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Abstract

Using data collected by the International Institute of Agriculture, we document the disintegration of international commodity markets between 1913 and 1938. There was dramatic disintegration during World War I, gradual reintegration during the 1920s, and then a very substantial disintegration after 1929. The period saw the unravelling of a great many of the integration gains of the 1870-1913 period. While increased transport costs certainly help to explain the wartime disintegration, they cannot explain the post-1929 increase in trade costs. Protectionism seems the most likely alternative candidate.

Keywords: commodity markets, trade, disintegration, interwar economy

JEL codes: F13, F15, F59, N70

1. Introduction

Since the early work of pioneers such as Jeffrey Williamson (1974), Knick Harley (1978, 1980), John Hurd (1975) or Jacob Metzger (1974) there has been an explosion of work documenting the integration of national and international commodity markets during the 19th century. Successive papers have advanced the state of our knowledge along several dimensions. A small minority (e.g. O'Rourke and Williamson 1994, Klovland 2005) have documented patterns of price convergence or divergence for commodities other than the grains which have been the focus of most papers. Some authors, notably Karl Gunnar Persson (e.g. Persson 2004), have demonstrated the importance of comparing commodities of identical qualities in different markets. And during the past decade or so, much more sophisticated econometric procedures have been used to identify both the speed with which commodity prices moved back to equilibrium after a shock, and the trade costs which determined whether such an adjustment process would take place in the first place (e.g. Ejrnaes and Persson 2000).

Recent work has broadened the scope of these investigations well beyond the late 19th century. David Jacks (2005, 2006) and Federico and Persson (2007) have established that international commodity markets were becoming better integrated throughout the post-1815 period, and not just after 1870. O'Rourke and Williamson (2002) find no evidence of commodity market integration between continents before 1800, while the evidence provided by Jacks (2004) and Özmucur and Pamuk (2007) for market integration within early modern Europe is decidedly mixed. Meanwhile, international economists have recently started to uncover evidence of international price convergence for a variety of consumer goods during the late 20th century, although this finding is at odds with what little we know about international agricultural markets during the same period (Engel and Rogers 2004, Goldberg and Verboven 2005, Parsley and Wei 2002, O'Rourke 2002, Federico and Persson 2007).

Strikingly, however, there has been little or no work documenting price convergence or divergence during the interwar period. This is surprising, since the years after 1929 saw a collapse in world trade which has been extensively studied, as well as a rise in protectionism which has also been the subject of much scholarly attention. One of the classic questions which many have asked regarding the period is: can this post-1929 collapse in world trade (documented in Figure 1) be attributed to the Smoot-Hawley tariff of 1930 in the United States, and equivalent import restrictions imposed elsewhere, or was it simply a reflection of declining world output? Somewhat embarrassingly for economists to whom policies such as Smoot-Hawley symbolise the folly of interwar economic policy-making, quantitative analyses of the episode have tended to downplay the role of tariffs in explaining the world trade slump, emphasising instead the role of falling demand and output (Irwin 1998). However, Jacob Madsen (2001) argues that discretionary increases in protection were as important as nominal income declines in explaining the post-1929 world trade slump.

Presumably, if trade barriers had contributed to the fall of world trade, then this would have manifested itself in an increase in price gaps between markets, leading (*ceteris paribus*) to an increase in import prices, a decline in export prices, and a decline in trade volumes, with the size of all three effects depending upon elasticities of supply and demand. Increasing price gaps is a necessary, if not sufficient, condition for protectionism to have had any effects on world trade whatsoever. It thus seems as though the question of what happened to interwar commodity market integration should be of interest not just to scholars of market integration *per se*, but to those interested in the international economy of the period more generally. And yet, very little work has been done on the subject to date. One exception is Federico and Persson (2007), who look at world wheat markets over the past two centuries and find (using annual data) that while these were extremely well integrated in the early 1920s, there was a sharp increase in international price variance in the years after 1929. The aim of this paper is

to provide more such evidence, using higher-frequency data and more sophisticated techniques, for a greater range of commodities, and to ask: what was the impact of World War I on international commodity markets? To what extent did these recover during the 1920s? Did the years after 1929 see a further disintegration of international commodity markets, and if so, was this disintegration severe enough to leave these markets less well integrated than they had been before 1914? And what were the causes of the disintegration? Was it due to rising transportation costs, as suggested by Estevadeordal, Frantz and Taylor (2003), or to policy, or to some combination of the two?

2. Empirics

Data

The primary source for this study is the International Institute of Agriculture's *International Yearbook of Agricultural Statistics*. Although this publication provides a wealth of information on international commodity markets during the interwar period, it has not yet been exploited by economic historians, as far as we know. The Institute was founded in 1905 and headquartered in Rome. The IIA was a "world clearinghouse for data on crops, prices, and trade to protect the common interests of farmers of all nations." Thus, it was the first international organization dedicated to the task of generating and publicizing world agricultural data. Initially comprising forty nations, membership was extended to 51 by 1913. It was succeeded in 1945 by the United Nation's Food and Agricultural Organization (FAO).

The first statistical *Yearbook* was produced in 1909 and covered a wide range of statistical material, from land area and population to agricultural production and agricultural prices. After World War I, these volumes were published in subsequent years from 1920 to 1939. Their express purpose was to document the changes in global commodity markets after the First World War. To quote, "the opinion was widely held that world economy [sic] would

return to the position existing on the eve of the conflagration so that data for the years immediately preceding the War could be taken in a sense to represent the normal and thus to constitute a good basis of comparison” (International Institute of Agriculture, 1933).

The data collection efforts of the International Institute of Agriculture were prodigious. They cover 374 weekly commodity price series over 46 commodity classifications in locales as far-flung as Rangoon, Rio de Janeiro, and almost all conceivable commercial ports in between. Of the 374 series, we are able to exactly match 27 commodity-specific city pairs. These range from (Danish, creamery for export) butter in Copenhagen and London to (No. 2 winter, American) wheat in Chicago and Liverpool. The commodity and temporal coverage of our exact matches is documented in Table 1. We note that the *International Yearbook of Agricultural Statistics* potentially allows for an even larger number of matches. However, we have employed a very conservative selection criterion to ensure that differences in product quality can play no role in our results.

In the *International Yearbook of Agricultural Statistics*, all weekly prices were quoted in local currencies and measurements. Quoted prices in the source country were converted into the currency and measurement of the matched destination country. For instance, (Danish, creamery for export) butter in Copenhagen was quoted in crowns per 100 kilograms and converted into shillings per hundredweight based on standard physical conversion rates and nominal exchange rates derived from the Global Financial Database.

Methodology

Our chief focus is on estimating trade costs—that is, the costs of physically transporting goods across markets inclusive of freight rates, tariffs and non-tariff barriers to trade—over the interwar period, with an especial regard to comparing these to conditions prevailing on the eve of the First World War. In recent years, a voluminous literature has

emerged in economics and economic history on how to gauge the trade costs separating markets on the basis of price differentials (Balke and Fomby 1997; Obstfeld and Taylor 1997). For instance, Jacks (2005, 2006) documents the process of market integration in the context of the Atlantic economy by examining grain price data from over 100 markets in Europe and North America from 1800 to 1913.

