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Early globalizations: the integration of Asia in the world economy, 1800–1938

Article (Accepted version) (Refereed)

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By David Chilosi and Giovanni Federico

Abstract

This paper contributes to the debate on globalization and the great divergence with a comprehensive analysis of the integration of Asia in the world market from 1800 to the eve of World War Two. We examine the patterns of convergence in prices for a wide range of commodities between Europe and the main Asian countries (India, Indonesia, Japan and China) and we compare them with convergence between Europe and the East Coast of the United States, hitherto the yardstick for the 19th century. Most price convergence occurred before 1870, mainly as a consequence of the abolition of the European trading monopolies with Asia, and, to a lesser extent, the repeal of duties on Atlantic trade. After 1870, price differentials continued to decline thanks to falling freights and to better communication after the lay-out of telegraph cables. There was only little disintegration in the inter-war years.

Keywords: globalization; market integration; international trade; economic growth; Asia; nineteenth century.

Standard economic theory holds that trade and market integration foster economic growth. Indeed, the era of the so-called first globalization, before World War One, coincided with a period of unprecedented economic growth in Europe and in its Western Offshoots (Maddison 2013). Yet, at the same time, the Asian countries (with the partial exception of Japan) fell increasingly behind the advanced European ones (Broadberry 2013), in spite of rapidly growing exports (Federico and Tena 2013). Some scholars have tackled the paradox posed by this "great divergence" (Pomeranz, 2000) by pointing out that exports of primary products did benefit the Asian economies, but their effect was too small to foster economy-wide growth (Feuerwerker 1980, 1983, Booth 1988, Tomlison 1993, van der Eng 1996, Roy 2000, Brandt et al. 2013). Others blame the colonial powers for forcing the Asian economies to export primary products, thus damaging their growth potential (Dutt 1969, Parthasarathi 2011). For Williamson (2008, 2011, 2012, 2013), too, specialization in primary products damaged the long-term prospects for industrialization in the periphery. In his view, however, this specialization was the unintended consequence of market integration, which improved the terms of trade before the 1870s. In the same vein, Allen (2011) argues that peripheral countries could have escaped this "curse of primary products" (Sachs and Warner 2001) only by adopting a coherent industrialization policy, which was conspicuously lacking in all Asian countries but Japan.

Testing these competing views about exports and economic growth entails a huge and very challenging research agenda. This paper contributes to this agenda by exploring price convergence, an essential component of integration, between Europe (United Kingdom, the Netherlands, or France) and the four main Asian countries, China, British India, the Dutch East Indies (henceforth Indonesia) and Japan from the beginning of the 19th century to the eve of World War Two. In so doing, we fill in two key gaps in the literature on the integration of Asia in the world economy: we analyze the period 1800-1870 and quantify the impact of the abolition of Western trading monopolies. Previous work has shown that price gaps were high before 1800 (O'Rourke and Williamson 2002, Rönnbäck 2009), narrowed after 1870 (O'Rourke and Williamson 2002, Hynes et al. 2012), and widened during the Great Depression (Hynes et al. 2012). However, no empirical research, to date, has dealt with the period 1800-1870. Yet, these years featured massive processes of integration both within Europe (Federico 2011, 2012) and in the Atlantic economy (Jacks 2005, Uebele 2011, Sharp and Weisdorf 2013), raising the question of how does Asia compare? The same years also saw the abolition of the monopolies by the Western companies trading with Asia. Their demise must have boosted

integration, but we lack measures of the actual size of this effect, relative to those of the decline in duties and advancements in transport and communication technology.

We present our dataset in Section Two and discuss the patterns of price convergence in Section Three. The key period of integration across routes was the early, rather than the late nineteenth century, while price differentials remained roughly stable in interwar years. Section Four deals with the main barriers to trade, focusing on the trading companies and on their abolition, while Section Five estimates the contribution of different causes (institutional change, fall in transport costs, trade liberalization and so on) to price convergence with a panel regression. In spite of the similarities in trends across oceans, the processes of integration had roots in different institutions: while in the Atlantic economy the repeal of duties was a key determinant, much of the price convergence between Asia and Europe was due to the demise of the British East India Company (EIC) and, to a lesser extent, the Dutch trading monopoly (*Nederlandsche Handel-Maatschappij* or NHM). Section Six concludes.

2) The data-base

The quantitative analysis of integration faces a trade-off between the quality of the data and their representativeness of changes in the overall market. In particular, as Federico (2012) argues, in order to produce reliable results, the price series should meet three conditions:

i) The price ratios should refer to pairs of markets which were actually trading. Otherwise, price differentials can be lower than costs and move (quasi-) randomly within the band of commodity points. If markets trade and are efficient à la Fama (1970), in equilibrium price gaps must be equal to transaction costs, inclusive of monopoly mark-ups.

ii) Each price series should refer to a specific quality rather than to the market average and each pair of series should refer to the same quality. Otherwise, price gaps might reflect quality differentials, and any change in quality in a market might introduce spurious trends.

iii) The commodities should be representative of the actual trade flows. Extending inferences from one product only (e.g. cereals), is tantamount to assume that that movements in transport costs, barriers to trade and market efficiency are similar across all traded goods

Table 1
The data-base

	Period	Market		Homogeneous quality?		
				Within markets		Across
		Origin	Destination	Origin	Destination	Markets
Atlantic						
Cotton	1801-1938	New York	Liverpool	Yes	Yes	Yes
Wheat	1800-1937	New York	London	No	No	No
Far East						
Silk	1834-1877	Canton	London	Yes	Yes	Yes
Silk	1874-1913	China	London	Yes	Yes	Yes
Silk	1874-1914	China	Lyon	Yes	Yes	Yes
Silk	1894-1914	Yokohama	Lyon	No	No	No
Silk	1894-1938	Yokohama	New York	No	No	No
Tea	1811-1831	Canton	England	No	No	Yes[a]
Tea	1820-1877	Canton	London	Yes	Yes	Yes
India						
Cotton	1796-1845	Calcutta	London	Yes	Yes	Yes
Cotton	1867-1938	Bombay	London	Yes	Yes	Yes
Indigo	1822-1931	Calcutta	London	Yes	Yes	Yes
Jute	1844-1938	Calcutta	London	Yes	Yes	Yes
Linseed	1846-1938	Calcutta	London	Yes	Yes	Yes
Rapeseed	1871-1921	Calcutta	London	Yes	Yes	Yes
Rice	1870-1938	Rangoon	London	Yes	Yes	Yes
Saltpetre	1796-1853	Calcutta	London	Yes	Yes	Yes
Silk	1796-1856	Calcutta	London	Yes	Yes	Yes
Silk	1857-1877	Calcutta	Lyon	Yes	Yes	Yes
Sugar	1796-1856	Calcutta	London	Yes	Yes	Yes
Tea	1893-1931	Calcutta	London	Yes	Yes	Yes
Wheat	1861-1931	Calcutta	London	Yes	No	No
Indonesia						
Coffee	1833-1913	Batavia	Rotterdam	No	Yes	No
Pepper	1828-1938	Batavia	Amsterdam	No	No	No
Rice	1848-1913	Batavia	Amsterdam	Yes	Yes	Yes
Rubber	1913-1938	Batavia	London	Yes	Yes	Yes
Sugar	1822-1938	Batavia	London	No	No	No
Tea	1893-1938	Batavia	Amsterdam	Yes	Yes	Yes
Tin	1863-1913	Batavia	Amsterdam	Yes	No	No

Notes: [a] since all these figures refer to tea imported and sold at auctions by the East India Company, we expect the quality mix to be similar in the same year, but not necessarily across years.

Sources: see Chilosi and Federico (2013: Appendix B).

Unfortunately, we cannot examine integration on the import side because the data on prices of manufactures are very scattered and refer to different qualities. The data for primary products are

much more abundant and thus we have been able to collect series of prices for the same commodities in 26 pairs of markets (Table 1).[1]

All cities in our sample were major trading centers in their own countries, and trade statistics report bilateral trade of that specific good for about 93 per cent of the observations. Missing data are mostly scattered, which suggests failure to record rather than absence of trade. There is a small chance that absence of trade could be an issue in only about 2 per cent of the cases. Quality is homogeneous across markets (Yes in the relevant column) in the overwhelming majority of pairs, 22 out of 29 pairs. In two of the other cases, one series only can be considered as qualitatively homogeneous (Yes in the Column "within market"), but the quality surely differs between series (No the Column "across markets"), while in the remaining ones the quality differs between markets and changes in time in each market (No in all three columns). In short, in the worst case, homogeneity might be a problem at most for one fourth of cases. Last but not least, these products accounted for about half or more of exports from India and Indonesia nearly the whole period, from United States before the Civil War and from China until 1900 (Table 2). The coverage is poor only for Japan.

