Exchange-Rate Regimes and International Trade: Evidence from the Classical Gold Standard Era

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Abstract

In this paper we show that the spread of the classical gold standard in the late nineteenth century increased international trade flows. This positive effect was compounded whenever a group of countries formed a monetary union. Applying the gravity model of trade to more than 1,100 country pairs during the 1870-1910 period, we find that two countries on gold would trade 60 percent more with each other than with countries on a different monetary standard. Moreover, a monetary union would more than double bilateral trade flows. Our findings are relevant for current discussions on alternative monetary arrangements for the twenty-first century.

Keywords: international trade; empirical; panel; currency union; exchange rate regimes; gold standard; gravity model; data; history.

JEL Classification Numbers: F33, N21, N23, N26

1 Introduction

For modern observers, the history of the late nineteenth century global economy presents a period of global integration very comparable to the contemporary resurgence of globalization. According to O'Rourke and Williamson (2000) the 1800s saw startlingly rapid integration between formerly isolated national markets. But the prologue to our story begins in the 1850s and 1860s. These years ushered in a period of historic international cooperation and policy harmonization in areas as disparate as weights and measures at

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the 1855 International Statistical Congress of Paris [Reti (1998)], trade relations with the Cobden-Chevalier treaty, and monetary regimes with the International Monetary Conference of 1867.[1]

Similarly, authors like Bordo, Eichengreen, and Irwin (1999) suggest that today there is an even stronger resurgence of market integration. This is also accompanied by increasing international cooperation on trade policy, monetary integration (e.g., an ever-expanding European Monetary Union and calls for the dollarization of significant parts of Latin America), and even an ideological/policy harmonization as embodied in the so-called Washington Consensus. The question then arises: what role did similar institutional arrangements such as monetary unions, monetary regimes (e.g., the gold standard) have in promoting or impeding integration in the late nineteenth century? We find they played a major role. In particular, we find that the gold standard and the monetary unions of the time massively increased international trade.

We address these issues by studying the correlates of bilateral trade for a global sample of nations from 1870 to 1910. Simply using a *gravity* equation we are able to explain a large portion of the variance in trade patterns for the closing years of the nineteenth century. Besides controlling for geographical and economic factors, we determine the effects of exchange rate volatility, monetary union membership and being on the same commodity money standard as a partner on the size of bilateral trade. We show that from 1870 to 1910 membership in a monetary union roughly doubled bilateral trade among members while linking up to the gold standard when a trade partner was on gold increased trade by at least 60 percent. We also find that exchange rate volatility had a negligible effect on the level of trade, but that in a few particular cases (e.g., parts of South America) high volatility co-existed with high trade volumes. Additionally, the gravity framework allows us to use a novel approach to re-confirm economic historians' views

[1] The International Monetary Conference of 1867 contemplated a motion for a global mono-metallic gold standard with uniform coinage. That policy was never implemented, but the meetings reveal how far policymakers of the day were willing to go with global policy harmonization. As of the year 2000, is it imaginable that member nations of the IMF or the OECD would actually approve of a world monetary union à la Mundell (1961)?

that falling transportation costs and the level of development of two trading partners increased bilateral trade [see Saul (1996) and Bairoch (1996)].

We begin by introducing the historical issues and contemporary work surrounding monetary policy variables and trade. In section 3 we introduce our econometric methodology, and in section 4 we describe our panel data set. We turn to a discussion of our main findings in section 5, including checks for the robustness of our baseline results with a variety of specification tests (5.4). Section 6 tackles potential endogeneity and simultaneity problems that may affect the estimated effect of the gold standard on trade. We conclude our discussion in section 7.

2 Historical background and previous work

Historians have long had the data available to study the general trade patterns of the first period of globalization. Bairoch (1996) examined the shares in European trade for various regions of the planet. His work showed that roughly 80% of all European trade was with developed countries, and this share was roughly constant over time. Bairoch attributed (without the aid of regression analysis) those particular patterns of trade to three main variables: "the geographical location of the country, the availability of a colonial empire and the degree of industrialization." while also noting that the size of a country did not seem to influence the direction of trade. Bairoch's analysis is deficient because it is not based on rigorous statistical analysis that holds other factors constant, and because it discards the possibility that monetary regimes, trade protection and other institutional variables could explain a large part of the observed trade patterns. Nowhere does the oft-cited "one market, one money" mantra fit into Bairoch's analysis.

To the best of our knowledge, the only work investigating similar factors in the 1800's is unpublished work by Flandreau (1993). This work is based on a limited European sample for 1860, 1870 and 1880 and controls only for the product of total trade of each of the two countries, distance, sharing a border, and membership in the Latin Monetary Union or the Scandinavian Monetary Union (in 1880 only). His results suggest that Latin

Table 1: Monetary Regimes of the Countries Included in the Baseline Sample: here

Monetary Union membership could not explain bilateral trade flows.[2] Contemporary evidence by Rose (2000) has shown that monetary unions are likely to increase trade by nearly 200 percent. Did monetary factors play as large a role in the past? Contemporary observers thought so, and our econometric evidence shows that monetary factors heavily influenced trade patterns and the evolution of the global economy.

The first International Monetary Conference was held in Paris in 1867. Among other issues, the attendees approved a motion, subject to subsequent approval by domestic political authorities of course, to adopt a monometallic gold standard, and delegates seriously considered adopting a globally uniform coinage system [Reti (1998)]. While such global monetary harmony never materialized, the years 1870 to 1910 were a period of a ever-increasing homogenization in monetary regime choice. The early years of the period saw the world separated into countries with currencies convertible into either silver, gold or both (e.g., bimetallism). Table 1 presents the countries in our sample that shared a similar monetary arrangement at any one time. This state of affairs dissolved quickly after 1871 giving way to the nearly global adoption of some form of the gold standard. By 1905 most nations were *de jure* if not *de facto* gold standard countries. This uniformity of monetary regimes seems striking given the previous 2000 years of monetary history when sundry metals like copper, silver and gold all played monetary roles concurrently, and compared to the rest of the nineteenth century when large blocs of gold, silver and bimetallist countries co-existed. We believe that this convergence onto a similar institutional arrangement can help explain the rise of "the first truly global economy"; an economy characterized by an historically substantial degree of trade integration.

Further, during the period we study, a wide range of principal countries of the world

[2] Flandreau and Maurel (2000) also use a gravity model during the late 1800s for Europe. They find that monetary unions increase integration.

Table 2: Monetary Unions: here

participated in some form of a monetary union.[3] The monetary unions can be classified into three broad types. The first is an EMU-type of union. Countries in this sort of union had a unique monetary authority with only one system of coinage. Another kind of monetary union, like the Latin Monetary Union, or the Scandinavian Monetary Union was established by treaty, did not have a completely uniform coinage, but did allow full legal tender status of member-nations' currencies in any country of the union, and also had autonomous national monetary authorities. The final type of monetary union we observe in the nineteenth century was more akin to contemporary de facto or de jure dollarized countries. In these types of arrangements, one country declared the currency of another country legal tender while it may or may not have had its own uniform currency. Table 2 shows which countries in our sample were involved in which type of a monetary union.

Curiously that number would have been augmented greatly had the American republics, including the United States, carried out proposals for an *American Monetary Union* (AMU). Subercaseaux (1915) highlights the costs and benefits such a policy would have entailed. Subercaseaux points out, as did nearly all economists of the day, that fiat currencies would give rise to fluctuations and nominal depreciation, and argues that being on a gold standard was equivalent to a nineteenth-century-style monetary union. In either case the currencies are pegged but the former arrangement saves the political costs of having to negotiate escape clauses and contingency plans for members that do not abide by the treaty. Further he argued that the only benefits from AMU would accrue to tourists who would save on exchange operations. Apparently policymakers did not think this was a large enough benefit to justify the implementation costs.

Subercaseaux reiterates a point often made by merchants and policymakers of the

[3]See Willis (1901) for the most authoritative study on the Latin Monetary Union, Bordo and Jonung (1999) for a recent survey on a range of monetary unions since the nineteenth century, and Henriksen and Koergard (1995) for a look at the origins of the Scandinavian Monetary Union.

late nineteenth century, namely, that monetary regimes determined in part the direction of trade. Henri Cernuschi, a leading Parisian political-economist and banker of the 1870s argued that Europe ought to retain a role for silver in its monetary system in order to facilitate the clearing of its persistent trade deficit with the Orient [Cernsuchi (November, 1876)]. Also, in testimony before the House of Representatives of the United States, J.S. Moore, a U.S. Treasury official, averred that trade largely depended on having a similar monetary standard [United States Monetary Commission (1879)]. The testimony is as follows:

> Q. 118. Do you not think that the use of a common standard of value has a tendency to promote a free commercial interchange between the various countries using it?
>
> A. ...and if two countries , be they ever so distant from each other should have the same standard of money ... there would be no greater harmonizer than such an exchange. If our silver dollar were to pass current in Mexico and South America, or if we had a union dollar, we should have much more of their trade and intercourse...

The quote reflects the opinion of important policymakers of the time, and it also highlights another issue. Although having a common standard of value is good, having a monetary union is even better. Flandreau (1996) also points out that French merchants thought the same as the treasury official. In a monetary survey from 1868, northern merchants who had major business with gold-backed England preferred a gold regime while southern traders with connections to the silver-using East preferred retaining silver's monetary role. Policymakers of the day believed that monetary regimes and financial issues played a key role in determining the shape of international commerce.

Volatility in exchange rates also worried policymakers as Subercaseaux's thoughts on fluctuations illustrate. In these years, markets for hedging exchange risk were not as well developed as they are today. By pegging the price of a precious metal, nations could nearly eliminate exchange rate volatility against other countries by pegging the price of the same metal in terms of the domestic currency unit.[4] Nevertheless, it appears that some hedging was available for merchants. A.A. Low, a New York merchant with links to China during the 1870s, illustrates the point [see United States Monetary Commission (1879)]. Low, desiring to buy Chinese merchandise would have a "letter of credit" sent to China for which he paid nothing. If the merchant's agents that went to China found prices reasonable at the current rate of exchange, the bill would be sold for silver and merchandise would be bought. On the other hand, if prices were unreasonable, the letter would be discarded and Low would have lost nothing. Fluctuations in the exchange rate may not totally capture the level of risk in the foreign exchange market and hence small levels of volatility might not have been extremely troublesome for traders, especially if the metallic peg was credible. At the same time large fluctuations in exchange rates may not have deterred trade either because price effects could have outweighed the risk factors.

The a priori expectation of how exchange rate volatility might have affected commerce is ambiguous, and historical actors seem not to have paid too much attention to such oscillations. Even modern researchers like Obstfeld (1997) and Wyplosz (1997) have all but discounted the negative effects of volatility on trade and their conclusions rest on a large body of empirical research that shows the same. The only strong evidence on the negative impact of volatility on trade that we are aware of is Rose (2000) who convincingly shows a large negative relationship between bilateral exchange rate volatility and trade. We can measure the effect of exchange rate volatility using the cross-sectional approach as Rose does, and we provide evidence that in the nineteenth century volatility had a negligible effect on trade.

