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THE RISE AND FALL OF WORLD TRADE, 1870–1939

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ABSTRACT

Measured by the ratio of trade to output, the period 1870–1913 marked the birth of the first era of trade globalization and the period 1914–39 its death. What caused the boom and bust? We use an augmented gravity model to examine the gold standard, tariffs, and transport costs as determinants of trade. Until 1913 the rise of the gold standard and the fall in transport costs were the main trade-creating forces. As of 1929 the reversal was driven by higher transport costs. In the 1930s, the final collapse of the gold standard drove trade volumes even lower.

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I. INTRODUCTION

Most observers claim the world has gotten smaller, but few can agree on exactly how, why, and when. The debate over globalization has been particularly lively when it comes to explaining the causes and consequences of the growth of world trade in the postwar period. Yet seen on a grand time scale, this is only one episode—it is not the first world trade boom, nor, if the past is any guide, is it guaranteed to persist and not become a bust. This paper attempts to make a distinctive contribution to this debate by looking to history to draw lessons for the present. Figure I sets out our *explicandum*, the rise and fall of world trade-output ratios from 1870 to 1939, set in the broader context of trade trends for the last five centuries.[1] Notwithstanding the fact that the data before 1870 are decidedly fuzzy (and are shown thus) we can clearly see that the period from 1870 to 1939 was a genuine break from the past, the first ever rise in the trade ratio to modern levels, followed by an abrupt collapse. Why was the trade boom from 1870 to 1913 followed by a trade bust from 1913 to 1939? Could a similar fate await us today given fears of a globalization backlash? We would be better able to address the latter question if we could first answer the former, since we might then have a sense of the different threats to world trade, and how much damage each might do, based on the only laboratory at our disposal: the demise of last age of globalization.

At the risk of oversimplification, the conventional textbook account of the boom and bust goes as follows. From circa 1800 to 1914, world trade volumes increased by a factor of about twenty and by a factor of ten relative to world output.[2] The big surge in international economic integration came late in the century as the pace of integration in all markets accelerated after 1870, a trend often associated with dramatic declines in transport costs.[3] The interwar period then stood in marked contrast to its predecessor. Although economic growth continued, the century-long trade boom ground to a halt, and even reversed. A frequently blamed culprit is protectionism, which grew in the 1920s and then peaked in the Depression years.[4]

While this conventional account is based on rich historical narratives, their quantitative foundations are surprisingly weak. To our knowledge, there exists no empirical study that might

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[1] Economic historians have been reminding us that the globalization of trade began in the mid-nineteenth century [O'Rourke and Williamson 1999]. By introducing evidence on price movements, their convergence and correlation, this work points to minimal market integration before 1800 [O'Rourke and Williamson 2002ab].

[2] To those familiar with the long run evidence on trade-output ratios, this comes as no surprise, as goods trade was so small in centuries past. This aggregate view leaves unmoved world historians in the school of Braudel. Like him they could protest that "every time the volume of a leading sector is compared to the total volume of the whole economy, the larger picture reduces the exception to more modest or even insignificant proportions. I am not entirely convinced" [Braudel 1992, vol. 2, p. 453]. One might respond that even if certain goods, locations, companies, and traders enjoyed boom times, globalization requires more than a few of these "exceptions."

[3] In other markets, international migration had become largely free, and numbers increased from a few thousand per year to around a million. International capital markets had become ever more integrated and the flows and stocks of foreign capital had greatly multiplied [Obstfeld and Taylor 2003ab; O'Rourke and Williamson 1999].

[4] See in particular the classic works by Kindleberger [1986; 1989]. In other world markets, migration slowed as receiving countries like the U.S. erected barriers to entry. International investment was discouraged by explicit capital controls and by currency uncertainty [Obstfeld and Taylor 2003ab; O'Rourke and Williamson 1999].

confirm, or overturn, the conventional account. We therefore attempt the first quantitative explanation of the evolution of world trade volumes over the entire period 1870–1939.[5] We go beyond previous research that has looked at particular countries and sub-periods; our focus is *total* world trade. Our empirical strategy draws on the most successful model for explaining trade patterns, the gravity equation, and incorporates some of the more recent theoretical and empirical advances related to it.[6] Having substantiated the model's fit, robustness, and other statistical properties, we then go on to explore its quantitative implications by running the critical "horse race." Unlike other studies that have examined various frictions and their impact on trade one at a time, we seek to measure the relative importance of different potential explanatory sources of changing trade volumes over a span of many decades in a unified model.

We find that, controlling for changes in the scale of world economic activity, we can explain most of the rise and fall of world trade. In contrast to traditional explanations that focus only on obvious goods markets frictions, such as transport costs and commercial policy, we find that a large part of the change in trade volumes can be explained by a "common currency" effect, related to the rise and fall of the gold standard. Tariffs seem to have played a minimal role before 1914 but they mattered more after 1914 when policies became more activist. Transport costs on maritime routes played a big role in both boom and bust: they fell dramatically before 1914, as is well known, but they then rose steeply up to 1939—a lesser known fact, but one that we can document, and that we think is attributable to a combination of technological change and restrictive cartel and labor practices.

Our conclusions offer important new perspectives on the obstacles that might confront the current wave of globalization. It is important not to see transport frictions as on a never-ending downward trend; as the interwar period shows, this is not inevitable, and we discuss the reasons for this finding. We also find that it is essential to focus not just on conventional commercial policy frictions, such as tariffs. Equally important barriers to trade arise from the payments frictions associated with the currency regime. This is an important lesson from history at a time when debates over further trade liberalization at regional and multilateral levels intersect with strong differences of opinion over the costs and benefits of floating, fixing, and unifying currencies.

II. MODELING TRADE WITH FRICTIONS

We approach the historical analysis from a contemporary perspective. As Bayoumi and Eichengreen [1997] noted, the workhorse for empirical studies on the pattern of trade has been the gravity model, which was widely used even though it was not until the 1980s that it gained rigorous theoretical underpinnings [Anderson 1979; Bergstrand 1985; Helpman and Krugman 1985]. Thanks to these and other modeling refinements and their application to debates on the

[5] A very distant relative is the study by Maizels [1963], which surfaces in economic history texts today. Covering only trade in manufactures, it is more of an accounting type of exercise and eschews formal trade theory.

[6] See some contemporary exercises in Feenstra [1998] and Baier and Bergstrand [2001].

growth of international trade, the gravity model has established itself as a serious empirical tool [Evenett and Keller 2002]. Its main use has been to sort out the relative importance of geographical factors versus policy factors. Among the former, the favorite explanation has to do with technology-driven declines in transportation costs shortening the "effective" distance between countries; among the policy explanations, the favorite candidates are the reductions in policy frictions such as trade barriers or exchange rate volatility. We review each briefly.

While it is uncontroversial to claim that trade liberalization or falling transport costs or reduced exchange rate volatility are important drivers of trade booms, few efforts have been made to estimate the relative magnitudes of each for the postwar period, and none in the late nineteenth century. One exception by Baier and Bergstrand [2001] attempted to decompose the growth in OECD trade from the late 1950s to the late 1980s and found that income growth explains about 67 percent, tariff reductions about 25 percent, and transport-cost declines about 8 percent of postwar trade growth.[7] The relatively minor impact of transport costs accords with Hummels's [1999] finding that ocean freight rates have not declined much in the postwar era—in itself a surprising fact that deserves more attention.[8] Interestingly, this fact resonates with one of our revisionist findings: that much of the interwar trade collapse stemmed from the emergence of relatively high transport costs as early as the 1920s and 1930s.

Our paper adopts a unified approach to the decomposition of the sources of trade shifts, an approach we think preferable to most empirical work. In works where frictions are analyzed, and counterfactuals examined, one at a time, a balanced view of the various forces is hard to piece together. What is the accepted wisdom? With respect to commercial policy frictions, the literature on the effects of tariffs and trade agreements on trade is not as large as one would expect. Linnemann and Verbruggen [1991], Tamirisa [1999], Di Mauro [2000], and Estevadeordal and Robertson [2002] are some of the few examples that explicitly incorporate direct tariff measures into a gravity model. The rest of the literature has mostly explored the effects of preferential trade agreements on trade via the inclusion of dummy variables for trade agreements.[9] The effects of being member of a free trade area on trade are sometimes found to be large, but the results are by no means consistent [Frankel 1997, Baier and Bergstrand 2002; Rose 2002].

The empirical literature on the effects of exchange rate volatility on trade has not yielded conclusive results. While some find negative effects of volatility on trade, the effects are generally quite small, have decreased over time, and their significance varies considerably

[7] They also find that income convergence among their sample of OECD countries explains virtually none of their measured growth in trade from the late 1950s to the late 1980s.

[8] Despite the growing importance of air transport, whose costs have fallen over time, Hummels [1999, p. 4] notes that a body of work investigating the relative importance of tariffs and transportation costs in trade consistently finds "that transport costs pose a barrier at least as large, and frequently larger than tariffs." Limão and Venables [2001] show, the quality of infrastructure is an important determinant of transport costs. They estimate that poor infrastructure accounts for about 40 percent of predicted transport costs for coastal countries and as much as 60 percent for landlocked countries.

[9] Also, there is a large literature based on computable general equilibrium (CGE) models that estimates the impact of trade liberalization, including scenarios of regional trade agreements, on trade that we do not review here.

depending on the study in question.[10] Frankel and Wei [1993], for example, find significant negative effects from 1965 through 1980, but the effect disappears in more recent periods, perhaps due to the appearance of hedging instruments. In the case of developing countries, however, such hedging markets may be very illiquid or nonexistent. This is relevant for us, since one might expect to see these effects matter more not only in developing countries but also in more distant historical periods.[11]

However, some monetary regime choices do seem to matter. Dozens of studies have drawn attention to the potential impact of currency unions on international trade patterns starting with Rose [2000], who found that countries sharing the same currency traded over three times as much during the period 1970–90 as countries with different currencies, holding other factors constant.[12]. The effects of joining a currency union go beyond the reduction, or even elimination, of exchange rate volatility. Currency unions eliminate transaction costs arising from the need to operate with multiple currencies, a feature not captured by previous studies on exchange rate volatility. Still, it would be a mistake to think that the formation of currency unions had much, if anything, to do with the dramatic growth in postwar trade. Unlike the twelve members of the recently conceived European Monetary Union (EMU), many of the currency unions Rose studied involved countries that were small, poor, or both, and they accounted for a very small share of world trade.[13] He therefore cautioned against extrapolating his general result to the EMU countries and other similarly advanced economies.[14]

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[10] For a survey of this literature, see Edison and Melvin [1990]. Out of 12 studies examined by these authors, six find negative and significant effects, five have inconclusive results, and one finds effects that are positive and significant.

[11] Estevadeordal, Frantz, and Sáez [2001] and Panizza, Stein, and Talvi [2002] find that the effects of exchange rate volatility on bilateral trade are positive for industrial countries, although generally not significant. In the case of developing countries, the effect of exchange rate volatility is negative and significant, and has no declining trend.

[12] His results are robust to changes in the sample of countries, the definition of a common currency, the measure of exchange rate volatility, and the measure of distance, as well as the inclusion of possibly omitted variables and the use of different estimation techniques.

[13] Examples include African economies in the CFA franc zone and Caribbean economies in an analogous currency zone. Rose also considered all countries, dependencies, territories, overseas departments, colonies, etc., for which the U.N. Statistical Office collects trade data. For simplicity, he refers to all of these as “countries.”

[14] In fact, one of the ambiguities that has prompted criticism of Rose’s study is whether his results are due to these particular country characteristics, which might make country pairs likely to trade disproportionately with one another and which may not be adequately controlled for. Utilizing different methodologies, two studies have attempted to control for such characteristics. Persson [2001] uses a matching technique, borrowed from the labor literature, in which the monetary union (“treated”) observations are matched to control observations, which are as likely as the treated observations to be involved in monetary unions. His results point to a much smaller effect (approximately a 66 percent increase in trade), though some might argue that this effect is still quantitatively pretty large. Glick and Rose [2002] use panel data with fixed effects, exploiting those country pairs that altered their monetary union status during the sample period, and find that currency unions effectively double trade. While such methods may be useful for controlling for characteristics that make a country pair more likely to enter a currency union, in both cases the answer provided is indicative of the probable effects of currency unions on trade only for countries exhibiting such characteristics. It remains unclear whether these results can be extrapolated to alternate country pairs. On the endogeneity issue, Alesina, Barro, and Tenreyro [2002] explore additional potential benefits besides an increase in international trade from entering into a currency union. See also Rose and Engel [2002], Frankel and Rose [2002], and Rose and van Wincoop [2001].

Given these shortcomings in contemporary studies, a more fruitful testing ground for exploring the effects of different frictions on trade might be the historical epoch of late nineteenth and early twentieth centuries. This period surely meets any requirement for adequate variability in the data: first, because of the magnitude of the boom and bust of world trade compared to the postwar experience, our left-hand side variable; second, because of the volatility in the "frictions", our right-hand side variables. This period witnessed the formation of the largest currency arrangement in history, the gold standard, arguably a better laboratory in which to examine the impact of payments frictions on larger economies—and the world as a whole—as compared to the Rose sample. In addition, there was a spectacular decline in transport costs prior to 1914 due to the revolutionary technologies in transportation and communications introduced throughout the nineteenth century. Finally, this was a period with stable low tariffs up to 1914 and very volatile tariffs thereafter, a traditional force behind the explanations of contemporary trade expansion.

Our task is to sort out these different forces, and we find few precedents in the literature. In one pioneering study, Eichengreen and Irwin [1995] analyzed the extent to which trade blocs and currency arrangements were responsible for the changing patterns of trade observed in the 1930s among 34 developed and developing countries. Looking at the interwar period only, in the years 1928, 1935, and 1938, they found that trade bloc membership increased trade, exchange rate volatility slightly reduced trade, but being on a similar monetary regime, i.e., the gold standard, played no conclusive role in explaining trade patterns. Their results also indicated that any beneficial effects of exchange rate stability on trade among the members of a residual gold bloc were neutralized by the trade restrictions they imposed in the face of increasingly overvalued exchange rates.

However, extremely recent work does find an impact of the gold standard on trade. A paper written contemporaneously by López-Córdova and Meissner [forthcoming] examines the period 1870–1910 and finds that being on the gold standard had a large effect on trade flows. Specifically, their results from a quinquennial panel indicate that two countries on gold would trade 60 percent more with each other than they would with countries on different monetary standards. In addition, they estimate that a monetary union would more than double bilateral trade flows. Yet another contemporaneous paper by Flandreau and Maurel [2001], using an annual panel, reaches similar conclusions. However, neither paper uses these findings to decompose the changes in trade volumes over time.

Our distinct contribution to this literature is twofold. First, we present evidence that spans both the pre-1914 and interwar periods to examine the stability and statistical significance of these estimated effects over a longer period. Second, we go beyond the tests of statistical significance in these other studies, and try to assess the broader quantitative significance of the results by running the critical "horse race." We compare the contributions of gold-standard effects, that is, *payments frictions*, with shocks to *policy frictions* and *transport frictions* to measure the relative importance of each and thus piece together a more complete account of the global trade boom and bust from 1870 to 1939.

