a mild reduction in bilateral prices around this event.[15] This shows that the change in prices did not come from some specific change in the US relative to all the other countries. In 1933, the change in relative prices between the US and Germany is similar to the change in relative prices between the US and the UK.

The results found in this section are consistent with an incomplete pass-through. This incomplete pass-through is present around the main events that we analyze in this paper as well. This is consistent with a multipolar world as described in Farhi and Maggiori (2018). In addition, Benguria and Wagner (2022) find a similar pass-through when the Euro was established, moving to likely two currency of invoicing in Europe. The implication is that exporters gained competitiveness in 1933, but the ones exposed to the UK in 1931 lost competitiveness. In the next section, we evaluate whether changes in competitiveness had an impact on the level of economic activity

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[15] According to Gopinath et al. (2020) pass-through of import prices should be driven by changes in the dominant currency. Eichengreen and Flandreau (2009) using data from Nurkse (1944) show that up to the 1930s the pound was still the dominant currency, but the US was also an important source of currency reserves. The British pound has been a more dominant currency for the United States than for Germany, which can explain why prices in the US might have declined slightly relative to the prices in Germany following the depreciation of the British pound. In any case, these relative changes are small.

4 Local Effect of Exchange Rate Changes on Economic Activity

We evaluate the effect on local economic activity. Historical narrative indicates that the effect of the devaluations were fast. In Section 2, we show historical evidence that suggests effects of changes in exchange rate within weeks after the events. In addition, in Section 3, we see effects on prices within the first month after the changes in exchange rate. Because of that, we aim to obtain a measure of economic activity with high frequency. In addition, we want to obtain a sufficiently large cross-sectional variation, so we can see different exposure to the shocks.

We use data on bank debits for more than 269 cities available on a weekly basis. This measure corresponds to debits to all individual accounts reported by clearing houses in the given city to the Federal Reserve Board.[16] The data comes from the report G.6 of the Federal Reserve Board, reported weekly. This measure includes claims to the individuals accounts, including checks. As shown in Pedemonte (2020), this measure strongly correlates with measures of economic activity. Bank debits were indeed used at the time as a proxy of economic activity, as in Matthews and Eckler (1928). The authors describe bank debits as a "extremely representative measure of the complex of activities included under the term general business." Interestingly, they use geographic variation at the Federal Reserve district level to characterize what happened in the agricultural sector, for example. Because bank debits constituted the check transactions, they claim that they represented the production of consumption goods, wholesale and retail sales, construction of buildings and engineering projects, and agriculture.

In our sample size, this measure highly predicts measures of economic activity, such as spending on cars, department store sales, industrial production and business activity, at the state, Federal Reserve District, and national levels on a monthly basis (see Appendix A.1, Tables A.1 and A.2). The high frequency and relation with economic activity will allow us to measure the effects of changes on exchange rate in a short window, as well as allowing us to evaluate effects in longer periods. We aggregate these data to a monthly frequency to get the same frequency than the data on

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[16] The list of cities and summary statistics on monthly debits are described in Table A.6.

exchange rate. We seasonally adjust the series.[17] This is relevant, since our measure of exposure depends on economic characteristics of the cities, which can have important seasonal fluctuations, in particular in sectors such as agriculture.

We construct a measure of the exposure to changes in the exchange rate at the city level. In order to do this, we combine country sector-specific exports for the US in 1928 [18] the bilateral exchange rate from 1928 to 1935, and city-level sectoral employment shares from the census of 1930 (Ruggles et al. 2021). With this information, we construct a time-varying indicator that combines the specific exposure of a city to a country, through its economic specialization as in Topalova (2010) and get the variation over time through fluctuations in the bilateral exchange rate. Specifically, we construct the following measure of exposure:

$$Exposure\_Trade_{c,t} = \sum_{s} Sh\_W_{s,c,1930} \sum_{d} Sh\_Ex_{s,d,1928} \times RER_{d,t}, \tag{3}$$

where c indexes cities and t indexes dates. $Sh\_W_{s,c,1930}$ represents the share of workers in sector s in city c according to the census of 1930. $Sh\_Ex_{s,d,1928}$ is the sector's export share going to destination d and $RER_{d,t}$ is the relative bilateral nominal exchange rate of the US relative to destination d normalized to 1 in July 1931.

In order to combine the census industrial employment data with the sectoral trade information, we make a correspondence between both sources of information as described in Table A.3 in Appendix A.1. We have 45 sectors that represent US merchandise exports to 33 destinations. This information gives enough variation in terms of the exposure to trade to different destinations. While Canada and the UK were the main trading partners of the US, Japan, for example, dominated in forestry and fertilizers. Mexico dominated in explosives and firearms, the Netherlands in precious stones, and Germany in cotton. Also, while iron ore went mainly to Canada and the UK, only 12 percent of explosives and firearms went there in our sample. This variation gives us exposure to different exchange rate regimes and shocks.

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[17] We take logs and run a regression with city-month fixed effects. Then, we obtain the residual of the regression.

[18] The data comes from the report "Foreign Commerce and Navigation of the United States, 1928" of the Bureau of Foreign and Domestic Commerce of the U.S. Department of Commerce.

$Exposure\_Trade_{c,t}$ incorporates the variation at the city level and across time. Considering the cross-sectional variation, the average value for each city shows how exposed to trade a city is relative to other cities. But it also incorporates the variation that is relevant given the exchange rate dynamics present in the Great Depression. For example, China had a flexible exchange rate with the US. This means that cities exposed to a sector where China is an important destination were losing competitiveness since the beginning of the Great Depression, but if those cities where not exposed to sectors where the UK or pound-tied countries were important, the appreciation of 1931 should not have been so relevant for those cities. At the same time, cities more exposed to France or Germany should benefit relatively more from the depreciation of 1933. Table A.6 shows the specific variation of this measure at the city level for each individual cities, there is significant variation among cities.

In order to illustrate the characteristics of this measure, we take two cities as examples: Pueblo, CO, and New Bedford, MA. Pueblo is an inland city, with geographical conditions less favorable to international trade. Surprisingly, this city had the median allocation of labor to exporting sectors according to our sample: 35.3 percent of its working population, as it had the main plant of the Colorado Fuel and Iron Company, an important steel conglomerate. Eighteen percent of the labor force of Pueblo worked in the steel manufacturing sector. The main destination of this sector's product was Canada, with 44 percent of the total exports in our sample, and then Japan, with 18 percent.[19] On the other hand, New Bedford was a city open to international trade. Located on the coast of Massachusetts, the city had direct access to the Atlantic. This explains why 55 percent of the city's labor force worked in the exporting sector. They specialized in textiles, another important exporting sector of the US. Forty-two percent of New Bedford's working population was employed in the cotton sector, distributed among several cotton mills in the city. The main destination of the semi-manufactured cotton products was Germany (25 percent of all the exports in our sample) and the UK (24 percent). These characteristics of the cities' employment exposed them to different shocks. We show the measure of exposure for both cities in the left panel of Figure 4

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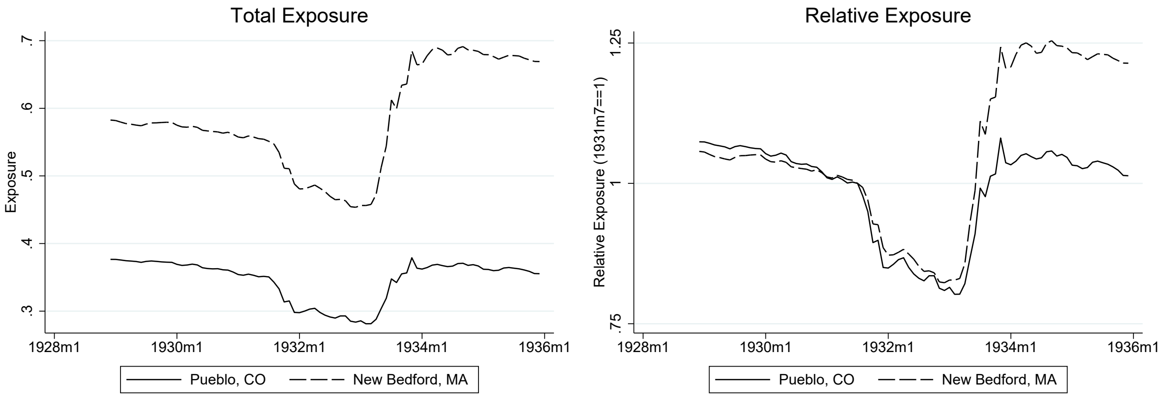
[19] In this example, in order to be affected by trends in Canada or Japan, Pueblo does not need to necessarily export directly to those markets, but that the international price of that good in dollars to be affected by what happens in those markets.

and the exposure relative to the city's value in July 1931 in the right panel.

Figure 4: Exposure Measure for Selected Cities



Notes: The figure shows the value of the variable from equation (3) for Pueblo, Colorado, and New Bedford, Massachusetts. The left panel shows the raw measure and the right panel shows the same measure, but relative to the city value in July 1931.

The left panel of Figure 4 shows that the measure is lower for Pueblo compared to New Bedford. This reflects the fact that Pueblo had a smaller fraction of its population working in the export sector. The right panel shows the same index normalized to 1 in July 1931. We can see that until July 1931, there were no changes in the relative exposure of both cities. This is because both cities were exposed to countries that had a fixed exchange rate with the US up to 1931. Then, we can see that starting in April 1933, the New Bedford exposure increases relative to the Pueblo exposure. This is because there were no significant changes in the bilateral exchange rate with Japan, while the US dollar depreciated sharply against the German mark.

Overall, we can see that the measure combines general exposure to trade, with time series variations reflecting exposure to countries and their exchange rate movements. From the example, we see interesting cross-sectional changes coming in periods where no important countries left the gold standard. This variation comes from countries with flexible regimes. We use the measure of exposure to evaluate the effect of trade on economic activity. Using monthly data, we run the following regression:

$$D_{c,t} = \gamma_c + \gamma_t + \beta \times Exposure\_Trade_{c,t} + \varepsilon_{c,t}, \quad (4)$$

where $D_{c,t}$ is the log of bank debits in city c at time t. We do not have many controls at the city-monthly level, so we include a city fixed effect in all specifications. We do this to focus on the variation in debits within the city, independent of the size. We include a time fixed effect to control for the common variation and focus on the cross-sectional variation given by changes in the relative exchange rate by individual countries. This control is important, as depreciation should induce a monetary easing, so controlling for common variation is relevant. With this control, we focus on the cross-sectional variation, likely the expenditure switching effect. In some specifications, we include state-time fixed effects to control for any common change at the state level or Fed-time fixed effects to control for any common change at the Federal Reserve District level. Errors are clustered at the city level. Table 2 shows the results.

Table 2: Exposure to Trade and Exchange Rate Variation and Economic Activity

	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Trade	1.194***	0.836***	0.759***	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	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	≤1933m3	≤1933m3	≤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

Notes: The table shows the results of regression (4). The dependent variable is the log of bank debits at the city level. The independent variable is the measure constructed according to equation (3). The different columns show the results with a combination of fixed effects as specified in the table. Standard errors are clustered at the city level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

We find a significant effect of trade exposure (competitiveness) on economic activity. A big part of the identification comes from the common variation, since the main events affected many countries. But thanks to our measure, which considers country-specific variation, we can estimate an effect even including time fixed effects. A 1 percent variation in the city cross-section exposure, considering the time variation, increases economic activity by 1.19 percent. Using even more granular variation at the state level still yields positive and significant results. This variation takes into account some common exposure of regions. For example, cities in Michigan specialized in the automotive industry, so the results with state-time fixed effects take that common variation into account. The results are still significant and large, with a coefficient of 0.76.

These results should consider the variation in the trade exposure measure. In particular, we should account for the share of workers in the exporting sector, as the exchange rates are normalized to 1 in July 1931. In this case, the average and median city had 35 percent of its workers in the exporting sector. This measure goes from 3.7 percent to 75.2 percent in our sample. These numbers imply that the result found in this section should consider those levels, meaning that the median city increased its economic activity between 0.27 and 0.42 percent after an effective 1 percent city-specific depreciation.[20]

One concern is that the results might be biased by US-led events and might be endogenous. In April 1933, the US abandoned the gold standard. As we explained before, there is no evidence that this event was expected, but still the results might be contaminated by that common variation across US cities and other policies that were implemented at that time. In columns (4)-(6) we consider only the period when the US was on the gold standard. Therefore, the variation in the exchange rate came from policy decisions in foreign countries. We can see that the coefficients are not only significant, but even larger: Including time fixed effects, a 1 percent variation in the city cross-section exposure increases economic activity by 2.17 percent. These results are in line with Obstfeld, Ostry, and Qureshi (2019), who show that under fixed regimes,

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[20] One concern comes from the role of time fixed effects. According to Borusyak, Hull, and Jaravel (2022), in shift-share (an average of a set of shocks with exposure weights) instrumental variable designs, time fixed effects only isolate within-period shock variation when the exposure shares add up to one. With incomplete shares, as in our case, time fixed effects need to be interacted with the sum of exposure shares. To address this concern, in Appendix A.4, we use Borusyak, Hull, and Jaravel (2022) econometric framework to estimate coefficient β in equation (4). We obtain that the coefficients are not only significant, but even larger: Including time fixed effects (and an interaction of time fixed effects with the sum of exposure shares), a 1 percent variation in the city cross-section exposure increases economic activity by 2.31 percent.

global shocks are magnified. We also show that the overall effect of an specific local depreciation is an increase in economic activity, showing that tariffs did not play an important role to explain our results.

One potential concern is that changes in tariffs could have affected the bilateral exchange rate. The Smoot-Hawley tariffs is one example that affected the US in 1930, before our main sources of variation. First, those tariffs were imposed on US imports, not affecting directly the exporting sector. The exporting sector could have been affected by the exchange rate. The link is through the appreciation of the US dollar, which is the mechanism that we are evaluating, so we will be capturing how an appreciation affects the exporting sector, coming from the tariffs imposed in the US.

In addition, Mitchener, Wandschneider, and O'Rourke (2021) document that other countries retaliated against the US later. These retaliations probably affected the exporting sectors. Our empirical model doesn't aim to explain all the variations in the exporting sector, but the one that comes from changes in exchange rate. Nevertheless, an increase in tariff can also depreciates the US dollar, offsetting the effect of the tariff at least partially (Jeanne and Son 2020). In that case, changes in exchange rate should produce a lower effect on US export, biasing our results toward zero or negative values. Given the magnitude of the changes in exchange rate in the sample and the limited and infrequent retaliations, we expect that the effect of tariffs is small, but it will be tested empirically: if those effects dominate, we should not find a positive effect of a sectoral depreciation. In Section A.6, we document robustness checks, controlling for the effect of the tariffs. First, our results are robust to the exclusion of observations in 1930, when the tariffs occurred. Second, the results are remain the same after controlling for specific city exposure to sectoral and time variation in tariffs. Overall, our results are robust to those events, which doesn't mean that they had an effect in the US economy, as shown by Crucini and Kahn (1996).

In Appendix A.5, we estimate the partial equilibrium contribution of trade exposure to the depth of the Great Depression between 1931 and 1932 and to the recovery between 1933 and 1934. For simplicity, we use a version of equation (4) with a unique time fixed effect. Then, we assess the contribution of the average effect over the cities $\beta \times \overline{Exposure\_Trade}_{c,t}$ compared with the time effect γ_t, around the two main events covered in this paper. This analysis abstracts from spillover effects and only shows direct effects and general equilibrium considerations as it will be discussed in Section 6, but helps to give a sense of the size of the estimates in the data.

5 Robustness

5.1 Bartik Instrument

In this section, we use another measure of trade exposure as a robustness test, exploiting the growth rates of the export sectors between 1932 and 1933. This measure will closely indicate the increase in income that cities received given their sectoral exposure to trade. We rely on the main events analyzed before -the UK exit in 1931 and the US exit in 1933- to evaluate the effect of changes in the exchange rate on the economic activity of export-oriented cities. For this empirical exercise, instead of using the changes in the exchange rate, we rely only on time fixed effects interacted with the measure of exposure to an increase in exports to see whether more exposed cities had a relatively stronger economic recovery compared with less exposed cities.