Other important issues which we seek to investigate with the gravity approach are questions already familiar to economic historians. For instance, the rapid declines in

[4] The reason that exchange rate volatility is not completely eliminated is because it was costly to ship the bullion to the relevant markets to eliminate price differentials.Thus exchange rates could fluctuate within the "gold points" despite having a fixed exchange rate in theory. Even so the average level of volatility compared to the last 30 years experience was very low: 1.5 percent versus about four percent for the period 1960-1990 (see table 6).

transportation costs over the nineteenth century are a well known phenomenon. We are able to measure the effects of distance on bilateral trade and to get an estimate on the change over time of its effects. We also try to shed light on the impact that the trade policies of the time had on commercial exchange. The 1870s saw a resurgence of protectionism in Europe, beginning with the great grain invasions of the 1870s. Such protectionism was accompanied by many bilateral trade agreements that kept tariffs reduced for a given pair of countries, but that discriminated against third parties. We present evidence suggesting that the use of the most-favored nation (MFN) clause ameliorated, to some degree the negative effect of discriminatory protection.

In addition, cultural and political variables may have mattered for integration. Colonial domination and political union are generally thought to increase commercial intercourse by harmonizing the institutional environment. We are able to see just how strong these forces were. Also, current literature has found evidence that having a common language with a trading partner may also increase the level of trade, especially in differentiated goods markets (see Bordo, Eichengreen, and Irwin (1999) for a summary of these conclusions). The nineteenth century might be seen as an era of less differentiated production. If so then language should not have influenced the direction of trade significantly in the nineteenth century. Finally, we can rigorously test the notion that trade remained "intra-industry" over the course of the nineteenth century.

Overall the gravity approach allows us to test a number hypotheses and conjectures salient to researchers of the contemporary economy and economic historians. To our knowledge, we are the first to estimate econometrically all of these effects using such a broad ranging data set for the period under scrutiny. The next section presents our approach and our data.

3 Empirical strategy

One way to capture the effects of our key variables on trade patterns and integration is to use the gravity equation. In the spirit of Newtonian physics, the gravity equation

Table 3: Summary of Previous Studies here

posits that trade flows (i.e., gravitational forces) are in large part a function of the distance of two countries from each other and their combined mass as measured by gross domestic product. Distance, through its effects on transportation costs, acts as a barrier that discourages bilateral trade. In contrast, as a country's GDP increases, its demand for foreign imports, and hence bilateral trade, rises. Moreover, the model allows the addition of any other important variables that theory or observation might suggest are important in explaining the variance in bilateral trade. For example, GDP per capita is usually included in the standard gravity equation and is considered to increase bilateral trade because richer countries usually rely on trade barriers to a lesser extent than poorer countries, and because intra-industry trade would be higher between richer countries. The gravity approach is an attractive methodology because it consistently returns precise point estimates in samples that vary widely over space and time, giving remarkably similar results in all studies on the key baseline parameters of distance, output and output per capita. We summarize the findings of some previous research using the gravity equation in table 3.

Rose (2000) , studying the period 1970 to 1990, finds that when two countries are in a monetary union bilateral trade flows increase *by three times*. In addition, he finds heretofore undiscovered evidence showing that exchange rate volatility slightly decreases trade among any two countries. Eichengreen and Irwin (1995) run a gravity equation for the inter-war period. Besides finding very comparable parameter estimates on distance and GDP variables to all other studies, they find that trade bloc membership increased trade, exchange rate variability slightly reduced trade, but in contrast to our findings, similarity in monetary regime (i.e., being on the gold standard) played no conclusive role in shaping trade patterns.

But what was the relationship between exchange rate volatility and monetary regime choice in the late nineteenth century? After all this was a period of relatively deep commercial integration (unlike the Bretton Woods era), when many countries shared a similar monetary regime, and when many economically important nations of the world belonged to some sort of monetary union.[5] To get at these relationships we estimate the following gravity equation:

$$\begin{aligned}\ln(\text{Trade})_{ijt} &= \beta_0 + \beta_1\text{Gold}_{ijt} + \beta_2\text{Silver}_{ijt} + \beta_3\text{Bimetal}_{ijt} + \beta_4\text{MonetaryUnion}_{ijt} \\ &+\beta_5\text{Volatility}_{ijt} + \beta_6\ln(Y_{it}Y_{jt}) + \beta_7\ln\left(\frac{Y_{it}Y_{jt}}{Pop_{it}Pop_{jt}}\right) + \beta_8\text{Distance}_{ijt} \\ &+\beta_9\text{Border}_{ijt} + \beta_{10}\text{Political union}_{ijt} + \beta_{11}\text{MFN}_{ijt} + \varepsilon_{ijt},\end{aligned}$$

where subscripts i and j are country specific identifiers; t is the year of observation; $\beta' = [\beta_0, ..., \beta_{11}]$ is a vector of parameters of marginal effects; ε_{ijt} is a disturbance term; and Y_{it} and Pop_{it} refer to country i's GDP and population in period t. The rest of the variable definitions appear in table 4. We estimate our baseline regression, which includes time dummies, using ordinary least-squares (section 5), although we use more sophisticated econometric techniques to validate the robustness of our baseline estimates (section 5.4).

Table 4: Variables here

4 Data

Our baseline regressions use an unbalanced panel consisting of 1,140 country-pair observations. A list of the variables used in these regressions is presented in table 4, with summary statistics in table 5. The data cover the period 1870 to 1910 in five-year increments, for a total of 9 annual observations. Given the limited availability of nineteenth-century GDP data, the last row of table 1 shows that the size of our annual cross-sections increases as we move into the 1900s. Similarly, the number of countries that make up our pairwise observations is larger toward the end of our sample period. Not surprisingly,

[5] We emphasize that there was substantial variance in the particular type of monetary regime compared to later periods. See table 1 for a breakdown of the countries sharing a given arrangement.

Table 5: Summary statistics here

table 1 also indicates that present-day OECD member countries are heavily represented in our sample.

We obtained bilateral trade data for 2,848 country dyads. We complemented a data set put together by Barbieri (1996) on the direction of trade across independent states since 1870, with information from national statistical yearbooks and other publications from the period; a detailed description of our sources appears in the data appendix. Trade figures were transformed into 1990 U.S. dollars using the U.S. consumer price index. This made our trade information comparable to the real GDP data in Maddison (1995). Maddison's figures take into consideration purchasing power differences across countries and are therefore better suited for international comparisons.

Information on every country's monetary regime was used to create dummy variables indicating whether any pair of countries shared a common monetary standard. In table 1 we report the monetary standard used in each country that enters our baseline regression. Observe that there was a general movement in favor of the adoption of the gold standard as the nineteenth century progressed, although a number of countries remained outside the gold bloc throughout our period of analysis. There are also a number of important countries that changed regimes throughout the period. These countries help in the identification of the effects we study.

We constructed our measure of exchange-rate volatility as the standard deviation of the first difference of the natural logarithm of the monthly bilateral exchange rate for the previous three years. Monthly exchange rates, mostly with respect to the pound sterling, were taken from Schneider, Schwarzer, and Zellfelder (1991) ; additional exchange rates with respect to the U.S. dollar were obtained from *Global Financial Data's* "Long-Term Database". For our sensitivity analyses, we also constructed alternative measures of exchange-rate volatility which we describe in appendix B.

Table 6 shows that mean exchange-rate volatility was more than one percentage point

Table 6: Bilateral Exchange Rate Volatility Under Each Monetary Regime here

lower among gold-bloc countries when compared to country pairs that used different monetary standards. Similarly, exchange rate volatility among silver countries was higher than in countries on the gold standard. These observations suggest that, to the extent that volatility discourages trade flows, adopting the gold standard at least could facilitate international commerce by reducing volatility.

Nevertheless, it is interesting to note that these effects may lose their economic significance given the fact that exchange rate volatility over the period of analysis was substantially low from an historical perspective. Whereas mean exchange-rate volatility in our sample was only 1.5 percent, Frankel and Wei (1998, table 7.3) report that in 1990 volatility in a sample of 63 countries was 7.7 percent. Similarly, mean volatility reported by Rose (2000) for the period 1970-1990 stood at 4.7 percent. Starting from such low levels, the reductions in volatility that resulted from adopting the gold standard could have had an economically imperceptible effect on bilateral trade.

We also constructed a dummy variable indicating whether a common currency was legal tender in both country-pair members; we refer to this variable as "monetary union." Accordingly, for the members of the Latin and Scandinavian Monetary Unions, this variable received the value of one. More subtly, Canada was considered to be in a monetary union with the United Kingdom and some of the British colonies and dominions, as well as with the United States. This is because both British sovereigns and the U.S. dollar were legal tender in Canada.[6] Since Canadian residents or merchants could easily cover for exchange-rate uncertainty with Britain and the United States by carrying out international trade transactions in the currencies of the latter countries, we believe that the effects of a monetary union we look to capture are present in this case.[7] In contrast, there were instances in which trade transactions were carried out using the currency of a third

[6] Of course, this does not imply that the United States was in a monetary union with Britain.

[7] It should be emphasized that our results do not rely on the fact that Canada and the United States are coded as having a monetary union. See section 5.1.

country, but the latter was not legal tender (e.g., Mexican silver pesos in use in China). Those cases were not considered to form a monetary union because exchange risk still existed for people earning their incomes in silver pesos who desired to make purchases in China. See table 2 for the list of our monetary unions and the countries in each union. In our data set we have over 100 observations (i.e., roughly 10% of our sample) where both of the trading partners are in a monetary union.

In estimating the gravity equation, it is important to control for the effect of trade policy on the bilateral exchange of goods. Even though in 1870 protectionism was relatively mild, the last two decades of the nineteenth century were characterized by increasing tariffs and intermittent trade wars. While England maintained its free-trade stance, countries like Germany and the United States raised tariffs. Moreover, Frieden's (1997) study of nineteenth-century U.S. monetary politics suggests that tariffs could have been used to compensate import-competing industries that would be hurt by the adoption of the gold standard. In this case increased imports arising from an appreciating gold currency could have been mitigated by higher protectionism.

We stress that protectionism is problematic to the extent that it is not applied evenly to all nations. In the postwar era, the inclusion of the "most-favored nation" (MFN) principle in Article I of the GATT reduced the scope for the use of trade policies that discriminated against particular countries.[8] In contrast, MFN treatment during the nineteenth century was negotiated in bilateral trade agreements and, as such, would in all certainty affect bilateral trade. To control for this possibility, we constructed a dummy indicating whether two countries shared a trade agreement including an MFN clause; the sources are described in the data appendix.

