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 and find gains in competitiveness after a depreciation. Using novel monthly data on city level activity, combined with employment composition and sectoral export data, we show that American cities were significantly affected by changes in bilateral exchange rates. They were negatively impacted when the UK abandoned the gold standard in 1931 and benefited when the US left the gold standard in April 1933. We show that the gold standard deepened the Great Depression, and abandoning it was a key driver of the economic recovery.

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1 Introduction

Many countries have used some sort of fixed exchange rate in the past decades. There is an extensive literature that justifies its use as a way to promote price and financial stability. Fixed exchange rate has been used in forms of unilateral pegs (i.e. Argentina in 1990s), monetary unions (Euro area) or committing to international monetary rules (gold standard). But its use can have negative implications in economic crisis, hindering the adjustment of relative prices and the associated external re-balancing as Milton Friedman pointed out in 1953.[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 occurred in 1933.

Using monthly data on economic activity at the city level in the 1930s, we show that cities more specialized in exports were significantly affected by exchange rate appreciations, relative to cities that were less export oriented. We analyze events that occurred outside of the US, but affected 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 of the US with trading partners, we construct a measure of 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 Mexico depreciated. One month later, the UK left the gold standard, followed by several countries that were tied to the British pound. We also document that the US experienced a significant de-

[1] See Friedman (1953).

preciation relative to its trading partners in April 1933, when President Franklin D. Roosevelt took the United States off the gold standard.

These facts are consistent with losses in competitiveness due to the friction of having a fixed exchange rate. We first study how changes in exchange rate affect the terms of trade. 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 that we evaluate, the UK abandoning the gold standard in 1931 and the US in 1933.

We then turn to evaluate the effect on economic activity. We construct a measure of trade exposure at the monthly and city level; using census data, destination-sector specific exports from the US in 1928, and 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 the total employment, the variable shows how specialized is a city to overall exports. The exporting was particularly affected in the Great Depression, so it works 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 rate, that has variation on country-specific movements. Therefore, the measure interacts level city exposure with monthly variation coming from the exchange rate of countries that are more important in some sectors than others. Thanks to these features, we can control by time fixed effects, exploiting the cross-sectional variation and differential exposure to exchange rate shocks.

Using this measure, we show that cities with the average trade exposure increased their economic activity by 0.76 percent after a 1 percent city-specific depreciation, after controlling for common state variation. We start with the events of August and September 1931, when Mexico devaluated and the UK left the gold standard, depreciating the British pound relative to the US dollar. All these events produced an appreciation of the US dollar relative to their trading partners of more than 15 percent. We show that following common pre-trend, cities with higher trade exposure exhibited an important drop in economic activity relative to non-exposed cities. The average exposed city reduced their level of economic activity by 10 percent, relative to a non exposed city by the end of the first half of 1932. We document that this drop accounts directly for over a sixth of the drop in economic activity that the US experienced between 1931 and 1932, the deepest moment of the Great Depression.

After measuring the importance of the exchange rate movements for the external sector in the US, we explore the depreciation of 1933. The US economic activity started to increase after President Roosevelt's inauguration. We show that since April 1933, cities exposed to exports to countries that the US depreciated the most in 1933 increased their economic activity more rapidly than cities with lower exposure. The growth of the average exposed city accounts for almost all the increase in economic activity by the end of 1933 and accounted by around three fifths one year after the US abandoned the gold standard. These results suggest that a flexible exchange rate plays an important role in buffering macroeconomic shocks.

The role of the gold standard in shaping monetary policy has been in the debate lately, where important policy stakeholders have advocated for the return to the gold standard in the US.[2] Diercks, Rawls, and Sims (2020) show that such monetary regime in the context of a closed economy would have decrease 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 in the implications for the exchange rate regime. In that line, Obstfeld, Ostry, and Qureshi (2019) find that fixed exchange rate regimes magnify global financial shocks. The implications of the regimes can be larger due to the increased vulnerability of countries 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 trading sector would also be affected by that vulnerability.

From the economic history side, there are many theories that try to explain why March 1933 marks a turning point in economic activity in the US, reflecting the fact that several policies were implemented at that time (Romer (1992), Eggertsson (2008), Hausman, Rhode, and Wieland (2019), Jalil and Rua (2016), Jacobson, Leeper, and Preston (2019), among others).[3] 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.[4] In this paper we focus on large exchange rate fluctuations and their impact on the level of economic activity through changes in the competitiveness of exports. We first test this mechanism using the large appreciation of the US dollar in 1931, when the UK and other trading partners abandoned the gold standard.

[2] One example was former President Trump's Fed nominee, Judy Sheldon.

[3] That month Roosevelt began his first term. He immediately started a battery of policies in a period called the "Hundred Days".

[4] Abandoning the gold standard gave central banks and governments more leeway to stabilize the banking system, whose instability was the main source of monetary contraction in the United States (Bernanke (1995)). Devaluation raises final product prices lowering real production costs. All of the above mechanisms helped remove expectations of deflation, which is especially useful when nominal interest rates are stuck at the zero lower bound. On the other side, Bordo and Meissner (2020) show that currency issue of debt was an important consideration for countries to maintain the fixed exchange rate and avoid an increase in their debt burden.

This shock was unanticipated, and consequently, perceived as exogenous. Then, we focus on the role that the depreciation of the US dollar played in the recovery of 1933.[5]

We contribute to this literature by providing a clearer identification strategy, by exploiting cross sectional variation within the US and testing the main effects in periods with exogenous shocks. The exposure measure built for this paper that has city specific variation, the large panel of data on economic activity at the city level and the high frequency of the data allows us to control by common time effect in the US and evaluate effect in a very short window. This setting provides a clean identification relative to the other evidence of the events of the Great Depression. We show that fluctuations in the exchange rate were key, not only for deepening the crisis but also to exit it. We call this mechanism the trade channel.

This paper also relates closely to the literature of the role of exchange rate in economic growth. Rodrik (2008) argues that a depreciated exchange rate promotes economic growth. Levy-Yeyati and Sturzenegger (2003) find that flexible exchange rates are associated with higher economic growth, while Lopez-Cordova and Meissner (2003) find that fixed exchange rates promote trade, in the context of the early gold standard. In the short run, currency changes can have effect on economic activity in the presence of market power and other rigities, as explained by Dornbusch (1987). The condition discussed in that paper are met in a open economy New Keynesian model, where a key variable to evaluate the effect of exchange rate movements is the price pass-through. Many papers have estimated empirically exchange rate pass-through in different periods of time. Feenstra (1989) and Knetter (1989) are examples of early empirical works, that continued later, as described by Goldberg and Knetter (1997). This debate continued adding other considerations such as the currency of invoicing as discussed and estimated 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 exchange rate due to changes in regime. We find similar re-

[5] Although the depreciation of the dollar in this case cannot be considered as an exogenous shock.

sults of the one discussed in Goldberg and Knetter (1997), and finding heterogeneity over tradability as in Burstein, Eichenbaum, and Rebelo (2005).

Finally, we also add to the literature of the costs of fixed exchange rate, especially when local shocks occur. For example, Obstfeld and Rogoff (1995) discuss that when there is a shock that affects demand for local goods (namely, a productivity shock that affects terms of trade, or some shock abroad that reduces the demand for local goods), a fixed exchange rate will damage the local economy, as local producer's prices will not be able to adjust. This is aggravated by a restricted monetary authority. An alternative is to abandon the peg, which is more likely to occur when a negative export shock happens, as is found by Mitchener and Pina (2020). 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 fixed exchange rate in deepening the crisis. Eichengreen, Jung, Moch, and Mody (2014), discuss the similarities between both cases and the role of external adjustment (in particular with fiscal instrument constrained). This paper shows that this is the case using detailed micro level data.

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 the contribution of this mechanism around main events. Section 6 concludes.

2 The Trade Channel

The US dollar experienced a large depreciation in March 1933. After years in 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 (1995)).

As stated by Bernanke (1995), understanding the Great Depression is holy grail of macroeconomics. Eichengreen and Sachs (1985) argue that the length, depth and recovery from the Great Depression 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, buffers the decline in competitiveness through price adjustments.[6] In this paper, we evaluate this mechanisms empirically using novel micro data. We complement Eichengreen and Sachs (1985) evidence, by exploiting cross sectional variation in the US. This variation allows as to control by common shocks in the US and identify the contribution of the mechanism.

We start by showing some stylized facts in this section. We construct a measure of export-weighted exchange rate for the US. The US was not the first country to abandon the gold standard. Mexico abandoned in August 1931 after the monetary reforms called "Plan Calles", the UK left in September 1931,[7] while other countries had flexible regimes since the beginning of the Great Depression. This variation generates many exchange rate shocks depending on the exposition of exporting sectors to those countries. The objective of this measure is to have a general idea of the main changes in exchange rate that the US suffered during the Great Depression. To construct this measure, we obtain exchange rates at the monthly level for 33 countries representing 86.6 percent of the total US trade with foreign countries in 1928.[8] We normalize the exchange rate of each country to July 1931 (equal to 1). Then, we take the share over the total exports of the sample of each country's US imports and construct a weighted average exchange rate with those shares.[9] Figure 1 shows the evolution of this export weighted exchange rate and the normalized bilateral exchange rate for some particular countries.

