THREE ESSAYS ON TRADE AND FINANCE IN THE INTERWAR PERIOD

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Für meine Eltern.

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CHAPTER 1
INTRODUCTION

To understand the Great Depression is the Holy Grail of macroeconomics.

—Ben S. Bernanke (1995)

The 2008 global financial crisis and the ensuing recession marked the worst economic downturn since the Great Depression (International Monetary Fund, 2009, p.9). The political aftershocks of the crisis are still being felt a decade later. Politicians of the extreme and populist right have been most effective in harnessing post-crisis popular discontent, notably in the United States (U.S.) and Europe.[1] Global multilateralism, propagated by the U.S. since the end of World War II, has taken an aggressive turn towards unilateralism under the Trump administration. At the time of writing, the U.S. is engulfed in trade wars with China, Mexico and the European Union. The European Union pursued deeper economic and political integration for decades but is now facing a looming Brexit. Future historians might see the global financial crisis as a watershed in the post World War II wave of globalization.

There has been an increasing demand by the public to make sense of the highly unexpected and complex situation since 2008. But traditional macroeconomics was unable to provide satisfactory explanations for the financial crisis. In response, the media and economic commentators were increasingly making references to the 1930s and the lessons that might be learned from the Great Depression.[2] This dissertation is a response to this demand and contributes to the literature on the macroeconomics and the economic history of the interwar period.

[1] Tooze (2018) connects the Global Financial Crisis to the rise of European and U.S. right wing populism. More generally, Funke et al. (2016) provide evidence that parties of the extreme right outperform parties of the center or the left after financial crises.

[2] See for example Krugman (2009) and Wolf (2009).

Economic history, a subject that is now almost absent from the university curriculum, is a vital tool for understanding economics. Economic history gives economics context. It teaches us that economic decisions are embedded in a social and political order subject to a historical framework. Economic decisions have a past and the great crisis of the interwar years is a prime example of this. The international financial crisis of 1931 was deeply intertwined with the political crisis between Germany, Great Britain, the U.S. and France. The political crisis dealt with settlements on war debts, reparations and disarmament that had been agreed upon in the Treaty of Versailles, which ended World War I and established the post-war order.

Economic history also teaches us lessons about unexpected events, policy errors or extreme macroeconomic volatility. It reminds us that the economy's development can be more dynamic and more volatile than we thought was possible. It reminds us of how radical change can be; so radical as to threaten the basis of our democratic society, if we fail to develop and embrace new ideas to cope with change. This is true today, as society is threatened by high levels of inequality, a disintegrating world economy and climate change. It was also true for the 1920s, when a majority of economists and politicians believed that the return to the gold standard after World War I was a return to normality. Today we know that John Maynard Keynes (1923) was right when he said that the gold standard was already a barbarous relic. The gold standard did not fulfil its purpose as it did before the war and the ideology that kept it alive was a crucial factor in causing the Great Depression.

Providing context and lessons are then the key motivations that lead this dissertation. Context, because the interwar years provide a context against which to test new economic models and ideas. Lessons, because the Great Depression can teach us what went wrong and how we can avoid the mistakes of the past.

Of course, many outstanding scholars have been motivated to study the Great Depression. Indeed, the topic has been named the holy grail of macroeconomics and the past eight decades have produced a substantial amount of research. By using modern econometrics

and new data, I am able to contribute to the field in a novel way, providing answers to some old questions and uncovering new insights. This dissertation consists of three self-contained papers that each fill a gap in the literature.

One disputed area, for example, is the exact nature of the collapse of international trade in the 1930s. Chapter (2) aims to fill this gap. Using modern econometric techniques and new data on freight rates, it estimates the effect that changes in real transport costs, increased protectionism and the collapse of the gold standard have had on international trade. I find that tariff and non-tariff trade barriers explain the majority of the collapse of world trade, especially after 1932. While the collapse of the gold standard into regional currency blocs had some negative effects on trade, real transport costs only contributed to the decline during the early phase of the depression, but cannot explain why world trade remained at such a low level afterwards. Chapter (2) also contributes to the literature on the estimation of the gravity model, the workhorse model for analyzing the determinants of bilateral trade flows. My study is a vindication of Bergstrand et al.'s (2015) proposed solution to the distance elasticity puzzle, the seemingly paradoxical result of an increasing elasticity of trade to distance despite falling transport costs. An unbiased distance coefficient requires controlling for heterogeneity across country pairs by including a set of country-pair fixed effects. Moreover, my results suggest that ignoring the effects of *economic integration areas* biases the coefficient on distance.

Chapter (3) of this dissertation explores the early history of the Federal Reserve System (Fed). The Fed had the potential power to act as a monetary hegemon and stabilize the international financial system in 1931. This is relevant today, since the Fed's policy errors are seen by many modern economists, including Ben Bernanke (chairman of the Federal Reserve Board from 2006 to 2014) as the prime cause of the Great Depression.[3]

Indeed, the Fed took on great responsibility during the Global Financial Crisis of 2008, when it prevented the total collapse of the transatlantic dollar-based financial system by

[3] See Bernanke (2002).

extending unprecedented support to the European Central Bank via its swap line facility. The scale and necessity of this liquidity support during the global financial crisis has been interpreted as a reassertion of U.S. monetary hegemony (Tooze, 2018). But why was such an assertion of monetary hegemony not forthcoming in the interwar years?

In Chapter (3), I show how large amounts of short-term U.S. trade credit, called bankers' acceptances, built up from 1927 to 1930. These credits provided Germany with funds to finance her working capital. The question of why the Fed did not stabilize this system in 1931 is answered by looking at the prevailing ideologies and doctrines of policy makers, bankers and Fed officials. Contrary to other accounts in the literature of the Fed's early history, I find that doctrinal influences were diverse and ideological differences significant. In this regard, my narrative complements that of Tooze (2014), as it shows how the Fed's history resembles a history of an American public coming to terms with modernity and how America's role changed after World War I. Faced with the responsibilities of an international lender of last resort, Washington sought shelter in the nation state system.

More specifically, Chapter (3) seeks to explain the collapse of the market for bankers' acceptances between 1931 and 1932 by tracing the doctrinal foundations of Fed policy and regulations back to the 1913 Federal Reserve Act. It argues that a determinant of the collapse of the market was Carter Glass' and Henry P. Willis' insistence on one specific interpretation of the "real bills doctrine", the idea that the financial system should be organized around commercial bills. The Glass-Willis doctrine, which stressed non-intervention and the self-liquidating nature of real bills, created doubts about the eligibility of frozen acceptances for purchase and rediscount at the Reserve Banks and caused accepting banks to curtail their supply to the market. The Glass-Willis doctrine is embedded in a broader historical narrative that links president Woodrow Wilson's approach to foreign policy with the collapse of the international order in 1931.

Finally, Chapter (4) investigates the role of the financial system in propagating macroeconomic shocks. Loan supply shocks have been identified as important drivers of business

cycle fluctuations in advanced economies in the recent period and in the U.S. during the Great Depression (Gambetti and Musso, 2017; Bernanke, 1983). So far, there is no study that tests for the presence of credit constraints during the Great Depression in Germany, which faced one of the most severe downturns in the interwar period. Chapter (4) suggests that the German banking system played a significant role in aggravating the Great Depression in Germany. Together with Walter Jansson (Bank of England), I study the effect of loan supply shocks on industrial production and investment for the years 1927 to 1932. Employing a time-varying vector autoregressive model, we identify loan supply shocks in addition to standard macroeconomic shocks. Our findings indicate that the whole period between 1927 and 1932 was associated with negative loan supply shocks, which supports the view that a structurally weak banking sector was an important contributor to the German Great Depression.

This dissertation highlights the international aspects of the Great Depression and the importance of trade, monetary and financial policy. As the League of Nations remarked in 1942:

> International trade is much more than the exchange of goods between one country and another; it is an intricate network that cannot be rent without loss (Hilgerdt, 1942).

In addition to international trade, this dissertation emphasizes the role of finance. Finance is simply the other side of the coin in international economics. Trade and finance are intimately linked. It is hoped that the reader will appreciate this linkage and that it will spur further research on the Great Depression

CHAPTER 2

RETURN OF THE TARIFFS: THE INTERWAR TRADE COLLAPSE REVISITED

2.1 The Tariff Menace

In 2016, the Brexit referendum and the U.S. presidential election of Donald Trump indicated that the globalization of the last decades might be coming to an end. These fears seemed to be confirmed in 2018, when the U.S. imposed tariffs on solar panels, aluminum, steel, and washing machines from most countries including its closest trading partners. These tariffs caused retaliation from many countries and fears are mounting that U.S. - China relations might escalate into a large-scale trade war. The increased trade tensions and the threat of a shift away from a multilateral trading system forced the International Monetary Fund (IMF) to revise its World Economic Outlook for 2019 downwards. In the eyes of the IMF (2018) the "intensification of trade tensions, and the associated rise in policy uncertainty, could dent business and financial market sentiment, trigger financial market volatility, and slow investment and trade. Higher trade barriers would disrupt global supply chains, [...] lowering global productivity and [harming] low-income households disproportionately."

Many observers point to the risk of returning to a 1930s beggar-thy-neighbor trade policy.[1] Strikingly, anti-globalization rhetoric and policies have increased only recently even though global trade has already been slowing down since 2012. Because protectionist policies were not put in place after the disruption of the 2008 financial crisis, economists were initially looking for other explanations for the stall in world trade growth. Economists looked at the dramatic collapse of world trade in the 1930s to draw conclusions about the causes of deglobalization. Estevadeordal et al. (2003) explore the causes of the collapse of

[1] See for example Stephens (2018).

world trade during the interwar period. They argue that because productivity growth in the shipping sector was slower than average total factor productivity (TFP) growth, real transport costs rose in the interwar period. To explain the contemporary trade stagnation, Krugman (2016) popularized Estevadeordal et al.'s (2003) interpretation, arguing that higher transport costs were the main determinant in the collapse of world trade in the 1930s.

Independently of whether one can apply this argument to the present period of trade stagnation, it is worth looking at the interwar period again, which has historically been associated with rising tariff and non-tariff trade barriers rather than with rising transport costs. Estevadeordal et al. (2003) present increased protectionism, the collapse of the international payment system and rising transport costs as possible causes of the collapse of world trade in the 1930s. This paper takes a fresh look at the three candidates. It makes use of recent advances in the workhorse model of international trade, the gravity model that seeks to explain bilateral trade flows. Changes in the partial effects of distance, borders and the payment system are estimated for a sample of 36 countries and the resulting trade cost function is incorporated into a full endowment general equilibrium (GE) model, which allows me to revisit the horse race of Estevadeordal et al. (2003).

My regression results suggest that the border effect, which measures the thickness of international borders and serves as a proxy for average bilateral tariff and non-tariff trade barriers, had increased by 89% between 1925 and 1937. At the same time, there was no significant change in the trade-reducing effect of bilateral distance. The trade-increasing effect of the gold standard was relatively small. Being on gold increased members' bilateral trade by only 9% and this effect is relativized when taking into account the potentially trade-increasing effects of the trade and currency blocs that followed the collapse of the gold standard. Indeed, my gravity model, which controls for the average effect of deglobalization, provides evidence that one trade bloc, the imperial preference system (IPS), and one currency bloc, the sterling bloc, increased bilateral trade among their members. This contrasts with previous studies, which find that no trade or currency bloc in the 1930s

increased trade. The finding that the trade-increasing effects of the IPS and the sterling bloc are large, positive, significant and free from reverse causality has an important implication: The economic benefits that could be reaped from a retreat into empire, made Britain's exit from the multilateral trade and payment system, the gold standard, less severe than for other countries.

My specification of the structural gravity model also serves to explore the seemingly paradoxical result of a declining elasticity of trade to distance that previous studies have found, despite rising transport costs during the interwar period. My results support previous explanations for the distance puzzle, which argue that commercial and financial policies increasingly dominated the effect of distance, but also stress the heterogeneity of tariff rates between trading partners. The "simple" solution to the post-war distance puzzle proposed in the international trade literature is not sufficient to solve the interwar distance puzzle. Instead, it requires the inclusion of a large and significant effect of the IPS, indicating preferential tariff rates between the British Empire and its dominions, to get an unbiased coefficient of distance as a trade cost factor. Only after the inclusion of the empire effect can transport costs be reasonably proxied by the distance elasticity, suggesting that the IPS, agreed upon at the Ottawa conference in 1932, was successful in defying gravity, i.e. making the physical trade cost of distance relatively less important.

The estimated partial effects yield the trade cost function, which is incorporated into a full endowment GE model. Analyzing three different counterfactual scenarios in the GE model is akin to Estevadeordal et al.'s (2003) horse race and allows me to answer the following questions:

- What would have been the level of world trade in 1937, had the gold exchange standard not collapsed into a system of trade and currency blocs?
- What would have been the level of world trade in 1937, had tariff and non-tariff trade barriers remained at their 1928 levels?

- What would have been the level of world trade in 1937, had transport costs remained at their 1928 level?

The results suggest that if transport costs had remained at their 1928 level, trade in 1937 would have been 19% lower. This effect is however not significantly different from zero. Had the gold standard not collapsed and had the IPS and the sterling bloc not formed, global trade would have been merely 3% larger in 1937. But had average tariff and non-tariff trade barriers, as proxied by the border effect, not increased after 1928, world trade would have been 64% larger in 1937. These results contrast sharply with the results of Estevadeordal et al. (2003), the only study to date that quantifies the individual contributions of tariffs, transport costs and the payment system. My results provide quantitative estimates that reestablish the conventional narrative that protectionism was the culprit of the interwar trade bust.

To support my results, I present additional evidence on real transport costs during the interwar period. I manually collected high-frequency data on cotton freight rates from New York along 21 routes from 1925 to 1936, which I deflate by the product price in New York to get ad-valorem freight rates. The data imply only a marginal increase in ad-valorem freight rates. On average, real freight rates increased by less than two percentage points between 1925 and 1936. This lends support to the regression results I obtain from estimating the gravity model.

Finally, I match the real freight rates with the quantities shipped to the destinations. This allows me to create a Laspeyres index, which is an additional contribution to the interwar shipping literature, which until today had relied exclusively on the Isserlis-index. Contrary to the Isserlis-Index, my new cotton freight index covers different shipping routes and is based on freight rates for the liner industry. It tracks historical events such as the coal strike of 1926 well and shows an increase of 50% between 1925 and 1936. More importantly, my transport cost index mirrors the movement of the distance elasticity from the gravity model. Both, the index and the distance elasticity, shoot up during the Great Deflation of

1929-1933, which I attribute to cartelization, rather than to a productivity slowdown in the shipping sector. Future research could delve into the question of the role that the sharp increase in real transport costs around 1931 played in the initial trade bust.

2.2 Gravity Between the Wars: The Empire Adrift

For international trade economists, the contraction of world trade during the first phase of the Great Depression is remarkable, both in absolute and relative terms to GDP. From 1929 to 1933, world exports in constant prices fell by 35%. When output started to recover, it was not followed by international trade, and in 1937 real volume of world trade was barely 95% of its 1928 level.[2] What caused this collapse in international trade?

A major factor of the trade bust was the fall in world income, but again this cannot explain the low level of trade after income had recovered. The period was also marked by a surge in protectionism following the infamous Smoot-Hawley Tariff imposed by the U.S. in 1930. But tariffs are only one of several factors that increased the costs of trade between countries. The financial crisis in continental Europe in summer of 1931 marked the beginning of the collapse of the gold standard and was followed by devaluation, the introduction of capital controls and the formation of new currency blocs. This collapse of the multilateral payment system is seen as an important factor in its own right, separately from tariff and non-tariff trade barriers. A third potential factor is an increase in real transportation costs (Irwin, 2011).

Estevadeordal et al. (2003) innovatively investigated the relative impact of these three factors by using a gravity model.[3] Of the six percentage point decline in the trade-to-GDP ratio between 1929 and 1938 they attribute 29% to the collapse of the payment system, 27% to higher transport costs and only 14% to higher tariffs. Arguing that the interwar trade collapse was caused more by higher shipping costs than by rising tariffs earned them a reputation as revisionists (Jacks et al., 2011).

Albers (2018) challenges Estevadeordal et al.'s (2003) finding by estimating a gravity

[2] Statistics in this paragraph are computed from table D.14 in Federico and Tena Junguito (2016), which shows world exports in constant 1913 USD.

[3] Another study that quantitatively investigates the trade collapse is Madsen (2001), who argues that approximately 41% of the world trade collapse over the period 1929 to 1932 can be attributed to tariff and non-tariff trade barriers, and the rest is due to declining incomes. However, Madsen (2001) only deals with the immediate depression period and does not consider transport costs or the collapse of the payment system as possible causes.

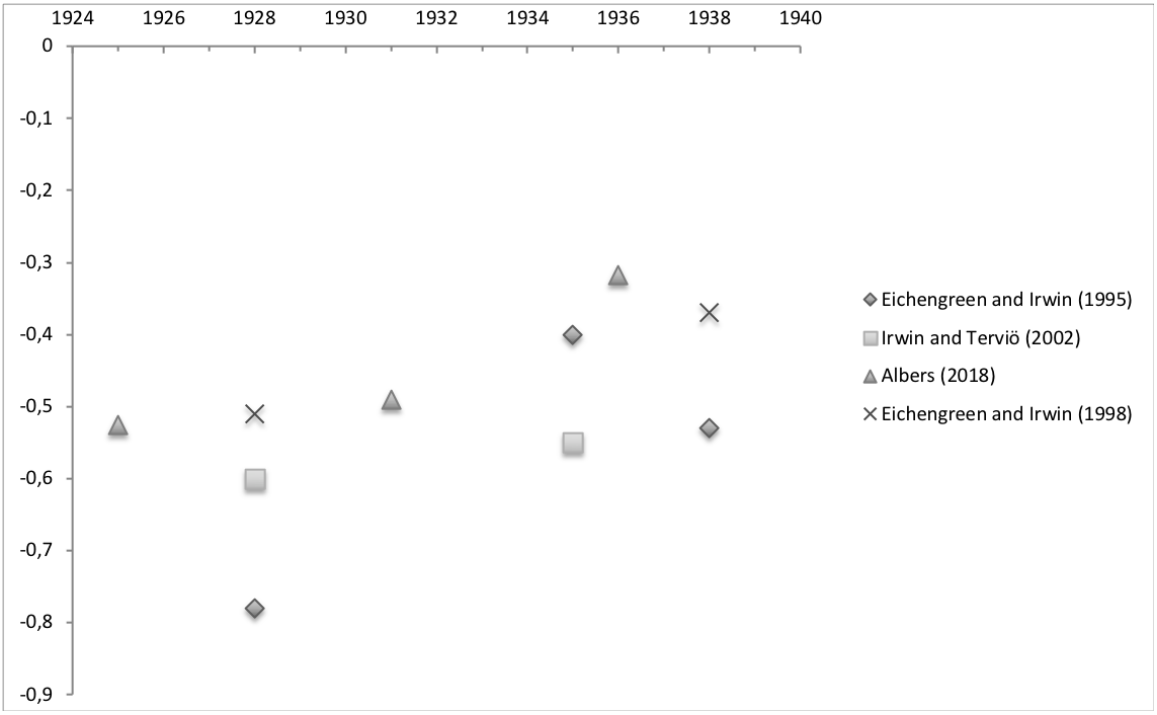
model for twelve consecutive years from 1925 to 1936 to determine the elasticity of trade with respect to distance. He confirms an earlier finding by Eichengreen and Irwin (1995) of a rise in the coefficient of distance from 1929 onwards. Since the distance elasticity is negative, a rise (decrease in absolute value) means that distance becomes less important as the world enters the depression phase. Because distance becomes less important at a time when real transport costs are rising, Albers (2018) names his finding the "interwar distance puzzle" referring to the postwar distance puzzle in the meta-study of Disdier and Head (2008). Albers (2018) considers that his finding means that tariffs were becoming a more important factor in determining trade relative to transport costs. Since the effect of tariffs outweighs the effect of transport costs, the relative importance of distance diminishes. This is in line with the interpretation of Eichengreen and Irwin (1995) who argue, "that commercial and financial policies increasingly dominated the effects of geography". Following Disdier and Head (2008), I analyze all studies that provide distance coefficients for individual years of the interwar period. Figure (2.1) plots the coefficients of the main regression of each study over time. We indeed observe a significant decline in the absolute value of the distance-coefficient.

Another recent study by Fouquin and Hugot (2016a) estimates the distance elasticity as yearly repeated cross sections from 1827 to 2014. While their paper does not present any numerical results, their figure 18 shows that the distance elasticity has roughly the same value in 1938 as in 1920. This stands in stark contrast to the studies in figure (2.1).[4]

Recent research has solved the postwar distance puzzle by incorporating internal trade and internal distance into the gravity model. Yotov (2012) argues that the puzzle had persisted because previous studies estimated *international* trade costs relative to other *international* trade costs, when one should instead measure *international* relative to *intranational* trade costs. A bias in the distance coefficient could arise, for example, if a country unilat-

[4]Unfortunately, the estimation strategy by Fouquin and Hugot (2016a) is not completely clear. For example, they do not seem to use a balanced sample, but instead have a different number of observations for each year. However, Fouquin and Hugot (2016a) include internal trade and the border effect in their regression, which is part of the solution to the distance puzzle as discussed below.

Figure 2.1: The Interwar Distance Elasticity Puzzle



Notes: This figure plots the distance coefficients of four studies (Albers, 2018; Eichengreen and Irwin, 1995, 1998; Irwin and Terviö, 2002) over time.

erally increased its tariffs. Nearby economies previously exporting to this country would redirect some of their exports to more distant countries. A regression that does not include intranational trade then sees the effect of international distance decline.[5]

Internal trade is also included in Bergstrand et al. (2015) who estimate a panel version of the gravity model from 1990 to 2002. Their model allows to control for unobserved heterogeneity across country pairs by including a set of country-pair fixed effects. They also include a dummy variable for international borders that captures the average decrease (or increase) in tariff and non-tariff trade barriers or more generally the average effect

[5]Where trade flows are redirected to and how strong this bias is depends on exporters' and importers' trade openness, their economic size and market integration, or their location in the world economy (see e.g. the discussion in Liu and Meissner (2015)). Moreover, a change in trade policy or transportation costs affects countries differently depending on their product mix (see appendix (A.1)). Finally, variations in productivity lead to variations in the extensive margin. If a change in trade policy or transport costs affects the fixed costs of exporting, heterogenous effects arise in the extensive margin of trade (Chaney, 2008). Such heterogeneity across countries of a changing distance elasticity has also been observed by Borchert and Yotov (2017) who suggest the inclusion of a set of country-specific fixed effects for internal trade. As discussed below, I deal with such problems by adopting the estimation strategy of Bergstrand et al. (2015).

of globalization (or deglobalization). Because Bergstrand et al. (2015) provide the best solution for the post-war distance puzzle to date, I follow their econometric strategy to measure changes in the distance elasticity in the interwar period. This approach should provide us with a good proxy for real transportation costs. Still, I find that the distance elasticity has fallen over the course of the 1930s even after controlling for international borders.

The state-of-the-art features of the gravity model are also indispensable to get an unbiased estimate for dummy variables that measure the effect of trade agreements, currency unions or other *economic integration areas* (Bergstrand et al., 2015). Including these specifications is an improvement over earlier studies of the interwar period such as Gowa and Hicks (2013), who investigate the system of trade and currency blocs that evolved after the collapse of the gold standard, or Jacks (2014), who asks whether Canada was able to divert trade flows towards members of the IPS agreed upon at the Ottawa conference in 1932. Gowa and Hicks (2013) find that no bloc increased or decreased trade among its members, and also Jacks (2014) finds that Canada was not able to defy gravity and divert trade flows towards members of the IPS. Because these studies do not include internal trade, they are not able to account for the effect of deglobalization which increases internal trade relative to international trade. The absence of accounting for this effect biases the estimate for trade and currency blocs downwards. Controlling for deglobalization, I find that the IPS is economically and statistically significant. Moreover, there is enough evidence to suggest that sterling bloc membership increased trade between members. Including these two blocs is essential to get an unbiased estimate of distance that proxies transport costs. These results lend support to a recent study by De Bromhead et al. (2019) who argue that the discriminatory trade policies of the British Empire and its dominions were a significant factor in shifting trade towards the empire. In that sense, it is no surprise that the interwar distance puzzle is resolved once we control for the IPS and sterling bloc. Following the Ottawa conference in 1932, the British Empire decoupled itself and drifted away from the rest of

the world. The breakaway of the empire from the rest of the world effectively decreased the relative distance between the empire and its dominions, while decreasing the relative distance between countries of the rest of the world. Overall, the preferential tariff rates and the many exceptions granted to the dominions on non-tariff barriers rendered distance relatively less important as a trade cost.

Equipped with a complete trade cost function, I conduct GE static exercises to analyze the individual contributions of transport costs, the multilateral trade and payment systems, and tariff and non-tariff trade barriers to the global trade bust.

This paper contributes to three strands of the literature. First, my results are a vindication of Bergstrand et al.'s (2015) proposed solution to the distance elasticity puzzle, which goes beyond Yotov's (2012) inclusion of intranational trade and suggests that ignoring the effects of *economic integration areas*, or blocs, biases the coefficient on distance. Second, it contributes to the debate on the system of trade and currency blocs in the 1930s by showing that the IPS and the sterling bloc were successful in shifting trade towards their members. Third, and most importantly, my results question the existence of a rise in real transport costs and challenge the findings of Estevadeordal et al. (2003). This study supports the more conventional explanation for the interwar trade collapse: protectionism.

2.3 Interwar Gravity Redux

This section first deals with the theoretical foundation of the structural gravity model and then uses the model to estimate the direct, or partial, effects of distance, international borders and the payment system on international trade. Finally, I use the resulting trade cost function to perform GE analysis in three counterfactual scenarios.

2.3.1 Methodology and Data

Since the 1960s, trade economists have used the "gravity equation" to provide econometric estimates for the effects of distance, national borders, currency unions, and other measures of trade costs on bilateral international trade flows. It is only in the last two decades that the gravity model has evolved from a simplistic analogy with Newtonian physics to the workhorse model of international trade.

The early 2000s saw a gravity revolution caused by the influential works of Eaton and Kortum (2002) and Anderson and Van Wincoop [AvW] (2003), who endowed the gravity equation with micro-foundations. Eaton and Kortum (2002) derive the gravity equation from a Ricardian supply-side framework, while AvW derive the gravity model from a demand-side Armington (i.e. CES-National Product Differentiation) framework. Although the starting points of these two studies are radically different, they arrive almost at the same results. Indeed, Arkolakis et al. (2012) have shown that the gravity equation can be derived not only from an Armington and Ricardian framework but from an even wider range of trade models, including models in the spirit of Krugman (1980) and Melitz (2003). The present study uses the Armington framework in the tradition of AvW to analyze the impact of different trade costs on world trade during the interwar period. However, Allen et al. (2020) have recently developed a universal gravity framework with sufficient conditions for the existence and uniqueness of the trade equilibrium for a wide class of GE models including AvW. Therefore, the macroeconomic conditions inherent in the gravity trade

model impose sufficient structure so that its particular microeconomic details do not pose a problem in its characterization.

The model considered in this study consists of N countries, where each country produces a variety of goods that is traded with all other countries. In this Armington (1969) framework goods are differentiated by place of origin. Denoting the fixed supply of each good with Q_i and the factory-gate price with p_i, the value of production, or income, in country i is defined as $Y_i = p_i Q_i$. Aggregate expenditure is defined as $E_i = \phi_i Y_i$, where ϕ_i is an exogenous parameter defining the relation between the value of output and aggregate expenditure, such that when $\phi_i > 1$, country i faces a trade deficit, while country i runs a trade surplus when $1 > \phi_i > 0$. The complete gravity model that explains exports (X_{ij}) from country i to j is described in equations (2.3.1) to (2.3.5).[6] Π_i and P_j are structural terms which AvW call outward and inward multilateral resistance terms. τ_{ij} is the trade cost factor between i and j, σ is the elasticity of substitution and α_i is the CES preference parameter.

[6]For a full derivation of the micro-founded gravity model from an Armington framework the reader is directed to AvW's original article or one of the guides and handbooks on the topic. The most recent guide on the gravity model on which the present study draws extensively is Yotov et al. (2016). Equations (2.3.1 - 2.3.5) and the estimation procedure (including much of the Stata code) for the GE analysis are adapted from Yotov et al. (2016) and can be downloaded at https://vi.unctad.org/tpa/web/vol2/vol2home.html.

Full Endowment (GE)

Conditional (GE)

Direct (PE)

$$X_{ij} = Y_i E_j \left(\frac{\tau_{ij}}{P_j \Pi_i} \right)^{1-\sigma} \tag{2.3.1}$$

$$\Pi_i \equiv \left(\sum_{j=1}^{C} E_j \left(\frac{\tau_{ij}}{P_j} \right)^{1-\sigma} \right)^{1/(1-\sigma)} \tag{2.3.2}$$

$$P_j = \left(\sum_{i=1}^{C} Y_i \left(\frac{\tau_{ij}}{\Pi_i} \right)^{1-\sigma} \right)^{1/(1-\sigma)} \tag{2.3.3}$$

$$p_i = (Y_i)^{1/(1-\sigma)} \frac{1}{\alpha_i \Pi_i} \tag{2.3.4}$$

$$E_i = \phi_i Y_i = \phi_i p_i Q_i \tag{2.3.5}$$

Equation (2.3.1) represents the theoretical gravity equation that governs bilateral trade flows and consists of a size term $Y_i E_j$ and a trade cost term $(\tau_{ij}/P_j \Pi_i)^{1-\sigma}$. At the heart of the structural gravity model are the multilateral resistance terms P_j and Π_i, AvW's key innovation, that differentiates the theory-founded gravity models from the earlier ones. These remoteness terms, which represent the importer j's and exporter i's ease of market access, have to be controlled for to get an unbiased estimate of the partial effect of any factor within the trade cost function when estimating the gravity model econometrically. The theory-founded gravity model then includes trade with all N trading partners of country i including country i itself. Not including intranational trade will result in biased estimates of any partial effect of trade costs since it ignores the effects of trade diversion (Bergstrand et al., 2015). These trade diversion effects work through the multilateral resistance terms and arise because the more integrated country i is with a particular trading partner j, the more remote it becomes relative to all other countries. Because previous studies of the interwar period did not incorporate internal trade, this is the first study to estimate a properly

specified theoretical gravity model for the interwar period.

Moreover, any counterfactual analysis, that is performed to examine a change in trade costs between i and j using the partial effect only, as in Estevadeordal et al. (2003), ignores feedback effects affecting other countries. This drawback can be overcome using the GE analysis framework operating via the multilateral resistance channels, captured by equations (2.3.2) and (2.3.3). Whereas the partial effect is captured by adjusting bilateral trade costs τ_{ij} while keeping output, expenditure and multilateral resistance terms constant, the *conditional GE* effects allow for adjustment in the multilateral resistance terms.

The channel described in equations (2.3.4) and (2.3.5) endogenizes the value of output and expenditure by allowing factory-gate prices to respond to trade cost changes. Analyzing a change in trade costs, the *full endowment GE* then takes into account the associated feedback effects in multilateral resistances, via equation (2.3.4), and then translates the changes in factory-gate prices into changes in the value of domestic production and aggregate expenditure, via equation (2.3.5).[7]

In the following subsections, the structural gravity model will be used to evaluate the impact of changes in transport costs, the payment system and political trade barriers on world trade. Section (2.3.2) makes use of recent econometric advances to estimate the partial effects of distance, international borders and the payment system. Equipped with a complete trade cost function τ_{ij}, section (2.3.3) then solves the complete GE model in equations (2.3.1) to (2.3.5) for the year 1937 and compares it with three counterfactual scenarios (CF 1 - 3) in which specific trade costs are assumed to have remained at their 1928 level. This will answer the following questions:

CF 1: What would have been the level of world trade in 1937, had the gold exchange standard not collapsed into a system of trade and currency blocs?

[7] An implicit assumption in this paper, as in all standard gravity models, is that the trade cost function is exogenous to income and trade growth. If a negative income shock causes a rise in tariffs, capital controls or other trade barriers, then the role of trade costs in explaining the fall of world trade could, of course, be weaker. Unfortunately, this is an issue that remains outside the scope of this paper.

CF 2: What would have been the level of world trade in 1937, had tariff and non-tariff trade barriers remained at their 1928 levels?

CF 3: What would have been the level of world trade in 1937, had transport costs remained at their 1928 level?

Performing a complete GE analysis representative of world trade requires data on bilateral trade, geographical variables such as distance, gold standard and bloc membership, and internal trade for a large number of countries. To construct the dataset, I draw on a number of existing data sources, the most important of which is Fouquin and Hugot (2016b). Although the past two decades have seen substantial improvements in data for the interwar period, obvious data limitations are still present. The primary difficulty is that for the model to be closed it requires $N * N$ observations per year (i.e. a quadratic matrix of trade relationships between the N trading partners). This presents the risk of missing observations, if one does not want to reduce the number of countries to a non-representative sample with a geographical bias.

The sample used to estimate the trade cost function to perform the GE analysis in section (2.3.3) consists of 36 countries over five interval years and consequently 6480 observations, of which 881 missing observations are assumed to be zero. The total number of observations in the *GE sample* that take the value zero is 1038. This is a large number of zeros and some country-pairs do not report a single positive trade flow for any year. This causes 390 observations to be dropped from the estimation and in order to get the baseline trade cost function for these country pairs, I apply the two-step procedure suggested by Anderson and Yotov (2016). Fortunately, the restriction of $N * N$ observations can be abandoned in the estimation of the partial effects. This allows me to estimate the trade cost function with more confidence. The estimation of the trade cost function is robust to using the more rigorous *partial sample*.