Last, we incorporated a number of additional explanatory variables. The standard distance variable, in logs, was taken from Rose (2000).[9] Common language, common border and year-specific dummies were included. We also created a "political union"

[8]Some exceptions to MFN treatment, such as those that exist under Article XXIV allowing for the creation of free trade areas and customs unions, have been properly accounted for in the gravity-equation literature, whereas others, like the unilateral preferences granted to developing countries, have not.

[9]The distance measure comes in turn from the CIA's website and measures Great Circle distance.

Table 7: Pooled OLS Regressions here

Table 8: Annual OLS Regressions here

dummy encompassing a colonial relationship —colony-colonizer and colonies with the same colonizer— as well as countries that formed a single political entity —e.g., Russia and Finland, and, until 1905, Sweden and Norway.

5 Baseline results

We report pooled OLS estimates and robust standard errors of the baseline regression in table 7.[10] Our baseline specification explains over half of the variation in bilateral trade flows. The coefficients on GDP, GDP per capita, and distance are precisely estimated and their signs and magnitudes are consistent with a standard gravity model's predictions. Moreover, they are remarkably similar to those found by other authors. Our estimates show that monetary regimes had a non-negligible impact on international trade and are in accordance with previous studies. Other explanatory variables seem in line with our predictions although in some instances they are statistically insignificant. Annual cross-section regression results appear in table 8. The limited size of our annual samples for some years resulted in poor regression results, but in broad terms annual estimates support our conclusions.

5.1 Monetary variables

Our main variables of interest confirm the notion that monetary regimes had an economically significant impact on bilateral trade flows. The coefficient on "gold", "silver", and "monetary union" are positive and statistically significant. Our baseline results show that two countries that were on the gold standard traded 62% ($e^{0.48} - 1$) more with one another than with countries under a different monetary regime. Trade between countries

[10]Standard errors are corrected for heteroscedasticity among country pairs.These are Huber/White/sandwich standard errors.

on silver received an even bigger boost from the common monetary regime of approximately 115% ($e^{0.76}-1$). Nevertheless, we must keep in mind that the number of pairs in which "silver" is equal to one is small, and that these observations tend to appear at early stages of our period of analysis. Bimetallism does not seem to be a significant force encouraging bilateral trade flows.[11] Monetary unions contributed an additional impetus to bilateral trade. Controlling for being under the same monetary standard, forming a monetary union more than doubled ($e^{0.72}-1=105\%$) commercial exchange between two countries.[12]

It is worth observing that the effect of joining a monetary union is actually being understated in our sample since joining a monetary union effectively implied being on the same standard. Given that most of our observations of monetary unions are for gold standard countries as well, it is reasonable to assert that the effect on bilateral trade when both countries belong to a monetary union is to increase trade $3.30 \approx (e^{.716+.479})$ times.[13]

According to our baseline regression, after controlling for the type of monetary arrangements between two countries, exchange-rate volatility *positively* affects international trade, with a statistically significant coefficient of 0.17. This finding contradicts our expectations and is in contrast to Frankel and Wei (1998) and Rose's (2000) findings. As we argue in appendix B however, the puzzling result is explained by unexpectedly large trade in Brazil and Chile even though exchange rate volatility was high in both countries. Therefore, we are compelled to take our results with a grain of salt and to conclude, instead, that exchange rate volatility's impact on trade is more likely to be negligible.

[11] Evidence from unreported regressions showed that treating a bimetallic country as if it were on both silver and gold could not explain trade flows. It would seem as if bimetallism's fallibility to Gresham's Law made relationships too unstable for trade to be generated.

[12] We ran our baseline regression under the alternative assumption that the United States and Canada were not part of a "monetary union". Our new estimates, which we do not report, remain virtually the same.

[13] Remarkably, this is precisely the figure Rose (2000) suggests is a reasonable estimate of the effect of monetary unions on trade.

5.2 Gravity-equation variables

The estimated coefficient on GDP, 0.86, is slightly higher than those reported by Frankel and Rose (2000) and by Rose (2000), around 0.8 in both cases, but smaller than Eichengreen and Irwin's (1995) coefficient (from 0.8-1.0). Frankel and Rose (2000) interpret their estimate as indicating that a one percent increase in GDP, keeping GDP per capita constant, implies that the ratio of trade to GDP falls by 0.2 percent. Under this logic, a literal reading of our estimate suggests that trade openness during the nineteenth century was affected to a lesser extent by the size of a country and that commercial integration had reached a level at least as high as today's level.

Our estimate for GDP per capita, 0.66, is identical to the Frankel-Rose results. This is a bit of a surprise since one would expect that as income per capita increased over the twentieth century, a larger proportion of bilateral commerce would have taken the form of intra-industry trade. Indeed, for the interwar period, Eichengreen and Irwin (1995) find lower estimates on income per capita than those found by other authors looking at the post-war era, and take this as evidence that intra-industry trade gained prominence after World War II.

In our regression, a one percent increase in the distance between two countries reduces bilateral trade by only 0.66 percent —compared to a one percent decline in the late twentieth century, according to Frankel and Rose (2000). Considering that improvements in transportation technology throughout the twentieth century certainly eroded geographical barriers, one would expect distance to have a larger negative effect on trade during our period of analysis. Of course, it is unreasonable to compare our estimates with Frankel and Rose's (2000) and expect to find evidence that distance has become less of an impediment to trade. In particular, neither our work nor Frankel and Rose (2000) contain a completely satisfactory measure for the level of protection and the distance coefficients may be capturing differences in the degree of trade openness that existed in each period. Still, our annual OLS regressions (table 8) indicate that, starting in 1880, the negative effect of distance on trade flows gradually declined, reflecting, perhaps, a reduction in transportation costs.[14]

5.3 Other variables

Estimates on the rest of our explanatory variables have the correct sign, although we did not find statistically significant coefficients for the common language and MFN dummies. If product differentiation during the nineteenth century was limited, cultural similarities, captured in the common language dummy, would have been a less important determinant of trade, explaining the lack of significance of the former variable. We attribute the statistically insignificant estimate of the MFN dummy to the dearth of easily accessible sources regarding nineteenth century trade treaties. In contrast, both contiguity and close political ties between two countries (or colonies) substantially promoted trade. A common border was estimated to raise trade by 90 percent, while countries in a political union traded two and one-half times more with one another than independent nations.

5.4 Sensitivity analysis

Our initial results provide strong evidence that monetary regimes matter for explaining trade patterns. At the same time, they provide econometric support for the pre-existing but limited views of the determinants of trade flows in the economic history literature. In this section we see if our results are robust to imperfections in the data and model specification. We use an array of theoretically more attractive estimators and approaches, but our baseline pooled-OLS results are similar to results from the following specifications.

First we tackled the important issue of *endogeneity* of national output. If there is an exceptionally large error term in any given year, the GDP variable for the dyad is likely also to be exceptionally high. Such correlation between an explanatory variable and the error term can give rise to an *inconsistent* estimate of the effects of GDP and GDP per capita on bilateral trade. We use the natural logarithm of the product of total land area of the countries and the log of the product of the percentage of the population in cities

[14]Our increasing (in absolute terms) distance coefficient through the 1870s may be reflecting the increasing protectionism of the decade.

Table 9: Endogeneity of GDP and Omitted Variables here

of greater than 50,000 inhabitants to instrument for these two variables. The size of a country might have been correlated with the size of GDP because it provided a more extensive market or simply because it increased the available inputs to the production function including land and labor. However, there is no reason to suspect that there could be a correlation between the error term and the land area of a country (even in a world of shifting borders). The second variable is likely to be correlated with GDP per capita when spillover effects or spatial externalities are present. It is also a key historical fact that as countries industrialized (and their levels of output per capita increased) that they became more urbanized. At the same time, we can think of no reason why urbanization *rates* and the error term should be correlated. We use *two stage least squares* to re-estimate our baseline equation using these instruments. Regressions 1 and 2 in table 9 reports the results. The sample size drops by 300 observations because of a lack of instruments. A Hausmann test rejects the null hypothesis of exogeneity of the variables at the one-percent confidence level. The elasticities on GDP and per capita output increase from 0.86 and 0.66 to 1.18 and 1.15 respectively. Other parameters of interest in the regressions remain significant but fluctuate in magnitude. Volatility seems to increase trade more than it did before while the gold standard coefficient rises a bit and the coefficient on monetary union increases from 0.72 to 1.1. In this specification, monetary union membership triples bilateral trade, while membership in the gold club increase trade by roughly 72 percent ($\exp^{.54} - 1$).

In addition, we were concerned that our baseline regression excluded other determinants of bilateral trade. In table 9, regressions 3 and 4, we report results in which we include other variables that affect bilateral trade. First, we show that, in line with the predictions of the Heckscher-Ohlin model of trade, the wider the gap in a dyad's income per capita, and the larger the disparity in natural resource endowment —proxied here as the ratio of land-to-population— the more the two countries would trade. Also, we show that when two countries are in different hemispheres, they will trade more with one another. This would occur, for example, because seasonalities in agricultural trade would increase the demand for imports from southern hemisphere countries in the northern countries. We also included dummies indicating when a country pair consists of at least one Latin American or Asian country; both are significant, but whereas the former is positive, the latter is negative. Last, armed conflict, defined either as a war between the two states or a civil war in one of them, shows up with an expected negative sign, although it is statistically insignificant. Importantly, the coefficients on "gold", "silver", and "monetary union" remain significant and positive; in fact, the first two are estimated to have a substantially larger impact on trade.

We also run various specifications for panel data. Whether a panel specification is proper in this situation depends on what one believes about the country pairs as separate observations. Far from being the same individual or firm over time, we have a data set of country pairs in which partners are undergoing significant structural changes (big spurts, takeoffs and crashes, changes in international relations and domestic institutional arrangements etc.) so that it is questionable whether we would expect to capture any more from the data by using it as a panel.

Table 10 presents results from a weighted-least-squares, fixed-effect between estimator and a random effects estimator of our baseline equation. The between estimator yields results somewhat similar to the pooled OLS results, although most of our monetary variables have increased in magnitude. The gold standard variable remains significant, but its effect now is to increase trade by 1.2 times. The monetary union variable suggests that trade increases by roughly 1.6 times when two countries belong to such an arrangement. The effect of joining a monetary union, using the previous logic that any two monetary union countries share the same standard thus implies that trade is increased by 5.5 times. Additionally the standard gravity variables remain nearly unchanged in terms of magnitude and precision. The random effects estimator yields results closer to the baseline regression, but we can reject the null hypothesis of the consistency of the

Table 10: Panel Regressions here

random effects estimators at the one percent level. Given our results, we conclude that our preliminary OLS estimators which do not impose the condition of similarity among observations, are still a reasonable measure of the relative magnitudes of the coefficients of interest.