III. THE *EXPLICANDUM* AND THE CONVENTIONAL WISDOM

The volume of world trade grew at a rapid and unprecedented pace in the nineteenth century. The conventional textbook estimates state that the ratio of trade to output increased by a factor of roughly 11 from 1800 to 1913. Defining trade volume as the sum of exports and imports, we find this measure stood at approximately 22 percent in 1913, leading one to infer that in 1800 trade volumes were no greater than a mere 2 percent of output, an order of magnitude smaller, though as Figure I shows there is considerable uncertainty about trade ratios circa 1800 [cf. Cameron 1993, p. 275; Kenwood and Lougheed 1999, p. 79].[15]

Textbook discussions of the interwar period strike a very different tone. As Lewis [1949, p. 139] notes, "production and the standard of living rose, but unemployment, prices and international trade caused uneasiness throughout the period." In each decade from 1881 to 1913 trade per capita had grown on average 34 percent, but it grew at an almost negligible rate of 3 percent per decade from 1913 to 1937. In both periods output and population were rising, but in the interwar period trade volumes did not keep up. Only in the late 1920s was this trend briefly reversed before a deep plunge during the Great Depression [Foreman-Peck 1995, p. 200; Kenwood and Lougheed 1999, p. 211].

These figures from various established secondary sources are presented here for illustration, but they can be corroborated. Our own newly-assembled data span 56 countries on an annual basis for the period 1870 to 1939, and measure the bulk of world trade. Figure I has already shown our detailed annual series on world trade volumes, and as far as the rise and fall of trade over the period, our data tell a story that is completely in accord with all textbook descriptions: a rapid rise to 1913 followed by stability, even decline.

Having no quarrel about the stylized facts, our aim is instead to critically examine—and, we might claim, substantially revise—the conventional narrative, by which we mean the traditional, textbook explanations put forth to account for the rise and fall of trade from 1870 to 1939. A review of the literature reveals that the boom-and-bust story of world trade from 1820 to 1939 is commonly told as a story in three parts, with a strong emphasis throughout on only two factors—transport costs and commercial policy.

- In the first phase, which predates our study, from the end of the Napoleonic Wars circa 1820 to about 1870, the spread of free-trade ideology is emphasized, as is the decline in transport costs. The revolution in commercial policy began with Britain's move to free trade in the 1840s, most notably with the repeal of the Corn Laws, the Anglo-French Cobden-Chevalier Treaty of 1860, and the ensuing network of similar treaties that enveloped the whole of Europe [Kenwood and Lougheed 1999, p. 90]. A new age of liberalism in economic policy began, despite a mildly protectionist backlash in some European countries that was to surface

[15] Growth of trade was by no means even, but it progressed steadily upwards. It appears that the most rapid sub-period of growth occurred from the early 1840s to circa 1873, when volumes rose at 6 percent annually, five times faster than population, and three times faster than output. There was some slowdown in the subsequent two decades, but in the years 1893–1913 again the growth rate picked up to about 4.5 percent per annum. Over the period as a whole, volumes probably grew on average at about 3 percent annually, a rate similar to that seen in the entire twentieth century [Cameron 1993, pp. 275, 280, 283].

in the 1870s [Cameron 1993, chap. 11; Foreman-Peck 1995, chap. 3].[16] The gold standard, adopted in only a few countries, played little or no role yet in the rise of trade.

- In a second phase from 1870 to 1913, the dominant explanations of the trade boom narrow to just one major factor, transport costs, since tariffs remained fairly stable. In contrast, the importance of a multilateral payments system with gold convertibility, though central in discussions of financial history, appears as only a minor player in the trade story. It is seen as enhancing trade a little on the margin, as when Kenwood and Lougheed [1999, p. 101; see also chaps. 6 and 7] note that the "world economy could thus achieve *maximum* benefits from trade and investment, especially when barriers to trade and capital flows were minimal, that is under a system of free trade and *convertible currencies*" (italics added). More recently, in their influential treatise on the Atlantic economy of the late nineteenth century, O'Rourke and Williamson [1999] single out one explanatory factor as the prime mover in the globalization of goods markets. They stress the primacy of transport costs as an explanation of changes in goods price dispersion, domestic factor prices and inequality, and political responses.
- After 1913 the bust is seen first and foremost as the result of a rise in tariffs, quotas, and other commercial policy barriers [James 2001, chap 3]. Yet all kinds of friction increased. Transport costs did not continue their decline, and by the 1930s they were back at something close to their 1869 level [Findlay and O'Rourke 2003]. The international payments system was undermined as the gold standard dissolved. Each setback amounted to a reversal of the four decades of progress from 1870 to 1913. Although such frictions might have repressed trade, this explanation is rarely put forward in textbook accounts of the interwar slump. Rather, "most contemporaries blamed commercial policies for the decline in trade" [Foreman-Peck 1995, p. 181] even if they saw such reactions as inevitable during depressions and crises. Many observers would appear to concur. Kindlebereger [1989] described how in an unplanned way these commercial policies evolved. Trade barriers shot up after 1914 and were high and rising in the mid-1920s. A common perception, which we think unduly optimistic, was that barriers then came down, slowly and fitfully, in the late 1920s as a supposed "reconstruction" of system began. An economic recovery began, and "in spite of Britain's problems, most of Europe prospered in the late 1920s. For five years, from 1924 to 1929, it seemed that normality had indeed returned" [Cameron 1993, p. 356]. Kindleberger speaks of the "Normalization of World Trade" in the late 1920s, but in our view his evidence suggests that normalization in commercial policy was more hoped for than achieved.

We will establish a more secure quantitative basis for some of these extant explanations, and we will criticize others, but we will go much further by addressing two remarkable lacunae in the current literature. First, strikingly absent is any major consideration of the role of payments frictions. Narratives have not altogether omitted this influence on the course of trade, but it still

[16] On the "backlash": the question of "how mild is mild?" will be discussed shortly.

appears as something of a sideshow.[17] If this is the impression received, we think it is misleading, and pays too little attention to venerable assessments of the gold standard as a trade-promoting institution—opinions voiced before our period by Classical economists such as John Stuart Mill [1848], and seen again in the postmortems of worried contemporaries who had witnessed the interwar trade collapse first hand, such as Edwin Kemmerer [1944] and Ragnar Nurkse [1944].[18] Second, we try to improve on the existing and rather one-dimensional studies, as we claim that using a "one-horse race" to account for this central episode in global economic history is incomplete. Instead, we need a true horse race, where we can discover how the boom-and-bust was driven by the each of the various frictions: transport, commercial policy, and payments. In such a framework all of the frictions could have mattered at one time or another. The question to be asked is, how much?

IV. APPLYING THE GRAVITY MODEL

We follow the literature in employing an empirical tool with a remarkably consistent history of success in explaining trade patterns. Trade between two countries is inversely related to the distance between them d (the resistance force) and positively related to their economic size Y (GDP, the attraction force). These two opposing forces have analogs in Newtonian physics, giving the gravity model its name. Thus, a basic expression for bilateral trade is

$$\text{(1)} \qquad \text{Volume of trade}_{ij} = \frac{Z_{ij}}{d_{ij}{}^{\mu}} \left(\frac{Y_i Y_j}{Y_W} \right)^{\lambda},$$

where Y_W is total world income, $\lambda, \mu > 0$, and Z_{ij} depends on tastes, preferences, transaction costs, and other factors.

A typical theoretical restriction is that $\lambda = 1$, so that trade volumes rise proportionally as the scale of the world economy increases, that is, trade volume is homogeneous of degree one in all income levels Y. The exponent μ is unrestricted and derives from an elasticity of trade with respect to underlying transport costs, presumed to be a well-behaved monotonic function of the distance d between the two markets. Though such an assumption is common, it is rarely examined. Since we have some shipping cost data for our period, we can empirically examine

[17] For example, the prewar rise of a multilateral payments system is discussed in chapters by Foreman-Peck [1995] and Kenwood and Lougheed [1999]. In a discussion of the interwar collapse of trade, Foreman-Peck [1995, p. 197] notes that the collapse of lending created frictions that hurt trade. A suggestive correlation, but one whose causation is hard to infer, indicates another possible source of trade volume trends: in theory, trade and factor flows might be complements rather than substitutes. Interwar trade and factor flows fell together, just as prewar they had risen together [Bairoch 1993; Foreman Peck 1995, p. 182; Collins, O'Rourke, and Williamson 1999], but the causal link and quantitative significance has not been explored in great detail and suitable instruments would surely prove elusive.

[18] For a detailed review of the history of thought on this issue see Flandreau [2000].

this implicit cost-distance mapping later in the paper, and it will prove useful for our counterfactual analysis.

Distance aside, any number of other pair-specific putative "friction" variables could be added to the Z_{ij} term, making it useful for analyzing the effects on bilateral trade of regional trade agreements, geographic characteristics, cultural affinities, colonialism, and so on. Since our objective is to evaluate the relative importance of various policy regimes in explaining global trade patterns we include here measurements of *payments frictions*, that is being on or off the gold standard, and *policy frictions*, using average tariff levels. (We will later discuss how *transport frictions*, already proxied by distance, can be incorporated into the empirical analysis). We also include a number of other standard regressors in the Z_{ij} term, and the basic equation we estimate is

$$\begin{aligned}(2)\quad \ln(\text{Trade}_{ijt}) = {} & \beta_0 + \beta_D \ln(\text{Distance}_{ijt}) + \beta_Y \ln(Y_{it}Y_{jt}) + \beta_y \ln(y_{it}y_{jt}) \\ & + \beta_L \text{Landlocked}_{ijt} + \beta_A \text{Adjacent}_{ijt} + \beta_I \text{Island}_{ijt} + \beta_C \text{Colonial}_{ijt} \\ & + \beta_G \text{Gold}_{ijt} + \beta_T \text{Tariff}_{ijt} + \beta_E \text{ERvol}_{ijt} + \beta_{DIV} \text{Diversion}_{ijt} + \varepsilon_{ijt},\end{aligned}$$

where *i* and *j* denote the countries, *t* is the year of observation (1913, 1928 or 1938), β is a vector of coefficients, and ε_{ij} is a disturbance term assumed to satisfy the necessary properties. The variables are defined at time *t* as:

Trade_{ijt} is total bilateral trade (i.e., imports plus exports) between *i* and *j*;
Distance_{ijt} is the great circle distance, in miles, between *i* and *j*;
Y_{it} is country *i*'s GDP;
y_{it} is country *i*'s GDP per capita;
Landlocked_{ijt} is a dummy variable equal to 1 if either *i* or *j* is landlocked;
Adjacent_{ijt} is a dummy variable equal to 1 if *i* and *j* share a border;
Island_{ijt} is a dummy variable equal to 1 if either *i* or *j* is an island;
Colonial_{ijt} is a dummy variable equal to 1 if *i* and *j* shared a colonial relationship during the period;[19]
Gold_{ijt} is a dummy variable equal to 1 if *i* and *j* were both on the gold standard;
Tariff_{ijt} is a measure of the tariff rate of protection on trade for *i* and *j*;
ERvol_{ijt} is a measure of nominal exchange rate volatility between *i* and *j*.
Diversion_{ijt} is a dummy variable equal to 1 if *i* or *j* (but not both) were on the gold standard;

We estimated the gravity model using pooled data for 1913, 1928 and 1938. We rejected separate cross sectional estimation for each year because there is too little "within" variation in gold standard adherence in each year to allow a precise estimate of the currency effect. Most countries were on gold in 1913 and 1928, and most off in 1938. As expected, the "within" estimates were found to be very unstable. Instead, like Glick and Rose [2001], we think panel

[19] For the useable observations within our sample, this includes all the pairs within the British Empire set (Australia, Canada, Egypt, India, New Zealand, and the United Kingdom) plus the Phillipines-United States pair.

estimation provides the only meaningful way of estimating the currency effect, by exploiting changes in adherence in the time dimension without discarding identifying variance for gravity characteristics in cross section.

Most of the data on trade, GDP, and country characteristics come from the Irwin and Terviö [2002] study of trade and income over the entire twentieth century for a sample of 40 countries.[20] For gold standard adherence, we relied on data from Meissner [2002] for 1913,[21] supplemented by interwar data found in Eichengreen and Flandreau [1996] and Eichengreen [1992]. For tariffs we relied on Clemens and Williamson's [2001] estimates of duties divided by imports, which are the best panel data available, though they do not capture pair specific bilateral tariff rates as one would ideally want.[22] Following Rose [2000], nominal exchange rate volatility was set equal to the standard deviation of the monthly log bilateral nominal exchange rate over a lagged five year window, using Global Financial Data as a source. The subset of 28 countries for which these data are all available is shown in Appendix 2.

IV. A. Traditional Specification

The pooled regression estimates are reported on the left side of Table I.[23] To control for other changes between periods that are not captured by our right-hand side variables we can also include year effects;[24] these are negative and usually significant, indicating that trade was lower in 1928 and 1938 than is accounted for by our explanatory variables alone. One interpretation would be that these time effects reflect the increase in non-tariff barriers and non-cooperation between the wars, and it is a measure of what is still missing from the model. However, it could also be a side effect resulting from the unbalanced nature of our panel. We return to this issue below.

For various specifications, columns 1 to 3 show that the standard gravity variables, distance, GDP, and GDP per capita are precisely estimated and their signs and magnitudes are consistent with estimates from other gravity models.[25] Also as expected, the landlocked and adjacent dummy variables are usually statistically and quantitatively significant, and, when so, carry the right sign. The island effect is statistically insignificant and quantitatively small (about –12 percent). In our preferred specification, column 2, the average tariff has a quantitatively

[20] We thank Douglas Irwin and Marko Terviö for generously providing this data. Because their trade data was in nominal U.S. dollars, and their GDP per capita data was in constant 1990 U.S. dollars, we had to convert their GDP per capita figures into current dollars to obtain country GDPs. This was done by first normalizing their GDP per capita data to the U.S. and then scaling the normalized figures by U.S. GNP per capita. U.S. GNP per capita data for these years are available from the Bureau of the Census [1975].

[21] We thank Christopher Meissner for generously providing this data.

[22] We thank Michael Clemens and Jeffrey Williamson for generously providing this data.

[23] The estimates in Table 1 use ln (Trade_{ijt}) as the dependent variable and exclude observations for which trade between a country pair is zero. Alternatively, as is typical in the literature, we could employ Tobit estimates by constructing a new dependent variable ln (1+Trade_{ijt}). We checked for sensitivity using this and other standard approaches followed in the literature, but these exercises produced similar results and are not reproduced here.

[24] Similarly, López-Córdova and Meissner [forthcoming] add year dummies to their pre-1914 pooled regressions.