Three variables are used to estimate the partial effects of transport costs, tariff and non-tariff trade barriers, and the payment system: distance, international borders and gold

standard or currency bloc membership. Some authors have argued that distance and borders hinder trade much more than transports costs or tariffs can explain. In particular, Grossman (1998) and Head and Mayer (2013) have argued that distance and borders measure lack of information and home-variety biased preferences. Here I will make the reasonable assumption that these factors did not change over the period under study so that any change in the elasticity of distance and the border effect can directly be interpreted as a change in the trade decreasing effects of transportation costs and tariff and non-tariff trade barriers.

To determine the partial effect of the collapse of the payment system Estevadeordal et al. (2003) use an indicator variable that describes gold standard adherence between two trading partners. This may be overly pessimistic, as I will show, since the gold standard did not collapse into N national payment systems, but into a system of trade and currency blocs. Contrary to previous studies that estimated the impact of these blocs, I find that membership of the IPS had a large, statistically significant, positive effect on trade. Moreover, I provide evidence that sterling bloc membership increased trade. Controlling for these two blocs in the gravity equation solves the interwar distance puzzle since it removes the omitted variable bias that stems from the heterogeneity in tariff rates. After the Ottawa conference, and as a result of preferential tariff rates, it may have been cheaper for the UK to import goods from far away dominions than from nearby European countries. Since this is based on the presumption that currency blocs did in fact increase trade between members, I will provide additional estimates on the partial effects of all trade and currency blocs and test these blocs for reverse causality.

The last factor in the trade cost function, the border effect, itself will then capture the remaining international trade costs independent of distance, the payment system and other standard gravity control variables such as common language, colonial linkage or contiguity. The border effect should be interpreted as capturing tariff and non-tariff barriers, such as capital controls, quota systems, restrictions on the use of imported inputs by domestic producers, undue controls at frontiers, and regulation.

The complete construction of the data, its sources, and sample selection are discussed in detail in the appendix (A.1).

2.3.2 Partial Effects

Recent econometric advances in the estimation of the gravity model, discussed in section (2.2), provide us with reliable estimates of the partial effects of distance, international borders, and the payment system. Using a panel of 36 countries and five years (1925, 1928, 1931, 1934, 1937), I estimate the following equation using the PPML estimator:[8]

$$X_{ij,t} = exp[\sum_{T=1928}^{1937} \beta_{1,T} \ln(Dist_{ij,T}) + \sum_{T=1928}^{1937} \beta_{2,T} INTL\_BRDR_{ij,T}] * \\ exp[\beta_3 Cbloc + \beta_4 Cbloc_{t-s} + \beta_5 Cbloc_{t+4} + \gamma_{i,t} + \delta_{j,t} + \phi_{ij}] + \epsilon_{ij,t} \tag{2.3.6}$$

The estimation strategy described in (2.3.6) follows Bergstrand et al. (2015) and estimates a panel version of equation (2.3.1). Equation (2.3.6) includes exporter-year $\gamma_{i,t}$ and importer-year $\delta_{j,t}$ fixed effects to account for income and expenditure, endogenous prices, and unobserved time-varying exporter and importer multilateral heterogeneity. By including a set of country-pair fixed effects ϕ_{ij} we control for unobserved heterogeneity across country pairs.[9]

The inclusion of time-invariant country-pair fixed effects captures all time-invariant factors, which means that we cannot estimate the distance elasticity and the border effect. However, we can observe time-varying changes in these bilateral trade costs by interacting $Dist_{ij}$ and $INTL\_BRDR_{ij}$ with a year dummy. The specification in equa-

[8]The Poisson pseudo-maximum likelihood (PPML) estimator accounts for heteroskedasticity bias and allows for trade flows to be zero. Silva and Tenreyro (2006) have shown that, under heteroskedasticity and due to Jensen's inequality, the use of the OLS estimator severely biases the coefficient on distance. Indeed, recent studies estimating the gravity equation rely almost exclusively on the PPML estimator, as it has been declared best practice in the gravity literature (Yotov et al., 2016).

[9]Unless otherwise stated, I estimate equation (2.3.6) by using the fast PPML command provided by Larch et al. (2017) and limit pair fixed effects to be symmetric (i.e. $\phi_{ij} = \phi_{ji}$).

tion (2.3.6) then allows for different effects of distance and border in each year $T \in \{1928, 1931, 1934, 1937\}$. These variables will capture all bilateral factors that depend on distance and borders influencing trade relative to the base year 1925.

Moreover, I include intranational trade and the variable $INTL\_BRDR_{ij,T}$, which indicates international trade, providing us with an estimate of the border effect and also ensuring that we measure international relative to intranational trade costs. This dummy variable, which takes the value of one for international trade ($i \neq j$) and zero for intranational trade ($i = j$), accounts for average increases across countries in unobservable export costs that decrease international trade relative to intranational trade. We expect the coefficient of this variable to be negative and increasing over time, capturing the effects of increasing capital controls, tariffs and other non-tariff trade barriers.

Finally, the variable $Cbloc$ indicates whether two countries are on the gold standard or members of one of the following trade or currency blocs: the sterling bloc, gold bloc, U.S. dollar bloc, Reichsmark bloc, exchange-control bloc, reciprocal trade agreements act (RTAA) or the IPS.

Indeed, the principle reason to use a panel approach is to get unbiased estimates for the gold standard and the trade and currency blocs. At least since Baier and Bergstrand's (2007) criticism, authors have been including country-pair fixed effects that control for potential endogeneity of trade agreements, currency areas or any form of economic integration area. All authors who investigated the interwar bloc system have confirmed the presence of strong endogeneity in these blocs. Eichengreen and Irwin (1995), Gowa and Hicks (2013) and Wolf and Ritschl (2011) all concur that the blocs are endogenous to preexisting trade flows among their members, reflecting rather than increasing their trade. However, equation (2.3.6) is an improvement over previous studies since it includes all features considered best practices in the gravity literature (Yotov et al., 2016).

First, I control for the border effect by including the variable $INTL\_BRDR_{ij,T}$. Bergstrand et al. (2015) have shown that the estimator of postwar currency unions is biased upward

because it captures the average effects of globalization. Applied to the interwar period, the bloc dummy would be biased downward, capturing the average effect of deglobalization. Including the border dummy isolates the effect of trade and currency blocs on bilateral trade to determine how much a bloc increased trade between two members, but at the same time controls for increasing trends in unobservable bilateral trade costs that decreased international trade relative to intranational trade.

Second, I give trade flows the opportunity to adjust in a three-year interval. Trade policy changes will not be instantaneous and it is best practice among economists to give trade flows three to five years to adjust. Because the use of interval years comes at the cost of a decreased time variation, I also estimate the model using data for all 13 years as a robustness check.

Third, as a further robustness check I allow for nonlinear effects of currency blocs to capture the possibility of the effects of blocs changing over time. This is done by including various lags ($Cbloc_{t-s}$) in the specification. There are two economic reasons why we should include lags. First, the bloc dummy is constructed using the dates of entry and exit. Academic debates over these dates put aside, it is reasonable to expect that the full economic effect of an exit from the gold standard or the entry into a new trade or currency bloc is felt only sometime after the event. Second, the collapse of the multilateral payment system into regional blocs alters the terms of trade and as is well known from the literature in international economics, terms-of-trade changes tend to have lagged effects on trade volumes.

Finally, I test whether the specification, through the inclusion of pair fixed effects, properly accounts for possible "reverse causality" between trade and bloc formation. I implement an easy test to assess the "strict exogeneity" of currency blocs by adding a new variable capturing the future level of currency blocs. A lead variable $Cbloc_{t+4}$ (4 years) of the bloc dummy is included in the specification to test for reverse causality. In the panel context here, if currency bloc changes are strictly exogenous to trade flow changes, $CBloc_{t+4}$

should be uncorrelated with the concurrent trade flow.

Table (2.1) presents the results from estimating different variants of equation (2.3.6). Column (1) shows the result for the main specification using the GE sample. The first thing to note is that the coefficient on distance is insignificant for all years except 1931. Because I control for any unobservables at the bilateral level by including pair fixed effects, this means that the distance coefficients describe the change in the distance elasticity relative to 1925.[10] Since the distance elasticity is negative, a negative coefficient in table (2.1) implies an increase (in absolute value) in the distance elasticity relative to 1925. The coefficient on $Dist_{ij,1931}$ in column (1) implies that the effect of distance had increased by 7.5% $(100 * (e^{0.0725} - 1)$ in 1931.

The second finding is a very large and increasing border effect. The coefficient on $INTL\_BRDR_{ij,1937}$ implies that, all else being equal, the trade-decreasing effect of international borders had increased by 89.6% $(100 * (e^{0.64} - 1)$ in 1937 relative to 1925.

The third finding in column (1) is that the coefficients on $Gold_{ij,t}$, $SterlingBloc_{ij,t}$ and $IPS_{ij,t}$ are large and significant. These coefficients state that being on gold increases trade between two members by 9.2% on average $(100 * (e^{0.088} - 1)$, sterling bloc membership increases trade by 13% $(100 * (e^{0.122} - 1)$ and IPS membership increases trade by 21% $(100 * (e^{0.191} - 1)$. This is the baseline trade cost function that I use in the GE analysis in the next section. As discussed in section (2.3.1), the *GE sample* assumes a large number of missing observations to be zero. The remainder of this subsection therefore uses the partial sample, which lets us estimate the gravity model with more confidence.

Column (2) reestimates the main specification with the partial sample. The only difference in the estimated coefficients is the coefficient on sterling bloc membership, which is now insignificant. This suggests that there is no market difference when using the more rigorous partial sample. The justification for including the two bloc variables $SterlingBloc_{ij,t}$

[10]The pair fixed effects control for *initial* distance and border effects. As described in section 2.3.1, we assume that some factors do not change during this short time period. In that sense, the pair fixed effects control for much heterogeneity including nonlinearities in transport costs, impediments to information flows and home-variety biased preferences.

Table 2.1: Estimation of the Interwar Trade Cost Function

VARIABLES	(1) PPML X_{ij}	(2) PPML X_{ij}	(3) PPML X_{ij}	(4) PPML X_{ij}	(5) PPML X_{ij}
$\ln(Dist_{ij,1928})$	-0.0156	-0.0164	-0.0152	-0.0162	-0.0211
	(0.0275)	(0.0124)	(0.0124)	(0.0124)	(0.0132)
$\ln(Dist_{ij,1931})$	-0.0725**	-0.0734**	-0.0607**	-0.0619**	-0.0762***
	(0.0351)	(0.0288)	(0.0271)	(0.0270)	(0.0249)
$\ln(Dist_{ij,1934})$	0.0353	0.0328	0.0439	0.0701**	0.0630**
	(0.0284)	(0.0281)	(0.0281)	(0.0273)	(0.0280)
$\ln(Dist_{ij,1937})$	0.0600	0.0556	0.0671*	0.0947***	0.0915**
	(0.0368)	(0.0368)	(0.0369)	(0.0360)	(0.0373)
$INTL\_BRDR_{ij,1928}$	-0.0627	-0.0624*	-0.0625*	-0.0572	-0.00905
	(0.0612)	(0.0369)	(0.0370)	(0.0374)	(0.0335)
$INTL\_BRDR_{ij,1931}$	-0.289***	-0.289***	-0.302***	-0.296***	-0.232***
	(0.0839)	(0.0705)	(0.0686)	(0.0686)	(0.0585)
$INTL\_BRDR_{ij,1934}$	-0.669***	-0.671***	-0.680***	-0.709***	-0.718***
	(0.0635)	(0.0692)	(0.0703)	(0.0719)	(0.0723)
$INTL\_BRDR_{ij,1937}$	-0.640***	-0.633***	-0.644***	-0.675***	-0.698***
	(0.0897)	(0.0937)	(0.0947)	(0.0970)	(0.0988)
$Gold_{ij,t}$	0.0876**	0.0878**	0.0836**	0.0773**	
	(0.0397)	(0.0342)	(0.0339)	(0.0346)	
$SterlingBloc_{ij,t}$	0.122*	0.124			
	(0.0690)	(0.0761)			
$IPS_{ij,t}$	0.191**	0.194**	0.247***		
	(0.0826)	(0.0921)	(0.0846)		
Observations	6,090	5,085	5,085	5,085	5,085
Sample	*GE*	*Partial*	*Partial*	*Partial*	*Partial*
Country Pair Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: All estimates are computed with data for the years 1925, 1928, 1931, 1934 and 1937, and use exporter-time, importer-time and pair fixed effects. Column (1) uses the PPML command, while all other estimations use the fast PPML command provided by Larch et al. (2017). All pair fixed effects are restricted to be symmetric (i.e. $\phi_{ij} = \phi_{ji}$). The estimates of fixed effects are omitted for brevity. Standard errors are clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

and $IPS_{ij,t}$ can be seen in columns (3) to (5). Excluding these two blocs in the specifications in column (4) and (5) changes the coefficient on distance, which now takes positive values for the years 1934 and 1937. For example, the coefficient on $Dist_{ij,1937}$ in column (4) suggests that the elasticity of trade to distance had declined by 9.9% $(100 * (e^{0.095} - 1)$ relative to 1925. This is a striking result since it means that distance was significantly less important as a trade cost in 1937 than in any other year in the sample, even though transport costs are said to have risen over the course of the interwar years. Importantly, this estimate is not biased by any other *average* increase in trade costs such as a general rise in tariff levels, which would render distance *relatively* less important. The decline in absolute value of the coefficient on distance has been observed by Eichengreen and Irwin (1995) and named the *interwar distance puzzle* by Albers (2018) since it resembles the post-war distance puzzle described by Disdier and Head (2008). Both Eichengreen and Irwin (1995) and Albers (2018) have argued that political trade barriers caused the decline in the distance elasticity. Contrary to these authors, I include intranational trade and a dummy for international borders, thereby measuring international relative to intranational trade costs while at the same time controlling for the average effect of deglobalization (i.e. the average increase in tariff and non-tariff trade barriers). This strategy has proved to be a solution to the post-war distance puzzle (Yotov, 2012; Yotov et al., 2016). In that sense, the results presented in columns (4) and (5) in table (2.1) should provide a solution to the interwar distance puzzle and the fact that the puzzle is not resolved indicates an omitted variable bias.

The puzzle is resolved once we add IPS and sterling bloc membership in columns (3) and (2). Controlling for these two blocs is important in order to get an unbiased estimate of the distance elasticity. Preferential tariff rates within the empire and fixed exchange rates between sterling bloc members rendered distance within these blocs (and consequently also between non-members) less important. I therefore include sterling bloc membership in the trade cost function although the coefficient on $SterlingBloc_{ij,t}$ in column (2) is just not

significant at the 10% level.

This solution to the interwar distance puzzle is robust when extending the partial sample to include all 13 years, interacting the pair fixed effects with a time trend, using asymmetric pair fixed effects or using lagged variables for the bloc dummies (see appendix (A.2)). Because of the large number of fixed effects and variables to be estimated with a relatively small number of observations, compared to post-war trade studies, I also estimate the gravity model by excluding the pair-fixed effects and including traditional gravity covariates such as colonial ties (see A.3). Here again, we observe the disappearance of the distance elasticity puzzle once we include sterling bloc and IPS membership. Moreover, in many specifications in the robustness appendix, the coefficient on sterling bloc membership is significant at the 10% level. Overall, the results presented in table (2.1) and the choice of the trade cost function are robust to the various specifications.

The decision to include IPS and sterling bloc membership in the regressions in table (2.1) is based on the regression results in table (2.2), which show that these blocs are the only ones that are significant and not subject to reverse causality. Table (2.2) uses equation (2.3.6) to estimate the effects of the currency blocs. We drop $Dist_{ij,t}$ and $Gold_{ij,t}$ for simplicity, but include $INTL\_BRDR_{ij,t}$ to control for the average effect of deglobalization. Column (1) includes the trade blocs IPS, exchange control bloc, RTAA and the gold bloc, column (2) includes the currency blocs sterling bloc, Reichsmark bloc, gold bloc and dollar bloc, and column (3) includes all blocs. RTAA, gold bloc and dollar bloc are insignificant in all specifications and are excluded from further analysis.

Column (4) tests the remaining four blocs for reverse causality by including a four-year lead variable for each bloc. These lead variables should be insignificant in the absence of any reverse causality. The test suggests that only the IPS and the sterling bloc are free from potential endogeneity issues. Although the sterling bloc dummy is insignificant in columns (3) and (4), I include it in the trade cost function for two reasons. First, adding the gold standard dummy, lags of the bloc variables, and distance drastically improves the

significance of the sterling bloc (see the appendix (A.2)). Second, including sterling bloc membership in the trade cost function solves the distance puzzle as we saw in table (2.1).

Overall, the results suggest a strong trade-increasing effect of the IPS that is economically and statistically significant in all specifications. This stands in contrast to the results obtained by Gowa and Hicks (2013) who find that not a single bloc increased member trade. Instead, my results support De Bromhead et al. (2019) recent finding that the IPS was successful in shifting trade towards the empire. More importantly, the results warrant the use of the variable in the regressions presented in table (2.1). To answer the question of how much the collapse of the gold standard contributed to the collapse of world trade in the 1930s, one needs to consider deducting the trade-increasing effect of these blocs, since without the collapse of the gold standard, the IPS and the sterling bloc might not have formed.

Table 2.2: Trade and Currency Blocs in the Interwar Period

VARIABLES	(1) PPML X_{ij}	(2) PPML X_{ij}	(3) PPML X_{ij}	(4) PPML X_{ij}
$INTL\_BRDR_{ij,1928}$	-0.0528***	-0.0541***	-0.0539***	-0.0793***
	(0.0155)	(0.0154)	(0.0154)	(0.0195)
$INTL\_BRDR_{ij,1931}$	-0.390***	-0.397***	-0.404***	-0.430***
	(0.0282)	(0.0294)	(0.0284)	(0.0309)
$INTL\_BRDR_{ij,1934}$	-0.630***	-0.549***	-0.570***	-0.581***
	(0.0362)	(0.0435)	(0.0437)	(0.0441)
$INTL\_BRDR_{ij,1937}$	-0.556***	-0.467***	-0.491***	-0.504***
	(0.0420)	(0.0433)	(0.0444)	(0.0442)
$SterlingBloc_{ij,t}$		0.133**	0.0692	0.102
		(0.0654)	(0.0674)	(0.0756)
$IPS_{ij,t}$	0.331***		0.228***	0.212***
	(0.0755)		(0.0755)	(0.0735)
$ExchangeControlBloc_{ij,t}$	0.0643		0.265***	0.318***
	(0.0740)		(0.0797)	(0.0808)
$RMBloc_{ij,t}$		-0.516***	-0.566***	-0.685***
		(0.131)	(0.130)	(0.123)
$SterlingBloc_{ij,t+4}$				-0.0401
				(0.0686)
$IPS_{ij,t+4}$				-0.0303
				(0.0385)
$ExchangeControlBloc_{ij,t+4}$				-0.223***
				(0.0540)
$RMBloc_{ij,t+4}$				0.362***
				(0.0823)
$RTAA_{ij,t+4}$	0.0926		0.0339	
	(0.0818)		(0.0852)	
$GoldBloc_{ij,t}$	0.0129	-0.000762	0.00619	
	(0.0368)	(0.0377)	(0.0378)	
$DollarBloc_{ij,t}$		0.00213	0.00232	
		(0.0847)	(0.0945)	
Observations	5,085	5,085	5,085	5,084
Country Pair Fixed Effects	Yes	Yes	Yes	Yes

Notes: All estimates are computed using the partial sample and the years 1925, 1928, 1931, 1934 and 1937. All regressions include exporter-time, importer-time and pair fixed effects. The estimates of fixed effects are omitted for brevity. All regressions are estimated using the fast PPML command provided by Larch et al. (2017) and pair fixed effects are restricted to be symmetric (i.e. $\phi_{ij} = \phi_{ji}$). Standard errors, in parentheses, are clustered by country pair; *** p<0.01, ** p<0.05, * p<0.1.

2.3.3 General Equilibrium Analysis

The analysis so far has focused solely on partial effects of distance, borders and the payment system. Using the gravity model in equations (2.3.1) to (2.3.5) I now undertake a quantitative general equilibrium (GE) comparative static exercise to get a complete evaluation of the impact of changing trade costs on the interwar trade bust.

As discussed in the previous section, a large part of trade data is missing or equal to zero for a given pair over the whole period of investigation. This makes it impossible to identify and obtain the estimates of the complete set of pair fixed effects, which are used to construct bilateral trade costs. I deal with the issue by adopting the two-stage procedure proposed by Anderson and Yotov (2016). First, I estimate my preferred specification of the gravity model in order to obtain the estimates of the bilateral fixed effects (ϕ_{ij}) for country pairs with at least one non-zero trade flow. The estimation results for this regression are shown in column (1) of table (2.1). For these observations, the following trade cost function is calculated for the year 1937 as the baseline scenario:

$$\begin{aligned} \tau_{ij,1937}^{BLN} = exp(\hat{\phi_{ij}} + 0.06 \ln Dist_{ij,1937} - 0.64 * INTL\_BRDR_{ij,1937}) * \\ exp(0.088 * Gold_{ij,t} + 0.191 * IPS_{ij,t} + 0.122 * SterlingBloc_{ij,t}) \end{aligned} \tag{2.3.7}$$

In the second step, I regress the estimates of pair fixed effects on distance, contiguity, colonial linkage, common language, the border dummy, and exporter and importer fixed effects:

$$\begin{aligned} \hat{\phi_{ij}} = exp[\alpha_1 * \ln Dist_{ij} + \alpha_2 * Contig + \alpha_3 * Colonial + \alpha_4 * ComLang] * \\ exp[\alpha_4 * INTL\_BRDR_{ij} + \gamma_i + \delta_j] + \epsilon_{ij} \end{aligned} \tag{2.3.8}$$

The predicted pair fixed effects from this second stage regression are used to fill up the

missing pair fixed effects in order to construct the complete set of bilateral trade costs that can then be used as the baseline scenario in the counterfactual analyses. I now reestimate the gravity model constrained with the complete set of bilateral trade costs for the year 1937. The estimates of the exporter and importer fixed effects from this regression are used in order to construct all baseline values of the inward and outward multilateral resistance terms, which in turn are used in combination with data on output and expenditure to obtain the GE indices of country i's overall trade in the baseline.

Next, we define three counterfactual scenarios (CF), which translate into three counterfactual trade cost functions. The first CF assumes that the gold standard, in its 1928 form, still existed in 1937 and that the IPS and sterling bloc had not formed. The conditional GE is achieved by reestimating the econometric gravity specification for the year 1937 under the following constraint

$$\begin{aligned} X_{ij} = exp[0.06 \ln Dist_{ij,1937} + -0.64 * INTL\_BRDR_{ij,1937}] * \\ exp[0.088 * Gold^{CF}_{ij,1928} * + \gamma_i^{CF} + \delta_j^{CF} + \hat{\phi_{ij}}] + \epsilon_{ij}^{CF} \end{aligned} \tag{2.3.9}$$

where the bloc variables now take their 1928 values. The CF then describes a scenario where gold standard adherence had remained at its 1928 level and the IPS and sterling bloc had not formed. The predicted volume of trade from regression (2.3.9) is used to calculate country i's counterfactual conditional GE trade volume ($\hat{X}_i^{CF} = \sum_{j=1}^{N} \hat{X}_{ij}^{CF}$ for all $j \neq i$). The new set of estimates of exporter and importer fixed effects from specification (2.3.9) and the constrained coefficients of the trade cost variables are used to construct the corresponding conditional GE multilateral resistances and obtain real GDP estimates for each of the 36 countries in the sample.[11] Finally, the effects of the full endowment GE are obtained by implementing a four-stage iterative procedure that allows for endogenous factory-gate prices, income, expenditure and trade to adjust to the counterfactual shock.

[11] I only present total exports. Other indices are available upon request.

The value for the elasticity of substitution is 7, which we take from the literature.[12] A detailed description of the calculation of the GE effects is summarized in appendix (A.3).

The second CF assumes that the trade-decreasing effect of borders had not changed in 1937 relative to 1928. Hence, we constrain the coefficient on $INTL\_BRDR_{ij,1937}$ to take its 1928 value (-0.063). The third CF constrains the coefficient on $\ln Dist_{ij,1937}$ to be equal to -0.016, the coefficient for 1928. Table (2.3) presents the results and shows how each country's total trade (in 1937 prices) would have changed under each of the three CF scenarios. The two lines at the bottom of the table show average change across countries and change in total trade aggregated over all 36 countries, which represent the counterfactual change in world trade.

The results are striking and show a clear winner of the horse race. Had the average level of tariff and non-tariff trade barriers, as captured by the border effect, not changed relative to 1928, world trade would have been 64.6 % larger. Crossing the finish line second is the collapse of the gold standard. Had countries remained on the common payment system and had the sterling bloc and IPS not formed, trade would have been 3 % larger. Finally, transport costs, as captured by distance, is not last but has to be disqualified as a cause of the great trade collapse since it ran off in the opposite direction. Had the distance elasticity remained the same, total trade would have been 19% lower on average. Since the baseline and counterfactual trade costs in this last CF are calculated with insignificant coefficients on the distance elasticty (see section (2.3.2)), the GE effects in CF 3 are likely to be zero.

There is a significant amount of variation of the impact these CF scenarios would have had across countries. A lower border effect would have benefited South Africa most, roughly doubling her trade. Great Britain, Italy and France would also have seen above average trade increases. Germany and the U.S., on the other hand, would have seen relatively small increases in their aggregate trade had borders remained at their 1928 level.

[12]The criteria of convergence are set so that either the standard errors or maximum of the difference between two iterations of the factory-gate prices are smaller than 0.01. All three scenarios in table (2.3) have also been calculated with an elasticity of substitution of 5, another common value in the literature. The results did not significantly change.

Table 2.3: General Equilibrium Comparative Statics

Country	CF 1: Gold		CF 2: Border		CF 3: Distance†	
	CDL GE	Full GE	CDL GE	Full GE	CDL GE	Full GE
ARG	2,49	2,52	46,51	48,94	-13,53	-20,83
AUS	-6,06	-6,79	50,28	51,96	-14,42	-21,83
AUT	8,02	7,97	71,15	71,17	-10,27	-16,08
BEL	7,87	7,86	61,47	61,94	-11,32	-16,58
BGR	4,37	4,82	26,30	31,07	-7,44	-14,20
BRA	8,93	8,81	73,90	73,31	-15,89	-22,44
CAN	1,64	1,48	54,45	56,67	-6,46	-14,32
CHE	9,09	8,86	74,89	73,52	-12,32	-17,51
CHL	4,01	4,69	35,39	40,17	-9,21	-17,64
COL	9,09	9,03	75,26	75,14	-16,19	-22,09
DEU	6,94	7,06	57,94	59,04	-8,83	-15,26
DNK	2,01	1,86	64,42	64,30	-10,43	-15,99
EGY	2,47	2,34	59,56	59,83	-16,40	-22,00
ESP	-0,29	-0,38	80,60	77,79	-12,81	-18,65
FIN	2,26	2,20	53,26	54,76	-11,08	-17,30
FRA	9,86	9,46	82,34	79,33	-11,71	-17,55
GBR	-3,93	-4,02	80,53	78,36	-18,10	-23,15
GRC	9,61	9,33	78,97	77,09	-18,52	-23,26
GTM	8,25	8,35	68,20	69,49	-20,64	-25,57
HND	-0,05	-0,02	65,09	66,52	-15,47	-21,22
HUN	5,44	5,85	48,38	51,79	-6,57	-13,07
IDN	5,00	5,25	46,42	49,40	-12,73	-20,25
IND	-4,72	-5,28	55,95	57,09	-13,42	-20,51
ITA	9,97	9,57	84,26	81,44	-13,50	-19,25
JPN	-0,03	-0,12	76,35	75,22	-17,41	-23,02
KOR	-0,05	-0,14	73,85	72,31	-13,78	-19,00
MEX	9,66	9,45	82,01	80,58	-12,87	-19,31
NLD	8,49	8,46	66,62	66,91	-11,27	-16,57
NOR	2,84	2,59	81,62	78,70	-12,58	-18,14
NZL	-11,73	-12,51	50,68	51,69	-18,91	-25,28
PRT	-5,48	-5,54	78,74	75,66	-16,04	-21,12
SWE	3,10	2,96	64,53	64,60	-10,30	-16,42
URY	6,96	7,14	57,77	59,05	-18,46	-24,44
USA	6,39	6,53	57,55	59,18	-10,27	-18,09
YUG	-0,28	-0,41	48,56	51,43	-7,49	-14,00
ZAF	-13,01	-12,66	101,76	94,01	-27,95	-31,80
Country Average	3,03	2,96	64,88	64,99	-13,46	-19,55
Aggregate Change	3,03	2,95	64,39	64,58	-12,59	-18,98

Notes: This table reports the GE trade effects of changing three components of the trade cost function in equation (2.3.7). The first scenario (CF 1) assumes that the gold standard had not collapsed and the IPS and sterling bloc had not formed. The second scenario (CF 2) assumes that the border effect had remained at its 1928 value, and the third scenario (CF 3) assumes that the distance coefficient had remained at its 1928 value. For all three scenarios, I report two different trade impacts: the conditional GE trade impact (CDL GE), which takes changes in the multilateral resistances (MR) into account, but holds GDPs constant; and the full endowment GE trade impact (Full GE), where MRs and GDPs adjust. The row "Country Average" shows the arithmetic average of the GE effects of all countries and the bottom line "Aggregate Change" states the total impact on aggregated trade.
† CF 3 is computed using insignificant coefficients. Hence, the GE effects are also insignificant.

The gold bloc countries (France, Belgium, Netherlands, Switzerland and Italy) and most of Latin America would have particularly benefited, had the gold standard not collapsed. Finally, we observe that, with the exception of Canada, the trade-increasing GE effect in CF 1 is negative for Great Britain and its colonies and dominions. This means that the trade-increasing effect of the IPS and sterling bloc outweighed the negative impact of the collapse of the gold standard for those countries.

These results are robust to the use of different parameters and counterfactual scenarios. I performed the same GE analysis above using column (3) in table (2.1) as the trade cost function, setting sigma equal to 5 and assuming as a CF that the IPS had formed even if the gold standard had not collapsed. [13]

[13] For brevity, these results are not shown here, but are available upon request. If anything, these alternative specifications provide even stronger evidence against transport costs as a cause of the low levels of world trade in 1937.

2.4 A New Transport Cost Index

Section (2.3) established that the distance elasticity increased (in absolute value) in 1931. However, after 1931 the distance elasticity decreased, so that in 1937 distance did not matter any more than it did in 1925. If we interpret the distance elasticity as a proxy for transport costs, the estimates suggest that transport costs rose during the worst years of the Great Depression but then returned to their pre-depression level. This section compares this result with evidence on real freight rates.

There has been considerable disagreement about the course of transportation costs in the interwar period (Estevadeordal et al., 2003; Mohammed and Williamson, 2004; Hynes et al., 2012; Albers, 2018). Much of the discussion about transport costs revolves around the Isserlis Index, the standard source of global freight trends, and the choice of the price deflator. Depending on the frequency of the data and the choice of the deflator, the Isserlis Index implies rising or falling transport costs. For example, Estevadeordal et al. (2003), who use the Sauerbeck consumer price index to deflate the Isserlis index, find rising real freight rates for the whole of the interwar period. However, the use of the Sauerbeck index is problematic since it includes non-tradable goods. Mohammed and Williamson (2004) make use of the original source of the Isserlis index, Angier's annual reports on British shipping, and construct route-specific deflators. Relative to the 1920s, their real freight rate index shows a fall between 1930 and 1934 and a rise between 1935 and 1939. Unfortunately, they only provide five-year averages and we cannot say how much of the increase during the late 1930s was driven by the year 1939, the start of World War II. A more general caveat concerning the use of the Angier data is that one relies on freight rates for British tramp shipping to make inferences about the general evolution of transport costs. Their index ignores the liner shipping industry, which carried high value articles, whereas tramps carried the high bulk, low value staples. Furthermore, liners, contrary to tramps, operated on fixed routes and fixed schedules. Therefore, we cannot assume that

Mohammed and Williamson's (2004) index is representative for the cost of shipping high value manufactures or for the entire British shipping industry. It also ignores transportation industries that transported goods on railroads, turnpikes, rivers and planes. Moreover, the Mohammed and Williamson (2004) index relies heavily on routes to and from Britain and completely ignores shipping between non-European ports.

Albers (2018) presents new freight data for wheat along four oceanic routes deflated by the price of the good at the place of origin. Additionally, he presents data on German railway freight rates deflated by the German wholesale price index. His series imply a modest but economically significant increase in real transport costs over the period from 1925 to 1936 and a spike around 1931. This mixed evidence calls for further evidence on the development of transport costs in the interwar period, which I provide with a new index on freight rates for US cotton.