Another issue we address is the possibility of a sample selection bias. During our period of analysis, trade statistics generally were reported only for the largest trading partners and often were not reported for partners whose trade was below a certain threshold.[15] There are also many countries that have been omitted from the sample simply due to missing data. These types of selection may be troublesome because missing data may be correlated with our economic and institutional variables. Such missing observations could give us inconsistent estimates of our parameters, leading to a downward bias on our gold standard dummy. This could arise if many non-gold standard and poor countries, such as the periphery states of Europe, Southeast Asia and America, had very low levels of trade or unreported trade with other gold standard countries in the core of Europe. Leaving these countries out could misleadingly weaken the coefficient on the gold standard dummy and may also give misleading parameters for the GDP effects. This problem can be resolved to some degree by using Heckman's two-step procedure. First we predict selection from the sample and then use this information to correspondingly adjust OLS coefficients to account for selection effects.

Table 11 presents the results of the maximum likelihood estimation of the OLS parameters adjusted for the selection bias. None of our results change drastically from the baseline. The coefficient on the gold standard, silver standard and the monetary union

[15]The threshold was in all likelihood dependent upon the statisitcal department and the size of the country that collected the data rather than being a universal cut-off point. A small country having a large percentage of its trade with a large country would likely have reported its data, given that it reported any data at all, but the large country, for whom trade with this small country was insignificant, might not have reported the data while it most likely reported some data. Alternatively, we could have assumed that all missing observations were true zeros. We explore this approximation to the data generating process below.

Table 11: Selection Correction Regressions here

Table 12: Tobit Estimation here

dummy increase in magnitude as expected. Sample selection does not seem to deny the importance of having a common monetary standard or joining a monetary union, neither can it account for the positive effect of volatility.

Another specification we ran was the *Tobit* estimator. In our case Tobit is the consistent estimator when the dependent variable is truncated at or above 0. Before analyzing the Tobit estimator, a word on our data is in order. As mentioned above, countries rarely coded a trade value to 0 even when the actual trade values *were* in all likelihood zero values. Thus we are unable to completely distinguish between a missing observation and a true zero for trade. We take the approach here of re-coding all missing trade observations to 0 with the understanding that this over-estimates the true number of zeros. This may be a bad way to characterize a missing trade observation especially between two usually important trade partners. However, leaving out any or all of the observations where the trade level was actually zero could be biasing our results as well. The coefficients of the re-coded variables then are one bound for the parameter estimates, while the marginal effects on the original dependent variables are perhaps another bound.

Re-coding the missing trade data to zero gives us nearly 300 more observations. The percentage of zero observations is near 30%. In table 12 we report both OLS and Tobit for the data with the zero-coded data and the original data, but in each case the independent variable is $\ln(1 + Trade_{ijt})$. In this way marginal effects are interpretable as elasticities and results are comparable to Table 7, while this transformation also makes the dependent variable lie above zero.

The Tobit estimates and OLS estimates for the original data yield similar results.[16] Similarly, when we re-coded our data, we find both in OLS and in Tobit that coefficients

[16]We report the margnial effects for the Tobit coefficients as $\widehat{\beta}\Phi(\widehat{\beta}\overline{x}/\widehat{\sigma})$ where Φ is the ditribution function for a normally distributed variable. See Greene (1997) for the derivation of this correction.

Table 13: Estimation with GDP Proxies here

maintain their size, and their significance is not altered. What little change there is in the expected direction. Since most of the missing observations were those with low levels of GDP the coefficients on GDP increase. Re-coding missing observations to zero arbitrarily imputes zero trade to gold countries and thus bumps down the effect of the gold standard on trade. Were we to know the true level of trade we imagine the marginal effects on all coefficients would be in between the Tobit and the OLS point estimates. In sum the Tobit results do not imply our original inferences and conclusions were incorrect.

Table 13 is a re-run of our baseline pooled-OLS regression that substitutes *proxy* variables for each partner's GDP, in order to augment the size of our sample. We use the product of the natural logarithm of miles of railroad track per square mile, the percentage of population in cities greater than 50,000 inhabitants, total population, and land area in square miles.[17] This new specification augments the sample by about 300 observations. The baseline results on the gold dummy and the monetary union dummy hold, and all variables keep their statistical significance. Bimetallism still has a negative effect but it is now statistically significant. The coefficient for silver countries grows to be unbelievably large, implying that trade would be nearly 7 times larger compared to countries with different standards or with gold or bimetallic standards.

We also checked for other more complex interactions and effects in the international monetary system. Perhaps our monetary variables were not creating trade but, instead, were diverting trade away from other nations. To explore this possibility, we constructed a dummy variable that is one if either country is on gold (but not both of them) and zero otherwise; we constructed similar variables for silver and bi-metallic countries. Furthermore, we created a dummy which is equal to one when at least one country in a dyad is a member of a monetary union, but the two are not members of the same monetary union. A negative coefficient on any of these indicator variables would suggest that the corresponding monetary arrangement is trade diverting. Table 14 reports our results un-

[17]These proxies account for 96% of the variance in the levels of GDP in an OLS regression.

Table 14: Monetary Variables and Trade Diversion here

Table 15: Convertibility and Trade here

der different econometric methods. Our estimates show convincingly that neither of the three monetary standards resulted in trade diversion. In fact, there is some suggestion that the gold standard was actually trade *creating*. In contrast, in our pooled OLS regression, monetary unions seem to have resulted in trade diversion, although in our panel, heckit, and tobit estimates the coefficient is not statistically significant, suggesting that the aforementioned sample-selection problems may be affecting our results. Thus, we stop short from reaching any definitive conclusions regarding the trade diverting effects of monetary unions.[18]

Also, we were interested in finding out whether our monetary standard variables were simply picking up trade among countries whose currencies were convertible. One might argue that convertibility was a mark of distinction among countries which assured stability of the monetary rule. Such stability and predictability might be leading to more trade among a group of well-kept economies. We constructed a dummy that was one if either of the countries were convertible, but not on the same standard. The interpretation of the coefficient is the extra effect that both trading partners becoming convertible adds to trade. Controlling for this allows us to assert that the coefficients on the other monetary standard dummies are picking up the effect of similarity in monetary regime. Table 15 shows that trade between two partners is not increased when both partners have convertible currencies, and similarity in monetary regimes remains important in promoting trade.

Overall, the specification tests provide no reason to doubt the economic importance, the direction, and the statistical significance of our baseline OLS coefficients. There is little reason to believe that our main coefficients of interest are biased or inconsistent in any significant way. Further, our research underscores older views in the economic

[18]Frankel and Rose (2000, table 1) find that monetary unions are in fact trade creating.

literature based on casual inspection of the data while, at the same time, the inescapable conclusion is that the gravity approach has immense explanatory power not just today, but over the long-run.

6 Endogeneity of the gold standard

Thus far we have provided evidence showing that being on the gold standard increased bilateral trade flows. Our baseline regression, as well as the different econometric tools used to check for the sensitivity of our results, assumed that our "gold" dummy was both uncorrelated with the error term in the baseline regression, and that the decision to join the gold standard was unaffected by bilateral trade flows. Both of these assumptions are debatable. First, *endogeneity problems* would imply that "gold" is correlated with the error term, which would yield biased estimates of the impact of gold standard on trade. Problems would exist in our estimates if there were omitted variables correlated with the gold dummy that were excluded from our baseline specification. For example, our baseline regression leaves out total trade by each country in the dyad. If using the gold standard not only had an impact on bilateral trade but influenced a country's total trade as well, our "gold" dummy would likely be correlated with the error term.

Second, *simultaneity problems* would be present if bilateral trade influenced the probability that any pair of countries adopted the gold standard. In this story, joining the gold standard is an endogenous decision made by each country. If a country traded heavily with countries that were already on gold, then it could have an incentive to adopt the same monetary regime as its main trading partners. Moreover, if, as we have suggested, the gold standard encouraged bilateral trade, this in turn could have led yet other countries to adopt gold. Thus, we would expect to observe a "virtuous cycle" in which gold leads to more trade and, in turn, this leads to more countries adopting gold.[19]

[19] Similar arguments could be presented regarding the decision to join a monetary union. Nevertheless, in our baseline regression there are only three cases, out of 1140 observations, in which countries moved to adopt a monetary union.

Table 16: Controlling for the Endogeneity of the Gold Standard here

We address the potential endogeneity problems with instrumental variables.[20] We instrument for the "gold" dummy, which is equal to one when both countries are on gold, with the product of the logarithm of each country's (i) average distance from all countries on gold, (ii) population, and (iii) land area. Using the gravity equation's intuition, the farther a country is from all gold countries, the less it would trade with the gold bloc and, therefore, the smaller the incentive to adopt the gold standard. Similarly, as a country's population increases, the relative importance of foreign trade falls and, as a result, the country will have a reduced incentive to join the gold standard. In contrast, as a country's land area increases, holding population constant, natural resource availability, as well as the country's trade orientation, would rise and adopting the gold standard becomes more likely. In an unreported regression of the gold dummy on the three instruments, the fitted coefficients have the predicted signs and are statistically significant.

We report two-stage least-squares regression results using instrumental variables in table 16. The estimated coefficients on "gold" and "monetary union" jumped to 1.95 and 0.86, respectively, indicating that the impact of both variables on bilateral trade is much larger than initially suggested —600% and 135%, respectively. While the rest of our variables suffer minor changes, it is interesting to note that having an MFN treaty now significantly affects trade. Our results are even more dramatic if we simultaneously instrument for the potential endogeneity of GDP and GDP per capita (see regression 2, 16).

We tackle the *simultaneity problem* by formulating a system of equations. In addition to the gravity equation, we now simultaneously estimate an equation describing the probability of both countries being on gold. We use a linear probability model in which we regress "gold" on bilateral trade, the three variables used as instruments in the previous paragraph —average distance from gold countries, population, and land area— and on

[20] Due to the small number of observations in which both countries used a silver or bimetal standard, we restrict our analysis to gold and paper countries.

Table 17: Simultaneity (Dependent Variable–Gold Standard) here

Table 18: Simultaneity (Dependent Variable–Bilateral Trade)

whether countries shared a border, had a monetary union, or had close political ties; that is, we view the probability of both countries being on gold as increasing in those factors that are expected to foster bilateral trade, as well as trade with the rest of the gold bloc.[21]

We report simultaneous equation estimates in tables 17 and 18. Table 17 supports our view that bilateral trade, proximity to the gold bloc, population, and land area are relevant factors explaining the decision to adopt the gold standard. Importantly, table 18 provides additional evidence about the favorable impact of the gold standard on bilateral trade. Depending on the different specification we use, our estimates range between 2.62 and 3.98, implying an enormous 13- to 50-fold increase in trade. Monetary unions retain their significant effect on bilateral trade and are comparable to our baseline results. We warn that our initial look at simultaneity, absent in comparable studies looking at the late twentieth century, must be taken with caution because of our ad-hoc equation for the determinants of being on the gold standard may create misleading identification problems. Nevertheless, we get some comfort in the fact that our estimates remain positive and statistically significant.

