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A tale of two globalizations: world trade and openness 1800-2010

Abstract

This paper compares globalization before World War One with the current one. Trade increased fast in both periods, but total openness increased before 1870, fluctuated widely without any trend in the next century and grew beyond the 1913 (and 1870) level in the latest three decades. We also argue that openness would have grown much more since 1973 had the share of services on GDP not grown. Changes in openness were common to all polities in most periods, but not from 1870 to 1913 nor during the Golden Age 1950-1913. Before World War One, openness stagnated in most rich countries and grew in the rest of the world, while after World War Two it grew in Europe and fell in less developed countries. Last but not least we estimate that, under reasonable values of trade elasticity, trade augmented world GDP by about 4% relative to full autarchy in 193 and by about 7-8% in 2007. We conclude that the two globalizations differ widely and the world is now in uncharted territory.

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1) Introduction

In 1999, R. Baldwin and P. Martin published a paper titled ‘Two waves of globalization: superficial similarities, fundamental differences’ (1999). The authors supply a long and detailed list of these latter, while they argue that ‘the chief similarities lie in the aggregate trade-to-GDP and capital-flows-to-GDP ratios. These stand today approximately at the level that they attained at the end of the 19th century’ (1999 p.1). This conclusion was clearly provisional, as it relied on few scattered data for UK, USA and other advanced countries until the mid-1990s, when the latest phase of globalization was just beginning. In contrast Maddison (1995 p.38) and Irwin (2002) state that export/GDP ratio in the early 1990s was already well above its 1913 peak. Trade and globalization have attracted much interest as of late (Findlay and O’Rourke 2007, Meissner 2014, Lampe and Sharp 2014), but the issue has not been settled. According to Klasing and Millionis (2014 Fig 5), world openness increased fast from about less than 20% in 1870 to 30% in 1913, collapsed in the interwar years, rebounded after World War Two and boomed in the last decades, up to around 50% in 2005. Fouquin and Hugot (2014 Figure 1) publish series of export/GDP ratios for time-invariant samples of different size. They increase before 1870 and in the last decades of the 20th century, but not in the period 1870-1913. As a result, openness was higher in 2007 than in 1913 in all series, but this is not true for a series, admittedly for a small sample, and anyway, the size of the gap differs substantially according to the size of the sample. Furthermore, one might argue that the standard measures of openness are flawed. The numerator excludes exports of services but includes the intermediate inputs embodied in traded goods (and transport costs if imports are included), while the denominator excludes these latter but includes non tradables.

Recent advances in the theory of international trade seems to offer a solution to the problem. It is possible to extract from micro-founded gravity models (Anderson and Van Wincoop 2003 and 2004, Jacks et al 2011) an index of bilateral trade costs, inclusive of transportation costs, duties and other barriers to trade. By definition, these costs are inversely related to openness, and thus one should only aggregate these indexes across all pairs of countries. This operation is apparently straightforward, but the results very sensitive to the coverage of trade flows and to the method of aggregation. Jacks et al (2011) obtain their baseline index by regressing the bilateral trade costs with a fixed-effect panel regression with time dummies. Trade costs declined before 1913, increased sharply during the Great depression, fell after the war, especially in the 1970s, but then they increased again. By 2000, they were similar to, if not higher than, costs in 1913. Other methods of aggregation yield somewhat different results, but none a sharp fall in trade costs. Likewise, Hugot (2014) gets quite different results, according to the sample and the method of aggregation: trade costs fall steadily for a pooled series of all pairs of available countries (Figure 5), but they were only marginally lower in 2012 than in 1913 for time- invariant samples (Figure 4 and 6).

In this paper, we return to the ‘traditional’ quantity-based framework, but we adopt a much more systematic approach. We exploit all the available data by computing different measures of openness for as many countries as possible, from 1830, the earliest possible date given the available GDP data, to 2007, the year before the Great Trade Collapse (Baldwin 2009). We address five issues:

- i) is the world more open now than it was on the eve of World War One and by how much?
- ii) how were levels of openness attained and how deep was the shock of the Depression (and therefore how ample was the scope for a rebound after the war)?