I compiled monthly data on cotton (American middling) freight rates from New York to 21 destinations (for high- and low-density cotton) from the The Commercial and Financial Chronicle (1925 - 1936). The data was published at least twice a month and I collected the data that is closest to the middle of the month.[14]

I deflate the arithmetic average between high- and low-density nominal freight rates (ct per lb) by the monthly price (ct per lb) of middling upland in New York, which I take from the Statistisches Reichsamt (1936), to get freight rates in ad-valorem terms. Figure (A.2) in the appendix plots these ad-valorem freight rates for all 21 routes. The graphs show that real transport costs of cotton did indeed rise during the Great Depression. At the beginning of 1925 ad-valorem rates ranged from 1.5% for Barcelona to 3.3% for Salonica. In 1928 ad-valorem rates ranged from 1.7% to 5% and in June 1932, at the height of the depression, rates had increased to 6.5% in Le Havre and 15.6% in Salonica. However, by December 1936 most European rates had fallen to 3% again, while Salonica stayed at 7.2%. Between 1928 and 1936 average ad-valorem freight rates increased by only 1.2 percentage

[14]Six routes are not covered for the whole period and either enter the series in 1926 (Venice) or stop reporting sometime in the 1930s (Lisbon, Oporto, Barcelona, Japan, Shanghai).

points. There is a strong positive relationship between these route specific freight rates and distance. A simple OLS regression suggests that the elasticity of ad-valorem freight rates to distance is between 0.4 and 0.5 (see table (A.6) in the appendix).

To examine how much transport costs rose when expressed as an index, I weight these routes by their export quantities to create a Laspeyres-type index:

$$F_t = \frac{\sum (f_{n,t} * q_{n,t})}{\sum (f_{n,10.1927} * q_{n,10.1927})} \tag{2.4.1}$$

where $f_{n,t}$ is the ad-valorem freight rate from New York to location n in month t and $q_{n,t}$ is the quantity (as a percentage of the total, i.e. $\sum_n q_{n,t} = 1$) exported to location n in month t. Quantities come from the Bureau of Foreign and Domestic Commerce (October, 1927) and I use October 1927 as the base month.[15] Figure (2.2) below depicts the freight index from 1925 to 1936.

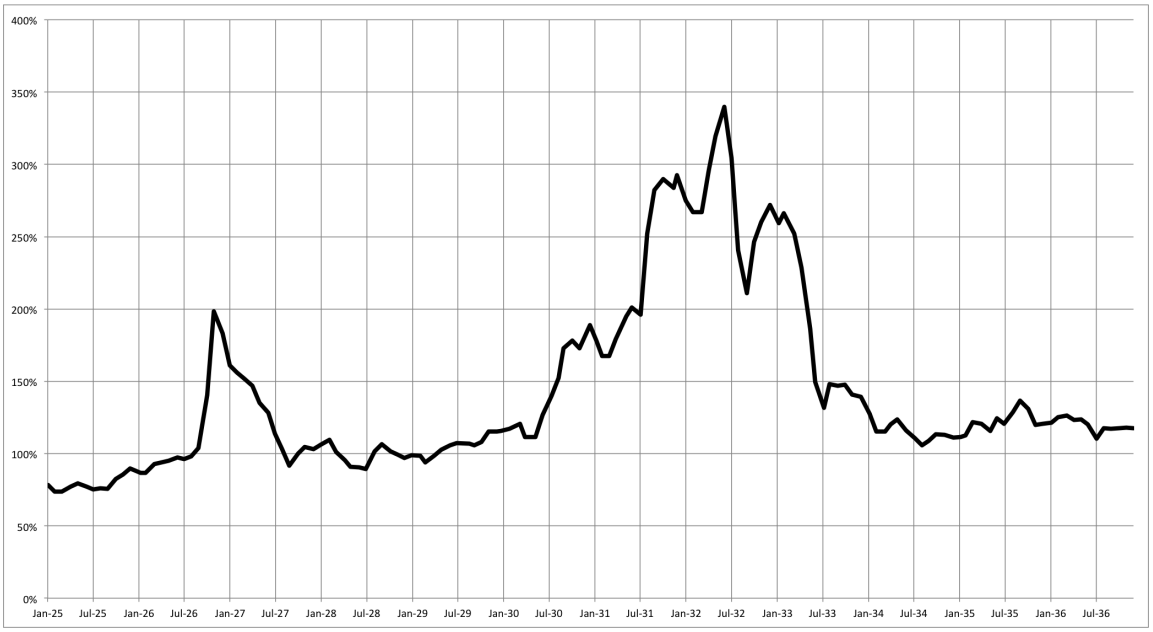
The first thing that deserves mention is the spike in the fall of 1926. The index increases by 100 % between mid-August and mid-November. This increase in real freight rates comes at the end of the British coal strike of 1926, which had started in May that year. After the strike ends, the index falls again and remains relatively stable until the summer of 1930. The index reaches its peak in June 1932 at the height of the worldwide deflation and falls sharply afterwards. In 1936 the index is on average 20 percentage points above the base period (October 1927) and 50 percentage points higher than the index average in 1925. However, this change is only large if expressed as an index. As we have seen above, freight rates in ad-valorem terms increased by less than two percentage points.

A difference of this index when compared with Mohammed and Williamson (2004) is that it relies heavily on the liner industry and is based on routes from New York to cities in Europe and Asia.[16] The index therefore should serve as a useful supplement to the British

[15] I use exports of unmanufactured cotton and match the export destination country with the destination port in the freight rate data. Whenever more than one route goes to the same country of destination, I allocate an equal share of the quantity to each port (e.g., I assume that 50% of cotton exports to Germany arrive in Hamburg and 50% in Bremen). For Fiume, Piraeus and Salonica I use exports to "other European countries".

[16] Liners that operated frequently on these routes include RMS Ascania, RMS Scythia and RMS Aurania

Figure 2.2: Cotton Freight Index



Notes: The graph shows an index of cotton freight rates calculated using the Laspeyres Index for 21 ocean routes. Data on freights rates, prices and quantities come from the The Commercial and Financial Chronicle (1925 - 1936), the Statistisches Reichsamt (1936) and the Bureau of Foreign and Domestic Commerce (October, 1927).

tramp shipping index of Mohammed and Williamson (2004). The drawback of this index is that its construction is based on only one commodity. It is thus difficult to make judgments about Estevadeordal et al.'s (2003) different hypotheses on the causes of the rise in shipping costs. On the one hand, real freight costs rose slightly over the entire period suggesting that productivity growth in the shipping sector was slower than productivity growth in the cotton sector. On the other hand, estimating the elasticity of freight rate to distance, a proxy for technology in the shipping industry, shows that this elasticity is lower in the post- than in the pre-depression period (see appendix (A.4)).

Their alternative explanation for rising shipping costs, rigidities that prevented nominal freight rates to adjust (e.g. shipping cartels), is clearly visible in figure (2.2). Overall, the index in figure (2.2) and the ad-valorem freight rates along different routes in figure (A.2) are broadly in line with the data on transport costs by Albers (2018). Furthermore, the large increase in real transport costs during the extreme deflation, between 1929 and 1933,

of the Cunard line (see the The Commercial and Financial Chronicle (1925 - 1936)).

resembles the increase in the distance elasticity in 1931 (see section (2.3)).

How does the evidence on transport costs compare with the regression results in section (2.3.2)? The assembled data in this section suggests that transport costs between 1933 and 1936 were not significantly different from those in the 1920s, at least in any economic sense. Although they may have contributed to the initial trade bust during the first years of the depression, the marginally higher level of transport costs, relative to the 1920s, cannot explain the low levels of international trade still present in the latter half of the 1930s. This is the same result I obtained econometrically in columns (1) and (2) of table (2.1), where the change in the distance elasticity in 1937 relative to 1925 is insignificant.

Although insignificant for the preferred specification in table (2.1) column (2), the coefficient on $Dist_{ij,T}$ is actually positive, suggesting that the distance elasticity had decreased by 5.7% $(100 * (e^{0.0556} - 1)$ relative to 1925. This effect becomes more significant if we use 1928 as the base year or drop the sterling bloc dummy. How does this more critical interpretation of the regression results square with the fact that we actually observe a small increase in transport costs?

A sensible explanation for this is that freight rates themselves do not perfectly describe transportation costs. Transportation of goods involves time, which increases with distance between locations. Hummels and Schaur (2013) have argued that time in transit is equivalent to an ad-valorem tariff of 0.6 to 2.1%. Although time as a trade barrier is likely to be more important in the age of global supply chains, one cannot disregard technological improvements in the transportation industry, the building of highways and the advent of aviation during the interwar period. Indeed, the regression results in table (A.6) suggest an improvement in the technological relationship between freight rates and distance over the interwar period.

A second reason why freight rates might not adequately describe the real costs of transportation is that during the depression, many governments started to subsidize freight costs. In 1933, the U.S. Secretary of Agriculture (1933) complained to Congress:

> Indirect export subsidies are sometimes granted by governments that operate the railways in their territory in the form of specially reduced freight rates. Reduced rates for export shipments apply, for instance, to wheat in India, sugar in Germany, corn in Rumania, and hops in Czechoslovakia.

Naturally, if governments subsidized freight costs, the data on freight rates will not be what exporters pay to ship their goods. Instead, increasing subsidies on the transportation of goods would render distance less important as a trade cost, which is precisely what a more critical interpretation of the regression results in section (2.3.2) suggests.

2.5 Conclusion

This paper revisits the debate about the causes of the collapse of world trade in the 1930s and examines the relative importance of higher transport costs, the collapse of the payment system, and increased tariff and non-tariff trade barriers. Using a fully specified gravity equation motivated by formal theoretical foundations, I estimate the effects of bilateral distance, international borders, and the payment system on trade.

I show that the gold standard increased trade among its members *only* by 9.2%. The negative effect that the collapse of the gold standard into a system of trade and currency blocs had on world trade is further reduced when we take into account the trade-increasing effects of the IPS and the sterling bloc. Distance, a proxy for transport costs, did not matter more in 1937 than it did in 1925 and thereby fails to explain the low levels of world trade in the 1930s. The factor that changed dramatically from 1930 onwards is the border effect. The trade-reducing effect of international borders captures all trade costs, unrelated to distance (transport costs) or network effects (payment systems). The border effect then is the combined effect of all commercial and financial policies (e.g. tariffs, import quotas, capital controls). This already large trade reducing effect, increased by 89% from 1925 to 1937. Had countries not resorted to beggar-thy-neighbor policies and tariff retaliation after 1928, world trade would have been 64% larger.

The result that transport costs did not matter for the low levels of world trade in the late 1930s is supported by new data on ad-valorem freight rates. Shipping cotton on ocean liners was only slightly more expensive in the late 1930s than in the 1920s and it is unlikely that this marginal increase was the result of slow productivity growth. Transport costs and the distance elasticity, however, show strong increases around 1931, a period of severe deflation, which suggests that cartelization in the shipping industry did in fact matter. In that sense, transport costs might have mattered for the initial trade collapse at the beginning of the Great Depression. Future research would do well, in estimating a dynamic macroeco-

nomic model for the years 1929 to 1933 to evaluate the relative importance of commercial policies, transport costs and credit frictions during these years.

This study also provides a novel contribution to the quest for an unbiased estimate of the distance elasticity in gravity models. I argue that the retreat into the British Empire decoupled a large part of the world's multilateral trade and payment system. Overall, this made distance less important, relative to other trade costs. Only after I control for the gold standard, the IPS and the sterling bloc, does the evolution of the distance elasticity approximate the evolution of transport costs in the interwar period. Future work should test whether harmonization of political trade barriers add to the solution of the post-war distance puzzle.

CHAPTER 3

LIQUIDATING BANKERS' ACCEPTANCES: INTERNATIONAL CRISIS, DOCTRINAL CONFLICT AND AMERICAN EXCEPTIONALISM IN THE FEDERAL RESERVE 1913-1932

3.1 Introduction

In his seminal work on the Great Depression, Charles Kindleberger (2013) argued that the economic and political crisis of the interwar period resulted from a lack of leadership. More recently, Adam Tooze (2014) has adopted a revised version of the "hegemonic failure" interpretation of the interwar period. This new interpretation stresses the racist and nationalist elements of the Wilson administration and accuses its Republican successors of a reluctance to assume leadership. In this paper, I offer a direct link between Wilsonianism and Federal Reserve (Fed) policy at the height of the Great Depression in late 1931. I show how the insistence on a Wilsonian interpretation of the real bills doctrine, i.e. the idea that the financial system should be organized around bills backed by commercial transactions, was an important cause in the collapse of the market for the dollar-denominated trade credit instrument known as bankers' acceptances.

Before the Federal Reserve Act of 1913, U.S. foreign trade was financed through the London money market. Only 17 years later, bankers' acceptances were rivaling the mighty sterling bill. New York and London were both leading financial centers. By 1930, dollar acceptances were not only financing large parts of international trade outside the U.S., but had also become the major short-term credit instrument to channel funds into Germany. When continental Europe was hit by a financial crisis in the summer of 1931 and the standstill agreement between Germany and its creditors froze all outstanding German dollar acceptances, Senator Carter Glass insisted on the self-liquidating nature of acceptances as

an eligibility requirement for purchase and rediscount at the Federal Reserve Banks. This political and public pressure triggered a negative shock to the supply of acceptances and contributed to the all but complete collapse of the market.

The importance of acceptances in the context of the U.S. banking crisis of late 1931 is highlighted by the fact that in addition to the 40 percent gold cover ratio of Federal Reserve notes in circulation, Reserve Banks had to hold other eligible assets to cover the remaining 60 percent of the note issue. If eligible assets fell short of 60 percent of Federal Reserve notes in circulation, the Reserve Banks had to hold additional gold to make up for the shortfall. The extent to which the Fed could have offset the largest decline in the monetary base (M1) in the history of the U.S. via open market purchases between September 1931 and January 1932, was thus constrained by the amount of eligible assets on the Fed's balance sheet. The so called "free gold problem" might have been alleviated had the Fed purchased more acceptances (Friedman and Schwartz, 1963, p.400-404). This paper contributes to the literature on this crucial episode of U.S. monetary history by presenting a major obstacle that prevented the Fed from acquiring larger quantities of acceptances: The insistence on the self-liquidating nature of acceptances as an eligibility requirement.

This argument, however, is not a simple restatement of the hypothesis that adherence to the real bills doctrine was responsible for the Fed's policy failures in 1931 (Meltzer, 2003). In section (3.2), I show that the Federal Reserve Act of 1913 allowed for two different interpretations of the real bills doctrine to coexist until 1931. One version, put forward by Glass and economist Henry Parker Willis, focused on self-regulation and decentralization. The second version of the real bills doctrine, favored by Paul Warburg and other New York bankers, focused on central active management and promoted the development of an international market for dollar acceptances.

I recount the early historiography of the Federal Reserve Act in section (3.3) as a battle between Glass and Warburg over the question of authorship. As the usage of dollar acceptances increased around the world, the Warburg doctrine became visible as an inherent

feature of the Federal Reserve System. Glass' prime motive to do away with the acceptance system was to be seen as the father of the Federal Reserve System and to depict the Federal Reserve System as a product of Wilsonianism.

Section (3.4) highlights two factors that contributed to the rapid growth of the volume of dollar acceptances between 1927 and 1930. First, a direct outcome of the Warburg doctrine was the liberalization of eligibility requirements towards acceptances that covered the sale and storage between foreign countries. Second, the growth in these foreign acceptances coincides with an increasing demand for foreign short-term credits by Germany. At the time of the German financial crisis, dollar acceptances were the largest short-term asset group by type and denomination, accounting for 14 percent of all foreign short-term credits to Germany.

Section (3.5) describes the effort that Glass and Willis put into exposing the risks of acceptances. Starting with a Senate investigation in January 1931, Glass and Willis alleged that German acceptances were frozen. As the international financial system started to collapse and these accusations became a reality, both sides of the political spectrum blamed the Warburg doctrine for this development. Moreover, many Reserve Banks themselves were unsure about the eligibility of these frozen acceptances for purchase and rediscount. As markets expected more rigid examinations of the underlying transactions of acceptances, this increased the cost of gathering information for accepting banks. Moreover, holding frozen German acceptances in particular were seen as a sign of bad reputation. This caused accepting banks to curtail their supply of acceptances and contributed to the collapse of the market after 1931.

I conclude in section (3.6) by highlighting avenues for future research.

3.2 The Political and Economic Visions of the Real Bill Doctrinaires

In 1913, with the signing of the Federal Reserve Act, Congress established the Fed. It was the outcome of a long struggle for banking reform accompanied by ever more frequent

financial crises. The movement for reform gained momentum in 1907, when a banking crisis put the responsibility of stabilizing the entire US banking system in the hands of J.P. Morgan and a few other large New York banks. The apparent defects of the National Banking System and the agitations of the agrarian populists against the money trust on Wall Street provided a counter balance to the deep-rooted suspicion towards a central bank and concentrated power in Washington. But the fatal controversies that accompanied every attempt for currency reform produced a Federal Reserve Act full of ambiguity, undefined terms and unclear mandates. Even the locus of decision-making power was not clear and became a source of friction between the twelve Reserve Banks and the Federal Reserve Board, until the Banking Act of 1935 shifted the locus of power to the Board. The very nature of the Federal Reserve Act gave much responsibility and powers to central bankers in the Fed's early years. Because there was no Fed in 1913, only a mandate to create one, central bankers had to exercise discretion so broad that they were effectively taking legislative action (Chandler, 1958).

Even the doctrinal foundations of the Act were not clearly formulated. Indeed, the ambiguity of the Federal Reserve Act left space for various doctrines to coexist during the Fed's formative years (Eichengreen, 2014). Written into the heart of the Federal Reserve Act was the real bills doctrine. But there were, in fact, two versions of the real bills doctrine, one focused on self-regulation and decentralization and the other emphasizing central active management of real bills (Mehrling, 2002).

The first version of the real bills doctrine, proposed by Chicago economist Laurence Laughlin, argued that the monetary liabilities of the banking system should be secured by holdings of short-term, self-liquidating commercial bills. This would ensure that as bills mature, funds flow back to the banks. The inflow of funds would be available to pay out deposits and ensure that a bank could meet its obligations. The idea was that a financial system built around a market for commercial bills would be able to adjust elastically to the changing credit needs of the economy. A self-regulating system around real bills was

supposed to be an alternative to central banking and was intended to privilege commercial credit over speculative credit to Wall Street. This doctrine was worked into the bill by Laughlin's student Willis and Virginian Representative Glass. I therefore call it the Glass-Willis doctrine.

The second version of the real bills doctrine focused on the centralization and mobilization of reserves to give the Fed the capacity to curb credit fluctuation and to stabilize the crisis-prone U.S. banking system. It envisioned an active acceptance market that allowed acceptances to serve as secondary reserves, salable when credit was tight and movable to where reserves were most needed. This version of the real bills doctrine further envisioned supporting the market by giving acceptances privileged access to the discount window and helping to foster the market with the central bank acting as a market maker of last resort. The control of the discount rate would then be the primary instrument through which the central bank would intervene to influence the market rate of interest. Open market purchases would serve to provide dealer liquidity and stabilize the price of prime bills (Mehrling, 2002; Eichengreen, 2014). This doctrine was worked into the Aldrich bill, the precursor to the Federal Reserve Act, by Paul Warburg, so I call it the Warburg doctrine.[1]

The Aldrich bill of 1912 was an important milestone in the founding of the Fed. Warburg, the intellectual force behind the bill was a German-born banker from a famous Jewish banking dynasty. In 1910, together with Senator Nelson Aldrich and other prominent bankers, among them Frank Vanderlip of National City Bank and Benjamin Strong of J.P. Morgan, Warburg met on Jekyll Island to begin drafting the Aldrich bill. The hostility towards Aldrich and his Wall Street connections forced them to meet secretly to discuss their plan for monetary reform. From 1920 onward, the secret meeting would give rise to conspiracy theories that have lasted until today. But in 1912, when the Aldrich bill was presented to the House of Representatives, the name giver's close affiliation to Wall Street

[1]Eichengreen (2014) defines the Warburg doctrine as the view that the Fed should act as a market maker to foster the development of a market for dollar acceptances. The definition I suggest also encompasses the view that the credit system can be centrally managed by the Fed through interventions in the acceptance market.

and the strong support of the American Bankers Association and other lobby groups was enough to discredit the bill as a creature of Wall Street (Lowenstein, 2015). Although the Aldrich bill failed, many features were adopted, and the Federal Reserve Act turned out to be strikingly similar to the bill.

The Federal Reserve Act in its initial form was so broadly formulated as to leave ample space for interpretations that could fit both versions of the real bills doctrine. The Federal Reserve Act deals with real bills in sections 13 and 14, which explain the powers of the Reserve Banks to rediscount and engage in open market operations in acceptances. The trade credit instrument known as Banker's Acceptance (or simply "acceptance") evolved out of the classical bill of exchange, which had been used for centuries to finance trading activities of merchants all over the world. The instrument made it possible for exporters to benefit from the proceeds of a sale before receiving payment. After the signing of a contract between an exporter and importer about the delivery of goods in a fixed amount of time, the exporter could draw a bill against the importer's bank, ordering it to pay the holder of that bill a certain amount at a certain date. The bank, upon presentation of the shipping documents, will then eventually have the bill "accepted" against some commission fee. The signature transforms the bill into a tradable security, and the importer can then discount the acceptance to receive immediate payment. When the bill is due, the accepting bank, which in the meantime has received payment from the importer, will then pay whoever is holding the bill. Because acceptances were backed by goods involved in a commercial transaction, they were considered self-liquidating, since the funds to repay the credit came automatically from the payment for the goods. Those were the real bills which Warburg thought were needed to transition from the national banking system, which had its money supply fixed to the amount of government bonds, to the Federal Reserve System. But until 1912, virtually no acceptances were provided by U.S. banks. Instead, U.S. banks provided trade financing through the London money market with acceptances denominated in sterling. Both the Aldrich bill and the Federal Reserve Act permitted the creation of acceptances by

member banks, with the difference that the Aldrich bill required that acceptances underly a "commercial transaction", while the Federal Reserve Act only allowed for acceptances to be drawn for "transactions involving the importation or exportation of goods" (Warburg, 1930a, p.278). In 1916, under the leadership of Warburg on the Federal Reserve Board, the Federal Reserve Act would be amended to allow the creation of acceptances arising out of domestic transactions and finance drafts. These war amendments and later regulatory changes would become the subject of sharp critique by Glass and Willis, who followed a much stricter interpretation of the real bills doctrine.

Under the Aldrich bill, the power to engage in open market purchases of acceptances would have been centralized at the board. Warburg, who had wanted a more centralized system, tried to influence Willis through Laughlin. Although Willis and Laughlin succeeded in convincing Glass to abandon his idea of totally independent regional Reserve Banks and persuaded him of the need for a unified system, they were not aiming for centralization (Lowenstein, 2016, p.154). For Willis and Laughlin, a unified but decentralized system was the optimal solution, since it rendered any need for central active management unnecessary. This stands in stark contrast to Paul Warburg, Benjamin Strong, Frank Vanderlip and other New York bankers, who saw a need for active central management of the market for commercial bills.

Paul Warburg's goal was to actively create a deep and liquid market for dollar acceptances through active purchases. But contrary to the Aldrich bill, the Federal Reserve Act provided the newly created Reserve Banks with the power to purchase acceptances. Handing the power over open market operations to the individual Reserve Banks, however, caused the Federal Reserve Bank of New York (NYFRB) to lead the way on open market purchases of acceptances. Because Benjamin Strong, governor of the NYFRB, shared Warburg's views about the acceptance system, the NYFRB was the one Reserve bank were there was a serious influence of the Warburg doctrine, the doctrine to actively create and manage a market for acceptances (Eichengreen, 2014). For Warburg, the dislocation of

power and the higher capital requirements for holding acceptances stipulated in the Federal Reserve Act were to blame for the failure to develop a discount market outside New York (Warburg, 1930a, p.280). To Warburg this was "one of the System's most serious shortcomings" (Warburg, 1930a, p.457).

To Glass, it was quite the opposite. Towards the end of the 1920s, Glass , by then Senator, started blaming the Warburg doctrine for the speculative excess on Wall Street. As he wrote to Edmund Platt, Vice-Governor of the Federal Reserve Board, on February 9, 1929:

> I gather from your letter that the system and not the federal reserve bank of New York alone is carrying the excessive amount of approximately $717 Mio of outstanding volume of acceptances. [...] The domestic acceptance system inflicted on the federal reserve system by Warburg's so-called "war amendments", and of which Warburg's acceptance bank seems to have been the chief beneficiary, has no analogy, as far as I have been able to discover, in the banking system of any civilized nation on earth. I have been intending for two years to see if we might not get rid of it; but I have been so constantly immersed in other matters as to have had little time to consider an intelligent review of federal reserve legislation. At the next regular session of Congress I hope to have better luck. (Carter Glass Papers, 1858 - 1946, [hereafter CGP] 15/3)

An admirer of the Jeffersonian ideal of strong individual states rights, Glass was determined to fight against concentrated power in New York. For Glass, the Warburg doctrine departed from what the Federal Reserve Act stipulated and led to the corruption of the System by big finance in New York. Glass, whose political aims included maintaining white supremacy, worked towards preventing the southern banking industry from joining the Republicans, as this might undermine the system of racial exclusion (Lowenstein, 2016, p.153). From 1930 onwards, Glass and Willis tried to get rid of the acceptance system. However, a domestic view is insufficient to explain the developments of 1931, which led

to the collapse of the acceptance market, which will be discussed in section (3.5). Both the Warburg doctrine and the Glass-Willis doctrine extended to the international sphere of monetary economics.

After his retirement from the Federal Reserve Board, Warburg founded the International Acceptance Bank, the market leader in issuing acceptances in the early 1920s, and was the first chairman of the American Acceptance Council, which provided important public goods to the market by disseminating information and using moral suasion to raise demand for acceptances (Ferderer, 2003).[2] In 1924, as the German currency stabilized after hyperinflation, Warburg pointed out to Owen D. Young, member of the First Committee of Experts on Reparations and director of the NYFRB, that "it would be invaluable advantage [*sic*] for American discount market if as a result of America's entering the field now substantial portion future German gold reserve [*sic*] were invested in dollar acceptances.[3]" Warburg took the lead and organized a bankers' consortium around the International Acceptance Bank that provided a 50 Mio USD loan to found the Gold Discount Bank, a subsidiary of the Reichsbank, which was organized to furnish trade credit to German exporters. At the same time Paul Warburg, as chairman of the Federal Advisory Council (FAC) of the Federal Reserve System, was the driving force behind important regulatory decisions of the Fed. In 1924, the Federal Reserve Board issued a ruling that made German dollar acceptances payable in the U.S. eligible for open market purchases and rediscount, if endorsed by the Gold Discount Bank and a U.S. member bank.[4] In 1927 bankers' acceptances saw a further relaxation in eligibility requirements for open market operations and rediscount at the Fed. Upon the suggestion of the Federal Advisory Council, the Board decided that it

[2]While living in the U.S., Warburg still maintained close ties with brother Max Warburg who headed the family-owned bank M.M. Warburg in Hamburg, Germany. The Warburgs used their informational advantage to extend the business of trade financing in dollars to Germany and beyond (Accominotti, 2019).

[3]Warburg to O. D. Young, March 14, 1924 (Clarke, 1967, p.61).

[4]See Federal Reserve Bulletin (June, 1924). A detailed description of the Boards decision process in the matter is found in Charles Hamlin's diary entry Vol. 8, 7 Jan.-17 June 1924 (pp. 580-656) (Charles S. Hamlin Diaries, 1887-1937, hereafter CHD). From Hamlin's diary it is clear that Warburg was the main proponent of this regulation. Warburg had proposed this relaxation of regulatory requirements as early as 1915 (Warburg, 1930b, p.325).

would deem acceptances eligible even if the goods on which the bill was based had already arrived at their destination.[5]

Taking a business viewpoint, Warburg aimed at "putting America's discount market on the map and complete [America's] position as world bankers" (Clarke, 1967, p.62). Indeed, Warburg saw the London discount market and the Bank of England as a role model and thought that the U.S. should be put "in a position to finance the trade of other nations and to play, in this respect, the part of an international banker that has heretofore been played almost exclusively by England (Warburg, 1930b, p.324)." The aim was to promote the dollar acceptance market in order to make the U.S. a major international financial center and pursue management of the international gold standard à la Bank of England. This view was profoundly shared by Benjamin Strong (Chandler, 1958, p.87 ff). Moreover, Warburg saw the need for more cooperation under the gold exchange standard and supported the founding of the Bank for International Settlements (BIS), which to Warburg's regret, the United States did not officially join (The Commercial and Financial Chronicle, 1931b, January, 10). Finally, Warburg was in favor of a reduction in reparations and war debt relief to spur the recovery of Europe after the War (Warburg, 1930b, p.799). The international monetary system that Warburg envisioned had at its center a private discount market for acceptances, which required active management by the leading central banks. In the long run, the Fed would take the lead in this system of international central banking.

But Warburg's vision ran counter to contemporary tendencies in American life, such as isolationism and the extreme nationalism that usually goes with it. Much of the electorate, especially to the west and south of the capital, showed racial, religious, and nativist phobias, resentment of big business and intellectuals, hatred toward Europe and Europeans, and toward the East Coast and its culture (Hofstadter, 1955). For this indigenous Yankee-Protestant political tradition central bank management, as stipulated by the War-

[5]Again, Warburg took part in advocating the new regulation. Having retired from the FAC in 1925, he acted as an alternate to the New York representative in the FAC's meetings of November 17 and 18, 1927 when the issue was discussed and the recommendation drafted (Federal Advisory Council, 1927).

burg doctrine, was an infiltration of Hamiltonianism, which would lead to a European-style monarchy.[6] Nevertheless, there was, at times, ample support for progressive reforms. After all, Glass not only championed the Federal Reserve Act, but was also a strong supporter of the League of Nations and even blamed the failure of the U.S. to join the League as the cause for the international monetary instability in the early 1920s (CGP, 10/15). For Woodrow Wilson and his followers, "Progressive internationalism was an integral part of Progressive nationalism" (Eisenach, 2006, p.284). This was true in their economic analysis, as well as in the larger sense of envisioning the U.S. as the vanguard nation leading the world in advancing democracy. It was an early form of American exceptionalism, the idea that the U.S. has a unique mission. But this American exceptionalism, contrary to the one propagated in the post-World War II era, refrained from intervention and active central management. Instead, it favored decentralization and self-regulation within a set of institutional boundaries.

An institution that would manage the international monetary system was at odds with the Glass-Willis doctrine. In May 1922, Wilson asked Glass for an opinion about Frank Vanderlip's proposal to create an international reserve bank, which Glass after consulting with Willis dismissed as unnecessary. Willis saw the Vanderlip proposal as a mechanism to promote the dollar as an international currency that would be managed by a syndicate of central banks led by the Federal Reserve. This ran counter to Willis' belief in the traditional real bills doctrine of self-regulation. An international reserve system, therefore, was not needed. Glass adopted this line of reasoning in his reply to Wilson, to which he added his own argument:

> ...[Economics] aside, I am afraid there are inherent obstacles of an almost insuperable nature to the formation of an international reserve banking system. The various nations which might be expected to contribute to the establishment of such a bank and become stockholding factors are so different of race, tempera-

[6] See for example the letter and accompanied newspaper clip "Our Country - A Monarchy", T.J. Anketell to Glass (CGP, 15/26).

ment and habits as to make complete cooperation exceedingly difficult. (CGP, 10/15)

For Glass, the approach to international finance was that which Wilson applied to international relations. The strategy of Wilsonians was emphatically directed towards suppressing imperialism, understood as the violent rivalry of the great powers that threatened to divide the world into segmented spheres of interest (Tooze, 2014). Government involvement in the management of private international debt markets would only further escalate imperialist tendencies. Even worse, they felt that the United States was constantly threatened by imperialist ideas from Europe. Over dinner with Glass and Willis, Charles Hamlin, member of the Federal Reserve Board, called Warburg a German Imperialist whose sole aim was centralization of the Federal Reserve System. According to him, these Hamiltonian tendencies had to be avoided.[7]

Of course, for the U.S. to be the vanguard nation in terms of social justice and democracy it needed to live up to the moral standards which it held against Europe. In that sense, the desire to keep a distance from the violent forces in Europe came also from the realization of how fragile the U.S. system still was. After all, America's own entering into modernity, in the wake of the civil war, was just as violent as elsewhere in the world (Tooze, 2014). Glass himself experienced the end of the civil war as a young boy and took a leading part in the powerful social upheaval in Virginia that rewrote the state constitution and disenfranchised voters of color. Realizing the still apparent fragility of the political system, the vision of Wilsonians was to shield themselves from the violent forces of Europe and Asia in order to preserve their own national order that had formed in the wake of the civil war. This strategy would ensure a state-building process that lives up to their Jeffersonian ideal. Imperative for this vision were new institutions that evolved out of the reformism of

[7]In that sense the League of Nations fits with the approach of relinquishing Jeffersonian means to achieve Jeffersonian ends (Schlesinger, 2003). The League of Nations would serve as the stage where the U.S. would act as the arbiter of the world and work towards disarmament and an end to imperialism. Political self-determination of each nation would go along with economic self-regulation between nations. This vision of Glass is just the Jeffersonian ideal of strong individual states rights and the aversion towards economic centralization in New York applied to the international level.

the era, and had their origin in the U.S., Washington D.C. It is the insistence on the success of Jeffersonian Republicanism that made it imperative for Glass that the Federal Reserve Act was written in Washington and not by an "imperialist" European in New York.

3.3 The Fed: An Early Historiography

In a 1926 letter to Glass, Warburg quipped that "the mother of the Federal Reserve Act must have been a very immoral woman because there are so many men who claim to be the father of the child." But Warburg's attempt to avert an escalation about the authorship of the Federal Reserve Act was fruitless. In late 1926, Glass had already drafted his own account of the founding of the Fed, which he first published in a series of newspaper articles and then, in 1927, in a book. In "An Adventure in Constructive Finance", Glass (1927) would present himself, with Willis as his right hand, as the main force behind the Federal Reserve Act, overshadowed only by the star of the Democratic Party, President Wilson. But this effort to narrate the history of the Federal Reserve Act as a legacy of Bourbon Democrats was only the response to the latest historical account of House and Seymour (1926) who ascribed the paternity of the Act to Colonel E. M. House and saw a greater role for New York bankers in the writing of the Act. In fact, in early 1923, Glass and Willis had already "agreed upon the facts to be presented...[because] Senator [Ladd] from North Dakota again retailed the Jekyll Island bunk and reiterated the stuff about Warburg being the author of the Federal Reserve Act" (CGP, 10/23). Hence, one must start earlier, if the aim is to investigate the impact of Fed historiography on Fed history. This section narrates the Fed historiography in three acts.