In contrast to earlier work which looked mainly at average annual price gaps between markets, the modern literature has relied on methods directly based on or indirectly inspired by the threshold autoregression approach first developed by Tsay (1989). Here, we adopt the latter approach and make use of an extremely parsimonious model of commodity market integration. The basic idea is that agents—given the prevailing costs of transport, tariffs and non-tariff barriers to trade, the costs of obtaining credit and contracting in foreign exchange markets, etc.—will exploit all profitable opportunities in terms of price differentials. In this case, the basic arbitrage conditions will always be:

$$1.) P_t^1 \leq P_t^2 + TC^{21}$$

$$2.) P_t^2 \leq P_t^1 + TC^{12}$$

That is, the price in location 1 must be less than or equal to the price in location 2 plus the trade cost associated with moving a given commodity from location 2 to location 1.

Likewise, the price in location 2 must be less than or equal to the price in location 1 plus the trade cost associated with moving a given commodity from location 1 to location 2. Where commodities are known to be moving in one direction only, say from location 1 (the source city) to location 2 (the destination city), this implies that

$$3.) P_t^2 - P_t^1 = M_t^{21} \leq TC^{12}$$

In this case, the difference in prices for a given commodity and for a given city-pair will follow a basic threshold auto-regression (TAR) process, whereby

$$4.) \Delta M_t^{21} = \lambda(M_{t-1}^{21} - TC^{12}) + \varepsilon_t.$$

In models of this class, λ is allowed to vary according to whether M_{t-1}^{21} is below (that is, $M_{t-1}^{21} \leq TC^{12}$) or above (that is, $M_{t-1}^{21} > TC^{12}$) the threshold defined by the trade cost term, TC^{12} . If $M_{t-1}^{21} \leq TC^{12}$, then there are no profitable arbitrage opportunities available and λ is equal to zero. However, if $M_{t-1}^{21} > TC^{12}$, then a profitable arbitrage opportunity exists, and we assume that agents exploit such opportunities, which would imply that λ is negative.

The *International Yearbook of Agricultural Statistics* reports weekly observations on commodity prices. Consequently, we are able to estimate TARs for every individual year available. This comes at the cost of assuming a constant trade cost term for each year. Given the slowly evolving dynamics of international shipping and commercial policy, this does not seem to be too heroic an assumption. Finally, we are not open to the identification problem highlighted by Coleman (2007). Given that the IIA reports exact commodity-specific city-pair matches (for example, Danish creamery butter for export, in Copenhagen and London) chosen to represent bilateral trading relations, the goods are traded between our city pairs by definition, so there is little need to worry about the emergence of triangular arbitrage shipments, which apparently characterised the pre-World War I gold trade between New York City and London.

Results

Figure 2 illustrates the estimation procedure for a single commodity for a given city-pair in a given year. Here, we consider the case of the market for Danish butter for export in Copenhagen and London in 1913. Throughout the year, the price in shillings per hundredweight is always higher in London than in Copenhagen. Thus, the margin informs us about the likely size of the composite trade costs—that is, all the costs of transportation and transaction involved in exporting Danish creamery butter from Copenhagen to London.

Price margins in hand, we estimate the trade cost term in equation 4.) above using the finmetrics module in S-Plus. The procedure yields an estimate of 8.13 shillings per hundredweight, depicted as the solid horizontal line, and a 95% confidence interval of (5.86, 8.58) depicted as the dashed horizontal lines in Figure 2. The associated speed of adjustment parameter, $\hat{\lambda}$, is -0.2925 with a standard error of 0.1395 (t-statistic = 2.10). In order to make this figure for the speed of adjustment parameter more intuitive, it is common in the literature to calculate the half-life of deviations from the (trade-cost-adjusted) law of one price using the following formula:

$$5.) \frac{\ln(0.5)}{\ln(1 + \hat{\lambda})}.$$

In this case, the estimated half-life of a shock to the pricing system is 2. That is, in 1913 it took on average about two weeks until the arbitrage trade in butter reduced a pricing deviation above the trade cost estimate between Copenhagen and London by 50 percent.

Thus, from 52 weekly observations on the price margin between two cities for a particular commodity in a particular year, the procedure generates a set of annual estimates of the trade cost separating these markets, as well as the adjustment speed. In what follows, we concentrate on the trade cost estimates for two reasons. First, we are primarily interested in the changes in the costs of doing trade between 1913 and 1939. It is these costs which would have led to international commodity price gaps widening, assuming that this in fact happened, and which would have reflected the impact of rising protectionism. At the same time, there seems little reason to believe that the technology underlying the commodity trade and, thus, determining the speed at which the commodities in our samples were shipped, or prices arbitrated, radically changed in this period. These markets had witnessed the introduction of such innovations as steamships and telegraphs well beforehand.¹ Second, the

¹ The inauguration of the Panama Canal in 1914 is an obvious exception to this general statement. However, none of those city pairs for which we have price information in 1913 is likely to have been affected by

identification of the threshold parameter comes off the entire set of observations for a given year (generally 52), while the identification of the adjustment parameter comes off the subset of observations that the TAR routine determines to be most likely to be above the trade-cost threshold, resulting in less precision.²

In any case, most of the estimated coefficients are significant at the 10 percent level, and, as predicted, we always find a negative adjustment parameter λ and a positive trade cost TC . We combine these commodity-, city pair-, year-specific estimates of trade costs with information on the average annual prices of the same commodities in destination cities to arrive at a unit-less measure of trade costs which is comparable across commodities and years. Tables 2a and 2b summarize the estimated trade costs as a share of destination market prices for the 291 observations at our disposal.

The first finding which we want to discuss is the comparison between trade cost levels in 1913 versus the post-war period. For the fourteen trade cost series at our disposal with observations both in 1913 and in the post-war period, fully ten register an increase in trade costs as a share of destination market prices. Regarding the four which register a decrease, we note that three of these involved the trade in grains between North American and the United Kingdom (oats between Winnipeg and London, wheat between Winnipeg and London, and wheat between Chicago and London). These three exceptions are less surprising if we consider the staggering heights of commercial activity in these trades—and presumably, investment in the attendant handling and shipping facilities—achieved during World War I (Food Research Institute, various years). Comparing trade costs in 1913 to those in 1922 for those series with available data suggests that, on average, trade costs rose by 60%. The

its completion, as a quick review of Table 1 will confirm. We discuss interwar transportation technologies further below.

² In an exercise to follow, we estimate two TARs on all pre-1930 observations, and all post-1929 observations, for the handful of commodities with sufficient data. These results bear out our expectation that adjustment speeds cannot be distinguished from one another, pre- and post-1929, but that estimates of trade costs can.

respective figures for 1927 and 1929 are 48% and 42%, suggesting that the international economy was slowly converging back to the levels of integration set in 1913. The evidence from the price data is thus consistent with the recovery in world trade volumes during the 1920s apparent in Figure 1.

The cataclysm of the Great Depression and the corresponding fallout in commercial policy changed all of this. The ratio of trade costs in 1933 to trade costs in 1913 is a staggering 2.59—that is, trade costs as a share of destination market prices had increased by almost 160%. Furthermore, apart from some fits and starts in re-establishing some semblance of order to international markets, the ratio still stood at 2.68 in 1938.

Some of these patterns can be detected in Figure 3. Rather than plot all the available series, we simply consider those trade cost series which bridge the critical period from 1929 to 1933. That is, we are able to track individual commodity trade costs from the onset of the Great Depression to the nadir in global trade and beyond. The figure distinguishes between series representing different orientations of trade flows. Thus, in panel A there are five trade cost series—groundnuts from Madras to London, jute from Calcutta to London, linseed from Bombay to London, rapeseed from Karachi to London, and rice from Burma to London—which represent trade between the British Empire (or, more precisely, British India including Burma) and the United Kingdom. In panel B, there are four trade cost series—cotton from New Orleans to Liverpool, maize from Buenos Aires to London, butter from Copenhagen to London, and linseed from Buenos Aires to London—which represent trade between non-British Empire countries and the United Kingdom. In panel C, there are three trade cost series—coffee (I) from Rio de Janeiro to New York City, coffee (II) from Santos to New York City, and maize from Buenos Aires to Rotterdam—which represent trade among non-British Empire countries. Finally, in panel D, there are two trade cost series from Buenos

Aires and Winnipeg to London, which allow us to compare the trade in wheat to the United Kingdom from British Empire and non-British Empire countries.