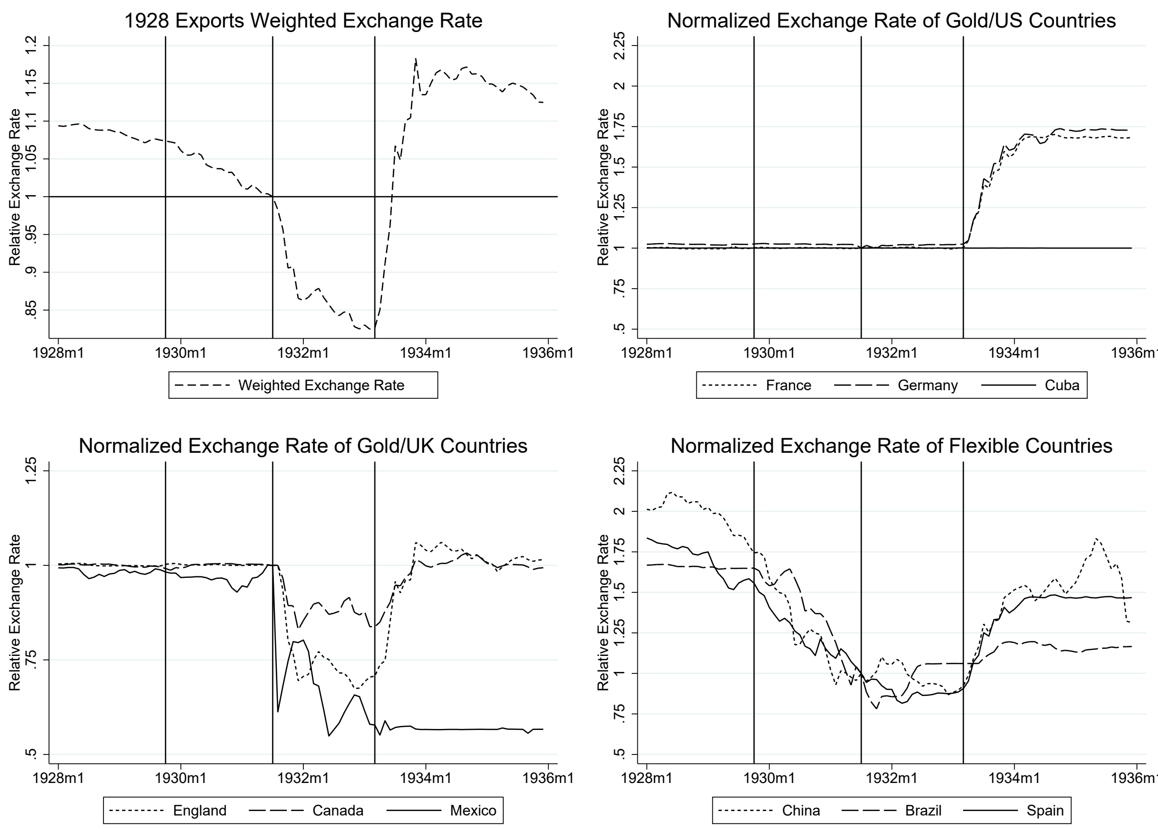
[6] In appendix A.2, we show that this is likely in the context of an open economy New Keynesian model. In the model, we show that a change in regime produces a faster recovery.

[7] Farhi and Maggiori (2018) argue that the exit of the UK, and the consequential devaluation of the sterling, was 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.

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

[9] Solomou and Vartis (2005) use a similar strategy for the UK.

Figure 1: End of Gold Standard and Exchange Rates



Note: The up-left panel (1) shows the weighted nominal exchange rate for the US. This measure is constructed by getting share of exports of the US 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 up-right panel (2), down-left (3) and down-right (4) 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.

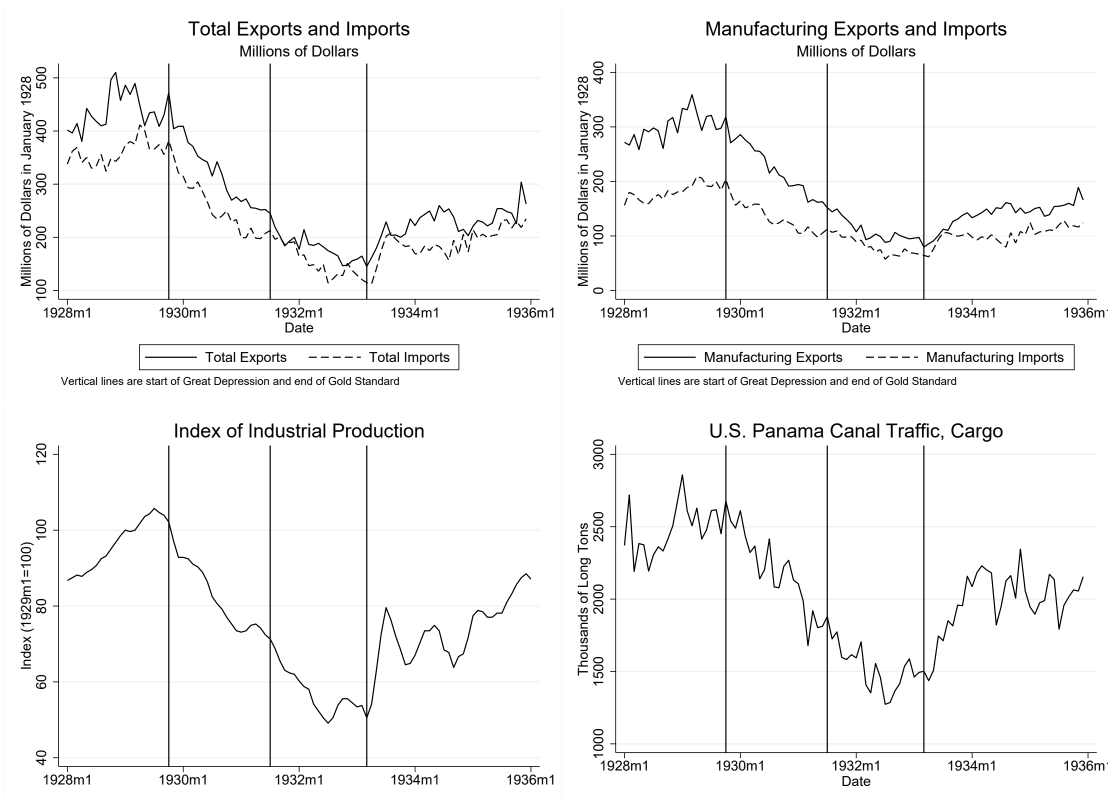
The left panel of Figure 1 shows that the weighted exchange rate of the US was slowly appreciating since 1928. This is mainly due to countries that had not fixed exchange rate with the US, such as China (2.7 percent of total exports in 1928), Brazil (2 percent) and Spain (1.7 percent). Then, in August 1931 we can see a large appreciation of the US dollar relative to their trading partners. Mexico (2.6 percent) had a large depreciation of its currency that year as seen in the right 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 followed depreciating their currencies. Other countries remained tied to the 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. 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 the gold, such as Canada and the UK, but also relative to the countries that remained in the gold standard, such as France and Germany, remaining tied to just a few countries, such as Cuba.

Figure 2 shows that following these main events, measures of trade also reacted. Exports and quantities of exports, decreased sharply during the Great Depression. Panel 1, 2 and 4, show that after the depreciation, exports experienced an increase measured as value and volume. These trend coincides with the evolution of industrial production, that 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 their currency. This situation was aggravated when the UK and other economies tied to the British pound depreciated their currencies in 1931. Before October 1929, exports where slowly growing according to many measures, as well as economic activity. The gold standard worked in a cooperative way until 1928 (Eichengreen (1995)), but approaching October 1929, that cooperation ended, producing a tightening of the money supply that increased the effects of the Great Crash.[10] During the years of the depression, real exports dropped almost 70 percent while industrial production dropped in a similar magnitude.

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

Figure 2: End of Gold Standard and Trade



Note: The up-left panel (panel 1) is the seasonally adjusted total exports in millions of dollar normalized by the CPI (base January 2008). The data comes from the NBER Macrohistory Database. The up-right panel (2) is the seasonally adjusted total exports in manufacturing in millions of dollar normalized by the CPI (base January 2008). The data comes from the NBER Macrohistory Database. The down-left panel (3) shows monthly industrial production, normalized to January 1929 (100). The data comes from the Fed's G.17 Industrial Production and Capacity Utilization. The down-right panel (4) is the seasonally adjusted log 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. After reaching its lowest point in April 1933, the value of exports grew by 75.21 percent in the next six months. This effect was not only accounted for by rising prices. By April 1934, the weight of US cargo in the Panama Canal was 53.3 percent higher than in April 1933. The manufacturing sector

(66 percent of total exports in September 1929) was particularly hit. In March 1933, their exports in real terms were 73 percent lower than the exports in September 1929. Crude materials (32.5 percent of exports in September 1929) decreased 50 percent. By March 1934, manufacturing exports were 85 percent higher, while crude material were 50 percent higher than one year ago.

Relevant economic stakeholders at the time suggested that the volume of trade could have been even much greater after the Unites States went off the gold standard. The expansion of the 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 pilling 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 United States abandoning 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 reallocation of resources towards import intensive firms, due to the fact that large exporters are at the same time large importers (Amiti, Itskhoki, and Konings (2014), Bernard, Jensen, Redding, and Schott (2007), and Albornoz and García-Lembergman (2020)).[11] The effect on net exports is ambiguous.[12] This narrative and quantitative evidence shows that the external sector expanded in starting in April 1933.