The first act starts just after the 1920-21 depression with the publication of a set of articles called "The International Jew" in Henry Ford's newspaper *The Dearborn Independent*. These anti-Semitic texts claimed that the Fed was a conspiracy of Jewish bankers created to achieve global domination. Drawing on and misusing an early contribution of Edward Seligman (1914) and the anti-Semitic fabricated text "The Protocols of the Elders of Zion",

the *Dearborn Independent* stated that "the Federal Reserve Act will be associated in history with the name of Paul M. Warburg" (Ford, 1921).[8] The impact this had on historical narratives of the Fed can be seen by a correspondence between Glass and G.W. Armstrong, a Texas business man and politician (CGP, 7/32).[9] In the correspondence Armstrong, an avowed anti-Semite, asked Glass to admit that "the real authorship of the Federal Reserve Act was in New York and not in Washington." A similar conspiratorial narrative about the founding of the Fed was reiterated by North Dakota Senator Ladd (R), referred to in the above paragraph. Championing easier credit for farmers before congress Ladd rejected further legislations on the basis of the Federal Reserve Act since "there could not be a more effectual way of abandoning the interests of the farmer and setting another trap for his enslavement" (U.S. Congress, 1922, p.30). Glass and Willis realized that questions about the Fed's legitimacy would inevitably be raised in the face of severe monetary restraint. Since the Glass-Willis doctrine necessarily accepted deflation as an unavoidable cure to speculative excess, they agreed upon the fact that the Federal Reserve Act had been written in Washington. This served to shield the Fed from attacks that depicted it as a conspiracy of Jewish bankers, created secretly to benefit the interests of Wall Street. By the time of Willis's (1923) publication on the origin of the Federal Reserve Act, however, prices were rising again and the Fed gained credibility.

The second act takes place around the time of the McFadden Act of February 1927, which re-chartered the Fed, liberalized branch banking for national banks and increased competition between member and non-member banks. Fearing that the Fed would be subject to the same fate as the First and Second Banks of the United States, Congress re-chartered the Fed seven years earlier and in perpetuity. Glass was a strong supporter of the bill and claimed credit for "the really outstanding features of the McFadden-Pepper

[8] "The Protocols of the Elders of Zion" were forged in Russia around 1903. While the document has been proven to be fake, it had a major impact throughout Europe and the U.S. in the 1920s and 1930s. Today, the text is still presented by conspiracy theorists as a genuine document (Landes and Katz, 2012).

[9] Having lost a fortune during the 1920/21 deflation, Armstrong would campaign against the Fed in Texas and eventually run for governor of the state of Texas. For details about the life and influence of Armstrong, see Hendrickson (2002).

bill, [...] which include] (1) the branch banking provision [...] and (2) the indeterminate charters of federal reserve banks to prevent a country-wide agitation against the system by demagogues" (CGP, 13/7). Glass even clashed with Willis over the McFadden Act, whom he accused of having assisted Democratic "Senator Wheeler and two or three of his radical associates to defeat the bank bill." Although Glass acknowledged "valid objections to certain provisions of the McFadden bill", he argued that "all they want is to [...] destroy the federal reserve system" (CGP, 13/11). Glass' prime motive was to shield the Federal Reserve System from the attacks of agrarian populists and anti-semites such as Rep. McFadden (R), Rep. Heflin (D), Sen. Brookhart (R), Sen. Ladd (R) or Sen. Wheeler (D).[10] To this end he published his narrative on the founding of the Fed in a number of newspaper articles between November 1926 and February 1927 when the heated discussion about the McFadden Act was taking place in congress. His case of the Federal Reserve System as a product of Wilsonianism, written in Washington, served to invalidate arguments that the Fed was controlled by Wall Street bankers.[11]

The immediate response to Glass were strident replies by Seligman (Feb 1, 1927) and Untermyer (1927). Soon after, by June 1927, Glass and Willis learned that Warburg started working on a book as a direct response to Glass and Willis. Having already published their own accounts, Glass and Willis changed their strategy to eliminate the main features of the Federal Reserve System that could be traced back to the Warburg doctrine. The shift in strategy is also explained by the fact that, after a secret meeting between central bankers of Germany, France, Great Britain, and the U.S. in New York, the Fed reduced discount rates and embarked on a large-scale program of acceptance purchases (Meltzer, 2003, p.176-177). From September 1927 onwards, Glass and Willis would take up the task to "get

[10]Sen. and Rep. stand for Senator and Representative. Party affiliation is indicated by (D) for Democrat or (R) for Republican.

[11]Glass' narrative was also a response to the account of House and Seymour (1926) which depicts Colonel E. House as the political chief negotiator. A close confidant to President Wilson, House sympathized with the Aldrich bill early on and met frequently with Warburg and other New York bankers during the legislative process of the Federal Reserve Act. Having read Charles Seymour's account, which describes House as the crucial mediator between New York bankers and politicians in congress, Glass started to discredit everyone but himself, Willis and Wilson for the writing of the Federal Reserve Act.

rid of [...] Warburg's so-called 'war amendments' [and his] acceptance system". Attacks by Willis in the editorial of *The Journal of Commerce* on Fed policy prompted Benjamin Strong to bring the matter to Glass, who promised "to meet [Willis] and talk over certain matters" (CGP, 14/2). But Glass himself warned Strong about "an unsound development of the use of acceptance credits" and argued that "the privilege [to issue acceptances] was not properly safeguarded by law, but left wide open for the free exercise of discretion and acquisitiveness by the thousands of banks which have no facilities or resources for the transaction of such business and should never have been accorded the privilege" (CGP, 14/2). The third act of the historiography thus encompasses the publications of Warburg (1930a,b), Laughlin (1933), and Willis' and Glass' Senate investigation of the acceptance system, which culminated in an influential senate report (Glass, 1932).

Glass, Willis and Laughlin went so far as to deny Warburg any intellectual credit in the making of the Federal Reserve Act:

> Prof. Seligman becomes increasingly amusing when he assumes to think that nobody on this side the Atlantic Ocean knew or cared anything much about the principles of European banking until Mr. Warburg came to America: Not even the memorable lectures of Dunbar at Harvard, or the exposition of Conant, unsurpassed in their clarity, ... nor ... other ... virile writers in such periodicals as the AER, the QJE, the PSQ — none of this constant pounding, accentuated by recurring financial panics, excited any real interest in the US until Mr. Warburg "recalled to our minds" how things were done in Europe! (The New York Times, 1927, February 15)

The fact that Warburg had been working on his book, which turned out as a two-volume account of the origins of the Federal Reserve Act, with a detailed comparison to the Aldrich bill, continued to occupy Glass and Willis through the late 1920s, as their constant exchange of "hearsay" about Warburg's progress shows (CGP, 13/11, 14/22, 15/5, 15/9).[12]

[12] See also CHD.

Meanwhile, Glass and Willis focused their energy on blaming Warburg's war amendments and the acceptance policy of the NYFRB for the stock-market boom and the supposedly excessive lending to German banks (Glass, 1932, 4-5). Supporters of the Glass-Willis doctrine saw active central management as the cause of both maladjustment and a major determinant in the Great Depression. They believed that, to ignite recovery in the 1930s, it was necessary to restore confidence and have liquidation run its course (Laughlin, 1933, p.273-275).[13]

The antagonism of Glass, Willis and Hamlin against Warburg reached its peak with the publication of Warburg's book. After Platt's resignation from the Board in late 1930, Warburg and Eugene Meyer were considered as candidates for chairman. This was unacceptable to Hamlin, Glass and Willis. Despite acknowledging that Warburg was of practical banking experience, he was "the central figure" in the advocacy for a central bank, "a German imperialist" and "loyal only to himself" (CHD, Sept. 2, 1930).[14]

Although Warburg's (1930a) book would soon bring about another reply by Laughlin (1933), this is beyond the scope of this paper. By 1933, the volume of acceptances was in rapid decline, power over monetary policy had shifted from New York to the Board in Washington, and the Fed had failed to counteract at least part of the monetary contraction in October 1931 through increased purchases of acceptances. Importantly, these three events are connected to the historiography described above. The Senate investigation into the acceptance system, which Glass and Willis launched in January 1931, was an attempt to eliminate traits of the Warburg doctrine and strengthen the Glass-Willis doctrine as the fundamental feature of the Federal Reserve Act. Section (3.5) argues that the insistence on "self-liquidating commercial bills" as an eligibility requirement for the note issue contributed to all three of these events. I attribute the increase in adherence to the Glass-Willis

[13]The view that the Warburg doctrine is responsible for the Great Depression has been reiterated in more recent accounts of early Fed history (Rothbard, 2009, p.77).

[14]Glass was chiefly responsible for the reappointment of Hamlin to the board in 1926 (CGP, 12/14). Despite being a close ally to Glass, Hamlin was resentful of Warburg because of Warburg's claim that Hamlin was subservient to Secretary of the Treasury McAdoo during the redistricting episode in 1915 (CGP, 15/9 and CHD, Nov. 26, 1930).

doctrine in 1931 to the senate investigation and the direct pressure of Glass and Willis. Yet, this focus on the acceptance market itself served a specific purpose: To get rid of the Warburg doctrine and present the Fed as a product of Glass, Willis, Wilson and Laughlin.

3.4 The Rise of the Acceptance Market

The period from 1925 to early 1931, was marked by extraordinary growth in the volume of dollar acceptances. This period preceded the final clash of the two doctrines and the collapse of the market for acceptances between 1931 and 1932. The growth in acceptances was subsequently characterized as a period of speculative excess and blamed for the Great Depression. Moreover, this growth made the U.S. dollar the main source of international trade credit and the international currency, surpassing the pound sterling just before the international financial crisis of 1931 (Eichengreen and Flandreau, 2012). This section argues that this growth was caused by two factors. First, growth was driven by Germany's demand for U.S. short-term credits to finance her balance of payments deficit. Second, active support by the Fed and deregulations of the Fed's eligibility requirements, both caused by the Warburg doctrine, increased the supply of acceptances. Both factors went directly against the ideology of the Glass-Willis doctrine.

Figure (3.1) shows total dollar acceptances outstanding. The data comes from the American Acceptance Council (various issues 1919 - 1935), which also reports total acceptances disaggregated into six categories.[15] Figure (3.1) disaggregates total acceptances into acceptances based on storage in and shipment between foreign countries, and acceptances where at least one leg of the trade in goods is the U.S.. Acceptances based on foreign goods were virtually nonexistent prior to 1925 and showed only a modest increase in the next two years. But from 1927, the growth in the volume of foreign acceptances accelerated.[16] The total volume of acceptances shows a drastic increase in the late 1920s and the

[15]These different categories are acceptances based on (1) U.S. imports, (2) U.S. exports, (3) shipment within the U.S., (4) storage in U.S. warehouses, (5) furnishing dollar exchange and (6) storage in and shipment between foreign countries.

[16]Direct observations for such foreign dollar acceptances does not exist prior to February 1925. Instead

main driver of the boom in acceptances was the growth of foreign acceptances.[17] By 1930, the amount of foreign acceptances made up about a third of all acceptances outstanding.

Ferderer (2003) has argued that the stagnation of U.S. trade between 1927 and 1929, combined with an explosion of the volume of dollar acceptances suggests that American and international firms were substituting away from sterling-denominated acceptances towards dollar acceptances. The explanation according to which increased competitiveness of U.S. trade finance products caused this growth is only part of the story. Indeed, the supply of sterling acceptances had also grown in 1927 and 1928 (Truptil, 1936; Baster, 1937). On the demand side, dollar acceptances were becoming an important instrument in the reparations recycling process.[18] This was facilitated through deregulation on the U.S. side.

The growth in foreign acceptances starts in 1924, just after German monetary stabilization under the Dawes loan. Since acceptances were commercial credits, they fell under the transfer protection clause of the Dawes Plan, which made them senior to reparations in the event of a foreign debt crisis. This provided an incentive to foreign lenders, as the risk of default decreased with the transfer protection clause (Ritschl, 2002).[19] Competing with London, the U.S. was hoping that Germany would hold at least part of its foreign exchange reserves not in gold but in dollar acceptances.[20] With a 50 Mio USD loan a bankers consortium around the International Acceptance Bank, under the chairmanship of Paul Warburg,

these acceptances seem to have been included in the series for acceptances based on furnishing dollar-exchange before February 1925. Dollar-exchange acceptances increased by a factor of about 5 from February 1925 to their peak in December 1929. Although significant, this is low in comparison to the 33 fold increase in foreign acceptances in the same period.

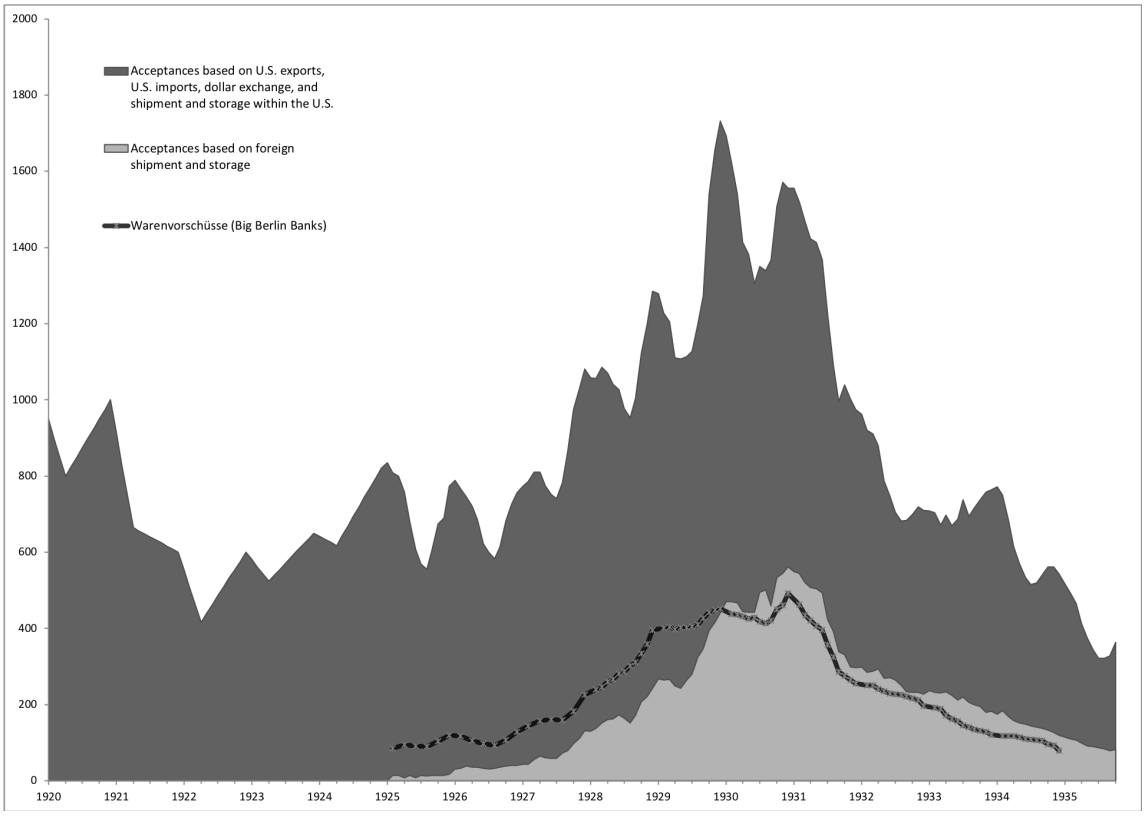
[17]Between November 1924 and November 1930, the total volume of acceptances increased by 154 percent. More than half (57 percent) of that growth was due to the increase of foreign acceptances.

[18]The process linked U.S. credits with reparations payments to France and Great Britain, which in turn owed war debts to the US.

[19]Moreover, Ritschl (2002) has argued that the Dawes Plan provided an incentives for German policy makers to undermine reparations payments and when seniority was reversed under the Young Plan, foreign lending halted. Although short-term credits based on acceptances increased until early 1931, this does not refute Ritschl's (2002) argument, since since short-term credits could have compensated for the decline in long-term lending.

[20]Warburg, by then chairman of the International Acceptance Bank, the market leader in issuing bankers' acceptances and chairman of the FAC, was the driving force behind this idea see (Clarke, 1967, chapter, p. 61 ff.).

Figure 3.1: Dollar Acceptances Outstanding (in Mio. USD)



Notes: *Total Acceptances* are acceptances created to finance U.S. exports, U.S. imports, good shipped between and stored in foreign countries ("Foreign Shipment and Storage"), goods shipped within the U.S. or stored in U.S. warehouses, and dollar exchange. *Source: American Acceptance Council (various issues 1919 - 1935)*; Advances on goods (*Warenvorschüsse*) (in Mio. USD); *Source: Statistisches Reichsamt (1936)*

helped to found the Gold Discount Bank, a subsidiary of the Reichsbank, which was organized to furnish trade credit to German exporters.[21] At the same time the Federal Reserve Board issued a ruling that made German dollar acceptances, payable in the U.S., eligible for open market purchases and rediscount, if endorsed by the Gold Discount Bank and an American member bank.[22] Beginning in 1924, the Fed changed the institutional structure by relaxing the eligibility requirements to "foreign" acceptances.[23] In 1927, bankers' ac-

[21] London also played a major role in the establishment of the Gold Discount Bank. (.ibid).

[22] See Federal Reserve Bulletin (June, 1924) .

[23] A detailed description of the Boards decision process in the matter is found in Charles Hamlin's diary entry Vol. 8, January 7 - June 17, 1924 (pp. 580-656). Although the board is explicitly talking about German trade acceptances (not bankers' acceptances), the distinction in this instance is not relevant. Trade acceptances carry more default risk since without an acceptor the drawee is primary liable. Therefore, extending eligibility requirements to trade acceptances should include bankers' acceptances. This alone should have given banks an incentive to act as acceptors. Hence, even if trade acceptances don't show up in the data presented in figure

ceptances saw a further relaxation in eligibility requirements. Upon the suggestion of the FAC, the Board decided that it would deem acceptances eligible even if the goods on which the bill was based had already arrived at their destination. This regulatory change was a main contributor to the growth of foreign acceptances (Federal Reserve Board, 1936).[24]

Foreign acceptances reached their peak in December 1930, with a total volume of 561 Mio USD outstanding, despite the fact that world trade had been contracting rapidly since 1929. Although world trade between June 1929 and June 1931 had fallen by 38 percent in nominal values, foreign acceptances increased by 87 percent over the same period. The majority of U.S. acceptance credits was employed in Germany. Acceptance credits extended to Germany by U.S. banks at the height of the German financial crisis in July 1931 were 396 Mio USD, which made up roughly a quarter of all dollar acceptances outstanding in July. Acceptance credits represented over half of all U.S. short-term loans to Germany at the time.[25]

In addition to the shaded areas, figure (3.1) includes data on advances on goods (*Warenvorschüsse*) by the big Berlin banks, depicted by the black line. Almost all of those advances were foreign acceptance credits and therefore serve as a good proxy for the total amount of acceptance credits by foreign banks extended to Germany.[26] Even though the

(3.1) the new regulation will have contributed indirectly to the growth of the market for bankers' acceptances through liquidity spillovers. Moreover, from Hamlin's diary it is clear that Warburg was the main proponent for this regulation. Indeed, Warburg had proposed this relaxation of regulatory requirements as early as 1915 (Warburg, 1930a).

[24]Paul Warburg advocated for the new regulation. Having retired from the FAC in 1925, he acted as an alternate to the New York representative in the FAC's meetings of November 17 and 18, 1927 when the issue was discussed and the recommendation drafted (Federal Advisory Council, 1927).

[25]The 38 percent fall in world trade is calculated from the statistics given by (Kindleberger, 2013, p.172). The acceptance figure of 396 Mio USD comes from the Federal Reserve Board (1936), which uses data from American banks. The figures by the Wiggin committee report Germany's foreign trade acceptance liabilities in the order of 1487 Mio RM (351 Mio USD) and total U.S. short-term credits as 2093 Mio RM (497 Mio USD) (Wiggin, 1931).

[26]Foreign acceptance credits that financed imports and exports appeared as *Rembourskredite* on German banks' balance sheets (Palyi and Quittner, 1933; Wiggin, 1931). From March 1928 onwards monthly data on *Warenvorschüsse* disaggregated into *Rembourskredite* and others can be found in Die Bank (various issues 1927-1933) for a larger number of banks. The series in figure (3.1) tends to underestimate the total volume of foreign acceptance credits for two reasons. First, the big Berlin banks intermediated the majority but not all of those credits (e.g. 77 percent of all *Rembourskredite* in March 1928). Second, foreign banks could also lend directly to German companies. For March 1931, *Warenvorschüsse* by the big Berlin banks are equal to 70 percent of all foreign acceptance credits (Wiggin, 1931). The series is converted into USD with a constant

series includes foreign acceptance credits granted in currencies other than USD, it tracks the market development of dollar acceptances extremely well. This constitutes additional evidence that much of the growth in the volume of dollar acceptances between 1927 and 1931 was driven by an increase in short-term capital flows to Germany.

Relaxing the eligibility requirements was not the only way how the Fed contributed to increasing the supply of acceptances. There is strong evidence that the Fed actively and successfully supported the acceptance market by acting as a market maker of last resort. The reduced risk born by dealers, increased market liquidity and made dollar acceptances an attractive investment (Ferderer, 2003; Eichengreen and Flandreau, 2012).

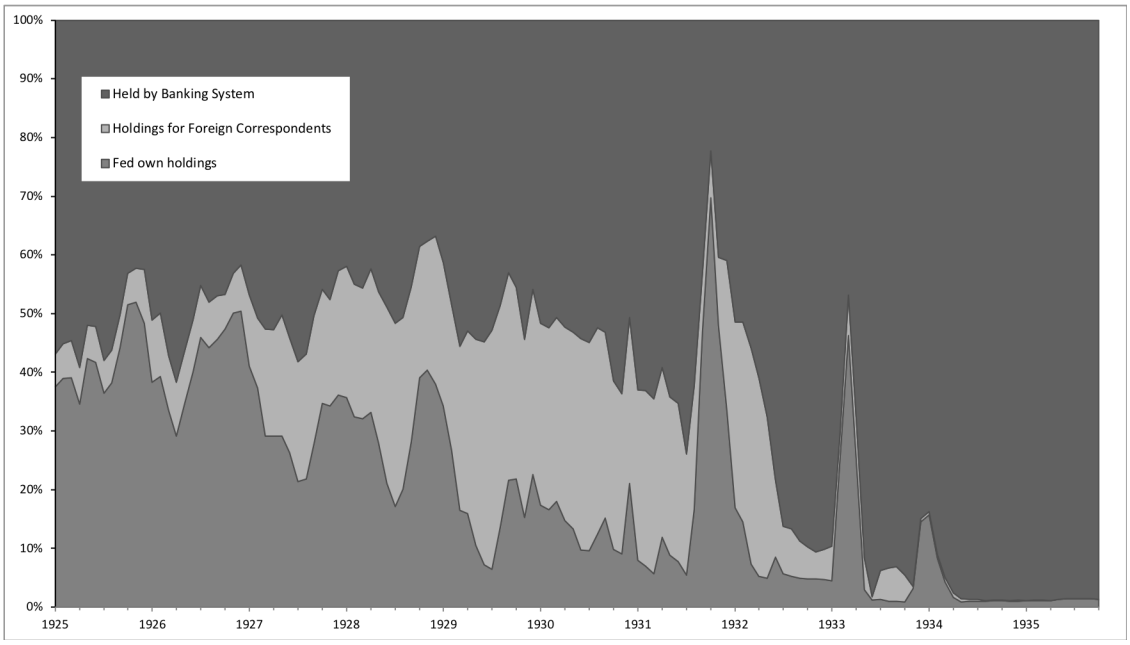
Figure (3.2) illustrates the activity of the Fed by showing the distribution of all acceptances outstanding by holders. The Fed held acceptances for its own account and for the account of foreign central banks. The rest was held by the private banking system. While the share of the Fed in the market was about 50 % on average between 1925 and 1929, the Fed began to replace its own holdings with the holdings for the account of foreign central banks after 1927. Total Fed holdings, for its own account plus for foreign central banks, were trending downwards from 1930 and decreased sharply after the financial crisis of late 1931, when Fed holdings briefly spiked to 80% of total acceptances outstanding. The proportion of bills held by the Reserve Banks fell sharply after 1931. The next section analyzes the Fed's acceptance policy during the Great Depression and the reasons for the decline in the Fed's share in the market in more detail.

3.5 The Liquidation of the Acceptance Market

What caused the decline in the total volume of outstanding acceptances? Eichengreen and Flandreau (2012) have argued that the Fed withdrew its support for the market after 1931, thereby contributing to both its absolute and relative decline. Here, I argue that the Fed did not withdraw its primary mechanism of support. Instead, the German financial crisis

exchange rate of 4.20 RM/$.

Figure 3.2: Distribution of Acceptances (in Percent)



Source: American Acceptance Council (1931) and American Acceptance Council (various issues 1919 - 1935)

made investors and Federal Reserve Banks realize that German acceptances were not as self-liquidating as previously thought. Political pressure by Glass and public denunciation in newspaper articles by Willis created doubts about the eligibility of frozen acceptances for purchase and rediscount at the Federal Reserve Banks. From October 1931 onwards, the discount market started to discriminate against German acceptances. German acceptances became a sign of bad reputation and were held until maturity by the accepting banks. In essence, 1931 was a trust-destroying year for the acceptance market. It destroyed the trust that member banks had in the asset that was supposed to be the cornerstone of the Federal Reserve System. In particular, investors expected more rigid examination by Reserve Banks and dealers on the self-liquidating nature of bills. This significantly reduced the probability that Reserve Banks would serve as reliable purchasers or rediscount facilities of acceptances. Mistrust can be classified as an expected reversal of the regulatory policies, which had liberalized the acceptance market prior to the Great Depression, and thus represents a negative real shock to the market, like a tax on the banking system that raises

the cost of gathering information.[27]

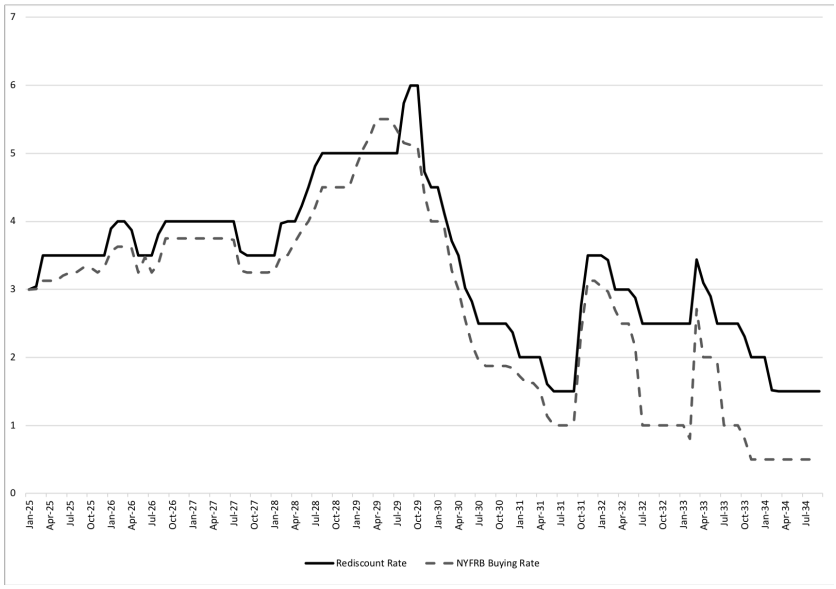
The primary channel of support that the acceptance market received was the Fed setting its buying rate below its rediscount rate. This provided an incentive for banks to sell acceptances to the secondary market rather than refund themselves at the discount window. In essence, the NYFRB served as the market maker of last resort and promoted the private supply of liquidity by limiting the risk borne by dealers (Ferderer, 2003). If the Fed had withdrawn its support for the market after 1931, we would observe it in the spread between the buying rate and rediscount rate.

Figure (3.3a) shows the NYFRB's buying rate and rediscount rate between 1925 and 1936. The rediscount rate is above the buying rate for most of the period, except for the brief period between February and July 1929. Importantly, the rediscount rate is well above the buying rate throughout the depression years. The spread between these rates even increased to 150 basis points in early 1932, suggesting that the Fed increased its support for the acceptance market. This contrasts with the decline in the holdings of acceptances in the portfolio of Federal Reserve Banks as depicted in figure (3.2). Eichengreen and Flandreau (2012) have argued that the Fed's holdings of acceptances indicates the extent to which the Fed supported the market. But Fed holdings of acceptances is not a good indicator of Reserve bank support. As NYFRB's deputy director Case explained to governor Young of the Board:

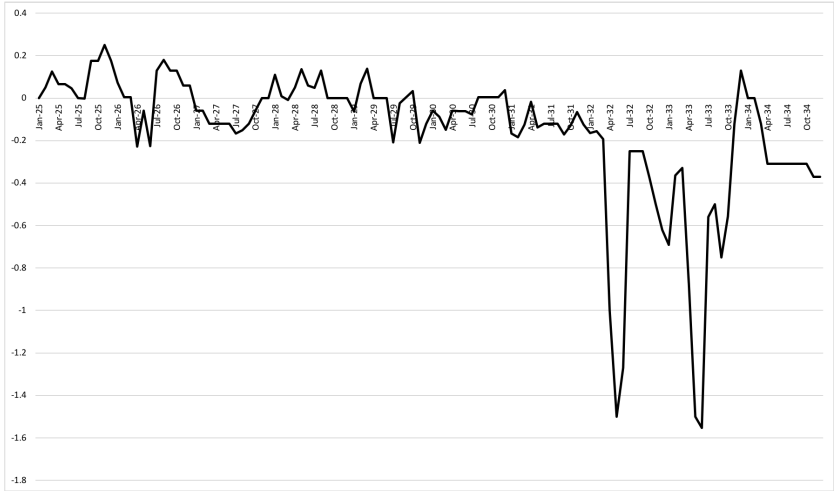
> Operations in bankers acceptances are, of course, governed by a technique quite different from operations in government securities. Whereas the volume of purchases or sales of government securities may be determined directly, the volume of holdings of bankers acceptances on the other hand is subject largely to a rate control which must be adjusted promptly from time to time to changing market conditions, and therefore does not subject itself to determination in

[27]Toma (2013) has recently argued that such a trust-destroying event had already occurred in early 1929 during the direct pressure episode. Toma's (2013) argument goes much further than the present study, as it claims that the direct pressure episode reduced the probability that Reserve Banks would, more generally, serve as reliable lenders of last resort. This is compatible with the present study.

Figure 3.3: Interest Rates on Dollar Acceptances



(a) NYFRB Buying and Rediscount Rate



(b) Spread between Market and Buying Rate

Notes: (a) shows the NYFRB's rediscount rate and the NYFRB's buying rate of acceptances; (b) shows the spread between the market rate and the NYFRB's buying rate of acceptances. *Source: Federal Reserve Board (1943)*

> advance by an open market policy conference. (OMPC Minutes, 1930-1933, Case to Young, May 15, 1930)

The volume of acceptances for the Fed's own account and for the account of foreign banks was determined by how much dealers were willing to sell to the NYFRB at its prevailing buying rate. Only when the market rate for acceptances rose above the NYFRB's buying rate did the Fed start to accumulate bills. Thus, Fed holdings were determined by the spread between the market rate and the NYFRB's buying rate as shown in figure (3.3b). This spread is the second indicator that Eichengreen and Flandreau (2012) suggest as a measure for Reserve bank support. And indeed, the negative spread after 1931 suggests that Reserve bank support had ended. In particular, the sharp spikes after March 1932 show that market rates fell much faster than the Fed reduced its buying rate. It is, however, not clear that the Fed intentionally withdrew support from the acceptance market by not reducing buying rates fast enough, for three reasons. First, facing heavy gold withdrawals from foreign central banks, the Fed was hesitant to lower interest rates any faster. When the Fed did start reducing interest rates in January 1932, the reduction in the buying rate preceded the reduction in discount rates with the explicit intention to increase the Fed's acceptance holdings (OMPC Minutes, 1930-1933, Jan 1932). Second, as we will see, the secondary market was hit by a shock in 1931, which caused large volumes of acceptances to be withheld from the secondary market so that even a sharper reduction in the buying rate would not necessarily have translated into larger Fed holdings of acceptances. Finally, the market rate for acceptances fell sharply once the Fed embarked on a program of large-scale open market purchases, after the Glass-Steagall Act had liberalized eligibility requirements for the note issue. I will elaborate on the first two reasons in more detail.