In particular, we build a constant city-level measure of exposure to trade. As in the previous section, we get industrial employment at the county and industry level in 1930. Then, we obtain data on the sectoral exports of the US between April 1932 and March 1933 and compare them with the data between April 1933 and March 1934. With that information, we construct the following measure of exposure à la Autor, Dorn, and Hanson (2013):

$$Trade\_Exposure_{c,33-32} = \sum_{s} \frac{L_{c,s,1930}}{L_{c,1930}} \times \frac{Exports_{s,1934m3} - Exports_{s,1933m3}}{Exports_{s,1933m3}}, \quad (5)$$

where $L_{c,s,1930}$ is employment in 1930 in county c and sector s, $L_{c,1930}$ is total employment in county c, and $Exports_{s,y}$ is total exports in sector s over the last 12 months of y. This measure of exposure combines the sectoral employment composition of the county where the city is located with goods-level information on exports in terms of the US products that were more in demand abroad. Table A.4 shows the composition of merchandise exports between April 1932 and March 1933 and the annual growth rate of the value of exports from April 1933 to March 1934, compared with April 1932-March 1933 by type of commodities.

With this measure we will show which cities grew more after the shock in 1933, relative to the lowest level of exports in 1932. This could be seen as a direct effect. A city that exported more will have an increase in economic activity if exports rise. But in our estimations, we will compare the growth of the more exposed cities relative to less export-dependent cities, so we are an estimating the additional direct effect on the exposed cities.

As in the previous section, we estimate the effect of the appreciation of 1931 on economic activity in trade-exposed cities. Here, we will not use the changes in the exchange rate; instead, we will use the across-time variation as a source of identification because the largest appreciation occurred at a specific period. We can compare the pre-trends with the performance of the more exposed cities following the appreciation. This event occurred outside the US so it is unlikely that a more exposed city could have influenced that event. We run the following specification:

$$D_{c,t} = \alpha_c + \gamma_{s(c),t} + \sum_{\tau=0}^{T} \beta^{\tau} \times Trade\_Exposure_{c,33-32} \times \mathbb{1}_{\tau} + \varepsilon_{i,t}, \tag{6}$$

where $D_{c,t}$ is the seasonally adjusted log debits, $Trade\_Exposure_{c,33-32}$ is the trade exposure measure shown in equation (5), $\gamma_{s(c),t}$ is a state-time fixed effect, and α_c is a city fixed effect. $\mathbb{1}_{\tau}$ is an indicator variable that is one for year τ. The regression includes time-specific effects, meaning that β^{τ} will capture differential outcomes across more and less exposed cities. This empirical design implies that the coefficient β^{τ} represents the time fixed effect of average exposed cities relative to a baseline that considers the average effect of the rest of our sample. We will run this exercise around main events when countries with fixed exchange rates changed their regime. This exercise allows us to isolate those events from other changes in the bilateral exchange rate that occurred in countries with flexible exchange rates, that could be influenced by local shocks, such as changes in tariffs.[21]

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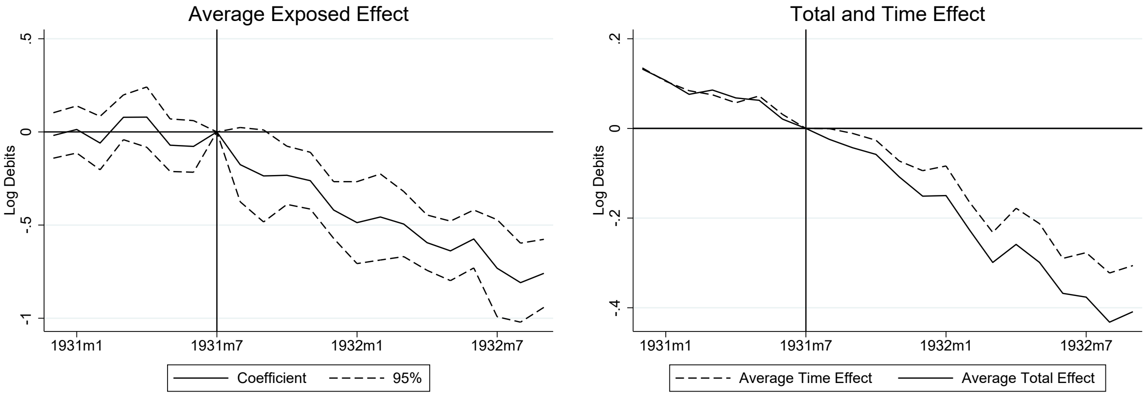
[21] For evidence on the effect of changes on tariffs in the US during the Great Depression, see Crucini and Kahn (1996) and Mitchener, Wandschneider, and O'Rourke (2021).

In 1931, the economic activity of the whole country was decreasing. $\gamma_{s(c),t}$ will capture that effect even at the state level. The left panel of Figure 5 shows how more exposed cities behaved after the appreciation of the US dollar, given the shock of several countries exiting the gold standard. In the right panel, we show the contribution of this effect relative to the average effect over the cities at each period of time. We compute the average time effect ($\overline{\gamma_{s(c)t}}$), and the average exposed effect ($\overline{\gamma_{s(c)t}} + \beta^t \times \overline{Trade\_Exposure_{c,33-32}}$).

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



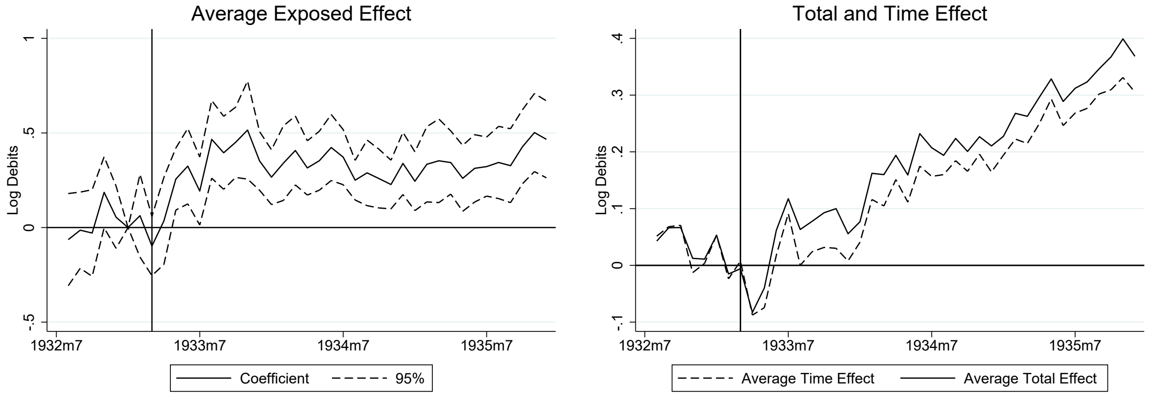
Notes: The right panel shows the results from the regression of the specification in equation 6. The solid line represents the coefficient β^t. The coefficient is relative to July 1931 (equal to 0). The dashed lines represent confidence intervals at the 95 percent level. Standard errors are two-way clustered at the city and time level. The right panel plots the average time effect $\overline{\gamma_{s(c)t}}$ and the average total effect $\overline{\gamma_{s(c)t}} + \beta^t \times \overline{Trade\_Exposure_{c,33-32}}$.

After having similar trends, cities more exposed to trade show a large decrease in economic activity after August 1931 relative to the rest of the sample. This effect is economically relevant. As shown in the left panel of Figure 5, the average exposure compared with the common trend of cities (time fixed effects) represents around a third of the effect by 1932.

These effects are large. The average measure of exposure is 0.136 and the standard deviation is 0.091. This means that in August 1932, an average trade-exposed city decreased its economic activity by 10 percent, relative to a less exposed city even in the same state. We can see in the right panel of Figure 5 that the contribution of this effect is economically significant. These results are similar to those found in the previous section. We can also see that for this event there is no pre-trends, meaning that exposed and not exposed cities were behaving in a similar way before the events of August 1931. The lack of pre-trends validates our shift-share approach, as described in Goldsmith-Pinkham, Sorkin, and Swift (2020).

We then run the specification in equation 6, but relative to January 1933 to capture the effect of the depreciation. The other policies implemented at the time do not seem to have a special focus on the external sector, so those considerations will be captured by common trends by the time fixed effect if they affected trade cities in the same way as no-trade cities. In this regression we will basically see if the trade channel has a differential effect versus the other channels. Figure 6 shows the effect following the abandonment of the gold standard by the US.

Figure 6: Trade Exposure Effect and US Abandons the Gold Standard



Notes: The figure shows the results from the regression of the specification in equation (6). The solid line represents the coefficient β^t. The coefficient is normalized to 1 in February 1933. The dashed lines represent confidence intervals at the 95 percent level. Standard errors are two-way clustered at the city and time level. The right panel plots the average time effect $\overline{\gamma_{s(c)t}}$ and the average total effect $\overline{\gamma_{s(c)t}} + \beta^t \times \overline{Trade\_Exposure_{c,33-32}}$.

We observe that after April 1933, more exposed cities experienced a large increase in their economic activity. There is a small drop in the more exposed cities in March

1933. That month was characterized by a bank holiday, so there are fewer observations for our sample and some cities show very small numbers that month. After that, there is an immediate increase in economic activity in more exposed cities. This effect is persistent. More exposed cities continued to have a higher level of economic activity. Overall, we can see that the trade channel also played an important role in the recovery that occurred in 1933.

The coefficient is close to 0.5 by the end of 1933, which represents on average 7 percent more economic activity compared to the average growth. As explained before, many other policies were implemented at that time. Many of those are captured by the state-time fixed effect. The results show that more exposed cities grew relative to the rest of the sample. This indicates that the trade channel accounts for a significant differential effect, in a period when the whole country was growing. Considering this estimation, the contribution of the trade channel is similar to the numbers obtained in the previous section.

These results show that cities that increased their export-related income because of their trade exposure and increased their exports due to the exit of the US from the gold standard also significantly increased their spending relative to the other cities. Also, these results show that those same cities were particularly affected when the UK left the gold standard.

5.2 State-Level Evidence

The city- level estimation does not consider a large part of the country that can be affected by this policy. In particular, a large proportion of the agricultural sector might not be part of the counties included in the sample of cities. In order to have a better representation, we include results at the state level, so we include all the workers and exports of the economy.

An additional concern could be that bank debits are a poor measure of spending.[22] As a robustness check, in this section, we run the regressions with a direct measure of spending: new car sales, used in Hausman, Rhode, and Wieland (2019). These data have monthly frequency and are available at the state level. We create a measure of

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[22] Which would not be justified, since we have already shown that bank debits correlate highly with several measures of economic activity and spending.

exposure at the state level, using the same data used in the previous section. We run regression (4) using the logarithm of new car sales by state. As we do not have reliable monthly data on population at the state level, we include state fixed effects to control for the constant size of the state. Table 3 presents the results.

Table 3: Log New Cars by State

	(1)	(2)	(3)	(4)	(5)	(6)
Exposure 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
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

Notes: The table shows the results of regression (4). The dependent variable is the log of new car sales at the state level. The independent variable is the measure constructed according to equation (3). The different columns show the results with a combination of fixed effects as specified in the table. Standard errors are clustered at the city level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

We can see very consistent results as in the bank debit regression. The coefficients are statistically significant and large for all the specifications considered. A 1 percent city-specific depreciation increases new car sales between 3.7 percent and 14.4 percent depending on the specification and the period included.

The implied results are somewhat higher than the estimates with bank debits. This is shown in part in Table A.1. The reason behind these larger coefficients is the fact that cars are a durable good, so we expect them to react more to shocks. Summarizing, this result confirms that the exchange rate variation produced economic effects. In addition, we show that when we include the complete external sector in the US at the time, the effects remain similar.

5.3 County-Level Evidence

Another source of evidence available is yearly retail sales at the county level. We use retail sales per capita in 1967 US dollars from Fishback, Horrace, and Kantor (2005a). This data only coincide with our sample for 1929, 1933, and 1935. Since our measure of exposure depends on Census data and national aggregates, we can build the measure of trade exposure at the county level. We construct the measure of trade exposure using the exchange rates at the end of the year. We also run a regression using the year-over-year change in the exchange rate. Table 4 show the results.

Table 4: Exposure to Trade and 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

Notes: The table shows the results of regression (4). The dependent variable is retail sales at the county level. The independent variable is the measure of trade exposure at the county level constructed according to equation (3). Columns (1)-(2) construct the measure of trade exposure using the exchange rates at the end of the year while columns (3)-(4) construct the measure of trade exposure using the year-over-year change in the exchange rate. The different columns show the results with a combination of fixed effects as specified in the table. Standard errors are clustered at the county level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Result confirms the findings using the bank debit data. A one percent depreciation increases retail sales per capita between 40 and 47 dollars. When we look at changes, the effect is even larger. A one percent city-specific change in the exposure to trade increases retail sales per capita by between 576 and 621 US dollars. Those effects are significant in magnitude, but considering that the exchange rate is normalized and the exposure to trade is, on average, 35 percent, these results are scaled in a big magnitude. In any case, it vindicates the importance of the trade channel. In the next section, we explore the aggregate implications of this shock.

6 Aggregate Effects

The results in the previous section show how tradable cities affected by a specific depreciation behaved relative to other cities. These cross-sectional results tell us little about the aggregate effects of those changes. In Appendix A.5, we try to inform the aggregate effect with the time fixed effect, but that is not necessarily the proper counterfactual, as aggregate policies (for example monetary policy). Even with a positive cross-sectional effect, it is not clear what the aggregate effect is after an exchange rate shock. After a depreciation, an exposed city increases its output relative to the non-exposed city, but we do not have a good sense of the levels. The non-exposed city could also be expanding, as there could be an increase in demand for its good from the exposed cities. On the other side, the depreciation increases the price of the good produced in the exposed regions, which can reduce demand in the less exposed city, thereby reducing output. Moreover, interest rates are also affected. These general equilibrium effects are not captured in the cross-sectional estimates. In addition, the import competition margin can play an important role, but we do not have data on that. So, the model can inform us about this margin.

In this section, we propose a simple model to help us obtain the aggregate effect of the exchange rate shock. The model has the essential ingredients necessary to replicate the empirical results found. Then, we will shock the exchange rate from a symmetric steady state. With this shock and similar data, we can replicate the empirical estimate, calibrate the model, and estimate the aggregate effect after an exchange rate shock.

The model has a "Home" country with two regions that trade with each other. Each region of the home country specializes in trade with one foreign country. For simplicity, we assume there is no trade between the two foreign countries. The preferences for a particular region in the home country are

$$U_{i,t} = \frac{C_{i,t}^{1-\gamma}}{1-\gamma} - \psi \frac{L_{i,t}(z)^{1+\alpha}}{1+\alpha},$$

where $L_{i,t}(z)$ is the labor supply to a specific firm in region i, at time t producing variety z. $C_{i,t}$ is the consumption bundle in region i and at t and it is defined as

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

where $C_{H,i,t}$ is the good produced in the local region, $C_{C,i,t}$ is the good produced in the other region of the country, and $C_{F,i,t}$ is the good produced in the foreign country. We assume that $\phi_H + \phi_C + \phi_F = 1$. In the case of the foreign country, we have

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

Each type of good has varieties. Consumers everywhere have the same elasticity of substitution equal to η and have access to incomplete bond markets. Firms face sticky prices a la Calvo, with a probability of updating prices equal to θ. The price of each variety is the same in the country in which it is produced and between regions in the home country, but in the case of international trade, they must pay an exchange rate equal to E_j, where $j = 1, 2$ are the foreign countries. The Phillips curve for the home country is:

$$\pi_{i,t} = \beta \pi_{i,t+1} + \frac{(1-\theta\beta)(1-\theta)}{\theta} mc_{i,t},$$

where $mc_{i,t}$ is the marginal cost for a firm in region i and for the foreign country

$$\pi^*_{j,t} = \beta \pi^*_{j,t+1} + \frac{(1-\theta\beta)(1-\theta)}{\theta} mc^*_{j,t},$$

where $mc_{j,t}$ is the marginal cost for a firm in country $j \neq H$.The market clearing conditions are

$$Y_{1,t} = C_{H,1,t} + C_{C,2,t} + C^*_{F,1,t},$$

$$Y_{2,t} = C_{H,2,t} + C_{C,1,t} + C^*_{F,2,t},$$

$$Y^*_{1,t} = C^*_{1,t} + C_{F,1,t},$$

and

$$Y^*_{2,t} = C^*_{2,t} + C_{F,2,t}.$$

The risk-sharing condition holds between regions and countries, as well as the uncovered exchange rate parity. Using the risk-sharing condition, the market clearing conditions, and the optimal conditions of consumers, we see that local output depends on the terms of trade (as in Gali and Monacelli 2005), which will change depending on the exchange rate pass-through. Then, we have that the log-linearized[23] output of the local economy's output depends on

$$\check{y}_t = \check{y}_t^* + \left[2\sigma(\phi_H + \phi_C)\phi_F + \frac{1}{2\gamma}\left(1 - 2(\phi_H + \phi_C)\right)^2 \right] \check{q}_t,$$

with $\check{y}_t$ being the aggregate output of the home economy, $\check{y}_t^*$ is the sum of the foreign output and $\check{q}_t = \check{q}_1 + \check{q}_2$ is the sum of the terms of trade with $\check{q}_{i,t} = \check{p}_{i,t}^* + \check{e}_{i,t} - \check{p}_{i,t}$ and $i = \{1, 2\}$. With this expression, we can get an expression of the net exports over the aggregate GDP of the home region

$$\check{nx}_t = \phi_F \left((\phi_H + \phi_C) \left(\sigma - \frac{1}{\gamma} \right) - \frac{\gamma - 1}{2\gamma} \right) \check{q}_t.$$

We can see that aggregate output, conditional on the production of the foreign region, depends positively on the terms of trade as long there is home bias. The net exports' sign hangs on the substitution elasticity between the tradable and non-tradable goods and its relationship with the intertemporal elasticity of substitution.