The opposite mechanism happened 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 sectors. The New York Times for example, highlighted the potential gains for the UK, expecting an increase in England's exports while increasing American imports. They considered that the US would experience "a temporary reduction in the standard of living." The article was optimistic about an increase in the demand of US raw materials to the UK, which can explain why crude material exports did not decline as much as manufacturing during the Great Depression. This optimism did not last long: in October 4, the same newspaper documented that the American cotton exports were stagnant. They attributed this situation to the "decline in sterling values," describing an "steady decline in prices." The article highlighted that they did not know when the price decline was going to stop.

After this aggregate data facts ans narrative, we turn to estimate 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. Then, we measure the effect on economic activity, comparing the economic performance of more export

[11] 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 the purchasing power of the US dollar became an obstacle for importers by July 1933, as reflected by the decline on the year-over-year growth rate of imports, while the export growth rate increased progressively after August 1933.

[12] The increase in net exports is related with the elasticity of substitution between the local and foreign variety. We show and discuss this point in appendix A.2.

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. Pass-through of less than 1 percent will imply some gains in competitiveness for the US producer, as she will receive more local currency for the same product.

In order to have incomplete pass-through in economics model, many works such as Atkeson and Burstein (2008), have focused on variable markups. Incomplete pass-thought can also be achieved in a New Keynesian model with elasticity of substitution between goods and sticky prices as in Monacelli (2005).[13] In appendix A.2 we show that 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 start estimating exchange rate pass-thought, in order to evaluate the extend of the gains in competitiveness. For this, we gather prices at the individual good level for the US, the UK, France and Germany. We do not have data for all the goods and all these countries, but all products are at least in the US.[14] We use monthly

[13] The market conditions to achieve that results were proposed in Dornbusch (1987)

[14] 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).

data from 1928 to 1934 for most products .[15] Then, we run the following regression to see the effect of the exchange rate on prices:

$$\Delta Prices_{c,j,t} = \beta \Delta Exchange\_Rate_{c,t} + \gamma_{j,c} + \theta_{j,t} + \varepsilon_{c,j,t}, \tag{1}$$

where $Prices_{c,j,t}$ is the 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 in time t. We also add a country-product fixed effect ($\gamma_{j,c}$) to control for the unit of the good, so we do not have to worry if the price of the product is in pounds or kilograms for example and a product-time fixed effect ($\theta_{j,t}$) that control for any general effect in prices and also for any product specific shock or seasonality. Standard errors are clustered at the product-country level and at the time level.

In addition to this regression, we can see whether more tradable products have a higher or lower pass-through. Every good has some tradable and non-tradable component, so we expect that β should be significant for all the goods, but we expect that the effect should be more pronounced in goods that have a higher tradable component.[16] Table 1 shows the results for the regression just mentioned.

[15] Pig Iron not available for the UK in 1934, wheat available until November 1934 for UK and June 1934 for France

[16] We classify as tradable goods Copper, Cotton Yard, Hides, Oats, Pig Iron, Potatoes and Wheat

Table 1: Effect of Exchange Rate Changes on Prices

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

Note: The table shows results of specification 1. The dependent variable is the change of log of prices. Exchange rate is the change in logs of the exchange rate, measure as US dollars over one unit of local currency (1 for the US). Tradable is a dummy equal to 1 for tradable goods. 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, and indicates a gain in competitiveness. For example, after a 1 percent depreciation in the UK, prices in the UK are around 0.5 percent more expensive in their currency, 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. Consistent with Burstein, Eichenbaum, and Rebelo (2005), we find higher pass-through for tradable goods as shown in column (4). This means that even within the country, the effect shows that there are gains in competitiveness in tradable goods. The average coefficient goes in line with those found in Goldberg and Knetter (1997) and Burstein and Gopinath (2014). For tradable goods the coefficient is close to 0.8. This is a high pass-through, but close and relatively smaller than the one found by Gopinath, Itskhoki, and Rigobon (2010) for non-dollar invoiced goods and Auer, Burstein, and Lein (2021) for Euro invoiced goods.

In addition to this result, we explore what happened during two important events during the Great Depression. The first event is September 1931, when the UK left the gold standard, producing an appreciation of the US dollar of more than 25% relative to British pound between September and December 1931, as shown in Figure 1.

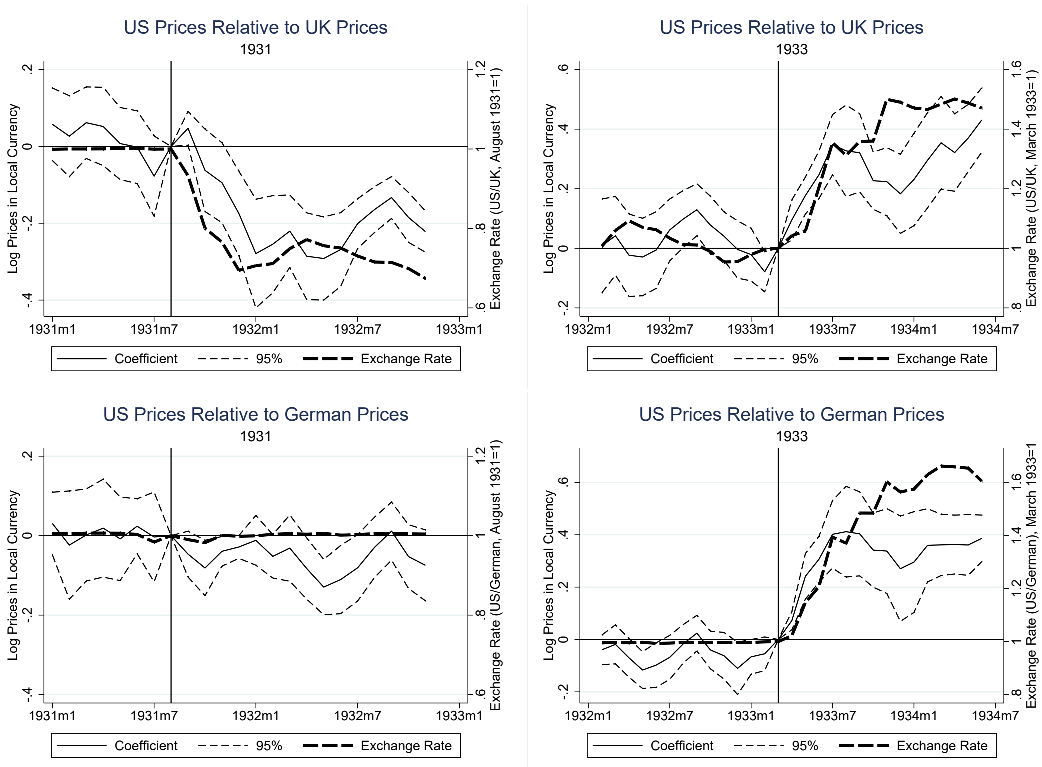
This shock is relatively exogenous from the US point of view. There is no evidence of changes in price expectations during that time (Binder (2016)). So, likely the policy conducted in the UK was not related to the prices of the US. This consideration will be more important when we discuss the results in terms of economic activity.

The second event is April 1933, when the US left the gold standard. In this exercise, we only use product prices between two 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 equations. We explore the effect for both events of 1931 and 1933 and show the results for all the time series to test pre-trend and how persistent are these effects. Figure 3 shows the results.

Figure 3: Exchange Rate and Price Reaction after Gold Standard



Note: The Figures represent results from regression (2). The left figures represent results when the UK abandoned the gold standard in September 1931 and the right figures represent the event when the US left the gold standard in April 1933. The top panel represents results of equation (2) with data of the US and the UK and the bottom panel represents results of equation (2) with data of the US and Germany. The solid line represents the coefficient of the regression (β^t) for each period of time, that shows the reaction of US prices relative to the other economy. The light-dashed line represent confidence intervals at the 95 percent. 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 the UK prices at a lower rate than the bilateral exchange rate appreciation, implying a reduction in the competitiveness of the US relative to the UK. 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 bilateral exchange rate depreciation, implying a gain in the competitiveness of the US relative to the UK. These changes are large. 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 (1 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.[17] This shows that the change in prices did not come from some specific change in the US relative to all the countries. In 1933, the change in relative prices between US and Germany is similar to the change in relative prices between US and UK.[18]

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. From the price results, the implications is that exporters gained competitiveness in 1933 while were affected in 1931. In the next section, using detailed cross sectional variation in the US, we evaluate whether changes in competitiveness had an impact on the level of economic activity

4 Local Effect of Exchange Rate Changes in Economic Activity

We evaluate the effect on local economic activity. We use data of bank debits for more than 200 cities available at the weekly basis. As shown in Pedemonte (2020), this measure strongly correlates with measures of spending on durable goods. This mea-

[17] According to Gopinath, Boz, Casas, Díez, Gourinchas, and Plagborg-Møller (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. To the extent that the British pound has been a more dominant currency for the United States than for Germany, can explain why the 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.

[18] Note that this result is consistent with the British pound as a dominant currency.

sure highly predicts measures of economic activity at the state, federal reserve district and national level at the monthly basis, such as car spending, department store sales, industrial production and business activity (see appendix A.1, table A.1 and A.2). We aggregate these data to the monthly frequency and seasonally adjust the series.[19] This is relevant, as we are going to control for economic characteristics of the cities, which can have important seasonal fluctuations, in particular in sectors such as agriculture.