[25] The gravity model appears to perform quite well in contrast to rival models, such as the Heckscher-Ohlin model, which performs about as poorly in the past as it does today [Estevadeordal and Taylor 2002].

large coefficient of –0.84, though this effect is also statistically insignificant. Colonial ties clearly had a huge impact on bilateral trade, boosting it for such pairs by a whopping ($e^{1.8}$–1) ≈ 500 percent. It is certainly possible to interpret these two components—tariffs and colonial links—as substitutes, however, and there is ample evidence that during the nineteenth-century Age of Empire, the European powers viewed colonial expansion as a means to construct a system of preferential trade relationships [Alesina 2002].

The gold standard effect is a positive and highly significant +0.42, meaning that country pairs which jointly tied their currencies to gold traded ($e^{0.42}$–1) ≈ 72 percent more. Though less than Rose's initial estimate of the currency union impact of ($e^{1.21}$–1) ≈ 235 percent, we still find that countries in a formal monetary arrangement tend to trade disproportionately with one another and the effect is economically large. Comparing columns 1 and 2, we also find that this impact is distinct from, and more important quantitatively, than that of exchange rate volatility *per se*. Although ERvol is statistically significant, it is quantitatively second order: increasing ERvol from zero to 0.5 (a very large change in absolute terms) would have decreased trade by only about 7 percent.[26]

In Column 3 of Table I we make an additional robustness check to see whether joining the gold standard was potentially a cause of trade diversion. We construct a new dummy variable equal to one when one, but not both, countries in a pair was on gold. This variable is insignificant, and even positive, so that going on gold might have been trade creating with respect to *all* trading partners. This may not be surprising given that most trade was conducted using sterling bills, so the removal of any friction vis-à-vis sterling would be likely to encourage trade.[27]

IV. B. Endogeneity Issues

Are these results robust? One problem that has riddled the literature on monetary regimes and international trade is the issue of simultaneity. Mundellian optimal currency area (OCA) logic suggests that a country should stabilize its currency (or form a currency union, or join a gold standard) with respect to trading partners, amongst other reasons [Alesina and Barro 2002]. Monetary arrangements would then follow from trade rather than vice-versa. To deal with the problem, economists have employed instrumental variable estimation. This requires a variable that is linked to exchange rate volatility (or currency unions, or the gold standard) but is unaffected by trade considerations.[28]

In a contemporary context, Rose [2000] dismissed this argument as hypothetical, citing evidence that trade considerations seem unrelated to the decision to join or leave a currency

[26] This seems like a meaningful experiment for our sample period. In cross section, the mean ERvol (calculated from a lagged five-year window) was 0.01 in 1913, 0.22 in 1928, and 0.04 in 1938. Thus, an increase from 0 to 0.5 corresponds to a two-standard-deviation shift in this variable for 1924–28, the most volatile period in our data.

[27] Similarly, López-Córdova and Meissner [forthcoming] find trade creation for the gold standard during 1880–1910.

[28] A common instrument is the volatility of relative money supplies, since exchange rates are highly correlated with this variable under the monetary theory of exchange rates, but monetary policy is less likely to influence trade.

union.[29] However, the simultaneity problem is harder to dismiss in our historical context. Countries appear to have joined the gold standard as a result of their trade dependence on other countries that happened to switch to gold. One example, noted by Gallarotti [1995, p. 61], was the Scandinavian Monetary Union, whose members "found the German transformation [from silver to gold] compelling given a pronounced trade dependence on German states; hence once Germany made the switch, they decided that their monetary systems would have to follow along. Given their own monetary interdependence, each recognizing the monies of the others as legal tender, the move to gold would best be instituted *en bloc*."[30]

We address this problem by using as an instrumental variable (for the gold dummy) the product of the logarithm of each partner country's average distance from all countries on gold. Here, one reasons that the farther a country is from gold countries, the less likely it would be to trade with gold countries, thereby reducing the incentive to adopt the gold standard. Repeating all the OLS specifications, the 2SLS results are reported in columns 4 to 6 of Table I, with no great surprises. The coefficient on gold is stable in these regressions and very close to the range obtained in our baseline OLS specifications. So the results appear robust even with controls for endogeneity.[31]

IV. C. State-of-the-Art Specification

The gravity model has recently received further theoretical refinement and the specifications now considered "state of the art" have implications for the estimated coefficients. Specifically, we think it is necessary to add *country fixed effects* to our specification. There are several motivations for their inclusion. First, they control for unmeasured country-specific market attributes or frictions on both the export and import side, as argued in recent econometric critiques of simple pooled estimates [Mátyás 1997; Egger 2000]. Moreover, the same specification also emerges from recent gravity models of trade with tight microfoundations, whether they are based on consumer differentiation among goods on the demand side [Anderson and van Wincoop forthcoming; Redding and Venables 2001] or Ricardian differences in technology on the supply side [Eaton and Kortum 2002].[32] Although all these models differ in

[29] Nevertheless, he attempted to test for endogeneity utilizing the same instrumental variables used as instruments for exchange rate volatility. Though still correctly signed and significant, his results are, in his own words, "wildly implausible." His results point to the difficulty in finding appropriate instruments for a currency union dummy.

[30] Members of the Scandinavian Monetary Union were Denmark, Norway, and Sweden. In addition to testing for the effects of the gold standard on trade, we also considered the effects of the Latin Monetary Union, which included Belgium, France, Italy, Greece, and Switzerland from our sample, and the Scandinavian Monetary Union, separately and jointly, in 1913. No significant impact was found, however. We think this is result is most likely due to a lack of observations. Indeed, only about 2 percent of all observations took on a value of 1 for the dummies constructed to examine these unions' effects. This problem obviously does not affect the pre-1914 long panels used by López-Córdova and Meissner [forthcoming] and Flandreau and Maurel [2001], studies which do find significant impact.

[31] We conducted even more sensitivity checks, but space constraints preclude their inclusion. Most importantly, we implemented a SUR estimation strategy following Eichengreen and Irwin [1995], allowing the residuals of the 1913, 1928 and 1938 cross sections to be correlated, and once again we found our results to be robust.

[32] For more details on the state of the art, see the excellent survey by Harrigan [2001].

their details, empirical implementation in all three revolves around an estimating equation of essentially the same form. Exports of a good from *i* to *j* are given by

$$x_{ij} = \left(\frac{p_i t_{ij}}{P_j} \right)^{-\theta} y_i y_j ,$$

where p_i is the price at location *i* of a good from *i* (that is, f.o.b.), $t_{ij} > 1$ is the iceberg transport cost factor for moving goods from *i* to *j*, $P_j = \left[\sum_i (\beta_i p_i t_{ij})^{-\theta} \right]^{-1/\theta}$ is the overall price index in market *j*, y_k is output or expenditure at location $k = i, j$, and we assume the elasticity θ and weights β_i are strictly positive. This expression is intuitive. Bilateral exports increase if the home country expands (a larger set of goods produced) or if their prices *p* fall; if transport costs fall (the arbitrage element); and lastly if the import market expands (more expenditure) or if it becomes less competitive (a rise in overall prices *P* of goods from rival sources).

We must also note that, in such models, total world trade is homogeneous of degree zero in the iceberg costs, which might sound unappealing at first, since, with fixed product and expenditure assumptions, this sounds like a "lump of trade" fallacy. However, it must be remembered that these models also include a prediction of "intranational trade" x_{ii} and they allow a role for internal costs t_{ii}. As long as international frictions t_{ij} fall relative to intranational costs t_{ii} then lower transport costs do indeed promote external trade via a process of trade "diversion" from goods traded within to goods traded between countries.

Two observations follow from this idea when it is extended to all types of frictions between any pair of countries in the model. First, trade will be boosted whenever *any* bilateral friction on the pair falls relative to the relevant measure of "multilateral resistance" between each country and all possible trading partners. Second, if we recognize the implicit intranational trade in the model, then international trade will increase in the aggregate whenever international frictions decline relative to intranational ones. This insight makes the model relevant for our aggregate analysis of world trade: in the period we study, overall inter-country frictions fluctuated dramatically over time relative to intra-country frictions—due to the rise and fall of transport costs, the gold standard, and tariffs—and in this model such shocks do not just generate trade diversion, but also aggregate trade creation (or destruction).

These refined gravity models are useful as an empirical tool if the iceberg costs can be reasonably parameterized by distance and other geographic or policy variables. Unfortunately, they also raise the stakes in terms of data requirements. Specifically, such models require price indices for each location. In some cases this is feasible, as in the work of Baier and Bergstrand [2001] on a postwar OECD sample. However, when such data are unavailable, we have a potential omitted variable problem. The only solution is to include fixed effects to mop up the missing country-specific terms, as in Rose and van Wincoop's [2001] cross section analysis of developing countries. Historical data for our period are similarly incomplete, so we adopt the same empirical strategy.[33]

These results are shown in columns 7 through 12 of Table I using OLS (2SLS results are again similar and are not reported). In this table our preferred specification is shown in Column 7. Columns 8 and 9 show that exchange rate volatility and trade diversion add nothing to the regression. Columns 10 through 12 indicate that the same is true when time effects are introduced. This is important, because the use of time effects provide a check on the robustness of our results in the presence of an unbalanced panel where composition effects might bias the estimates. Yet, for our key coefficients, there is no real difference between Columns 7 and 10. Columns 11 and 12 reveal that the inclusion of exchange rate volatility and time effects can push the gold standard coefficient down, but still the "combined measure" of monetary regime (Gold and ERVol) remains jointly significant, and we can accept the restricted Column 10 specification against Columns 11 and 12 based on standard specification tests. We suspect that collinearity pollutes the latter results, but what our take on this is that the data says the best summary statistic of the impact of monetary regime is Gold alone, and hence Column 7 will be our preferred specification (though Column 10 has an even higher Gold coefficient, and so we are safely biasing the results against ourselves).

Using our more refined specification, the model suggests a quite stable relationship between trade and the underlying variables with or without time effects.[34] Otherwise these new results conform quite closely to the previous pooled results in Table I.[35] The trade diversion impact of going on gold remains statistically insignificant and small. The conventional gravity variables all have similar magnitude and statistical significance. The one exception is income per capita, which now appears insignificant. This may be considered quite reasonable, however, if we view pre-1940 trade as being driven less by intra-industry trade and differentiated product types, where more varieties (and hence more trade) might be associated with higher levels of development.

One major change stands out: the much smaller magnitude of the gold standard effect. Compared to the pooled results without fixed effects, this coefficient has fallen to +0.352,

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[33] Some mathematical housekeeping is needed. As is evident from the theory, the fixed effects of the exporting (reporting, R) and importing (partner, P) country are distinct, so that these fixed effects on total bilateral exports should be written as *two* sets of country fixed effects, using the Kronecker delta,

$$x_{ij} = \sum_k \left(R_i \delta_{ik} + P_j \delta_{jk} \right).$$

But recall that our data are only for total trade (exports plus imports), hence we write total bilateral trade as

$$x_{ij} + x_{ji} = \sum_k \left([R_i + P_i] \delta_{ik} + [R_j + P_j] \delta_{jk} \right) = \sum_k \left([R_k + P_k][\delta_{ik} + \delta_{jk}] \right),$$

where the last expression follows from the algebra of Kronecker deltas. That is, we need to adopt a specification where each country dummy equals 1 whenever that country enters as part of the bilateral pair, and is zero otherwise.

[34] This was one case where Tobit yielded somewhat different results (available on request), and we speculate that this is perhaps because interwar controls could have shut down some bilateral trade channels completely, leading to more zeroes, and more severe truncation problems in those years. However, this does not affect our conclusions dramatically since our subsequent counterfactuals correspond only to the OLS specification.

[35] The time-invariant island and landlocked dummies are now omitted because they are collinear with the fixed effects. In a pure cross-section, some other variables (GDP, GDP per capita, and gold) would also be collinear with the fixed effects, but this is not the case when pooled data is used as here.

implying that going on gold raised trade by ($e^{0.352}$–1) ≈ 42 percent. A more conservative estimate of the effect of the gold standard on trade volumes, this is consistent with other results in the literature. Table II shows currency regime impacts on trade volume from several of the dozens of studies alluded to earlier. We can see here that the effect of the gold standard on trade was much weaker than the effect of common currencies today. This is not surprising since the gold standard still left countries with their own money, under more or less strict rules, and included escape clauses; by contrast, a currency union is "fixing for life." Trade effects might be smaller for the gold standard case because the regime thus had slightly less transparency and credibility, and slightly more friction. Also, like every other study that has included country fixed effects, we find that this specification yields much more moderate estimates of the currency effect. This consistency is welcome and deflects some of the criticism of early "currency effects" as being just too large to believe. Indeed, López-Córdova and Meissner [forthcoming] found their gold standard coefficient form 1870–1910 fell from 0.48 to 0.28, and the latter point estimate is close to ours. [36] This is reassuring since, when the coefficients are similar and the accounting exercises fruitful, their work on a different period amounts to an out-of-sample check on our empirics, and vice versa.[37]

V. THREE LARGE COUNTERFACTUALS

How do these results help us understand the causes of the global trade boom and bust? There are three main counterfactual experiments to be considered to account for variations in the three kinds of frictions in markets.

1. *Payments frictions.* The effect of the gold standard will be inferred by posing the following counterfactual question: what path would world trade have followed from 1870 to 1939 had countries maintained their actual 1913 commitment to gold throughout the entire period?
2. *Policy frictions.* The effect of trade policy will be inferred by posing the following counterfactual question: what path would world trade have followed from 1870 to 1939 had countries maintained their actual 1913 tariff levels throughout the entire period?

[36] Flandreau and Maurel [2001] find pooled estimates very close to our results on the left hand side of Table 1. They do not present results using the country fixed effect specification.

[37] An alternative estimation strategy is to simply employ fixed effects for *all* country pairs, as was argued by Pakko and Wall [2000]. This may better control for all pair-specific characteristics that affect trade, but this method can be criticized in a number of grounds. Inclusion of all dyads drastically reduces the degrees of freedom and since this method allows all the fixed effects to absorb *any* time-invariant pair characteristics, such as distance, adopting such a method amounts to a complete rejection of the gravity model framework, which is the fundamental theoretical model we are trying to put to the test. Rather it is a pure econometric approach completely detached from any theoretical model of trade. Though Pakko and Wall find no significant effect of postwar currency unions on trade. Rose has no sympathy for their critique (see the unpublished rebuttal on Rose's web site), because there are too few observations of switches in and out of currency unions to identify this effect precisely. He argues for exactly the approach we follow here, a panel implementation of the gravity model as in Glick and Rose [2002] in an augmented postwar sample with many switches. Interestingly, when we include all pair fixed effects in our specifications, replicating the Pakko and Wall approach, we do not find a collapse or reversal in our gold standard effect, and this sensitivity analysis is discussed in Appendix 3. So here, at least, the point is moot.

3. *Transport frictions.* The effect of transport costs will be inferred by posing the following counterfactual question: what path would world trade have followed from 1870 to 1939 had transport costs maintained their actual 1913 level throughout the entire period?