The British suspension of the gold standard led to large withdrawals of gold from the U.S.. The attack on the dollar caused the liquidation of large volumes of acceptances held at the Fed for the account of foreign central banks. As figure (3.2) shows, holdings for foreign central banks gradually substituted for the Fed's own holdings during the late 1920s. When

the crisis hit in autumn 1931, the Fed defended the external drain with a 2 percentage point hike in its rediscount rate. The buying rate was also increased but the positive spread between the two rates was maintained. At the end of October 1931 the Fed was holding, for its own account, almost $725 million (or 70% of all acceptances outstanding in the system). Foreign withdrawals slowed down in late October, in particular because the higher interest rates encouraged the Bank of France to resume its purchase of dollar acceptances. In January, however, the article "Inflation is the order of the day" by Willis appeared in the French newspaper *Agence economique et financiere* and predicted, correctly, that the Fed would lower its acceptance buying rate. This caused the central banks of France, Belgium and Switzerland to resume gold purchases (Chandler, 1971, p.171). Thus, a faster reduction in the buying rate would not only have endangered the already low gold reserves of the Fed, but it would almost certainly have caused a faster liquidation of the acceptances held for the account of foreign central banks. Could the Fed have taken on a larger volume of acceptances for its own account, had it reduced the bill buying rate faster? Could a faster rate reduction have, perhaps, even induced new issues of acceptances? Given the large negative supply shock to the market, this paper suggests a negative answer to these questions.

We can use available data on acceptances to observe the negative supply shock to the secondary market, because of the way the market was structured. On the one hand, 74 percent of all acceptances were created by New York banks. On the other hand, New York dealers were holding 92 percent of all bills held in inventory by dealers in 1930 (Ferderer, 2003). Although the market was regionally concentrated in New York, acceptances were not held exclusively by New York banks. Once created by the accepting bank and sold to the secondary market, these acceptances were sold on to private investors throughout the country. Likewise, those acceptances purchased by the NYFRB were allotted to other Reserve Banks. From 1931 onwards, however, supply from New York to the other Reserve districts was curtailed.

Table 3.1: Acceptances Held by Institutions (in Mio. USD)

	Dec- 1928		Dec- 1930	
	Amount	(in %)	Amount	(in %)
N.Y. Private banks and Dealers	249	21%	489	31%
NYFRB	250	21%	270	17%
Private Banks and Dealers outside N.Y.	130	11%	311	20%
11 Federal Reserve Banks	562	47%	497	32%
Total	1191	100%	1567	100%

Notes: Data on acceptance holdings of private banks comes from American Acceptance Council (1931) and Federal Reserve Board (1930) and is calculated as accepting banks own acceptances held in portfolio, acceptances of other banks held in portfolio of accepting banks and purchased acceptances held by member banks on call dates. Data on dealer inventories comes from NYFRB (1929-1933, Box 13111). Reserve bank holdings of acceptances is calculated from The Commercial and Financial Chronicle (1928 & 1931c) and deducting the amount of bills payable in foreign currency from the NYFRB's bill holdings. Data on bills payable in foreign currency is from Federal Reserve Board (1930).

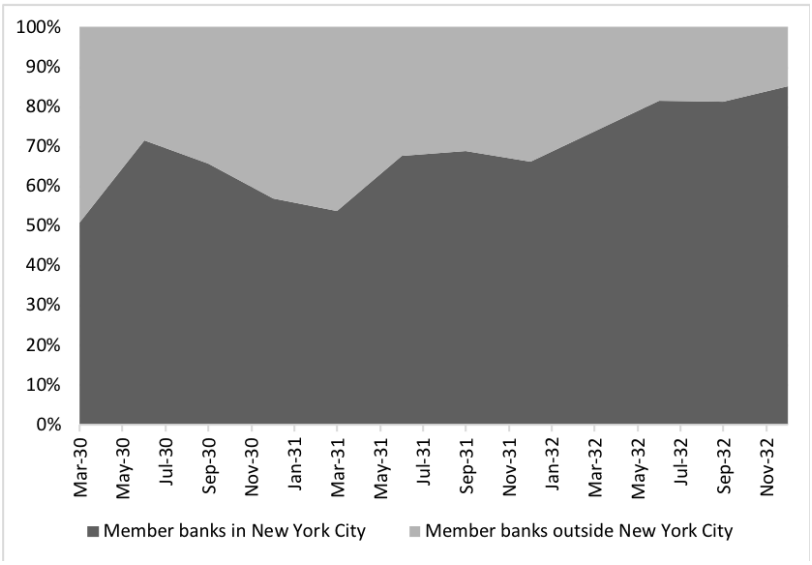
Table (3.1) provides estimates of the distribution of acceptances across private and public institutions for New York and the other reserve districts at year end for 1928 and 1930. Holdings of private banks are calculated as the sum of acceptances held in the portfolios of accepting banks and acceptances purchased by member banks, the data for which comes from the American Acceptance Council (1931) and the Federal Reserve Board (1930).[28] To this I add the inventory of private dealers, which can be found in the archives of the Federal Reserve Bank of New York [hereafter NYFRB] (1929-1933, Box 13111). Holdings of the individual Reserve Banks can be found in the weekly statements of the Commercial and Financial Chronicle(1928 & 1931c).[29] At both points, over 50 percent of all acceptances outstanding were held by institutions outside New York. Lacking data on New York's accepting banks' holdings of acceptances after December 1930, I cannot provide estimates for later periods. There is however strong evidence that the share of acceptances held outside New York declined in 1931 and 1932, as can be seen in figures (3.4a) and (3.4b).

Figure (3.4a) shows the distribution of acceptances held by member banks in and out-

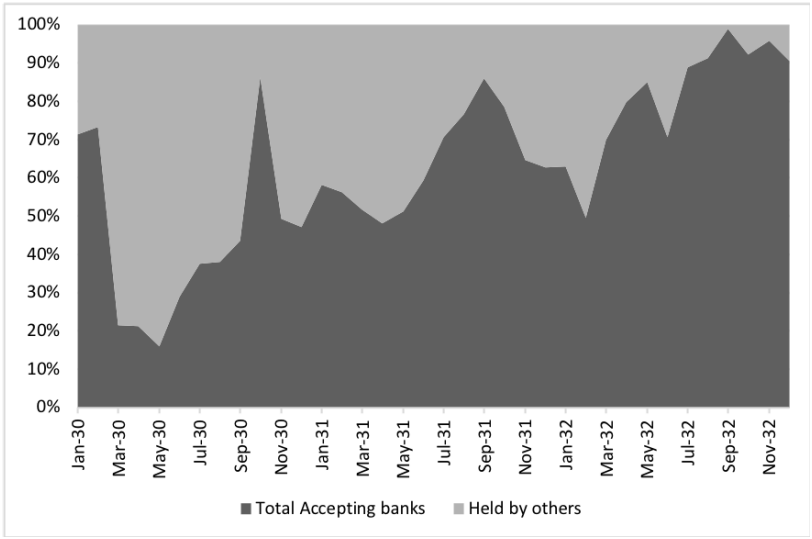
[28]This estimate neglects the amount of acceptances held at nonmember banks which were not accepting banks. It also double counts the amount of acceptances of other banks held in the portfolio of accepting banks, if these other banks were also member banks.

[29]Reserve bank holdings are calculated as total bill holdings minus holdings of bills payable in foreign currency plus acceptances held for the account of foreign central banks.

Figure 3.4: Distribution of Acceptances Held by Different Institutions.



(a) Geographical Distribution of Acceptance Holdings by Member Banks



(b) Distribution of Acceptance Holdings between Accepting Banks and Others

Source: Federal Reserve Board (1932, No.90 and No. 91)

side New York City. In March 1931, just before the international financial crisis, member banks outside New York City held 46% of all acceptances in the portfolio of member banks. By December 1932 this had decreased to 14.8%. Figure (3.4b) divides all acceptances held privately into two categories; held by accepting banks and held by others. The share of acceptances in the portfolios of accepting banks, of which the vast majority was situated in New York, increased from 51.7% in March 1931 to 90% in December 1932. What emerges is a picture of a steady reduction of the supply of acceptances from accepting banks in New York to the rest of the U.S. banking system between 1931 and 1932.

The cause of the curtailed supply of acceptances to the secondary market was the international financial crisis of 1931, which froze a large volume of acceptances. Together with the renewed assertion of the Glass-Willis doctrine this created doubts about the eligibility of acceptances. In 1931, the Glass-Willis doctrine was reinforced by Fed officials outside New York, the financial press and Glass, the most influential member in the Senate Banking and Currency Comittee.[30] Adherents to the Glass-Willis doctrine insisted on the self-liquidating nature of bills as an eligibility requirement for purchase and rediscount at the Reserve Banks. Public denunciation of frozen German acceptances caused accepting banks not to sell them on to the secondary market out of fear of reputation losses. As NYFRB's Deputy Governor Edwin R. Kenzel wrote to Governor George L. Harrison in June, 1932 about the $250 Mio American acceptances still outstanding for the German account:

> That figure includes a considerable volume of bills which acceptors hold in portfolio because they regard them as ineligible or of doubtful eligibility, and includes also, of course, the considerable volume of bills which are held by acceptors as a matter of policy because they do not wish their name in the market on any German paper. (NYFRB, Kenzel to Harrison, June 6, 1932; Box 0122219)

[30]Even though Senator Norbeck was the chairman of the Senate Banking and Currency Committee, historical accounts agree that Glass was the dominating force on the committee (Patrick, 1993, p.58).

Confidence in acceptances as an eligible asset experienced several shocks during 1931. In January, Glass chaired a subcommittee of the senate committee on banking and currency "to make a complete survey of the national and Federal Reserve banking systems" and Willis served as its technical advisor. Testimony before the subcommittee was given by top Fed officials and bankers. In addition, the Reserve Banks were asked to answer questionnaires concerning Fed policy and practices. Both, the testimonies and the questionnaires, focused extensively on the acceptance market. Glass and Willis claimed that acceptance credits based on goods stored in warehouses abroad were being rolled over and were therefore not self-liquidating (U.S. Senate, 1931, p.212). Willis argued that acceptances were used to substitute for the decline in long-term German lending and was interrogating Harrison about the purchases of German acceptances (U.S. Senate, 1931, p.235 and p.101). The same allegations had been made by Willis in the weeks prior to the Senate investigations in various newspapers and periodicals.[31] As a result of these articles, George R. James, member of the Federal Reserve Board, called on the NYFRB for a thorough investigation of the issue (NYFRB, James to Case, February 6, 1931; Box 0122219).

The allegations of Glass and Willis against German acceptances turned out to be true. On July 4, 1931, after large gold withdrawals and the failure of its second largest commercial bank, Germany effectively abandoned the gold standard by introducing capital controls.[32] In addition, the top New York banks agreed to maintain their existing short-term credit lines in a "Gentlemen's Agreement" (The New York Times, 1931d, Aug, 1). Acceptances were therefore frozen. Whereas the frozen acceptances caused an almost immediate

[31] In particular, the *Journal of Commerce* where Willis was the editor-in-chief until his resignation on May 13, 1931, frequently featured Willis' views on the acceptance market. Kenzel, who was the expert for the acceptance market at the NYFRB, summarized Willis' views stated in these articles as follows: As opposed to the continuation of the War amendments to the Act; As opposed to the broadened acceptance powers of member banks; As regarding acceptance credit as frequently, if not generally abused, and bankers' acceptances as representing to a large extent credits against frozen goods; As believing the discount market has been and is dependent almost entirely upon Federal Reserve Banks; As opposed to international bankers, i.e. American acceptance corporations doing international business (NYFRB, Kenzel to Harrison, January 16, 1931; Box 616523).

[32] The exact nature of the German crisis is disputed. All accounts on the crisis have stressed the importance of foreign withdrawals. However, Ferguson and Temin (2003) argue for a first-generation type currency crisis and blame politics, whereas Schnabel (2004) also stresses bank behavior.

transmission to the London money market, panic did not spread to New York, possibly because of the more diversified portfolios and higher capital ratios of New York's accepting banks (Accominotti, 2012, 2019). In any case, a substantial amount of acceptances were held by institutions in the rest of the country, as shown above. The German crisis could therefore have affected banks outside of New York, if the freezing of acceptances made them ineligible for purchase and rediscount at the Reserve Banks.[33]

On July 31, 1931 Germany owed a total of $2840 Mio short-term credits to foreign creditors, of which approximately $746 Mio. were owed to American banks. Of these American short-term credits, $396 Mio were held in the form of acceptances (Federal Reserve Board, 1936). Negotiations about an official standstill agreement began in London (July 20–23) and quickly moved to Basle. An agreement was proposed by the Wiggin-Layton committee on August 19. The committee was chaired by Albert Wiggin, chairman of Chase National Bank, who was considered to be speaking for all American banks. At the same time, the private banking systems of each country organized their own committees and standstill schemes. The committee of U.S. banks that was chaired by F. Abbot Goodhue had evolved out of the "Gentlemen's agreement", in place since mid-July, and consisted of 11 New York banks (Wegerhoff, 1982, p.98-102). The standstill agreement that the committee of New York banks under the chairmanship of Goodhue, chairman of the International Acceptance Bank, announced on September 17, increased the maturity of all short-term claims on German entities until February 29, 1932.

Goodhue immediately sent notice to 486 clearing house associations throughout the country and advised them to instruct their members that such an agreement existed and that, if they held any German loans, they should communicate at once with the committee, or with their Federal Reserve bank, so as to become parties to the agreement (The New York Times, 1931a, September, 16). The first standstill agreement was signed by 80 banks, 46 of which were in New York (Federal Reserve Board, 1936). Smaller institutions refused

[33]It has been documented that banks outside of New York held between $300–$400 million in German debt, almost as much as the New York banks (Boyce, 2009, p.312).

to comply after the first conference at the Fed on July 22 (Wegerhoff, 1982, p.102). The issue was whether these bills would be eligible for purchase and rediscount at the Reserve Banks. Only 39 percent of the German standstill acceptances were considered definitely self-liquidating on October 31, 1931 (Federal Reserve Board, 1936).[34] When announcing the standstill agreement, Goodhue was therefore forced to touch upon the issue of eligibility:

> It would be a mistake to look upon this transaction as a freezing transaction in as much as the underlying transactions which will be financed will be running business based upon import and export transactions which will be self-liquidating and form the basis for eligible bills which can be purchased by or rediscounted with the Federal Reserve Banks. (The Commercial and Financial Chronicle, 1931a, September 19)

On September 11, however, Kenzel observed possible discrimination in the discount market against bankers' acceptances which had their origin in German trade (NYFRB, Kenzel to Clerk, September 11, 1931; Box 171546). On September 30, Kenzel had to calm the Reserve bank of Cleveland who questioned the eligibility of the German acceptances allotted to them by the System (NYFRB, Kenzel to Zurlinden, September 30, 1931; Box 171546). Tensions increased as more acceptances were offloaded to the Reserve Banks in late October and early November. The Reserve bank of Kansas for example, for some time and until Kenzel convinced them otherwise, refused to rediscount acceptances from the Fidelity National Bank and Trust Co. which were backed by German imports from Rotterdam (NYFRB, Worthington to Kenzel, November 2, 1931; Box 0122219).[35] Between

[34]The numbers in table 9 in the supplementary report are based on reports of 100 American banks. 39% of acceptances were regarded as self-liquidating because they had definitive proof of shipment or other documents. A further 31% was regarded as probably self-liquidating and 30% were regarded as definitely not self-liquidating.

[35]Which policy should be adopted was also questioned by the Reserve bank of San Francisco, which inquired about the NYFRB's policy with respect to German acceptances (NYFRB, Clerk to Kenzel, November 2, 1931; Box 0122219). The St. Louis Reserve bank had inquired about the eligibility of German trade bills already in 1929 (NYFRB, Gilmore to Gidney, October 29, 1929; Box 0122219).

October 15 and 19, five Reserve Banks discontinued their participation in the purchase of bankers' acceptances, officially due to their reserve position. This line of reasoning is not convincing, since acceptances served as secondary reserves for the note issue and the purchase of eligible bills would have increased the systems amount of free gold (Friedman and Schwartz, 1963, p.400-404).[36]

On July 16 and again on October 7, Glass pressured Federal Reserve Board member Hamlin, claiming that the Federal Reserve Act did not grant the System the right to purchase German acceptances since these were not "genuine commercial bills".[37] At the same time, it became ever more apparent that there was a shortage of eligible assets for purchase and rediscount at the Fed. To increase lending to the economy, President Hoover suggested the establishment of the private National Credit Corporation (NCC), which began its operations on November 11. As the NCC quickly proved ineffective, the U.S. administration on December 7 introduced a bill before Congress for the establishment of the Reconstruction and Finance Corporation. Moreover, by January 1932, bankers and top Fed officials lobbied for legislative action that would increase the lending powers of the Fed. Yet, it was clear that no banking bill could be enacted without Glass' consent (Chandler, 1971, p.188). To the contrary, Glass was working hard towards introducing his own banking bill to the Senate, which he did on January 21.[38] Only on October 8, Glass had announced that he would not agree to any legislation that liberalized the rediscount rules of the Fed towards frozen assets (The New York Times, 1931b, October, 9). To prevent any broadening of eligibility towards frozen acceptances, Glass used his political capital to win over Sen. Frederic C. Walcott (R) on his sub-committee and Rep. Louis McFadden (R) leader of the

[36]The free gold problem comes from the requirement that Federal Reserve notes must be backed by a minimum of 40 percent in gold and the rest was backed by eligible paper, which until the passage of the Glass-Steagall Act in 1932 did not include government securities. A decline in eligible paper means that Reserve Banks would have to substitute them for gold.

[37]See the letter from Glass to Hamlin on July 16 (Charles S. Hamlin Papers, 1894-1939, [hereafter CHP] 364/8) and Hamlin's diary entry on October 7, 1931 (CHD). See also the letters between Platt and Glass that were forwarded to Hamlin (CHP, 365/1]).

[38]A first version of the Glass bill, as it was known throughout its legislative process, was already introduced on June 17, 1930. In total there were at least six distinct Glass bills that led to the passage of the Glass-Steagall Act of 1932 and to the Banking Act of 1933 (Preston, 1933).

House Committee on Banking and Currency (CGP, 17/2).

When President Hoover announced that he favored changes in the Federal Reserve Act to broaden eligibility requirements to enable smaller banks to liquidate their sound but now frozen assets, Glass immediately released the answers to the questionnaires, which his sub-committee had sent to all Reserve Banks at the beginning of the year. The answers seemed to imply that Reserve Banks opposed any change in existing regulations on eligibility requirements (The New York Times, 1931e, December 1). Moreover, the release made it clear that the sub-committee considered the liberalization of the acceptance market in the 1920s as having gone too far and beyond the intentions of the original Federal Reserve Act (The Commercial and Financial Chronicle, 1931d, December 26). A hateful speech by Rep. McFadden in the House, where he accused Warburg of "having engineered the great depression [and] stuffed this country full of worthless German acceptances", did the rest (The New York Times, 1931c, December 16).

What markets expected was not a widening of eligibility requirements, but the stricter enforcement of existing rules, at least in the (secondary) market for acceptances. As the New York times observed on December 1, 1931:

> The general examination of foreign bills occasioned last summer by the anxiety over German acceptances forced most bankers here to the conclusion that a more rigid examination of the underlying transaction should be enforced in the future by foreign acceptance dealers (The New York Times, 1931e, December, 1).

Prior to 1931, the underlying transaction of a banker's acceptance was not factored into the risk evaluation in the secondary market. Final investors deemed a bill safe as long as they regarded the names of the endorser and acceptor on the bill as creditworthy. Screening of the underlying transaction was thus passed on from the investor to the accepting bank, who in turn passed it on to the endorser who in many cases was in another country. The Senate investigation and the publicity around them revealed a real risk for the final investor

of an acceptance. If the accepting bank went bankrupt, investors would have to collect the proceeds from the next institution down the line. This risk, however, was negligible as long as the Reserve Banks stood ready to take acceptances onto their own balance sheets in times of need (U.S. Senate, 1931, p.557).[39] Throughout 1931, however, the perceived probability that the Reserve Banks would discount and purchase all acceptances, as long as the credit of the accepting bank was of prime quality, declined drastically. Instead, as shown above, there were instances when Reserve Banks rejected or at least delayed the rediscounting of frozen acceptances. This caused the secondary market to discriminate against German acceptances. Without a well-functioning secondary market accepting banks stopped creating new acceptances. As James P. Warburg, freshly elected President of the International Acceptance Bank, told his Uncle Max, who headed the family owned bank M.M. Warburg in Hamburg, Germany:

> I absolutely disagree about new business, even if it is, as you say, absolutely first class and self-liquidating (James P. Warburg Personal Papers, 1912-1969, J. P. Warburg to M. Warburg, December 30, 1931; 4/1).

3.6 Conclusion

This paper has argued that the insistence on the Glass-Willis doctrine, a legacy of Wilsonianism, was an important factor in the collapse of the market for bankers' acceptances. Insistence on this version of the real bills doctrine by Glass, Willis and their followers imposed a real constraint on the Federal Reserve System - what kind and therefore what amount of bills where eligible for purchase and rediscount at the Fed. This is an important finding, but one that needs to be weighed against the other potential causes of the collapse

[39] Such was the case with the Bank of the United States, which failed in late 1930. According to Robert Bean, Chairman of the American Acceptance Council, investors did not lose a single dollar on the acceptances guaranteed by the Bank of the United States (U.S. Senate, 1931, p.457). In another testimony one banker stated that there was no problem with the marketability of bills accepted by the Bank of the United States even after its failure (U.S. Senate, 1931, p.556).

of the market: The collapse of international trade and the overproportionate price decline in agricultural commodities.

I have presented evidence that a substantial amount of acceptances was held by institutions in Reserve districts other than New York at the end of 1930. Future research would do well in collecting information on the amount of frozen continental European acceptances held by banks outside New York. Although Ritschl and Sarferaz (2014) have provided empirical evidence on financial factors in the transmission of the international financial crisis from Europe to the United States in 1931, this banking channel has largely been rejected in favor of the monetary "golden fetters" transmission channel (Richardson and Van Horn, 2009, 2018). However, this literature has so far only considered the effect on the New York money market, neglecting the fact that New York's accepting banks organized revolving syndicate credit lines, which extended all the way to institutions such as the Fidelity Trust Bank in Kansas, the Guardian Trust Company in Cleveland or to Continental Illinois in Chicago. This latter institution in particular, apart from holding and accepting German trade bills, was also the largest holder of German state debt among U.S. banks.[40] Moreover, the majority of short-term claims came due between August and September (Wiggin, 1931). The crisis might have started only when U.S. banks started to test the self-liquidating nature of their acceptance holdings by not renewing their credit lines.

Finally, one puzzling fact about short-term capital flight from Germany in the first half of 1931 is that U.S. institutions were able to reduce their short-term claims on Germany at a much faster rate than their British counterparts. U.S. short-term claims were reduced by 37 percent between end of March and mid July, against an 8 percent reduction for Britain. Moreover, acceptance liabilities for British banks actually increased over the pe-

[40]On the Fidelity Trust Bank see section (3.5); To avoid taxes and restriction by the German government, the acceptance credit line in which the Guardian Trust Company took part was in favor of N.V. Centrale Handelsvereenigung Rotterdam, which drew bills on Vereinigte Stahlwerke (NYFRB, Burgess to Keepers & McLaughlin, October 11, 1933; Box 0122219); Continental Illinois was part of the syndicate loan organized by the IAB on which the Gold Discount Bank drew in July 1931 (The Commercial and Financial Chronicle, 1924, April, 24); For data on holdings of German municipal and state debt by individual U.S. banks see Bundesarchiv (1878-1945, R43 I / 316).

riod (Wiggin, 1931, Annex V). Furthermore, there is evidence that U.S. short-term credit lines were extended to Germany via subsidiaries in Holland to avoid taxes and restrictions by the German government. An assessment of the causes and transmission channels of the international financial crisis of 1931 would need to take into account these facts.

CHAPTER 4

CREDIT CONSTRAINTS AND THE PROPAGATION OF THE GERMAN GREAT DEPRESSION

4.1 Introduction

If to understand the Great Depression is the holy grail of macroeconomics, then Germany may be the place to start the quest.[1] Germany's depression has received particular scholarly attention, because of the nation's position in the nexus of war debts, reparations and US foreign lending. The collapse of this triangular system of capital flows, which linked the largest industrial economies, transmitted deflationary shocks through the Gold Standard. Thus, understanding the causes of Germany's depression is crucial for identifying the culprits of the world-wide depression.[2] Moreover, the German slump was not only particularly early, but also extremely deep with a collapse in GDP and unemployment figures exceeding those of most advanced countries, thereby effectively contributing to the rise of National Socialism. Indeed, recent research provides evidence that both the austerity policies of the Brüning administration between 1930 and 1932, as well as the banking crisis of 1931, were direct contributors to the rise of Nazism (Galofré-Vilà et al., 2017; Doerr et al., 2019).

This paper analyzes one particular mechanism that we demonstrate contributed to the

[1] Romer (1993) argues that the epicenter of the Great Depression lies in the US, which should make it the focal point of research. Bernanke (1995) argues for a comparative approach across countries to study forces of the depression. We believe that Germany, for its economic size and the reasons outlined in this paragraph, deserves as much attention from researchers as the US.

[2] The treaty of Versailles in the aftermath of WWI imposed reparations on Germany to be paid to Britain and France. In turn, France and Britain owed large sums of war debts to the US. After German hyperinflation had eliminated German savings in the early 1920s, US credits stabilized the German economy and indirectly financed the transfer of reparations to France and Britain. When capital flows reversed in 1930/31, deflationary shocks were transmitted to other nations via the Gold Standard. The literature has not settled on which party in the triangle is most to blame. Kindleberger (2013) and more recently Tooze (2014) point at the U.S., Irwin (2010) and Eichengreen (1992) emphasize the role of France, and Ferguson and Temin's (2003) contribution puts much responsibility on Germany.

depth of the German Depression: the *bank lending channel*. In his seminal work on the U.S. Great Depression, Bernanke (1983) emphasizes the role of disruptions in financial intermediation and supply of bank loans. This non-monetary channel was able to explain declines in U.S. GDP over and above the effect of monetary shocks, the primary cause in the story of Friedman and Schwartz (1963). Previous studies on the interwar German economy have stressed the structural weakness of the German credit banks after the hyperinflation (Balderston, 1991), the possibility of constraints on bank lending after the stock market crash of May 1927 (Voth, 2003), and the persistence of a banking crisis even after a general bank holiday and the introduction of capital controls in July 1931 (Balderston, 1993). Yet, there exists, to the best of our knowledge, no empirical evidence on the existence and impact of loan supply shocks.

We estimate a Bayesian time-varying parameter vector autoregressive (TVP-VAR) model with monthly German data ranging from 1925:1 to 1934:12. This approach is well-suited for our purposes, as it allows us to identify loan supply shocks in addition to standard macroeconomic shocks. The extreme macroeconomic volatility during the late 1920's and early 1930's would make inferences from a simpler VAR model highly inaccurate. The TVP-VAR is able to lessen issues associated with changes in the prevailing macroeconomic regime, and has been successfully applied to studying changing macro-financial linkages in the context of recent financial crises (Bijsterbosch and Falagiarda, 2015; Gambetti and Musso, 2017). Perhaps most importantly, the model allows for stochastic volatility in the shocks, whereby it does not confound time-varying macroeconomic or financial instability with structural change in the relationship between credit and economic conditions.

Our results shed light to four key issues in the literature on the German Great Depression. First, as the German Hyperinflation had deteriorated the financial sector's balance sheets, our results empirically support the hypothesis that the rebuilding process itself contributed to the credit banks' sluggish performance and constrained lending to the real economy (Balderston, 1991). Second, we lend indirect support to Voth (2003) who argued

that the stock market crash initiated Germany's slide into depression, but provides no evidence on the bank lending channel, which he hypothesizes was the crucial channel of how the shock was transmitted to the economy as a whole. Third, the austerity policies of the Brüning administration between 1930 and 1932 and the twin crisis of 1931 were aggravated by the debt-deflation effects of a credit constrained economy. Finally, while the German Great Depression had many causes, it resembled the depression in other countries in terms of having the banking sector as an exacerbating factor (Bernanke, 1995; Grossman, 1994).

The remainder of the paper is structured as follows. After an overview of the debate on the economic history of post-inflation Weimar Germany, we provide details on the structural weakness of the banking sector and elaborate why we should expect the bank lending channel to be operative. The subsequent sections discuss the econometric approach and the results. Finally, we discuss the limitations and contributions of our study and explore areas for future research.

4.2 The Great Depression in Germany: An Overview

Much ink has been spilled on the causes of the German Great Depression. Until the seminal work by Borchardt (1979) the consensus of economic historians was that deflationary and budget-balancing policies of Heinrich Brüning, chancellor from 1930 to 1932, caused the depression.[3] According to the Keynesian paradigm, alternatives to austerity were available and feasible. Within the classic Keynesian framework there are several possibilities to explain the crisis. One interpretation is that restrictive monetary policy between 1925 and 1929 raised Germany's interest rate above the world rate of interest. The balance of payments equilibrium was restored after 1929 when the government reacted by cutting expenditure and increasing taxes.[4] A second possibility, famously advanced by Kindleberger (2013), is that an autonomous movement of capital, caused by a decline in US lending, shifted the balance of payments equilibrium to a higher interest rate. This line of reason-

[3] c.f. the early and influential work by Haberler (1937).

[4] For a graphical illustration of this line of argumentation ork the reader is referred to Ritschl (1998).

ing, which sees the causes outside Germany, has been dismantled by the seminal work of Peter Temin (1971), who showed that the downturn in Germany began already in 1927, too early to have been caused by an autonomous decline in US foreign lending. The alternative Keynesian explanation would thus be that output began to decline either because of a shock to German exports or through a reduction in autonomous investment. The traditional Keynesian interpretation became the subject of heavy critique with the work of Knut Borchardt (1979, 1980). Borchardt's revisionist argumentation is based on distributional conflict and inept attempts for their resolution, especially excessive wage increases during the 1920s. This depressed profits and created a very unfavorable position of the German economy during the World Depression. During the Great Depression the German government was cut off from access to credits because of the burden caused in the 1920s. The deflationary policies were thus a predicament and not intentional policies. It follows that economic expansion from 1933 onwards was only made possible by the removal of the restrictions that caused the compelling deflationary policies of Brüning.

Ritschl (1998) offers a solution that reconciles the Borchardt hypotheses within a Keynesian analytic framework. Introducing the reparations problem in a sovereign debt model he argues that at a certain debt threshold further credits to Germany were denied. The connection between reparations and the German economy is found in the missing incentive structure of the different reparation regimes. Because the Dawes-regime, from 1924 to 1929, gave Germany no incentive for a real-resource transfer of reparations, she subverted paying reparations by accumulating massive foreign debts. This strain on the balance of payments is ultimately responsible for the depth of the German crisis.

Crucially, the Young plan 1929/1930 represents a regime change as the seniority of commercial credits over reparations reverses. Because the Young plan effectively increased the public debt overhang by the amount of reparations and above the amount deemed acceptable by private creditors, credit constrains became binding. This forced Germany into deflation.

A challenge for this interpretation is that the German Depression had already been underway by 1928 and seems to have started in late 1927 as several indicators of investment show (Temin, 1971; Ritschl, 1999). In 1928 net investment fell by 15 percent, most of it driven by lower inventory investment. From 1927 to 1929, the fall in investment was 55 percent, enough to explain the fall in national production. It needs to be stressed, however, that investment did not see a very sharp downturn. Instead the German economy gradually slid into Depression from 1927 onwards. If the origin of the German Depression was internal, it might very well be that foreign creditors started to withdraw capital once investment deficiencies became obvious and the viability of the German economy was put into question. Priority only became pressing once capital inflows ceased (Ferguson and Temin, 2003).

The tests that such a hypothesis must pass are multidimensional. Was the beginning of the German Depression caused internally? Are there feedback mechanisms that can cause an initially relatively minor event to have a negative effect that grows over time? Is this enough to cause an outflow of capital?

Voth (2003) gives an answer to the first question that goes beyond Temin's claim of an autonomous fall in investment. He provides qualitative evidence that Hjalmar Schacht, president of the Reichsbank, perceived the stock market boom of 1926/27 as a bubble and his econometric evidence suggests that pricking the non-existing bubble, by threatening the big banks to restrict credit, had significant adverse effects on investment. To answer the second question Voth suggests three possible transmission mechanism. First, the stock market crash had a negative effect on business sentiment. Second, the collapse in trading volume made German shares less liquid causing transaction costs to rise significantly. Consequently, the stock market's role in allocating capital became more difficult. Third, the destruction of equity values lowered the value of collateral and affected investment via the bank lending channel. Specifically, Voth argues that the stock market crash may have been instrumental for the reduction in credit and the curtailment of business investment.

Our emphasis on Voth's third transmission mechanism, the bank lending channel, is supported by research which has shown the close relationship between asset price changes and financial intermediation (Adrian and Shin, 2010; Gan, 2007). Yet, evidence for the bank lending channel seems to be nonexistent for the German depression. But as the next section will show, the structural weakness of the German credit banks during the period suggests that the bank lending channel could be a powerful mechanism to explain the collapse of investment.

Lastly, the bank lending channel may have been a key contributor to the rise of the Nazi Party towards the end of the Weimar Republic. In a recent paper Doerr et al. (2019) show how the failure of Jewish-led Danatbank in 1931 induced a strong reduction in the wage bill for connected firms. This led to increasing city-level unemployment in cities with more Danat-connected firms. These cities saw increased anti-Semitism and increased Nazi Party support. While Doerr et al. (2019) do not investigate the specific mechanism through which Danat-connected firms reduced their wage bill, an increase in the real costs of credit intermediation because of the bank-failure as in Bernanke (1983) is the obvious candidate.

4.3 The German Credit Banks and the Development of the Short Term Foreign Credit Market

Although Balderston stresses the weak structure of the German credit banks, this story has little to no place in his narrative about the collapse of investment (Balderston, 1993, chpt. 5). Moreover, Balderston (1983, 1993) has argued against a collapse in business confidence as a cause for the fall of investment because the downturn, he contends, started not in inventories but in infrastructure fixed investment and housebuilding. Instead, Balderson stresses the importance of the German bond market, which had been severely impaired by hyperinflation and received further blows because of Reichsbank President Schacht's hostility to foreign borrowing and Parker Gilbert's, the Agent General for Reparations, critic of German public finances.[5] This increased the long term interest rate and thereby exerted a negative effect on investment.