We construct a measure of exposure to changes in exchange rate at the city level. In order to do this, we combine country-sector specific exports for the US in 1928, bilateral exchange rate from 1928 to 1935 and city level sectoral employment shares from the Census of 1930 (Ruggles, Flood, Goeken, Grover, and Meyer (2020)). With this information, we construct a time varying indicator that combines the specific exposition of a city to a country, through their economic specialization and get 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 merchandise exports of the US to 33 destinations. This information gives enough variation in term of the exposure to trade to different destinations. While Canada and the UK were the

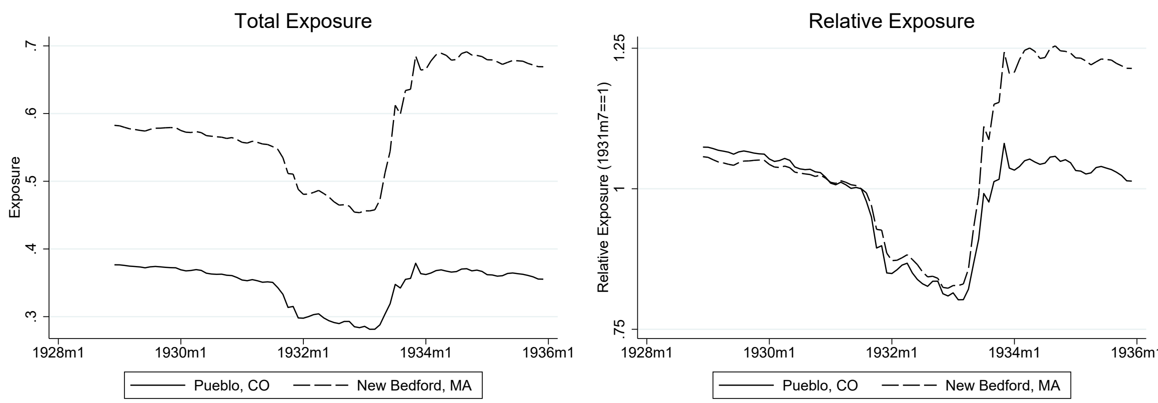
[19] We take logs and run a regression with city-month fixed effect. Then, we obtain the residual of the regression.

main trading partners of the US, Japan, for example, dominated in forestry and fertilizers. Mexico dominated in explosives and firearms, Netherlands in precious stones and Germany in cotton. Also, while iron ore went mainly to Canada and the UK, only 12 percent of explosive and firearms went there in our sample. This variation gives us exposure to different exchange rate regimes and shocks.

$Exposure\_Trade_{c,t}$ incorporates 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 also, it incorporates 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 loosing competitiveness since the beginning of the Great Depression, but if those cities were not exposed to sectors were the UK or pound-tied countries were important, the appreciation of 1931 should have not be so relevant for those cities. At the same time, cities more exposed to France or Germany should be relatively more benefited by the depreciation of 1933.

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 has the median allocation of labor to exporting sectors according to our sample, with 35.3 percent of its working population. This city had the main plant of the Colorado Fuel and Iron Company, an important steel conglomerate. 18 percent of labor force of Pueblo worked in the steel mill manufacturing sector. The main destination of this sector was Canada, with 44 percent of the total exports in our sample and then Japan, with 18 percent. On the other hand, New Bedford, MA was a city open to international trade. Based in the coast of Massachusetts, the city had direct access to the Atlantic. This could explain why 55 percent of the city's labor force worked in the exporting sector. They specialized in textile, another important exporting sector of the US. 42 percent of its working population was employed in the cotton sector, distributed in several cotton mills in the city. The main destination of the cotton semi-manufacturing products was Germany (with 25 percent of all the exports of our sample) and the UK (with 24 percent). These characteristics of the employment of the city exposed them to different shocks. We show the measure of exposure for both cities in the left panel of Figure 4 and the exposure measure relative to its value in July 1931, in the right panel.

Figure 4: Exposure Measure for Selected cities



Note: The Figures show the value of the variable with equation 3 for Puebla, Colorado and New Bedford, Massachusetts. The left panel shows the raw measure and the right panel show 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 comparing to New Bedford. This reflects the fact that Pueblo had a smaller fraction of the population working in the export sector. The right panel shows the same index normalized to one 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 since April 1993, 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 variation reflecting exposure to countries and their exchange rate movements.

We use this variable to evaluate the trade effect on economic activity. Using monthly data, we run the following regression:

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

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

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

	(1)	(2)	(3)	(4)	(5)	(6)
Exposure Trade	1.193***	0.836***	0.758***	2.176***	1.965***	1.564***
	(0.253)	(0.260)	(0.216)	(0.449)	(0.453)	(0.529)
City FE	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	-	-	Yes	-	-
Fed-Time FE	No	Yes	No	No	Yes	No
State-Time FE	No	No	Yes	No	No	Yes
Sample	All	All	All	≤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

Note: The table shows 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 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) in terms of economic activity. A big part of the identification comes from common variation, as main events affected many countries. But thanks to our measure that 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 in 1.19 percent. Using even more granular variation at the state level still gets a positive and significant results. This variation takes some common exposure of regions. For example, cities in Michigan specialized in the automotive industry, so the results with state-time fixed effect takes that common variation. The results are still significant and large, with a coefficient of 0.76.

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 only consider the period were the US was in the gold standard. Therefore, the variation in exchange rate came from foreign policy decisions. We can see that the coefficient are not only significant, but even larger: including time fixed effects, a 1 percent variation in the city cross section exposure, increasis economic activity in 2.17 percent. This results are in line with Obstfeld, Ostry, and Qureshi (2019), that shows that under fixed regimes, global shocks are magnified.

Next, we estimate the contribution of the 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 an 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. In particular, we will show how much of the total change on economic activity after those events can be attributed to the trade channel. This analysis abstracts from spillover effects and only shows direct effects. In a sense, it would be a lower bound of the total contribution of the trade channel.

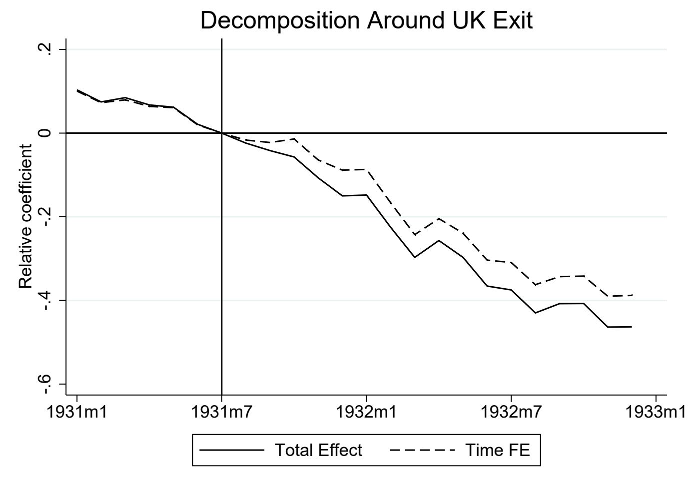
As we showed before, when large changes in exchange rate occurred, not every city was exposed in the same way to trade. Actually, only 35 percent of the workers in our sample were employed in trade sectors according to our classification, that varies from cities with less than 5 percent, as Washington DC, and others with more than 70 percent as Elberton, GA. This variation interacts with changes in exchange rate, creating variation even when there are some common movements. Because of this, the time fixed effect captures common movements, considering cities that were almost not exposed in our sample. In the next subsection, we evaluate the event of 1931.

4.1 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 taken 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, that are particular cities in the US.

Figure 5 plots the total average effect $\gamma_t + \beta \times \overline{Exposure\_Trade}_{c,t}$ versus the time effect γ_t. For both cases, it shows the changes over it 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.

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



Note: The figure plots the changes in the average time effect γ_t and the average total effect $\gamma_t + \beta \times \overline{Exposure\_Trade}_{c,t}$ relative to July 1931. Result come from regression 4 reported in table 2

Figure 5 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 exchange rate. This effect is economically significant. As shown in Figure 5, on average, the economy reduced its economic activity by 16 percent by the end of 1931 and around 40 percent of that effect was due to the trade exposure. After that, the economy continues to decline. By the end of 1932, the trade exposure effect accounted directly by 16 percent of that effect.

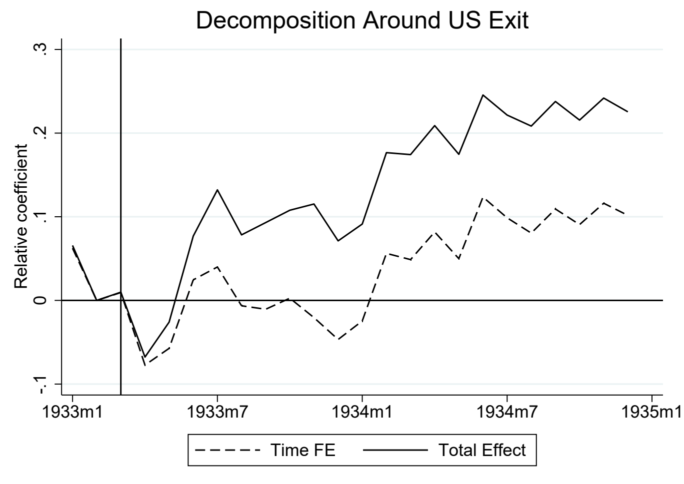
This result shows that the effect of the trade channel was relevant compared with the common trends that the economy had at that time. This is a direct effect, meaning that we do not estimate any other type of multiplier. The appreciation of the US dollar in 1931 was strong, but the depreciation of 1933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

4.2 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 part of the plan of the democratic party according to Eggertsson (2008) and not expected until March 1933 (Hsieh and Romer (2006)). Anyways, the change in policy was accompanied by many other policy changes. There are many factors that can explain the recovery that the economy experienced since spring 1933. Some works had focused on expectation channels, where higher inflation expectations induced by Roosevelt's policies reduced the ex-ante real interest rate, stimulating investment and consumption through traditional channels (Eggertsson (2008), Jalil and Rua (2016), Sumner (2015), and Taylor and Neumann (2016)). Other focus on the role of public debt in a context of higher inflation as Jacobson, Leeper, and Preston (2019). Hausman, Rhode, and Wieland (2019) argue that higher traded crop prices redistributed income to relatively high marginal propensity to consume agents (farmers) from relatively low marginal propensity to consume agents (nonfarm households and businesses). Other works emphasize the speed of recovery. Cole and Ohanian (2004), find that recovery from the Great Depression was weak due to New Deal cartel-type policies.