Later, a simpler fourth counterfactual will show how to account for income convergence effects.

As a basis for explaining the evolution of world trade, our counterfactuals accord most closely with Regression 7 in Table I. This regression implies some simplifying parameter restrictions: we can accept that $\beta_Y = 1$ and $\beta_y = 0$, meaning that trade is homogeneous of degree 1 in output as suggested by theory, and invariant to changes in per capita income.[38] We can also accept that $\beta_E = 0$, and all currency effects operate via the gold standard. We therefore adopt parameter estimates in the simulations as follows. The gold standard parameter is taken to be +0.352. The tariff elasticity of trade is taken to be –1.559, and the distance elasticity –0.659. It should be noted, however, that the confidence intervals for these parameters are quite large: two-standard-error bands centered on the point estimates yield intervals of [-0.816,-0.500] for distance, [0.072,0.632] for gold, and [-0.088,-3.286] for tariffs, and these margins should be kept in mind during the counterfactual analysis that follows.

The gravity model will work well for the first two experiments, with the geography variables assumed to remain unchanged.[39] Since transport costs do not directly figure in the econometric analysis, the third counterfactual requires some ingenuity to introduce appropriate auxiliary assumptions. To perform the counterfactual exercises we need annual data on trade, gold standard adherence, tariff protection, and transport costs from 1870 to 1939.

V. A. Time Series Data for the Counterfactuals

Construction of the trade and GDP time series data are discussed in Appendix 1. Trade volumes in local currency for up to 120 countries are from Mitchell [1992, 1993, 1995]. These were converted to current U.S. dollars using exchange rates from Global Financial Database, and then converted to constant 1913 U.S. dollars using the U.S. GDP deflator [from Obstfeld and Taylor 2003b]. To eliminate bias due to a changing sample size, a sample with constant cross section size (N = 56) was constructed by imputing data. The coverage of this database is fairly comprehensive. Compared to “total” trade from the 120-country sample, the subsample we use covers about 98 percent of trade at the start of the period, falling to about 95 percent in 1910, and 85 percent by 1939. The data were shown in Figure I and general trends discussed. A world trade to GDP ratio was then constructed from a world real GDP series derived from the estimates in Maddison [2001], with interpolation, and again converted to constant 1913 U.S. dollars using the deflator.

For panel data on the gold standard adherence of the 56 countries we make use of the work of López-Córdova and Meissner [forthcoming] for 1870–1914 and Eichengreen [1992] for

[38] Baier and Bergstrand [2001] also find that $\beta_Y = 1$ is not rejected on contemporary OECD data.

[39] This is not exactly true, when samples change over time due to the creation of new countries. Territorial boundary changes can affect the variables Distance, Landlocked, Adjacent, and Island, all of which might have made some difference to trade patterns in Europe after 1919. So perhaps, more accurately, we should think of our counterfactual as assuming away such changes.

1919–39. For missing data and in the war years 1915–18 we rely on various sources, and where wartime data is unavailable we assume most countries adherence in these four years was the same as in 1919. A summary of this data is shown in Figure II(a), which depicts gold standard adherence using both country weights and export weights. The rise of the system after 1870 was dramatic, with adherence increasing from less than 15 percent of countries to almost 90 percent by 1913. The subsequent collapse was rapid to around 25 percent after the war. Reconstruction followed and adherence fleetingly regained its 1913 level in the late 1920s. In the 1930s, a final collapse brought adherence down again to around 25 percent.

For panel data on tariffs we are grateful to Clemens and Williamson [2001], who allowed us to make use of their 35-country sample of tariff estimates. Their methodology estimates the overall average tariff level according to import duties divided by total imports.[40] The data are shown in Figure II(b) in the form of a world average tariff level, using export weights. Some important trends in this series warrant mention. First, despite all the talk of a protectionist backlash against free trade after 1870 and up to 1914, we see little evidence of it here. On average, world tariff barriers rose in this period from around 12 percent to around 15 percent. Next we should note that average tariffs *fell* from around 1900 to 1914 and then strongly to 1920. World inflation undermined the *ad valorem* impact of the predominantly specific tariffs of this period. This prompted legislative pressure to restore protection, albeit with a lag. In the 1920s, the tariff reductions were undone, but the earlier peak was by no means exceeded, though trade was repressed in this period by other means, such as quotas and other frictions. In the 1930s, tariffs rose to much greater levels than had been seen since 1870, around 20 percent.

On international transportation costs, we are in no position to construct a panel database over 1870–1939 for costs in trade for each country, let alone for each country pair in each year. The only reasonably comprehensive series for global freight rates covering almost the entire period is that for 1869–1936 due to Isserlis [1938] and based on British tramp shipping freights on routes worldwide, displayed in Figure II(c).[41] Of course, this index covers only maritime costs, and says nothing about the changing nature of overland transport costs, a subject we shall return to shortly. There also could be unresolved problems on long versus short routes, where compositional effects might be critical.[42] For example, based on only two data points, and hence useful only as an illustration of composition problems, we note that the freight/cost markup fell from 41 percent to 22 percent on North Atlantic wheat shipping 1870–1914, but from 74 percent to 18 percent on rice from Burma to Europe [Williamson 2002]. Another potential problem with the data occurs during the wartime period 1914–1918, when freight rates are shown to be

[40] The sample of countries is smaller than our 56-country dataset for trade, so we are limited in the number of countries for which we can perform a tariff counterfactual (see Appendix 2). However, the data covers between 70 to 80 percent of trade in our 56-country sample in most years, falling to 60 to 70 percent in the 1930s.

[41] Still, the Isserlis index is more "global" than one might at first think. British merchant shipping in this period carried freight to and from all the world's major ports, and Isserlis was able to use rates from over 300 routes to build his index.

[42] A 50 percent fall in freight cost markups is likely to matter more for boosting trade as c.i.f./f.o.b ratios fall from 200 to 150 on a long and expensive route, than when they fall from 110 to 105 on a short and cheap route. This point is made by Hummels [1999] in relation to postwar trade and the compositional changes due to the rise of containerization and then air freight.

quadrupling. A rise in freight rates would be expected due to wartime dangers and restrictions, but the British shipping industry was not operating under market mechanisms in this period. Accordingly, we treat the data with caution, and we do not attach any significance to our results for these years, omitting them from the subsequent analysis.

Other than this, the prewar data appear very plausible: a roughly 30 percent decline in freight rates is seen over the period 1870–1913. What might appear more surprising on first glance is that a virtually complete reversal of that trend is then seen to 1939. However, this reversal appears to be well understood in the discussions of shipping in the historical literature. The first explanation is productivity shocks. From 1870 to 1914 shipping was a sector with faster than average productivity advance, due to steam power, new infrastructure, communications and navigation improvements, and so on. As a result, its costs fell faster than the rest of the economy. This trend was reversed after 1914 as other sectors boomed in the roaring twenties, such as automobiles and other production line enterprises. As Hummels [1999] points out for the postwar period, economywide TFP growth raises factor prices everywhere, but such costs raise prices in sectors with lower than average TFP growth. Shipping appears to have suffered from this effect since at least World War One. A second explanation is monopolistic behavior by shipping cartels, aided by the rise of protectionism in the shipping industry [Podolny and Scott Morton 1999]. Price fixing was probably encouraged by the passage of "navigation acts" after the war in a number of countries as a means to protect their merchant fleets against competition. Lastly, one can also account for some of the rise in interwar transportation costs as a result of increasing labor militancy, including the notoriously violent and disruptive strikes by longshoremen and stevedores in many ports around the world. The resulting new wage bargains pushed costs higher. For example, in addition to collusion, this was seen as a major factor in rising transport costs for the case of Australia [Blainey 1982, p. 286]. These readings of the interwar trends suggest that the reversal of transport costs after 1914 is indeed reasonable and quite explicable in terms of economic shocks.

V. B. Simulation 1: The Gold Standard

In our first counterfactual we infer how much of trade variation in each year relative to 1913 was attributable to the gold standard alone. By equation (2), if all countries are given their 1913 gold standard commitment in year *t*, then the change in trade for each pair is

(3) $$\Delta \ln (\text{Trade}_{ijt}) = \beta_{\text{G}} (\text{Gold}_{ij,1913} - \text{Gold}_{ijt}).$$

Hence the counterfactual trade level Trade_{it} for country *i* is given by

(4) $$\begin{aligned}\text{Trade}^{\text{C}}_{it} &= \Sigma_j \text{Trade}^{\text{C}}_{ijt} = \Sigma_j \{1 + (\exp(\beta_{\text{G}})-1)(\text{Gold}_{ij,1913} - \text{Gold}_{ijt})\} \text{Trade}_{ijt} \\ &= \text{Trade}_{it} \{1 + (\exp(\beta_{\text{G}})-1) \Sigma_j (\text{Gold}_{i,1913}\text{Gold}_{j,1913} - \text{Gold}_{it}\text{Gold}_{jt}) \text{Trade}_{ijt}/\text{Trade}_{it}\}.\end{aligned}$$

Thus, in the base year and 1913, the gold standard impact on trade for any country is, to a linear approximation, the product of two terms: the elasticity measured by β_G and the "network effect" (under the summation), which equals the trade-weighted number of partners that are on gold at the same time. Note that we can also perform other counterfactuals this way, for example, replacing $\text{Gold}_{i,1913}$ $\text{Gold}_{w,1913}$ by unity for an "all on gold" counterfactual trade level were *every* country to have been on gold.

Note the importance of the weight of bilateral trade in the "network effect" term. This poses an empirical challenge. It is surely impossible to construct a complete set of bilateral trade-weight matrices $\{\text{Trade}_{ijt} / \text{Trade}_{it}\}$ for all *i-j* pairs and all years *t*. We make the simplifying assumption that these weights remain fairly stable over time, and use the 1913 bilateral weights $\{\text{Trade}_{wj,1913} / \text{Trade}_{w,1913}\}$ in all years as an approximation to country specific trading patterns, which we expect to be somewhat persistent over time.[43]

The results are shown in Figure III(a), and indicate the powerful effects on trade of payments frictions. Had the 1913 gold standard been applied in 1870, trade volumes would have been about 30 percent higher. From 1870 to 1913 the trend growth of world trade would have been 3.2 percent per annum versus the actual 3.8 percent. Since world output grew at about 2 percent per annum over the same period, this would have cut the growth rate of the trade-output ratio from 1.8 percent to 1.2 percent, a very significant retardation. Part of the interwar stagnation of trade is similarly explained by gold standard collapse, for under the counterfactual the trend growth of trade from 1913 to 1938 would not have fallen so much. Clearly this is not the whole story and other frictions must have slowed the trend growth of trade after the early 1920s. It is also clear from the "all on gold" counterfactual that the 1913 gold standard came very close to achieving maximal benefits from reducing payments frictions: perhaps only another five percent of extra trade volume could have been eked out by placing the entire world on gold at that time.

V. C. Simulation 2: Tariff Protection

Following the above logic, we next ask what might have been the pattern of trade had countries counterfactually maintained an even level of tariff protection at 1913 levels. By equation (2), if all countries were given their 1913 tariff level in year *t*, then the change in trade for each pair is

$$(5) \qquad \text{Trade}^C_{it} = \Sigma_j \text{Trade}^C_{ijt}$$
$$= \text{Trade}_{it} \{1 + \Sigma_j \exp[\beta_T(1+t_{i,1913})/(1+t_{it})] \ \exp[\beta_T(1+t_{j,1913})/(1+t_{jt})] \text{Trade}_{ijt}/\text{Trade}_{it}\}.$$

Again we make the simplifying assumption that the bilateral weights remain fairly stable over time, and use the 1913 weights $\{\text{Trade}_{wj,1913} / \text{Trade}_{w,1913}\}$ in all years. We could also explore

[43] For our 56-country sample, bilateral weight data for 1913 cover 34 countries, or 98 percent of the total trade in that sample. The data are from League of Nations [1927]. We use overall world trade shares as weights for the 22 smaller omitted countries (the largest of these is Mauritius, with only 0.75 percent of total trade in the 56-country sample). Any bias resulting from this approximation will not affect the overall result.

other counterfactuals, such as a uniform zero tariff. For that exercise we would replace $t_{i,1913}$ and $t_{w,1913}$ in the above expression by zero.

The results are shown in Figure III(b), and indicate the weak prewar effects of tariffs on trade. Had the 1913 tariffs been applied in 1870 trade volumes would have been no different. This is no surprise given that tariff levels barely changed in the 1870–1914 period. This is not to say that tariffs had no potential to affect trade—in fact, had zero tariffs prevailed in 1913, supposedly a high-water mark year for "free" trade, world trade would have been one third higher still! Although protection did not vary much before 1914 it was fairly high. The interwar period offers greater scope for tariff effects, but the impacts are uneven. In the 1920s they worked in the wrong direction, but by the 1930s tariffs had reached a high level. Trade could have been on average about 50 percent higher had 1913 tariff levels prevailed in the 1930s. Conventional narratives are partly right, and the effects of tariffs could be even larger than we estimate here if our inability to obtain pair-specific tariffs has biased the tariff coefficient downwards. We conclude that tariffs explain some of the fall in trade after 1914. But they are not the whole story and other frictions helped reverse the trend growth of trade in the interwar period.

V. D. Simulation 3: Transport Costs

Since we have no transport costs data for bilateral pairs, but only a global time series, we were unable to include this variable directly in the gravity model. However, the gravity model *does* include transport frictions, implicitly, in its formulation. Transport costs are embedded in the distance variable, of course, where trade theorists tend to posit a distance-cost relationship for shipping. In that setting, a fall in transport costs will be analogous to a fall in global distances. That is, by invoking a concept of *effective* distance, we can imagine that the impact of globalization is to literally "shrink distance."[44,45]

Can shipping costs be mapped into distances explicitly? To do this we need to estimate some kind of shipping technology. The leading exponent of this technique for the postwar period, Hummels [1999], suggests a technology of the form

$$\ln(\text{Cost per ton}) = a + b \ln(\text{Distance}). \qquad (6)$$

His estimates of the parameter b from postwar data range from 0.81 for worldwide data, and 0.5 on U.S. trade and North American routes. Are these parameters a guide to the shipping technology of 1870–1939? A complete study of this question would take us too far afield, but in

[44] An alternative approach is to consider a transport cost wedge as analogous to a tariff wedge. This method was also applied, but space does not permit full discussion of the results. Appendix 5 explains why this alternative method is not preferred, although it gives quite similar answers.

[45] We are unaware of other studies that have attempted to embed changing transport costs in the gravity model this way. A related approach is that of Coe et al. (2002), but they look for postwar "globalization" in the form of a changing distance coefficient in the gravity model. However, this criterion may be unduly restrictive: we are able to show here that changes in effective distance due to cost change in shipping may leave such an elasticity unchanged, whilst still expanding or contracting trade considerably.