To summarize, an explicit consideration of potential endogeneity problems not only confirmed the positive impact of the gold standard on trade, but suggests that such effect is stronger than we initially thought. Similarly, we paid attention to the possibility that simultaneity problems were present in our baseline regression and showed that the estimates of a simultaneous system of equations remained significant. Nevertheless, we concluded with the suggestion that one must keep in mind that identification problems may affect our results.

[21] Using a probit model, instead of a linear probability model, would substantially increase the complexity of our estimation without necessarily changing our results.

7 Concluding remarks

In this paper we suggest that monetary regime choice made a large impact on patterns of trade in the first period of globalization. Trade flows increased by more than 60 percent when two countries were able to adopt the gold standard. Monetary unions, *controlling for all other effects*, also increased trade among members to the union by more than 100 percent. Combining these two effects, which was the case more often than not, increased trade by three times for member countries relative to trade with countries on a different standard and without a common currency.

The effects on trade of standard variables such as GDP and GDP per capita appear to be robust. Our evidence supports Rose's and Rose and Frankel's late twentieth century evidence and, since our estimates of the effects of monetary unions are so similar, there seems to be a heretofore un-noticed long-run stability in the parameters. It should also be noted that our point estimates on the gold standard dummy are roughly similar to Eichengreen and Irwin's values for the inter-war period (approximately 0.48 versus 0.55, respectively). This strongly suggests that this period of the global economy has a large degree of similarity to the contemporary international economy.

The other implication from these results is first that the institutional environment that governed the global economy very much influenced the operation of that economy. To the extent that monetary regime decisions were political, it would appear that the political effects on the course of the global economy are of the utmost importance. When a global consensus emerged on the "right" policy to adopt (e.g., gold), and nations adopted, trade seemed to flourish, much as it has today under the Washington Consensus.

Further, given our results, it appears that there is remarkable long-run stability in the gains to be had from monetary regime harmonization. This is unexpected given advances in financial, production, and institutional technologies over the last one-hundred years. As Rose (2000) comments, perhaps the cost of hedging exchange risk is much greater than previously thought and has remained so despite advances in financial instruments. Monetary regime harmonization may be one way in which countries, separate political entities, edge towards building a common market. Economic historians conjecture that the extent of the market can largely explain the rise of the United States' economy in the nineteenth century. The implication of our work is that as the world harmonizes and begins to look more and more like a single country with shared institutional arrangements, its productivity gains will be large and are compounded enormously as more and more countries adopt similar arrangements.

What then is the story behind the similarity in standards making a difference given that we have explained away the likely culprit of exchange rate volatility reduction? Perhaps similarity in monetary regime shadowed the likelihood that two countries would engage in similar monetary policies in the future. Given that predictability is the key to understanding dynamic macro-environments, perhaps monetary regimes provided signals of such predictability. The mundane notion that similarity enhanced payments clearing mechanisms is also a possibility. Most of the monetary unions were started for this reason. But, this seems difficult to reconcile with the historians' views that bullion shipments mattered little after the 1870's. Whatever the case may be, the effect of common monetary regimes and monetary unions on the global economy is large...very large.

Appendix A

Data Appendix

GDP: Figures were obtained from Maddison (1995). They are in real PPP U.S. dollars.

Volatility: We use monthly exchange rate data from the Global Financial Database and Schneider, Schwarzer, and Zellfelder (1991). Some series are for "sight" transactions on foreign exchange while others are for "three-month" or "six month" exchange rates, though we operate under the assumption these series never diverge significantly. We observe that in some cases, when all series are available, this is in fact the case. The margin of error for a random variable like volatility is doubtlessly small. Countries for which we use data from Schneider are France, Netherlands, Germany, Italy, Switzerland, the United States, Norway, Sweden, Finland (before 1900), Portugal, Austria, and Belgium. To construct the volatility measure, we then take the standard deviation of $\ln(e_{ijt}) - \ln(e_{ijt-1})$ multiplied by 100. Where e_{ijt} is the bilateral exchange rate between country i and j in month t. We use cross rates when necessary.

Common Language: We code a country pair as one if both countries have significant portions of the population that speak the same language. Languages and the countries in which they are spoken are: English: UK, Canada, Australia, United States New Zealand; French: France, Belgium, Switzerland, Canada; German: Germany, Austria-Hungary, Switzerland; Dutch: Holland, Belgium; Italian: Italy, Switzerland; Spanish: Spain, Mexico, Argentina, Chile. Portuguese: Portugal, Brazil.

Distance: Distance is taken from Rose (2000). The data were downloaded from http://haas.berkeley.edu/~arose. He in turn lifted the data from the CIA's website.

Political Union: Pairs are coded one if one country is a dependency of the other (or vice-versa), countries are in a colonizer-colony relationship, are dependencies, or have a "dominion" arrangement. Countries (or colonies) with a political union are:

UK with Canada and Australia, Egypt, India, Sri Lanka, New Zealand, South Africa (and all permutations of the preceding); United States with the Philippines (1900-1910); Netherlands with Indonesia; Sweden with Norway (until 1905); Finland with Russia; Spain and the Philippines before 1900.

Monetary Regimes: We code observations as one if both countries have the same regime. A regime can be silver, gold or bimetallism. See table 2 for the regime coding. Data are from Meissner (2000).

Trade: Trade data are expressed in millions of 1990 U.S. dollars using U.S. consumer price index information kindly provided by Alan Taylor. Since Taylor reports a CPI with 1987 as the base year, we re-based his CPI to 1990. We complemented Barbieri's (1996) *International Trade Dataset*, which reports bilateral trade in current U.S. dollars among independent states, with information collected from national statistical yearbooks and other statistical compendia, especially with regard to trade data with non-independent territories. Our sources included:

General sources: Mitchell (1992), Mitchell (1995), Mitchell (1993), Foreign Commerce of the American Republics and Colonies, U.S. Bureau of Statistics (1909), Ministere du Commerce, de L'Industrie Des Postes et Des Telegraphs (Various issues); Australia: Ministry of Trade and Customs (Various issues); Belgium: Ministere de L'Interieur et de L'Instruction Publique (Various issues); Canada: Department of Agriculture (Various issues); Chile: International Bureau of the American Republics (1909), Ortuzar (1907); China: Hsiao (1974); Finland: Bureau Central de Statistique de Finlande (1911); France: Ministere du Commerce (Various issues); Germany: Statistisches Jahrbuch fur das Deutsche Reich. Berlin; Great Britain: Gastrell (1897), Board of Trade (1886); Holland: Societe de Statistique Des Pays-Bas (Various issues); Italy: Istituto Centrale Di Statistica (1958), Direzione Generale Della Statistica E Del Lavoro (Various issues); Norway: Utgit Av Det Statistiske Centralbyraa (Norway) (1911); Sweden: Utvingen Av Kungl. Statistiska Centralbyran (1914); Switzerland: Bureau de Statistique du Departement Federal de L'Interieur (Various issues); United States: Department of State (1898).

GDP proxies: Proxies for GDP —miles of railroad track per square mile, the percentage of population in cities of greater than 50,000 inhabitants, total population, and land area in square miles— were taken from Banks (1976).

MFN: We assigned a value of one to this variable whenever a commercial treaty containing a most-favored nation clause was in place between a pair of countries. In addition, we coded the variable as one whenever countries formed a political union, as defined above. The reason is that countries in a colonial relationship or with strong political bonds typically granted preferential treatment to one another. In some cases (e.g., France and its colonies), countries formed a monetary union; in others, preferential tariff treatment was granted (e.g., Great Britain and its Dominions); whereas in others, trade policy did not discriminate against third countries (e.g., Dutch colonies) [see United States Tariff Commission (1922a)]. We relied on the following sources: United States Tariff Commission (1922b), de Bernhardt (1912), United States Tariff Commission (1940), House of Commons (1908).

Appendix B

Volatility

In this appendix we explore exchange rate volatility's impact on trade in more detail. Contrary to our baseline regression's suggestion that volatility led to higher trade, we argue that such impact was negligible and is explained by unusually high trade for observations including Brazil or Chile.

First, we must remember that volatility was considerably lower during our period of analysis than during the post-Bretton Woods era. As argued earlier, low levels of volatility may have little effect on trade in most cases and our regressions may reflect that possibility. Second, in order to test for a non-linear impact of volatility on trade, we ran our baseline regression once again introducing a quadratic volatility term (see table 7, regression 1). The coefficient on volatility flips sign and is now -0.25, while the square of volatility is 0.07; both coefficients are significant. These estimates show that, starting from its mean of 1.5 percent, eliminating volatility altogether increases trade by roughly 25 percent.[22] Of course, our estimate also suggest that *increasing* volatility sufficiently beyond its mean will increase trade.

Third, the latter observation led us to test whether our baseline results are driven by observations with extreme values of volatility. In table 7, regression 2, we show estimates of our baseline regressions in which we have dropped observations in which volatility was in the upper fifth percentile of our sample distribution; only 32 observations were eliminated from a total of 1140. While the rest of our estimates remain roughly the same, the coefficient on volatility drops to 0.02 and becomes statistically equal to zero.[23] Furthermore, since Brazil appears in 17 of the 32 observations with high volatility, while Chile appears in 13 of the 32,[24] we estimated our baseline regression again introducing

[22]That is, $e^{-\left[(-0.25)(1.5)+(0.07)(1.5)^2\right]}-1 = 25\%$ (some discrepancies are due to rounding of our regression estimates).

[23]In an unreported regression, we also dropped observations in the lowest 5th percentile of the volatility distribution and confirmed that volatility is statistically insignificant.

[24]Both countries appear together in 2 instances. The observations occurred mainly in 1900 (20 observations) and 1910 (11 observations).

dummies indicating whether either of the two countries appeared in a dyad (see table 7, regression 3). The coefficient on volatility is now negative but insignificant. This result supports our claim that, if anything, volatility would have a negligible effect on trade during the period in question (controlling for the type of monetary arrangement).

Fourth, we explored whether volatility affected countries within each type of monetary arrangement. We augmented the baseline regression with interaction terms in which each monetary dummy is multiplied by our volatility measure (see table 7, regression 4). Although the volatility coefficient remains positive and significant, the interaction term between volatility and gold is *negative* and significant at the 5 percent level; the interaction term with the silver dummy is negative but statistically insignificant. Importantly, in both instances, the sum of each interaction term and the monetary-regime dummies is insignificantly different from zero. Thus, within each monetary bloc, standard hypothesis tests reveal that volatility does not affect trade flows. We pursue this idea by running our baseline regression on countries within the gold bloc only (see table 7, regression 5). Although statistically insignificant, the exchange-rate volatility coefficient is now negative.

Finally, we experimented with other measures of exchange rate volatility. We used the highest absolute first difference in the log of the exchange rate in the three years preceding the year of observation, the ninetieth percentile of that change (same time period), the standard deviation of the level of the exchange rate over the previous three years and the standard deviation of the first difference of the logarithm of the exchange rate over the previous year. None of these measures changed the conclusion in the baseline regression that volatility increases bilateral trade.