In order to evaluate the contribution of the trade channel relative to the other policies, we perform the same exercise than in the previous sub section, 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 effect) if they affected trade cities in the same way than non-trade cities. 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



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

As Figure 6 shows, in this case the trade channel contribution is very important. We observe that after April 1933, more exposed cities experienced a larger increase in their economic activity. After March 1933 there is a drop on average. That month was characterized by a bank holiday, so there is less 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 remained with a higher economic activity level. Overall, we can see that the trade channel also played an important role in the recovery occurred after 1933.

The effect is large. We can see that the contribution of the trade channel is particularly important in 1933. By the end of that year, all the effect in terms of recovery was due to the trade exposure, were cities on average increased their economic activity around 10 percent relative to February, even if the common trend was negative. Starting 1934, the average time effect is positive. By April 1934, the average total effect was 20 percent relative to February 1933, the trade channel contributed more than 60 percent of the total effect. By the end of 1934 the contribution was still over 50 percent.

We can see that the main driver of the economic recovery was directly this effect and it continues to have an effect after.

These results were obtained with very granular data at the city level, but a good part of the variation is common to the cities. In the next section, we construct a measure of the increase in economic activity an we interact it with time dummies, to not rely on the effect of the exchange and see how income translated to spending. We use these results as robustness.

5 Robustness Using Bartik

In this section, we use another measure of trade exposure as a robustness, 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 exposition 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 shock on economic activity of export oriented cities. For this empirical exercise, instead of using the changes in exchange rate, we rely only on time fixed effects interacted with the measure of exposure to increase in export to see whether more exposed cities had a relative 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 industrial level in 1930. Then, we obtain data on sectoral exports of the US between April 1932 and March 1933 and compared it with data between April 1933 and March 1934. With that information, we construct the following measure of exposure a la Autor, Dorn, and Hanson (2013):

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

where $L_{c,s,1930}$ is the 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.[20] The data on economic activity is at the city level, but we use employment at the level of the county where the city belongs.[21] This measure of exposure combines the sectoral employment composition of the county where the city belongs with good level information of exports in terms of the US products that were more demanded 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. The main exports are unmanufactured cotton (21.4 percent), petroleum and products (13.9 percent), automobiles and other vehicles (6.1 percent), tobacco and manufactures (4.6 percent) and fruits and nuts (4.9 percent).[22] The product categories that experienced the highest growth in the value of their exports by March 1934 were iron and steel semi-manufactures (157.8 percent), meat products (62.7 percent), nonferrous metals (55.5 percent), automobiles (50.0 percent), other nonmetallic mineral products (49.9 percent), wood semi-manufactures (46.7 percent), unmanufactured cotton (46.1 percent) and tobacco (36.8 percent). We can see that the sectors that grew the most were related to the metal manufacturing industry and some agricultural sectors, such as cotton, which is concentrated in certain areas of the country.

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 direct. 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 estimating the additional direct effect on the exposed cities.

[20] Table A.3 in Appendix A.1 contains the correspondence between export sectors and industrial sectors.

[21] There are some cities that are independent, in which case we only use the city level employment.

[22] It is estimated that in 1934 the production of goods for export provided direct living for about two million persons, where approximately one million were cotton farmers and another half a million were engaged in other agricultural activities. Additionally, several million benefited indirectly by supplying goods and services to the export sector (Patch (1935)).

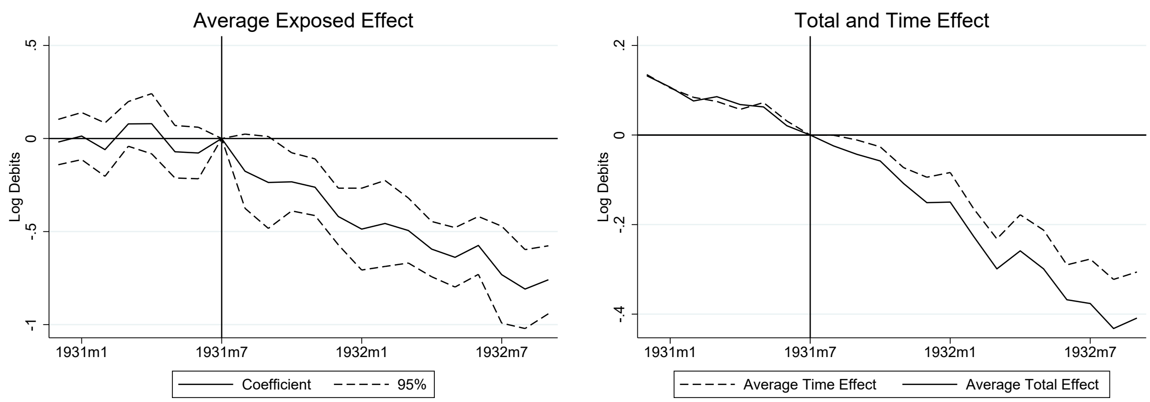
In case other policies where more important (for example, associated with benefiting the financial sector), this coefficient should not be positive or even negative. Because of that, this marginal effect will measure if the cities more exposed were benefited more, relative the any other common effect or specific effect in other industries.

As in the previous section, we estimate the effect of the appreciation of 1931 on economic activity of 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, due to the fact that the largest appreciation occurred at a specific period. We can compare the pre-trends with the performance of 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 conditions on 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} represent the time effect of average exposed cities relative to a baseline that considers the average effect of the rest of our sample. In 1931, the economic activity of the whole country was decreasing. $\gamma_{s(c),t}$ will capture that effect even at the state level. Left panel of figure 7 shows how more exposed cities behaved after the appreciation of the exchange rate in the US, given by the exogenous 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 7: Effect of Exchange Rate Appreciation on Trade Exposed Cities



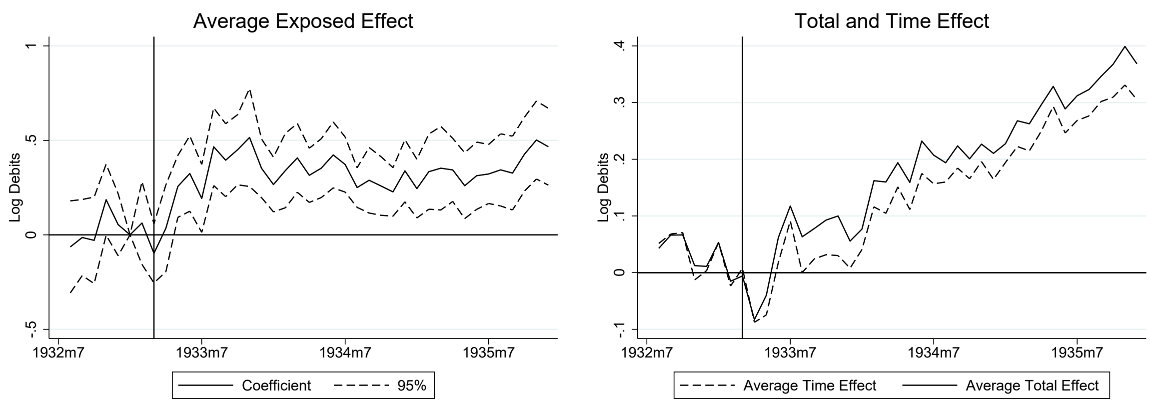
Note: The right panel shows results from regression of specification 6. The solid line represents the coefficient β^t. The coefficient is relative to July 1931 (equal to 0). The dashed lines represent confidence intervals at the 95 percent. Standard errors are two-way clustered at the city and time level. 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 7, the average exposure compared with the common trend of cities (time fixed effect) 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 on 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 7 that the contribution of this effect is economically significant. These results are similar to those found in the previous section.

We then run specification 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 than non-trade cities. In this regression we will basically see if the trade channel has a differential effect versus the other channels. Figure 8 shows the effect following the abandonment of the gold standard by the US.