Across all panels, the series again demonstrate that trade costs were on the decline during the 1920s. There appears to have been some retrenchment in the later 1920s, but this seems more to be a slowing in the trend than a turning point. However, 1930 witnessed a marked transition in the trade cost series. The average for all series shot up from 0.1511 in 1929 to 0.3350 in 1933. Of the fourteen series depicted in 1933, only one — cotton from New Orleans to Liverpool — stood at a level comparable to that of 1929 (0.1119 versus 0.1128, respectively). And even in this case, cotton trade costs increased by 70% between 1929 and 1932. The series are also roughly synchronized on the downside with most bottoming out no later than 1935. Finally, after stabilizing at levels generally higher than in the 1920s, the averages show no clear trend in the years immediately preceding the outbreak of World War II.

Even more telling than these generalized trends is the differences between Empire and non-Empire trade. For the series in Panel A, involving trade between British Empire countries and the United Kingdom, trade costs increased on average by 62% between 1929 and 1933. For the series in Panel B, involving trade between non-British Empire countries and the United Kingdom, trade costs increased on average by 135% between 1929 and 1933, or almost twice as much. Among the series in Panel C, involving trade among non-British Empire countries, trade costs increased on average by 205%. Of course, the commodity composition of trade flows differed across these three categories, and this matters since commercial policy responses across goods and countries is likely to have been highly asymmetric. It is therefore instructive to turn to the series in Panel D, showing trade costs for wheat between Argentina and the United Kingdom on the one hand, and between Canada and the United Kingdom on the other. Again, membership in the British Empire seems to have

mattered: Argentine trade costs increased by 219% between 1929 and 1933, while Canadian trade costs increased by 35% over the same period. These patterns are consistent with the re-orientation of world trade in light of the system of imperial preferences instituted in the Import Duties Act and the Ottawa Conference of 1932 (Eichengreen and Irwin, 1995).

A longer run perspective: international price gaps, 1870-1938

Some authors, such as Giovanni Federico (2008), prefer to use simpler indicators, such as the average annual price gaps between markets, as a measure of international commodity market integration. In this section we therefore provide this evidence for the interwar period, and compare interwar price gaps with those pertaining in the late 19th century, so as to gain a longer-run perspective on interwar disintegration.

Table 3 gives annual average price gaps for twenty commodity routes between 1913 and 1937. As a sensitivity check, the sample of routes presented here differs slightly from those presented earlier: the selection criterion used here is that monthly data for the commodity in question be provided in the IIA Yearbooks, expressed in both markets in gold francs per quintal. Reassuringly, the same qualitative message emerges from these data as earlier.³ First, the war directly disrupted commodity markets, and price gaps were everywhere higher in 1922 than they had been in 1913. Second, the early to mid 1920s saw a gradual reversion to normality, with price gaps narrowing between 1922 and 1927 for each of the seven routes for which we have data. In some cases (the wheat trade between Britain and North America) the net result was that 1927 price gaps were below their 1913 levels, but in all other cases price gaps were still higher in 1927 and 1929 than they had been before the war. Third, the years after 1929 saw further disintegration. Price gaps rose in 14 out of 19 cases between 1929 and 1933, and in 17 out of 18 cases between 1929 and 1937. For

³ Grades are identical for most of the commodities. However there are some minor discrepancies in the grades for wheat. For example Argentinean wheat is graded as Barletta in Buenos Aires and as Plate in Liverpool.

example, the New York-Rio coffee price gap rose from 9.8% in 1913 to 15.8% in 1929 and 103.6% in 1933, before declining to a still high 58.2% in 1937.

Figure 4 shows annual average price gaps for nine commodity-routes for which we have data that are more or less comparable both before and after 1913. The data are taken from the International Institute of Agriculture, as before, as well as from the 1919 and 1923 volumes of the Indian Department of Commercial Intelligence's *Prices and Wages in India*. For Indian cotton, jute, wheat and cottonseed, as well as for Burmese rice and US cotton and wheat, the same route is considered for both periods, while for Indian linseed and rapeseed the routes are different, representing different embarkation points in India (Calcutta before 1913; Bombay and Karachi for linseed and rapeseed, respectively, afterwards). Four stylised facts emerge clearly from the figure. First, the well-known commodity market integration of the late 19th century is confirmed. Second, the First World War saw a dramatic disintegration of international commodity markets. The Liverpool-Bombay cotton price gap rose from 20% in 1913 to 102% in 1917; the London-Calcutta jute price gap rose from 4.4% to 106.8%, the rapeseed price gap rose from 14% to 140%, the wheat price gap rose from 16% to 118% and the linseed price gap rose from 22% to 217%; the Hull-Bombay cottonseed price gap rose from 40% to 278%; and the London-Rangoon rice price gap increased from 26% to 422%. Third, those wartime losses were later recouped. And fourth, once this process of post-war recuperation was over, there was no further progress towards commodity market integration, while in the cases of rice, linseed, rapeseed, and US cotton, there was disintegration from the late 1920s onwards, with 1929 appearing as a breakpoint. In the case of the London-Rangoon rice trade, for example, price gaps in the 1930s were back in the 40%-50% range where they had been in 1873. On some routes, the interwar period saw a halt to further integration; on others, it saw a significant erosion of the progress which had been made during 1870-1913.

Sources of disintegration: policy or technology shocks?

One of the questions remaining is the source of this disintegration. The historical literature strongly suggests that any changes in trade costs in the early 1930s were the result of drastic changes in commercial policy. At the same time, the recent work of Estevadeordal, Frantz, and Taylor (2003) suggests that there might have been some room for rising transportation costs in explaining the interwar trade bust and, thus, the climb in estimated trade costs.

The available evidence is ambiguous regarding what actually happened to interwar transport costs. The interwar period saw several incremental improvements to ocean shipping technologies, such as better boilers on steamships, or the development of turboelectric transmission mechanisms. According to Shah Mohammed and Williamson (2004), TFP growth in the British tramp shipping industry was as fast if not faster between 1909-11 and 1932-34 as before the war, with annual TFP growth rates of 2.83% on the transatlantic route, 1.27% on the Alexandria route, and 1.05% on the Bombay route. However, most of the improvements had been realised by 1923-5, suggesting war-induced technological change. Moreover, Estevadeordal *et al.* point out, citing Hummels (1999), that what matters for the relative cost of shipping is its TFP growth rate relative to the economy-wide TFP growth rate (since the latter will raise factor prices throughout the economy, and thus raise costs for sectors experiencing below-average productivity growth).

Estevadeordal *et al.*'s finding that rising real maritime freight rates (from the mid-1920s through the end of the 1930s) can help explain the interwar trade bust is based on the Isserlis (1938) maritime freight rate index, which ends in 1936, and which they deflated by the British consumer price index. However, there are at least two reasons why this finding should not be accepted uncritically. The first is that the way in which Isserlis constructed his index has been criticized, for example by Yasuba (1978) who argues that there was an

upward bias built into the index based on its choice of routes. The second is that if we are concerned about the impact of freight rates on international trade, we should be deflating them, not by a general consumer price index, but by the prices of the goods being traded.