Table 2

Shares of covered products on total exports (in percentage)

	China	India	Indonesia	Japan	United States
1810		26.4	84.0[a]		34.8
1830		45.0[b]	67.1		50.8
1850		40.5	76.3		46.5
1870	95.4	55.5	73.3	28.8	64.9
1890	58.7	57.1	59.4	24.0	33.5
1900	33.3	46.5	56.4	20.6	22.2
1913	29.0	53.3	43.4	26.3	26.7
1929	20.3	46.0	57.2	29.4	17.1
1938	9.5	42.2	43.1	9.0	10.0

Notes: [a] 1823, [b] 1828
Sources: see Chilosi and Federico (2013: Appendix B) and Federico and Tena (2013)

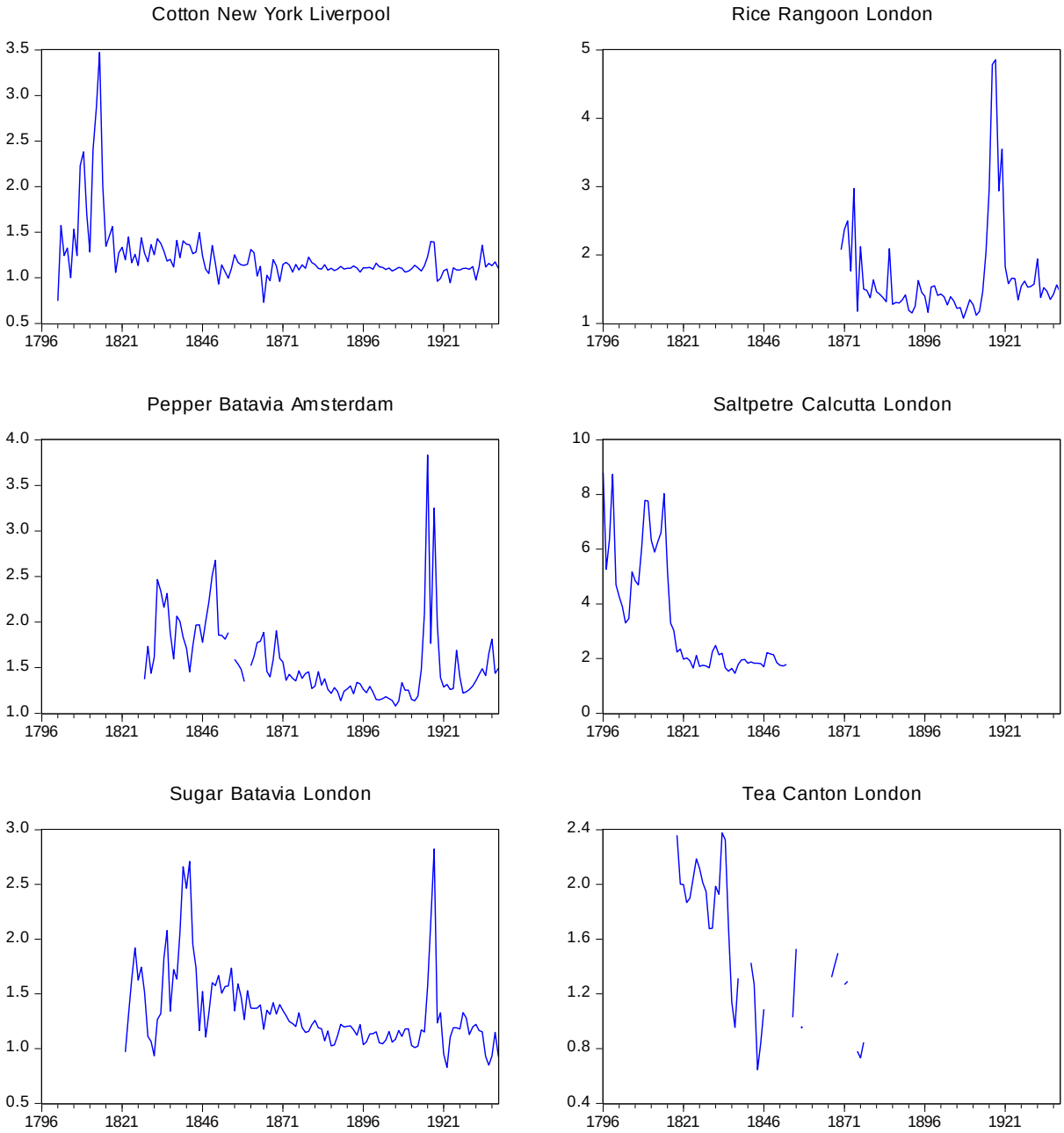
Summing up, the data-base, though falling short of being perfect, can be considered as fit for our purposes.

[1] For a more detailed discussion of our sources see Chilosi and Federico (2013: Appendix B). We have considered a larger sample, but we have decided to drop some series (e.g. tobacco from Indonesia) which did not meet the minimum quality threshold.

3) The process of integration: a statistical analysis

Figure 1

Price ratios: selected commodities



Notes: the price ratios are computed with the yearly means of import and export prices.

Sources: see Chilosi and Federico (2013: Appendix B).

A visual inspection of some representative series of price ratios (Figure 1) reveals that, on the one hand, as expected, the price ratios were fairly high at the beginning of the 19th century and fell in the long run, with a spike during World War One. On the other hand, the differentials differed hugely

among commodities at the same time (as seen in the vertical axis) and they often suddenly collapsed rather than steadily declined.

More precise information on convergence can be obtained by estimating the equation (Razzaque et al., 2007):

$$\Delta Ln\ RP^{i} = \alpha + \beta\ TIME + \psi\ ln\ RP^{i}_{t-1} + \varphi\ ln\ \Delta Ln\ RP^{i}_{t-1} + u \qquad 1)$$

Where RP^{i} is the relative price of the *i-th* good between two markets and *TIME* is a linear trend. We compute the long-run rate of change as $t = -(\beta/\psi)$. The error correction model coefficient ψ (ranging between -1 and 0) tests whether and estimates how rapidly price ratios return to this trend after a shock, while the lagged change in relative prices is added to address possible serial correlation. We first run Equation 1) as a fixed effects panel for the whole sample and separately by country, considering jointly the (comparatively few) observations for the two Far Eastern countries, China and Japan.

Table 3
Long-run convergence: panel estimation

	N	Initial ratio	Half-life (months)	Rate (in percentage)	Cumulated change (in percentage)
All	1725	1.940	24	-0.443***	-46.72
Atlantic	257	1.618	20	-0.401***	-42.46
Far East	191	2.024	18	-0.520***	-52.22
India	805	2.085	26	-0.501***	-50.89
Indonesia	472	1.746	18	-0.402***	-37.25

Significant at * 10 per cent; ** 5 per cent; *** 10 per cent.

Notes: N=sample size. Fixed-effects estimation of equation 1) is used in all cases.

Sources: see Chilosi and Federico (2013: Appendix B).

The results (Table 3) confirm the conventional wisdom: at the beginning of the series (which differed by product and route), European prices were on average double the Asian ones and by the end this difference had been cut by a half. All rates are statistically significant and very similar across routes. The half-lives of shocks are comparatively quite high. One might sum up that the market was becoming increasingly integrated, but overall it had still a long way before becoming really efficient.

However, such a conclusion might be a tad hasty: it assumes stationary efficiency and linear price convergence with equal rates by product. We explore difference in timing of integration by running

separate panel regressions for five periods: the twilight of mercantilism (1796-1815), the early globalization (1815-1870), the heyday of globalization (1870-1913) and the war and interwar (1914-1938). We also run for these periods a pooled group estimator, which allows rate of change to differ across products and then averages them (Table 4).