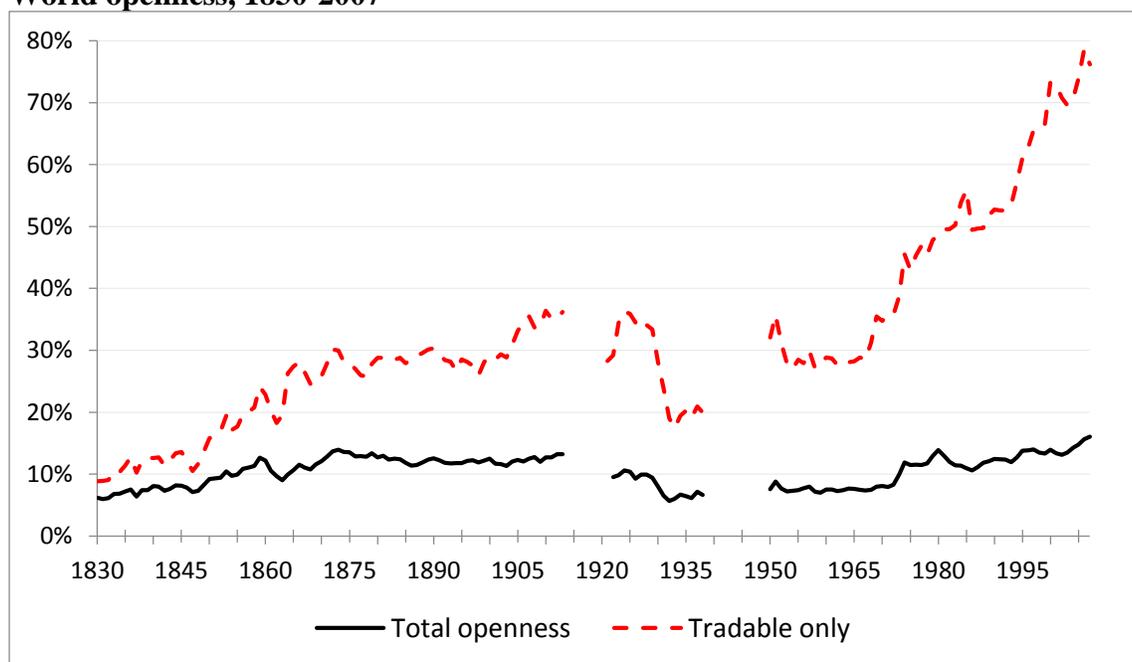
iii) to what extent did movements in world openness reflect structural change within countries (changes in the composition of the GDP) and across countries (changes in their relative size)

iv) did changes affected all countries uniformly and did differences between countries depend on their location and/or level of development?

v) how large were static gains from trade openness ?

Section Two describes our data. We rely on standard international sources for the period after 1950, while for the period before 1938 we have collected all available series of GDP and we have estimated new series of trade by country. We sketch out the evolution of world trade in Section Three, while Section Four deals with changes in openness. We start with a general discussion of the ideal measures of openness and then we present the indexes which we have been able to compute given the data. Figure 1 offers a flavor of our results. It plots the ratio of exports to GDP (or total openness) and to the Value Added in agriculture, mining and manufacturing (openness tradables): the two share the main trends to the early 1970s, while thereafter openness tradables increases much faster than total openness. In Section Five, we show that this gap is accounted for by changes in the composition of GDP by polity, with a marginal role for changes in the distribution of ‘world’ GDP. Section Six deals with trends in openness by continent and by level of development and Section Seven measures the static gains from trade, following Arkolakis et al (2012). Section Eight concludes, focusing on the differences between the two globalizations.