A more recent paper, by Shah Mohammed and Williamson (2004), addresses both of these concerns. Shah Mohammed and Williamson collect freight rates for a larger and more representative sample of routes, and deflate by route-specific deflators, based on the prices of the commodities being shipped on those routes. The resulting nominal and real freight rate indices, for the period 1870-1944, are plotted in Figure 5. As can be seen, despite the wartime improvements in transportation technology mentioned earlier, freight rates shot up after 1914, as a result of higher wages and fuel, and more expensive ships. Transport cost increases are thus *prima facie* a plausible contender in explaining the wartime disintegration of international commodity markets documented earlier. Nominal freight rates remained higher during the 1920s than they had been before the war, although they fell continuously, and regained pre-war levels briefly in the early 1930s. They then increased as the 1930s progressed, before exploding once more during World War II.⁴

However, it is real freight rates that matter for trade, and commodity prices were much higher after the First World War than before. The data show real freight rates falling through the 1920s, at levels below those experienced in 1913, so that the real freight rate index stood at 0.58 in 1930-34, as opposed to 0.75 in 1910-14. The index then increased to 0.75 in 1935-39, although how much of this rise was due to developments in 1939 is not clear. An immediate implication of this index is that the interwar trade bust could *not* have been due to rising transport costs, since real freight rates only started rising in the mid-1930s, *after* world trade volumes had started to recover.

⁴ This evidence is consistent with the idea that because of the endogeneity between freight rates and trade flows the two series should be positively correlated—see Jacks and Pendakur (forthcoming) on this issue.

While the Shah Mohammed index represents the current state of the art, there is thus a certain ambiguity regarding the course of international transport costs during the interwar period. We therefore use our price data to gain some sense of whether or not the technology of information transmission and goods shipment changed over that time. That is, with the onset of the Great Depression, did commodity markets experience technological regression as the world market imploded? We set a break-point in 1929 and estimate two TARs on all pre-1930 observations and all post-1929 observations for two series: wheat between Buenos Aires and London and wheat between Winnipeg and London. The choice of these two series is strictly predicated on data availability.⁵

Estimating TAR models, as in equation 4.), for 1922 to 1929 and 1930 to 1938, we generate the results reported in Table 4. In the upper panel, we find that trade costs in shillings per quarter between 1922 and 1929 were 7.90 and 6.54 for the Buenos Aires and Winnipeg routes, respectively. Combined with information on the average prices of the specific varieties of wheat in London, this translates into proportional trade costs of 0.1574 and 0.1190, respectively—results which seem consistent with those in Table 2b above. The speed of adjustment parameters are also fairly precisely estimated, at -0.3786 and -0.1944.

Turning to the post-1930 environment in the lower panel, we see that trade costs as a proportion of the average London price increased to 0.2341 in the case of Argentine wheat and 0.1698 in the case of Canadian wheat. At the same time, the speed of adjustment parameter for Buenos Aires rose to -0.2882, while for Winnipeg it fell, to -0.2516. Thus, trade costs as a proportion of London prices rose by roughly 50% in both instances.

⁵ The price data used in the previous section experienced gaps in reporting from August to December 1926, and from September to December 1932. That is, the observations for 1926 and 1932 previously presented were estimated over the range of January to July and January to August, respectively. This does not present a problem for estimation in a given year as the only data requirement for the TAR procedure is that the price data is evenly spaced (in this case, weekly) and continuous. However, when estimating over the entire period 1922 to 1929, or 1930 to 1938, the data need to be augmented so as to fill those gaps with observations from the latter halves of 1926 and 1932. Fortunately, the Food Research Institute's *Wheat Studies* provides a wealth of data not only on consumption, production, and transactions worldwide, but also on trends in wheat prices in international markets. Combining the two sources, we have continuous weekly time series for these two wheat markets from January 1922 to December 1938.

Moreover, the difference is statistically significant across periods. By contrast, while the speed of adjustment parameters do change across regimes, they do so in an inconsistent manner, and the differences are not statistically significant. We take this as *prima facie* evidence that the communication and transportation technology surrounding trade did not change in this period, but that policy and other barriers to trade almost certainly did.

Is there any other evidence from these particular markets which might guide us on this point? Luckily, the *Wheat Studies* publication also provides some limited information on prevailing freight rates linking prominent markets in the worldwide wheat trade. In this instance, we are limited to considering the case of the wheat trade between Winnipeg and London. Figure 6 depicts the ratio of the estimated trade costs to the London price, and the ratio of quoted freight rates to the London price. Both ratios start in 1922 at or near their pre-war levels of 0.2351 and 0.0787, respectively. As in Table 2b, the trade cost to destination price ratio falls rapidly in the early 1920s, but then remains rather steady up to 1929, when it was 0.1382. From 1929, the trade cost series explodes, reaching a peak in 1932 of 0.2977, and then quickly recedes by the mid-1930s. In contrast, the ratio of freight rates to the destination price declines continuously through the 1920s with an inflection point being reached in 1929. However, the ratio never rises above 0.1000 and is not marked by the dramatic spike surrounding the onset of the Great Depression found in the trade cost series. Thus, we are left with the proposition that the spikes in the proportionate trade cost series depicted in Figure 3 must have been driven by other processes. Again, the historical literature leads us to believe that commercial policy is a very likely contender. However, future work should also consider the collapse of the gold standard, as well as the likely evaporation of commercial credit in the wake of the Great Depression.

3. Conclusion

This paper has documented a dramatic wartime disintegration of international commodity markets; a gradual reintegration during the 1920s; and yet another phase of disintegration from 1929 onwards. The post-1929 disintegration was not due to increasing freight costs, unlike the disintegration of the wartime years, and protectionism seems the most likely alternative candidate. On the other hand, an increasing scarcity of trade finance, similar to what is happening today, may also have been playing a role. Another possibility, suggested by Estevadeordal, Frantz, and Taylor (2003), is that the increase in transaction frictions associated with the collapse of the interwar gold standard may have increased trade costs. On the other hand, the net impact of abandoning gold on trade remains to be seen, given that, as Irwin (1993) points out, countries which maintained monetary orthodoxy were more likely to impose quantitative restrictions on trade than those which abandoned gold.

On balance, this paper provides evidence in favour of the view that interwar protectionism led to a severe disintegration of international commodity markets. Our hope is that it will stimulate others to undertake the kind of work which has been extensively undertaken for the pre-1913 period, so that we will ultimately arrive at a fuller understanding both of 20th century trends in international integration, and of the causes of the spectacular decline in world trade which occurred after 1929.