Table 4
Trends by period: panel regression

	N	Initial ratio	Half-life (months)	Rate (in percentage)	Cumulated change (in percentage)	Pooled Group estimator
Twilight of mercantilism (1796-1815)						
All	102	2.274	10	0.968	20.20	1.920
Atlantic	27	1.215	9	3.249	62.81	4.855
India	72	3.099	9	0.285	17.00	-0.195
Early globalization (1815-1870)						
All	565	1.973	16	-0.896***	-38.92	-0.759**
Atlantic	109	1.632	10	-0.678***	-31.12	-0.668***
Far East	48	2.245	12	-1.501**	-55.55	-0.436
India	263	2.125	17	-1.243***	-49.51	-1.506***
Indonesia	145	1.892	12	-0.504**	-21.48	0.235
Heyday of globalization (1870-1913)						
All	765	1.291	8	-0.418***	-16.44	-0.379***
Atlantic	88	1.129	12	-0.288***	-11.65	-0.230
Far East	114	1.266	12	-0.334**	-13.37	-0.235*
India	330	1.326	7	-0.517***	-19.95	-0.461*
Indonesia	233	1.311	8	-0.347***	-13.85	-0.359***
War and interwar (1914-1938)						
All	313	1.441	10	-1.128***	-23.71	-1.116***
Atlantic	37	1.084	7	-0.160	-3.78	-0.260
Far East	27	1.157	0	-0.250*	-5.82	
India	150	1.559	10	-1.478**	-28.86	-1.425***
Indonesia	99	1.483	9	-1.181**	-24.69	-1.045**

Significant at * 10 per cent; ** 5 per cent; *** 10 per cent.

Notes: N=sample size. N=sample size. Fixed-effects estimation of equation 1) is used in all cases.

Sources: see Chilosi and Federico (2013: Appendix B).

As posited by the conventional wisdom, the results show no integration before 1815, although they rely on a small and thus potentially non representative number of observations. The data for the two subsequent periods are undoubtedly representative and they yield a clear conclusion: overall, convergence was twice faster in the “early globalization” than during its (alleged) “heyday”. The difference between the two periods is particularly wide for the Far East, while convergence between Indonesia and Europe was only 45 per cent faster in 1815-1870 than in 1870-1913. Integration of

Indonesia during the “early globalization” is also the only case where the two estimators yield different results. The negative coefficient(s) for the war and interwar period reflects the return to normal levels of price differentials, after the sharp war-time increase. Indeed, dropping the first five years, the rates become positive for the total and for all areas but the Far East. Yet the rates of inter-war disintegration remain relatively small and are not statistically significant.[2] In other words, the inter-war disintegration of the world trading network affected little the Asian and American exports of primary products analyzed here.

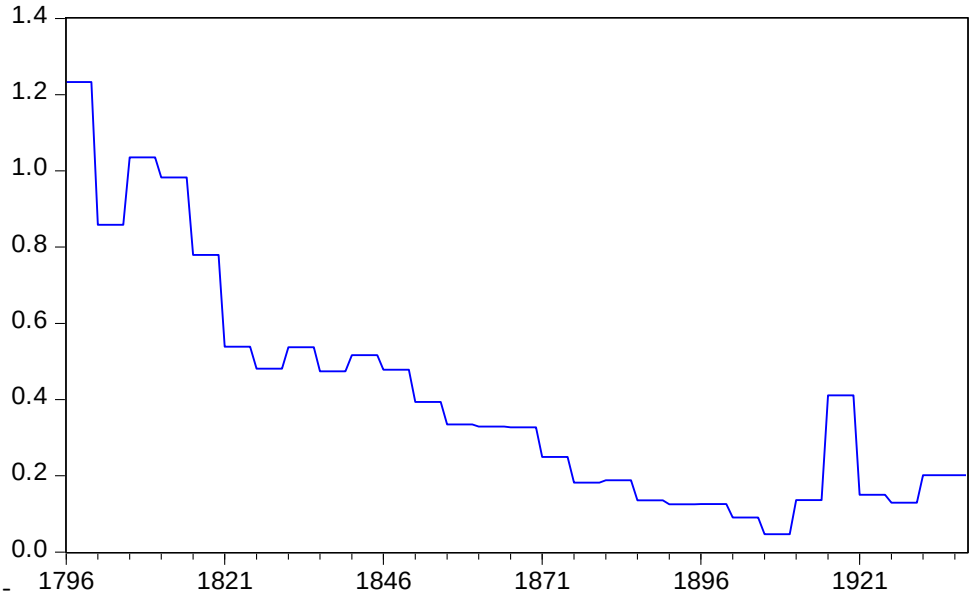
The increase in the speed of reaction between the second and third periods suggests an increase in market efficiency. However, this is modest and the reaction remains rather slow: one may surmise that in modern markets, most shocks were arbitraged away within the year and that, consequently, our yearly series capture only very large shocks, which needed more time to be absorbed. This conjecture should be tested with higher frequency data (Brunt and Cannon 2014).

One might suspect the inter-temporal comparisons to be biased by composition effects as the coverage by product differs between periods. The absence of some bulky product from the panel before 1870 implies a negative bias in the pace of integration during the “twilight of mercantilism”, while the sample for the “heyday of globalization” includes high-value goods whose price differentials were already very small by 1870 and could not fall further. We address this concern by running fixed-effect panel regression of the natural logarithm of price ratio as a function of five year time dummies (Bateman 2011).

[2] The overall rate of change (in percentage) is 0.50 (not significant), while rates by area are -0.39 for the Far East (significant at 10 per cent), 0.63 for India, 0.53 for Dutch East Indies and 0.51 for the United States (none significant).

Figure 2

Long-run convergence: five year averages



Notes: The dependent variable is the natural logarithm of the ratio between import and export prices; the only independent variables are five years dummies. Fixed-effects estimation is used.

Sources: see Chilosi and Federico (2013: Appendix B).

The results (Figure 2) confirm that if anything the linear trends understate the difference between 1815-1870 and 1870-1913. The pattern is almost identical also if we omit non-homogenous goods and very similar (although statistically less precise) if we run separate regressions for the four trade routes. On top of this, Figure 2 shows that price convergence concentrated in fairly short periods of time, most notably between 1815 and 1825, in the 1850s, and in the early 1870s and the 1880s. Thus, we look for structural breaks in the series of price ratios with a Bai-Perron (1998, 2003) test. We find at least one break in twenty-three series out of twenty-nine and two or more breaks in six of them, for a total of 31 breaks. About a third of these breaks feature also a shift in level exceeding a third of the differential before the break. Table 4 sums up the results. Column 1 reminds the number of series by period and country (from Table 1). Columns 2 to 4 report the number of trends, distinguishing between periods of convergence (negative and significant coefficient of the time variable), divergence (positive and significant trend) and periods without a significant trend in price ratios. The number of trends (sum of Columns 2 to 4) exceeds the number of pair of markets (Column 1) whenever there is more than one trend within a given period. Then we count the number of breaks which entail also an upward (Column 5) or downward (Column 6) jump exceeding 10 per cent of the last year of the previous trend. We estimate the total change in each period/country (Column 7) and the contribution

Table 5

The four phases of globalization

		Number of trends			Number of breaks		Total change in the period	Contribution of shocks	Implicit rate of change
	Pairs of markets	Convergence	Divergence	Trendless	Upward shock	Downward shock	(in percentage)	(in percentage)	(in percentage)
Twilight of mercantilism (1796-1815)									
Atlantic	2			2			-1.10	0.00	-0.10
India	4			4			-3.50	0.00	-0.31
All	6			6			-2.70	0.00	-0.24
Early globalization (1815-1870)									
Atlantic	2	1		2		2	-27.60	45.50	-0.45
Far East	3	1	1	2		1	-28.50	25.80	-0.79
India	8	4		5	1	5	-46.10	41.80	-1.90
Indonesia	5	3	1	3		2	-10.60	16.20	-0.47
All	18	9	2	12	1	10	-32.50	33.39	-1.20
Heyday globalization (1870-1913)									
Atlantic	2			2			-8.40	21.40	-0.21
Far East	4	3	1	1		1	-2.80	5.70	-0.06
India	8	6	1	2	1	2	-19.30	22.70	-0.54
Indonesia	6	3		3		2	-14.30	41.30	-0.40
All	20	12	2	8	1	5	-13.40	24.76	-0.37
War and interwar (1914-1938)									
Atlantic	2			2			-1.80	0.00	-0.08
Far East	1	1					-2.90	0.00	-0.12
India	8	4	2	2	3		1.80	17.50	0.28
Indonesia	4	1	1	2	2	1	4.90	43.50	0.16
All	15	6	3	6	5	1	1.84	20.91	0.17

Notes: The dependent variable in each regression is the natural logarithm of the ratio between import and export prices; the only independent variable is the time trend. The Bai-Perron (1998, 2003) tests detect structural breaks in the constant and the slope. The total change and the implicit rate of change for each product in each period (Columns 7 and 9) are based on the formula *Delta* = $(rp_T$-

Table 5-continued

$rp_0)/rp_0$, where *Delta* is the total change and the *rps* denote the fitted values at the end and beginning of the period. As at times trends and shifts offset one another, to examine the extent to which cumulated changes are explained by them, we decompose the sum of the absolute values of the predicted changes (Chilosi 2014), using the following formula: $Delta\_abs=|(rp_{n1}-rp_{n0})/rp_{n0}|+|(rp_{n2}-rp_{n1})*rp_{n1}/(rp_{n1}*rp_{n0})|+|(rp_{n3}-rp_{n2})*rp_{n2}/(rp_{n2}*rp_{n0})|+\ldots$ where rp_{ni} changes whenever there is a shift and again with the new trend. In practice, there are at most two trends in each period (i.e. i=1, 2 or 3). The figures reported in Column 8 are based on the proportions of *Delta_abs* explained by the shifts.