We model the exchange rate regimes to mimic what happened during the period studied in the previous sections. The home and foreign country 2 have a fixed exchange rate, as they are on the gold standard. Their nominal GDP is equal to a constant value, and the log-linearized expression for the exchange rate between both countries is

$$\check{e}_{2,t} = 0.$$

In the case of the exchange rate with foreign country 1, this depends on an exogenous shock that represents the changes in the exchange rate that we see in the data

$$\check{e}_{1,t} = \nu_t,$$

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[23] We define $\check{x}_t \equiv \frac{X_t - \bar{X}}{\bar{X}}$.

with

$$\nu_t = \rho \nu_{t-1} + \varepsilon_t.$$

Foreign country 1 has an independent monetary authority. To simulate the model, we set a trade elasticity equal to $\sigma = 5.0$ and the intertemporal elasticity of substitution to $\gamma = 2.0$. From Nakamura and Steinsson (2014), we use $\alpha = 1.0$. We use parameters to obtain monthly variation, so $\theta = 0.92$, consistent with a yearly price adjustment, and $\beta = 0.996$, consistent with the real interest rate at the time. From the employment census data, we estimate a size of the tradable economy of 35 percent of total employment. We simulate the model to obtain the value of the foreign share ϕ_F, as we can not separate it from employment. Then, we obtain ϕ_H and ϕ_C using the size of the intra-region trade from Nakamura and Steinsson (2014). From the export data, we find that imports over national income equaled 6.3 percent in 1928, likely the steady state, but this could not be the case for our sample of cities. Moreover, we estimate these effects for the tradable economy, so the size of ϕ_F should be a lower bound, as it would have to be escalated by 0.35, which is the size of the tradable sector (considering local and foreign varieties). We aim to match the empirical finding. As bank debits do not map exactly the changes in industrial production, we multiply the empirical findings in column (3) of Table 2 (0.759) with the regressions of the bank debit results on industrial production, found in column (1) of Table 5, that is, a coefficient of 0.346. We generate a series of prices, output by region, and exchange rates with each simulation.

With that information, we run regression (2).[24] Those data include prices for the same variety in the local currency, but we cannot differentiate between local and foreign goods. We then run the regression over the price indexes. We also run regression (4); that is, we run a regression of overall output in regions 1 and 2 on their respective exposure to the exchange rate. Region 1 is fully exposed, while region 2 is not exposed. In both regressions, we control by time fixed effects. Then, we use those parameters to generate the values of γ and ϕ_F that can replicate the regression results. In particular, for the price regression, we match the results in column (3) of Table 1 (-0.507). For the output regression, we match the results in column (3) of Table 2 multiplied by the results in column (1) of Table A.2 ($0.759 \times 0.346 = 0.262$). Figure 7 shows the

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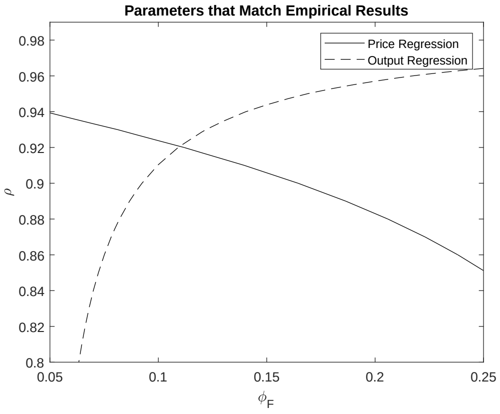
[24] The log-linearized model and exact regressions are in Appendix A.7.

combination of parameters that generates the values for the regressions.[25]

Figure 7: Parameters That Match Empirical Results



Notes: The figure shows the combination of parameters that generates the results from the price regression, that is, column (3) of Table 1 (-0.507), and output regression, that is, the coefficient in column (3) of Table 2 multiplied by the coefficient in column (1) of Table A.2 ($0.759 \times 0.346 = 0.262$).

We can see that in the intersection of both lines, a combination of parameters matches both regressions. That combination is $\rho = 0.92$ and $\phi_F = 0.11$. We can see that this implies a persistence shock, which is consistent with regime changes that produce long-lasting effects on the exchange rate. The size of the external sector is larger than the foreign trade sector in 1928 (around 6.2 percent). Still, given that we are modeling the tradable economy, it is a reasonable number. With those values, we simulate what happened to the aggregate economy after the shock. Figure 8 shows the aggregate effect of the exchange rate shock in the global economy.

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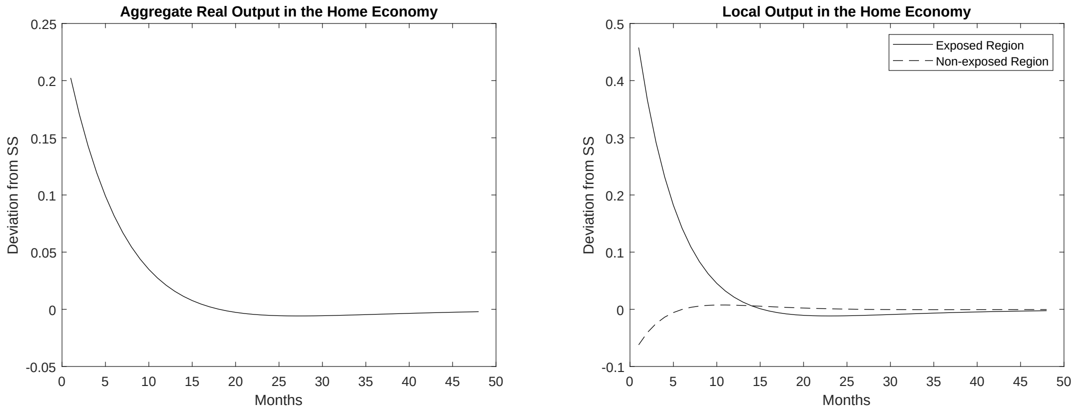
[25] The outputs for different parameters are shock in Figure A.1, in Appendix A.1

Figure 8: Aggregate Output after Depreciation



Notes: The left panel shows how aggregate output in the home economy reacts to a 1 percent depreciation in one of the economies. The right panel shows the deviation of each region with respect to the steady state after the shock.

We can see that a 1 percent depreciation increases local output by 0.46 percent on impact in the exposed region but decreases output in the non-exposed region by 0.06 percent. The non-exposed region output drops at the onset of the shock as goods in the exposed region are relatively more expensive, given the demand increase. The home economy's total real output grows 0.2 percent on impact.[26]

The results confirm that the cross-sectional estimates found in the empirical part may be associated with aggregate effects, but the coefficients are upward biased. Running a regression on aggregate output and the export-weighted exchange rate produced by the data gives us an estimate of 0.640 (or 0.320 for a depreciation of the exchange rate that affects half of the exporting sector), which is smaller than the cross-sectional estimate but still high. This highlights the role of the events of 1931 in the Great Depression. Using this estimate, we evaluate the contribution of the changes in the exchange rate to aggregate economic activity. Between July 1931 and June 1932, the export-weighted exchange rate decreased by 14.2 percent due to a more than 30

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[26] In Appendix A.8 we consider a version of the model where both regions of the home country are exposed to both countries, and each region has a more intensive trade with one of the foreign countries. Under that version, a 1 percent depreciation increases local output by 0.35 percent on impact in the exposed region but decreases output in the non-exposed region by 0.02 percent. The home economy's total real output grows 0.165 percent on impact.

percent appreciation of the US dollar relative to the British pound. If we consider that those estimates affect half of the exporting sector, there would be a 4.6 percent drop in economic activity for our sample of cities. This effect accounts for 15.7 percent of the decline in industrial production between July 1931 and August 1932 (1 year, 29 percent). When we look at the depreciation of the US dollar in 1933, the export-weighted exchange rate increased by 39 percent. Considering this magnitude, this change in the exchange rate implies an increase in economic activity of 12.5 percent for our sample, relative to a rise in industrial production of 39 percent by February 1934. According to our estimates, the trade channel could explain 32 percent of the increase in industrial production.

7 Conclusion

This paper explores the effect that the gold standard, as a fixed exchange rate system, had on the US economy during the Great Depression. Using novel micro data, we show that the terms of trade adjusted after the large currency changes that occurred when countries abandoned the gold standard. We show that the US was affected by the exit of the UK. The average trade-exposed city led the decline in economic activity in 1931. We also find that the opposite happened when the US abandoned the gold standard. This paper shows that the trade channel played an important role in the depth of and the recovery from the Great Depression.

This channel can be added to others that have been analyzed in the literature, but it has the advantage that we tested it in a different context than the recovery of 1933, when many other policies were implemented at the same time.

This paper shows that fixed exchange rate regimes contributed to the economic crises of the past and can have important implications today. Some type of fixed exchange rate is still used by a large number of countries according to recent evidence (Ilzetzki, Reinhart, and Rogoff 2019). Our results show that those regimes could have detrimental effects for their external sectors in the case of negative shocks. Moreover, countries belonging to currency unions, such as those of the Eurozone, have experienced different recovery paths since the Great Recession. In a world with high financial and trade integration, limiting the ability of the exchange rate to adjust can have important sectoral implications that could translate into deep economic recessions.

This paper also shows that relaxing those pegs could be beneficial for economic recovery. In this paper we show that exporting cities experienced an almost immediate recovery compared with nonexporting cities when the dollar depreciated in 1933. As Friedman (1953) pointed out, the exchange rate is a relatively flexible price that allows the rest of the prices in the economy to adjust relative to those in other countries. The results of this paper confirm that logic and highlight the importance of that mechanism in buffering macroeconomic shocks.

References

Albornoz, Facundo and Ezequiel García-Lembergman. 2020. "Importing After Exporting." *Unpublished Manuscript* .

Amiti, Mary, Oleg Itskhoki, and Jozef Konings. 2014. "Importers, Exporters, and Exchange Rate Disconnect." *American Economic Review* 104 (7):1942–78.

Atkeson, Andrew and Ariel Burstein. 2008. "Pricing-to-Market, Trade Costs, and International Relative Prices." *American Economic Review* 98 (5):1998–2031.

Auer, Raphael, Ariel Burstein, and Sarah M. Lein. 2021. "Exchange Rates and Prices: Evidence from the 2015 Swiss Franc Appreciation." *American Economic Review* 111 (2):652–86.

Autor, David H., David Dorn, and Gordon H. Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *American Economic Review* 103 (6):2121–68.

Benguria, Felipe and Rodrigo Andres Wagner. 2022. "Trade Invoicing Currencies and Exchange Rate Pass-through: The Introduction of the Euro as a Natural Experiment." *Available at SSRN 4214962* .

Bernanke, Ben S. 1995. "The Macroeconomics of the Great Depression: A Comparative Approach." *Journal of Money, Credit and Banking* 27 (1):1–28.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott. 2007. "Firms in International Trade." *Journal of Economic Perspectives* 21 (3):105–130.

Binder, Carola Conces. 2016. "Estimation of Historical Inflation Expectations." *Explorations in Economic History* 61:1–31.

Blaum, Joaquin. 2019. "Global Firms in Large Devaluations." *Unpublished Manuscript, Brown University* .

Borusyak, Kirill, Peter Hull, and Xavier Jaravel. 2022. "Quasi-experimental shift-share research designs." *The Review of Economic Studies* 89 (1):181–213.

Bouscasse, Paul. 2021. "Canst Thou Beggar Thy Neighbour? Evidence from the 1930s." .

Burstein, Ariel and Gita Gopinath. 2014. "International Prices and Exchange Rates." In *Handbook of International Economics*, vol. 4. Elsevier, 391–451.

Campa, Jose Manuel. 1990. "Exchange Rates and Economic Recovery in the 1930s: An Extension to Latin America." *Journal of Economic History* 50 (3):677–682.

Cole, Harold L, Lee E Ohanian et al. 1999. "The Great Depression in the United States from a neoclassical perspective." *Federal Reserve Bank of Minneapolis Quarterly Review* 23:2–24.

Crucini, Mario J and James Kahn. 1996. "Tariffs and aggregate economic activity: Lessons from the Great Depression." *Journal of Monetary Economics* 38 (3):427–467.

Diercks, Anthony M., Jonathan Rawls, and Eric Sims. 2020. "Bury the Gold Standard? A Quantitative Exploration." *NBER Working Paper* 28015.

Dornbusch, Rudiger. 1987. "Exchange Rates and Prices." *American Economic Review* 77 (1):93–106.

Eggertsson, Gauti B. 2008. "Great Expectations and the End of the Depression." *American Economic Review* 98 (4):1476–1516.

Egorov, Konstantin and Dmitry Mukhin. 2020. "Optimal Policy under Dollar Pricing." *Available at SSRN 3404660* .

Eichengreen, Barry. 1996. *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939*. Oxford University Press.

Eichengreen, Barry and Marc Flandreau. 2009. "The rise and fall of the dollar (or when did the dollar replace sterling as the leading reserve currency?)." *European Review of Economic History* 13 (3):377–411.

Eichengreen, Barry, Naeun Jung, Stephen Moch, and Ashoka Mody. 2014. "The Eurozone Crisis: Phoenix Miracle or Lost Decade?" *Journal of Macroeconomics* 39:288–308.

Eichengreen, Barry and Jeffrey Sachs. 1985. "Exchange Rates and Economic Recovery in the 1930s." *Journal of Economic History* 45 (4):925–946.

Fajgelbaum, Pablo D, Pinelopi K Goldberg, Patrick J Kennedy, and Amit K Khandelwal. 2020. "The return to protectionism." *The Quarterly Journal of Economics* 135 (1):1–55.

Farhi, Emmanuel and Matteo Maggiori. 2018. "A Model of the International Monetary System." *The Quarterly Journal of Economics* 133 (1):295–355.

Feenstra, Robert C. 1989. "Symmetric pass-through of tariffs and exchange rates under imperfect competition: An empirical test." *Journal of International Economics* 27 (1):25–45.

Fishback, Price, William Horrace, and Shawn Kantor. 2005a. "The Impact of New Deal Expenditures on Local Economic Activity: An Examination of Retail Sales, 1929-1939." *Journal of Economic History* 65:36–71.

Fishback, Price V., William C. Horrace, and Shawn Kantor. 2005b. "Did New Deal Grant Programs Stimulate Local Economies? A Study of Federal Grants and Retail Sales during the Great Depression." *The Journal of Economic History* 65 (1):36–71. DOI http://www.jstor.org/stable/3875042.

Forbes, Kristin J. 2002a. "Cheap labor meets costly capital: the impact of devaluations on commodity firms." *Journal of Development Economics* 69 (2):335–365.

———. 2002b. "How do large depreciations affect firm performance?" *IMF Staff Papers* 49 (1):214–238.

Friedman, Milton. 1953. "The case for flexible exchange rates." *Essays in Positive Economics* 157 (203):33.

Gali, Jordi and Tommaso Monacelli. 2005. "Monetary Policy and Exchange Rate Volatility in a Small Open Economy." *Review of Economic Studies* 72 (3):707–734.

Goldberg, Pinelopi Koujianou and Michael M. Knetter. 1997. "Goods Prices and Exchange Rates: What Have We Learned?" *Journal of Economic Literature* 35 (3):1243–1272.

Goldsmith-Pinkham, Paul, Isaac Sorkin, and Henry Swift. 2020. "Bartik instruments: What, when, why, and how." *American Economic Review* 110 (8):2586–2624.

Gopinath, Gita, Emine Boz, Camila Casas, Federico J Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller. 2020. "Dominant Currency Paradigm." *American Economic Review* 110 (3):677–719.

Gopinath, Gita, Oleg Itskhoki, and Roberto Rigobon. 2010. "Currency Choice and Exchange Rate Pass-through." *American Economic Review* 100 (1):304–36.

Hausman, Joshua K., Paul W. Rhode, and Johannes F. Wieland. 2019. "Recovery from the Great Depression: The Farm Channel in Spring 1933." *American Economic Review* 109 (2):427–72.