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Table 4.1 Monetary regimes of the countries in the baseline sample

	Year								
Country	*1870*	*1875*	*1880*	*1885*	*1890*	*1895*	*1900*	*1905*	*1910*
UK	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
France	Bimetal	Bimetal	Gold	Gold	Gold	Gold	Gold	Gold	Gold
US	Paper	Paper	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Belgium	Bimetal	Bimetal	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Switzerland	--	--	--	--	--	--	Gold	Gold	Gold
Italy	Paper	Paper	Paper	Gold	Gold	Paper	Paper	Paper	Paper
Germany	Silver	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Netherlands	Silver	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Denmark	Silver	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Norway	Silver	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Sweden	Silver	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Finland	Silver	Silver	Gold	--	--	--	--	Gold	Gold
Austria	Paper	--	--	--	--	--	Paper	--	--
Russia	Paper	--	--	--	Paper	--	Gold	--	--
Spain	Bimetal	--	--	--	Paper	--	Paper	Paper	Paper
Portugal	Gold	--	--	--	Gold	--	Paper	--	--
Australia	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Canada	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Japan	Silver	--	--	Paper	Paper	Paper	Gold	Gold	Gold
Brazil	Paper	--	--	--	Paper	--	Paper	Paper	Gold
Mexico	Silver	--	--	--	Silver	--	Silver	Gold	Gold
Chile	--	--	--	--		--	Paper	Paper	Paper
Argentina	--	--	--	--	Paper	--	Paper	Gold	Gold
Egypt	--	--	--	--	--	--	Gold	--	--
India	Silver	--	--	--	Silver	--	Gold	Gold	Gold
China	Silver	--	--	--	--	--	Silver	--	--
Indonesia	--	--	--	--	Silver	--	Silver	Silver	Silver
New Zealand	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold	Gold
Philippines	--	--	--	--	--	--	Silver	--	--
Total # countries	23	14	14	14	22	14	28	23	23
Total # country pairs	90	56	59	70	139	81	274	189	182

NOTE: "--" indicates that the country was not included in the sample during a given year.

Table 4.2
Monetary Regimes

Latin Monetary Union	Scandinavian Monetary Union (from 1875)
France	Denmark
Belgium	Sweden
Switzerland	Norway
Italy	
Greece (1885)	
Sterling Union	**Other**
Great Britain	Canada with U.S.
Australia	
Canada	
New Zealand	

Table 4.3
Summary of Previous Studies

Dependent variable:	*Rose (2000)*		*Eichengreen and Irwin (1995)*					
			1928		1935		1938	
Bilateral trade	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error	Coefficient	Std. Error
Monetary variables:								
Gold	---		0.290	0.397	0.530	0.389	0.680	0.386
Silver	---		---		---		---	
Bimetal	---		---		---		---	
Monetary union	1.210	0.140	---		---		---	
Volatility	-0.017	0.002	-0.040	0.017	-0.030	0.027	-0.030	0.017
Gravity equation variables:								
GDP	0.800	0.010	0.910	0.032	0.730	0.031	0.770	0.032
GDP per capita	0.660	0.010	0.330	0.050	0.160	0.050	0.160	0.044
Distance	-1.090	0.020	-0.780	0.063	-0.400	0.047	-0.530	0.061
Other explanatory variables:								
Border	0.530	0.080	0.790	2.940	0.410	0.196	0.450	0.298
Political union	---		---		---		---	
Common language	0.400	0.040	---		---		---	
Free-Trade Asstn	0.990	0.080	---		---		---	
Number of obs	22948		561		561		561	
R-squared	0.630		0.690		0.630		0.630	
Root MSE	2.020		3.201		2.542		2.542	

Table 4.4
Variables

Variable	*Description*
Trade	Natural log of bilateral trade in 1990 U.S. dollars
Gold	Dummy equal to 1 if both countries were on the gold standard
Silver	Dummy equal to 1 if both countries used a silver standard
Bimetal	Dummy equal to 1 if both countries used a bimetallic standard
Monetary union	Dummy equal to 1 if a common currency is legal tender in both countries
Volatility	Bilateral exchange rate volatility (see text)
GDP	Natural log product of the two country's real GDP
GDP per capita	Natural log product of the two country's per capita real GDP
Distance	Natural log of the distance, in miles, between the two countries
Border	Dummy equal to 1 if the two countries shared a common border
Common language	Dummy equal to 1 if the two countries speak a common language
Political Union	Dummy equal to 1 if countries shared a colonial relationship, shared a co colonizer, or formed a single political entity
MFN	Dummy equal to 1 if a treaty containing an MFN clause was in force betw countries

Table 4.5
Summary Statistics

Variable	*# Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Trade	2848	4.006	2.367	-6.724	9.452
Gold	6556	0.263	0.441	0.000	1.000
Silver	6556	0.050	0.219	0.000	1.000
Bimetal	6556	0.010	0.099	0.000	1.000
Monetary union	11025	0.017	0.128	0.000	1.000
Volatility	3977	1.514	1.583	0.000	9.230
GDP	2050	19.741	1.969	14.358	25.236
GDP per capita	2050	15.150	0.926	12.367	17.639
Distance	10071	8.270	0.851	4.922	9.417
Border	11025	0.034	0.182	0.000	1.000
Common language	11025	0.093	0.291	0.000	1.000
Political Union	11025	0.023	0.150	0.000	1.000
MFN	11025	0.219	0.413	0.000	1.000

Table 4.6
Bilateral Exchange Rate Volatility Under Each Monetary Regime

Monetary standard	*# Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Same standard					
Gold	1256	0.688	0.998	0.000	6.148
Silver	123	1.748	1.272	0.000	6.687
Bimetal	12	0.660	0.799	0.000	2.538
Different standard	2586	1.907	1.673	0.000	9.230
All country pairs	3977	1.514	1.583	0.000	9.230

Table 4.7
Pooled OLS Regressions

Regressors	*Baseline*	*Reg. 1*	*Reg. 2*	*Reg. 3*	*Reg. 4*	*Reg. 5*
Gold	0.479	0.367	0.399	0.399	1.576	--
	(0.124)	(0.125)	(0.124)	(0.120)	(0.442)	
Silver	0.765	0.749	0.786	0.995	-0.087	--
	(0.394)	(0.373)	(0.378)	(0.365)	(0.368)	
Bimetal	-0.303	-0.336	-0.341	-0.292	0.707	--
	(0.269)	(0.264)	(0.269)	(0.267)	(0.149)	
Monetary union	0.716	0.527	0.621	0.631	0.655	1.046
	(0.186)	(0.192)	(0.187)	(0.188)	(0.185)	(0.205)
Volatility	0.167	-0.253	0.020	-0.014	0.194	-0.114
	(0.044)	(0.115)	(0.061)	(0.047)	(0.045)	(0.135)
Squared volatility	--	0.068	--	--	--	--
		(0.016)				
Gold * volatility	--	--	--	--	-0.309	--
					(0.127)	
Silver * volatility	--	--	--	--	-0.539	--
					(0.373)	
Bimetal * volatility	--	--	--	--	-0.212	--
					(0.354)	
GDP	0.861	0.867	0.863	0.904	0.870	0.896
	(0.028)	(0.027)	(0.028)	(0.026)	(0.027)	(0.031)
GDP per capita	0.656	0.588	0.612	0.759	0.604	0.491
	(0.081)	(0.081)	(0.083)	(0.083)	(0.083)	(0.101)
Distance	-0.661	-0.642	-0.664	-0.713	-0.651	-0.722
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)	(0.056)
Border	0.625	0.610	0.594	0.510	0.632	0.263
	(0.122)	(0.122)	(0.123)	(0.118)	(0.121)	(0.144)
Political union	0.927	0.968	0.982	1.101	0.915	0.527
	(0.293)	(0.287)	(0.290)	(0.289)	(0.292)	(0.275)
Common language	0.165	0.158	0.171	0.111	0.143	0.051
	(0.167)	(0.163)	(0.164)	(0.159)	(0.168)	(0.133)
MFN	0.142	0.153	0.109	0.091	0.149	0.172
	(0.095)	(0.094)	(0.096)	(0.090)	(0.095)	(0.111)
Brazil dummy	--	--	--	2.243	--	--
				(0.207)		
Chile dummy	--	--	--	0.868	--	--
				(0.366)		
Constant	-18.438	-17.353	-17.632	-20.365	-18.003	-14.117
	(1.392)	(1.394)	(1.415)	(1.409)	(1.407)	(1.648)
Number of obs	1140	1140	1108	1140	1140	622
R-squared	0.595	0.601	0.603	0.631	0.598	0.677
Root MSE	1.453	1.442	1.445	1.388	1.449	1.242

NOTES: Dependendent variable: ln(trade). Robust standard errors are reported in parentheses. Year dummies are not reported. Regression 2 excludes 32 observations with volatility above the 95th percentile. Regression 5 focuses on gold countries only.

Table 4.8
Annual OLS Regressions

Regressors	*1870*	*1875*	*1880*	*1885*	*1890*	*1895*	*1900*	*1905*	*1910*
Gold	1.583	0.894	2.603	0.191	-0.465	1.993	0.449	0.161	0.662
	(0.490)	(0.320)	(0.733)	(0.681)	(0.371)	(0.460)	(0.256)	(0.306)	(0.250)
Silver	1.479	–	–	–	–	–	-0.307	–	–
	(0.410)						(1.230)		
Bimetal	-0.366	-0.987	–	–	–	–	–	–	–
	(0.282)	(0.529)							
Monetary union	0.129	-0.138	2.558	0.737	0.363	1.448	0.380	0.933	0.778
	(0.404)	(0.662)	(0.817)	(0.784)	(0.646)	(0.477)	(0.459)	(0.575)	(0.408)
Volatility	0.396	-1.102	1.995	-0.899	0.209	0.373	0.163	0.073	0.282
	(0.190)	(0.246)	(0.917)	(0.971)	(0.364)	(0.340)	(0.070)	(0.172)	(0.082)
GDP	0.817	0.780	1.047	0.906	0.736	1.064	0.822	0.991	0.886
	(0.095)	(0.097)	(0.097)	(0.091)	(0.089)	(0.112)	(0.055)	(0.076)	(0.052)
GDP per capita	1.617	1.519	1.120	1.268	0.991	0.559	0.825	0.298	0.291
	(0.280)	(0.325)	(0.404)	(0.306)	(0.412)	(0.533)	(0.157)	(0.172)	(0.140)
Distance	-0.349	-0.724	-0.977	-0.888	-0.912	-0.755	-0.607	-0.672	-0.520
	(0.210)	(0.165)	(0.156)	(0.140)	(0.141)	(0.196)	(0.099)	(0.126)	(0.090)
Border	1.506	0.931	0.195	0.184	0.529	-0.023	0.645	0.503	0.697
	(0.366)	(0.379)	(0.377)	(0.374)	(0.371)	(0.417)	(0.275)	(0.405)	(0.274)
Political union	0.143	0.401	0.970	0.439	0.514	0.917	1.088	0.816	0.465
	(0.615)	(0.788)	(0.778)	(0.862)	(1.026)	(0.714)	(0.709)	(0.695)	(0.907)
Common language	0.611	0.545	-0.076	0.046	0.799	-0.488	0.228	-0.214	0.078
	(0.411)	(0.506)	(0.354)	(0.303)	(0.585)	(0.350)	(0.301)	(0.555)	(0.236)
MFN	0.187	-0.346	0.030	0.234	0.370	-0.028	-0.102	0.139	0.287
	(0.344)	(0.287)	(0.308)	(0.252)	(0.306)	(0.350)	(0.205)	(0.246)	(0.190)
Constant	-34.649	-28.406	-29.905	-26.777	-18.849	-22.036	-21.114	-15.682	-15.030
	(5.121)	(5.335)	(6.502)	(5.044)	(6.281)	(7.781)	(3.134)	(3.105)	(2.456)
Number of obs	90	56	59	70	139	81	274	189	182
R-squared	0.673	0.852	0.835	0.794	0.486	0.753	0.567	0.568	0.650
Root MSE	1.134	0.877	0.963	1.172	1.755	1.310	1.550	1.643	1.215

NOTES: Dependendent variable: ln(trade). Robust standard errors are reported in parentheses.