Sources: Chilosi and Federico (2013: table A1).

by shocks (Column 8), by averages of product specific figures. Last but not least, we compute an overall trend, comparable with the linear trends of Table 4, as an average the product-specific yearly rates of change (Column 9).

As a whole, our analysis confirms that convergence was consistently and significantly faster during the "twilight of mercantilism" than during the "heyday of globalization", although the difference for Indonesia is very small. The analysis adds three important results. First, the timing of the breaks only weakly supports the traditional periodization: slightly less than half of the breaks (14 out of 31) fall within an interval of six years around 1815, 1870 or 1913 and almost as many (10) are farther than ten years from these dates. Second, breaks mattered a lot. In the "twilight of mercantilism" phase, on average, they accounted for one third of changes, as compared to a quarter during the "heyday" and a fifth during the last period. Third, the timing of the breaks often coincided with important institutional changes, detailed in the next section. Almost all the major shifts, 10 out of 12, clustered around 1815 or 1913 –, i.e. at the end of the EIC monopoly in Indian trade (1813) or at the outbreak of World War One. One exception is the tea exported from Canton to London, whose price ratio saw a sudden fall in 1835, two years after the demise of the EIC monopoly on that route; the other one is the sugar exported from India, whose London price spiked up in 1839, after the ban on the import of West Indian sugar cultivated by slaves. Moreover, the three negative shifts around 1870 are all from Indonesia, where, as will be detailed in the next section, the monopoly on foreign trade was abolished from 1868, considerably later than in India and China.[3] By contrast, the Great Depression was definitely not a shock in the market for primary products.

4) The causes of convergence: transport costs and barriers to trade

The conventional wisdom attributes the fall in the transaction costs of world trade before World War One mostly to the combined effects of liberalization of trade and declines in transport costs;

[3] The remaining shift near 1870 is positive and signals a slowing down in the pace of integration of linseed between Calcutta and London. In fact, only in one case out of four does a structural break signal that the pace of integration increased after the 1870s (tin from Batavia).

improvements in communication and the gold standard are also routinely stressed as contributory factors. Similarly, the disintegration after the war is seen as the product of the protectionist backlash. We measure transport costs with the freight factor (the ratio of freights to price at the origin, assuming other costs to have been proportional to freights), and explore barriers to trade by looking at the nominal duty on each product – i.e. the sum of import duties in consuming countries and export taxes from India and Indonesia divided by the price at the origin. Figure 3 plots the transport costs and the duties for four representative commodities.

Figure 3
Barriers to trade for selected commodities

a) Transport costs (freight factors)

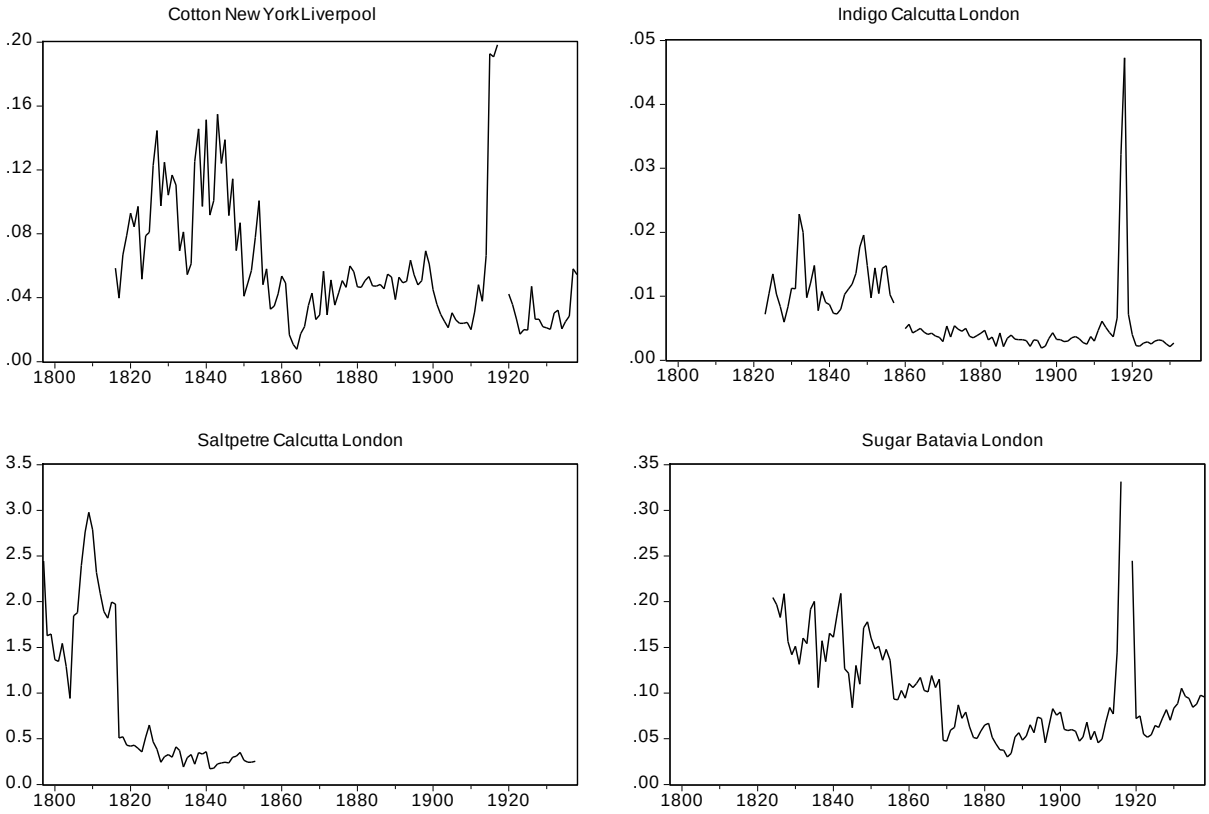
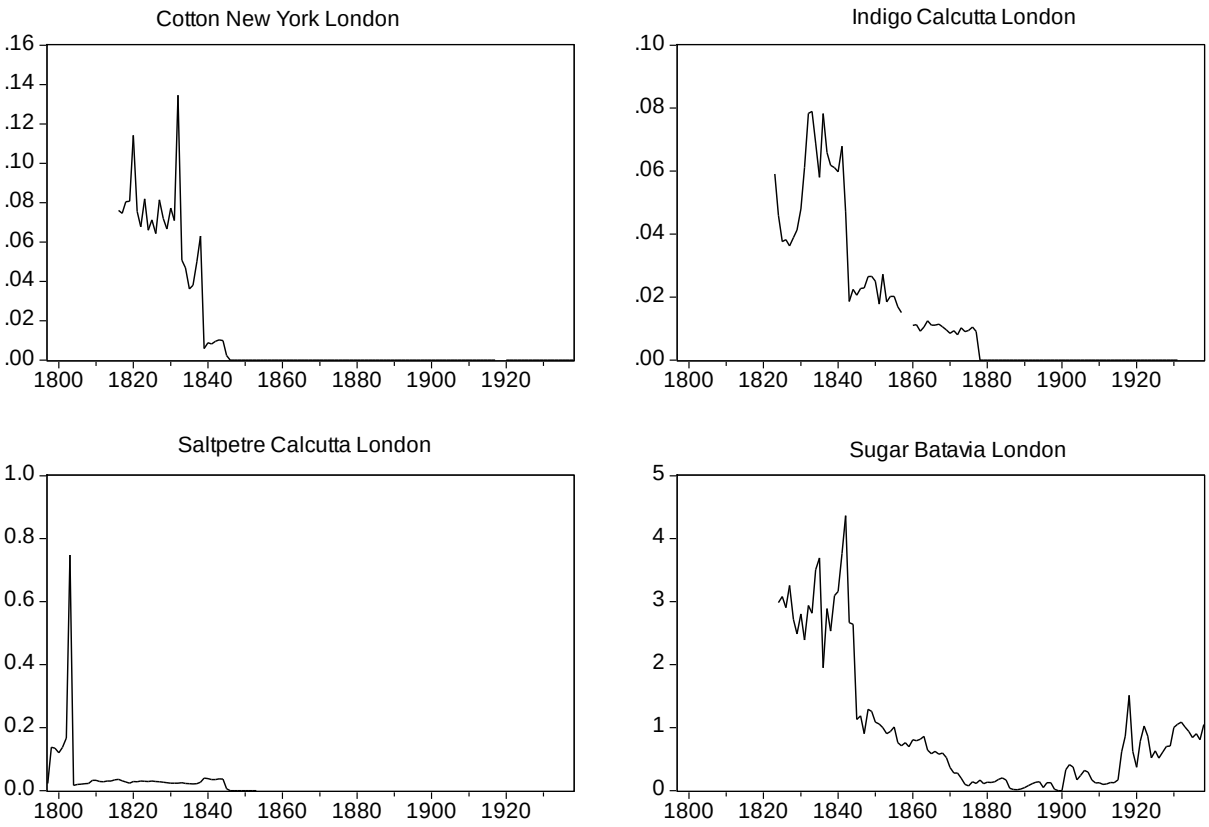