Hsieh, Chang-Tai and Christina D. Romer. 2006. "Was the Federal Reserve Constrained by the Gold Standard During the Great Depression? Evidence from the 1932 Open Market Purchase Program." *Journal of Economic History* :140–176.

Ilzetzki, Ethan, Carmen M. Reinhart, and Kenneth S. Rogoff. 2019. "Exchange Arrangements Entering the Twenty-First Century: Which Anchor will Hold?" *Quarterly Journal of Economics* 134 (2):599–646.

Itskhoki, O and D Mukhin. 2022. “Optimal Exchange Rate Policy.” Tech. rep., working paper.

Jacobson, Margaret M., Eric M. Leeper, and Bruce Preston. 2019. “Recovery of 1933.” .

Jalil, Andrew J and Gisela Rua. 2016. “Inflation Expectations and Recovery in Spring 1933.” *Explorations in Economic History* 62:26–50.

Jeanne, Olivier and Jeongwon Son. 2020. “To What Extent Are Tariffs Offset By Exchange Rates?” Tech. rep., National Bureau of Economic Research.

Knetter, Michael M. 1989. “Price Discrimination by U.S. and German Exporters.” *American Economic Review* 79 (1):198–210.

Lucas Jr, Robert E. 1994. “Review of Milton Friedman and Anna J. Schwartz’s “a monetary history of the United States, 1867–1960”.” *Journal of monetary Economics* 34 (1):5–16.

Matthews, Ada M. and A. Ross Eckler. 1928. “Regional Business Conditions: A Study of Bank Debits.” *The Review of Economics and Statistics* 10 (3):140–155. DOI http://www.jstor.org/stable/1928255.

Miranda-Agrippino, Silvia and Helene Rey. 2020. “U.S. Monetary Policy and the Global Financial Cycle.” *Review of Economic Studies* 87 (6):2754–2776.

Mitchener, Kris James, Kirsten Wandschneider, and Kevin O’Rourke. 2021. “The Smoot-Hawley Trade War.” *NBER Working Paper* 28616.

Monacelli, Tommaso. 2005. “Monetary Policy in a Low Pass-through Environment.” *Journal of Money, Credit and Banking* :1047–1066.

Nakamura, Emi and Jon Steinsson. 2014. “Fiscal stimulus in a monetary union: Evidence from US regions.” *American Economic Review* 104:753–92.

Nurkse, Ragnar. 1944. *International Currency Experience: Lessons of the Inter-War Period*, vol. 2. League of Nations.

Obstfeld, Maurice, Jonathan D. Ostry, and Mahvash S. Qureshi. 2019. "A Tie That Binds: Revisiting the Trilemma in Emerging Market Economies." *Review of Economics and Statistics* 101 (2):279–293.

Obstfeld, Maurice and Kenneth Rogoff. 1995. "The Mirage of Fixed Exchange Rates." *Journal of Economic Perspectives* 9 (4):73–96.

Patch, Buel W. 1934. "Foreign Trade and Currency Stability."

Pedemonte, Mathieu. 2020. "Fireside Chats: Communication and Consumers' Expectations in the Great Depression." *Federal Reserve Bank of Cleveland Working Papers* (WP 20-30).

Romer, Christina D. 1992. "What Ended the Great Depression?" *Journal of Economic History* 52 (4):757–784.

Ruggles, Steven, Sarah Flood, Ronald Goeken, Jose Pacas, Megan Schouweiler, and Matthew Sobek. 2021. "IPUMS USA: Version 11.0 [dataset]." *Minneapolis, MN: IPUMS* .

Solomou, Solomos and Dimitris Vartis. 2005. "Effective Exchange Rates in Britain, 1920-1930." *Journal of Economic History* 65 (3):850–859.

Temin, Peter and Barrie A Wigmore. 1990. "The end of one big deflation." *Explorations in Economic history* 27 (4):483–502.

Topalova, Petia. 2010. "Factor immobility and regional impacts of trade liberalization: Evidence on poverty from India." *American Economic Journal: Applied Economics* 2 (4):1–41.

Triffin, Robert. 1961. *Gold and the Dollar Crisis: The Future of Convertibility*, vol. 39. Yale University Press.

A Online Appendix

A.1 Other Tables and Figures

Table A.1: Relationship of Debits to Regional Measures of Economic Activity

	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
Observations	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

Notes: The table shows the results of regressions of economic activity variables and bank debits. Columns (1)-(4) show regressions of the monthly log of car registrations at the state level from Hausman, Rhode, and Wieland (2019) and log bank debit, between 1929 and 1934. Columns (5)-(8) show regressions of the percentage change in department store sales over the percentage change in debits at the monthly and Federal Reserve District level, excluding the NY Fed, between 1930 and 1935. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.2: Relationship of Debits to National Measures of Economic Activity

	Industrial Production			Business Activity		
	(1)	(2)	(3)	(4)	(5)	(6)
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

Notes: The table shows the results of regressions of economic activity variables and log bank debits. Columns (1)-(3) show regressions of the monthly log industrial production at the national level and log bank debit, between 1929 and 1938. Columns (4)-(6) show regressions of log business activity measures from the Cleveland Trust Company and log debits at the monthly level between 1929 and 1938. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: Correspondence between Export Sectors and Industrial Classification

Group	Commodities Groups	1930 Census Industrial Classification
1	Fish	Fish Curing and Packing
		Fishing
2	Dairy Products	Butter, Cheese, and Condensed Milk Factories
3	Animals, Edible	Slaughter and Packing Houses
	Meat Products	
	Animal Oils and Fats, Edible	
	Other Edible Animal Products	
	Hides and Skins, Raw, Except Furs	
	Animals, Oils, Fats, and Greases Inedible	
	Other Inedible Animals and Animal Products	
4	Leather	Trunk, Suitcase, and Bag Factories
	Leather Manufactures	Tanneries
		Harness and Saddle Factories
		Leather Belt, Leather Goods, etc Factories
		Shoe Factories
5	Grains and preparations	Flour and Grain Mills
	Fodders and Feeds	
	Vegetables Oils and Fats, Edible	
	Oilseeds	
	Seeds, Except Oilseeds	
6	Sugar and Related Products	Sugar Factories and Refineries
7	Cocoa and Coffee	Liquor and Beverage Industries
	Beverages	
8	Tobacco and Manufactures	Cigar and Tobacco Factories
		Agriculture (Tobacco)
9	Rubber and Manufactures	Rubber Factories

Continued on next page

Table A.3 – *Continued from previous page*

Group	**Commodities Groups**	**1930 Census Industrial Classification**
10	Fruits and Nuts	Agriculture (No Cotton-Tobacco)
	Vegetables and Preparations	
	Drugs, Herbs, Leaves and Roots Crude	
	Nursery and Greenhouse Stock	
	Miscellaneous Vegetable Products	
11	Silk manufactures	Silk Mills
12	Rayon and other Synthetic Textiles	Rayon Factories
		Hat Factories (felt)
13	Furs and Manufactures	Corset Factories
	Dyeing and Tanning Materials	Other and Not Specified Textile Mills
	Cotton Manufactures	Shirt, Collar, and Cuff Factories
	Wool Manufactures	Glove Factories
	Silk Unmanufactured	Carpet Mills
		Lace and Embroidery Mills
		Straw Factories
		Button Factories
		Sail, Awning, and Tent Factories
		Other Clothing Factories
		Broom and Brush Factories
		Textile Dyeing, Finishing, and Printing Mills
		Suit, Coat, and Overall Factories
		Knitting Mills
14	Cotton, Unmanufactured	Cotton Mills
	Cotton Semimanufactures	Agriculture (Cotton)
15	Jute and Manufactures	Hemp, Jute, and Linen Mills
	Flax, Hemp and Ramie Manufactures	Rope and Cordage Factories
	Other Vegetable Fibers and Manufactures	
16	Wool, Semimanufactures	Woolen and Worsted Mills

Continued on next page

Table A.3 – *Continued from previous page*

Group	Commodities Groups	1930 Census Industrial Classification
	Wool, Mohair, and Angora Rabbit Hair, Unmanufactured	
17	Wood, Unmanufactured	Forestry
	Naval Stores, Gums, and Resins	
	Cork and Manufactures	
18	Wood manufactures	Wagon and Carriage Factories
		Other Woodworking Factories
		Furniture Factories
19	Wood Semimanufactures-Sawmill Products	Saw and Planing Mills
20	Paper and Manufactures	Paper Box Factories
		Blank Nook, Envelope, Tag, Paper Bag, etc. Factories
21	Paper Base Stocks	Paper and Pulp Mills
22	Coal and Related Fuels	Coal Mines
		Charcoal and Code Works
23	Stone, Sand, Cement and Lime	Quarries
		Lime, Cement, and Artificial Stone Factories
24	Petroleum and Products	Petroleum Refineries
		Oil Wells and Gas Wells
25	Glass and Glass Products	Glass Factories
26	Clays and Clay Products	Potteries
		Brick, Tile, and Terra-Cotta Factories
27	Precious Stones including Pearls	Marble and Stone Yards
28	Other Nonmetallic Mineral Products	Salt Wells and Works
29	Iron Ore	Iron Mines
30	Iron and Steel, Advanced Manufactures	Tinware, Enamelware, etc, Factories
31	Precious Metals, Jewelry and Plated Ware	Jewelry Factories
32	Agricultural Machinery and Implements	Agricultural Implement Factories
33	Automobiles and other Vehicles	Automobile Factories
34	Coal-tar Products	Paint and Varnish Factories

Continued on next page

Table A.3 – *Continued from previous page*

Group	Commodities Groups	1930 Census Industrial Classification
	Pigments, Paints and Varnishes	
35	Fertilizer and Fertilizer Materials	Fertilizer Factories
36	Vegetable Oils	Soap Factories
	Soap and Toilet Preparations	
37	Musical Instruments	Piano and Organ Factories
38	Clocks and Watches	Clock and Watch Factories
39	Silver	Gold and Silver Mines
	Gold	Gold and Silver Factories
40	Iron and Steel Semimanufactures	Other Iron and Steel and Machinery Factories
	Steel Mill Products-Manufactures	Blast Furnaces and Steel Rolling Mills
41	Ferro-alloys	Not Specified Metal Industries
	Nonferrous Metals, except Precious	Copper Factories
		Brass Mills
		Not Specified Mines
		Lead and Zinc Factories
		Other Metal Factories
		Copper Mines
		Lead and Zinc Mines
		Other Specific Mines
42	Electrical Machinery and Apparatus	Electrical Machinery and Supply Factories
	Industrial Machinery	
43	Office Appliances	Other Miscellaneous Manufacturing Industries
	Printing Machinery	
44	Medicinal and Pharmaceutical Preparations	Other Chemical Factories
	Industrial Chemicals Specialties	
	Industrial Chemicals	
45	Explosives, Fuses, etc.	Explosives, Ammunition, and Fireworks Factories
	Firearms and Ammunition	

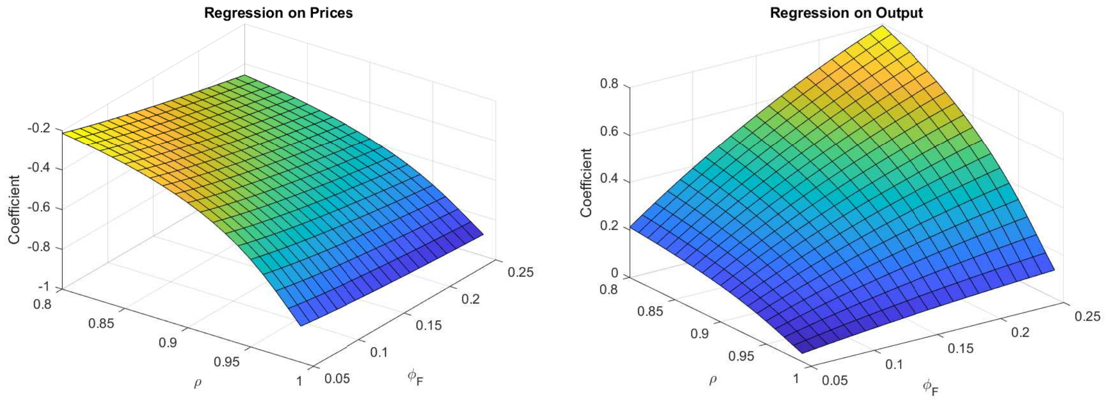
Notes: The table contains the correspondence between export sectors and industrial sectors. The classification of export sectors is the one used in the Statistical Abstract of the United States Foreign Commerce 1935. The classification of industrial sectors corresponds to the 1930 census industrial classification system.

Table A.4: Exports by Commodities Groups

Commodities Groups	**Exports Share 32A-33M (%)**	**Growth Rate 33M-34M (%)**
Group 00. Animal and animal products, edible	4.6	20.1
Animal oils and fats, edible	2.4	2.1
Meat products	1.3	62.71
Group 0. Animals and animal products, inedible	2.3	44.0
Group 1. Vegetable food products and beverages	10.6	-4.1
Fruits and nuts	4.9	13.3
Grains and preparations	3.9	-34.9
Group 2. Vegetable products, inedible, except fibers and wood	7.7	33.6
Tobacco and manufactures	5.0	36.8
Rubber and manufactures	1.1	27.7
Group 3. Textiles	25.7	38.2
Cotton, unmanufactured	21.4	46.1
Cotton manufactures	2.5	-9.6
Group 4. Wood and paper	3.8	39.1
Wood semimanufactures-sawmill products	1.8	46.7
Paper and manufactures	1.0	10.6
Group 5. Nonmetallic mineral products	18.5	10.4
Petroleum and products	13.9	7.5
Coal and related fuels	2.9	4.8
Other nonmetallic mineral products	1.1	49.9
Group 6. Metals and manufactures, except machinery and vehicles	5.5	71.6
Nonferrous metals, except precious	2.1	55.5
Iron and steel semimanufactures	1.0	157.8
Group 7. Machinery and vehicles	14.1	36.7
Automobiles and other vehicles	6.1	50.0
Industrial machinery	3.8	21.8
Electrical machinery and apparatus	2.7	28.7
Office appliances	1.0	27.8
Group 8. Chemicals and related products	4.8	19.88
Industrial chemicals	1.0	28.0
Group 9. Miscellaneous	4.2	-3.1
Miscellaneous articles	1.5	-9.2

Notes: The table shows the share of exports between April 1932 and March 1933 and the growth between April 1932-March 1933 and April 1933-March 1934. The table selects sectors with a percentage of total exports, excluding gold and silver, higher than 1 percent.

Figure A.1: Regressions under Different Parameters



Notes: The figure shows the results from the regression of the specification in equation (2) (left) and (4) (right) for the simulated data generated in the model for different values of ϕ_F and ρ.

A.2 Source of Price Data

Table A.5: Source and Origin of Price Data

Good	Country	Type	Source
Bread	US	Retail	NBER Macro History
Bread	France	Retail	NBER Macro History
Butter	US	Retail	NBER Macro History
Butter	UK	Country markets	Index of Agricultural Prices
Cattle	US	Wholesale	NBER Macro History
Cattle	UK	Representative markets	Index of Agricultural Prices
Copper	US	Wholesale	NBER Macro History
Copper	Germany	Wholesale	NBER Macro History
Cotton Yarn	US	Wholesale	NBER Macro History
Cotton Yarn	Germany	Wholesale	NBER Macro History
Eggs	US	Wholesale	NBER Macro History
Eggs	UK	Town and country markets	Index of Agricultural Prices
Hides	US	Wholesale	NBER Macro History
Hides	Germany	Wholesale	NBER Macro History
Hogs	US	Wholesale	NBER Macro History
Hogs	UK	Representative markets	Index of Agricultural Prices
Hogs	Germany	Wholesale	NBER Macro History
Milk	US	Wholesale	NBER Macro History
Milk	UK	Price paid to producers	Index of Agricultural Prices
Oats	US	Wholesale	NBER Macro History
Oats	UK	Wholesale	Index of Agricultural Prices
Pig Iron	US	Wholesale	NBER Macro History
Pig Iron	UK	Wholesale	NBER Macro History
Pig Iron	Germany	Wholesale	NBER Macro History
Pig Iron	France	Wholesale	NBER Macro History
Potatoes	US	Retail	NBER Macro History
Potatoes	UK	Wholesale	Index of Agricultural Prices
Poultry	US	Wholesale	NBER Macro History
Poultry	UK	Town and country markets	Index of Agricultural Prices
Wheat	US	Wholesale	NBER Macro History
Wheat	UK	Wholesale	NBER Macro History
Wheat	Germany	Wholesale	NBER Macro History
Wheat	France	Wholesale	NBER Macro History

Notes: The table shows the source the price data for each good and country of origin.