Table 4.9
Endogeneity of GDP and Omitted Variables

Regressors	*Reg. 1**	*Reg. 2**	*Reg. 3*	*Reg. 4*
Gold	0.540	0.643	0.689	0.595
	(0.166)	(0.191)	(0.119)	(0.126)
Silver	2.070	3.833	1.371	1.395
	(0.452)	(0.736)	(0.356)	(0.352)
Bimetal	-0.085	0.116	-0.082	-0.114
	(0.186)	(0.251)	(0.300)	(0.293)
Monetary union	1.105	1.061	0.612	0.642
	(0.246)	(0.244)	(0.191)	(0.192)
Volatility	0.41	0.425	0.084	0.076
	(0.046)	(0.046)	(0.041)	(0.046)
Gold * volatility	--	-0.174	--	--
		(0.149)		
Silver * volatility	--	-2.354	--	--
		(0.751)		
Bimetal * volatility	--	-0.330	--	--
		(0.266)		
GDP	1.181	1.172	1.085	1.067
	(0.082)	(0.081)	(0.035)	(0.033)
GDP per capita	1.153	1.146	0.561	0.713
	(0.203)	(0.204)	(0.109)	(0.135)
Distance	-0.702	-0.691	-1.064	-1.027
	(0.068)	(0.068)	(0.081)	(0.080)
Border	0.521	0.546	0.386	0.399
	(0.183)	(0.180)	(0.141)	(0.136)
Political union	0.935	0.908	0.939	0.944
	(0.281)	(0.283)	(0.247)	(0.242)
Common language	-0.206	-0.226	0.041	0.010
	(0.206)	(0.206)	(0.184)	(0.179)
MFN	0.106	0.112	-0.021	-0.026
	(0.108)	(0.108)	(0.089)	(0.088)
Same hemisphere	--	--	-1.278	-1.085
			(0.237)	(0.262)
Abs. difference in GDP per capita (log)	--	--	0.142	0.114
			(0.039)	(0.038)
Abs. difference in land/population (log)	--	--	0.112	0.107
			(0.035)	(0.034)
Latin America	--	--	0.816	0.804
			(0.254)	(0.251)
Asia	--	--	-0.680	-0.630
			(0.246)	(0.248)
Armed conflict	--	--	-0.318	-0.240
			(0.226)	(0.223)
Brazil dummy	--	--	--	0.668
				(0.276)
Chile dummy	--	--	--	-0.228
				(0.379)
Number of obs	881	881	900	900
R-squared	0.586	0.590	0.728	0.732
Root MSE	1.465	1.460	1.191	1.185

NOTES: Dependent variable: ln(trade). Robust standard errors are reported in parentheses. Year dummies and constant are not reported. * 2SLS estimation.

Table 4.10
Panel Regressions

Regressors	Fixed effects (Between est.)		Random Effects	
	Reg. 1	Reg. 2*	Reg. 3	Reg. 4*
Gold	0.902	0.714	0.164	0.136
	(0.304)	(0.303)	(0.074)	(0.074)
Silver	1.883	2.315	0.305	0.307
	(1.450)	(1.443)	(0.245)	(0.243)
Bimetal	-3.529	-3.739	0.280	0.259
	(2.582)	(2.553)	(0.306)	(0.303)
Monetary union	0.989	0.804	0.452	0.431
	(0.376)	(0.376)	(0.366)	(0.365)
Volatility	0.300	0.000	0.016	-0.045
	(0.102)	(0.141)	(0.023)	(0.030)
GDP	0.849	0.836	0.835	0.844
	(0.057)	(0.056)	(0.050)	(0.050)
GDP per capita	0.882	0.794	0.385	0.357
	(0.149)	(0.153)	(0.072)	(0.072)
Distance	-0.601	-0.604	-0.714	-0.723
	(0.100)	(0.099)	(0.099)	(0.101)
Border	0.697	0.627	0.628	0.561
	(0.305)	(0.306)	(0.366)	(0.368)
Political union	0.622	0.664	0.992	0.976
	(0.430)	(0.426)	(0.394)	(0.394)
Common language	0.137	0.187	0.271	0.282
	(0.300)	(0.301)	(0.361)	(0.364)
MFN	0.138	0.095	-0.026	-0.024
	(0.180)	(0.182)	(0.092)	(0.092)
Constant	-21.871	-19.681	-13.525	-13.143
	(2.778)	(2.822)	(1.599)	(1.608)
Number of obs	1140	1108	1140	1108
R-squared	0.644	0.651	0.578	0.589
Root MSE	1.318	1.313	–	–

NOTES: Dependent variable: ln(trade). Standard errors are reported in parentheses. Year dummies are not reported. The between estimation regression was performed using weigthed least squares. * Indicates that the top 5th percentile of the volatility observations was excluded.

Table 4.11
Selection Correction Regressions

Regressors	*Reg. 1*	*Reg. 2*
Gold	0.649	0.830
	(0.136)	(0.153)
Silver	1.493	2.585
	(0.384)	(0.632)
Bimetal	-0.113	0.337
	(0.252)	(0.290)
Monetary union	0.777	0.707
	(0.178)	(0.176)
Volatility	0.269	0.289
	(0.042)	(0.043)
Gold * volatility	---	-0.293
		(0.142)
Silver * volatility	---	-1.563
		(0.647)
Bimetal * volatility	---	-0.770
		(0.294)
GDP	0.892	0.891
	(0.034)	(0.035)
GDP per capita	0.617	0.592
	(0.128)	(0.129)
Distance	-0.612	-0.601
	(0.053)	(0.054)
Border	0.686	0.708
	(0.130)	(0.128)
Political union	0.057	0.025
	(0.178)	(0.179)
Common language	0.633	0.603
	(0.242)	(0.242)
MFN	0.250	0.257
	(0.098)	(0.098)
Constant	-18.862	-18.564
	(1.896)	(1.913)
rho	-0.238	-0.241
	(0.094)	(0.097)
Number of obs	1101	1101

NOTES: Dependent variable: ln(trade). Robust standard errors are reported in parentheses. Year dummies are not reported.

Table 4.12
Tobit Estimations

Regressors	*OLS*		*TOBIT*	
	Reg. 1	*Reg. 2**	*Reg. 3*	*Reg. 4**
Gold	0.636	0.546	0.637	0.508
	(0.135)	(0.136)	(0.130)	(0.181)
Silver	1.511	1.184	1.506	1.403
	(0.460)	(0.583)	(0.577)	(0.708)
Bimetal	-0.015	0.529	-0.011	1.033
	(0.379)	(0.346)	(0.677)	(1.056)
Monetary union	0.650	0.847	0.653	0.981
	(0.179)	(0.208)	(0.179)	(0.274)
Volatility	0.187	0.166	0.188	0.217
	(0.040)	(0.038)	(0.035)	(0.047)
Gold * volatility	-0.315	-0.265	-0.315	-0.217
	(0.116)	(0.109)	(0.111)	(0.150)
Silver * volatility	-0.583	-0.726	-0.608	-1.167
	(0.365)	(0.324)	(0.274)	(0.369)
Bimetal * volatility	-0.225	-0.729	-0.221	-0.702
	(0.356)	(0.782)	(1.102)	(1.556)
GDP	0.825	0.944	0.828	1.199
	(0.023)	(0.020)	(0.024)	(0.033)
GDP per capita	0.562	0.844	0.566	1.076
	(0.073)	(0.069)	(0.064)	(0.085)
Distance	-0.603	-0.819	-0.607	-1.072
	(0.041)	(0.041)	(0.043)	(0.060)
Border	0.614	0.649	0.610	0.483
	(0.117)	(0.158)	(0.151)	(0.2280
Political union	0.144	-0.043	0.142	-0.095
	(0.142)	(0.168)	(0.147)	(0.214)
Common language	0.849	1.317	0.856	1.876
	(0.277)	(0.291)	(0.207)	(0.310)
MFN	0.158	-0.076	0.161	-0.175
	(0.084)	(0.087)	(0.082)	(0.114)
Constant	-16.805	-22.946	-16.911	-30.780
	(1.211)	(1.160)	(1.111)	(1.506)
Number of obs	1150	1638	1150	1638
R-squared	0.620	0.680	--	--
Root MSE	1.290	1.590	1.280	2.020

NOTES: Dependent variable: ln(1+trade). Standard errors are reported in parentheses. Year dummies are not reported. Sigma is reported for Tobit, not RMSE. * Indicates that missing traded data was recoded to zero.

Table 4.13
Estimations with GDP Proxies

Regressors	*Reg. 1*	*Reg. 2*
Gold	0.466	0.535
	(0.091)	(0.102)
Silver	2.162	3.761
	(0.385)	(0.571)
Bimetal	-0.792	-0.749
	(0.155)	(0.249)
Monetary union	1.028	1.009
	(0.135)	(0.135)
Volatility	0.188	0.199
	(0.031)	(0.033)
Gold * volatility	--	-0.102
		(0.080)
Silver * volatility	--	-2.114
		(0.603)
Bimetal * volatility	--	-0.045
		(0.221)
Railroad Milleage	0.366	0.367
	(0.051)	(0.051)
Urban Population	1.275	1.271
	(0.073)	(0.074)
Population	0.537	0.537
	(0.043)	(0.043)
Land Area	-0.070	-0.072
	(0.032)	(0.032)
Distance	-0.542	-0.536
	(0.059)	(0.059)
Border	0.952	0.961
	(0.113)	(0.113)
Political union	0.686	0.671
	(0.223)	(0.224)
Common language	0.243	0.236
	(0.131)	(0.131)
MFN	0.152	0.153
	(0.080)	(0.080)
Constant	-1.902	-1.918
	(0.501)	(0.501)
Number of obs	1480	1480
R-squared	0.621	0.621
Root MSE	1.430	1.430

NOTES: Dependent variable: ln(1+trade). Robust standard errors are reported in parentheses. Year dummies are not reported.