Figure 3-continued

b) Import and export duties



Notes: the freight factors are equal to the nominal freights divided by the price at the origin. Similarly, the duties are equal to the sum of import and export duties divided by the price at the origin.

Sources: see Chilosi and Federico (2013: Appendix B).

Levels are not directly comparable because the scales on the vertical axis differ, but trends are by and large similar across countries and products. As expected, duties and freights did fall in the first part of the 19th century, while, consistent with the results of Table 5, the rise in protection during the Great Depression is very limited. From 1930 to 1938, total duties were on average equivalent to 26.8 per cent of the price in the exporting country, exceeding 50 per cent in 22 observations out of 95 (most of them on sugar). A fortiori, the impact of protection was limited over the whole period 1796-1938: total duties exceeded 5 per cent of prices in slightly more than a quarter of cases and 50 per cent only in about an eighth. On the same line, one should note that most of the fall in freights was over by 1875 and that the change was often quite sudden. The 75 per cent collapse in the freight factor for saltpetre in 1816-1817 is an extreme case, but there are several other instances of major jumps, including a 70 per cent fall in freights for tea from China to England in 1835. Such sudden

changes cannot be accounted for by innovations in shipping organization or technology, the two competing explanations for the fall in costs of sea transport (North, 1968; Harley, 1988; Shah and Williamson, 2004), which by their nature are likely to spread gradually. Thus the evidence points to a major role for the dismantling of the institutional barriers to Asian trade.

In Japan and China, these barriers were erected also by national governments to be dismantled by the force of Western powers: Japan was forced to open to trade in 1854, while the restrictions to Western merchants in China to trade in Canton only were lifted after the two opium wars in 1842 and 1858 (Dermigny 1964, Fairbank 1978, Wakeman 1978). The British East India Company (EIC) enjoyed a monopoly on exports of Chinese tea to the United Kingdom and of imports of Indian opium into China until 1833, when it ceased all its mercantile activities. The monopoly of trade between its Indian possessions and the United Kingdom had been already abolished in July 1813. The Company had traditionally paid very high freights, because it used large and heavily manned and armed ships (Indiamen), very expensive to build and operate, which it rented from the owners. These were a small group of Londoners, many of whom were also shareholders of the Company. Although the owners were barred from participation in the Court of Directors since 1710, they infiltrated it with the ships' husbands and captains, thus forming a cohesive oligopoly within the monopoly. According to the conventional wisdom, the "shipping interest", as it was known at the time, allowed the inflating of costs and thus the circumvention of the Company's official charter, which prevented it from earning extra-profits from trade (Wakeman 1978, Mui and Mui 1984: 63-64, Bowen 2006: 252-256, Webster 2009: 32-40).[4] Solar (2013) has recently suggested that the Indiamen were necessary to stave off the military threat of competing Western trading companies. In his view freights collapsed in the 1810s thanks to the combined effect of technical progress (mostly copper sheathing) and to the successes of the Royal Navy, which made it possible to use smaller and cheaper ships. Anyway, since 1813 trade with India was free and in all likelihood the market was competitive. The expectation of great profits from liberalized trade caused a glut in the market for transportation for India (Webster 2009: 72) and indeed our series of freight collapses in 1817.

The Dutch trade with its colonies in the Indian Ocean had been a monopoly of the *Vereenigde Oost-Indische Compagnie* from the early 17th century to its bankruptcy in the 1790s. Trade remained free

[4] The EIC charter stipulated that the price of company wares in London "should not exceed the prime cost, the freight and charges of importation, the lawful interest of capital from the time of arrival of such tea in Britain, and the common premium in insurance" (Mui and Mui 1984: ix). Indeed, the official profits of the Company were quite low (Wakeman 1978: 167).

until 1825, when a monopoly on commerce with the Netherlands was granted to a new trading company, the *Nederlandsche Handel-Maatschappij*, or NHM (Furnivall 1976, Horlings 1995: 142). Similarly to the EIC, the company rented ships from Dutch owners, at "exceptionally high" rates (Korthals Altes 1994: 161, Horlings 1995: 145). In its first years of activity, exports were reduced by a rebellion of natives, the so called Java War. At the end of the war, the Dutch government, desperate for revenues, established a system of compulsory delivery of coffee, sugar and indigo for exports, known as Cultivation System (de Klerck 1938, Dobbin 1983, Fasseur 1992, Houben 2002, van Zanden and Marks 2012). Peasants were paid much less than the world market price – about a half of the Batavia price for coffee (Fasseur 1992: 37). The goods were transported to Amsterdam, and there sold at auction: the profits, net of a fee for the NHM, accrued to the Dutch government. The amount was very substantial: at its peak, in the 1850s, it accounted for over half the state revenues and for about 3.8 per cent of Dutch GDP excluding any hidden subsidy to Dutch shipping and industry (Smits et al. 2000, van Zanden and van Riel 2004). However, the Cultivation System was increasingly unpopular at home and was slowly phased out. In 1850, the NHM liberalized the bidding contracts for renting ships and its monopoly was abolished altogether in 1868 (NHM 1924: 23, Furnivall 1976: 168, Korthals Altes 1994). The Dutch trade with the colonies remained free until 1918, when the sugar producers set up a private association (VJSP) to allocate the scarce available shipping (van der Eng 1996: 215-216, Knight 2010). The organization continued to manage sugar exports after the end of the war, and in 1932 it was substituted by a governmental organization (NIVAS) to manage sugar production quotas under the international agreement (van der Eng 1996: 224-226). The Great Depression featured also the first intervention in American agriculture: the Agricultural Adjustment Act (AAA), part of the New Deal policies, established a loan facility for cotton farmers, which in practice set a minimum price of cotton since 1934 (Federico and Sharp 2013).

5) The causes of integration: an econometric analysis

As implied by the preceding discussion, the ratio of prices for the *i-th* good (RP_{it}) at time t can be explained by the barriers to trade (***B***), the efficiency of markets ($\boldsymbol{E_m}$) and the transport costs ($\boldsymbol{T_c}$)

$$Log\ RP_{it}=F(\boldsymbol{B}, \boldsymbol{E_m}, \boldsymbol{T_c}) \qquad 2)$$

In our regression the set ***B*** includes the total duties (*LOG_DUTY*) and dummies for monopolies - a dummy for the *EIC* (1796 to 1816) and separate dummies for the *NHM* under the full monopoly regime (*NHM1*), from 1824 to 1850, and for the partially liberalized one (*NHM2*) from 1851 to 1868.[5] We also add dummies for the AAA support to American cotton prices (since 1933) and for the two marketing boards for Javanese sugar, the private VJSP (1918 to 1931) and the public NIVAS (after 1932). We expect duties and monopolies to increase price ratios, while the interventions on the commodity market may augment or reduce price gaps according to the details of the policies.