A.3 Summary Statistics of Cities

Table A.6: List of Cities and Summary Statistics of Main Variables

		Exposure Trade				Debits (Thousands)			
City	State	Mean	SD	Max	Min	Mean	SD	Max	Min
Aberdeen	SD	0.39	0.04	0.44	0.31	1052	373	2048	537
Abilene	TX	0.30	0.04	0.35	0.23	1506	545	3057	741
Akron	OH	0.48	0.05	0.55	0.39	15678	7068	30027	5544
Albany	NY	0.19	0.02	0.22	0.16	38302	8943	73149	22750
Albany	GA	0.37	0.04	0.42	0.29	730	228	1660	387
Albuquerque	NM	0.23	0.02	0.26	0.18	2311	590	3746	1223
Allentown	PA	0.46	0.04	0.51	0.38	6227	2026	10455	3831
Altoona	PA	0.15	0.01	0.16	0.12	2629	902	4402	1578
Asheville	NC	0.31	0.03	0.35	0.25	3381	2052	9081	1546
Atchison	KS	0.42	0.05	0.47	0.33	950	366	1639	511
Atlanta	GA	0.18	0.02	0.20	0.14	33069	8686	55586	20779
Augusta	GA	0.30	0.04	0.35	0.24	4176	1232	7962	1813
Aurora	IL	0.36	0.03	0.39	0.29	2309	1108	4439	875
Austin	TX	0.25	0.03	0.29	0.19	4654	1107	8897	3036
Bakersfield	CA	0.44	0.05	0.51	0.35	2520	735	4165	1408
Baltimore	MD	0.22	0.02	0.24	0.18	75438	18704	108665	46808
Bangor	ME	0.37	0.04	0.42	0.29	3005	622	4537	1809
Bartlesville	OK	0.49	0.06	0.56	0.39	4834	922	8052	2972
Battle Creek	MI	0.27	0.02	0.30	0.22	3260	1362	5960	980
Bay City	MI	0.46	0.04	0.52	0.37	2059	686	3528	790
Beaumont	TX	0.25	0.03	0.28	0.20	4528	1360	7630	2476
Bellingham	WA	0.43	0.04	0.48	0.34	1473	562	2646	736
Berkeley	CA	0.14	0.01	0.16	0.12	3867	820	5671	2482
Billings	MT	0.43	0.05	0.49	0.34	1619	453	3203	847
Binghamton	NY	0.47	0.05	0.52	0.38	4442	1078	7248	3060
Birmingham	AL	0.34	0.03	0.37	0.28	20539	8167	38916	10952
Bloomington	IL	0.35	0.04	0.39	0.28	2480	799	4607	1315
Boise	ID	0.30	0.03	0.34	0.24	2963	651	4470	1609
Boston	MA	0.17	0.02	0.19	0.14	329693	109516	647243	182970
Brockton	MA	0.45	0.05	0.51	0.37	4023	1069	7010	2620
Brunswick	GA	0.19	0.02	0.22	0.15	539	204	982	313
Buffalo	NY	0.29	0.03	0.33	0.24	67037	28482	151204	37740
Burlington	VT	0.44	0.05	0.47	0.33	1737	216	2068	1310
Butler	PA	0.50	0.04	0.56	0.41	2016	698	3671	1153
Camden	NJ	0.28	0.03	0.31	0.22	10698	3397	19160	6349
Canton	OH	0.43	0.04	0.47	0.35	7463	3138	14346	3470
Casper	WY	0.41	0.05	0.47	0.32	1253	389	2219	700
Cedar Rapids	IA	0.28	0.03	0.31	0.22	7207	2866	12509	2963
Champaign-Urbana	IL	0.28	0.03	0.31	0.22	2347	707	3543	1224
Charleston	SC	0.33	0.04	0.37	0.26	3739	1506	7280	1836
Charleston	WV	0.39	0.03	0.42	0.32	8914	1714	12807	5333
Charlotte	NC	0.35	0.04	0.40	0.27	10448	2130	16137	6307
Chattanooga	TN	0.36	0.03	0.39	0.29	8279	2505	13558	4746
Chester	PA	0.30	0.03	0.34	0.25	3823	1564	6691	2007
Cheyenne	WY	0.15	0.02	0.17	0.12	1404	263	2080	838

List of Cities and Summary Statistics of Main Variables (cont)

		Exposure Trade				Debits (Thousands)			
City	State	Mean	SD	Max	Min	Mean	SD	Max	Min
Chicago	IL	0.22	0.02	0.24	0.18	678666	246629	1334508	365982
Cincinnati	OH	0.27	0.02	0.30	0.22	71308	19859	123681	46071
Cleveland	OH	0.31	0.03	0.34	0.26	134095	53551	246524	67212
Colorado Springs	CO	0.21	0.02	0.23	0.17	3067	696	4938	1955
Columbus	GA	0.38	0.05	0.45	0.29	2451	689	3955	1474
Columbus	OH	0.21	0.02	0.24	0.17	32636	9409	49070	18474
Corsicana	TX	0.61	0.08	0.73	0.47	894	408	1945	452
Cumberland	MD	0.44	0.03	0.48	0.36	1721	427	2790	1007
Dallas	TX	0.18	0.02	0.21	0.15	41602	11289	74388	25982
Danville	IL	0.41	0.04	0.46	0.34	2274	802	4325	1333
Danville	VA	0.39	0.05	0.46	0.30	1709	689	3914	814
Davenport	IA	0.35	0.03	0.39	0.28	6572	3344	13301	2365
Dayton	OH	0.40	0.04	0.44	0.32	14540	6297	29333	6484
Decatur	IL	0.34	0.03	0.38	0.28	3280	1074	5422	1618
Denver	CO	0.15	0.01	0.17	0.12	32486	8180	53749	19541
Des Moines	IA	0.21	0.02	0.24	0.17	16921	3300	28205	10904
Detroit	MI	0.43	0.04	0.48	0.35	169308	72374	350672	7919
Dickinson	ND	0.55	0.06	0.63	0.44	276	82	496	150
Dothan	AL	0.60	0.07	0.70	0.47	544	194	1399	237
Dubuque	IA	0.40	0.04	0.45	0.32	2333	949	4204	874
Duluth	MN	0.32	0.03	0.35	0.26	11835	5525	28010	5217
Durham	NC	0.50	0.06	0.57	0.38	5779	1646	11713	3091
East St. Louis	IL	0.40	0.05	0.45	0.33	4888	902	7099	3461
El Paso	TX	0.21	0.02	0.25	0.17	5614	2348	10421	2699
Eldorado	AR	0.53	0.06	0.61	0.41	1129	460	2226	568
Elmira	NY	0.35	0.03	0.39	0.29	3539	1117	7472	2249
Enid	OK	0.37	0.04	0.42	0.29	2605	1311	8757	1057
Erie	PA	0.42	0.04	0.46	0.34	6244	2237	10300	3311
Eugene	OR	0.44	0.05	0.50	0.35	1199	410	2168	551
Evansville	IN	0.38	0.04	0.42	0.30	5216	2096	12074	2800
Everett	WA	0.46	0.05	0.52	0.36	1863	849	3534	786
Fall River	MA	0.55	0.07	0.65	0.43	4326	1398	8941	2560
Fargo	ND	0.37	0.04	0.42	0.30	3372	774	5476	1990
Flint	MI	0.55	0.05	0.63	0.45	6467	3036	13476	1641
Fort Smith	AR	0.39	0.04	0.44	0.32	2200	648	4099	1364
Fort Wayne	IN	0.41	0.04	0.45	0.33	7590	2929	14261	3574
Fort Worth	TX	0.21	0.02	0.24	0.17	16655	5354	30040	9361
Franklin	PA	0.33	0.03	0.37	0.27	833	331	1578	441
Fremont	NE	0.36	0.04	0.41	0.29	659	227	1238	337
Fresno	CA	0.45	0.05	0.51	0.36	5403	2123	11510	2607
Galveston	TX	0.15	0.02	0.17	0.12	5746	1832	12107	3413
Gary	IN	0.50	0.05	0.58	0.41	3050	1654	6419	958
Grand Junction	CO	0.42	0.05	0.48	0.34	580	200	1243	234
Grand Rapids	MI	0.36	0.03	0.41	0.29	12678	5018	23719	5560
Green Bay	WI	0.36	0.04	0.40	0.29	2637	660	3918	1507
Greensboro	NC	0.50	0.05	0.57	0.40	3493	1489	6536	662
Greensburg	PA	0.55	0.04	0.59	0.46	2300	1636	5709	770
Greenville	MS	0.72	0.10	0.86	0.55	835	255	1581	474
Greenville	SC	0.63	0.08	0.75	0.49	3518	1041	6279	1753

List of Cities and Summary Statistics of Main Variables (cont)

		Exposure Trade				Debits (Thousands)			
City	State	Mean	SD	Max	Min	Mean	SD	Max	Min
Guthrie	OK	0.47	0.06	0.55	0.37	468	217	973	209
Hagerstown	MD	0.40	0.04	0.45	0.33	1749	509	2957	821
Hamilton	OH	0.48	0.04	0.53	0.39	2143	635	3869	1293
Harrisburg	PA	0.30	0.03	0.32	0.24	6706	1310	9564	4515
Hartford	CT	0.38	0.03	0.42	0.31	39858	10685	76741	24889
Hattiesburg	MS	0.30	0.03	0.34	0.24	1027	368	1879	511
Hazleton	PA	0.42	0.03	0.45	0.36	2869	704	5394	1878
Helena	AR	0.66	0.09	0.78	0.51	615	446	2898	196
Holyoke	MA	0.51	0.05	0.57	0.41	2546	696	4456	1607
Homestead	PA	0.53	0.05	0.61	0.44	707	311	1412	312
Houston	TX	0.24	0.03	0.27	0.19	35470	8689	59529	22524
Huntington	WV	0.31	0.03	0.35	0.26	3490	1195	6234	2065
Hutchinson	KS	0.33	0.04	0.38	0.27	3327	1944	15715	1265
Independence	KS	0.43	0.05	0.49	0.34	1483	952	3426	454
Indianapolis	IN	0.26	0.02	0.29	0.21	34998	7776	50675	23017
Jackson	MI	0.40	0.04	0.45	0.33	3895	2048	7830	1040
Jackson	MS	0.43	0.05	0.51	0.34	4829	1327	7696	2371
Jacksonville	FL	0.12	0.01	0.14	0.10	13169	3112	20336	7597
Jamestown	ND	0.47	0.05	0.54	0.37	449	157	886	223
Jamestown	NY	0.47	0.05	0.53	0.38	3227	1169	6080	1671
Johnstown	PA	0.57	0.04	0.61	0.48	3563	1614	6759	1361
Joplin	MO	0.35	0.04	0.40	0.28	2062	751	4494	1045
Kalamazoo	MI	0.41	0.04	0.46	0.33	4324	1586	7402	2009
Kansas City	KS	0.27	0.03	0.30	0.22	3228	1067	5330	1784
Kansas City	MO	0.18	0.02	0.20	0.15	73499	20943	132448	44133
Knoxville	TN	0.36	0.04	0.40	0.29	5570	1690	9097	2812
La Crosse	WI	0.38	0.04	0.44	0.31	2089	690	4041	1216
Lancaster	PA	0.52	0.05	0.58	0.42	5255	2051	9973	2787
Lansing	MI	0.43	0.04	0.48	0.35	5056	2581	12074	1056
Lawrence	KS	0.35	0.04	0.40	0.28	882	228	1345	580
Lebanon	PA	0.54	0.05	0.59	0.44	1352	389	2277	828
Lexington	KY	0.23	0.03	0.26	0.18	4675	1815	11615	2600
Lima	OH	0.35	0.04	0.39	0.28	2313	791	4495	1006
Lincoln	NE	0.20	0.02	0.22	0.16	6173	1445	9070	3697
Little Rock	AR	0.22	0.03	0.26	0.18	8759	6034	27332	2899
Long Beach	CA	0.24	0.03	0.27	0.19	8324	3376	16225	4748
Lorain	OH	0.51	0.04	0.56	0.41	942	374	1734	429
Los Angeles	CA	0.16	0.01	0.18	0.13	173770	59942	316492	108549
Louisville	KY	0.25	0.03	0.28	0.20	33237	9001	53555	21568
Lowell	MA	0.30	0.03	0.33	0.24	3472	899	6550	2243
Lynchburg	VA	0.35	0.03	0.39	0.29	3587	784	5547	2371
Lynn	MA	0.48	0.05	0.54	0.39	5125	1627	9107	3065
Macon	GA	0.28	0.03	0.32	0.22	3060	975	5616	1549
Manchester	NH	0.55	0.06	0.63	0.44	3214	730	5264	2082
Mason City	IA	0.37	0.04	0.42	0.30	2033	614	3280	1128
Memphis	TN	0.24	0.03	0.28	0.19	26567	9467	60834	14145
Meridian	MS	0.38	0.04	0.44	0.30	2055	882	4408	1052

List of Cities and Summary Statistics of Main Variables (cont)

		Exposure Trade				Debits (Thousands)			
City	State	Mean	SD	Max	Min	Mean	SD	Max	Min
Miami	FL	0.12	0.01	0.13	0.09	5385	2281	11570	2311
Middletown	OH	0.49	0.05	0.56	0.39	1912	650	3304	1007
Milwaukee	WI	0.35	0.03	0.38	0.28	54581	12119	83988	35245
Minneapolis	MN	0.20	0.02	0.22	0.16	78223	21742	145863	40967
Minot	ND	0.39	0.04	0.45	0.31	1154	467	2673	561
Mobile	AL	0.20	0.02	0.23	0.16	6636	1837	11815	3924
Montclair	NJ	0.14	0.01	0.15	0.11	4481	1292	7841	2815
Montgomery	AL	0.35	0.04	0.40	0.27	4545	1371	8423	2469
Muscatine	IA	0.53	0.05	0.59	0.43	896	439	1942	243
Muskogee	OK	0.42	0.05	0.49	0.33	1903	593	3477	1145
Nashville	TN	0.24	0.02	0.27	0.20	16849	4830	31621	10704
New Bedford	MA	0.58	0.08	0.69	0.45	4477	1567	9864	2529
New Haven	CT	0.30	0.03	0.32	0.24	19299	6269	32468	11626
New Orleans	LA	0.12	0.01	0.13	0.10	56248	15974	91694	35393
New York	NY	0.19	0.02	0.21	0.16	5400000	3109086	13900000	2328777
Newark	NJ	0.25	0.02	0.28	0.20	85554	24099	148581	50624
Newnan	GA	0.76	0.09	0.89	0.60	358	110	764	165
Newport News	VA	0.04	0.00	0.04	0.03	2003	518	3135	1140
Norfolk	VA	0.13	0.01	0.14	0.10	10871	2840	19714	6418
Norristown	PA	0.34	0.03	0.38	0.28	2552	873	4579	1473
Oakland	CA	0.17	0.02	0.19	0.14	42501	7129	62020	30682
Ogden	UT	0.25	0.03	0.28	0.20	3310	1063	6792	1354
Oil City	PA	0.30	0.03	0.34	0.25	2613	1123	5188	974
Oklahoma City	OK	0.23	0.02	0.26	0.18	20336	6427	34320	11443
Okmulgee	OK	0.51	0.06	0.59	0.41	888	509	2221	390
Omaha	NE	0.19	0.02	0.22	0.15	35392	11084	57859	19275
Oshkosh	WI	0.48	0.05	0.54	0.39	2170	717	3850	1178
Owensboro	KY	0.55	0.06	0.63	0.43	1074	425	2301	452
Pasadena	CA	0.12	0.01	0.14	0.10	6067	2073	11305	3579
Passaic	NJ	0.43	0.04	0.47	0.36	6770	2722	12162	3026
Pensacola	FL	0.21	0.02	0.24	0.17	1365	266	1923	865
Peoria	IL	0.34	0.03	0.38	0.28	10006	2654	14926	5727
Philadelphia	PA	0.27	0.02	0.29	0.22	331118	117241	603307	194876
Phoenix	AZ	0.36	0.05	0.43	0.29	6775	2134	11611	3334
Pine Bluff	AR	0.62	0.08	0.73	0.48	1672	761	5244	822
Pittsburg	KS	0.40	0.03	0.44	0.34	940	287	1523	604
Pittsburgh	PA	0.23	0.02	0.25	0.18	168135	56086	295178	95476
Port Arthur	TX	0.52	0.06	0.60	0.41	1679	687	3333	850
Portland	ME	0.23	0.02	0.26	0.19	8451	2394	14795	4544
Portland	OR	0.20	0.02	0.22	0.16	32380	8373	53312	17526
Portsmouth	VA	0.19	0.02	0.22	0.16	913	206	1528	615
Poughkeepsie	NY	0.27	0.02	0.29	0.22	3206	733	5077	2202
Providence	RI	0.46	0.04	0.52	0.37	29360	8639	53012	18518
Pueblo	CO	0.35	0.03	0.38	0.28	3838	1528	10174	1827
Quincy	IL	0.45	0.04	0.50	0.36	1839	771	3462	880
Raleigh	NC	0.48	0.06	0.57	0.37	4966	1434	9195	2610
Reading	PA	0.49	0.04	0.54	0.40	7428	2574	12728	3794