Figure 8: Trade Exposure Effect and US Abandons the Gold Standard



Note: The figure shows results from regression of specification 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. 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 $\overline{\gamma_{s(c)t}} + \beta^t \times \overline{Trade\_Exposure_{c,33-32}}$

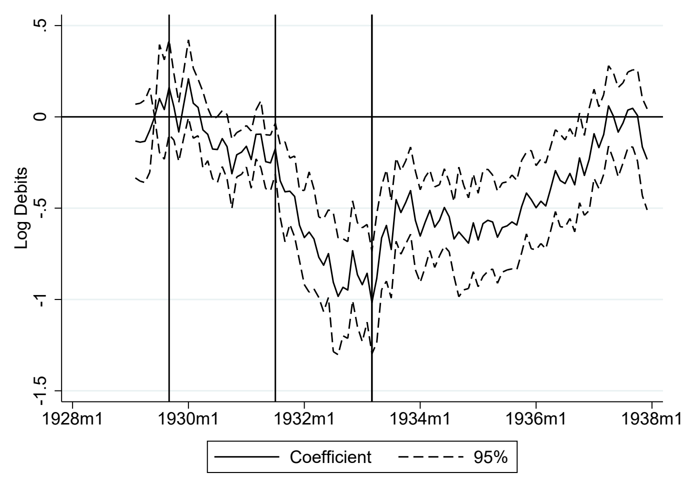
We observe that after April 1933, more exposed cities experienced a large increase in their economic activity. There is a small drop in the more exposed cities in March 1933. This month was characterized by a bank holiday, so there is less observations for our sample and some cities show very small numbers that month. After that, there is an immediate increase in economic activity in more exposed cities. This effect is persistent. More exposed cities remained with a higher economic activity level. Overall, we can see that the trade channel also played an important role in the recovery occurred of 1933.

The coefficient is close to 0.5 by the end of 1933, which represent on average 7 percent more economic activity compare to the average growth. As explained before, many policies were implemented at the that. 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 by a significant differential effect, in a period where the whole country was growing. Considering this estimation, the contribution of the trade channel are similar to the numbers obtained in the previous section.

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

With this specification we can map the whole Great Depression and see how trade exposed cities behaved. Also, we do not rely on data on exchange rate, that suffered changes over time. In the next figure, we plot the coefficient of regression 6, between 1929 to 1936, representing the whole Great Depression and the recovery before the crisis of 1937. We normalize the coefficient to 0 in June 1929.

Figure 9: Trade Exposure Effect and the Great Depression



Note: The figure shows results from regression of specification 6. The solid line represents the coefficient β^t. The coefficient is normalized to 0 in June 1929. The dashed lines represent confidence intervals at the 95 percent. Standard errors are two-way clustered at the city and time level. Vertical lines represent October 1929, August 1931 and March 1933

We can see an interesting pattern that coincides with some main events during the Great Depression. There is a stable relationship in the level of economic activity between exposed and non-exposed cities until June 1930, when the Smoot-Hawley Tariff Act was signed, and exposed cities lose ground relative to non-exposed cities. The Smoot-Hawley Tariff Act produced a trade war where countries retaliated and boycotted US products, which can explain why export oriented cities where affected (see Mitchener, Wandschneider, and O'Rourke (2021)). Then, when the UK and its major trading partners went off the gold standard, exposed cities are hit harder again. There is an incomplete recovery when the US left the gold standard in April 1933 and exposed cities begin to improve relative to non-exposed cities during the second half of 1935, when President Roosevelt started to sign trade agreements with main trading partners (e.g. with Canada in November 1935). Exposed cities converged to the level of less exposed cities at the state level only by the end of 1936.

These results show the importance of the trade channel during the Great Depression. US exporting cities were significantly affected relative to US less depended cities, and their recovery depended on the devaluation of the exchange rate and the creation of trade agreements.

6 Conclusion

This paper explores the effect that the gold standard as a fixed exchange rate system had on US economy during the Great Depression. Using novel micro data, we show that the terms of trade adjusted after 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 tradable city led the economic 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 and recovery of the Great Depression.

This channel add to other that had been analyzed in the literature, but has the advantage that we tested in a different context than the recovery of 1933, where many policies occurred at the same time.

This paper shows that fixed exchange rate regimes contributed to economic crisis 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 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 great 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 non exporting 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 the other countries. The results of this paper confirm that logic and highlights the importance of that mechanism to buffer macroeconomic shocks.

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A Appendix

A.1 Other Tables and Figures

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

	Log Car Registration (State)				% Change in Department Store Sales (Fed)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debits	0.610***	1.032***	0.588***	0.349***	0.376***	0.375***	0.248***	0.226***
	(0.008)	(0.037)	(0.006)	(0.053)	(0.023)	(0.023)	(0.037)	(0.037)
Region FE	No	Yes	No	Yes	No	Yes	No	Yes
Time FE	No	No	Yes	Yes	No	No	Yes	Yes
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

Note: The table shows the result to simple regressions of economic activity variables and bank debits. Rows 1 to 4 show regressions of the monthly log of car registration at the state level from Hausman, Rhode, and Wieland (2019) and log bank debit, between 1929 and 1934. Rows 5 to 8 show regressions of percentage change in department store sales over percentage change of 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 with National Measures of Economic Activity

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

Note: The table shows the result to simple regressions of economic activity variables and bank debits. Rows 1 to 3 show regressions of the monthly log industrial production at the national level and log bank debit, between 1929 and 1938. Rows 4 to 6 show regressions of log business activity measure from the Cleveland Trust Company over percentage change of 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	

Continued on next page

Table A.3 – *Continued from previous page*

Group	Commodities Groups	1930 Census Industrial Classification
8	Tobacco and Manufactures	Cigar and Tobacco Factories
		Agriculture (Tobacco)
9	Rubber and Manufactures	Rubber Factories
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 Unmanufactures	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

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Table A.3 – *Continued from previous page*

Group	Commodities Groups	1930 Census Industrial Classification
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
	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 Planning 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

Continued on next page

Table A.3 – *Continued from previous page*

Group	Commodities Groups	1930 Census Industrial Classification
		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
	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 Specific Metal Industries
	Nonferrous Metals, except Precious	Copper Factories
		Brass Mills
		Not Specific Mines
		Lead and Zinc Factories
		Other Metal Factories

Continued on next page

Table A.3 – *Continued from previous page*

Group	Commodities Groups	1930 Census Industrial Classification
		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	

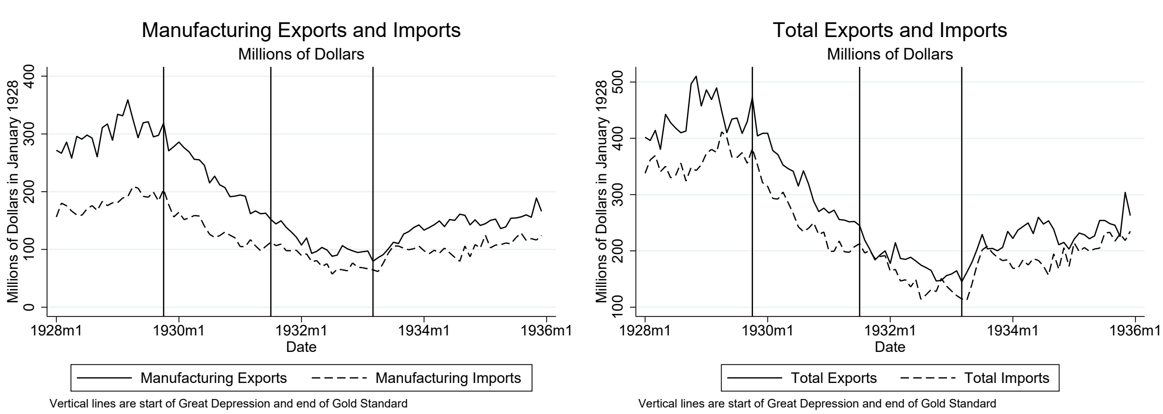
Note: The table contains the correspondence between export sectors and industrial sectors. The classification of export sectors is the one used in Statistical Abstract of the United States Foreign Commerce 1935. The classification of industrial sectors corresponds to the 1930 census industrial classification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

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

Figure A.1: Exports and Imports



A.2 A Model of the Gold Standard and Trade

In this section, we show how the external sector adjust in fixed and flexible exchange rate regimes after local shocks. The model aims to shed lights on the mechanism behind the effect that a depreciation could have after abandoning a fixed exchange rate regime. The model is a standard two country, multi-sector New Keynesian model with sticky prices, where countries might engage in fixed exchange rate. Households face the following lifetime utility function:

$$\sum_{k=0}^{\infty} \beta^{t+k} U_{j,t+k} = \sum_{k=0}^{\infty} \beta^{t+k} \frac{C_{j,t+k}^{1-\gamma}}{1-\gamma} - \frac{L_{j,t+k}^{1+\alpha}}{1+\alpha},$$

where $j = H, F$ denotes the home and foreign country, β is the intertemporal discount factor, γ is the intertemporal elasticity of substitution and α is one over the Frisch elasticity of labor supply. The total labor supply of country j in time t is $L_{j,t} = \int_0^1 L_{j,T,t}(z)dz + \int_0^1 L_{j,NT,t}(z)dz$ where $\int_0^1 L_{j,T,t}(z)dz$ and $\int_0^1 L_{j,NT,t}(z)dz$ denote the labor supply in the tradable (T) and non-tradable (NT) sector, respectively. The consumption bundle of country j, $C_{j,t}$, is composed by a tradable bundle $C_{j,T,t}$ and a non-tradable bundle $C_{j,NT,t}$ as

$$C_{j,t} = \left[\phi^{\frac{1}{\nu}} C_{j,T,t}^{\frac{\nu-1}{\nu}} + (1-\phi)^{\frac{1}{\nu}} C_{j,NT,t}^{\frac{\nu-1}{\nu}} \right]^{\frac{\nu}{\nu-1}},$$