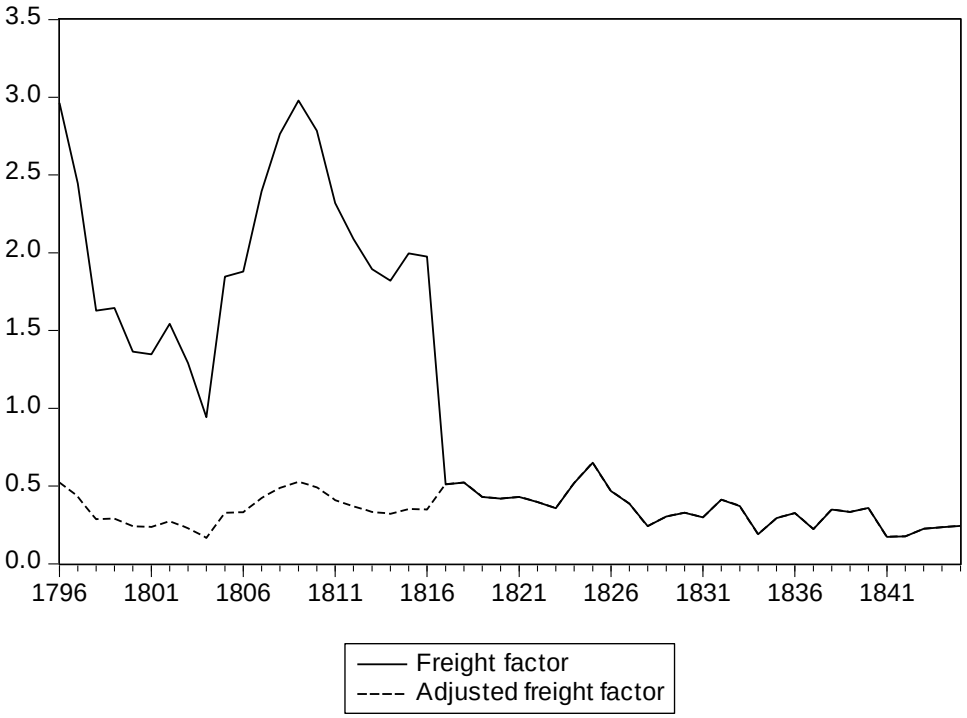
Arguably the most important contribution to increasing market efficiency was the connection by telegraph, which cut the time to transmit information from weeks to few minutes (Hoag 2006). The cable between the United Kingdom and the United States was operational since 1866, and it was followed four years later by the line to India and around 1875 by the line between Europe and Indonesia (Headrick 1988: 101). We expect the *TELEGRAPH* dummy to be negative. We also add dummies for a number of political events which may have disrupted the orderly working of markets, such as the Java War in 1825-1827 (*JAVA WAR*), the Indian Mutiny in 1857-1859 (*MUTINY*), the American Civil War (*CIVIL WAR*), the anti-slavery campaign, which boycotted Caribbean sugar, in 1840-1845 (*SLAVE*) and World War I (*WWI*).

By definition, the actual freights, the numerator of our measure of transport costs (*LOG_FREIGHT*), include any rent paid to privileged Dutch or British ship-owners under the NHM and EIC monopoly system. Consequently the *EIC* and *NHM* dummies measure only any additional effect of the trading monopoly – e.g. from a manipulation of the market. We try to capture the total effect of monopoly, including the rents to ship-owners by using an alternative series of freight factor (*LOG_FREIGHT_ADJ*) net of the rents to shippers. We obtain this series (Figure 4) by scaling down the actual series with coefficients from a fixed-effect panel regression, which explains freights with dummies for the NHM and the EIC. By construction, the series move in parallel to *LOG_FREIGHT*, except in the final year of the monopoly and thus the substitution affects the coefficient of transport costs only marginally.

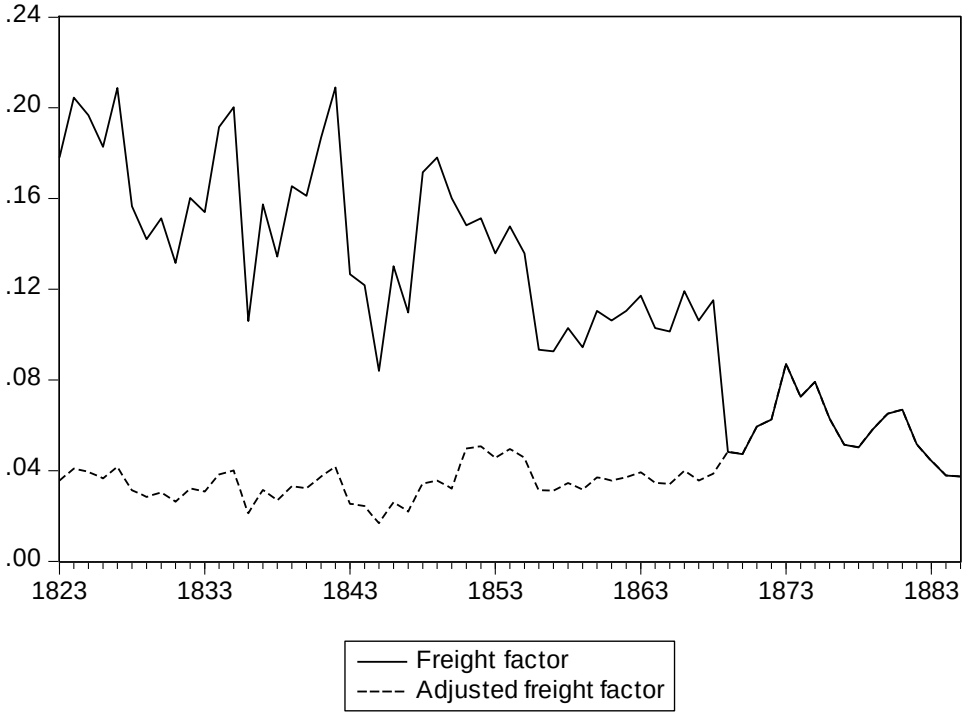
[5] The variable *LOG_DUTY* is computed as *log(1+t)*, where *t* is the ratio of (usually specific) duties to the price in the producing country. It is thus zero if *t=0*. The dummy *EIC* is equal to 1 until 1816. We do not add a specific dummy for the end of the Napoleonic Wars because it would be collinear with the *EIC* dummy and it might bias the estimate of its coefficient. Anyway, price gaps with Asia in Britain were much less affected than in continental Europe by the Napoleonic Wars (O'Rourke 2006).

Figure 4
Freight factors and adjusted freight factors: selected commodities

i) Saltpetre Calcutta London



ii) Sugar Batavia London



Notes: The freight factor is the nominal freight rate divided by the price at the origin. The adjusted freight series are constructed by firstly running the regression $LOG\_FREIGHT_{it}=c+\alpha_i+\beta_1 EIC_{it}+\beta_2 NHM1_{it}+\beta_3 NHM2_{it}+\varepsilon_{it}$ and secondly using the equation $LOG\_FREIGHT\_ADJ_{it}=LOG\_FREIGHT_{it}-(\beta_1 EIC_{it}+\beta_2 NHM1_{it}+\beta_3 NHM2_{it})$. Using alternative specifications, like including a time trend, yielded qualitatively identical results and only small quantitative differences.

Sources: see the text and Chilosi and Federico (2013: Appendix B).

We add the lagged value of the dependent variable to reduce auto-correlation and to take into account the possible delay in adjustment to shocks, but its omission does not affect qualitatively the results. The coefficients are thus short term elasticities; long run elasticities can be computed as $\beta_k/(1-\gamma)$ where β_k is the coefficient of the *k-th* variable and γ is the coefficient of the lagged dependent variable.

The descriptive statistics for all variables and the pairwise coefficient of correlation between them do not add much new information (Chilosi and Federico 2013). The correlation between explicative variables is in general very low and thus there is no risk of multi-collinearity. On the other hand, most variables are clearly non-stationary (cf. Chilosi and Federico 2013: Table A2, for a formal testing) and thus results might be spurious. We therefore test ex-post the stationarity of the residuals with a Levin et al. (2002) test for panel regressions.

Our analysis omits from the regression the Far Eastern markets, because the series are very short and their quality is comparatively poor. This leaves a total of 22 cross-sections and 1568 observation. As said before, we cannot categorically exclude that quality may be an issue for wheat (both from the United States and from India), coffee sugar, pepper and tin (all from Indonesia). Thus, in Column 3 of Table 6 we drop these products, reducing the coverage to 16 products and 1020 observations. Last but not least, Indian trade, with 838 observations, is overrepresented in the sample. We address this issue in two different ways. First, we run the regression with a restricted panel, featuring two products per route (wheat and cotton for the United States, sugar e indigo for India, and pepper and sugar for Indonesia), and we weight each of them with their share of the value of imports on that route. Thus, in this specification (Table 6, Column 6), each route has the same weight on the results. Second, we simply run separate regressions for the United States (Table 6, Column 7) India (Column 8) and Indonesia (Column 9), which supply additional insights on the different causes of integration.