List of Cities and Summary Statistics of Main Variables (cont)

		Exposure Trade				Debits (Thousands)			
City	State	Mean	SD	Max	Min	Mean	SD	Max	Min
Red Wing	MN	0.54	0.06	0.62	0.44	438	109	716	205
Reno	NV	0.20	0.02	0.23	0.16	2043	629	3489	675
Richmond	VA	0.19	0.02	0.22	0.15	29201	4215	39654	21072
Roanoke	VA	0.21	0.01	0.22	0.18	5463	1362	8504	3602
Rochester	NY	0.37	0.04	0.42	0.31	29029	8990	54798	18158
Rockford	IL	0.42	0.04	0.46	0.34	4915	2369	9620	2053
Roswell	NM	0.45	0.06	0.53	0.35	672	250	1500	369
Sacramento	CA	0.33	0.03	0.37	0.26	12482	5921	32510	4946
Saginaw	MI	0.46	0.04	0.52	0.37	4235	1525	7435	2033
Salt Lake City	UT	0.27	0.03	0.31	0.21	13412	3739	21759	7538
San Antonio	TX	0.18	0.02	0.20	0.14	14349	4255	22950	8400
San Bernardino	CA	0.33	0.03	0.37	0.26	1789	566	2826	862
San Diego	CA	0.17	0.02	0.19	0.14	9928	3063	16665	5968
San Francisco	CA	0.12	0.01	0.13	0.10	210544	71939	409452	123483
San Jose	CA	0.33	0.03	0.38	0.27	4982	1568	10350	2749
Santa Barbara	CA	0.35	0.04	0.40	0.28	2644	847	4306	1425
Savannah	GA	0.15	0.02	0.17	0.12	7007	2080	15373	3883
Scranton	PA	0.35	0.02	0.38	0.30	12589	2982	19960	8196
Seattle	WA	0.20	0.02	0.23	0.16	40841	13076	73000	21432
Sedalia	MO	0.31	0.03	0.35	0.25	621	321	1217	272
Sheboygan	WI	0.54	0.05	0.61	0.44	2717	734	4302	1632
Shreveport	LA	0.38	0.05	0.45	0.30	7188	1901	12750	4566
Sioux City	IA	0.30	0.03	0.34	0.24	9198	3278	15290	4633
Sioux Falls	SD	0.36	0.04	0.41	0.29	3602	1203	5715	1938
South Bend	IN	0.48	0.04	0.54	0.39	7782	3226	13721	3191
South St. Paul	MN	0.58	0.06	0.66	0.46	4765	2288	11103	2104
Spokane	WA	0.22	0.02	0.25	0.18	8925	3097	16205	4006
Springfield	IL	0.32	0.03	0.35	0.27	5710	1846	9697	3502
Springfield	MA	0.26	0.02	0.29	0.21	15051	3937	26583	9556
Springfield	MO	0.28	0.03	0.32	0.23	2886	671	4149	1825
Springfield	OH	0.40	0.04	0.45	0.33	3736	1321	7308	2034
St. Joseph	MO	0.28	0.03	0.32	0.23	7897	3113	14807	4157
St. Louis	MO	0.26	0.02	0.28	0.21	128910	36454	211271	76350
St. Paul	MN	0.19	0.02	0.21	0.15	32232	7273	48268	20221
Stamford	CT	0.38	0.03	0.42	0.31	3219	817	5274	2054
Steubenville	OH	0.52	0.04	0.57	0.43	1784	658	3496	857
Stockton	CA	0.48	0.05	0.54	0.38	4107	1467	7340	2212
Superior	WI	0.23	0.02	0.26	0.18	1209	518	2472	442
Syracuse	NY	0.32	0.03	0.35	0.26	16731	4244	27377	10992
Tacoma	WA	0.31	0.03	0.35	0.25	7046	2744	12355	3347
Tampa	FL	0.36	0.05	0.41	0.27	5581	1559	9390	3202
Terre Haute	IN	0.33	0.03	0.37	0.28	4044	927	5950	2486
Texarkana	AR	0.77	0.10	0.90	0.60	695	351	1636	351
Toledo	OH	0.34	0.03	0.38	0.28	28895	14406	69729	12799
Topeka	KS	0.17	0.02	0.20	0.14	3689	887	5704	2151
Trenton	NJ	0.34	0.03	0.38	0.28	15867	3258	24004	10086
Tucson	AZ	0.24	0.03	0.28	0.19	2132	548	3765	1101

List of Cities and Summary Statistics of Main Variables (cont)

		Exposure Trade				Debits (Thousands)			
City	State	Mean	SD	Max	Min	Mean	SD	Max	Min
Tulsa	OK	0.27	0.03	0.30	0.21	24364	8607	43771	12238
Utica	NY	0.39	0.05	0.43	0.31	7196	607	8785	5577
Valdosta	GA	0.48	0.05	0.55	0.38	779	293	2118	402
Vicksburg	MS	0.37	0.04	0.43	0.29	1234	370	2215	655
Waco	TX	0.37	0.05	0.44	0.29	3094	888	6443	1813
Walla Walla	WA	0.32	0.04	0.36	0.25	929	208	1444	509
Warren	OH	0.56	0.05	0.63	0.46	1892	895	4310	838
Washington	DC	0.04	0.00	0.04	0.03	49157	8822	68035	32262
Waterbury	CT	0.37	0.04	0.44	0.30	6898	2375	12853	3652
Waterloo	IA	0.33	0.03	0.37	0.27	3198	1482	6095	922
Wheeling	WV	0.34	0.03	0.37	0.28	8003	2337	13835	5137
Wichita	KS	0.24	0.02	0.27	0.19	10433	3580	19089	5704
Wichita Falls	TX	0.37	0.04	0.42	0.29	3531	1699	7445	1654
Wilkes-Barre	PA	0.39	0.03	0.42	0.34	7176	2204	13183	4420
Williamsport	PA	0.45	0.04	0.51	0.37	2878	1336	5687	1199
Wilmington	DE	0.32	0.03	0.35	0.26	13460	4354	32400	7459
Wilmington	NC	0.23	0.02	0.26	0.18	2478	940	4758	1275
Winona	MN	0.39	0.04	0.44	0.32	1427	289	2242	815
Winston-Salem	NC	0.56	0.07	0.65	0.42	7490	1675	12143	4616
Worcester	MA	0.48	0.05	0.54	0.39	12381	3988	21444	7168
Yakima	WA	0.47	0.05	0.54	0.38	2627	802	5037	1241
York	PA	0.58	0.06	0.64	0.46	4351	1110	6858	2611
Youngstown	OH	0.45	0.04	0.51	0.37	10573	4967	21700	4569
Zanesville	OH	0.45	0.04	0.49	0.37	1826	663	3386	1007
Average		0.36	0.14	0.90	0.03	38958	389547	13901431	150

Notes: The table shows summary statistics for each city's sample of available data. Exposure shows the interaction from the sector exposure times a variable bilateral exchange rate normalized to one in July 1931, as shown in equation (3) from December 1928 to December 1935. Debits (Thousands) shows the Debits for each city according to Report G.6. of the Federal Reserve board. Each measure is reported weekly, and we aggregated it at the monthly level. For each variable, we obtain the mean, standard deviation (SD), maximum value (Max), and minimum value (Min) over the sample for each city. The last row shows the same statistics over the sample of cities.

A.4 Shift-Share Instrumental Variable

Borusyak, Hull, and Jaravel (2022) develop a new econometric framework to understand shift-share instrumental variable (SSIV)[27] regressions in which identification follows from exogenous shocks when exposure shares are endogenous. Their approach is motivated by the fact that the orthogonality of the shift-share instrument with the unobserved residual can be represented as the orthogonality between the underlying

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[27] An average of a set of shocks with exposure weights.

shock and a shock-level unobservable. This equivalent result implies that SSIV regression coefficients can be obtained from an equivalent shock-level regression from where they derived conditions for SSIV identification and consistency: shocks are as-good-as-randomly assigned, mutually uncorrelated, large in number, and sufficiently dispersed in terms of their average exposure. Their setup nests shift-share reduced-form regressions, such as equation (4).

Our measure of trade exposure is constructed with incomplete export sector shares (the sum of exposure shares or lagged total share of export sector employment varies across observations) that are fixed across periods. Since we are using the variation in the total export sector share across cities and periods, one potential concern is that cities with higher export sector shares will tend to have systematically different values of trade exposure leading to bias when these cities have also different unobservables. The solution to this problem is to control for the sum of export sector shares, which we do by including city fixed effects in each specification of equation (4). However, a more subtle concern comes from the role of time fixed effects. According to Borusyak, Hull, and Jaravel (2022), in SSIV designs, time fixed effects only isolate within-period shock variation when the exposure shares add up to one. With incomplete shares, as in our case, time fixed effects need to be interacted with the sum of exposure shares. In this section, we use Borusyak, Hull, and Jaravel (2022) econometric framework to estimate coefficient β in equation (4).

Table A.7: Shock Summary Statistics

	(1)	(2)	(3)
Mean	0.355	1.015	0.000
Standard deviation	0.490	0.122	0.069
Interquartile range	0.951	0.153	0.052
Specification			
Excluding non-tradable sector	No	Yes	Yes
Residualizing on period FE	No	No	Yes
Effective sample size across sectors ($1/HHI$ of $s_{s,t}$ weights)	193.9	661.2	661.2
Largest s_{nt} weight	0.008	0.004	0.004
Observation counts			
No. of sector-period shocks	3825	3740	3740
No. of sectors	45	44	44

Notes: This table summarizes the distribution of bilateral nominal exchange rate shocks $g_{s,t}$ across sectors s and periods t. All statistics are weighted by the average sector exposure shares $sh_{s,t}$; shares are measured from export sector employment, as described in section 5.1. Columns (1) includes the non-tradable sector aggregate in each period with a shock of zero, while columns (2) and (3) restrict the sample to export sectors. Column (3) residualizes export sector shocks on period indicators. We report the effective sample size (the inverse renormalized Herfindahl index of the $sh_{s,t}$ weights) with and without the non-tradable sector at the sector-by-period level with the largest $sh_{s,t}$.

Our measure of trade exposure implicitly assumes that the exchange rate shock is constant and equal to zero for the non-tradable sector. Following Borusyak, Hull, and Jaravel (2022), we start by summarizing the distribution of exchange rate shocks $g_{s,t} = \sum_d Sh\_Ex_{s,d,1928} \times RER_{d,t}$, as well as the sector-level weights, $sh_{s,t} = \sum_c Sh\_W_{s,c,1930}$ (normalized to add up to one in the entire sample), to check if the assumptions under which the estimator of β is consistent are met. Table A.7 shows summary statistics for the sector-specific weighted exchange rate shocks, $g_{s,t}$, computed with importance weights $sh_{s,t}$, and characterizes these weights. Column (1) includes the missing non-tradable sector shock of zero in each period. The interquartile range is 0.951, the standard deviation is 0.490, and the effective sample size, measured by the inverse of its Herfindahl index ($1/\sum_{s,t} sh^2_{s,t}$) is relatively high, at 193.9. When we exclude the non-tradable sector (column 2), the interquartile range is 0.153, the standard deviation is

0.122, and the effective sample size increases to 661.2. Additionally, the mean of export sector shocks, 1.015, is significantly different from the zero shock of the missing non-tradable sector.[28] These analyses suggest that assuming that the exchange rate shock is constant and equal to zero for the non-tradable sector does not violate Assumption 2 (many uncorrelated shocks) in Borusyak, Hull, and Jaravel (2022); however, it does violate Assumption 1 (quasi-random shock assignment) required for the consistency of $\hat{\beta}$ in regression (4).[29] Thus, we should exclude the non-trabable sector from the identifying variation. To focus on the within-period variation in export sector shocks, column (3) residualizes export sector shocks on period indicators. Notice that even controlling on time, there is a sizable residual shock variation.[30]

Below we illustrate Borusyak, Hull, and Jaravel (2022) SSIV procedure applied to our regression to measure the effect of exposure to trade and exchange rate variation on the level of economic activity. Recall that our measure of trade exposure is constructed with incomplete export sector shares. Further controls to isolate the within-period variation in exchange rate shocks must be included. The reduced-form shift-share estimator equals the coefficient from a sh_s-weighted shock-level IV regression that uses the sector specific weighted exchange rate $g_{s,t}$ as the instrument in estimating

$$\overline{D}^{\perp}_{s,t} = \alpha + \beta \times \overline{Exposure\_Trade}^{\perp}_{s,t} + q^{'}_{s,t}\delta + \overline{\varepsilon}^{\perp}_{s,t}, \tag{7}$$

where $\overline{v}^{\perp}_{s,t} = \frac{\sum_c Sh\_W_{s,c,1930} v^{\perp}_c}{\sum_c Sh\_W_{s,c,1930}}$, $\overline{v}^{\perp}_{c,t}$ denotes the residual from the sample projection of a variable $\overline{v}_{c,t}$ on the control vector $w_{c,t}$ (for example city fixed effect, time fixed effect and time fixed effect interacted with the sum of exposure shares in our main specification) and $q_{s,t}$ which includes share-weighted sums of time effects.[31] Table A.8 reports the results[32]

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[28] This explains the high variation of the shock when the non-tradable sector is included, considering that the non-tradable sector accounts for a large fraction of total employment.

[29] Assumption 1 corresponds to $\mathbb{E}\left[g_{s,t}|\overline{\varepsilon}, sh\right] = g_{0,t} = 0$ and Assumption 2 corresponds to $\sum_{s,t} sh^2_{s,t}$, converges to zero as the number of cities increases. Even though the effective sample size is relatively high when the non-tradable sector is included, $\mathbb{E}\left[g_{s,t}|\overline{\varepsilon}, sh\right] \neq g_{0,t} = 0$.

[30] Note that we normalize to one the exchange rate of each country to July 1931.

[31] The inclusion of $q_{s,t}$ is important to get exposure-robust standard errors.

[32] Note that for all specifications, we should obtain the exact same regression coefficient with and without reshaping the data. For example, the coefficient from equation (4) when we control for city

Table A.8: SSIV Estimates of the Effect of Bilateral Exchange Rate Shocks on Economic Activity

	(1)	(2)	(3)
Exposure Trade	2.312***	1.381***	1.733***
	(0.281)	(0.528)	(0.548)
City FE	Yes	Yes	Yes
Time FE	Yes	-	-
Fed-Time FE	No	Yes	No
State-Time FE	No	No	Yes
Sample	All	All	All
Observations	3,825	3,825	3,825

Notes: The table shows the results of IV regression (7). The dependent variable is the log of bank debits at the city level. The independent variable is the measure constructed according to equation (3). The different columns show the results with a combination of fixed effects as specified in the table. Our measure of trade exposure has incomplete export sector shares. Further controls to isolate the within-period variation in exchange rate shocks must be included. Column (1) controls for an interaction of time fixed effects with the sum of exposure shares, column (2) controls for the interaction of Fed-Time fixed effects, and the sum of exposure shares while column (3) controls for the interaction of State-Time fixed effects, and the sum of exposure shares. Standard errors are clustered at the sector level. *** p<0.01, ** p<0.05, * p<0.1

A.5 Contribution of Exposure Relative to the Time Fixed Effect

A.5.1 UK's Exit and Trough of the Great Depression

We first analyze what happened to the external sector after the large appreciation of the US dollar in 1931. This event was the consequence of policies implemented by other countries to deal with their respective local crises. As discussed before, Mexico exited in August 1931 and the UK in September 1931. In this sense, the event is exogenous relative to our observation units, which are particular cities in the US.

Figure A.2 plots the total average effect $\gamma_t + \beta \times \overline{Exposure\_Trade}_{c,t}$ versus the time fixed effect γ_t. For both cases, it shows the changes over its own level in July 1931. As the dependent variable is in logs, this approximates to percentage changes with respect to the level of each effect in that period of time.