Figure 1
World openness, 1830-2007



2) The data: trade and GDP

We describe in detail the construction of our trade data in a companion working paper (Federico-Tena 2015) and thus here we provide only the essential information

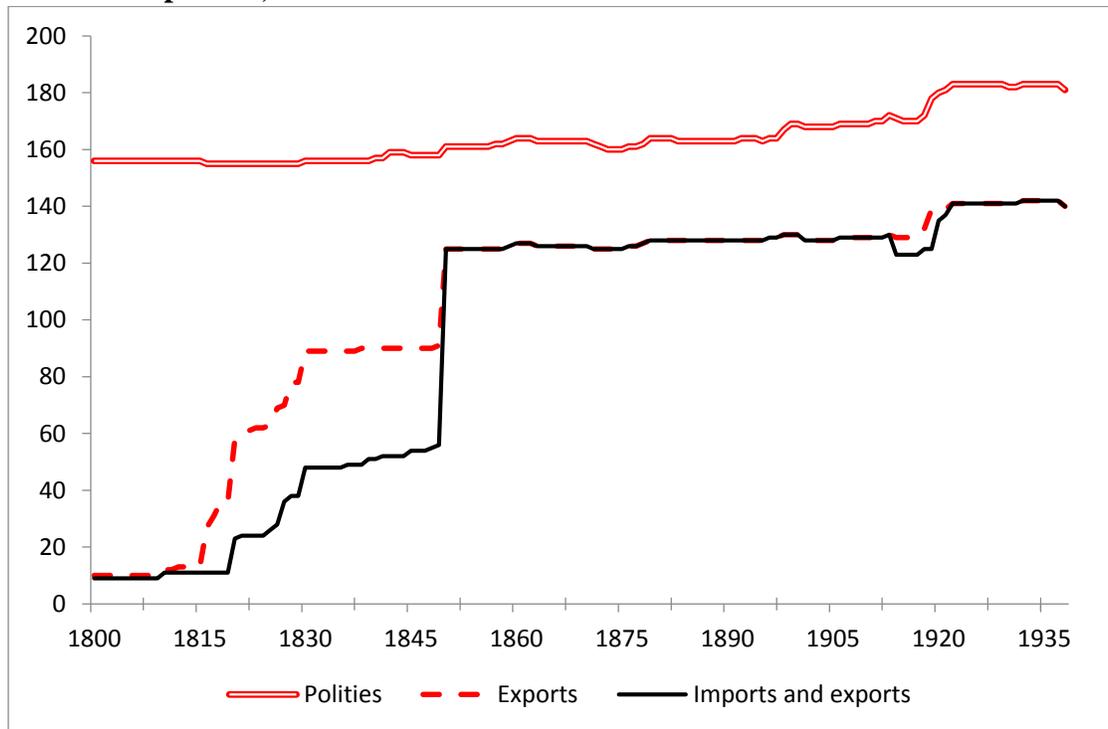
- i) we estimate four import and four export series – at current and constant (1913) prices and at current and constant (1913) borders- for each ‘trading polity’ – i.e. an independent country or a colony. All series start as soon as possible after 1800, or at the very latest in 1850 and end in 1938, or when the polity disappears ¹. Thus, several of our series begin before the formal establishment of an area as a trading polity, which in most cases coincided with Western colonization. For a number of polities, we extend in time the baseline series of exports at current and constant prices and current borders before 1850.
- ii) whenever possible, we rely on ‘modern’ series published by scholars, national statistical agencies and international organizations such as the League of Nations for trade at current and constant prices
- iii) If such series are not available, we collect series of trade at current prices from different sources (national yearbooks, collection of colonial and imperial statistics and so on). We deflate them with a set of purportedly-built price indexes, based on British prices adjusted for transportation costs².
- iv) when no data for a given polity are available, we guesstimate the series by using the trade statistics of trading partners, or by interpolating with series of similar countries.
- v) finally we convert all series from national currencies into US dollars, using whenever possible polity-specific sources, rather than the handy but sometimes flawed series from GlobalFinancialData

Figure 2 reports the number of available series in the data-base for each year and the number of existing polities in each year. This latter range from 155 to 183, while the number of series grows from 10 in 1800 to 125 in 1850. Thereafter, it changes only to reflect variations in political boundaries, up to a maximum of 142 in 1932-1937

¹ We have also omitted independent port cities, such as Hong-Kong, and few polities with population less than 0.1% of world total in 1913. During World War One, official trade series for sixteen polities are missing. We have substituted them with estimates of exports only.