Appendix 4 we show how to re-estimate the Hummels technology of equation (6) for 1935 ocean freights, using rates per ton from Isserlis [1938] between Europe and the rest of the world. We obtain an estimate of $b = 0.52$, very close to Hummels' postwar figure for U.S. routes.

Now suppose transport costs c fall by a factor z, $0 < z < 1$. The natural conclusion, we think, given a cost-distance mapping, is to assume that the impact on trade is just as if distances in the world shrank by a factor $z^{1/b}$. Using equation (2) again, counterfactual trade assuming 1913 transport costs in all years would then be given by

(7) $$\text{Trade}^{C}_{it} = \text{Trade}_{it} \exp\{(\beta_{D}/b) \ln(c_{i,1913}/c_{i,t})\}.$$

The results are shown in Figure III(c). The impacts of transport costs on trade according to this thought experiment are very large. (Note: the scale is adjusted to omit the wartime blip, which we ignore). Trade would have been 53 percent higher in 1870 under 1913 cost-equivalent distances; in 1900 it would have been higher by 24 percent, in 1929 by 33 percent, and in 1938 by a massive 89 percent. The effect is clear: the rise and fall of world trade relative to its long run trend, with the trend break in 1914, would have been considerably ironed out had transport costs remained steady.

By this reckoning, transport costs have great power to explain the trade boom and bust. But a caveat is in order: application of the Isserlis index to *all* routes is surely an overestimate of the transport cost effect. It assumes that all trade carried on overland routes (say, the bulk of trade across common borders in Continental Europe) experienced cost shifts that were the same as that on long oceanic routes (for example, between Britain and the Americas or Australasia). While land trade probably did experience costs shifts we have no reason to suppose that costs on railroads, turnpikes, or river barges had the same trends as tramps on the ocean. Hence, to achieve a lower bound, we constructed a MARITIME_{ij} indicator for country pairs where we felt sure that almost all trade went by ship. We set the indicator equal to one when two countries in a pair were in different geographic regions (except for the Russia-China trade) or when either one was an island.[46] We then recalculated bilateral trade for all pairs in 1913 and found that maritime trade so defined accounted for 56 percent of all world trade. This is likely a conservative (low) estimate since surely much trade even within regions went by coastal shipping (e.g. Argentina to Brazil or Spain to Netherlands). Thus, the aforementioned effects of cost changes on trade might be adjusted down by about 44 percent if we seek a reasonable lower bound, and the truth probably lies somewhere in between.

[46] The five possible values for REGION_i were arbitrarily chosen as: Africa, Europe (Continental), North America (includes Mexico); South America, and "Oceania" (which in this case means any island nation). As noted, we set $\text{MARITIME}_{ij} = (\text{REGION}_i \neq \text{REGION}_j)$, except for the Russia-China exception. A finer mesh would have undoubtedly led to a higher estimate of maritime trade.

VI. TOWARD AN ANALYTIC NARRATIVE OF WORLD TRADE

How does our study rewrite the history of world trade? For that, the three counterfactuals require summing up, and we also need to control for one other important source of variation in the data: the overall increase in world income levels and changes in their distribution. From our gravity model (where we neglect the insignificant income per capita term) income and trade, to a first approximation, are related according to the formulae

$$(8) \qquad \Delta \ln(\text{Trade}_{Wt}) = \Sigma_{ij}\,(\text{Trade}_{ijt} / \text{Trade}_{Wt})\,(\Delta \ln s_{it} + \Delta\ln s_{jt} + \Delta\ln Y_{Wt})$$
$$= \Delta \ln Y_{Wt} + \Sigma_i\,(\text{Trade}_{it} / \text{Trade}_{Wt})(2\,\Delta \ln s_{it}),$$

$$(9) \qquad \Delta \ln(\text{Trade}_{Wt} / Y_{Wt}) = \Sigma_i\,(\text{Trade}_{it} / \text{Trade}_{Wt})\,(2\,\Delta \ln s_{it}),$$

where $s_{it} = Y_{it} / Y_{Wt}$ is the share of country i in world GDP, and Y_{Wt} is total world GDP, and the simplification follows because the trade matrix is symmetric. The first term in (8) matters because from 1870 to 1939 world real GDP grew from about $70 billion (in 1913 prices) to $270 trillion; such a fourfold change in world output in would imply a fourfold change in trade, since trade should, *ceteris paribus*, bear a constant ratio to GDP, given a maintained assumption that $\beta_Y = 1$.[47] The expression at (9), the second term in (8), matters if income convergence played an important role in this period, in contrast to the postwar where its impact was negligible [Baier and Bergstrand 2001].

Under these conditions, Table III summarizes our explanation of the fall and rise of world trade by focusing on five benchmark years, 1870, 1900, 1913, 1929 and 1938. Rows 1 to 3 derive the rise and fall of trade-GDP ratios to be explained. Rows 4 to 6 show the three main explanatory variables. Rows 7 to 9 normalize to a 1913 benchmark and, since some of the changes are large, all data are put into natural logs. The rise in world trade is decomposed mechanically into changes in world GDP (the first term in equation 8) and changes in the trade-GDP ratio. In Panel (c), finally, Rows 10 to 12 display the results of our counterfactual experiments, the three simulations that apply to all years the 1913 gold standard, 1913 tariffs, and 1913 transport costs (where the latter uses "maritime routes" only). Row 13 also reports the impact of income convergence on trade (equation 9, using 1913 trade shares), the implicit counterfactual being the imposition of the 1913 size distribution of GDP at each date. Row 14 derives the unexplained residual at each date relative to the 1913 benchmark.

Our account of trade seems fairly complete and the unexplained residual is small in most periods. From Row 7 we see that from 1870 to 1913 trade grew by a factor of 5 (+406 percent ≈ $e^{1.62}–1$). After the scale effect of growing world output is subtracted (+151 percent ≈ $e^{0.92}–1$), we are left to explain a rise of the trade-GDP ratio of 101 percent (≈ $e^{0.70}–1$), the near doubling seen in Row 1 and Figure I. Both the gold standard (+35 percent ≈ $e^{0.30}–1$) and maritime transport

[47] Over the same span world GDP *per capita* doubled [Maddison 1995, Tables E2 and E3]. But in our preferred model, the coefficient on income per capita y is zero, so we impute no change in trade due to this variable.

costs (+35 percent ≈ $e^{0.30}$–1) each roughly account for an equally large share of this trade boom. But whereas the latter figures prominently in textbook explanations, the former deserves more recognition. Income convergence also played a large role (+27 percent ≈ $e^{0.24}$–1), a hitherto unrecognized effect of income convergence in the pre-1914 period arising from the rapid growth of several precocious follower countries—of that 24 percent trade growth, about 8 percent was attributable to the dramatic rise of the U.S. share of world output from 1870 to 1913, 4 percent to Argentina, and 3 percent to Germany. Tariffs are estimated to have been of trivial consequence overall, suggesting that the impact of the so-called globalization backlash was limited. The residual is small and negative. After 1900 the changes were smaller: there was a further 67 percent (≈ $e^{0.51}$–1) increase in trade, of which 21 percent (≈ $e^{0.19}$–1) was a rise in the trade-output ratio. Most of the work of the gold standard was done by then and the effect of income convergence was also trivial. Other factors loomed larger: continued transport costs declines continued to boost trade by about 13 percent, and a further 7 percent rise is explained by declining tariffs (some of this being due to fixed specific duties waning in real terms during the post-1900 era of gold-boom inflation). The residual was negligible.

After 1913, our explanations also fit the data quite well. Row 7 shows that trade was much larger in 1913 than in either 1929 (by 11 percent ≈ $e^{0.10}$–1) or 1938 (by 60 percent ≈ $e^{0.47}$–1). Relative to 1929, the very similar level of 1913 trade was attributable to the offsetting effects of lower transport costs in 1913 (+21 percent ≈ $e^{0.19}$–1) and a smaller world economy (–26 percent ≈ $e^{-0.30}$–1). Since the gold standard was by 1929 mostly rebuilt in its 1913 form, differences in payments frictions were small for this pair of dates. Relative to 1938, the 1913 trade level was much higher, because although the 1913 world economy was smaller (–34 percent ≈ $e^{-0.41}$–1), the scale effect was more than offset by the trade-boosting effects in 1913 of lower transport costs (+65 percent ≈ $e^{0.50}$–1), the broad presence of the gold standard (+38 percent ≈ $e^{0.32}$–1), and the much lower levels of protection (+22 percent ≈ $e^{0.20}$–1). In the interwar period, the effects of income convergence were relatively small (around 6 to 7 percent). Non-negligible log residuals of +0.13 (in 1929) or –0.21 (in 1938) leave a modest role for missing factor(s) in our model, possibly the non-tariff barriers erected in the 1920s, or mismeasurement bias due to the use of country average (rather than bilateral) tariffs. However, the direction of these residuals is not uniform, so they might indicate simple imprecision of our interwar model rather than any bias per se.

VII. Conclusions

Our work informs debates about globalization both past and present. As an historical analysis, this paper represents a challenge to some accepted narratives. The secular expansion of the world output level was the main driver of total world trade, but in any story of the change in the trade-output ratio there is a role for *both* payments frictions (the gold standard) *and* transport frictions (shipping costs). Furthermore, without diminishing any country-specific impacts, the so-called tariff backlash appears to have been much smaller than conventional wisdom suggests before

1914, although commercial policy probably did matter a great deal in the interwar period. Future research might be profitably directed to constructing a more complete account by addressing shortcomings in the data sources, especially transport costs and commercial policy, and by applying alternative models of trade. A more ambitious, research goal is to forge a complete account of world trade for two global centuries, from 1800 to the present.

As for the present, by many measures, the process of global integration has not surpassed the marks set by the world economy in 1913 and some insights are suggested. Although commercial policy has become more liberal over the last fifty years, at least in developed countries, an historical perspective shows that there are limits to what the reduction of these frictions alone can achieve. Other frictions matter but, beyond Europe, the unification of monetary standards remains a distant prospect and shipping costs have shown an uneven postwar trend. On the other hand, if those other frictions remain stable, history helps allay some fears of what a future globalization backlash might portend. Our results also show that it would take a great deal more than protectionism alone—even of the acute form seen during the interwar period—to seriously undermine the current levels of world trade.

APPENDIX 1: WORLD TRADE AND GDP DATA, 1870–1939

Trade volumes in local currency for up to 120 countries are from Mitchell [1992; 1993; 1995]. To eliminate bias due to a changing sample size, a sample with constant cross section size (N = 56) was constructed by imputing data. The following algorithm was used. Countries with at least 50 observations for exports and imports in the 60 years 1879–1938 were included. Missing data from 1870–1913 and 1920–39 were imputed by trend interpolation, backcast, and forecast using world trends. Missing data for 1914–19 was not imputed, but in these wartime years the sample size never fell below N = 51.

World GDP estimates were constructed for up to 56 countries based on Maddison [1995; 2001]. This source provides data in 1990 dollars for 30 countries beginning in 1870, with benchmarks and time series thereafter. Inter-benchmark gaps were filled based on average annual sample growth rates for available countries in each year, with the growth rates scaled to ensure the benchmarks for 30 countries were hit. This 30 country sample, using Maddison's estimates for 56 countries, was estimated to cover about 90 percent of the total 56 country GDP at all benchmark dates, so the final figures were inflated 10 percent to get an estimate of a 56 country sample for world GDP.

Lastly all data were converted to current U.S. dollars using exchange rates from Global Financial Database, and then converted to constant 1913 U.S. dollars using the U.S. GDP deflator [Obstfeld and Taylor 2003b].

APPENDIX 2: SAMPLES USED

Econometrics

Basic data for the gravity regressions for the following countries was drawn from Irwin and Terviö [2002]:

For 1913: Argentina, Australia, Austria-Hungary, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Denmark, Egypt, Finland, France, Germany, Greece, India, Italy, Japan, Mexico, Netherlands, Netherlands Indies (Indonesia), New Zealand, Norway, Peru, Philippines, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, U.S.S.R., United Kingdom, United States.

For 1928 and 1938 same as 1913 minus Egypt, plus Austria and Hungary (distinct), plus Czechoslovakia, Ireland, Venezuela, Yugoslavia.

The regressors were then augmented with exchange rate volatility from Global Financial Data and proxy tariff rates from Clemens and Williamson [2001]. Due to missing data in these sources, this generated an unbalanced panel of 1,088 observations, but zero trade for some country pairs and missing data reduces the sample further to 808 data points for OLS and 2SLS estimation (although the full set of 1,088 observations was used in the Tobit estimations, not reported).

Counterfactuals

Appendix 6 shows countries with trade data for *any* of the years 1870–1939. Countries in our 56-country trade data sample are marked *. The ratio of imputed to total trade in the 56-country sample is shown in Figure IV. The 35 countries with Clemens-Williamson tariff data are marked †. Countries with 1913 bilateral trade data used in the weighting matrix are marked §.

APPENDIX 3: RESULTS WITH COUNTRY PAIR FIXED EFFECTS.

Appendix 7 shows results when country pair fixed effects are included, that is, dummies for all dyads. Here we follow Pakko and Wall [2001], and like them we exclude time effects, which are anyway found to be insignificant (not reported). We also find that the trade diversion variable is insignificant in both OLS and 2SLS specifications (reported in columns 2 and 4). The preferred results here are therefore columns 1 and 3, where the gold standard variable is still positive and significant at about 0.21. This estimate is not significantly different from the result in Table I, a specification which we think is preferable on *a priori* grounds if one wishes to actually test the empirical content of the gravity model. With all the dyads dummied out, however, this specification, of course, allows no inclusion of any time invariant pair characteristic, such as distance.

Appendix 4: Shipping Technology in 1935

We impose Hummels' [1999] technology, ln (Cost per ton) = $a + b$ ln (Distance). We take 1935 shipping rates from Isserlis [1938, Table 10] as shown in Appendix 8. We use only major cities and measure distance from London (even though some freight is to "the continent"). Distances are great circle, not by sea. Estimation is by OLS. The slope is found to be 0.52 and the fit is shown in Figure V.

Appendix 5: Alternative Transport Cost Counterfactuals

It is also possible to construct alternative estimates of the elasticity of trade with respect to transport costs. We experimented with a "tariff analog" method as well as the "shrinking distance" method discussed in the main text.

For *ad valorem* transport costs c let us rite the gross cost mark-up factor $C = (1 + c)$ and for an *ad valorem* tariff t let us write the gross tariff mark-up factor $T = (1 + t)$. Clearly, the total mark-up factor, neglecting other frictions (such as domestic transport costs or other policies) would be $CT = (1 + c)(1 + t)$. That is, a change in *ad valorem* transport costs is isomorphic to a change in the *ad valorem* tariff level: the elasticity of trade with respect to C and T should be the same. For any pair applying symmetric tariffs, the elasticity with respect to T is $2\beta_T$. Hence, the elasticity of trade with respect to c is then given by

$$\Delta \ln \text{Trade}^{C}_{it} = 2\beta_T \Delta \ln C = \frac{2c}{1+c}\beta_T \Delta \ln c$$

Clearly the main drawback of this method is that it is highly sensitive to the estimate of *ad valorem* transport costs c. Unfortunately, data on transport cost mark-ups are difficult to obtain, seemingly impossible on a country basis. In addition the mark-up varies according to the composition of the goods shipped too. Still, what do we know?