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Commodity	Source	Destination	Years
Butter, Danish for Export	Copenhagen	London	1913, 1927-1938
Butter, Dutch for Export	Leeuwarden	London	1933-1938
Coffee, No. 7 Rio	Rio de Janeiro	New York City	1913, 1922-1938
Coffee, No. 4 Santos	Santos	New York City	1927-1938
Cotton, Middling, Fair Staple, Universal Standards	New Orleans	Liverpool	1913, 1919-1938
Cotton, Machine Ginned Broach, Fully Good, Good Staple, Universal Standards	Bombay	Liverpool	1913
Cotton, Sakellaridis, Fully Good Fair, Universal Standards	Alexandria	Liverpool	1913, 1927-1938
Cottonseed, Upper Egyptian	Alexandria	London	1933-1938
Cottonseed, Sakellaridis, Good Merchandable	Alexandria	London	1927-1932
Eggs, Danish for Export	Copenhagen	London	1913, 1927-1932
Groundnuts, Coromandel, Machine Shelled	Madras	London	1927-1938
Jute, First Marks	Calcutta	London	1927-1938
Linseed, Plata, 4% Impurities	Buenos Aires	London	1913, 1927-1938
Linseed, Bold	Bombay	London	1913, 1927-1938
Maize, Yellow Plata	Buenos Aires	London	1913, 1922-1938
Maize, Plata	Buenos Aires	Rotterdam	1927-1938
Maize, No. 2 Mixed American	Chicago	London	1913, 1922-1926
Oats, No. 2 White Western	Winnipeg	London	1913, 1922-1926
Oats, No. 2 White, 49 kilograms per hectolitre	Buenos Aires	London	1913, 1922-1938
Rapeseed, Toria, 3% Impurities, In Bags	Karachi	London	1927-1938
Rice, No. 2 Burma	Burma	London	1913, 1927-1938
Rice, No. 1 Saigon, Round White, 25% Broken	Saigon	London	1933-1938
Rye, No. 2 American	Minneapolis	Hamburg	1927-1932
Silk, Raw, Double Extra Cracks	Yokohama	New York City	1927-1932
Wheat, No. 1 Northern Manitoba	Winnipeg	London	1913, 1922-1938
Wheat, No. 2 Hard Winter	Chicago	London	1913, 1922-1932
Wheat, No. 2 Hard	Buenos Aires	London	1913, 1922-1938

Table 1. Commodity Coverage

Commodity:	Butter	Butter	Coffee	Coffee	Cotton	Cotton	Cotton
Source:	Copenhagen	Leeuwarden	Rio	Santos	New Orleans	Bombay	Alexandria
Destination:	London	London	NYC	NYC	Liverpool	Liverpool	Liverpool
1913	0.0640		0.1271		0.0927	0.0467	0.0454
1919					0.1028		
1920					0.1476		
1921					0.1260		
1922			0.1815		0.1194		
1923			0.2060		0.1151		
1924			0.1904		0.0294		
1925			0.1204		0.0763		
1926			0.0589		0.0990		
1927	0.1007		0.1155	0.2314	0.1216		0.0464
1928	0.0659		0.0989	0.1438	0.1106		0.0353
1929	0.1032		0.1169	0.1584	0.1128		0.0287
1930	0.0935		0.2191	0.2065	0.1156		0.0281
1931	0.0943		0.1968	0.4570	0.1293		0.1294
1932	0.1372		0.3497	0.4735	0.1909		0.1380
1933	0.2415	0.2658	0.5434	0.4955	0.1119		
1934	0.2646	0.3637	0.4209	0.4423	0.1124		
1935	0.2248	0.2958	0.5690	0.5113	0.1357		
1936	0.2137	0.2290	0.4943	0.4666	0.1194		
1937	0.1956	0.1865	0.4830	0.4494	0.1504		
1938	0.1900	0.1681	0.4367	0.4413	0.1134		

Commodity:	Cottonseed I	Cottonseed II	Eggs	Groundnuts	Jute	Linseed	Linseed
Source:	Alexandria	Alexandria	Copenhagen	Madras	Calcutta	Buenos Aires	Bombay
Destination:	London	London	London	London	London	London	London
1913						0.1217	0.1351
1919							
1920							
1921							
1922							
1923							
1924							
1925							
1926							
1927		0.1087	0.2335	0.1785	0.2981	0.1366	0.1543
1928		0.0954	0.1186	0.0518	0.1992	0.1214	0.1538
1929		0.1536	0.4977	0.1631	0.2056	0.1255	0.1389
1930		0.1222	0.6494	0.0828	0.1810	0.1264	0.1259
1931		0.2229	0.1705	0.2173	0.2400	0.1922	0.1623
1932		0.1528	0.5321	0.2103	0.2406	0.1904	0.2127
1933	0.2437			0.2822	0.2914	0.4450	0.1976
1934	0.2170			0.2334	0.2929	0.1500	0.1891
1935	0.1434			0.1181	0.2345	0.1232	0.2183
1936	0.2109			0.1821	0.2340	0.1525	0.2144
1937	0.2205			0.2056	0.2122	0.1641	0.2314
1938	0.1903			0.2173	0.2670	0.1489	0.2124

Table 2a. Estimated Trade Costs as a Share of Destination Market Prices

Source: see text.

Commodity:	Maize	Maize	Maize	Oats	Oats	Rapeseed	Rice
Source:	Buenos Aires	Buenos Aires	Chicago	Winnipeg	Buenos Aires	Karachi	Burma
Destination:	London	Rotterdam	London	London	London	London	London
1913	0.1085		0.0884	0.3107	0.0873		0.3570
1919							
1920							
1921							
1922	0.2632		0.2131	0.3013	0.2599		
1923	0.2474		0.1161	0.3103	0.2350		
1924	0.3267		0.1078	0.2425	0.1939		
1925	0.1618		0.1642	0.2499	0.1668		
1926	0.1728		0.1563	0.3147	0.2583		
1927	0.2387	0.1771			0.4709	0.1342	0.2129
1928	0.2391	0.1935			0.4325	0.1469	0.2121
1929	0.1925	0.2154			0.4776	0.1343	0.1855
1930	0.2568	0.1652			0.5202	0.1665	0.1882
1931	0.2804	0.3921			0.6683	0.2147	0.3240
1932	0.2681	0.2399			0.5237	0.1885	0.2449
1933	0.4846	0.4448				0.2319	0.3324
1934	0.1752	0.1551				0.1859	0.3605
1935	0.2183	0.2351				0.1606	0.1857
1936	0.3242	0.2909				0.1829	0.2782
1937	0.3285	0.3016				0.2073	0.3816
1938	0.1757	0.1626				0.1821	0.3258

Commodity:	Rice	Rye	Silk	Wheat	Wheat	Wheat
Source:	Saigon	Minneapolis	Yokohama	Winnipeg	Chicago	Buenos Aires
Destination:	London	Hamburg	New York City	London	London	London
1913				0.2351	0.1194	0.1458
1919						
1920						
1921						
1922				0.2199	0.0764	0.1969
1923				0.1507	0.0777	0.1665
1924				0.1085	0.1195	0.1251
1925				0.1376	0.1073	0.0979
1926				0.1846	0.0662	0.0308
1927		0.1686	0.0729	0.1469	0.1209	0.1246
1928		0.1553	0.1281	0.1655	0.0664	0.1223
1929		0.1387	0.1263	0.1382	0.0744	0.1258
1930		0.2446	0.0963	0.2354	0.1078	0.0630
1931		0.0944	0.1111	0.2266	0.0706	0.2488
1932		0.2307	0.0602	0.2977	0.0934	0.2048
1933	0.2665			0.1872		0.4011
1934	0.3255			0.1688		0.1540
1935	0.2591			0.1125		0.1179
1936	0.2620			0.1201		0.1626
1937	0.2718			0.1430		0.0527
1938	0.2467			0.1624		0.2191

Table 2b. Estimated Trade Costs as a Share of Destination Market Prices

Source: see text.