All regressions use fixed-effects specification with panel corrected standard errors to address cross-sectional heteroskedasticity (reflecting different levels of transaction costs) and contemporaneous correlation (which may arise from common shocks). Although we report results of an OLS estimate (Tab 6, Column 1) for comparative purposes, we prefer to use instrumental variables because prices in the exporting country appear in the denominator of the dependent variable and of two explicative

Table 6

The causes of integration

	(1) PCSE	(2) PCSE/IV	(3) PCSE/IV	(4) PCSE/IV	(5) PCSE/IV	(6) PCSE/IV	(7) PCSE/IV	(8) PCSE/IV	(9) PCSE/IV
C	0.517	0.365	0.327	0.366	0.329	0.224	0.312	0.386	0.416
	(17.18)***	(8.73)***	(5.53)***	(8.73)***	(7.92)***	(4.48)***	(4.93)***	(5.51)***	(6.84)***
LOG_DUTY	0.084	0.051	0.048	0.051	0.033	0.039	0.13	0.021	0.057
	(3.64)***	(2.03)**	(0.87)	(2.04)**	(1.28)	(1.31)	(2.75)***	(0.32)	(1.54)
EIC	0.173	0.236	0.253	0.345	0.287	0.347		0.343	
	(5.05)***	(6.30)***	(5.66)***	(9.98)***	(7.38)***	(7.04)***		(9.12)***	
NHM1	-0.105	-0.044	-0.021	0.054	0.021	0.078			0.137
	(-4.48)***	(-1.68)*	(-0.22)	(2.26)**	(0.74)	(2.37)**			(4.83)***
NHM2	-0.07	-0.046	0.013	0.023	-0.022	0.049			0.087
	(-3.42)***	(-2.26)**	(0.34)	(1.04)	(-1.05)	(1.50)			(3.43)***
AAA	0.038	0.032	0.032	0.032	0.02	0.018	0.012		
	(0.79)	(0.69)	(0.67)	(0.69)	(0.46)	(0.25)	(0.28)		
VJSP	-0.079	-0.035		-0.035	-0.011	-0.011			-0.031
	(-2.08)**	(-0.90)		(-0.90)	(-0.28)	(-0.24)			(-0.78)
NIVAS	-0.185	-0.125		-0.126	-0.105	-0.105			-0.153
	(-3.61)***	(-2.35)**		(-2.35)**	(-1.93)*	(-1.60)			(-2.83)***
LOG_FREIGHT	0.123	0.067	0.053				0.085		
	(13.27)***	(4.64)***	(2.48)**				(3.65)***		
LOG_FREIGHT_ADJ				0.067		0.034		0.068	0.073
				(4.64)***		(2.01)**		(2.64)***	(4.44)***
*LOG_FREIGHT*LIGHT*					0.033				
					(2.14)**				
*LOG_FREIGHT*BULKY*					0.108				
					(6.73)***				

Table 6-continued

TELEGRAPH	-0.043	-0.082	-0.095	-0.081	-0.083	-0.076	-0.017	-0.117	-0.046
	(-2.57)**	(-4.31)***	(-3.63)***	(-4.31)***	(-4.45)***	(-3.75)***	(-0.74)	(-3.32)***	(-2.01)**
JAVA_WAR	0.064	0.063		0.063	0.072	0.071			0.066
	(0.83)	(0.80)		(0.80)	(0.89)	(0.86)			(0.82)
MUTINY	-0.071	-0.066	-0.068	-0.066	-0.085	-0.060		-0.094	
	(-0.82)	(-0.75)	(-0.76)	(-0.75)	(-0.99)	(-0.47)		(-1.06)	
SLAVE	0.239	0.195	0.285	0.195	0.189	0.139		0.293	0.148
	(5.62)***	(4.41)***	(4.91)***	(4.41)***	(4.20)***	(2.70)***		(4.98)***	(2.38)**
CIVIL_WAR	-0.009	-0.055	-0.08	-0.055	-0.085	-0.082	-0.006		
	(-0.26)	(-1.47)	(-1.35)	(-1.46)	(-2.25)**	(-1.61)	(-0.15)		
*WWI*ATLANTIC*	-0.067	0.012	0.033	0.012	0.048	0.044	-0.034		
	(-1.23)	(0.21)	(0.55)	(0.21)	(0.92)	(0.62)	(-0.58)		
*WWI*INDIA*	0.087	0.151	0.167	0.151	0.144	0.086		0.152	
	(2.08)**	(3.40)***	(3.40)***	(3.40)***	(3.32)***	(1.14)		(2.93)***	
*WWI*INDONESIA*	0.171	0.212	0.181	0.212	0.242	0.278			0.227
	(5.67)***	(6.59)***	(4.34)***	(6.58)***	(7.09)***	(4.85)***			(7.27)***
LOG_RATIO1	0.445	0.497	0.513	0.496	0.463	0.452	0.503	0.51	0.338
	(17.77)***	(18.00)***	(15.80)***	(18.00)***	(16.52)***	(12.11)***	(8.70)***	(14.90)***	(7.86)***
N	1534	1534	1020	1534	1534	619	231	821	482
Adjusted R-squared	0.79	0.78	0.79	0.78	0.79	0.64	0.76	0.79	0.76
F	153.67***	129.36***	120.24***	129.37***	129.61***	49.38***	77.07***	133.66***	76.88***
LLC t-stat	-33.12***	-37.82***	-32.65***	-37.82***	-37.65***	-22.88***	-16.25***	-28.45***	-20.65***
Exogeneity chi-squared test		24.82***	22.79***	24.85***	30.43***	10.97***	7.85**	20.20***	7.70**
Exogeneity F test		12.90***	12.90***	12.83***	11.31***	3.81**	7.89***	12.23***	3.95**
Shea's partial R-squared 1st inst.		0.89	0.86	0.89	0.88	0.75	0.96	0.94	0.74
Shea's partial R-squared 2nd inst.		0.46	0.42	0.46	0.46	0.32	0.41	0.45	0.44
Shea's partial R-squared 3rd inst.					0.6				

Table 6-continued

Significant at * 10 per cent; ** 5 per cent; *** 1 per cent.

Notes: PCSE=panel corrected standard errors; IV=instrumental variables estimation; *N*=sample size; *inst.*=instrument. The dependent variable in each regression is the natural logarithm of the ratio between import and export prices. Fixed-effects estimation with panel corrected standard errors is used in all cases; instrumental variable estimation for specifications (2) to (9); weighted least squares estimation for specification (6). Specification (3) includes only homogeneous goods; specification (6) includes only two goods per route; specifications (7) to (9) include only goods exported from the U.S., India and Indonesia, respectively.

Sources: see Chilosi and Federico (2013: Appendix B).

ones (duties and freights). Furthermore, freights might be endogenous in the short-run as well, if the supply of shipping on those routes were inelastic (Jacks and Pendakur 2010). Specifically, we instrument *LOG_DUTY* with the ratio of yearly duties to the average price throughout the whole period – so that within variations depend only on the exogenous changes in specific duties. Likewise we use average prices as denominator of the instrument for *LOG_FREIGHT,* while the numerator is the trend component of a Hodrick-Prescott decomposition of the series of nominal freights.