According to Williamson's [2002, Table 1] figures (cited earlier) the wheat mark-up on Atlantic routes was about 20 percent in 1913, and this is also the same as the mark-up on the longer Rangoon to Europe rice run. As an estimate for all trade this could be biased too high if these bulk commodities had low value-to-weight ratios. Williamson [2002, Table 1] also cites World Bank estimates of *ad valorem* shipping costs suggesting figures of 27.5 percent in 1920 and 18.7 percent in 1940. We would obtain values of 41 percent in 1921 and 29 percent in 1939 based on 0.2 times the Isserlis index. Thus a plausibly wide range of values for c in our time period would be from 0.2 to 0.5.

This range is rather unhelpful, since, given the above formula, the elasticity of trade with respect to transport costs would then fall in the following ranges (given $\beta_T = -1.559$):

Estimate of c	0.2	0.3	0.4	0.5
Implied elasticity $\frac{2c}{1+c}\beta_T$	-0.52	-0.72	-0.89	-1.04

For comparison, our "shrinking distance" methodology provided an elasticity of trade with respect to costs of $\beta_D/b = -1.27$ (given $\beta_D = -0.659$, and $b = 0.52$). Thus, at the higher end of the plausible range of *ad valorem* transport costs the two methods deliver approximately the same result, close to unity.

This conclusion is reassuring since the tariff elasticity β_T estimate really is a poor proxy for the cost elasticity, as one could argue that the tariff-cost analogy is inexact: tariffs can be avoided and apply to a limited range of goods, whereas transport costs cannot, so the "true" elasticity for the latter is larger than for the former. However, given the uncertainty over the precise value of c, we prefer to use the distance method shown in the text.

APPENDIX 6: SAMPLE DESCRIPTIONS

	Albania		Guinea		Paraguay
* §	Algeria		Guinea-Bissau	* † §	Peru
	Angola	*	Guyana	* † §	Philippines
* † §	Argentina		Haiti	†	Poland
* † §	Australia	*	Hawaii	* §	Portugal
* † §	Austria/Hungary		Honduras	*	Reunion
*	Barbados		Hong Kong		Romania
* §	Belgium		Hungary	* † §	Russia
	Benin	* † §	India	*	Sabah
	Bolivia	*	Indochina		Samoa
* † §	Brazil	* † §	Indonesia	*	Sarawak
	British Somaliland		Iran	*	Senegal
†	Brunei		Iraq	†	Serbia
	Bulgaria	* † §	Italy	*	Sierra Leona
	Cameroon	* †	Jamaica		South Africa
* §	Canada	* §	Japan	* † §	Spain
	Cape Of Good Hope		Jordan	†	Sri Lanka
* † §	Chile		Kenya		Straits Settlements
* † §	China		Korea		Sudan
†	Colombia		Madagascar		Surinam
	Costa Rica		Malawi	* † §	Sweden
†	Cuba		Malaya	* §	Switzerland
*	Cyprus	*	Martinique		Syria
	Czechoslovakia	*	Mauritius		Taiwan
* † §	Denmark	* † §	Mexico		Tanzania
	Dom. Republic		Morocco	* † §	Thailand
	Ecuador		Mozambique		Togo
* † §	Egypt	†	Myanmar	*	Trinidad & Tobago
* §	El Salvador		Natal	*	Tunisia
*	Equatorial French Africa	* §	Netherlands	†	Turkey
*	Fiji	*	Netherlands Antilles		Uganda
* §	Finland		New Caledonia	* † §	United Kingdom
* † §	France	* † §	New Zealand	†	Uruguay
	French Polynesia	*	Newfoundland	* † §	USA
*	Gambia		Nicaragua		Venezuela
* † §	Germany	* §	Nigeria		Western Samoa
*	Ghana	* † §	Norway		Zaire
†	Greece		Orange Free State		Zambia
*	Guadeloupe		Palestine		Zanzibar
	Guatemala		Panama		Zimbabwe

Notes: This table shows countries with aggregate trade data for *any* of the years 1870–1939. Countries in our 56-country trade data sample are marked *. The 35 countries with Clemens-Williamson tariff data are marked †. Countries with 1913 bilateral trade data used in the weighting matrix are marked §.

APPENDIX 7: REGRESSION ESTIMATES WITH COUNTRY PAIR FIXED EFFECTS

	OLS		2SLS	
GDP	0.752	0.735	0.747	0.729
	(5.73)	(5.58)	(5.68)	(5.53)
GDP per capita	-0.138	-0.137	-0.131	-0.131
	(0.82)	(0.82)	(0.78)	(0.78)
Gold	0.211	0.122	0.203	0.111
	(2.36)	(1.13)	(2.27)	(1.02)
Tariff	-1.958	-2.257	-1.975	-2.287
	(3.93)	(4.19)	(3.96)	(4.24)
Exchange rate volatility	-0.009	-0.008	-0.009	-0.008
	(2.27)	(2.14)	(2.29)	(2.15)
Diversion	—	-0.156	—	-0.162
		(1.45)		(1.51)
Observations	808	808	808	808
Adjusted R^2	0.903	0.903	0.903	0.903
Root MSE	0.748	0.747	0.748	0.747

Notes: See Table I.

APPENDIX 8: FREIGHT RATES AND DISTANCES IN 1935

U.K. or continental trade by destination and type of freight		Great circle distance from London (miles)	Isserlis freight rate (shillings/ton)
Lisbon	Coal outbound	980	6.94
Piraeus (Athens)	Coal outbound	1,490	9.17
Black Sea (Istanbul)	Grain inbound	1,560	10.04
Montreal	Coal outbound	3,240	7.00
Delhi	Grain inbound	4,170	20.40
Cuba	Sugar inbound	4,710	13.17
North Pacific (San Francisco)	Grain inbound	5,350	19.00
Burma	Grain inbound	5,590	22.52
Cape Town	Grain inbound	6,010	13.94
Saigon	Grain inbound	6,330	23.67
Buenos Aires	Coal outbound	6,920	8.90
Buenos Aires	Grain inbound	6,920	14.65
Chile (Santiago)	Fertilizer inbound	7,250	19.40
W. Australia (Perth)	Grain inbound	9,000	26.04
Queensland (Brisbane)	Sugar inbound	10,500	28.75
Victoria (Melbourne)	Grain inbound	10,510	26.50
Sydney	Grain inbound	10,560	23.13

Source: Selected freights to and from major cities from Isserlis [1938, Table 10]. Distances from a digital map.

References

Alesina, Alberto, "The Size of Countries: Does it Matter?" Harvard University, August 2002, photocopy.

Alesina, Alberto, and Robert J. Barro, "Currency Unions," *Quarterly Journal of Economics* CXVII (2002), 409–36.

Alesina, Alberto, Robert J. Barro, and Silvana Tenreyro, "Optimal Currency Areas," in *NBER Macroeconomics Annual 2001*, Mark Gertler and Kenneth Rogoff, eds. (Cambridge MA: MIT Press, 2002).

Anderson, James E., "A Theoretical Foundation for the Gravity Equation," *American Economic Review* LXIX (1979), 106–116.

Anderson, James E., and Eric van Wincoop, "Gravity with Gravitas: A Solution to the Border Puzzle," *American Economic Review*, forthcoming.

Baier, Scott L., and Jeffrey H. Bergstrand, "The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity," *Journal of International Economics* LIII (2001), 1–27.

Baier, Scott. L., and Jeffrey. H. Bergstrand, "On the Endogeneity of International Trade Flows and Free Trade Agreements," Mendoza College of Business and Kellogg Institute for International Studies, University of Notre Dame, 2002, photocopy.

Bairoch, Paul, *Economics and World History: Myths and Paradoxes* (New York, NY: Harvester Wheatsheaf, 1993).

Bayoumi, Tamim, and Barry Eichengreen, "Is Regionalism Simply a Diversion? Evidence from the EU and EFTA," in *Regionalism versus Multilateral Trade Agreements*, Takatoshi Ito and Anne Kreuger, eds. (Chicago, IL: University of Chicago Press, 1997).

Bergstrand, Jeffrey H., "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence," *Review of Economics and Statistics* LXVII (1985), 474–81.

Bergstrand, Jeffrey H., "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade," *Review of Economics and Statistics* LXXI (1989), 143–53.

Blainey, Geoffrey, *The Tyranny of Distance: How Distance Shaped Australia's History*, revised ed. (South Melbourne: Macmillan, 1982).

Braudel, Fernand, *Civilization and Capitalism, 15^{th}–18^{th} Century*, translated by Siân Reynolds, 3 volumes (Berkeley and Los Angeles, CA: University of California Press, 1992).

Cameron, Rondo E., *A Concise Economic History of the World: From Paleolithic Times to the Present*, 2nd ed. (New York, NY: Oxford University Press, 1993).

Clemens, Michael, and Jeffrey G. Williamson, "A Tariff-Growth Paradox? Protection's Impact the World Around 1875–1997," National Bureau of Economic Research, Working Paper Series No. 8459, September 2001.

Coe, David T., Arvind Subramanian, and Natalia T. Tamirisa, with Rikhil Bhavnani, "The Missing Globalization Puzzle," IMF Working Paper WP/02/171, October 2002.

Collins, William J., Kevin H. O'Rourke, and Jeffrey G. Williamson, "Were Trade and Factor Mobility Substitutes in History?" in *Migration: The Controversies and the Evidence*, Riccardo Faini, Jaime De Melo and Klaus F. Zimmermann, eds. (Cambridge: Cambridge University Press, 1999).

Deardorff, Alan V., "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World," in *The Regionalization of the World Economy*, Jeffrey A. Frankel, ed. (Chicago, IL: University of Chicago Press, 1998).

Di Mauro, Francesca, "The Impact of Economic Integration on FDI and Exports: A Gravity Approach," CEPS Working Document No. 156, November 2000.

Eaton, Jonathan, and Samuel Kortum, "Technology, Geography, and Trade," *Econometrica* LXX (2002), 1741–79.

Edison, Hali J., and Michael Melvin, "The Determinants and Implications of a Choice of Exchange Rate Regime," in *Monetary Policy for a Volatile Global Economy*, William S. Haraf and Thomas D. Willett, eds. (Washington, DC: AEI Press, 1990).

Eichengreen, Barry J., *Golden Fetters: The Gold Standard and The Great Depression, 1919–1939* (Oxford: Oxford University Press, 1992).

Eichengreen, Barry J., and Marc Flandreau, "The Geography of the Gold Standard," in *Currency Convertibility: The Gold Standard and Beyond*, Jorge Braga de Macedo, Barry J. Eichengreen and Jaime Reis, eds. (London: Routledge, 1996).

Eichengreen, Barry J., and Douglas A. Irwin, "Trade Blocs, Currency Blocs and the Reorientation of World Trade in the 1930s," *Journal of International Economics* XXXVIII (1995), 1–24.

Egger, Peter, "A Note of the Proper Econometric Specification of the Gravity Equation," *Economics Letters* LXVI (2000), 25–31.

Estevadeordal, Antoni, Brian Frantz, and Raúl Sáez, "International Trade and Exchange Rate Volatility." Inter-American Development Bank, October 2001, photocopy.

Estevadeordal, Antoni, and Raymond Robertson, "From Distant Neighbors to Close Partners: FTAA and the Pattern of Trade," Inter-American Development Bank, May 2002, photocopy.

Estevadeordal, Antoni, and Alan M. Taylor, "A Century of Missing Trade?" *American Economic Review* XCII (2002), 383–93.

Evenett, Simon J., and Wolfgang Keller, "On Theories Explaining the Success of the Gravity Equation," *Journal of Political Economy* CX (2002), 281–316.

Feenstra, Robert C., "Integration of Trade and Disintegration of Production in the Global Economy," *Journal of Economic Perspectives* XII (1998), 31–50.

Findlay, Ronald, and Kevin H. O'Rourke, "Commodity Market Integration, 1500–2000," in *Globalization in Historical Perspective*, Michael D. Bordo, Alan M. Taylor, and Jeffrey G. Williamson, eds. (Chicago, IL: University of Chicago Press, 2003).

Flandreau, Marc, "The Economics and Politics of Monetary Unions: A Reassessment of the Latin Monetary Union, 1865–71," *Financial History Review* VII (2000), 25–43.

Flandreau, Marc, and Mathilde Maurel, "Monetary Union, Trade Integration, and Business Cycles in 19th Century Europe: Just Do It," Centre for Economic Policy Research, Discussion Paper Series No. 3087, November 2001.

Foreman-Peck, James, *A History of the World Economy: International Economic Relations Since 1850*, 2nd ed. (New York, NY: Harvester Wheatsheaf, 1995).

Frankel, Jeffrey A., *Regional Trading Blocs in the World Economic System* (Washington, DC: Institute for International Economics, 1997).

Frankel, Jeffrey A., and Andrew K. Rose, "An Estimate of the Effect of Common Currencies on Trade and Income," *Quarterly Journal of Economics* CXVII (2002), 437–66.

Frankel, Jeffrey A., and Shang-Jin Wei, "Trade Blocs and Currency Blocs," in *The Monetary Future of Europe*, Guillermo de la Dehesa et al., eds. (London: Center for Economic Policy Research, 1993).

Gallarotti, Giulio M., *The Anatomy of an International Monetary Regime: The Classical Gold Standard, 1880–1914* (New York, NY: Oxford University Press, 1995).

Glick, Reuven, and Andrew K. Rose, "Does a Currency Union Affect Trade? The Time-Series Evidence," *European Economic Review* XLVI (2002), 1125–51.

Harrigan, James, "Specialization and the Volume of Trade: Do the Data Obey the Laws," National Bureau of Economic Research, Working Paper Series No. 8675, December 2001.

Helpman, Elhanan, and Paul R. Krugman, *Market Structure and Foreign Trade* (Cambridge, MA: MIT Press, 1985).

Hummels, David, "Have International Transportation Costs Declined?" November 1999, photocopy.

Irwin, Douglas A., and Marko Terviö, "Does Trade Raise Income? Evidence from the Twentieth Century," *Journal of International Economics* LVIII (2002), 1–18.

Isserlis, L., "Tramp Shipping Cargoes, and Freights," *Journal of the Royal Statistical Society* CI (1938), 53–146.

James, Harold, *The End of Globalization: Lessons from The Great Depression* (Cambridge, MA: Harvard University Press, 2001).

Kemmerer, Edwin W., *Gold and the Gold Standard: The Story of Gold Money, Past, Present and Future* (New York, NY: McGraw-Hill, 1944).

Kenwood, A. G., and A. L. Lougheed, *The Growth of the International Economy, 1820–2000*, 4th ed. (London: Routledge, 1999).