where ϕ represents the preferences for tradable and ν is the elasticity of substitution between tradable and non-tradable goods. The tradable bundle is defined as

$$C_{j,T,t} = \left[\phi_T^{\frac{1}{\sigma}} C_{jj,t}^{\frac{\sigma-1}{\sigma}} + (1-\phi_T)^{\frac{1}{\sigma}} C_{jj',t}^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}},$$

where $C_{jj,t}$ is the bundle of tradable goods produced locally and $C_{jj',t}$ is the bundle of tradable goods imported. ϕ_T denotes the preferences for local tradable goods. σ measures the substitutability between local tradable goods and imported goods. The local tradable bundle, imported bundle and non-tradable bundle consist in a CES consumption bundle of a continuous of producers with a common elasticity of substitution η:

$$C_{jj,t} = \left[\int_0^1 C_{jj,t}(z)^{\frac{\eta-1}{\eta}} dz\right]^{\frac{\eta}{\eta-1}}$$

$$C_{jj',t} = \left[\int_0^1 C_{jj',t}(z)^{\frac{\eta-1}{\eta}} dz\right]^{\frac{\eta}{\eta-1}}$$

$$C_{j,NT,t} = \left[\int_0^1 C_{j,NT,t}(z)^{\frac{\eta-1}{\eta}} dz\right]^{\frac{\eta}{\eta-1}}$$

where $z \in [0,1]$ denotes good variety. Consumers face the following budget constraint:

$$W_{j,t}L_{j,t} + \Pi_{j,t} + B_{jj,t-1}R_{j,t-1} = B_{jj,t} + P_{j,t}C_{j,t},$$

where $W_{j,t}$ is the local wage, $B_{jj,t}$ is the local risk-less bond, $R_{j,t} \equiv (1 + i_{j,t})$ is the local gross return, that pays an interest rate $i_{j,t}$ and $\Pi_{j,t}$ are the profits of the domestic firms. $P_{j,t}$ is the local price index, defined as

$$P_{j,t} = \left[\phi P_{j,T,t}^{1-\nu} + (1-\phi) P_{j,NT,t}^{1-\nu}\right]^{\frac{1}{1-\nu}},$$

where $P_{j,T,t}$ is the price index for tradable goods consumed locally, defined as

$$P_{j,T,t} = \left[\phi_T P_{jj,t}^{1-\sigma} + (1-\phi_T)\left(\mathcal{E}_{j,t} P_{j'j',t}\right)^{1-\sigma}\right]^{\frac{1}{1-\sigma}},$$

where $\mathcal{E}_{j,t} = 1/\mathcal{E}_{j',t}$ is the exchange rate that the local consumer needs to pay to buy a foreign good and $P_{jj,t}$ denotes the price index for tradable goods produced in the country j:

$$P_{jj,t} = \left[\int_0^1 P_{jj,t}(z)^{1-\eta} dz\right]^{\frac{1}{1-\eta}}.$$

$P_{j,NT,t}$ is the price index for non-tradable goods:

$$P_{j,NT,t} = \left[\int_0^1 P_{j,NT,t}(z)^{1-\eta} dz \right]^{\frac{1}{1-\eta}}.$$

An important value will be the term of trade. We define terms of trade as

$$Q_{j,t} = \frac{P_{j'j'}}{P_{jj}} \mathcal{E}_{j,t}.$$

Terms of trade represent how expensive are local tradable goods compared with foreign tradable goods from the consumers' point of view. In this sense, a reduction of the terms of trade implies that for the local consumer, buying imported goods is more convenient. A similar argument can be made for the foreign consumer. Therefore a reduction of the terms of trade implies that the local tradable good loses competitiveness. We have that the uncovered interest parity condition holds, meaning that

$$i_{H,t} - i_{F,t} = E_t e_{H,t+1} - e_{H,t},$$

where $i_{j,t}$ is the interest rate in j and e_t is the log-linearized exchange rate. Finally, the risk sharing condition holds. We have:

$$\left(\frac{C_{H,t}}{C_{F,t}} \right)^{\gamma} = \vartheta_0 \mathcal{E}_t \frac{P_{F,t}}{P_{H,t}}.$$

Countries are symmetric. We assume that initially countries have the same wealth, meaning that $\vartheta_0 = 1$.

We have also two type of firms by country that produce each variety of the tradable and non-tradable good. Each firm has a linear production function that depends on labor and a productivity term that is common across sectors $A_{j,t}$, defining $Y_{j,s,t}(i)$ the output of the firm producing the variety i, in country j and sector s, and $L_{j,s,t}(i)$ its labor demand, the production function is:

$$Y_{j,s,t}(i) = A_{j,t} L_{j,s,t}(i)$$

Firms adjust prices infrequently with an exogenous adjustment parameter θ. Firms compete facing monopolistic competition, resulting in the following expression for the price setting:

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

where $mc_{j,s,t}$ is the average marginal cost for a firm in country j and in sector s. The market clearing conditions are:

$$Y_{j,NT,t} \equiv \left[\int_0^1 Y_{j,NT}(i)^{\frac{\eta-1}{\eta}}di\right]^{\frac{\eta}{\eta-1}} = C_{j,NT,t}$$

and

$$Y_{j,T,t} \equiv \left[\int_0^1 Y_{j,T}(i)^{\frac{\eta-1}{\eta}}di\right]^{\frac{\eta}{\eta-1}} = C_{jj,t} + C_{j'j,t}.$$

As we mentioned before, the terms of trade determine how are the gains of competitiveness for the local product. Moreover, in equilibrium we can get an expression for the overall net exports. It has been argue (e.g. Hausman, Rhode, and Wieland (2019)) that due to the fact that changes in net exports made small contributions to US growth in 1933 and 1934, the devaluation could not be expansionary through a higher demand for domestic goods. In the linearized version of this model (the details of the model are in Appendix section A.2), we can get an expression between net exports and terms of trade as follows:

$$nx_t \propto \left(\frac{2\phi_T(1-\phi)-1}{\gamma} + 2(1-\phi_T)\nu(1-\phi) + 2\phi\sigma - 1\right)q_t,$$

where nx_t is the log deviation with respect to its steady state and q_t the log-linearized term of trade. We can see that the sign of the relationship is ambiguous and depends positively on the elasticity of substitution between local and foreign varieties, a value that is usually low. Actually, as shown in Gali and Monacelli (2005), it is direct to show that when $\sigma = \gamma = \nu = 1$, trade is always balanced, no matter the size of the change in the terms of trade. This can explain why even if exports increased sharply after the depreciation of 1933, net exports only increase mildly in 1933. We can also show that local consumption is positively related to the term of trade:

$$C_{H,t} = C_{F,t} + \frac{2}{\gamma}\phi_T(1-\phi)q_t.$$

Finally, there are two regimes of monetary policy. The first is the fixed exchange rate regime that comes from the gold standard. In that case, we assume that nominal product is equal to a monetary mass that is equal to the world supply of gold. At the same time, this regime implies a fixed exchange rate, giving by

$$P_g M_t = P_{H,t}Y_{H,t} + P_{F,t}Y_{F,t}$$

and

$$\mathcal{E}_t = 1,$$

where M_t is the world supply of gold that we take as constant, the same that the price of gold P_g. All countries have the same gold rule, so equalizing the rule everywhere, implies the fixed exchange rate. In the second regime, each country has its own monetary policy rule, given by

$$i_{H,t} = \phi_\pi \pi_{H,t} + \phi_y y_{H,t}$$

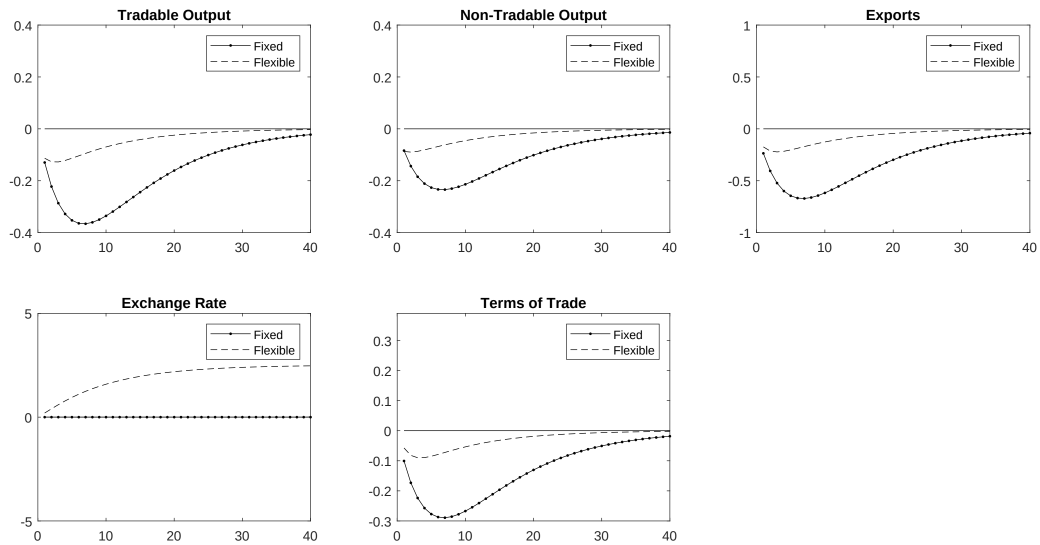
and

$$i_{F,t} = \phi_\pi \pi_{F,t} + \phi_y y_{F,t},$$

with ϕ_π and ϕ_y the weights on the monetary decision for inflation and output. In both regimes the uncovered interest parity holds. We start evaluating the effect of a local negative productivity shock in the country H comparing between both regimes. We calibrate the data using $\beta = 0.99$, $\alpha = 1.0$, $\eta = 7$, $\rho = 0.9$, $\gamma = 1$, $\theta = 0.7$, $\phi_\pi = 1.5$,

$\phi_y = 1.0$, $\phi = 0.7$, $\phi_T = 0.7$, $\nu = 6$ and $\chi = 4$. Figure A.2 compares the dynamic of the economy under both regimes.