The overall performance of the model is good. The residuals are stationary; the combined variables are highly significant (F-test) and explain about four fifths of the total variance. Almost all the signs agree with expectations. In all cases, the Wooldridge's (1995) and the regression-based tests find strong evidence of that the OLS estimates sufficiently differ from the instrumental variables' ones to recommend the use of the latter. All first stage tests find that the instruments are highly correlated with the variables, so that the expected small-sample bias is low. Turning to the results:

i) As expected, the coefficients for freights are positive, highly significant and robust to the substitution of monopoly-adjusted series (*LOG_ ADJFREIGHT)*. A 10 per cent increase in freights augmented price gaps by about 0.6-0.9 per cent in the short run and by about 1-1.5 per cent in the long run. Moreover, as expected, the impact of costs is much bigger for bulky goods than for than for light products; over three times, in fact (Column 5).[6]

ii) The variable *LOG_DUTY* is positive and significant in the baseline specification and its coefficient is similar to the coefficient of freights. Indeed, the averages of the two variables are almost identical: 18.1 per cent for the freight factor and 18.2 per cent (17 per cent on imports and 1.2 per cent on exports) for duties. Duties were high only on wheat, under the British Corn Laws before 1846, and

[6] We run an OLS regression with *LOG_FREIGHT* as dependent variable, explained by a linear trend and by route and product dummies. The product dummies yield a ranking of commodities from the lightest to the heaviest (silk, indigo, tin, cotton, tea, coffee, pepper, rubber, sugar, wheat, jute, saltpetre, linseed, rapeseed, and rice). We define 'light' the first nine products ("light") and 'bulky' the others: this distinction closely mirrors the conventional one between "grain and seeds" and "lighter goods".

sugar. In fact, the coefficient of *LOG_DUTY* is high and significant for the Atlantic trade (Column 7), low and significant only at the 13 per cent level for Indonesia (Column 9) and very low and not significant for India (Column 8).

iii) As expected, the monopoly of the British East India Company widened the price differentials, by a quarter in the baseline specification with *LOG_FREIGHT* (Column 2) and by more than a third (corresponding to a 70 per cent increase in the long run) if we add the effect of monopoly on freights (Columns 4 and 7). In contrast, the NHM apparently fostered convergence both before (*NHM1*) and after 1850 (*NHM2*). This effect however disappears if we use the monopoly-adjusted series of freights (Columns 4 and 8). The *NHM* dummies become positive and significant, although the coefficients are less than a quarter of the *EIC* one. In short, the NHM affected negatively long-range integration only because it charged high freights, while it may have even increased the efficiency of the market, by improving the transmission of information and by reducing the risks.[7] In contrast, the monopoly of the EIC harmed trade even discounting the effect on freights. The overall effect of state intervention after World War One seems modest. Neither the Dutch (private) marketing board (VJSP) in the 1920s nor the support to American agriculture after the Great Depression (AAA) affected significantly integration. Only the Dutch public marketing board (the NIVAS) had a positive impact, reducing price gaps between Indonesia and Europe by 10-15 per cent.

v) The variable *TELEGRAPH* is negative as expected and significant in all specifications.[8] We have tried to interact it with a time trend to capture the effect of technical progress and increases in transmission (or changes in policy to set rates), but the results are poor. Our results confirm the earlier work by Lew and Cater (2006) on the positive effect of telegraph on world trade.

vi)The political shocks in producing countries seem not to have affected international price differentials, although of course they may have had important consequences in producing areas. In contrast the campaign against slave-produced sugar in the United Kingdom (*SLAVE*) had a massive

[7] An official history of the Company offers an alternative explanation of the negative signs in the baseline specifications: it claims that the NHM sold at a loss to help Dutch middlemen to be competitive on the European market (NHM 1924: 18-19).

[8] We have tested separately three additional measures of efficiency: time trends, total traded quantity and a dummy for fixed exchange rates between countries (i.e. the gold standard). All variables are expected negative. More trade should increase the flow of information, fixed exchange rates should reduce the risks of trading and time trends should capture all other improvements. The trends are significant only in Indonesia, but the variable is unexpectedly positive – i.e. *ceteris paribus* markets have been disintegrating. The quantity variable is negative, but it worsens the overall results of the regression (available upon request), probably because of endogeneity issues. The dummy for fixed exchange rate is incorrectly signed but not significant. Evidently, more refined measures of exchange rate volatility than afforded by the available data are needed to adequately capture the effect of exchange rate risk. The time trend is positive and significant for Indonesia – i.e. efficiency would have decreased, *ceteris paribus*. We speculate that the coefficient reflects the increasing exposure to price shocks originating in other markets.

effect on the sugar market. The dummies for *WWI* are positive and significant, as expected, for India and Indonesia but not for the Atlantic. We interpret them as the effect of disruption in the market on top of war-related increase in transport costs, which should already be captured by the variable *LOG_FREIGHT*.

How much did each variable contribute to long run convergence? To answer, in Table 7 we report the share of the total change accounted for by each variable.

Table 7
The causes of integration: decomposition analysis (in percentage)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	All	All	All	All	Atlantic	India	Indonesia
Years	1816-1913	1816-1870	1871-1913	1816-1913	1816-1913	1815-1913	1849-1913
EIC	39.27	49.57		57.25		69.14	
NHM1							43.36
LOG_DUTY	4.65	5.56	1.14	4.65	42.11	1.72	2.98
LOG_FREIGHT	34.74	42.3	59.48		82.49		
LOG_FREIGHT_ADJ				16.79		8.16	24.99
TELEGRAPH	20.34	15.8	37.3	20.31	13.08	23.47	14.6
Total	98.99	113.24	97.92	98.99	137.68	102.5	85.92

Notes: all the decompositions report the share of the percentage change in the dependent variable accounted for by each independent variable and are based on the results of the panel analysis presented in Table 6. Columns (1) to (3) are based on the second specification, Column (4) is based on the fourth specification, and Columns (5) to (8) are based on the seventh, eighth and ninth specifications, respectively. The exact starting date differs somewhat across samples in order to maximise the number of covered goods. We omit explicative variables which did not affect the dependent variables at the beginning and/or at the end of the period (such as the World War dummies). The cumulated change in the dependent variable is obtained as the average of the differences between the values fitted by the panel at time *0* and that of time *T* divided by the former.
Sources: see the text and Chilosi and Federico (2013: Appendix B).

As the last row of Table 7 shows, the model performs very well: the divergence between the cumulated effect of the variables and the actual change is less than 5 per cent in four cases and exceeds 20 per cent only in the Atlantic trade. Most of the total convergence is explained by changes in transportation costs and by the abolition of the EIC, which looms large in the long run analysis, partly because the majority of observations in 1815 refer to India.[9] According to the baseline specification (Column 1), the fall in freights mattered almost as much, but this conclusion is decidedly changed if we use the coefficient from *LOG_FREIGHT_ADJS* (Column 4). The NHM does not appear

[9] But even if we give each route equal weight (i.e. using the sixth specification from table 6), the EIC emerges as by far the most important factor, accounting for over 45 per cent of the overall decline.

among the variables in the aggregate analysis, because the series for Indonesia start later, but as Column 7 shows, it played a very important role in the convergence of prices between the colony and Europe, too. The telegraph did help a lot as well, accounting for between a sixth and a quarter of long-run price convergence. In contrast, the cut in duties contributed substantially to the integration only in the Atlantic economy (Column 5). The separate estimates by period (Columns 2 and 3) highlight the sharp differences in the causes of integration. The "early globalization" was mostly determined by the trade liberalization and the abolition of monopolies, while further convergence during the "heyday of globalization" was achieved thanks to the lay-out of the telegraph lines and to fall in sea-borne transport costs. On the whole, political decisions mattered more in the long run because, as shown in section four, most of total convergence pre-dated 1870.

8) Conclusion

Our results are relevant for two literatures, that on market integration and that on trade and growth in Asia, which, although clearly related, have so far remained largely distinct. Our work contributes to filling in gaps in the literature on global market integration, strengthening the emerging consensus view in the literature on Europe and the Atlantic trade. The process started early in the 19th century and it was determined to a large extent by institutional changes. Within Europe and between Europe and North America, barriers were raised essentially by protectionist trade policies, while commerce with Asia was hampered by the monopoly of Western trading companies. These barriers were progressively abolished and, at least for the sample of products/routes we are considering, were only partially re-instated during the Great Depression. Once trade was free from institutional constraints, further convergence was mainly achieved by cutting transportation costs. The cost of sea-borne trade, however, was fairly low already at the beginning of the 19th century and thus the scope for further convergence was limited.[10] These findings are consistent with the view that market integration was at the root of the terms of trade boom experienced by Asian countries in the decades before 1870.[11] Future research should systematically assess this impact and examine the implications of market integration for trade and welfare.

[10] In contrast, transport costs from the producing areas to the ports were surely high and indeed there is a strong evidence of growing integration in the second half of the 19th century in the domestic market in the United States (Federico and Sharp, 2013), in India (Hurd1975, Studer 2008, Andrabi and Kuehlwein 2010) and also in the Dutch East Indies (Marks 2010; van Zanden and Marks 2012: 25-26). Indeed, in a recent paper, Donaldson (2014) estimates that on average trade created by railways increased Indian GDP by as much as a sixth from 1870 to 1930.

[11] This is particularly so as new estimates of terms of trade show that India took part in this boom, too (Chilosi and Federico 2013: 8).

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