Kindleberger, Charles P., *The World in Depression, 1929–1939*, revised ed. (Berkeley and Los Angeles, CA: University of California Press, 1986).

Kindleberger, Charles P., "Commercial Policy Between the Wars," in *The Cambridge Economic History of Europe*, vol. 8, Peter Mathias and Sidney Pollard, eds. (Cambridge: Cambridge University Press, 1989).

Klein, Michael W., "Dollarization and Trade," Working Paper Series, No. 8879, National Bureau of Economic Research, April 2002.

League of Nations, *Memorandum on International Trade and Balances of Payments, 1912–1926*, 2 volumes (Geneva: League of Nations, 1927).

Levy Yeyati, Eduardo, "On the Impact of a Common Currency on Bilateral Trade," Universidad Torcuato de Tella, 2002, photocopy.

Lewis, W. Arthur, *Economic Survey: 1919–1939* (London: George Allen and Unwin, 1949).

Limão, Nuno, and Anthony J. Venables, "Infrastructure, Geographical Disadvantage, Transport Costs, and Trade," *World Bank Economic Review* XV (2001), 451–79.

Linnemann, Hans, and Harmen Verbruggen, "GSTP Tariff Reduction and Its Effects on South-South Trade in Manufactures," *World Development* XIX (1991), 539–51.

López-Córdova, J. Ernesto, and Christopher M. Meissner, "Exchange-Rate Regimes and International Trade: Evidence from the Classical Gold Standard Era," *American Economic Review*, forthcoming.

Maddison, Angus, *Monitoring the World Economy* (Paris: OECD, 1995).

Maddison, Angus, *The World Economy: A Millennial Perspective*, *Development Centre Studies* (Paris: OECD, 2001).

Maizels, Alfred, *Industrial Growth and World Trade* (Cambridge: Cambridge University Press, 1963).

Mátyás, László, "Proper Econometric Specification of the Gravity Model," *World Economy* XX (1997), 363–68.

Meissner, Christopher M., "A New World Order: Explaining the Emergence of the Classical Gold Standard," National Bureau of Economic Research, Working Paper Series no. 9233, October 2002.

Mélitz, Jacques, "Geography, Trade and Currency Union," Discussion Paper Series, No. 2987, Center for Economic Policy Research, October 2001.

Mill, John Stuart, *Principles of Political Economy* (London: Longmans, 1848 [1929]).

Mitchell, Brian R., *International Historical Statistics: Europe, 1750–1988* (New York, NY: Stockton Press, 1992).

Mitchell, Brian R., *International Historical Statistics: The Americas, 1750–1988* (New York, NY: Stockton Press, 1993).

Mitchell, Brian R., *International Historical Statistics: Africa, Asia & Oceania, 1750–1988* (New York, NY: Stockton Press, 1995).

Nurkse, Ragnar, *International Currency Experience: Lessons of the Inter-War Period* (Geneva: League of Nations, 1944).

O'Brien, Patrick, "European Economic Development: The Contribution of the Periphery," *Economic History Review* XXXV (1982), 1–18.

O'Rourke, Kevin H., Alan M. Taylor, and Jeffrey G. Williamson, "Factor Price Convergence in the Late Nineteenth Century," *International Economic Review* XXXVII (1996), 499–530.

O'Rourke, Kevin H., and Jeffrey G. Williamson, *Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy* (Cambridge, MA: MIT Press, 1999).

O'Rourke, Kevin H., and Jeffrey G. Williamson, "When Did Globalization Begin?" *European Review of Economic History* VI (2002), 23–50.

O'Rourke, Kevin H., and Jeffrey G. Williamson, "After Columbus: Explaining the European Overseas Trade Boom 1500–1800," *Journal of Economic History* LXII (2002), 417–56.

Obstfeld, M., and A. M. Taylor, "Globalization and Capital Markets," in *Globalization in Historical Perspective*, Michael D. Bordo, Alan M. Taylor, and Jeffrey G. Williamson, eds. (Chicago, IL: University of Chicago Press, 2003a).

Obstfeld, Maurice, and Alan M. Taylor, *Global Capital Markets: Integration, Crisis, and Growth* (Cambridge: Cambridge University Press, 2003b, in progress).

Pakko, Michael R., and Howard J. Wall, "Reconsidering the Trade-Creating Effects of a Currency Union," *Federal Reserve Bank of St. Louis Review* LXXXIII (2001), 37–45.

Panizza, Ugo, Ernesto Stein, and Ernesto Talvi, "Assessing Dollarization: An Application to Central American and Caribbean Countries," in *Dollarization*, Eduardo Levy Yeyati and Federico Sturzenegger, eds. (Cambridge, MA: MIT Press, 2002, forthcoming).

Persson, Torsten, "Currency Unions and Trade: How Large is the Treatment Effect?" *Economic Policy* XVI (2001), 433–48.

Podolny, Joel M., and Fiona M. Scott Morton, "Social Status, Entry, and Predation: The Case of British Shipping Cartels 1879–1929," *Journal of Industrial Economics* XLVII (1999), 41–67.

Redding, Stephen, and Anthony J. Venables, "Economic Geography and International Inequality," CEP Discussion Paper Series, No. 495, London School of Economics, April 2001.

Rose, Andrew K., "One Money, One Market: The Effect of Common Currencies on Trade," *Economic Policy* XV (2000), 7–33.

Rose, Andrew K., "Do We Really Know That the WTO Increases Trade?" National Bureau of Economic Research, Working Paper Series no. 9273, October 2002

Rose, Andrew K., and Charles Engel, "Currency Unions and International Integration," *Journal of Money, Credit, and Banking* XXXIV (2002), forthcoming.

Rose, Andrew K., and Eric van Wincoop, "National Money as a Barrier to International Trade: The Real Case for Currency Union," *American Economic Review* XCI (2001), 386–90.

Tamirisa, Natalia T., "Exchange and Capital Controls as Barriers to Trade," *IMF Staff Papers* XLVI (1999), 69–88.

Tenreyro, Silvana, "On the Causes and Consequences of Currency Unions," Harvard University, December 2001, photocopy.

United States Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970, Bicentennial Edition*, 2 volumes (Washington, DC: Government Printing Office, 1975).

Williamson, Jeffrey G., "Land, Labor, and Globalization in the Pre-Industrial Third World," *Journal of Economic History* LXII (2002), 55–85.

TABLE I
REGRESSION ESTIMATES

	(a) OLS, pooled			(b) 2SLS, pooled			(c) OLS, country fixed effects (coefficients not shown)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Distance	-0.788	-0.778	-0.779	-0.787	-0.778	-0.778	-0.658	-0.643	-0.643	-0.660	-0.642	-0.642
	(10.99)	(11.18)	(11.18)	(10.98)	(11.18)	(11.16)	(8.33)	(8.41)	(8.39)	(8.34)	(8.38)	(8.38)
GDP	0.851	0.860	0.859	0.851	0.860	0.860	1.176	1.064	1.068	1.222	1.108	1.093
	(27.27)	(28.00)	(27.80)	(27.26)	(27.99)	(27.81)	(5.54)	(5.05)	(4.99)	(4.74)	(4.30)	(4.14)
GDP per capita	0.416	0.419	0.418	0.418	0.421	0.421	-0.51	-0.352	-0.354	-0.416	-0.299	-0.296
	(6.69)	(6.93)	(6.87)	(6.71)	(6.96)	(6.92)	(1.88)	(1.31)	(1.31)	(1.19)	(0.88)	(0.87)
Landlocked	-0.745	-0.743	-0.740	-0.749	-0.747	-0.747	—	—	—	—	—	—
	(3.17)	(3.22)	(3.20)	(3.19)	(3.24)	(3.23)						
Adjacent	0.565	0.576	0.578	0.565	0.576	0.576	0.680	0.718	0.719	0.679	0.723	0.719
	(2.45)	(2.54)	(2.54)	(2.45)	(2.54)	(2.53)	(3.05)	(3.30)	(3.29)	(3.04)	(3.31)	(3.29)
Island	-0.144	-0.118	-0.118	-0.145	-0.118	-0.118	—	—	—	—	—	—
	(1.17)	(0.98)	(0.98)	(1.17)	(0.98)	(0.98)						
Colonial relationship	1.852	1.819	1.821	1.855	1.823	1.823	2.049	2.009	2.010	2.047	2.013	2.008
	(7.11)	(7.21)	(7.21)	(7.13)	(7.23)	(7.22)	(7.51)	(7.63)	(7.62)	(7.50)	(7.64)	(7.60)
Gold standard	0.504	0.424	0.458	0.490	0.408	0.409	0.352	0.246	0.257	0.380	0.195	0.131
	(3.91)	(3.30)	(2.08)	(3.79)	(3.16)	(1.83)	(2.51)	(1.75)	(1.46)	(2.27)	(1.10)	(0.43)
Average tariff*	-1.303	-0.848	-0.843	-1.308	-0.847	-0.847	-1.559	-1.687	-1.653	-1.584	-1.473	-1.520
	(2.27)	(1.39)	(1.38)	(2.28)	(1.39)	(1.39)	(2.01)	(2.11)	(1.91)	(1.84)	(1.64)	(1.65)
Exchange rate volatility	—	-0.014	-0.014	—	-0.014	-0.014	—	-0.009	-0.009	—	-0.010	-0.010
		(2.61)	(2.58)		(2.63)	(2.62)		(1.54)	(1.54)		(1.49)	(1.51)
Diversion	—	—	0.038	—	—	0.002	—	—	0.016	—	—	-0.056
			(0.19)			(0.01)			(0.10)			(0.26)
Year=1928	-0.640	-0.574	-0.572	-0.641	-0.575	-0.575	—	—	—	-0.204	-0.112	-0.090
	(4.28)	(3.86)	(3.84)	(4.28)	(3.86)	(3.86)				(0.42)	(0.23)	(0.18)
Year=1938	-0.275	-0.362	-0.332	-0.284	-0.374	-0.372	—	—	—	-0.151	-0.211	-0.236
	(1.43)	(1.88)	(1.34)	(1.48)	(1.94)	(1.50)				(0.27)	(0.38)	(0.42)
Observations	820	808	808	820	808	808	820	808	808	820	808	808
Adjusted R^2	0.627	0.635	0.634	0.627	0.635	0.634	0.696	0.705	0.705	0.695	0.704	0.704
Root MSE	1.495	1.448	1.449	1.495	1.448	1.449	1.350	1.301	1.302	1.352	1.303	1.303

Notes: * Average tariff = $\ln(1+t_i) + \ln(1+t_j)$. For 2SLS, Gold standard is instrumented by ln(mean distance from i to its gold partners) plus ln(mean distance from j to its gold partners). t-statistics in parentheses. Diversion is equal to one when one, but not both, countries in a pair is on gold. See text.

TABLE II
GOLD STANDARD AND COMMON CURRENCY EFFECTS ON TRADE:
A COMPARISON WITH THE LITERATURE (SELECTED STUDIES)

Period	"Common currency" effect	Estimation method	Number of observations
		(a) Classical gold standard	
López–Córdova & Meissner (forthcoming)			
1870–1910	0.48 (0.12)	OLS	1,140
1870–1910	0.97 (1.32)	IV	681
1870–1910	0.64 (0.13)	TOBIT	1,150
1870–1910	0.28 (0.13)	OLS time & country effects	1,140
Flandreau & Maurel (2002)			
1880–1913	0.31 (0.05)	2SLS	3,558
		(b) Interwar Gold Standard	
Eichengreen & Irwin (1995)			
1928	0.29 (0.39)	SUR	561
1935	0.53 (0.38)		
1938	0.68 (0.38)		
		(c) Postwar Currency Unions	
Rose (2000)			
1970–1990	1.21 (0.14)	OLS time effects	22,948
1970–1990	1.57 (0.18)	Tobit time effects	22,948
1970–1990	1.69 (0.21)	IV time effects	16,855
1970–1990	0.77 (0.16)	OLS time & country effects	22,948
Glick & Rose (2001)			
1948–1997	1.20 (0.13)	OLS	219,558
1948–1997	0.65 (0.05)	OLS country effects	219,558
Levy Yeyati (2001)			
1970–1990	0.73 (0.21)	OLS country effects	22,948
1970–1995	1.22 (0.16)	Tobit country effects	31,226
Mélitz (2001)			
1970–1975	1.45 (0.18)	OLS time effects	31,101
Pakko & Wall (2001)			
1970–1990	1.17 (0.14)	OLS time effects	21,758
1970–1995	-0.38 (-0.53)	OLS time & country effects	21,758
Persson (2001)			
1970–1990	0.93 (0.15)	OLS time effects	22,948
Tenreyro (2001)			
1978–1997	0.72 (0.12)	OLS time effects	25,695
Rose & van Wincoop (2001)			
1970–1995	1.38 (0.19)	OLS time effects	31,101
1970–1995	0.86 (0.19)	OLS time & country effects	31,101
Alesina, Barro &Tenreyro (2002)			
1960–1997	0.75 (0.20)	OLS	348,295
1960–1997	0.91 (0.18)	OLS country effects	348,295
1960–1997	1.56 (0.44)	IV	348,295
1960–1997	2.70 (0.44)	IV country effects	348,295
Frankel & Rose (2002)			
1970–1975	1.38 (0.19)	OLS time effects	31,226
Klein (2002)			
1974–1997	1.52 (0.17)	OLS	152,960

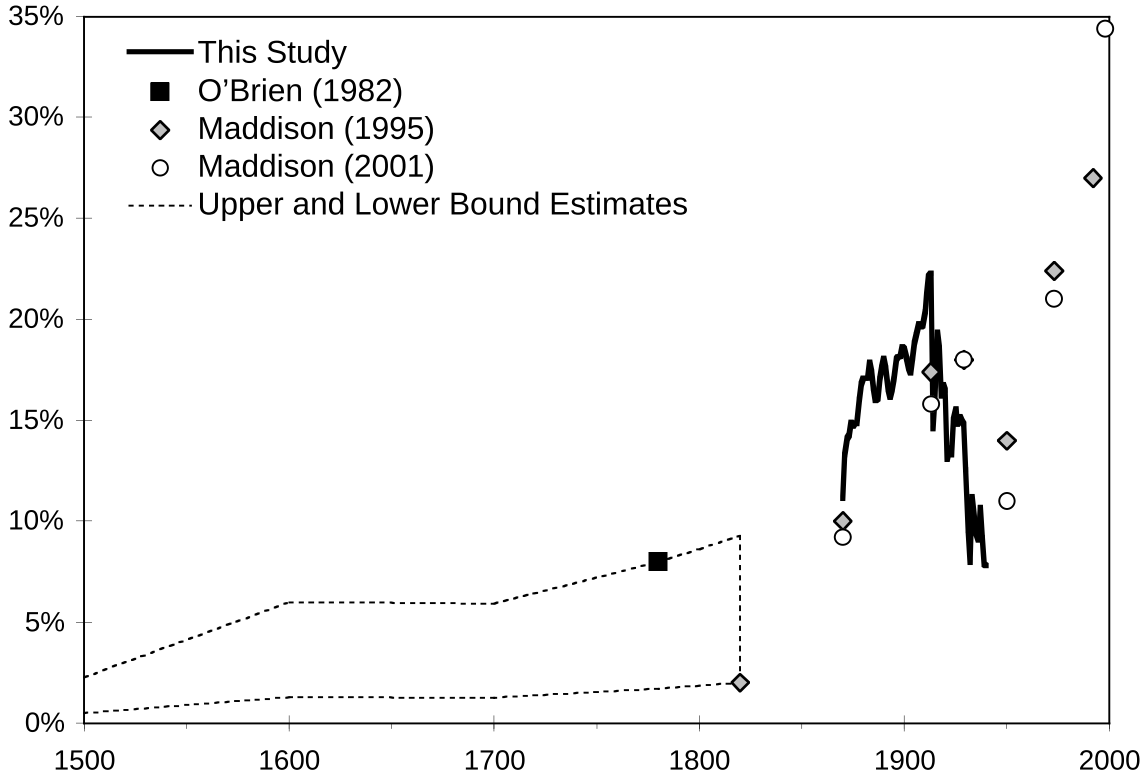
Notes: Coefficients shown are those from pooled regressions only (i.e., those with more than one cross section).