Commodity	Grade	Markets	1913	1922	1927	1929	1933	1937
Wheat	No. 2 Winter	Liverpool-Chicago	16.0	24.6	12.9	8.7		
Wheat	No. 1 Northern Manitoba	London-Winnipeg	24.5	34.7	7.7	9.9	20.7	17.7
Wheat	Plate	London-Buenos-Aires	9.0	26.3	11.0	11.6	10.1	5.8
Maize	Plate	London-Buenos-Aires	18.7	39.3	25.3	21.0	25.5	33.6
Oats	Plate	London-Buenos-Aires	13.5	33.2	29.1	25.7	26.0	
Rice	Birmanie No. 4	London-Rangoon			25.9	27.7	50.4	55.3
Rice	Saigon No. 1	London-Saigon			76.2	39.7	39.0	44.2
Rapeseed	Toria	London-Karachi			14.7	15.1	21.8	27.3
Groundnut	Coromandel	London-Madras			20.5	15.2	27.1	26.6
Linseed	Bombay	London-Bombay			17.6	16.8	23.9	27.9
Linseed	La Plata	London-Buenos-Aires			16.0	14.7	13.1	22.2
Cotton	Middling	Liverpool-New Orleans	12.0	22.1	12.2	12.2	15.9	16.5
Cotton	Broach	Liverpool-Bombay			4.0	8.4	5.4	8.8
Cotton	Sakellaridas	London-Alexandria			6.2	5.4	13.0	10.1
Cottonseed	Sakellaridas	London-Alexandria			17.5	19.8	23.8	24.2
Eggs	Danish	London-Denmark			43.6	58.7	71.5	73.8
Eggs	Dutch	London-Holland			12.8	23.6	15.4	45.7
Butter	Danish	London-Copenhagen			7.9	10.1	36.7	24.7
Coffee	Rio No. 7	New York-Rio	9.8	17.0	15.5	15.8	103.6	58.2
Coffee	Santos No. 4	New York-Santos			28.0	19.3	89.8	55.8

Table 3. Average annual commodity price gaps, 1913-1937 (percent)

Source: *International Yearbook of Agricultural Statistics*, International Institute of Agriculture, various years. Data for 1927-37 are based on annual averages of monthly price data, expressed in gold francs per quintal. There are two exceptions: such monthly price data are only available for Liverpool-Chicago wheat prices for 1927-32; and for London-Buenos Aires oats prices for 1927-33. Where monthly data in gold francs per quintal are not available, price gaps are calculated based on the weekly price data used elsewhere in this paper.

1922-1929:		
Commodity:	Wheat	Wheat
Source:	Buenos Aires	Winnipeg
Destination:	London	London
Units:	Shillings per quarter	Shillings per quarter
Trade costs:	7.90	6.54
95% confidence interval:	(7.53, 8.98)	(6.54, 11.38)
Average price in London:	50.19	54.94
Trade costs as a proportion of London price:	0.1574	0.1190
Adjustment parameter:	-0.3786	-0.1944
Standard error:	0.0455	0.0213
N:	417	417
1930-1938:		
Commodity:	Wheat	Wheat
Source:	Buenos Aires	Winnipeg
Destination:	London	London
Units:	Shillings per quarter	Shillings per quarter
Trade costs:	6.54	5.72
95% confidence interval:	(3.05, 6.60)	(5.69, 5.72)
Average price in London:	27.93	33.69
Trade costs as a proportion of London price:	0.2341	0.1698
Adjustment parameter:	-0.2882	-0.2516
Standard error:	0.0406	0.0225
N:	471	471

Table 4. Long-run Threshold Autogressions, pre- and post-1930

Source: see text.

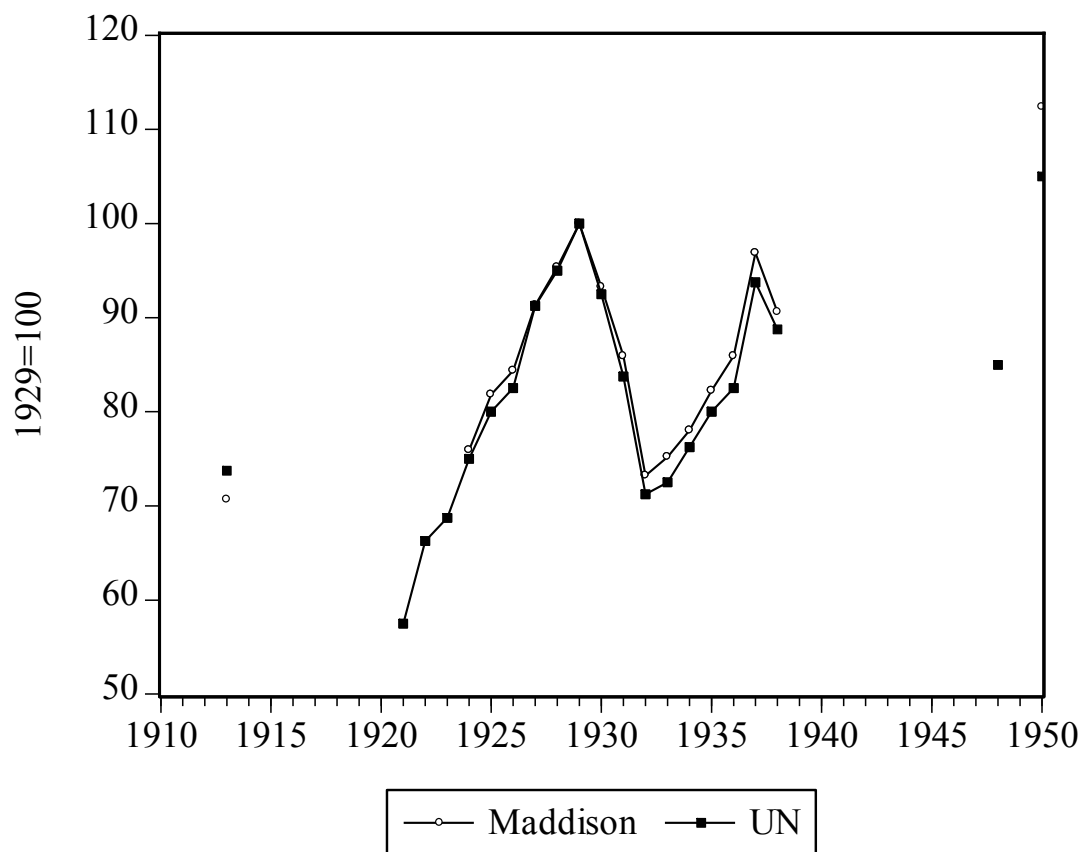
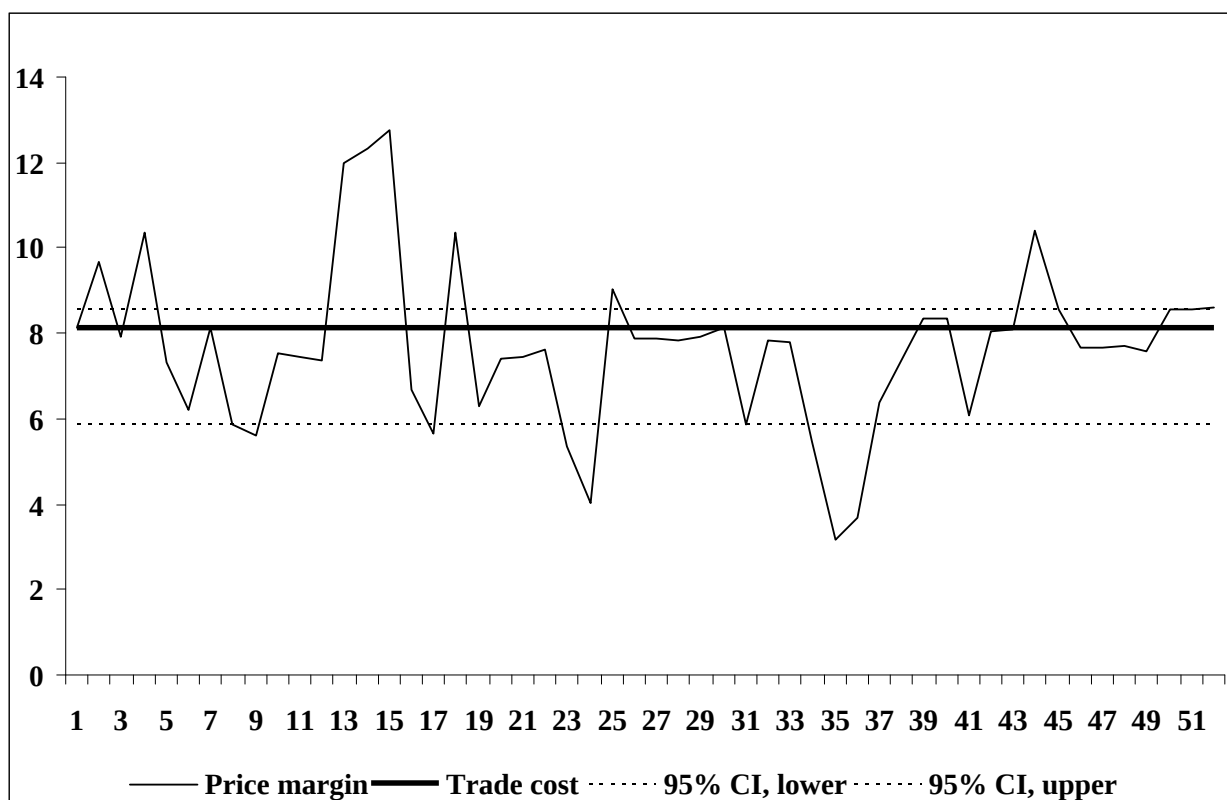