Yet, we claim that the banking sector played an important part in supplying loans to German businesses and that it needs to be connected to the decline in output. Moreover, to the extent that market-based and bank-based finance are substitutes, the latter cannot be excluded from a narrative of financial constraints. We will hence briefly describe the structural weakness of the banking sector between 1927 and 1931, which can make for a large bank lending channel.

Table 4.1 shows advances, which are tantamount to loans, and equity plus reserves of the Berlin great branch banks. The Berlin great branch banks in 1929 consisted of *Deutsche Bank und Disconto-Gesellschaft*, *Darmstädter und Nationalbank*, *Dresdener Bank* and *Commerz- u. Privatbank*. Together they accounted for more than 20 percent of the banking sector's total assets at the end of 1920s. More importantly for our analysis, they accounted for about half of all *advances* (Debitoren) in the banking system. We observe that advances increased every year until 1929, with the largest absolute increases in 1926/27 and

[5] Schacht was responsible for the withdrawal of the exemption from the capital yield tax in December 1926 that foreigners hitherto enjoyed. Although the exemption was reintroduced in June 1927, Schacht then started to pressure the Advisory Council for Foreign Credits to enforce stricter criteria of eligibility for foreign loans.

1928/29. The equity base of these banks had been eroded during the hyperinflation and equity plus reserves (column 4) could not keep up with the increases in advances, but was actually decreasing between 1927 and 1929. The banks accepted lower liquidity ratios in the 1920s than they did before the war, because of more severe competition from foreign banks, smaller savings banks and from other joint-stock banks. Competition for deposits decreased the credit banks' profitability. On the one hand, lower profits prevented the banks from issuing new securities because this would have impaired dividends. On the other hand, banks were forced to undertake more adventurous balance sheet expeditions by increasing their advances (Balderston, 1991).

A caveat of the series in table (4.1) is that it excludes the large provincial banks, who often maintained regional branch networks similar to the structure of the great branch banks. The large provincial banks, of which *Bayerische Hypotheken- und Wechselbank* (BHW), *Allgemeine Deutsche Credit-Anstalt* (ADAC), *Bayerische Vereinsbank* and *Barmer Bankverein* were the most important, stood in direct competition with the great branch banks, not the least because their loan portfolios were dominated by industrial loans for which they competed with the great branch banks (Schnabel, 2004). However, the data series we use in our econometric analysis in section (4.4) includes the BHW and ADAC. For the descriptive purpose of this section about the structural weakness of the banking sector which can explain the presence of the bank lending channel, the series in table (4.1) is regarded as sufficient.

Both, the series in table (4.1) and the series used in section (4.4) exclude the two great non-branch banks *Berliner Handels-Gesellschaft* (BHG) and *Reichs-Kredit-Gesellschaft*. Yet, we don't think these two institutions are important for our analysis since these banks worked mostly with a small number of wealthy and homogeneous clients (Schnabel, 2004).[6] For the remainder of the paper we will use the term *great banks* (Grossbanken) for the set of banks which we analyze, which excludes the great non-branch banks but includes the

[6] Average loans and deposits where higher for these two banks. This implies lower verification costs when granting these loans and we would expect the bank lending channel not to be as significant.

two large provincial banks BHW and ADAC.

Table 4.1: Advances and Equity + Reserves of 4 Credit Banks (in Mio. RM)

Balance at	Advances (Debitoren)			Equity + Reserves
end Year	Total	a) secured	b) unsecured	
1913	2948.7	2208	740.6	1490.8
1924	1478.4	780.1	692.3	621.3
1925	2300.7	1462	838.7	629.7
1926	2848.5	2113.7	734.8	720.4
1927	3795.7	2767.5	1028.2	769.8
1928	4287.6	2643.8	1362.8	757.1
1929	5311.4	3957.1	1354.3	714.5
1930	5286.4	4026.1	1260.3	779,5
1931	4381.3	3198	1183.3	529.2
1932	4053.9	3097.3	956.6	444.2

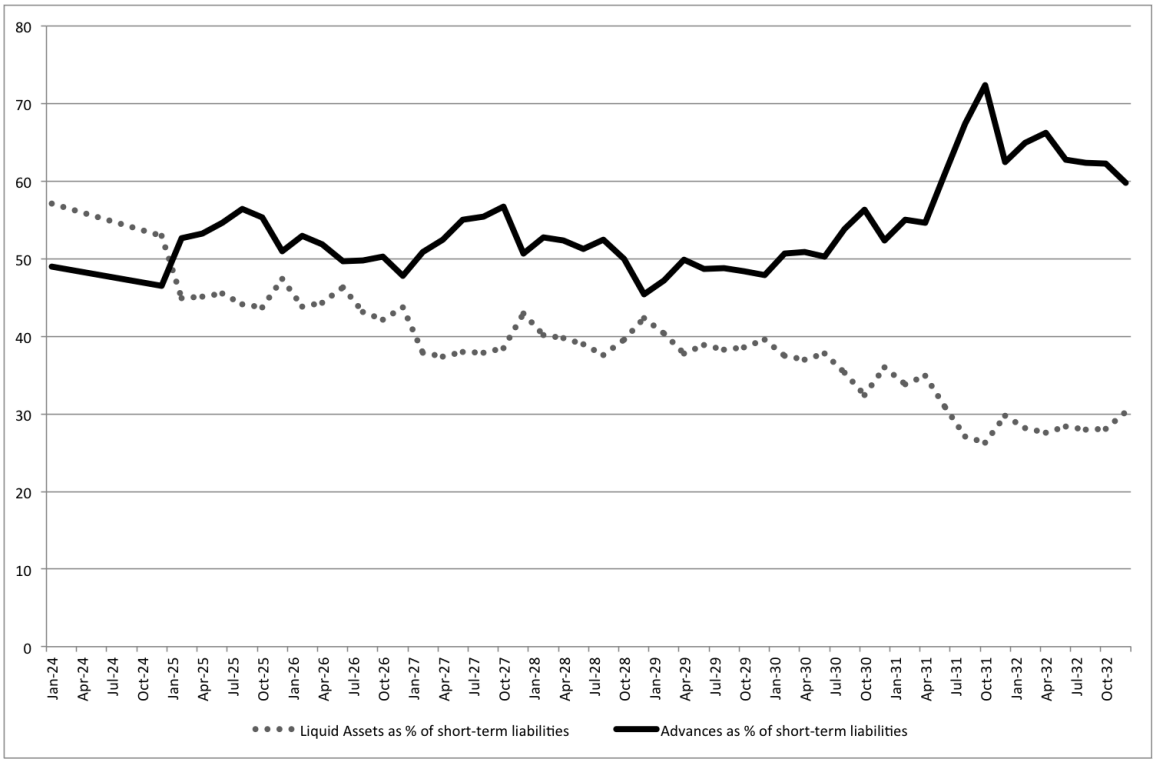
Notes: The four banks are Deutsche Bank und Disc.-Ges., Dresdener Bank, Commerz- u. Privatbank. The data includes the institutions absorbed by these banks. *Source*: (Die Bank, various issues 1927-1933, 1928, p.514).

One way to look at the liquidity of the great banks is by considering advances as a percentage of short-term liabilities (i.e. mainly deposits) or liquid assets as a percentage of short-term liabilities. Liquid assets include till cash, deposits at note-issuing and other banks, and bills of exchange. These ratios are plotted in figure (4.1), which also demonstrates their inverse relationship. The solid line represents the advances to short-term liabilities ratio.

Five months after the stock market crash of May 1927 this ratio stood at 56.7 percent, which is the highest value for the period between 1924 and April 1931. The fact that this ratio increased constantly between the stock market crash and October 1927 can imply that banks were trying to accommodate clients by allowing longer repayment periods for loans.[7] But from October onwards, the advances ratio reached a level higher than what bankers felt comfortable with (Habedank, 1981). The banks increasingly referred customers to foreign banks for advances on their goods, which can be seen in the steep increase of reimbursement credits (i.e.*Warenvorschüsse* (Statistisches Reichsamt, 1936, No. 132)).

[7]This is consistent with evidence from mid-1927 of increased delays in the settlement of trade debts. See footnote 25 in Balderston (1983).

Figure 4.1: Liquidity Ratios of the Great Banks



Notes: The series show liquid assets as a percentage of short-term liabilities and advances as a percentage of short-term liabilities. The data comes from Table 5.12 in Balderston (1993).

But because German banks acted as intermediaries on these advances a contingent risk remained on the banks' balance sheets. The German banks were willing to take this risk. As table (4.2) shows, German banks' and non-banks' foreign short-term debt increased at least until 1929. Especially, "liabilities for clients", the balance sheet counterpart to reimbursement credits, show a disproportional increase from 1927 onwards. If borrowers had the opportunity to switch to foreign banks for funding, this poses a potential problem for the bank lending channel. Yet, we think this effect is negligible. Reimbursement credits were only granted to companies that were generating enough foreign exchange to service their debt and thereby the substitution towards foreign credit should have happened only in the export sector. In any case, if there was a substitutability between domestic and foreign credits, our empirical estimates below are biased against the bank lending channel hypothesis. In this light, our findings provide even stronger support for credit constraints

Table 4.2: Short-term Liabilities of 92 Credit Banks and Estimated Total Short-Term Debt Owed to Foreigners Incl. Non-Banks (in Mio. RM)

State at end of June	Total short-term debts (w/o German interbank deposits)	of which		Estimated total foreign short-term debt (incl. non-banks)
		a) Foreign deposits	b) "Liabilities for clients"	
1925	4588	837	391	4000
1926	5658	1312	300	5100
1927	7632	2485	521	8600
1928	9825	3768	1136	12000
1929	11866	4020	1769	15700
1930	13382	3880	2062	15300
1931	10580	1530	2068	13100
1932	7869	615	1324	9700
1933	7157	527	1116	8000

Notes: The second column of this table states the total amount of short-term debts of 92 credit banks without interbank deposits. Together columns 3 and 4 then state the total amount of short-term debt of these 92 credit banks owed to foreigners. Column 4 is an estimate of the total foreign short-term debt including non-banks.
Source: (Die Bank, various issues 1927-1933, 1928, p.514) and (Untersuchungsausschuss für das Bankenwesen, 1933, p.512)

being a meaningful driver of the economy.

Together, the increase in advances and short-term foreign financing indicates that the German economy in 1927 moved from financing itself in the bond market towards bank based finance. An economy, such as Germany in the period from 1927 to 1932, so reliant on bank loans should be particularly vulnerable to loan supply shocks.

We are not in a position to judge whether this increased dependence on bank loans was caused by Schacht's and Gilbert's critique of foreign borrowing and the impairment of the German bond market as argued by Balderston.[8] Nor are we able to judge whether the initial shock that caused the downturn in investment is to be found in the collapse of the bond market, a change in business sentiments or the stock market crash. Yet, neither of these would by itself have had the power to drive the German economy into depression.

[8]Note for example that a collapse in business sentiment could cause borrowers to switch towards bank loans. In periods with low future profitability when reputation effects are important borrowers will choose monitored debt (bank loans) over non-monitored debt (bond issues) (Diamond, 1991).

Whatever the initial shock, without a severely credit constrained economy, it could have been absorbed by the banking system.

The motor of recession had started in mid to late 1927 and the narrowing trade deficit in 1928 reveals that the boom in Germany was coming to an end. Falling interest rates went alongside an increase in deposits that was faster than the increase in bills. Both the falling interest rate and the slackening demand for bills are signs that the IS curve was shifting to the left between 1928 and 1929.

Because of the low capital of banks and the impaired balance sheets we suspect that the credit banks exerted significant pressure on the German economy not only in late 1927 but also at other times during the period 1927 to 1932. Specifically, it is likely that the bank lending channel operated during the fiscal crisis between October and December 1929, when the great credit banks lost deposits to Switzerland and the Netherlands. Contrary to the usual seasonal decrease in advances, they did not fall this time. Neither did liquid assets show their usual seasonal upswing.

Finally, we expect the bank lending channel to be operating when Germany was hit by a twin crisis in June/July 1931. Although both the currency and banking crisis persisted into 1932, we think that the banking crisis was more damaging than the currency crisis after capital controls were introduced in July 1931 because of the bank lending channel. While the decision to hold Reichsmarks against foreign currency was marginal, the decision to hold Reichsmarks rather than real assets was no longer marginal in an era of continuously falling prices, i.e. the steady appreciation in the value of money. A debt deflation occurred and led to heavy disinvestments in stocks of inventory and massive bankruptcies.

Summing up, we expect the German economy to be susceptible to loan supply shocks for the whole period between May 1927 and January 1933, because of its low equity base, the high level of illiquid advances and the competition for short-term deposits.

4.4 Empirical Approach

We estimate a time-varying parameter vector autoregression (TVP-VAR) to study how changes in credit impacted the economy.[9] The motivation for doing this arises from the high degree of economic and financial instability observed during the interwar years, which could make results from static VARs misleading. The TVP-VAR is sufficiently flexible to allow for regime changes between financial and real economic variables, while also being able to deal with changing macroeconomic volatility. This flexibility is necessary when studying periods of financial instability. Indeed, the TVP-VAR has recently been used to study the impact of credit supply shocks in the context of the Great Recession.[10] More broadly, it has been shown to display good forecasting performance, even when applied to data incorporating different economic regimes (D'Agostino et al., 2013).

The TVP-VAR with ρ lags and N endogenous variables is specified as follows:

$$\boldsymbol{y_t} = \boldsymbol{\mu_t} + \sum_{i=1}^{\rho} \boldsymbol{B_{i,t}} \boldsymbol{y_{t-i}} + \boldsymbol{\nu_t} \; ; \; var(\boldsymbol{\nu_t}) = \boldsymbol{\Omega_t} \tag{4.4.1}$$

Where $\boldsymbol{\mu_t}$ are time-varying constants, $\boldsymbol{B_{i,t}}$ is an $N \times N$ coefficient matrix corresponding the ith lags of the N endogenous variables $\boldsymbol{y}$. $\boldsymbol{\nu_t}$ are error terms and $\boldsymbol{\Omega_t}$ contain the variances of the errors.

The covariance matrix is decomposed as follows:

$$\boldsymbol{A_t} \boldsymbol{\Omega_t} \boldsymbol{A_t'} = \boldsymbol{\Sigma} \boldsymbol{\Sigma'} \tag{4.4.2}$$

Where $\boldsymbol{A_t}$ is a lower triangular matrix with ones on the diagonal, governing the con-

[9] The model is based on work by Primiceri (2005).

[10] Gambetti and Musso (2017); Bijsterbosch and Falagiarda (2015).

temporaneous covariances between the coefficients:

$$\boldsymbol{A_t} = \begin{bmatrix} 1 & 0 & \cdots & 0 \\ a_{21,t} & 1 & \cdots & 0 \\ a_{31,t} & a_{32,t} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1,t} & \cdots & a_{nn-1,t} & 1 \end{bmatrix} \tag{4.4.3}$$

$\boldsymbol{\Sigma_t}$, meanwhile holds the diagonal terms of the covariance matrix:

$$\Sigma_t = \begin{bmatrix} \sigma_{1,t} & 0 & \cdots & 0 \\ 0 & \sigma_{2,t} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & \cdots & 0 & \sigma_{n,t} \end{bmatrix} \tag{4.4.4}$$

This decomposition allows us to write:

$$\boldsymbol{\nu_t} = \boldsymbol{A}_t^{-1}\boldsymbol{\Sigma}_t\boldsymbol{\epsilon}_t \tag{4.4.5}$$

With $\boldsymbol{\epsilon}_t \sim N(0, I_n)$

This decomposition is particularly helpful for modelling the dynamics of the parameters, which are assumed to follow random walks. In order to illustrate this, define an $(N\rho + 1) \times N$ matrix of all the coefficients as follows: $\boldsymbol{\beta_t} = vec([\boldsymbol{\mu}, \boldsymbol{B_{1,t}}, \boldsymbol{...B_{\rho,t}}])$. Furthermore, define $h_{i,t} = ln\sigma_{i,t}$, i.e. the logarithm of diagonal elements of the covariance matrix.

We can then write the random walk processes governing the parameter evolution as

follows:

$$\boldsymbol{\beta}_t = \boldsymbol{\beta}_{t-1} + \boldsymbol{e}_t; \;\; var(\boldsymbol{e}_t) = \boldsymbol{Q} \tag{4.4.6}$$

$$ln(h_{i,t}) = ln(h_{i,t-1}) + z_{i,t}; \;\; var(z_{i,t}) = w_i \tag{4.4.7}$$

$$a_{ij,t} = a_{ij,t-1} + v_{i,t}; \;\; var(v_{i,t}) = s_i \tag{4.4.8}$$

The matrices Q, S and W (the latter two have diagonal elements s_i and w_i respectively) are the hyperparameters governing the variances of the model states.

Even in the TVP-VAR context, a significant problem in the present case is the high degree of instability in the economic variables. If the underlying Bayesian priors are left relatively unconstrained, draws of $\boldsymbol{Q}$ might not be positive definite, which causes draws of $\boldsymbol{\beta}_t$ to "explode", leading to serious problems with the numerical stability of the algorithm and difficulty replicating the results. It would be possible to select only draws that are stationary, but this approach has been shown to lead to biased results (Koop and Potter, 2011). This issue can nevertheless be mitigated by using priors that lead to some degree of shrinkage. We therefore modify the estimation algorithm by Primiceri (2005) to allow for the 'data-based priors' by Korobilis (2014), which extends approaches from the recent prior-selection literature for univariate regression to the VAR context (Belmonte et al., 2014). These priors allow the data to have a considerable degree of influence on the amount of shrinkage that a given set of parameters take, which leads to increased stability especially for parameters which would otherwise cause unstable draws. The attractiveness of this prior choice is further increased by the relatively short span of our sample. Moreover, no shrinkage is imposed on the prior for the variance of the shocks, which can be an especially important feature of the series examined in the context of the Great Depression.

We estimate this TVP-VAR over the period from 1925:1 to 1934:12 using monthly German data. All variables are seasonally adjusted.[11] The VAR model has three lags,

[11] Seasonal adjustment is done using the X-13 ARIMA method (U.S. Census Bureau, 2016).

which has been selected based on the Deviance Information Criterion, outlined by Chan and Grant (2016). Estimating the model with four lags yields similar results.[12] Estimating the model with five or six lags leads to numerical instability.

The variables that we include in our specification are: investment (proxied by the production of investment goods); the index of industrial production (IP); the call money rate (r); and advances (credit). We chose the call money rate over the private discount rate because the latter shows no movement between October 1932 and May 1934 and therefore causes computational problems. Figure B.1 in the appendix plots both interest rates. The call money rate shows considerably more volatility and is usually above the private discount rate. Apart from that the two series exhibit strong co-movement. We achieve identification in the impulse responses by using Cholesky-decomposition with the following variable ordering: $\boldsymbol{y} = [Investment, IP, credit, r]'$.

Our credit series are advances of the great credit banks, which include Deutsche Bank, Dresdner Bank, Commerzbank, Bayerische Hypotheken- und Wechselbank, and Allgmeine Deutsche Credit-Anstalt including all institutions absorbed by these banks during the period. The series comprises about half of all advances granted by the banking system.[13] Advances are tantamount to loans, given that the majority of them were secured by some kind of asset. Moreover, these loans are almost exclusively loans to the non-bank private sector since business with government institutions was conducted mainly by the *Staats- und Landesbanken* and interbank loans were usually granted using bank bills or nostro accounts.[14] The series that we use is thus well suited to evaluate the effect of credit constraints

[12]The impact of credit shocks on investment become weaker, but still positive in this specification.

[13]The period that we study is marked by waves of amalgamations. Deutsche Bank merged with Disconto Gesellschaft in 1929, as did Commerzbank and Mitteldeutsche Credit bank. The second largest bank in 1931, Darmstädter und Nationalbank, was absorbed by Dresdner Bank following its bankcruptcy in 1931. In November 1929 advances from the banks in our series accounted for 54% of all advances in the banking system as reported in Die Bank (various issues 1927-1933). The monthly magazine Die Bank (various issues 1927-1933) reported aggregate balance sheet statistics of all credit banks, state-owned banks (Staats- und Landesbanken) and *Girozentralen* and thereby excludes mortgage banks, savings banks and the private bankers. These latter type of banks traditionally had a negligible share in granting direct loans to industry.

[14]Advances by credit banks to other banks made up only 5.9% of all advances in November 1929 as reported in Die Bank (various issues 1927-1933).

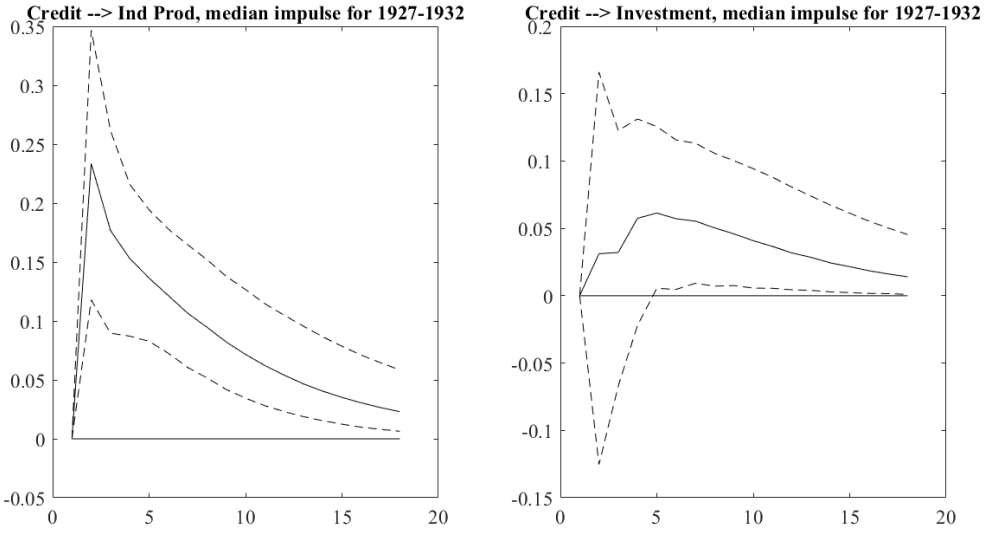
on production.

Advances were reported only on a bimonthly basis between 1925 and 1927 and we log-linearly interpolate the series to fill the gaps. These years are not incorporated into our impulse responses. The data comes from official statistics published in Statistisches Reichsamt (1936, 1937), Wagemann (1936) and Institut für Konjunkturforschung (1928). Table (B.1) in the appendix lists the exact composition and description of the data.

4.5 Results

Figure 4.2 shows impulse response functions of industrial production (IP) and investment to a shock in loans over a horizon of 12 months. The solid line shows the impact of a credit shock on a given variable and horizon. More specifically, this line is the point-wise median response at each forecast horizon. The dashed lines indicate the 86th and 14th percentiles of the draws from the MCMC algorithm, commonly used in Bayesian statistics.[15]

Figure 4.2: Impulse Responses of Industrial Production and Investment from Credit



The left-hand side figure shows the median impulse response of industrial production

[15]This is because models typically express high degrees of dispersion at the extreme quantiles.

for the years 1927-1932, whereas the right-hand side one shows the response of investment. Both of these variables responded to positive credit shocks, with industrial production rising 0.25% and investment rising 0.05% after a 1% credit shock. These results clearly support the hypothesis that credit shocks were a meaningful driver of economic conditions amidst the German economic downturn. The structural weaknesses in the Germany banking system in the late 1920s meant that their ability to provide credit was significantly constrained, whereby the domestic economy responded substantially to changes in bank lending. Moreover, the significance of the results suggests that regardless of what financing alternatives existed for bank loans, they were clearly insufficient to overcome the impact of the domestic banks' weaknesses.[16]

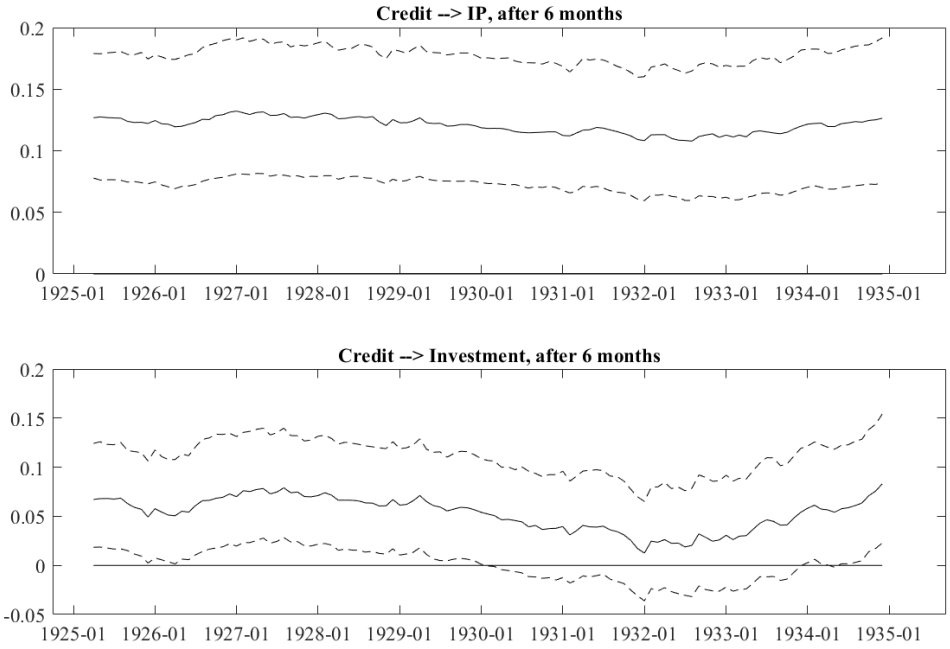
An alternative view of these results can be gained from figure 4.3, which shows that the impulse responses of IP and especially investment were time-varying. Credit was an important driver of industrial production throughout the period at issue, whereby credit shocks at any given moment could have influenced the economy. This supports our argument of a structurally weak banking sector in Germany. At the same time, note that the impact of credit on investment was most significant before 1930.

The time-varying impact of credit to investment and economic conditions comes to the fore more strongly in the forecast error variance decompositions shown in figure 4.4. These tell us that credit shocks could explain between 65% to 70% of fluctuations in industrial production itself in any given year between 1925-1935, and between 5% and 20% of changes in investment in these years. Therefore, the shocks in credit are likely to have been especially strong contributors to the growth and the subsequent decline in industrial production, which is likely to have been a key channel through which credit constraints transmitted to the economy more broadly.

Investment, as our literature review above suggests, may have been driven by factors pertaining to the financial markets more broadly as opposed to the banking system alone.

[16]If alternative forms of financing would have been readily available and easily substitutable for bank loans, we would expect the impulse response of economic conditions to loans to be less significant.

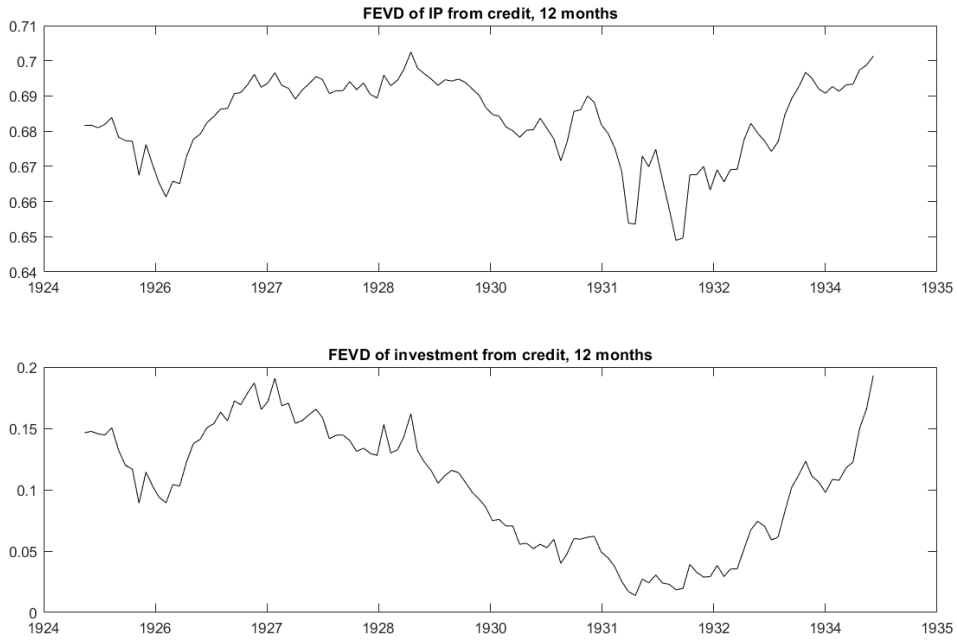
Figure 4.3: Time-Varying Impulse Responses of Industrial Production and Investment to Credit Shocks



In particular, we consider the reversal of international capital flows in 1930/31 and the decline in bond issuance and long-term financing abroad as a separate cause for the fall of investment. Hence, we add domestic and foreign bond issuance to our model in the appendix (B.3). Yet, our indicator for market-based finance has no impact on industrial production or investment and the effect of bank credit is unaffected by the inclusion of the new variable. This suggests that other factors pertaining to firms investment decisions, such as short-run ex ante real interest rates or expected profits, may have been more important drivers of investment between 1930 and 1933 and we acknowledge that this is a question ripe for further research.

The impulse responses of loans to shocks in industrial production and investment are plotted in figure 4.5. What this figure tells us is that banks did *not* increase their lending even as economic conditions improved. If they did, we would expect bank lending to respond positively to shocks to industrial production. Combined with the other results in

Figure 4.4: Time-varying Forecast Error Variance Decomposition of Shocks to Credit after 12 Months



this section, what emerges is a picture of a credit constrained economy. This is an important finding in so far as it provides an explanation for the relatively low level of investment of Weimar Germany's economy. Previous studies have sought an explanation for the low level of investment either in excessive wages (Ritschl, 1990) or excessive interest rates (Voth, 1995). While we don't deny that either one of these explanations may have had an effect on investment, our results indicate that new investment was also hampered by a credit constrained economy.

Indeed, as shown in figure 4.6, we find support for the argument that interest rate shocks influenced German investment especially during the depth of the depression in 1932. Together with our results in figure 4.3, this can be interpreted as saying that interest rate shocks were *more important* than credit shocks for investment in the German economy at the height of the crisis. In other years, however, interest rate shocks did not have as significant an impact on investment as credit did.

Figure 4.5: Impulse Responses of Credit from Industrial Production and Investment Shocks

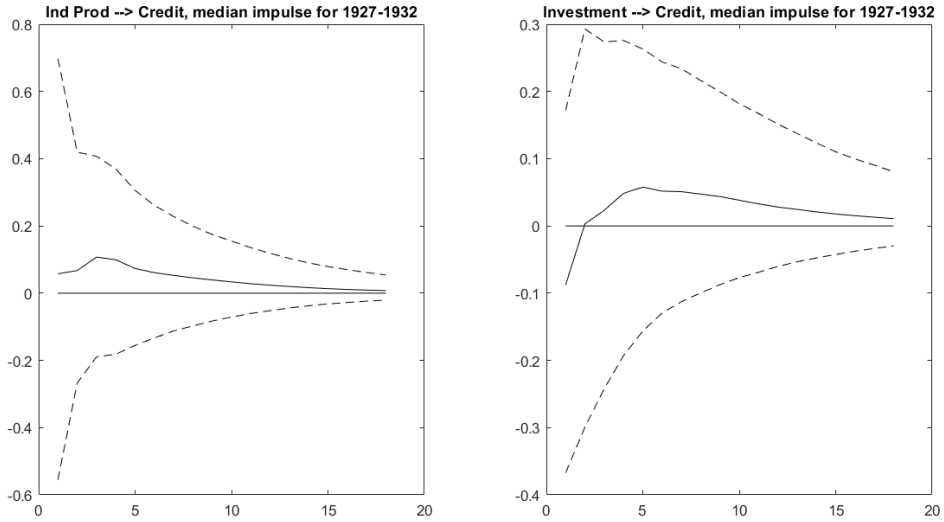
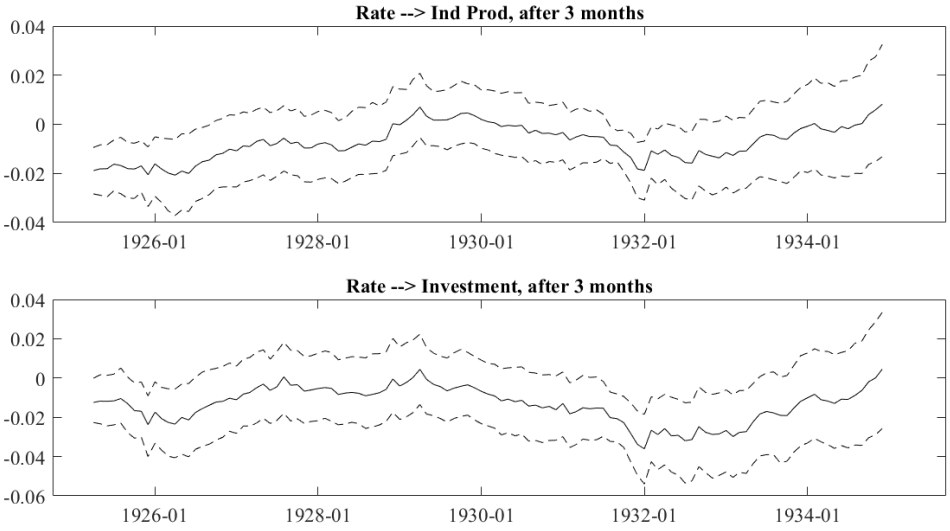


Figure 4.6: Impulse Responses of Industrial Production and Investment from Interest Rate Shocks



4.6 Conclusion

This is the first study to test for the presence of the bank lending channel during one of the most dramatic periods in German and global economic history. We estimate time-varying parameter vector autoregressions to evaluate the importance of credit constraints between 1924 and 1934. These methods are able to accommodate the significant changes that occurred in the German financial system during the period, and therefore offer a new approach to contributing to the discussion on the causes of the Great Depression in Germany.