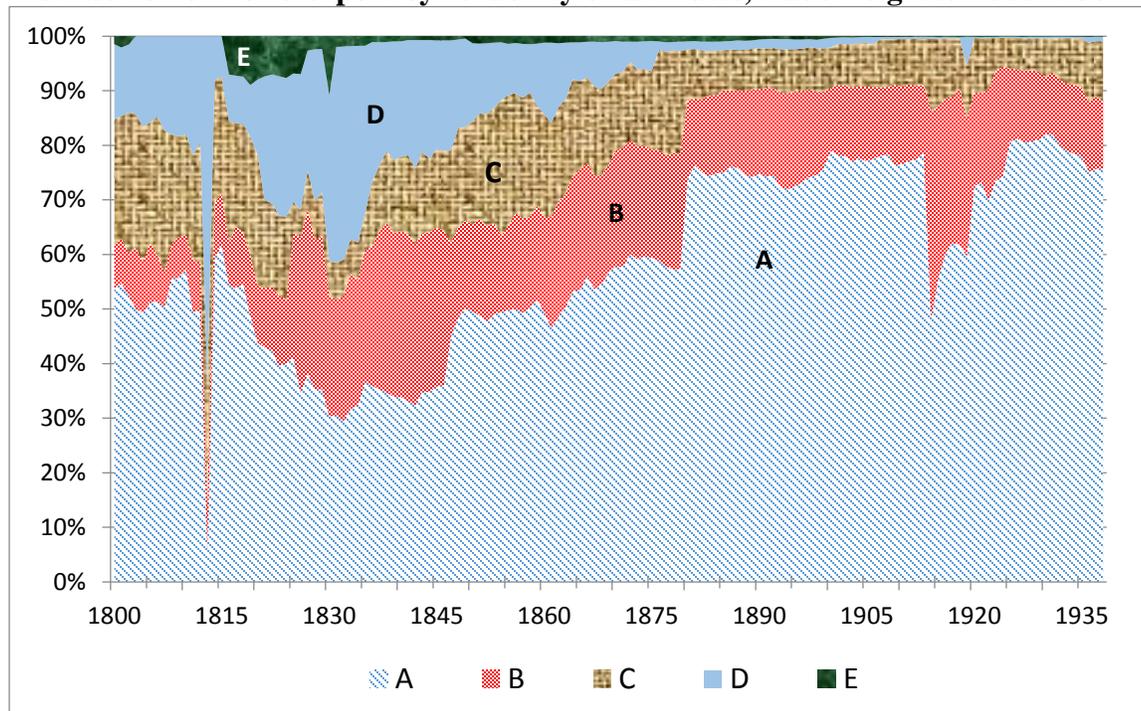
² We get prices of commodities are from Gayer-Rostow-Schwartz (1953) for 1800-1850 and Sauerbeck (ad annum) for 1846-1938, and unit values, mostly from manufactures, from the trade statistics (Board of Trade ad annum) for 1853-1938. Route-specific freights, mostly from Shah and Williamson (2004) and Jacks and Pendakur (2010)

Figure 2
Number of polities, 1800-1938



The reliability of trade series has always been controversial (Morgestern 1965 Federico-Tena 1991) but there is no doubt it varied a lot across countries and across time. We classify yearly observation in the data-base into five categories, from the very good (A) to the mere conjecture (E). Figure 3 weights these categories according to the cumulated shares on world trade at current prices. The results are reassuring: the A-rated polities, mostly from Europe and the Western Offshoots, accounted for between a third and a half of world exports before 1850 and this share rises over two thirds in the late 19th century.

Figure 3
Distribution of world export by reliability of estimates, trade weighted 1800-1938



The corresponding standard error of our estimates exceeds 30% for Asia and Africa before 1850, but worldwide it declines from about 10% at the beginning of the 19th century to about 5% in the 1850s and then it falls further to 2% or below ³. Thus, we are confident that our series captures fairly well also the early trends.