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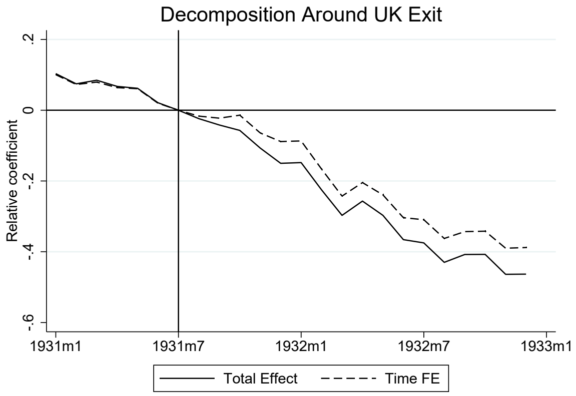
fixed effects, time fixed effects, and time fixed effects interacted with the sum of exposure shares must be precisely equal to the coefficient from regression (7) when we include the same set of controls.

Figure A.2: Effect of Exchange Rate Appreciation on Trade-Exposed Cities



Notes: The figure plots the changes in the average time fixed effect γ_t and the average total effect $\gamma_t + \beta \times \overline{Exposure\_Trade}_{c,t}$ relative to July 1931. The result comes from regression (4) reported in Table 2.

Figure A.2 shows a large reaction of trade-exposed cities. After having similar trends, cities more exposed to trade show a large decrease in economic activity after August 1931 relative to the rest of the sample, conditional on their individual exposure to changes in the exchange rate. This effect is economically significant. As shown in Figure A.2, on average, the economy had reduced its economic activity by 16 percent by the end of 1931 and around 40 percent of that effect was due to trade exposure. After that, the economy continues to decline. By the end of 1932, the trade exposure effect directly accounted for 16 percent of that effect.

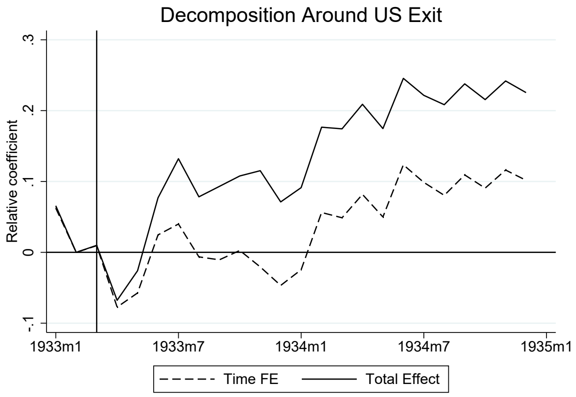
This result shows that the effect of the trade channel was relevant compared with the common trends in the sample at that time. This is a direct effect, meaning that we do not estimate any other type of multiplier. The appreciation of the US dollar in 1931 was strong, but the depreciation of 1933 was much greater in magnitude. In the next subsection, we evaluate the recovery starting in April 1933.

A.5.2 Recovery

In April 1933, the US left the gold standard and the US dollar depreciated relative to other currencies, as shown in Figure 1. The abandonment of the gold standard was not part of the plan of the Democratic Party according to Eggertsson (2008) and not expected until March 1933 (Hsieh and Romer 2006). But the change in policy was accompanied by many other policy changes. Many factors can explain the recovery that the economy experienced beginning in the spring of 1933.

In order to evaluate the contribution of the trade channel relative to that of other policies for our sample of cities, we perform the same exercise as in the previous subsection, but relative to February 1933 to capture the contribution of the depreciation. The other policies implemented at the time do not seem to have a special focus on the external sector, so those considerations will be captured by common trends (time fixed effects) if they affected trade cities in the same way as nontrade cities. Figure A.3 shows the effect following the abandonment of the gold standard by the US.

Figure A.3: Trade Exposure Effect and US Abandons the Gold Standard



Notes: The figure plots the changes of the average time fixed effect γ_t and the average total effect $\gamma_t + \beta \times \overline{Exposure\_Trade}_{c,t}$ relative to February 1933. The result comes from regression 4 reported in Table 2.

As Figure A.3 shows, in this case the trade channel's contribution is very important, relative a non-exposed city. We observe that after April 1933, more exposed cities experienced a large increase in their economic activity. After the bank holiday of March 1933, there is an immediate increase in economic activity in more exposed cities, relative to a non-exposed cities. We can see that the contribution of the trade channel is particularly important in 1933 in our sample.

A.6 Control Tariff

One concern about our main specification is the role of tariffs in this period. On one side, the US established tariffs on many products with the Smoot-Hawley Tariff Act of 1930. This event has been studied before, showing a significant effect of tariffs on GDP during the Great Depression, even though trade represented a small share of output (see Crucini and Kahn (1996) for example). Then, other countries established retaliations against the US, as described in Mitchener, Wandschneider, and O'Rourke (2021), while there is little evidence of the sectoral exposure to those retaliations and even less on the geographic effect.

Our identification assumption should not be affected by tariff movements. The main variation comes from countries that left the gold standard or decided to peg to the US dollar after those shocks. Those large movements in the exchange rate are mostly in periods that do not coincide with the Smoot-Hawley Tariff Act. The Tariff Act could affect our results by depreciating the country's currencies to which the US applied tariffs. In 1930, few countries had flexible exchange rates, but that variation might drive the main results. While events studies in Section 5 show no pre-trends and effects after the shock, exporting cities could benefit from those tariffs, driving part of the results. In Table A.9, we run regressions excluding 1930 (the act was effective in March 1930) and show that it does not alter the results. Columns (4)-(6) exclude the year 1930 and are very similar to columns (1)-(3), which are the results from the main specification.

Table A.9: Exposure to Trade Excluding Tariff Year

	(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

Notes: The table shows the results of regression (4). The dependent variable is the log of bank debits at the city level. The independent variable is the measure constructed according to equation (3). For the convenience of the reader, columns (1)-(3) repeat results in columns (1)-(3) from Table 2. Columns (4)-(6) exclude the year 1930 from the sample. Standard errors are clustered at the city level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Another concern is the retaliations from other countries affected US exports. In this case, a tariff imposed from a foreign country on imports from the US should depreciate the US dollar and, at the same time, negatively affect exporting cities, biasing our estimate toward zero. As there is no available information on the retaliation, we rely on exports tariff reported by the US. We obtain yearly tariffs for 15 sectors, and we build the following exposure to tariff measure, following a similar specification than Topalova (2010):

$$Exposure\_Tariff_{c,t} = \sum_{s} Sh\_W_{s,c,1930} \times Tariff_{s,y(t)}, \tag{8}$$

where c indexes cities and t indexes dates. $Sh\_W_{s,c,1930}$ represents the share of workers in sector s in the city c according to the census of 1930. $Tariff_{s,t}$ is the average tariff paid by exporting sector s in year y. We obtain data from 1928 to 1935 and add that control to regression (4). Results are presented in Table A.10.

Table A.10: Exposure to Trade and Tariff

	(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
Sample	All	All	All	All
Observations	21,807	21,807	21,807	21,164
R-squared	0.951	0.990	0.992	0.993

Notes: The table shows the results of regression (4) controlling for exposure to tariff, constructed according to equation (8). The different columns show the results with a combination of fixed effects as specified in the table. Standard errors are clustered at the city level. *** p<0.01, ** p<0.05, * p<0.1

Adding the tariff component does not alter the results. We can see that the coefficients are very similar to the baseline exercise. Moreover, we do not find an effect at the city level after controlling for a time and city-fixed effect, suggesting that most of the variation was common over time, having little impact at the cross-sectional level. Overall, these pieces of evidence do not indicate that tariffs did not affect economic activity but that tariff policy does not affect our measure of trade exposure.

A.7 Model Log-linearization and Estimation

In Section 6, we present a model of a simple monetary union. In this section, we present the log-linearize equations that are used to simulate the model. We define $\check{x}_t \equiv \frac{X_t - \bar{X}}{\bar{X}}$. We use upper case for the price index and price index inflation.

$$\check{c}_{1,t} = -\frac{1}{\gamma}(\check{i}_t - \check{\Pi}_{1,t+1}) + \check{c}_{1,t}$$

$$-\gamma\check{c}_{1,t} + \gamma\check{c}^*_{1,t} = \check{P}_{1,t} - \check{P}^*_{1,t} - \check{e}_{1,t}$$

$$-\gamma\check{c}_{1,t} + \gamma\check{c}_{2,t} = \check{P}_{1,t} - \check{P}_{2,t}$$

$$-\gamma\check{c}_{2,t} + \gamma\check{c}^*_{2,t} = \check{P}_{2,t} - \check{P}^*_{2,t} - \check{e}_{2,t}$$

$$\check{\pi}_{1,t} = \kappa \check{mc}_{1,t} + \beta \check{\pi}_{1,t+1}$$

$$\check{\pi}_{2,t} = \kappa \check{mc}_{2,t} + \beta \check{\pi}_{2,t+1}$$

$$\check{\pi}^*_{1,t} = \kappa \check{mc}^*_{1,t} + \beta \check{\pi}^*_{1,t+1}$$

$$\check{\pi}^*_{2,t} = \kappa \check{mc}^*_{2,t} + \beta \check{\pi}^*_{2,t+1}$$

$$\check{mc}_{1,t} = \alpha \check{y}_{1,t} + (\gamma - (1/\sigma))\check{c}_{1,t} + (1/\sigma)\check{c}_{H,1,t}$$

$$\check{mc}_{2,t} = \alpha \check{y}_{2,t} + (\gamma - (1/\sigma))\check{c}_{2,t} + (1/\sigma)\check{c}_{H,2,t}$$

$$\check{mc}^*_{1,t} = \alpha \check{y}^*_{1,t} + (\gamma - (1/\sigma))\check{c}^*_{1,t} + (1/\sigma)\check{c}^*_{H,1,t}$$

$$\check{mc}^*_{2,t} = \alpha \check{y}^*_{2,t} + (\gamma - (1/\sigma))\check{c}^*_{2,t} + (1/\sigma)\check{c}^*_{H,2,t}$$

$$\check{i}_t - \check{i}^*_{1,t} = \check{e}_{1,t+1} - \check{e}_{1,t}$$

$$\check{i}_t - \check{i}^*_{2,t} = \check{e}_{2,t+1} - \check{e}_{2,t}$$

$$\check{P}_{1,t} = \phi_H \check{p}_{1,t} + \phi_C \check{p}_{2,t} + \phi_F(\check{p}^*_{1,t} + \check{e}_{1,t})$$

$$\check{P}_{2,t} = \phi_H \check{p}_{2,t} + \phi_C \check{p}_{1,t} + \phi_F(\check{p}^*_{2,t} + \check{e}_{2,t})$$

$$\check{P}^*_{1,t} = (\phi_H + \phi_C)\check{p}^*_{1,t} + \phi_F(\check{p}_{1,t} - \check{e}_{1,t})$$

$$\check{P}^*_{2,t} = (\phi_H + \phi_C)\check{p}^*_{2,t} + \phi_F(\check{p}_{2,t} - \check{e}_{2,t})$$

$$\check{\Pi}_{1,t} = \check{P}_{1,t} - \check{P}_{1,t-1}$$

$$\check{\Pi}_{2,t} = \check{P}_{2,t} - \check{P}_{2,t-1}$$

$$\check{\Pi}^*_{1,t} = \check{P}^*_{1,t} - \check{P}^*_{1,t-1}$$

$$\check{\Pi}^*_{2,t} = \check{P}^*_{2,t} - \check{P}^*_{2,t-1}$$

$$\check{\pi}_{1,t} = \check{p}_{1,t} - \check{p}_{1,t-1}$$

$$\check{\pi}_{2,t} = \check{p}_{2,t} - \check{p}_{2,t-1}$$

$$\check{\pi}^*_{1,t} = \check{p}^*_{1,t} - \check{p}^*_{1,t-1}$$

$$\check{\pi}^*_{2,t} = \check{p}^*_{2,t} - \check{p}^*_{2,t-1}$$

$$-\check{c}_{F,1,t} + \check{c}_{H,1,t} = \sigma(\check{p}^*_{1,t} + \check{e}_{1,t} - \check{p}_{1,t})$$

$$-\check{c}_{F,2,t} + \check{c}_{H,2,t} = \sigma(\check{p}^*_{2,t} + \check{e}_{2,t} - \check{p}_{2,t})$$

$$-\check{c}_{C,1,t} + \check{c}_{H,1,t} = \sigma(\check{p}_{2,t} - \check{p}_{1,t})$$

$$-\check{c}_{C,2,t} + \check{c}_{H,2,t} = \sigma(\check{p}_{1,t} - \check{p}_{2,t})$$

$$-\check{c}^*_{F,1,t} + \check{c}^*_{H,1,t} = \sigma(\check{p}_{1,t} - \check{e}_{1,t} - \check{p}^*_{1,t})$$

$$-\check{c}^*_{F,2,t} + \check{c}^*_{H,2,t} = \sigma(\check{p}_{2,t} - \check{e}_{2,t} - \check{p}^*_{2,t})$$

$$\check{c}_{1,t} = \phi_H \check{c}_{H,1,t} + \phi_C \check{c}_{C,1,t} + \phi_F \check{c}_{F,1,t}$$

$$\check{c}_{2,t} = \phi_H \check{c}_{H,2,t} + \phi_C \check{c}_{C,2,t} + \phi_F \check{c}_{F,2,t}$$

$$\check{c}^*_{1,t} = (\phi_H + \phi_C)\check{c}^*_{H,1,t} + \phi_F \check{c}^*_{F,1,t}$$

$$\check{c}^*_{2,t} = (\phi_H + \phi_C)\check{c}^*_{H,2,t} + \phi_F \check{c}^*_{F,2,t}$$

$$\check{y}_{1,t} = \phi_H \check{c}_{H,1,t} + \phi_C \check{c}_{C,2,t} + \phi_F \check{c}^*_{F,1,t}$$

$$\check{y}_{2,t} = \phi_H \check{c}_{H,2,t} + \phi_C \check{c}_{C,1,t} + \phi_F \check{c}^*_{F,2,t}$$

$$\check{y}^*_{1,t} = (\phi_H + \phi_C)\check{c}^*_{H,1,t} + \phi_F \check{c}_{F,1,t}$$

$$\check{y}^*_{2,t} = (\phi_H + \phi_C)\check{c}^*_{H,2,t} + \phi_F \check{c}_{F,2,t}$$

$$\check{e}_{1,t} = \nu_t$$

$$\check{e}_{2,t} = 0$$

$$0 = \frac{1}{2}(\check{p}_{1,t} + \check{y}_{1,t} + \check{p}_{2,t} + \check{y}_{2,t}) + \check{p}^*_{2,t} + \check{y}_{2,t}$$

$$\nu_t = \rho\nu_{t-1} + \epsilon_t.$$

With that model, we then run a regression to obtain ϕ_F and ρ from the data. In order to do so, we run the following regressions:

$$\check{p}_{i,t} + \check{y}_{i,t} = \gamma_t + b \times \check{e}_{i,t} + \varepsilon_{i,t}.$$

with $i = 1, 2$. We compare the value b with β in equation (4)

$$\check{P}_{c,t} = d \times \check{e}_{c,t} + \gamma_t \varepsilon_{i,t}.$$

where $\check{P}_{c,t}$ is the price level in country c (home, foreign country 1 and foreign country 2) and $\check{e}_{c,t}$ is the bilateral exchange rate (home/c) with respect to country c. We use the value of d to compare it with β in equation (1). $\varepsilon_{i,t}$ is the error term. The regressions are run over 60 periods with the calibration explained in the main text. As regions are symmetric and have the same steady state, we do not include a region fixed effect.