We demonstrate that bank lending was an important driver of economic fluctuations in 1924-1934. Credit constraints were a drag on output, as proxied by industrial production, for the entire period under study. The effect on investment, however, is most significant only in the early phase of the Depression from 1927 to 1929. This is an important finding, but one that needs to be contrasted with other transmission channels and evaluated in relative terms against competing hypotheses of the causes of the German slump. In subsequent research we aim to dive deeper into the determinants of investment spending and the causes of the investment downturn in 1927 and after 1929.

Appendices

APPENDIX A

RETURN OF THE TARIFFS: THE INTERWAR TRADE COLLAPSE REVISITED

A.1 Gravity Data Appendix

I created a dataset by merging two existing datasets. I use the large dataset by Fouquin and Hugot (2016b) and merge it with the dataset provided by Gowa and Hicks (2013).[1] Because I needed observations for internal trade, I restricted the sample to include countries with observations on GDP.[2] The 36 countries included and their bloc membership are listed in table (A.1).

Table A.1: Countries in Both Samples and Bloc Membership

Country	Bloc	Country	Bloc
Argentina	St (1934)	India	St (1931), IPS (1932)
Australia	St (1931), IPS (1932)	Indonesia	
Austria	Ex (1931), RM (1932)	Italy	G (1931-34), Ex (1931)
Belgium	G (1931-35)	Japan	
Bulgaria	Ex (1931), RM (1932)	Korea	
Brazil		Mexico	
Canada	IPS (1932)	Netherlands	G (1931-36)
Chile		Norway	St (1933)
Colombia		New Zealand	St (1931), IPS (1932)
Denmark	St (1933)	Portugal	St (1931)
Egypt	St (1931)	South Africa	St (1931), IPS (1932)
Finland	St (1933)	Spain	
France	St (1938), G (1931-36)	Sweden	St (1933)
Germany	Ex (1931), RM (1932)	Switzerland	G (1931-36)
Greece	Ex (1931), RM (1932)	United Kingdom	St (1931), IPS (1932)
Guatemala		United States	
Honduras		Uruguay	
Hungary	Ex (1931), RM (1932)	Yugoslavia	Ex (1931)

Notes: St: Sterling bloc; G: Gold bloc; Ex: Exchange bloc; RM: Reichsmark bloc; IPS: Imperial Preference System. Data on bloc membership is taken from Gowa and Hicks (2013). Dollar bloc and RTAA membership is not reported here for brevity.

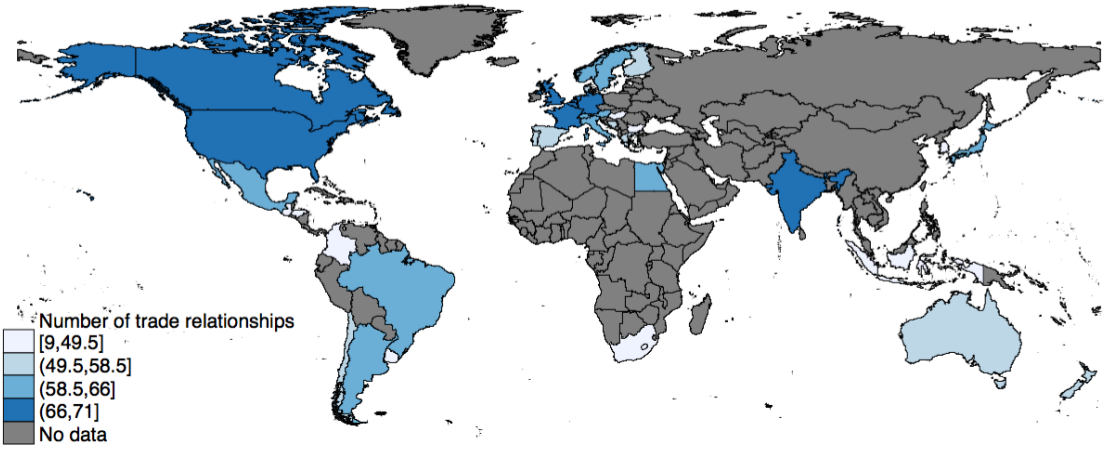
[1] I used the yearly British pounds per dollar exchange rate in Fouquin and Hugot (2016b) to convert the Gowa and Hicks (2013) trade flows into pound sterling.

[2] Despite existing data on GDP, I excluded the only communist country, the USSR, from the sample.

Next, I constructed two samples, one for the estimation of the partial effects in section (2.3.2) and one for the GE analysis in section (2.3.3), which I call *the partial sample* and *the GE sample*. The partial sample balances the panel, which means that for a given dyad an observation exists for every year from 1925 to 1937. Because the Fouquin and Hugot (2016b) dataset sometimes also reports observations with missing trade flows, *the partial sample* drops the country pairs that report missing trade flows for all years in the sample. I replaced the remaining 16 observations missing trade flows with the variable $FLOW_0$, which is equal to zero when it is reasonable to assume that the trade flow is missing because the trade flow is actually zero.[3]

Figure (A.1) shows the geographical distribution of the 1017 dyads in *the partial sample*. The sample covers most of Europe and the Americas.

Figure A.1: Geographical Distribution of *the Partial Sample*



Notes: This figure plots the geographical distribution of the sample on a map with current frontiers. The colors indicate the number of times a country appears in the observations. The partial sample includes 1017 country pairs from a total of 36 countries over five time periods. The map shows the number of trade relationships of a country in the sample. For example, Korea appears only in 9 dyads and is depicted in white.

The GE sample is obtained not by dropping dyads with missing observations in a given

[3]For details on the construction of the variable $FLOW_0$, see Fouquin and Hugot (2016b). The 16 observations that were replaced with zero are: IND - HND (1925, 1928); PRT - FIN (1937); BGR - IND (1925, 1928, 1937); KOR - IND (1928, 1931, 1934, 1937); GTM - IND (1931, 1934, 1937); COL - IND (1937); HND - NLD (1925); GTM - NLD (1925).

year, but instead by adding observations to obtain a quadratic matrix of $N * N$ observations per year (i.e. a quadratic matrix of trade relations between the N trading partners). This consequently results in 1296 observations per year or 6480 observations for 5 years, of which 881 missing observations are assumed to be zero.[4] These 881 missing observations are primarily country pairs of two distant small developing countries (e.g. Korea and Honduras) and it is reasonable to assume that these trade flows are zero or close to zero.

While it is possible to restrict the number of countries to reduce the number of missing observations, this comes at the cost of biasing the sample towards industrialized nations and reducing the total number of observations, which creates convergence problems. Note that biasing the sample heavily towards European countries increases the share of manufactures in aggregate trade as can be seen in table (A.2), which is taken from Hilgerdt (1942). Manufactured goods made up a larger share of trade (exports plus imports) of European countries compared to the rest of the world before and after the Great Depression. This affects the estimation of the distance elasticity through two channels, the elasticity of substitution and the elasticity of trade costs with respect to distance.[5]

σ is different for the two classes of goods, but the importance of transport costs also differs between the two classes of goods. Freight rates are usually measured per unit of the good in question and depend on how bulky the good is. Arguably, the value of a cargo full of manufacture goods should on average be much higher compared to the value of the same cargo full of primary products. The share of shipping costs in the price of manufactures should then be much lower than in primary goods. The elasticity of trade in agricultural goods to transport costs is therefore larger compared to manufactured goods. It might be

[4]Note that the partial sample contains only 5085 observations. This is because the partial sample loses 514 non-missing observations in the process of balancing the panel.

[5]In a previous version of this paper I estimated the gravity equation in yearly cross-sections for different samples. One observes that the "distance puzzle" is more pronounced if the sample is restricted to include primarily European countries (results are available upon request). This has also been observed by Albers (2018). This result has its analogy in the literature on the post-war distance puzzle. In a recent study, Borchert and Yotov (2017) show that on average the distance elasticity has fallen between 1986 and 2006, but that low-income countries have not seen a fall in the distance elasticity. The authors argue that the distance elasticity depends heavily on the composition of exports, in particular the value-to-weight ratio.

Table A.2: Percentage Composition of Merchandise Trade by Groups of Countries

		Imports		Exports	
	Class	1928	1935	1928	1935
Europe	c	32.00	31.33	50.67	50.67
	a+b	68.00	68.67	49.33	49.33
Other countries	c	57.50	57.14	15.00	16.21
	a+b	42.14	42.86	85.00	83.79

Notes: a: Foodstuffs and live animals; b: Materials raw or partly manufactured; c: Manufactured articles;
Source: (Hilgerdt, 1942, Table 7 p.23)

that the increase in real freight costs during the depression hit the trade of primary goods particularly hard.

Moreover, deflation in agricultural and primary products was more severe than in the manufacturing sector. Between 1925 and 1936, the export price ratio of manufactures to other goods increased by 29% (League of Nations, 1938).[6] Transport costs increased because real freight costs increased. It therefore matters that the deflation was more severe in the primary sector.[7] Dropping the countries with fewer observations (Korea, Honduras, Guatemala and Colombia) might therefore bias the results towards the "tariff explanation".

Both samples include observations for intranational trade (i.e. how much a country trades within its own borders). Lacking data on interregional trade or a measure of gross output (subtracting total exports from gross output would yield intranational trade), one needs another way of constructing a proxy for internal trade.[8] Jacks et al. (2011) simply use the GDP series as a proxy for gross output, which poses two problems. First, gross output is by construction larger than value-added GDP and so the use of GDP would lead to an underestimation of domestic trade. Second, as GDP includes services, which are not

[6]This is based on unit values; see (League of Nations, 1938, Table 1).

[7]Deflation also increases the effective tariff rate. Whether real freight rates increase more than the effective tariff rate depends on the stickiness of nominal freight rates and the rate at which tariffs increase in the respective sector.

[8]Indeed Bulgaria's GDP is smaller than her total exports for all years in the sample, which means that using GDP as a proxy of gross output would result in negative internal trade.

covered by the trade data, this leads to an overestimation of domestic trade. Fouquin and Hugot (2016a) follow a different approach. They scale up their GDP series by a factor of 3.16, which is the average ratio of gross output to value added from a post-1980 dataset. Here, I propose a more reasonable scale factor with which to multiply the GDP series. I use data from the US U.S. Department of Commerce ((1935 - 1937) of the interwar period and data from Federico (2004) to calculate average gross output to value added ratios for the U.S. manufacturing sector and international agricultural sector, and calculate internal trade as follows:[9]

$$X_{iit} = Y_{it}[(1 - s_{1,t} - s_{2,t}) + (s_{1,t} * v_{Agri,t}) + (s_{2,t} * v_{Manuf,t})] - X_{it} \tag{A.1.1}$$

In the above equation, Y_{it} is country i's GDP in year t. $s_{1,t}$ and $s_{2,t}$ are the global average shares of the primary and secondary sectors, which I take from Fouquin and Hugot (2016b). $v_{Agri,t}$ and $v_{Manuf,t}$ are the average ratios of gross output over value added. On average this yields a scale factor of 1.4. X_{it} is total exports and is taken from Fouquin and Hugot (2016b) for all countries but Yugoslavia. Total exports for Yugoslavia come from (Mitchell, 1998, p.580).[10]

In sections (2.3.2) and (2.3.3) I include a set of dummy variables that indicate whether two countries are on the gold standard or are members of the same trade or currency bloc. Data for the time on gold comes from Eichengreen (1992) and bloc membership is taken from Gowa and Hicks (2013).

Finally, I include a set of standard gravity covariates (distance, contiguity, common language, colonial linkage). I use the existing data on these variables in Fouquin and Hugot's (2016b) dataset, which I supplement with the CEPII distance dataset from Mayer and Zig-

[9]The data to calculate gross output to value added ratios for the manufacturing sector is taken from Inklaar et al. (2011). As this data is biennial, I use the same data point for two consecutive years. Federico's (2004) table D.1. provides data on indices for gross output and value added for the worldwide agricultural sector.

[10]I use the yearly pound sterling per dinar exchange rate in Fouquin and Hugot (2016b) to convert dinars into pound sterling.

nago (2011) for any missing observations. As a measure of distance, I use population-weighted distance. The contiguity dummy is equal to one if two countries share a common border. If they do not, it is zero. The language dummy takes the value one if at least 9% of the population speaks the same language and zero otherwise. The colonial dummy indicates whether they were ever in a colonial relationship.

A.2 Robustness Appendix

This section presents a battery of robustness and sensitivity checks. Many more specifications were tried and I present only the most relevant ones. Table (A.3) shows the estimation results for additional econometric specifications of equation (2.3.6). Columns (1) - (3) are a reproduction of column (2) in table (2.1), but include asymmetric pair fixed effects, a time trend interacted with the pair fixed effects, and both. The inclusion of pair-trends causes collinearity with country-pair specific variables. In my specifications most variation over time of the individual country-pairs is already captured by the distance and border variables. In column (2) Stata drops the coefficient on $\ln Dist_{ij,1937}$ and fails to create standard errors for the coefficient on $INTL\_BRDR_{ij,1937}$. In column (3) Stata drops both regressors entirely. Accordingly, the remaining coefficients should be interpreted differently. One way to think about the remaining coefficients on $\ln Dist_{ij,t}$ and $INTL\_BRDR_{ij,t}$ in columns (2) and (3) is that they should be interpreted as deviations from a trend. Given this interpretation, the main results concerning the border and distance elasticities is considered robust.

Columns (4) to (6) show the main specification and the solution to the interwar distance puzzle without using pair fixed effects. Instead, I include the standard gravity covariates $contiguity$, $colonial$ and $commonlanguage$. The coefficient on $\ln Dist_{ij,1925}$ in column (4) is not significantly different from the coefficient on $\ln Dist_{ij,1937}$. However, once we exclude sterling bloc and IPS membership from the regression, the distance puzzle reappears.

We also observe a very large and increasing border effect in the regressions without pair fixed effects. The estimate in column (4) for example implies that, all else being equal, international borders decreased trade by an average of $100 * (e^{\beta_{2,1928}} - 1) = 100 * (e^{-4.869} - 1) = 99\%$ in 1928. While this coefficient is larger than comparable coefficients for the present period, it is close to the coefficient estimated by Fouquin and

Hugot (2016a) for the interwar period.[11] Given the much higher level of protectionism in the 1920s and 1930s, it is not surprising to find a larger border effect. Yet there might be bilateral factors not controlled for in columns (4) - (6) that bias the absolute value of the coefficients on distance and border. However, for my counterfactual analysis the absolute value is of little relevance if one assumes a constant elasticity of trade to trade costs. What matters is how these individual trade costs change over time and the change in the distance and border variables is not qualitatively different if I include pair fixed effects. For example, multiplying the coefficient on $INTL\_BRDR_{ij,1925}$ in column (4), table (A.3) with the estimate on $INTL\_BRDR_{ij,1937}$ in column (2), table (2.1) yields a coefficient of -5.285 ($\ln\left(e^{-4.652} * e^{-0.633}\right)$), which is larger than the -5.151 obtained in column (4) here.

Finally, note that the indicator variables for gold standard adherence, sterling bloc and IPS membership are significantly larger than in the regressions with pair fixed effects. Not controlling for potential endogeneity and unobserved country-pair heterogeneity drastically increases these coefficients, confirming the view of Bergstrand et al. (2015) that not including pair fixed effects biases the coefficient on economic integration agreements.

Table (A.4) presents the results for additional specifications of estimating equation (2.3.6). Column (1) simply reproduces column (2) in table (2.1) excluding $Dist_{ij,t}$ from the regression. The sterling bloc is now significant at the 10% level and all other coefficients are similar in magnitude to those in column (2) of table (2.1). Dropping the gold standard dummy (column (2)) reduces the significance of the sterling bloc, but adding three-year lag variables and the gold standard dummy increases its size and significance (column (3)). The coefficient on sterling bloc also remains significant when I use four-year lag variables (column (4)) or add $Dist_{ij,t}$ again to the regression (column (5)). Column (5) in particular is a reproduction of column (2) in table (2.1) extended to account for phasing-in effects of the bloc dummies. The fact that the sterling bloc is now significant is taken as justification

[11] Yotov et al. (2016) find a coefficient of -2.474 for the year 2006. Fouquin and Hugot (2016a) do not present results in table form, but their figure 12 suggests that the coefficient on international borders varied between -4.5 and -6 during the interwar period.

Table A.3: Regression Estimates: Robustness

Horse Race

VARIABLES	(1) PPML X_{ij}	(2) PPML X_{ij}	(3) PPML X_{ij}	(4) PPML X_{ij}	(5) PPML X_{ij}	(6) PPML X_{ij}
$\ln(Dist_{ij,1925})$				-0.425***	-0.426***	-0.404***
				(0.0693)	(0.0696)	(0.0686)
$\ln(Dist_{ij,1928})$	-0.0155	-0.0259**	-0.0211*	-0.435***	-0.436***	-0.441***
	(0.0124)	(0.0118)	(0.0121)	(0.0651)	(0.0654)	(0.0665)
$\ln(Dist_{ij,1931})$	-0.0714**	-0.0980***	-0.0898**	-0.535***	-0.496***	-0.502***
	(0.0283)	(0.0375)	(0.0365)	(0.0661)	(0.0701)	(0.0690)
$\ln(Dist_{ij,1934})$	0.0317	-0.0190	-0.0154	-0.438***	-0.335***	-0.348***
	(0.0283)	(0.0153)	(0.0153)	(0.0632)	(0.0729)	(0.0716)
$\ln(Dist_{ij,1937})$	0.0524			-0.426***	-0.318***	-0.309***
	(0.0365)			(0.0676)	(0.0778)	(0.0773)
$INTL\_BRDR_{ij,1925}$				-4.652***	-4.689***	-4.628***
				(0.158)	(0.160)	(0.157)
$INTL\_BRDR_{ij,1928}$	-0.0623*	0.0793**	0.168***	-4.869***	-4.894***	-4.614***
	(0.0365)	(0.0345)	(0.0348)	(0.164)	(0.167)	(0.151)
$INTL\_BRDR_{ij,1931}$	-0.291***	-0.0597	0.116	-5.028***	-5.094***	-4.809***
	(0.0687)	(0.0973)	(0.0949)	(0.152)	(0.159)	(0.154)
$INTL\_BRDR_{ij,1934}$	-0.672***	-0.432***	-0.161***	-5.247***	-5.360***	-5.319***
	(0.0691)	(0.0367)	(0.0371)	(0.150)	(0.165)	(0.161)
$INTL\_BRDR_{ij,1937}$	-0.630***	-0.363		-5.155***	-5.275***	-5.302***
	(0.0925)	(0)		(0.164)	(0.183)	(0.183)
$Contiguity_{ij}$				0.515***	0.528***	0.548***
				(0.0767)	(0.0809)	(0.0833)
$Colonial_{ij}$				0.933***	1.012***	1.001***
				(0.0904)	(0.0945)	(0.0945)
$CommonLanguage_{ij}$				-0.0180	0.0501	0.0746
				(0.0607)	(0.0627)	(0.0616)
$Gold_{ij}$	0.0838**	-0.0142	-0.0132	0.353***	0.334***	
	(0.0333)	(0.0238)	(0.0238)	(0.0763)	(0.0785)	
$SterlingBloc_{ij}$	0.127	0.106	0.123*	0.713***		
	(0.0784)	(0.0714)	(0.0719)	(0.112)		
IPS_{ij}	0.202**	0.418***	0.437***	0.643***		
	(0.0894)	(0.0955)	(0.0935)	(0.153)		
Observations	5,075	5,085	5,075	5,085	5,085	5,085
Country Pair FE's	Yes	Yes	Yes	No	No	No
Asymmetric Pair FE's	Yes	No	Yes	No	No	No
Time trend	No	Yes	Yes	No	No	No

Notes: All estimates are obtained with data for the years 1925, 1928, 1931, 1934 and 1937, and use exporter-time and importer-time fixed effects. The estimates of fixed effects are omitted for brevity. Standard errors are clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

of its use in the trade cost function.

Finally, table (A.5) reproduces the most important regressions with data for all 13 years. Column (1), for example, is the same specification as in columns (1) and (2) in table (2.1). All coefficients are comparable in size and significance and the significance of the sterling bloc is even increased by adding all years. Moreover, columns (5) to (6) again show that the interwar distance puzzle is resolved once we include IPS and sterling bloc membership. This result is robust to the inclusion of asymmetric pair fixed effects. Again, the inclusion of a time trend causes collinearity problems and the coefficients on $INTL\_BRDR_{ij,1937}$ and $Dist_{ij,1937}$ are dropped in the specifications in columns (3) and (4). The interpretation of the remaining coefficients should change accordingly.

Table A.4: Regression Estimates: Blocs Lagged

VARIABLES	(1) PPML X_{ij}	(2) PPML X_{ij}	(3) PPML X_{ij}	(4) PPML X_{ij}	(5) PPML X_{ij}
$\ln(Dist_{ij,1928})$					-0.0181
					(0.0125)
$\ln(Dist_{ij,1931})$					-0.0747**
					(0.0292)
$\ln(Dist_{ij,1934})$					0.0351
					(0.0281)
$\ln(Dist_{ij,1937})$					0.0611
					(0.0378)
$INTL\_BRDR_{ij,1928}$	-0.106***	-0.0533***	-0.127***	-0.103***	-0.0828*
	(0.0201)	(0.0155)	(0.0302)	(0.0223)	(0.0440)
$INTL\_BRDR_{ij,1931}$	-0.447***	-0.396***	-0.491***	-0.435***	-0.338***
	(0.0309)	(0.0276)	(0.0475)	(0.0455)	(0.0803)
$INTL\_BRDR_{ij,1934}$	-0.607***	-0.638***	-0.645***	-0.597***	-0.721***
	(0.0352)	(0.0353)	(0.0391)	(0.0462)	(0.0755)
$INTL\_BRDR_{ij,1937}$	-0.520***	-0.558***	-0.518***	-0.520***	-0.638***
	(0.0392)	(0.0405)	(0.0399)	(0.0398)	(0.0949)
$Gold_{ij}$	0.107***		0.117***	0.104***	0.0996**
	(0.0326)		(0.0378)	(0.0368)	(0.0393)
$Gold_{ij,t-3}$			0.0453		0.0496
			(0.0321)		(0.0315)
$SterlingBloc_{ij,t}$	0.125*	0.0983	0.132*	0.105*	0.163**
	(0.0725)	(0.0675)	(0.0788)	(0.0632)	(0.0763)
$SterlingBloc_{ij,t-3}$		0.0182	-0.00232		-0.0698
		(0.0725)	(0.0739)		(0.0744)
$IPS_{ij,t}$	0.272***	0.272***	0.298***	0.290***	0.267***
	(0.0757)	(0.0884)	(0.0877)	(0.0542)	(0.0929)
$IPSij, t-3$		-0.0124	-0.0307		-0.0653
		(0.0407)	(0.0388)		(0.0483)
$Gold_{ij,t-4}$				-0.0127	
				(0.0408)	
$SterlingBloc_{ij,t-4}$				0.0616	
				(0.0854)	
$IPS_{ij,t-4}$				-0.0627	
				(0.0927)	
Observations	5,085	5,085	5,085	5,085	5,085
Country Pair Fixed Effects	Yes	Yes	Yes	Yes	Yes

Notes: All estimates are obtained with data for the years 1925, 1928, 1931, 1934 and 1937, and use exporter-time, importer-time and pair fixed effects. The estimates of fixed effects are omitted for brevity. Standard errors are clustered by country pair in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A.5: Regression Estimates: No Interval

VARIABLES	(1) PPML X_{ij}	(2) PPML X_{ij}	(3) PPML X_{ij}	(4) PPML X_{ij}	(5) PPML X_{ij}	(6) PPML X_{ij}	(7) PPML X_{ij}
$\ln(Dist_{ij,1926})$	-0.0239***	-0.0175**	-0.0329***	-0.0265***	-0.0188**	-0.0268***	-0.0287***
	(0.00860)	(0.00860)	(0.00838)	(0.00857)	(0.00848)	(0.00848)	(0.00830)
$\ln(Dist_{ij,1927})$	-0.0203**	-0.0159	-0.0260**	-0.0213*	-0.0150	-0.0219**	-0.0199*
	(0.0103)	(0.0102)	(0.0111)	(0.0112)	(0.0102)	(0.0101)	(0.0102)
$\ln(Dist_{ij,1928})$	-0.0192	-0.0144	-0.0301***	-0.0239**	-0.0139	-0.0208*	-0.0215
	(0.0123)	(0.0126)	(0.0113)	(0.0116)	(0.0126)	(0.0123)	(0.0132)
$\ln(Dist_{ij,1929})$	-0.0303**	-0.0257*	-0.0443***	-0.0370**	-0.0250*	-0.0318**	-0.0321**
	(0.0130)	(0.0132)	(0.0160)	(0.0161)	(0.0130)	(0.0129)	(0.0130)
$\ln(Dist_{ij,1930})$	-0.0837***	-0.0777***	-0.107***	-0.0963***	-0.0783***	-0.0865***	-0.0932***
	(0.0216)	(0.0208)	(0.0290)	(0.0280)	(0.0213)	(0.0213)	(0.0208)
$\ln(Dist_{ij,1931})$	-0.0797***	-0.0731***	-0.0956**	-0.0843**	-0.0619**	-0.0697***	-0.0767***
	(0.0278)	(0.0272)	(0.0373)	(0.0361)	(0.0256)	(0.0257)	(0.0249)
$\ln(Dist_{ij,1932})$	-0.0359	-0.0313	-0.0624**	-0.0532**	-0.0242	-0.00268	-0.00247
	(0.0231)	(0.0232)	(0.0246)	(0.0244)	(0.0225)	(0.0217)	(0.0218)
$\ln(Dist_{ij,1933})$	0.00492	0.00649	-0.0319	-0.0257	0.0144	0.0363*	0.0355*
	(0.0222)	(0.0227)	(0.0198)	(0.0199)	(0.0221)	(0.0213)	(0.0215)
$\ln(Dist_{ij,1934})$	0.0290	0.0321	-0.0117	-0.00398	0.0431	0.0657**	0.0636**
	(0.0277)	(0.0282)	(0.0152)	(0.0153)	(0.0280)	(0.0273)	(0.0278)
$\ln(Dist_{ij,1935})$	0.0479	0.0501	0.00304	0.00888	0.0625*	0.0859***	0.0842***
	(0.0320)	(0.0328)	(0.0119)	(0.0119)	(0.0326)	(0.0318)	(0.0325)
$\ln(Dist_{ij,1936})$	0.0418	0.0436	-0.00631	-0.00257	0.0564	0.0805**	0.0804*
	(0.0400)	(0.0405)	(0.0106)	(0.0108)	(0.0405)	(0.0405)	(0.0414)
$\ln(Dist_{ij,1937})$	0.0531	0.0541			0.0673*	0.0916**	0.0922**
	(0.0365)	(0.0366)			(0.0369)	(0.0362)	(0.0372)
$INTL\_BRDR_{ij,1926}$	-0.0263	-0.0390*	0.0568***	0.0467**	-0.0365*	-0.0188	-0.00904
	(0.0216)	(0.0216)	(0.0213)	(0.0216)	(0.0213)	(0.0213)	(0.0204)
$INTL\_BRDR_{ij,1927}$	-0.0307	-0.0385	0.107***	0.103***	-0.0406	-0.0222	-0.00791
	(0.0271)	(0.0269)	(0.0289)	(0.0288)	(0.0271)	(0.0269)	(0.0248)
$INTL\_BRDR_{ij,1928}$	-0.0476	-0.0558	0.160***	0.155***	-0.0573*	-0.0366	-0.00863
	(0.0341)	(0.0344)	(0.0317)	(0.0321)	(0.0348)	(0.0350)	(0.0335)
$INTL\_BRDR_{ij,1929}$	-0.0258	-0.0332	0.237***	0.232***	-0.0354	-0.0149	0.0122
	(0.0342)	(0.0342)	(0.0441)	(0.0436)	(0.0345)	(0.0345)	(0.0322)
$INTL\_BRDR_{ij,1930}$	-0.104**	-0.114**	0.221***	0.212***	-0.114**	-0.0917*	-0.0544
	(0.0517)	(0.0501)	(0.0757)	(0.0734)	(0.0511)	(0.0513)	(0.0477)
$INTL\_BRDR_{ij,1931}$	-0.267***	-0.279***	0.0997	0.0891	-0.292***	-0.269***	-0.230***
	(0.0645)	(0.0627)	(0.0975)	(0.0949)	(0.0615)	(0.0617)	(0.0587)
$INTL\_BRDR_{ij,1932}$	-0.509***	-0.521***	-0.126**	-0.134**	-0.529***	-0.547***	-0.560***
	(0.0536)	(0.0528)	(0.0611)	(0.0602)	(0.0528)	(0.0534)	(0.0518)
$INTL\_BRDR_{ij,1933}$	-0.604***	-0.610***	-0.148***	-0.151***	-0.614***	-0.632***	-0.645***
	(0.0533)	(0.0533)	(0.0506)	(0.0503)	(0.0537)	(0.0546)	(0.0542)
$INTL\_BRDR_{ij,1934}$	-0.671***	-0.680***	-0.162***	-0.169***	-0.687***	-0.707***	-0.720***
	(0.0683)	(0.0689)	(0.0374)	(0.0375)	(0.0698)	(0.0710)	(0.0719)
$INTL\_BRDR_{ij,1935}$	-0.759***	-0.766***	-0.201***	-0.206***	-0.775***	-0.797***	-0.811***
	(0.0798)	(0.0812)	(0.0273)	(0.0275)	(0.0816)	(0.0829)	(0.0848)
$INTL\_BRDR_{ij,1936}$	-0.742***	-0.749***	-0.141***	-0.145***	-0.759***	-0.783***	-0.802***
	(0.103)	(0.104)	(0.0256)	(0.0263)	(0.105)	(0.107)	(0.109)
$INTL\_BRDR_{ij,1937}$	-0.638***	-0.643***			-0.654***	-0.679***	-0.701***
	(0.0928)	(0.0928)			(0.0942)	(0.0961)	(0.0988)
$Gold_{ij,t}$	0.0691**	0.0657**	0.0121	0.0127	0.0671**	0.0545*	
	(0.0272)	(0.0265)	(0.0172)	(0.0171)	(0.0273)	(0.0279)	
$SterlingBloc_{ij,t}$	0.129*	0.132*	0.0188	0.0204			
	(0.0722)	(0.0764)	(0.0506)	(0.0522)			
$IPS_{ij,t}$	0.202**	0.209**	0.327***	0.332***	0.271***		
	(0.0964)	(0.0943)	(0.0716)	(0.0718)	(0.0819)		
Observations	13,143	13,130	13,143	13,130	13,143	13,143	13,143
Asymetric Pair FE's	No	Yes	No	Yes	No	No	No
Time trend	No	No	Yes	Yes	No	No	No

Notes: All estimates are obtained with data for all years from 1925 to 1937, and use exporter-time, importer-time and pair fixed effects. The estimates of fixed effects are omitted for brevity. Robust standard errors, clustered by country pair, are in parentheses; *** p<0.01, ** p<0.05, * p<0.1

A.3 General Equilibrium Appendix

This section briefly explains the techniques used to calculate GE effects. A more detailed discussion is found in Yotov et al. (2016) or in the Stata code that accompanies this paper (available upon request).

After having implemented the two-stage procedure by Anderson and Yotov (2016) and having obtained the complete set of bilateral trade costs $\tau_{ij,1937}^{BLN}$, I estimate the gravity model in equation (2.3.1) as follows:

$$X_{ij,1937} = exp[\ln \tau_{ij,1937}^{BLN} + \gamma_i^{BLN} + \delta_j^{BLN}] \tag{A.3.1}$$

The estimates of the importer fixed effects (δ_j^{BLN}) and of the exporter fixed effects (γ_i^{BLN}) from the above estimation are used to construct the baseline multilateral resistances (MR):

$$[\hat{P}_j^{1-\sigma}]^{BLN} = \frac{E_j}{exp(\hat{\delta}_j^{BLN})} * \frac{1}{E_{DEU}} \tag{A.3.2}$$

$$[\hat{\Pi}_i^{1-\sigma}]^{BLN} = \frac{Y_i}{exp(\hat{\gamma}_i^{BLN})} * E_{DEU} \tag{A.3.3}$$

where, output is constructed as $Y_i = \sum_{j=1}^{N} X_{ij}$ and expenditure is calculated as $E_j = \sum_{i=1}^{N} X_{ij}$. E_{DEU} is expenditure of the reference country, Germany, for which the inward MR is normalized to one and the corresponding fixed effect δ_{DEU} is removed from regression (A.3.1). The predicted volume of trade from regression (A.3.1) is used to calculate country i's baseline trade volume ($\hat{X}_i = \sum_{j=1}^{N} \hat{X}_{ij}$ for all $j \neq i$). The computation for the counterfactual MRs and trade volumes is analogous.[12] The conditional GE effects are calculated as the difference, in percentage, between the baseline and the counterfactual trade volumes.