Figure A.2: Productivity shock under Fixed and Flexible Exchange Rate

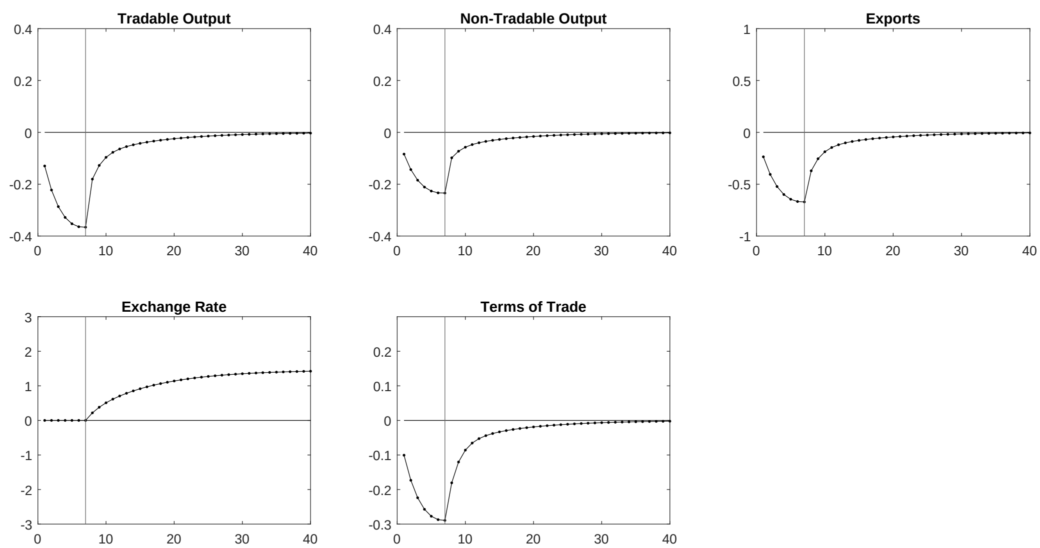


Note: The figure shows an impulse response from a 1 percent negative productivity shock in the home economy for tradable output, non-tradable output, exports, nominal exchange rate and terms of trade in the home economy as defined in the paper. The dashed line represents the impulse response in a flexible exchange rate regime and the solid-dot line represents it under the fixed exchange rate regime.

We can see that under the flexible exchange rate regime the recovery is much faster. Moreover, the contraction of tradable and non-tradable output is smaller. Under fixed exchange rate, terms of trade decrease much more following a negative productivity shock, which depress the external sector, as we can see in the decrease in exports. In the flexible regime, the exchange rate depreciates immediately buffering the reduction in the terms of trade. This creates a gain in competitiveness compared with the fixed exchange rate. This adjustment in relative prices permits an increase in demand for local produced goods that keeps tradable output relatively high and also increases demand for non-tradable goods.

When there is a fixed exchange rate the whole economy is more recessive and the recession lasts more. In the empirical part of this paper, we will evaluate two regime changes. We can use the model to inform how the transition will be. For that, we simulate the negative local productivity shock and after 8 periods we release the interest rate, moving towards the flexible exchange rate. This change of regime is unexpected. Figure A.3 shows the reaction in terms of output, exports and exchange rate.

Figure A.3: Productivity shock With Change in Regime



Note: The figure shows an impulse response from a 1 percent negative productivity shock in the home economy for tradable output, non-tradable output, exports, nominal exchange rate and terms of trade. Until the eighth period, the economy is under the fixed exchange rate regime. After that, the model unexpectedly switch to a flexible exchange rate regime.

When there is a change in regime we see that the model predicts some very similar figures compared with the empirical facts that we will show below. Exports increase strongly after the change in the exchange rate regime. This is produced by an increase in the terms of trade when the regime is changed. We can see that this also produces a strong recovery of the tradable sector, that also push up the non-tradable sector.

This model allows us to find some margins to evaluate the effect of the change of exchange rate regime. From the data and the model, we see a currency depreciation and an increase in exports after the change of regime. The increase in exports is not complete in the data, as it represents a shift to a new path of convergence. Empirically we can still evaluate other margins that are important in the model.

A.2.1 Log-linearization

The log-linearized solution is given by the following equations (for simplicity, all the variables in lower case represent log changes):

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

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

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

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

$$c_{F,t} = -\frac{1}{\gamma}(i_{F,t} - E_t\pi_{F,t+1}) + E_t c_{F,t+1}$$

$$i_{H,t} - i_{F,t} = E_t e_{t+1} - e_t$$

$$p_{H,T,t} = \phi p_{HH,t} + (1-\phi)(p_{FF,t} + e_t)$$

$$p_{F,T,t} = \phi p_{FF,t} + (1-\phi)(p_{HH,t} - e_t)$$

$$p_{H,t} = \phi_T p_{H,T,t} + (1-\phi_T)p_{H,NT,t}$$

$$p_{F,t} = \phi_T p_{F,T,t} + (1 - \phi_T) p_{F,NT,t}$$

$$\pi_{H,T,t} = p_{HH,t} - p_{HH,t-1}$$

$$\pi_{F,T,t} = p_{FF,t} - p_{FF,t-1}$$

$$\pi_{H,t} = p_{H,t} - p_{H,t-1}$$

$$\pi_{F,t} = p_{F,t} - p_{F,t-1}$$

$$p_{HH,t} = p_{H,NT,t}$$

$$p_{FF,t} = p_{F,NT,t}$$

$$mc_{H,T,t} = (1+\alpha) y_{H,T,t} + \left(\gamma - \frac{1}{\nu}\right) c_{H,t} + \left(\frac{1}{\nu} - \frac{1}{\sigma}\right) c_{H,T,t} + \frac{1}{\sigma} c_{HH,t} - (1+\alpha) a_{H,t}$$

$$mc_{F,T,t} = (1+\alpha) y_{F,T,t} + \left(\gamma - \frac{1}{\nu}\right) c_{F,t} + \left(\frac{1}{\nu} - \frac{1}{\sigma}\right) c_{F,T,t} + \frac{1}{\sigma} c_{FF,t} - (1+\alpha) a_{F,t}$$

$$mc_{H,NT,t} = (1+\alpha) y_{H,NT,t} + \left(\gamma - \frac{1}{\nu}\right) c_{H,Nt} + \left(\frac{1}{\nu} - \frac{1}{\sigma}\right) c_{H,NT,t} - (1+\alpha) a_{H,t}$$

$$mc_{F,NT,t} = (1+\alpha) y_{F,NT,t} + \left(\gamma - \frac{1}{\nu}\right) c_{F,t} + \left(\frac{1}{\nu} - \frac{1}{\sigma}\right) c_{F,BT,t} - (1+\alpha) a_{H,t}$$

$$c_{FH,t} - c_{FF,t} = \sigma(p_{FF,t} + e_t - p_{HH,t})$$

$$c_{HF,t} - c_{HH,t} = \sigma(p_{HH,t} - e_t - p_{FF,t})$$

$$c_{H,NT,t} - c_{H,T,t} = \nu(p_{H,T,t} - p_{H,NT,t})$$

$$c_{F,NT,t} - c_{F,T,t} = \nu(p_{F,T,t} - p_{F,NT,t})$$

$$c_{H,t} = \phi_T c_{H,T,t} + (1 - \phi_T) c_{H,NT,t}$$

$$c_{F,t} = \phi_T c_{F,T,t} + (1 - \phi_T) c_{F,NT,t}$$

$$c_{H,T,t} = \phi c_{HH,t} + (1 - \phi) c_{HF,t}$$

$$c_{F,T,t} = \phi c_{FF,t} + (1 - \phi) c_{FH,t}$$

$$y_{H,T,t} = \phi c_{HH,t} + (1 - \phi) c_{FH,t}$$

$$y_{F,T,t} = \phi c_{FF,t} + (1 - \phi) c_{HF,t}$$

$$y_{H,t} = \phi y_{H,T,t} + (1 - \phi) y_{H,NT,t}$$

$$y_{F,t} = \phi y_{F,T,t} + (1-\phi) y_{F,NT,t}$$

$$y_{H,NT,t} = c_{H,NT,t}$$

$$y_{F,NT,t} = c_{F,NT,t}$$

$$a_{H,t} = \rho a_{H,t-1} + \varepsilon_{H,t}$$

$$a_{F,t} = \rho a_{F,t-1} + \varepsilon_{F,t}$$

A.2.2 Fixed Exchange Rate Regime

$$e_t = 0$$

$$M = p_{H,t} + y_{H,t} + p_{F,t} + y_{F,t}$$

A.2.3 Nominal Exchange Rate Regime

$$i_{H,t} = \phi_\pi \pi_{H,t} + \phi_y y_{H,t}$$

$$i_{F,t} = \phi_\pi \pi_{F,t} + \phi_y y_{F,t}$$