A.8 Regions Exposed to both Countries

In this section, we consider a version of the model where both regions of the home country are exposed to both countries, and each region has a more intensive trade with one of the foreign countries. The consumption bundle in region i and at t is

$$C_{i,t} = \left[\phi_H^{\frac{1}{\sigma}} C_{H,i,t}^{\frac{\sigma-1}{\sigma}} + \phi_C^{\frac{1}{\sigma}} C_{C,i,t}^{\frac{\sigma-1}{\sigma}} + \phi_{1,F,i}^{\frac{1}{\sigma}} C_{F,i,1,t}^{\frac{\sigma-1}{\sigma}} + \phi_{2,F,i}^{\frac{1}{\sigma}} C_{F,i,2,t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}},$$

with $C_{H,i,t}$ is the good produced in the local region, $C_{C,i,t}$ is the good produced in the other region of the country, $C_{F,i,1,t}$ is the good produced in the foreign country 1, and $C_{F,i,2,t}$ is the good produced in the foreign country 2. In the case of the foreign country we have

$$C_{i,t}^{*} = \left[(\phi_H + \phi_C)^{\frac{1}{\sigma}} C_{H,i,t}^{*\frac{\sigma-1}{\sigma}} + \phi_{i,F,1}^{\frac{1}{\sigma}} C_{F,i,1,t}^{*\frac{\sigma-1}{\sigma}} + \phi_{i,F,2}^{\frac{1}{\sigma}} C_{F,i,2,t}^{*\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}.$$

where $C_{F,i,1,t}$ is the good produced in the region 1, and $C_{F,i,2,t}$ is the good produced in the region 2. We assume that $\phi_H + \phi_C + \phi_{1,F,i} + \phi_{2,F,i} = 1$ and $\phi_H + \phi_C + \phi_{i,F,1} + \phi_{i,F,2} = 1$ for $i = 1, 2$, which implies $\phi_{1,F,2} = \phi_{2,F,1} = \phi_F^r$ and $\phi_{1,F,1} = \phi_{2,F,2} = \phi_F^e$. We also assume that region 1 specializes in trade with country 1 (and region 2 with country 2), then $\phi_F^e > \phi_F^r$. The market clearing conditions are

$$Y_{1,t} = C_{H,1,t} + C_{C,2,t} + C_{F,1,1,t}^{*} + C_{F,2,1,t}^{*},$$

$$Y_{2,t} = C_{H,2,t} + C_{C,1,t} + C_{F,1,2,t}^{*} + C_{F,2,2,t}^{*},$$

$$Y^*_{1,t} = C^*_{1,t} + C_{F,1,1,t} + C_{F,2,1,t},$$

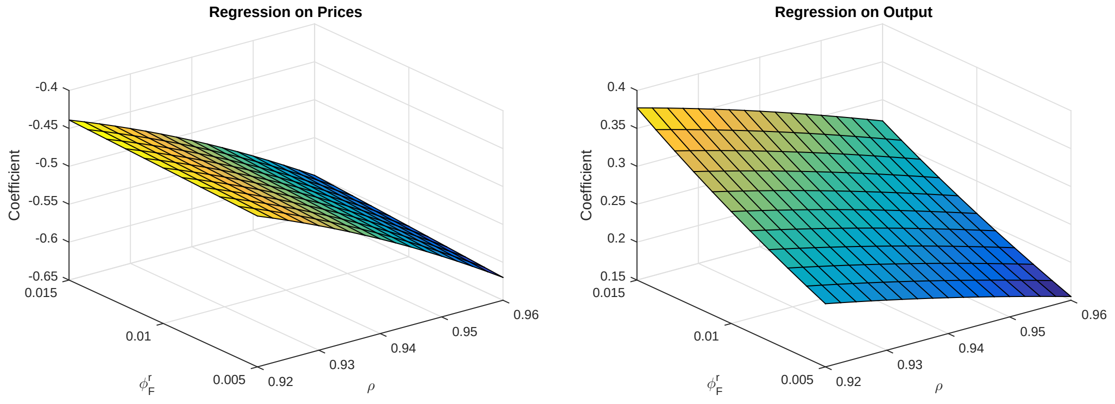
and

$$Y^*_{2,t} = C^*_{2,t} + C_{F,1,2,t} + C_{F,2,2,t}.$$

We set $\phi^e_F = 0.07$, and we use the same calibration as in section 6. Again, we simulate for the persistence of the shock ρ and ϕ^r_F, and obtain ϕ_H and ϕ_C. With each simulation, we generate a series of prices, output by region, and exchange rates.

With that information, we run regression (2). Those data include prices for the same variety in the local currency, but we cannot differentiate between local and foreign goods. We also run regression (4); that is, we run a regression of overall output in regions 1 and 2 on their respective exposure to the exchange rate. In both regressions, we control by time fixed effects. [33] Figure A.4 shows the results for the main coefficient of those regressions.

Figure A.4: Regressions under Different Parameters



Notes: The figure shows the results from the regression of the specification in equation (2) (left) and (4) (right) for the simulated data generated in the model for different values of ϕ^r_F and ρ.

Then, we use those parameters to generate the values of γ and ϕ^r_F that can replicate the regression results. In particular, for the price regression, we match the results in column (3) of Table 1 (-0.507). For the output regression, we match the results in column (3) of Table 2 multiplied by the results in column (1) of Table A.2

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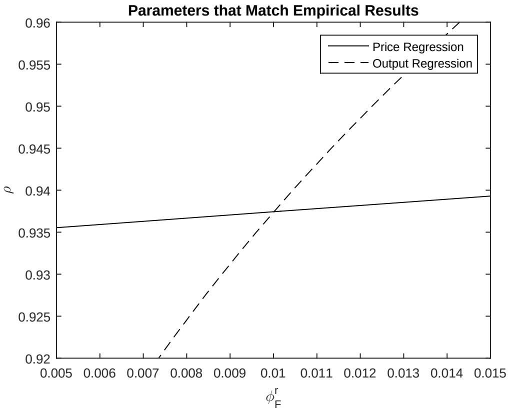
[33] The log-linearized model and exact regressions are in Appendix A.8.1.

(0.759 × 0.346 = 0.262). Figure A.5 shows the combination of parameters that generates the values for the regressions.

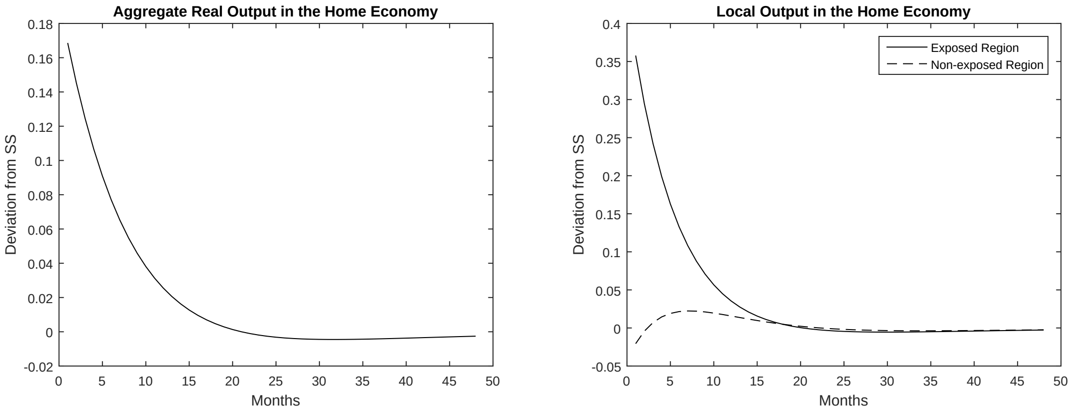
Figure A.5: Parameters That Match Empirical Results



Notes: The figure shows the combination of parameters that generates the results from the price regression, that is, column (3) of Table 1 (-0.507), and output regression, that is, the coefficient in column (3) of Table 2 multiplied by the coefficient in column (1) of Table A.2 (0.758 × 0.345 = 0.262). ϕ^e_F is set to a value of 0.07.

We can see that in the intersection of both lines, there is a combination of parameters that matches both regressions. That combination is $\rho = 0.938$ and $\phi^r_F = 0.01$. With those values we simulate what happened to the aggregate economy after the shock. Figure A.6 shows the aggregate effect of the exchange rate shock in the global economy.

Figure A.6: Aggregate Output after Depreciation



Notes: The left panel shows how aggregate output in the home economy reacts to a 1 percent depreciation in one of the economies. The right panel shows the deviation of each region with respect to the steady state after the shock.

We can see that a 1 percent depreciation increases local output by 0.35 percent on impact in the exposed region but decreases output in the non-exposed region by 0.02 percent. The home economy's total real output grows 0.165 percent on impact.

A.8.1 Model Log-linearization and Estimation

We use upper case for the price index and price index inflation.

$$\check{c}_{1,t} = -\frac{1}{\gamma}(\check{i}_t - \check{\Pi}_{1,t+1}) + \check{c}_{1,t}$$

$$-\gamma\check{c}_{1,t} + \gamma\check{c}^*_{1,t} = \check{P}_{1,t} - \check{P}^*_{1,t} - \check{e}_{1,t}$$

$$-\gamma\check{c}_{1,t} + \gamma\check{c}_{2,t} = \check{P}_{1,t} - \check{P}_{2,t}$$

$$-\gamma\check{c}_{2,t} + \gamma\check{c}^*_{2,t} = \check{P}_{2,t} - \check{P}^*_{2,t} - \check{e}_{2,t}$$

$$\check{\pi}_{1,t} = \kappa\check{mc}_{1,t} + \beta\check{\pi}_{1,t+1}$$

$$\check{\pi}_{2,t} = \kappa\check{mc}_{2,t} + \beta\check{\pi}_{2,t+1}$$

$$\check{\pi}^*_{1,t} = \kappa\check{mc}^*_{1,t} + \beta\check{\pi}^*_{1,t+1}$$

$$\check{\pi}^*_{2,t} = \kappa \check{mc}^*_{2,t} + \beta \check{\pi}^*_{2,t+1}$$

$$\check{mc}_{1,t} = \alpha \check{y}_{1,t} + (\gamma - (1/\sigma))\check{c}_{1,t} + (1/\sigma)\check{c}_{H,1,t}$$

$$\check{mc}_{2,t} = \alpha \check{y}_{2,t} + (\gamma - (1/\sigma))\check{c}_{2,t} + (1/\sigma)\check{c}_{H,2,t}$$

$$\check{mc}^*_{1,t} = \alpha \check{y}^*_{1,t} + (\gamma - (1/\sigma))\check{c}^*_{1,t} + (1/\sigma)\check{c}^*_{H,1,t}$$

$$\check{mc}^*_{2,t} = \alpha \check{y}^*_{2,t} + (\gamma - (1/\sigma))\check{c}^*_{2,t} + (1/\sigma)\check{c}^*_{H,2,t}$$

$$\check{i}_t - \check{i}^*_{1,t} = \check{e}_{1,t+1} - \check{e}_{1,t}$$

$$\check{i}_t - \check{i}^*_{2,t} = \check{e}_{2,t+1} - \check{e}_{2,t}$$

$$\check{P}_{1,t} = \phi_H \check{p}_{1,t} + \phi_C \check{p}_{2,t} + \phi^e_F(\check{p}^*_{1,t} + \check{e}_{1,t}) + \phi^r_F(\check{p}^*_{2,t} + \check{e}_{2,t})$$

$$\check{P}_{2,t} = \phi_H \check{p}_{2,t} + \phi_C \check{p}_{1,t} + \phi^r_F(\check{p}^*_{1,t} + \check{e}_{1,t}) + \phi^e_F(\check{p}^*_{2,t} + \check{e}_{2,t})$$

$$\check{P}^*_{1,t} = (\phi_H + \phi_C)\check{p}^*_{1,t} + \phi^e_F(\check{p}_{1,t} - \check{e}_{1,t}) + \phi^r_F(\check{p}_{2,t} - \check{e}_{2,t})$$

$$\check{P}^*_{2,t} = (\phi_H + \phi_C)\check{p}^*_{2,t} + \phi^r_F(\check{p}_{1,t} - \check{e}_{1,t}) + \phi^e_F(\check{p}_{2,t} - \check{e}_{2,t})$$

$$\check{\Pi}_{1,t} = \check{P}_{1,t} - \check{P}_{1,t-1}$$

$$\check{\Pi}_{2,t} = \check{P}_{2,t} - \check{P}_{2,t-1}$$

$$\check{\Pi}^*_{1,t} = \check{P}^*_{1,t} - \check{P}^*_{1,t-1}$$

$$\check{\Pi}^*_{2,t} = \check{P}^*_{2,t} - \check{P}^*_{2,t-1}$$

$$\check{\pi}_{1,t} = \check{p}_{1,t} - \check{p}_{1,t-1}$$

$$\check{\pi}_{2,t} = \check{p}_{2,t} - \check{p}_{2,t-1}$$

$$\check{\pi}^*_{1,t} = \check{p}^*_{1,t} - \check{p}^*_{1,t-1}$$

$$\check{\pi}^*_{2,t} = \check{p}^*_{2,t} - \check{p}^*_{2,t-1}$$

$$-\check{c}_{F,1,1,t} + \check{c}_{H,1,t} = \sigma(\check{p}^*_{1,t} + \check{e}_{1,t} - \check{p}_{1,t})$$

$$-\check{c}_{F,1,2,t} + \check{c}_{H,1,t} = \sigma(\check{p}^*_{2,t} + \check{e}_{1,t} - \check{p}_{1,t})$$

$$-\check{c}_{F,2,1,t} + \check{c}_{H,2,t} = \sigma(\check{p}^*_{1,t} + \check{e}_{1,t} - \check{p}_{2,t})$$

$$-\check{c}_{F,2,2,t} + \check{c}_{H,2,t} = \sigma(\check{p}^*_{2,t} + \check{e}_{2,t} - \check{p}_{2,t})$$

$$-\check{c}_{C,1,t} + \check{c}_{H,1,t} = \sigma(\check{p}_{2,t} - \check{p}_{1,t})$$

$$-\check{c}_{C,2,t} + \check{c}_{H,2,t} = \sigma(\check{p}_{1,t} - \check{p}_{2,t})$$

$$-\check{c}^*_{F,1,1,t} + \check{c}^*_{H,1,t} = \sigma(\check{p}_{1,t} - \check{e}_{1,t} - \check{p}^*_{1,t})$$

$$-\check{c}^*_{F,1,2,t} + \check{c}^*_{H,1,t} = \sigma(\check{p}_{2,t} - \check{e}_{2,t} - \check{p}^*_{1,t})$$

$$-\check{c}^*_{F,2,1,t} + \check{c}^*_{H,2,t} = \sigma(\check{p}_{1,t} - \check{e}_{1,t} - \check{p}^*_{2,t})$$

$$-\check{c}^*_{F,2,2,t} + \check{c}^*_{H,2,t} = \sigma(\check{p}_{2,t} - \check{e}_{2,t} - \check{p}^*_{2,t})$$

$$\check{c}_{1,t} = \phi_H \check{c}_{H,1,t} + \phi_C \check{c}_{C,1,t} + \phi^e_F \check{c}_{F,1,1,t} + \phi^r_F \check{c}_{F,1,2,t}$$

$$\check{c}_{2,t} = \phi_H \check{c}_{H,2,t} + \phi_C \check{c}_{C,2,t} + \phi^r_F \check{c}_{F,2,1,t} + \phi^e_F \check{c}_{F,2,2,t}$$

$$\check{c}^*_{1,t} = (\phi_H + \phi_C)\check{c}^*_{H,1,t} + \phi^e_F \check{c}^*_{F,1,1,t} + \phi^r_F \check{c}^*_{F,1,2,t}$$

$$\check{c}^*_{2,t} = (\phi_H + \phi_C)\check{c}^*_{H,2,t} + \phi^r_F \check{c}^*_{F,2,1,t} + \phi^e_F \check{c}^*_{F,2,2,t}$$

$$\check{y}_{1,t} = \phi_H \check{c}_{H,1,t} + \phi_C \check{c}_{C,2,t} + \phi^e_F \check{c}^*_{F,1,1,t} + \phi^r_F \check{c}^*_{F,2,1,t}$$

$$\check{y}_{2,t} = \phi_H \check{c}_{H,2,t} + \phi_C \check{c}_{C,1,t} + \phi^r_F \check{c}^*_{F,1,2,t} + \phi^e_F \check{c}^*_{F,2,2,t}$$

$$\check{y}^*_{1,t} = (\phi_H + \phi_C)\check{c}^*_{H,1,t} + \phi^e_F \check{c}_{F,1,1,t} + \phi^r_F \check{c}_{F,2,1,t}$$

$$\check{y}^*_{2,t} = (\phi_H + \phi_C)\check{c}^*_{H,2,t} + \phi^r_F \check{c}_{F,1,2,t} + \phi^e_F \check{c}_{F,2,2,t}$$

$$\check{e}_{1,t} = \nu_t$$

$$\check{e}_{2,t} = 0$$

$$0 = \frac{1}{2}(\check{p}_{1,t} + \check{y}_{1,t} + \check{p}_{2,t} + \check{y}_{2,t}) + \check{p}^*_{2,t} + \check{y}_{2,t}$$

$$\nu_t = \rho \nu_{t-1} + \epsilon_t.$$

With that model, we then run a regression to obtain ϕ^r_F and ρ from the data. In order to do so, we run the following regressions:

$$\check{p}_{i,t} + \check{y}_{i,t} = \gamma_t + b \times \frac{\phi_{1,F,i}}{\phi_{1,F,i} + \phi_{2,F,i}} \check{e}_{1,t} + \varepsilon_{i,t}.$$

with $i = 1, 2$. We compare the value b with β in equation (4)

$$\check{P}_{c,t} = d \times \check{e}_{c,t} + \gamma_t + \varepsilon_{i,t}.$$

where $\check{P}_{c,t}$ is the price level in country c (home, foreign country 1 and foreign country 2) and $\check{e}_{c,t}$ is the bilateral exchange rate (home/c) with respect to country c. We use the value of d to compare it with β in equation (1). $\varepsilon_{i,t}$ is the error term. The regressions are run over 60 periods with the calibration explained in the main text.