Figure 1. World trade indices, 1913-1950

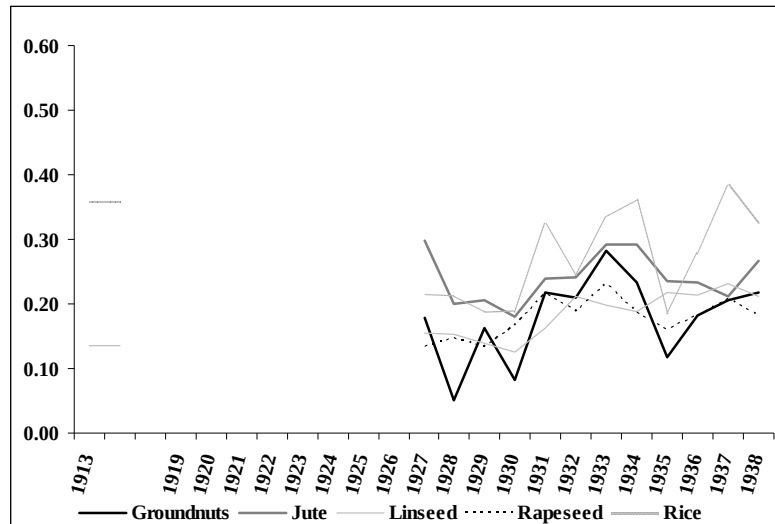
(1929=100)

Source: United Nations (1962), Maddison (1995, p. 239).

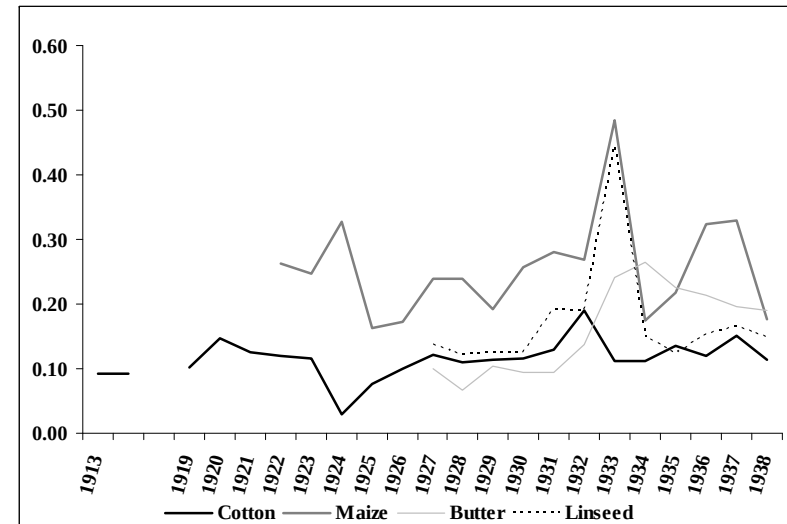


**Figure 2. Price Margins in the Market for Danish Butter, 1913
(shillings/hundredweight)**

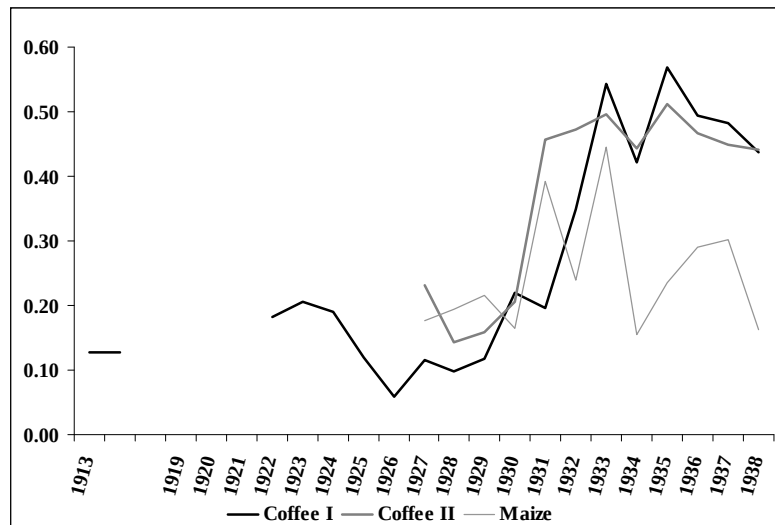
Source: see text.