Table 4.14
Monetary Variables and Trade Diversion

Regressors	*POOLED OLS*			*PANEL*	*HECKIT*	*TOBIT*
	Reg. 1	*Reg. 2*	*Reg. 3*	*Reg. 4*	*Reg. 5*	*Reg. 6*
Gold	0.494	0.814	0.763	1.424	0.975	0.559
	(0.123)	(0.234)	(0.423)	(0.531)	(0.281)	(0.273)
Silver	0.531	0.950	0.900	1.794	1.524	-1.080
	(0.392)	(0.429)	(0.239)	(1.507)	(0.458)	(0.456)
Bimetal	-0.247	-0.141	-0.008	-3.657	0.148	0.188
	(0.278)	(0.332)	(0.343)	(2.673)	(0.356)	(0.833)
Monetary union	0.421	0.736	0.423	0.819	0.608	0.755
	(0.218)	(0.184)	(0.218)	(0.432)	(0.217)	(0.296)
Volatility	0.155	0.183	0.173	0.318	0.272	0.156
	(0.044)	(0.046)	(0.046)	(0.106)	(0.045)	(0.048)
Trade diversion-Gold	--	0.336	0.404	0.547	0.316	0.451
		(0.197)	(0.201)	(0.470)	(0.231)	(0.222)
Trade diversion-Silver	--	0.100	0.090	0.183	0.014	-0.762
		(0.170)	(0.170)	(0.369)	(0.229)	(0.188)
Trade diversion-Bimetal	--	-0.082	0.029	-0.836	0.112	-0.768
		(0.218)	(0.225)	(1.024)	(0.233)	(0.311)
Trade diversion-Monetary union	-0.342	--	-0.365	-0.240	-0.206	-0.207
	(0.131)		(0.133)	(0.220)	(0.148)	(0.147)
GDP	0.852	0.861	0.851	0.844	0.888	1.184
	(0.028)	(0.027)	(0.028)	(0.058)	(0.035)	(0.033)
GDP per capita	0.693	0.652	0.687	0.900	0.610	1.027
	(0.080)	(0.084)	(0.083)	(0.157)	(0.129)	(0.088)
Distance	-0.678	-0.663	-0.679	-0.634	-0.623	-1.077
	(0.045)	(0.046)	(0.046)	(0.104)	(0.055)	(0.060)
Border	0.560	0.634	0.568	0.669	0.648	0.493
	(0.122)	(0.123)	(0.124)	(0.309)	(0.139)	(0.2282)
Political union	0.916	0.887	0.874	0.510	0.068	-0.050
	(0.281)	(0.289)	(0.277)	(0.437)	(0.181)	(0.213)
Common language	0.154	0.183	0.174	0.176	0.620	1.935
	(0.165)	(0.169)	(0.167)	(0.302)	(0.240)	(0.309)
MFN	0.150	0.136	0.147	0.147	0.250	-0.219
	(0.095)	(0.096)	(0.096)	(0.181)	(0.099)	(0.114)
Constant	-18.418	-18.550	-18.539	-21.729	-18.626	-28.859
	(1.387)	(1.448)	(1.444)	(2.875)	(1.932)	(1.554)
Number of obs	1140	1140	1140	1140	1101	1638
R-squared	0.598	0.596	0.599	0.648	rho = -0236	--
Root MSE	1.448	1.452	1.447	1.317	0.094	2.009

NOTES: Dependendent variable: ln(trade). Robust standard errors are reported in parentheses. Year dummies are not reported. The dependent variable in the ˉ regression is ln(1+trade); missing trade data were coded to zero; sigma, rather than RMSE, is reported.

Table 4.15
Convertibility and Trade

Regressors	*Reg. 1*	*Reg. 2*
Gold	--	0.541
		(0.130)
Silver	--	0.880
		(0.401)
Bimetal	--	-0.209
		(0.279)
Monetary union	0.632	0.763
	(0.185)	(0.184)
Volatility	0.105	0.181
	(0.041)	(0.044)
Convertible & diff. standard	0.049	0.295
	(0.145)	(0.159)
GDP	0.842	0.859
	(0.027)	(0.028)
GDP per capita	0.723	0.674
	(0.078)	(0.082)
Distance	-0.677	-0.661
	(0.046)	(0.045)
Border	0.640	0.621
	(0.125)	(0.123)
Political union	1.053	0.870
	(0.272)	(0.285)
Common language	0.173	0.162
	(0.164)	(0.168)
MFN	0.152	0.153
	(0.095)	(0.095)
Constant	-18.799	-18.802
	(1.375)	(1.417)
Number of obs	1149	1140
R-squared	0.589	0.596
Root MSE	1.465	1.451

NOTES: Dependendent variable: ln(trade). Robust standard errors are reported in parentheses. Year dummies are not reported.

Table 4.16
Controlling for the Endogeneity of the Gold Standard

Regressors	*Reg.1*	*Reg.2*
Gold	1.952	2.969
	(0.780)	(0.861)
Monetary union	0.855	1.003
	(0.188)	(0.052)
Volatility	0.410	0.985
	(0.098)	(0.252)
GDP	0.926	1.176
	(0.044)	(0.233)
GDP per capita	0.457	0.684
	(0.203)	(0.113)
Distance	-0.609	-0.512
	(0.059)	(0.071)
Border	0.764	0.898
	(0.144)	(0.189)
Political union	0.430	0.153
	(0.306)	(0.344)
Common language	0.017	-0.341
	(0.193)	(0.241)
MFN	0.236	0.140
	(0.105)	(0.124)
Constant	-17.501	-27.944
	(2.507)	(3.312)
Number of obs	900	881
R-squared	0.581	0.452
Root MSE	1.472	1.685

NOTES: Robust standard errors are reported. Year dummies are not reported.
Regression 1 -- Variable instrumented for: Gold. Instruments: Log product of
(i) average distance to all gold countries, (ii) population, (iii) land area.
Regression 2 -- Variable instrumented for: Gold, GDP, GDP per capita.
Instruments: Log product of (i) average distance to all gold countries,
(ii) population, (iii) land area, (iv) percent of population in cities of 50,000
or more inhabitants

Table 4.17
Simultaneity (Dependent Variable--Gold Standard)

Regressors	*Reg. 1*	*Reg. 2*	*Reg. 3*	*Reg. 4*	*Reg. 5*	*Reg. 6*
Bilateral trade	0.172	0.130	0.149	0.170	0.130	0.149
	(0.014)	(0.021)	(0.020)	(0.013)	(0.021)	(0.019)
Avg. distance to gold bloc	0.001	0.093	0.110	0.000	0.094	0.110
	(0.010)	(0.020)	(0.018)	(0.010)	(0.020)	(0.017)
GDP	--	-0.067	-0.097	--	-0.067	-0.097
		(0.021)	(0.018)		(0.021)	(0.017)
Population	-0.164	--	--	-0.161	--	--
	(0.014)			(0.014)		
Land	0.024	-0.011	--	0.024	-0.011	--
	(0.007)	(0.007)		(0.007)	(0.007)	
Monetary union	-0.088	0.003	-0.001	--	--	--
	(0.070)	(0.071)	(0.069)			
Border	-0.225	-0.216	-0.255	-0.238	-0.216	-0.255
	(0.057)	(0.062)	(0.059)	(0.058)	(0.063)	(0.059)
Political union	0.084	0.202	0.028	0.022	0.204	0.028
	(0.119)	(0.123)	(0.078)	(0.109)	(0.114)	(0.073)
Common language	-0.029	0.058	0.063	-0.045	0.058	0.062
	(0.057)	(0.057)	(0.055)	(0.056)	(0.056)	(0.053)
MFN	-0.013	0.041	0.048	-0.008	0.041	0.048
	(0.034)	(0.035)	(0.032)	(0.034)	(0.035)	(0.032)
Number of obs	900	900	1140	900	900	1140
R-squared	0.578	0.551	0.539	0.579	0.551	0.539
Root MSE	0.478	0.492	0.502	0.477	0.492	0.502

NOTE: Dependent variable: Gold. Standard errors reported in parentheses.

Table 4.18
Simultaneity (Dependent Variable--Bilateral Trade)

Regressors	*Reg.1*	*Reg.2*	*Reg.3*	*Reg.4*	*Reg.5*	*Reg.6*
Gold	2.622	3.679	3.975	2.604	3.681	3.973
	(0.563)	(0.608)	(1.304)	(0.566)	(0.607)	(1.302)
Monetary union	0.597	0.707	0.715	0.414	0.711	0.713
	(0.217)	(0.219)	(0.232)	(0.161)	(0.188)	(0.206)
Volatility	0.171	0.372	0.376	0.173	0.372	0.376
	(0.070)	(0.077)	(0.163)	(0.070)	(0.077)	(0.163)
GDP	0.891	0.866	0.857	0.890	0.866	0.857
	(0.037)	(0.038)	(0.039)	(0.037)	(0.038)	(0.039)
GDP per capita	0.202	0.227	0.167	0.217	0.227	0.167
	(0.144)	(0.159)	(0.217)	(0.144)	(0.159)	(0.217)
Distance	-0.471	-0.482	-0.495	-0.478	-0.481	-0.495
	(0.050)	(0.054)	(0.063)	(0.050)	(0.054)	(0.063)
Border	0.941	0.949	0.920	0.970	0.948	0.920
	(0.175)	(0.179)	(0.176)	(0.174)	(0.178)	(0.175)
Political union	0.214	-0.092	0.201	0.354	-0.096	0.202
	(0.383)	(0.387)	(0.370)	(0.368)	(0.378)	(0.364)
Common language	-0.021	-0.082	-0.055	0.016	-0.083	-0.054
	(0.173)	(0.175)	(0.167)	(0.171)	(0.173)	(0.165)
MFN	0.142	0.123	0.005	0.134	0.123	0.005
	(0.102)	(0.102)	(0.096)	(0.101)	(0.102)	(0.096)
Constant	-14.564	-14.632	-13.454	-14.712	-14.625	-13.458
	(1.713)	(1.940)	(2.212)	(1.722)	(1.938)	(2.207)
Number of obs	900	900	1140	900	900	1140
R-squared	0.463	0.333	0.228	0.466	0.332	0.228
Root MSE	1.649	1.839	1.988	1.645	1.839	1.987

NOTES: Dependent variable: ln(trade). Standard errors reported in parentheses.
Year dummies are not reported.