TABLE III
EXPLAINING THE RISE AND FALL OF WORLD TRADE, 1870–1939

		1870	1900	1913	1929	1938
(a) Actual levels						
(1) World trade/GDP (percent)		11	19	22	15	9
(2) World trade (exports + imports, million 1913 US$)		7,899	23,932	39,762	35,613	24,774
(3) World GDP (million 1913 US$)		71,020	129,032	178,280	240,678	269,299
(4) Gold standard (trade weighted share, up to 56 countries)		13	81	88	89	25
(5) Tariffs (trade weighted share, 35 countries)		12	13	11	13	20
(6) Transport Costs (1913 = 100, British real index)		125	112	100	116	138
(b) Change in ln(Trade) explained by output trend, 1913 versus base year						
(7) Actual Change in ln(Trade)		1.62	0.51	0.00	0.10	0.47
(8)	Change in ln(GDP)	0.92	0.32	0.00	-0.30	-0.41
(9)	Change in ln(Trade/GDP)	0.70	0.19	0.00	0.40	0.88
(c) Change in ln(Trade/GDP) explained by the gravity model, 1913 versus base year						
(10) due to:	Gold standard	0.30	0.04	—	-0.02	0.32
(11)	Tariffs	0.00	0.07	—	0.05	0.20
(12)	Transport costs	0.30	0.13	—	0.19	0.50
(13)	Income convergence	0.24	0.02	—	0.06	0.07
(14)	Residual	-0.13	-0.06	—	0.13	-0.21

Notes: See text. The transport costs counterfactual shown here includes only “maritime” routes.

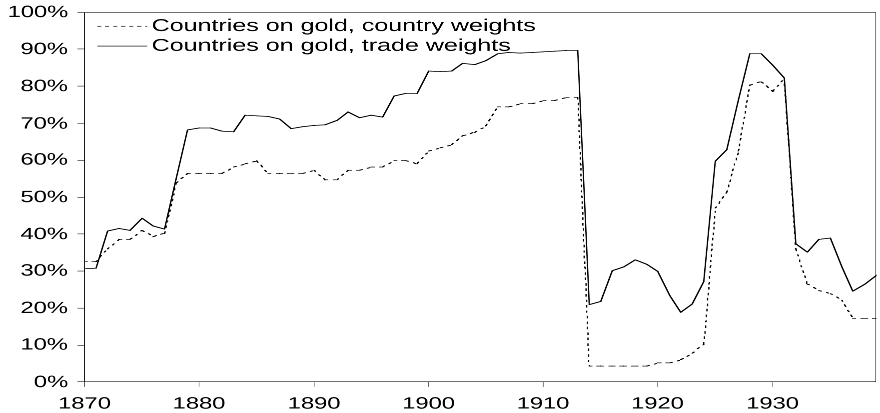
FIGURE I
Five Hundred Years of World Trade-to-GDP Ratios



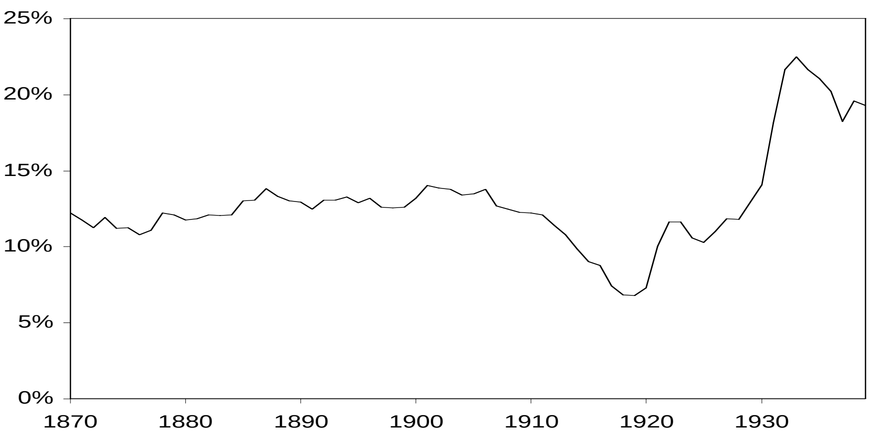
Notes and Sources: This study: Trade volume from Mitchell [1992 1993; 1995], converted to 1913 U.S. dollars using U.S. exchange rate and GDP deflator; see text. Data for a constant sample of 56 countries (excluding war 1914–19, when sample is at least 51 countries). Missing data imputed from trend interpolation. GDP data from Maddison (2001) adjusted and interpolated for missing data. See Appendix. 1500–1800: Trade growth rates from O'Rourke and Williamson [2002, Table 1; volume estimates only]. Level index derived, and scaled by world GDP levels from Maddison [2001, Table B-18]. The "upper bound" series is then scaled to the benchmark 8 percent European trade-GDP ratio for 1780 due to O'Brien [1982], probably an overstatement of the *world* trade-GDP ratio. The "lower bound" series is scaled to the benchmark 2 percent world trade-GDP ratio for 1820 due to Maddison [1995, Table 2-4], possibly biased downwards relative to the long-run trend because of the blockades during the Napoleonic Wars.

FIGURE II
Three Explanatory Variables

(a) Gold Standard Adherence



(b) Tariff Rates

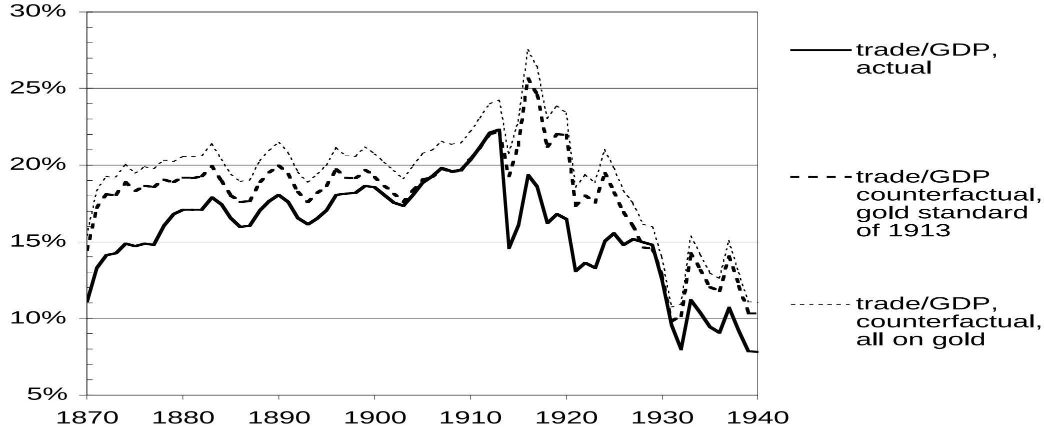


(c) Maritime Transport Costs

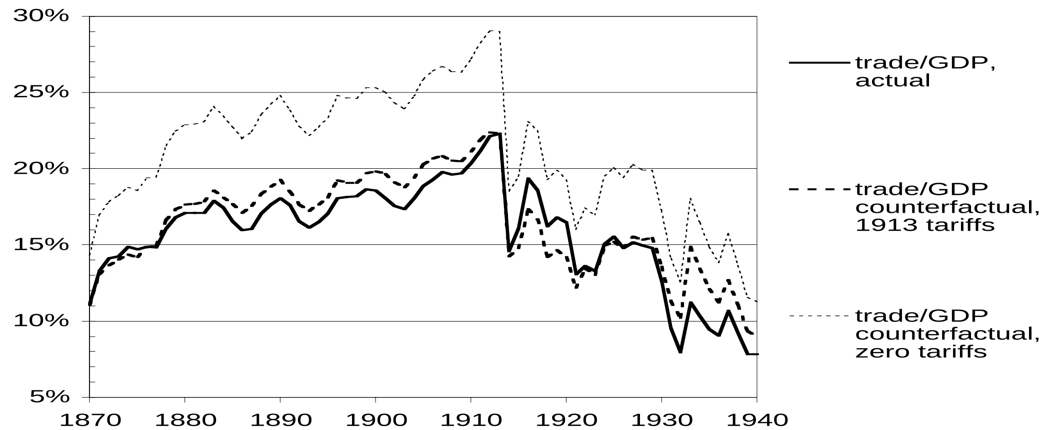
Notes and Source: Gold standard from Meissner and López-Córdova [forthcoming] and Eichengreen [1992]. Tariffs from Clemens and Williamson [2001]. Trade weights from our own database. Freight rates on British tramp routes, deflated by British CPI, from Isserlis [1938], with 1937–40 interpolated from 1930–36 trend. The wartime spike in costs peaks at about 450 on this index, but is omitted for clarity. See text and appendices.

FIGURE III
World Trade Under Three Counterfactual Regimes

(a) Gold Standard Adherence



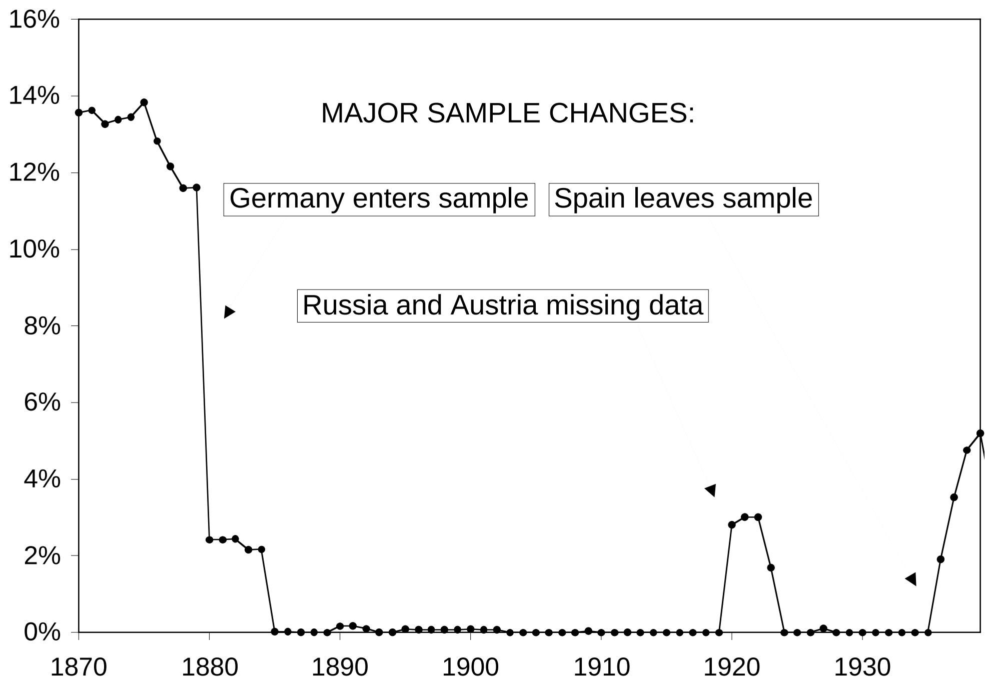
(b) Tariff Rates



(c) Maritime Transport Costs

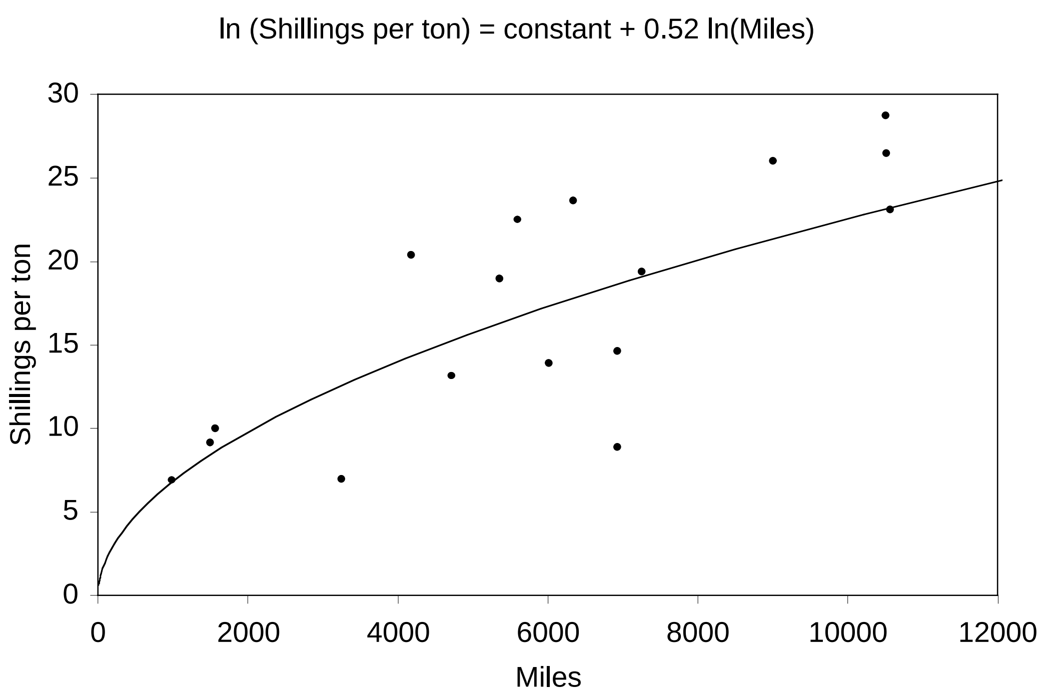
Notes: See text. The transport costs counterfactual shown here includes all routes.

FIGURE IV
Ratio of Imputed to Total Trade in 56-Country Sample



Notes: See Appendices 1, 2 and 6.

FIGURE V
Hummels Shipping Technology for 1935 Using Isserlis Freights



Notes: See Appendices 4 and 8.