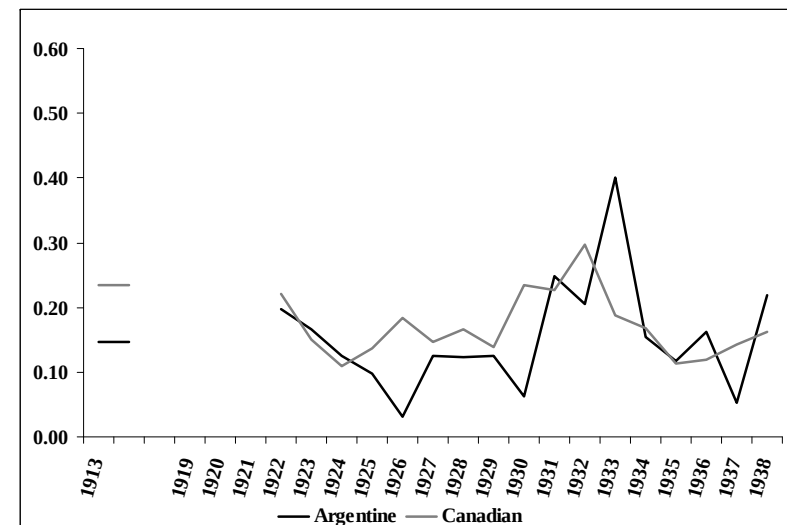
Panel A: British Empire to the UK



Panel B: Non-Empire to the UK



Panel C: Non-Empire to Non-Empire



Panel D: Wheat to the UK

Figure 3. Trade Costs, 1913, 1919-1938

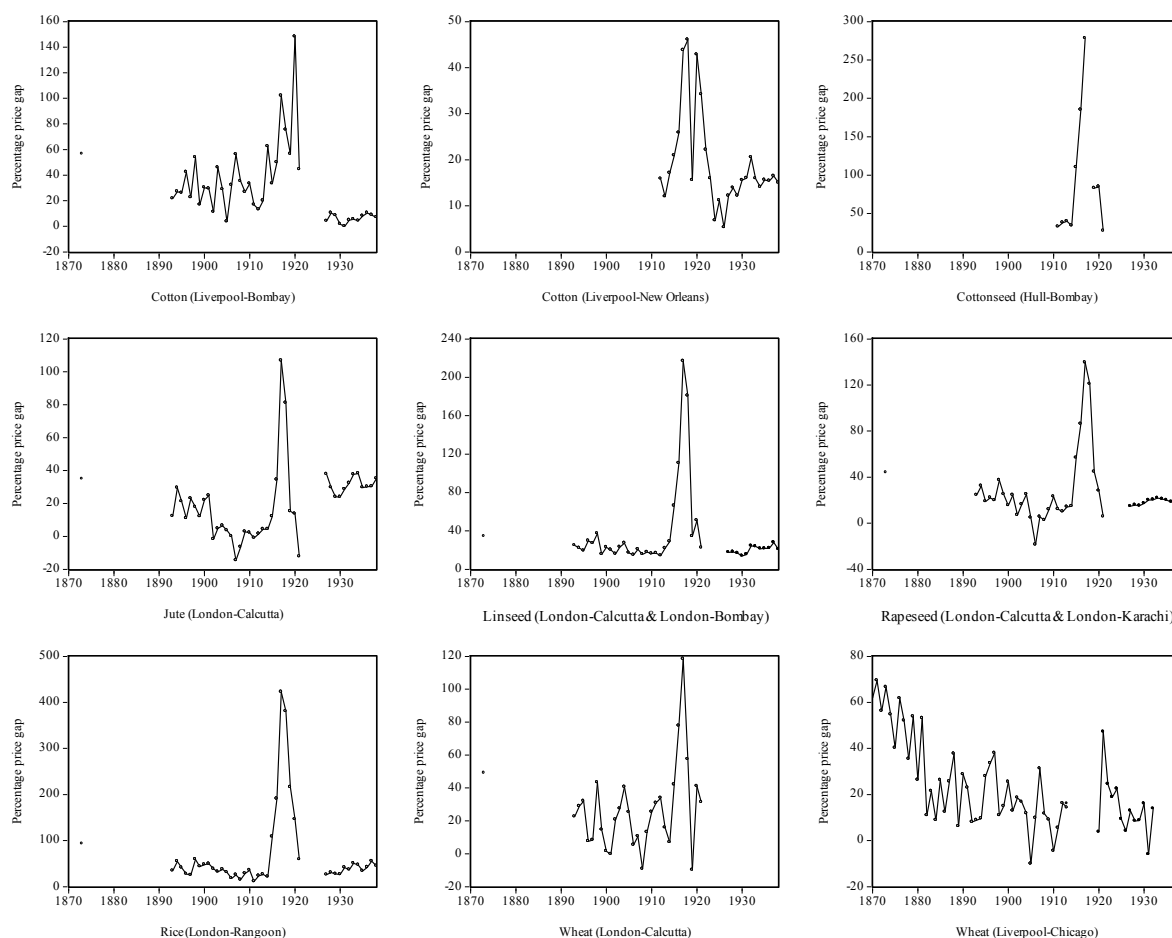


Figure 4. Percentage price gaps, 1870-1938.

Sources: data on Anglo-Indian price gaps, 1873-1921, are computed based on the price information in the 1919 and 1923 volumes of *Prices and Wages in India*. Data for 1927-1938 are based on *International Yearbook of Agricultural Statistics*, International Institute of Agriculture, various years. Data on the Liverpool-New Orleans cotton price gap are based on the price information in the *International Yearbook of Agricultural Statistics*. Weekly information is used for 1912-26; monthly data in gold francs per quintal are used for 1927-1938. Data on the Liverpool-Chicago wheat price gap are based on the price information for #2 winter wheat given in Harley (1980) for 1870-1913, and in *International Yearbook of Agricultural Statistics* for 1913-1932. Harley gives prices for #2 winter wheat in Liverpool for every year between 1870 and 1913, but Chicago information is only available for 1872, 1875, and 1879-1891. For the other years, we use his price data for #2 spring wheat in Chicago, adjusted up slightly to correct for the average price gap between the two grades of wheat in Chicago experienced between 1879 and 1891.

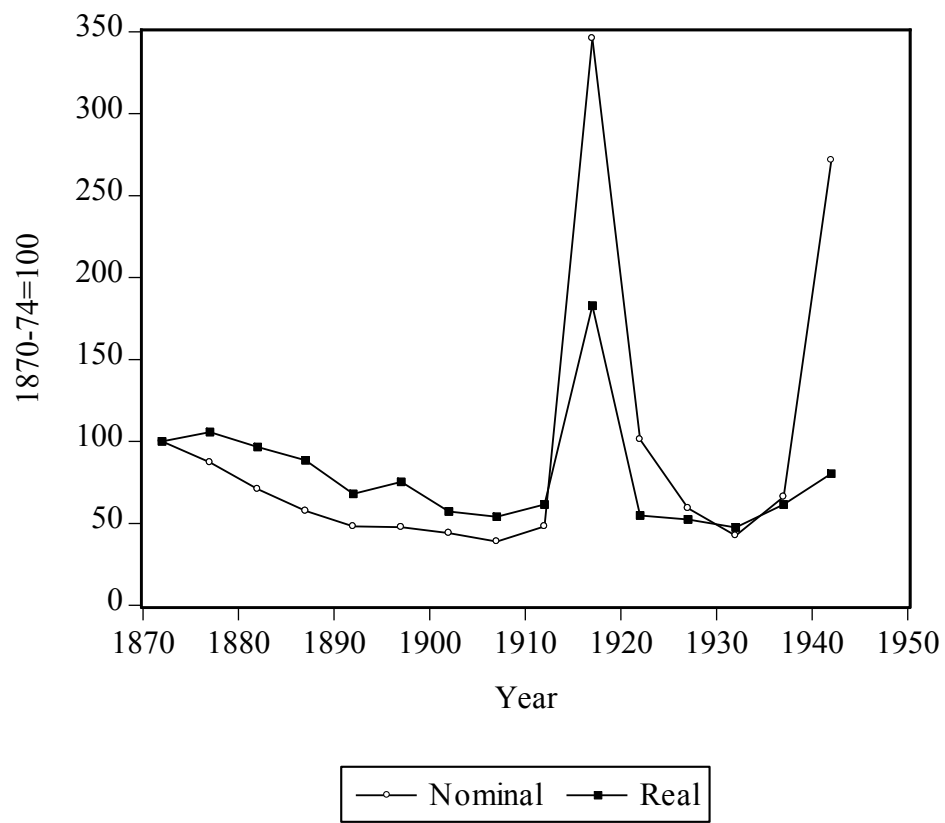


Figure 5. Freight rate indices, 1870-1944

(1870-74 = 100)

Source: Shah Mohammed and Williamson (2004), Table 3, p. 188.



Figure 6. Freight Rates and Trade Costs in the Anglo-Canadian Wheat Trade

Source: see text.