[12]Note that for the calculation of the counterfactual MRs the original data on output and expenditure is used. The conditional GE values of the MRs under the counterfactual scenario are then calculated analogous to equations (A.3.2) and (A.3.3) but use the fixed effects $\hat{\gamma}_i^{CF}$ and $\hat{\delta}_j^{CF}$ from estimating equation (2.3.9).

The full endowment GE effects are obtained by implementing a four-step iterative procedure. First, I use the market-clearing condition in (2.3.4) to translate the conditional GE effects on the multilateral resistance terms into first-order changes in factory-gate prices, by applying the definition of the estimated exporter fixed effects in equation (A.3.3):

$$\Delta p_i^{CF} = \frac{p_i^{CF}}{p_i} = \Big(\frac{exp(\hat{\gamma_i}^{CF})/E_{DEU}^{CF}}{exp(\hat{\gamma_i}^{BLN})/E_{DEU}} \Big)^{\frac{1}{1-\sigma}} \tag{A.3.4}$$

In the second step output and expenditure respond endogenously to the above change in factory gate prices: $Y_i^{CF} = (p_i^{CF}/p_i)Y_i^{BLN}$ and $E_j^{CF} = (p_j^{CF}/p_j)E_j^{BLN}$. This in turn will trigger additional changes in the multilateral resistance terms and so forth. The structural gravity equation (2.3.1) translates the changes in output and expenditure into changes in trade flows:

$$X_{ij,1937}^{CF} = \frac{(\tau_{ij,1937}^{CF})^{1-\sigma}}{(\tau_{ij,1937}^{BLN})^{1-\sigma}} * \frac{Y_i^{CF} E_j^{CF}}{Y_i^{BLN} E_j^{BLN}} * \frac{[\hat{\Pi}_i^{1-\sigma}]^{BLN}}{[\hat{\Pi}_i^{1-\sigma}]^{CF}} * \frac{[\hat{P}_j^{1-\sigma}]^{BLN}}{[\hat{P}_j^{1-\sigma}]^{CF}} * \hat{X}_{ij} \tag{A.3.5}$$

Equation (A.3.5) computes a counterfactual value of trade that accounts for changes in output and expenditure, via a change in the factory gate price, and changes in inward and outward multilateral resistances. Yet, these changes are only first-order changes, because they only capture the changes in the conditional outward multilateral resistances and the immediate response in the factory-gate prices.

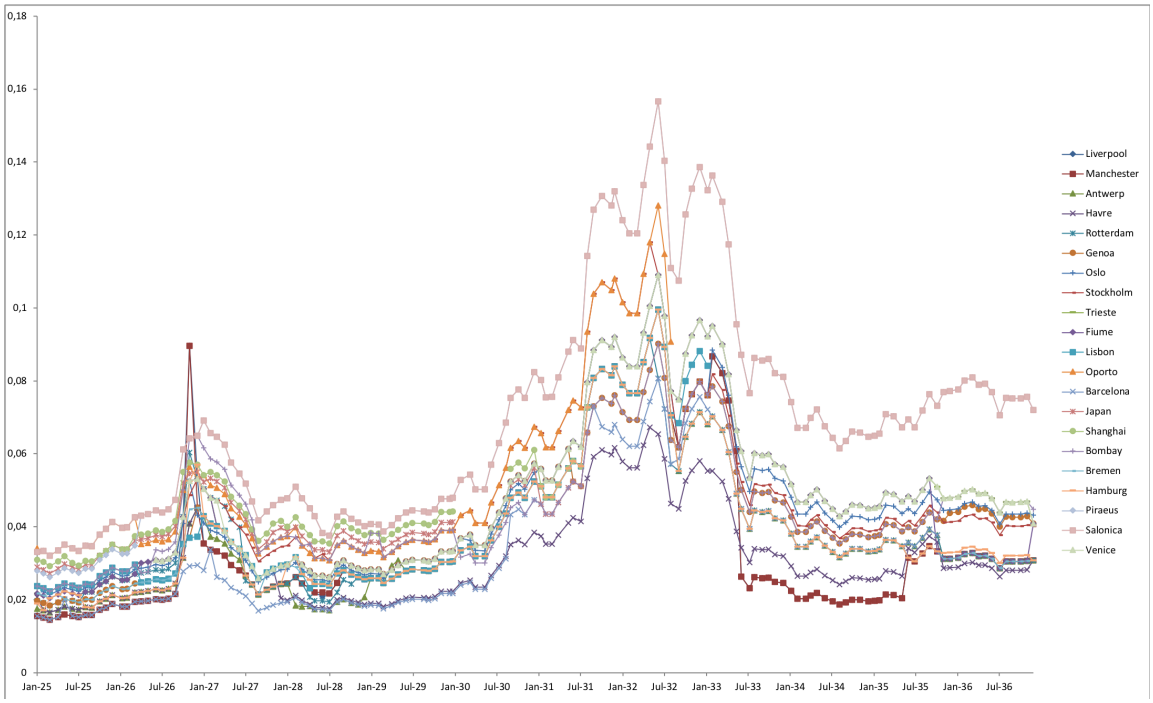
Hence, the third stage of the loop reestimates the gravity model (2.3.9) with the new value of bilateral trade, $X_{ij,1937}^{CF}$ from equation (A.3.5), and then computes the corresponding GE effects associated with the new fixed effect estimates. The idea is to update the value of bilateral trade to obtain additional responses in the multilateral resistances and in the values of output and expenditure. Once the new set of fixed effects associated with the new value of trade from equation (A.3.5) are estimated, the loop starts again at the first stage of the iterative procedure in order to obtain a new set of factory gate prices associ-

ated with these fixed effects. These three steps are repeated until the change in each of the factory gate prices is close to zero and the model has reached its new equilibrium. The difference in percentage between the baseline and the new equilibrium trade volumes yields the full endowment GE effect.

A.4 Transport Costs Appendix

Figure (A.2) plots the real freight rates of all 21 routes over time. In general, all routes move together, which is due to nominal freight rates changing very slowly and in tandem across routes. Most of the changes in real freight rates is then caused by the change in the price of cotton. This indicates that there has indeed been a significant degree of cartelization in the liner industry. As discussed above, tramp and liner shipping differ in their way of operation. Prices for tramp shipping are usually set in spot markets and tramps are hired on a charter basis. Liners run on fixed routes and fixed timetables, which makes the industry potentially more susceptible to cartelization. Indeed, the liner industry of the post-war period is organized into conferences, which discuss, and perhaps collude in, setting prices and market shares (Hummels, 2007).

Figure A.2: Cotton Ad-Valorem Freight Rates from New York to 21 Destinations



Notes: The graph shows cotton (American middling) freight rates for 21 routes deflated by the price at the place of origin (New York). *Sources*: The Commercial and Financial Chronicle (1925 - 1936) and Statistisches Reichsamt (1936).

Following Hummels (1999, 2007) and Estevadeordal et al. (2003) I can estimate the

Table A.6: Technology in the Interwar Liner Shipping Industry

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
VARIABLES	$\ln(f_{n,t})$	$\ln(f_{n,t})$	$\ln(f_{n,t})$	$\ln(f_{n,t})$	$\ln(f_{n,t})$	$\ln(f_{n,t})$
$\ln(Dist_{n,t})$	0.397***	0.499***	0.415***	0.467***	0.320***	0.440***
	(0.0374)	(0.0186)	(0.0482)	(0.0280)	(0.0436)	(0.0188)
Constant	-6.530***	-7.390***	-6.466***	-7.123***	-5.887***	-6.742***
	(0.312)	(0.164)	(0.401)	(0.240)	(0.363)	(0.164)
Observations	2,751	2,751	1,635	1,635	2,204	2,204
R-squared	0.039	0.778	0.043	0.697	0.024	0.829
Time Dummy	No	Yes	No	Yes	No	Yes
Years	All	All	1927-1929	1927-1929	1934-1936	1934-1936

Notes: The distance between New York and 21 port cities is taken from https://www.distance-cities.com/ Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

technological relationship between distance and transport costs with a simple OLS regression

$$\ln(f_{n,t}) = \alpha + \beta \ln(Dist_{n,t}) + D_t + \epsilon_{n,t} \tag{A.4.1}$$

where $f_{n,t}$ is the ad-valorem freight, $Dist_{n,t}$ is great circle distance between ports and D_t is an optional time dummy. Table (A.6) shows the regression results with and without time dummies for all years and for the pre and post-depression periods.

The coefficients on distance in column (1) and (2) are significantly larger than those obtained by Hummels (1999, 2007) for the post-war period, which one would expect given the technological improvements such as containerization.[13] When I estimate equation (A.4.1) for the period between May 1927 and May 1929 the elasticity of ocean transportation to distance is 0.415 (column (3)), but drops to 0.32 for the period May 1934 and May 1936. This drop is still apparent, although somewhat smaller when I include time fixed effects. This result suggests that, if anything, there was technological improvement in the shipping sector during the interwar period.

[13]Note, however, that Hummels (1999, 2007) includes a value to weight ratio in his regressions. This is not possible here, since I only consider one good.

APPENDIX B

CREDIT CONSTRAINTS AND THE PROPAGATION OF THE GERMAN GREAT DEPRESSION

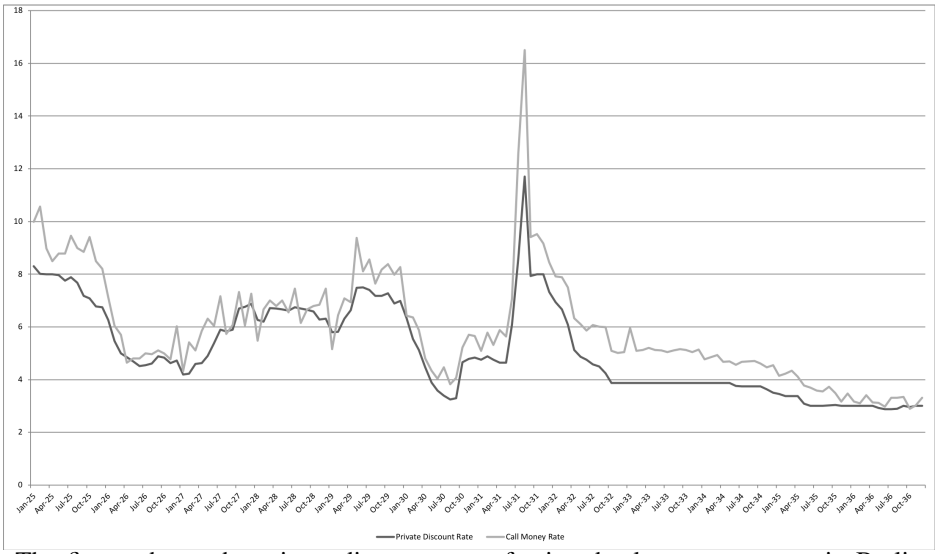
B.1 Data

Table B.1: Variable Descriptions and Data Sources

Variable	Description	Start	End	Source	Indicator
Ind Prod	Index of Industrial Production (1928=100)	1.1925	12.1934	Stat. Handb.	No. 10
Investment	Production of Investment goods (1928=100)	1.1925	12.1934	Konj. Stat. Handb. and Wochenbericht des Inst. f. Konjunkturforschung	No. 13
r	Call Money Rate *Tägliches Geld* (percent)	1.1925	12.1934	Stat. Handb.	No. 123
Credit	Advances *Debitoren* (Mio. RM)	1.1925	12.1934	Stat. Handb.	No. 133

SA: Seasonally Adjusted; Stat. Handb.: Statistisches Reichsamt (1936, 1937)

Figure B.1: Interest Rates in Germany

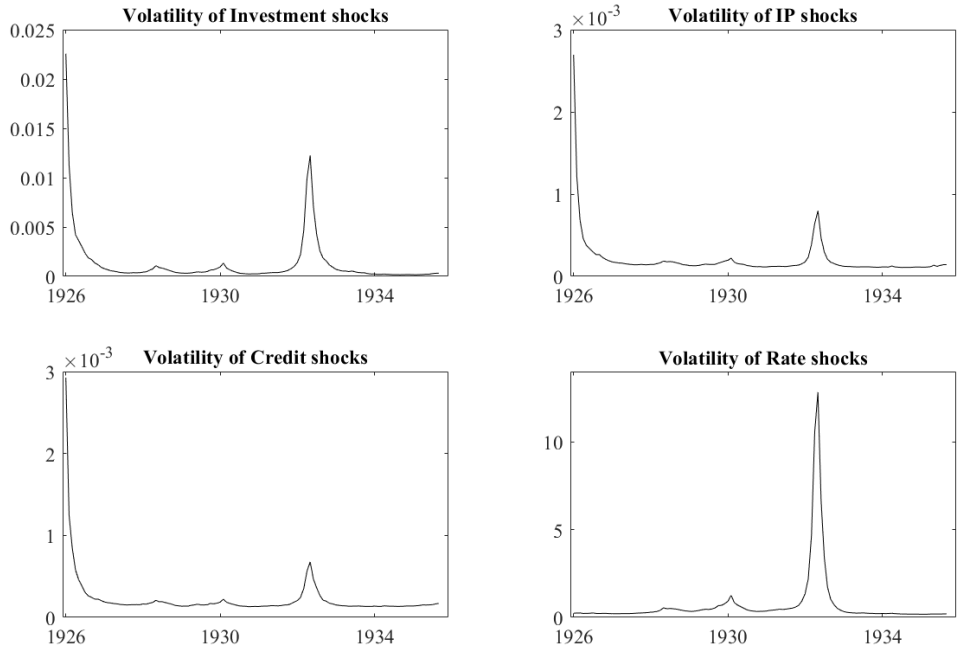


The figure shows the private discount rate of prime bankers acceptances in Berlin and the call money rate (Tägliches Geld). The series are taken from Statistisches Reichsamt (1936, 1937).

B.2 Stochastic Volatility

Figure B.2 demonstrates the importance of allowing

Figure B.2: Stochastic Volatility of Shocks



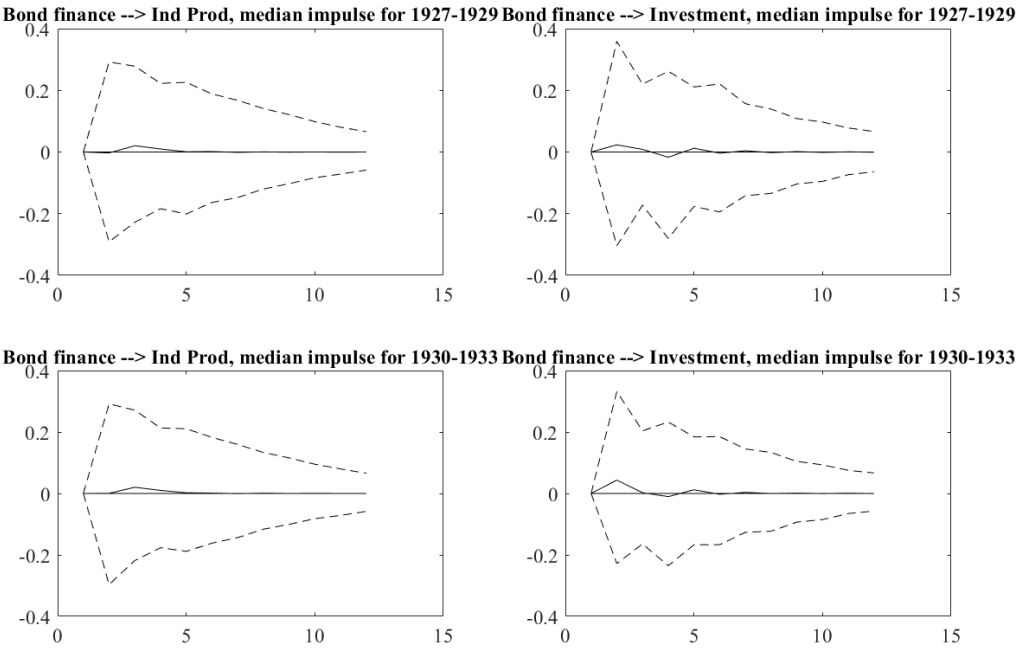
B.3 Robustness

B.3.1 Foreign Bond Issuance

Investment, as our literature review above suggest, may have been driven by factors pertaining to the financial markets more broadly as opposed to the banking system alone. Particularly, the reversal of international capital flows in 1930/31 is a likely factor that put severe strain companies that relied on long-term financing abroad (Accominotti and Eichengreen, 2016). To examine this, we test the robustness of our results using an indicator for market-based finance: the sum of domestic and foreign bond issuance (available in: Statistisches Reichsamt (1936)).

Our results presented above are robust to the inclusion of this variable. Figure B.3 shows that bond issuance did not meaningfully impact investment or industrial production, whereas figure B.4 shows that the impact of bank credit shocks on investment and industrial production remain significant after bond finance is included in the VAR-specification.[1] This reinforces our argument that bank credit was an important driver of macroeconomic conditions in Germany during the period at issue.

Figure B.3: Impulse Responses of Industrial Production and Investment from Bond Issuance



B.3.2 Alternative Investment Series

We experimented with using domestic orders of new machinery as an alternative indicator for domestic investment. As figure B.5 shows, the result of credit constraints being important is significant, although the response of the alternative indicator is meaningfully larger.

[1]The VAR retains the same lag structure as used above

Figure B.4: Impulse Responses of Industrial Production and Investment from Loans Controlling for Bond Issuance

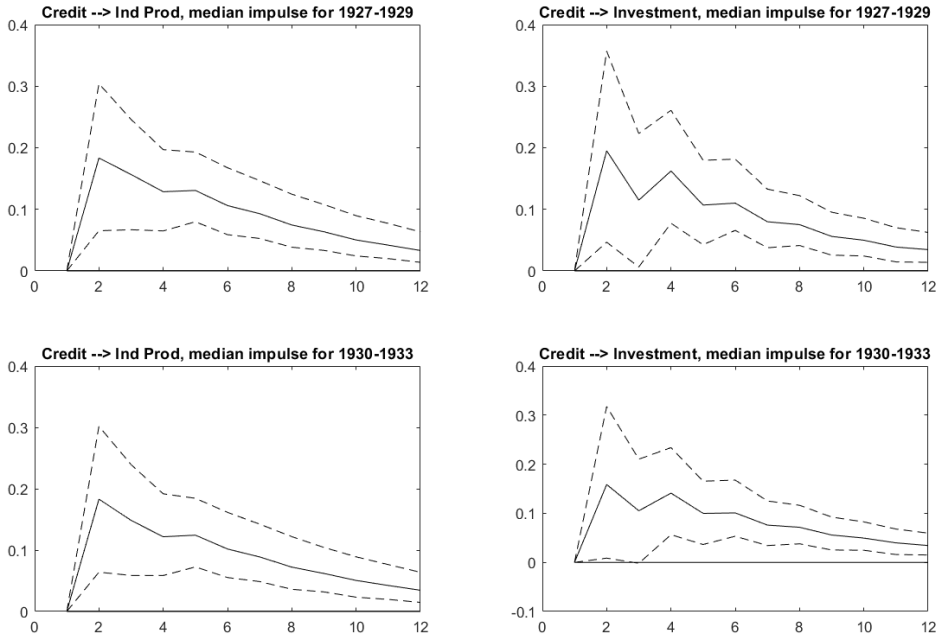
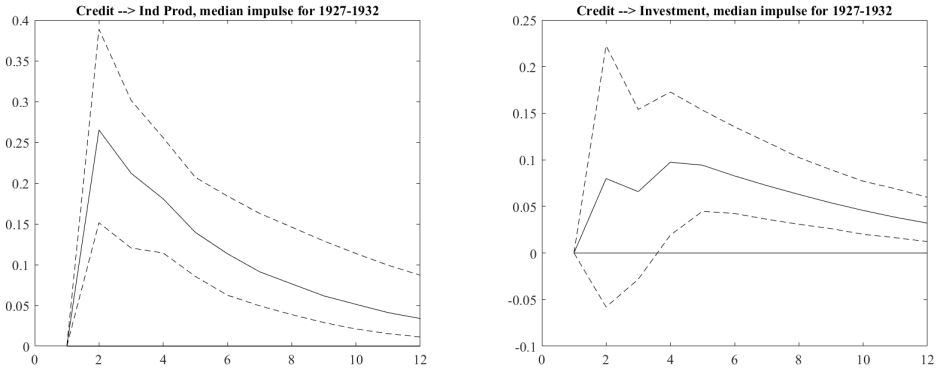


Figure B.5: Impulse Responses of Industrial Production and Investment from Loans with Alternative Investment Indicator



B.4 Priors

Bayesian priors are a convenient way to provide some degree of restriction to what values the parameters can take. In a time-varying model they are particularly important, because they also determine the amount of time-variance that can take place (Primiceri, 2005).

The priors of the parameters in the TVP-VAR with data-based priors specified can be outlined as follows

Define $\boldsymbol{x}_t = [1, y_{t-1}..., y_{t-p}]'$ and $\boldsymbol{z}_t = \boldsymbol{I}_n \otimes \boldsymbol{x}_t$. We then separate $\boldsymbol{z}_t\boldsymbol{\beta}_t$ such that: $\boldsymbol{z}_t\boldsymbol{\beta}_t = \boldsymbol{z}_t\boldsymbol{\alpha} + \boldsymbol{z}_t\boldsymbol{\alpha}_t + \boldsymbol{\epsilon}_t$. In this way, $\boldsymbol{\beta}_t$ is separated into a time-varying and time-invariant part. Define also $\kappa = N\rho + 1$, the number of parameters.

A part of the estimation algorithm therefore differs from the Primiceri (2005) one in that we sample $\boldsymbol{\beta}_t$ in two steps: the constant and time-varying part. Start with the time-invariant part:

1. We first draw $\boldsymbol{\alpha} \sim N(\bar{\boldsymbol{a}}, \bar{\boldsymbol{V}}_\alpha)$, with $\bar{\boldsymbol{\alpha}} = \bar{\boldsymbol{V}}_{\boldsymbol{\alpha}}(\sum_t \boldsymbol{z}_t\boldsymbol{\Omega}_t^{-1}\boldsymbol{y}_t^*)$; $\bar{\boldsymbol{V}}_\alpha = (\boldsymbol{V} + \sum_t \boldsymbol{z}_t\boldsymbol{\Omega}_t^{-1}\boldsymbol{z}_t)$, $\boldsymbol{V} = diag(\tau_1..., \tau_m)$ and $\boldsymbol{y}_t^* = \boldsymbol{y}_t - \boldsymbol{z}_t^{'}\boldsymbol{\alpha}_t$

2. Sample τ_i that do not refer to intercepts (these are set to 2): $\tau_i \sim IG(\rho_{i1}, \rho_{i2})$. We set $\rho_{1i} = \kappa_1 + 0.5$; $\rho_{2i} = 0.5 \times \ \alpha_i^2 + \kappa_2$.

3. Sample $\boldsymbol{\alpha}_t$ using Carter-Kohn algorithm, where the initial condition $\boldsymbol{\alpha}_0$ is set to zero.

4. Sample $Q \sim IW(\kappa + 1, 0.01 \times \boldsymbol{V})$

Where $N(\cdot)$, $IW(\cdot)$ and $IG(\cdot)$ denote the normal, inverse Wishart and inverse gamma distributions, respectively. The estimation algorithm is as in Primiceri (2005) after $\boldsymbol{\beta} = \boldsymbol{\alpha} + \boldsymbol{\alpha}_t$ and $\boldsymbol{Q}$ have been sampled. See Korobilis (2014) for details.

With these definitions, the priors of the model can then be summarised as follows:

$$\boldsymbol{\alpha}_0 \sim N(\bar{\boldsymbol{a}}, \bar{\boldsymbol{V}}_{\boldsymbol{\alpha}}) \; where \tag{B.4.1}$$

$$\bar{\boldsymbol{\alpha}} = \bar{\boldsymbol{V}}_{\alpha}(\sum_t \boldsymbol{z}_t \boldsymbol{\Omega}_t^{-1} \boldsymbol{y}_t^*) \; ; \; \bar{\boldsymbol{V}}_{\boldsymbol{\alpha}} = (\boldsymbol{V} + \sum_t \boldsymbol{z}_t \boldsymbol{\Omega}_t^{-1} \boldsymbol{z}_t) \; ; \tag{B.4.2}$$

$$\boldsymbol{V} = diag(\tau_1 ..., \tau_m) \; and \; \boldsymbol{y}_t^* = \boldsymbol{y}_t - \boldsymbol{z}_t^{'} \boldsymbol{\alpha}_t \tag{B.4.3}$$

$$\tau_i \sim IG(\rho_{1i}, \rho_{2i}) \; where \tag{B.4.4}$$

$$\rho_{1i} = \kappa_1 + 0.5; \; \rho_{2i} = 0.5 \times \; \alpha_i^2 + \kappa_2 \tag{B.4.5}$$

$$\boldsymbol{Q} \sim IW(\kappa + 1, 0.01 \times \boldsymbol{V}) \tag{B.4.6}$$

$$\boldsymbol{H}_0 \sim N(\hat{\boldsymbol{H}}_0, c_h \cdot \boldsymbol{I}_N) \tag{B.4.7}$$

$$\boldsymbol{A}_0 \sim N(\hat{\boldsymbol{A}}_0, c_a \cdot V(\hat{\boldsymbol{A}}_0)) \tag{B.4.8}$$

$$\boldsymbol{W} \sim IW(k_W^2 \cdot N, \boldsymbol{I}_N) \tag{B.4.9}$$

$$\boldsymbol{S}_i \sim IW(k_S^2 \cdot (i+1) \cdot V(\boldsymbol{S}_{prior}), (i+1)) \tag{B.4.10}$$

The other underlying parameters to be estimated are outlined in section 4.4. Here, S_i is the *i*th row of matrix S. S is block diagonal such that: $S_1 = s_1; \; S_2 = [s_2, s_3]$ and so on. W is a diagonal matrix with elements w_i.

For the data-based prior for τ_i, we set $\kappa_1 = 1$ and $\kappa_2 = 20$. As for the other priors, we use fairly uninformative values: $\bar{\boldsymbol{a}} = 0$; $V(\hat{\boldsymbol{A}}_0) = \boldsymbol{I}_N$; and $V(\boldsymbol{S}_{prior}) = \boldsymbol{I}_N$. The other priors are also consistent with the TVP-VAR literature. They are specified as follows: $k_S = 0.1$; $k_W = 0.01$; $c_a = 4$ and $c_h = 4$ (Primiceri, 2005).

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SUMMARY

This dissertation consists of three essays that deal with trade and finance in the interwar period. The first essay estimates the individual contributions of different trade costs to the collapse of world trade during the 1930s. The second essay narrates the early history of the Federal Reserve System and its relation to the market for bankers' acceptances. The third essay estimates the impact of loan supply shocks to output dynamics during the Great Depression in Germany.

The first of three essays — **Chapter 2: Return of the Tariffs: The Interwar Trade Collapse Revisited** — examines the causes of interwar trade collapse. Was the collapse of world trade between 1928 and 1937 caused by higher transport costs, increased protectionism or the collapse of the gold standard? Using recent advances in the estimation of gravity equations, I examine the partial and general equilibrium effects of bilateral distance, international borders, and the payment system on trade. My results suggest that had average tariff and non-tariff trade barriers remained at their 1928 level, total international trade would have been 64.6% higher in 1937. Had the gold standard not collapsed in 1931 and had the British Empire not departed to establish its own currency and trade blocs, international trade would have been 3% larger. Finally, had transport costs remained at their 1928 level, global trade would not have been significantly different nine years on. These results are supported by over 6,000 new hand-collected observations of ad-valorem ocean freight rates for cotton, which show an average increase of only 1.2 percentage points between 1928 and 1936. When expressed as an index, the movement of freight rates mirrors the evolution of the elasticity of trade to distance over the period.

The essay — **Chapter 3: Liquidating Bankers' Acceptances: International Crisis, Doctrinal Conflict and American Exceptionalism in the Federal Reserve 1913-1932** — seeks to explain the collapse of the market for bankers' acceptances between 1931 and 1932 by tracing the doctrinal foundations of Federal Reserve policy and regulations back

to the Federal Reserve Act of 1913. I argue that a determinant of the collapse of the market was Carter Glass' and Henry P. Willis' insistence on one specific interpretation of the "real bills doctrine", the idea that the financial system should be organized around commercial bills. The Glass-Willis doctrine, which stressed non-intervention and the self-liquidating nature of real bills, created doubts about the eligibility of frozen acceptances for purchase and rediscount at the Reserve Banks and caused accepting banks to curtail their supply to the market. The Glass-Willis doctrine is embedded in a broader historical narrative that links Woodrow Wilson's approach to foreign policy with the collapse of the international order in 1931.

The third essay — **Chapter 4: Credit Constraints and the Propagation of the German Great Depression** — is a joint project with Walter Jansson (Bank of England). We evaluate the contribution of exogenous loan supply shocks to output and investment dynamics during the Great Depression in Germany. Based on a time varying vector autoregression, we identify loan supply shocks in addition to standard macroeconomic shocks. Our results indicate that the whole period between 1927 and 1932 was associated with credit constraints, supporting the view that a structurally weak banking sector was was an important contributor to the German Great Depression.

Zusammenfassung

Die vorliegende kumulative Dissertation besteht aus drei Forschungsaufsätzen. Der erste Aufsatz schätzt die individuellen Auswirkungen von verschiedenen Handelskosten während der Zwischenkriegszeit. Der zweite Aufsatz befasst sich mit der frühen Geschichte der U.S.-Notenbank und ihrem Verhältnis zum Markt von Bankakzepten. Der dritte Aufsatz untersucht die Auswirkung von exogenen Kreditangebotsschocks auf die Produktion während der Großen Depression in Deutschland.

Der erste Aufsatz — **Kapitel 2: Return of the Tariffs: The Interwar Trade Collapse Revisited** — untersucht die Ursachen des Einbruchs des Welthandelsvolumens. Wurde der Zusammenbruch des Welthandels zwischen 1928 und 1937 durch höhere Transportkosten, stärkeren Protektionismus oder den Zusammenbruch des Goldstandards verursacht? Mit Hilfe neuer Fortschritte in der Schätzung von Gravitationsgleichungen untersuche ich die partialen und allgemeinen Gleichgewichtseffekte von bilateraler Distanz, internationalen Grenzen, und dem Zahlungssystem auf den Handel. Meine Ergebnisse zeigen, dass der internationale Handel 1937 64.6% größer gewesen wäre, wenn Zölle und nichttarifäre Handelshemmnisse auf dem Niveau von 1928 verblieben wären. Wäre der Goldstandard 1931 nicht aufgelöst worden und hätte sich Großbritannien nicht seinem eigenem Handels- und Währungsblock zugewandt, der Welthandel wäre 3% größer gewesen. Hätten hingegen die Transportkosten auf dem Niveau von 1928 verharrt, hätte sich der internationale Handel nicht signifikant verändert. Diese Ergebnisse werden durch über 6,000 neue, von Hand gesammelte Beobachtungen von ad-valorem Frachtkosten von Baumwolle unterstützt, die zwischen 1928 und 1936 einen durchschnittlichen Anstieg von lediglich 1,2 Prozentpunkten aufzeigen. Werden die Frachtkosten als Index dargestellt, so spiegeln sie die Evolution der Elastizität der bilateralen Distanz wieder.

Der zweite Aufsatz — **Kapitel 3: Liquidating Bankers' Acceptances: International Crisis, Doctrinal Conflict and American Exceptionalism in the Federal Reserve 1913-**

1932 — untersucht den Zusammenbruch des Marktes für Bankakzepte zwischen 1931 und 1932 mit Hinblick auf die Politik und Regulierungen der Federal Reserve und die doktrinären Fundamente des Federal Reserve Acts von 1913. Ich argumentiere, dass das Beharren von Carter Glass und Henry P. Willis auf eine strikten Auslegung der Real Bills Doktrin, nach welcher sich Zentralbankpolitik auf reine Warenwechsel fokussieren sollte, zum Zusammenbruch des Marktes beigetragen hat. Die Glass-Willis Doktrin, welche auf Zurückhaltung der Notenbank und auf die selbst-liquidierende Eigenschaft von Wechseln bestand, nährte Zweifel an der Legitimität der Zentralbank eingefrorene Wechseln zu kaufen oder zu rediskontieren. Die Glass-Willis Doktrin wird dabei in ein breiteres historisches Narrativ eingefügt, welches den außenpolitischen Ansatz von Woodrow Wilson mit dem Zusammenbruch der internationalen Ordnung um 1931 in Verbindung setzt.

Der dritte Aufsatz — **Kapitel 4: Credit Constraints and the Propagation of the German Great Depression**— ist ein Gemeinschaftsprojekt mit Walter Jansson (Bank of England). Wir untersuchen die Auswirkung von exogenen Kreditangebotsschocks auf Industrieproduktion und Investitionen während der Großen Depression in Deutschland. Anhand eines zeitlich variierenden Vektorautoregressionsmodells identifizieren wir Kreditangebotsschocks zusätzlich zu standardmäßigen makroökonomischen Schocks. Unsere Ergebnisse legen nahe, dass die gesamte Untersuchungsperiode von 1927 bis 1932 mit Kreditklemmen in Verbindung gebracht werden kann. Dieses Ergebnis impliziert, dass ein strukturell schwacher deutscher Bankensektor ein wichtiger Faktor in der Großen Depression war.

Ehrenwörtliche Erklärung

Hiermit erkläre ich, Marc Christopher Adam, dass ich die vorliegende Dissertation selbständig verfasst und alle Quellen ordnungsgemäß gekennzeichnet habe.

Ich versichere, dass die Dissertation nicht bereits in einem früheren Promotionsverfahren angenommen oder als ungenügend beurteilt wurde.

Berlin, 27. August 2019