After 1850, we estimate world trade as sum of exports, which, unlike imports, do not include transportation costs ⁴. Before 1850, the results would overstate the growth of trade, as they would spuriously increase any time a new series enters the data-base. We thus build three different indexes of trade, with a time-invariant coverage, starting respectively in 1800, 1823 and 1830. As Table 1 shows, the 1823 and 1830 samples are highly representative. The 1800 sample is unbalanced towards rich countries, but it still covers over half of world exports in 1850 ⁵.

³ Following Feinstein and Thomas (2001), we hypothesize that the range of error relative to the ‘true’ value is less than 5% for the As (i.e. the true value is within a $\pm 2.5\%$ of range from our observation), 5-10% for the Bs ($\pm 5\%$), 10-25% for the Cs ($\pm 12.5\%$), 25-40% for the Ds ($\pm 20\%$) and over 40% for the Es. In this last case, we assume the interval to be $\pm 25\%$. See for the criteria of classification Federico-Tena 2015.

⁴ According to the rules of the United Nations, which we try to follow as closely as possible, exports should be measured f.o.b. (free on board) and imports c.i.f. (cost, insurance and freight).

⁵ The 1800 sample consists of six countries from Europe (France, Netherlands, Portugal, Russia, Sweden and the United Kingdom) one for Asia (India) and three from the Americas (Cuba, Mexico and the United States), but none from Oceania

Table 1
Trade samples

	Number of available polities	Number of missing polities	Trade as ratio to total trade in 1850
1800 sample	10	115	55.9
1823 sample	62	63	81.0
1830 sample	89	36	95.1
Full sample (1850)	125	0	100

We then extrapolate stepwise the total trade in 1850 first to 1830 with the ‘1830 sample’, then to 1823 with the ‘1823 sample’ and finally to 1800 with the ‘1800 sample’ and we label this series ‘world trade’ We extend this series to present with the data from the United Nations web-site (See Appendix A). The same source reports data of exports at current prices by country, since 1950, and volume indexes, but only after 1980. We have been able to extend about half of these series to 1938 relying on the printed version (UN Statistical Yearbook) and other sources, but there still are substantial gaps. Thus, somewhat paradoxically, our data-base at constant prices is much more complete before 1938 than after the war ⁶.

We obtain series of GDP by polity at current borders from three different sources.

i) we compute total GDP at constant 1990 PPP dollars by multiplying a newly compiled set of series of population at current borders (Federico-Tena 2015b) by GDP per capita from the latest version of Maddison project, supplemented by series for Latin American countries from MOXLAD data-base and by estimates for African countries by Prados de la Escosura (2012). When necessary, we interpolate linearly the data, obtaining a total of 51 series until 1938. We extend to 2007 with the Maddison data, adjusting for changes relative to the pre-war boundaries whenever possible. Then we replicate Maddison’s procedure to convert our series of trade (in 1913 dollars at market exchange rates) in 1990 PPPs dollars. First, we express the level of exports in 1990 in PPPs by dividing our data by the ratio of GDP at market prices to GDP at PPPs in 1990 and then we extrapolate this figure forward and backward with an index of exports at constant prices (1990=1) ⁷.

ii) we have collected a total of 39 series of GDP at current prices from historical national accounts (see Appendix A) and data on the division in three sectors (agriculture, industry and services) for 22 of them. We extend all the series from 1970 onwards with the UN on-line data-bases.

or Africa. Thus, the sample over-represents European countries (70% of exports 1850 vs. 62% in world trade) and under-represents all other continents.

⁶ We try to keep the reference area as homogeneous as possible with our pre-1938 series. Thus, Germany from 1950 to 1991 is the sum of former Democratic and Federal republics of Germany, and India includes Pakistan, Bangladesh (after 1971) and Myanmar, which was included in trade statistics of British India.

⁷ Without this adjustment, the trade/GDP ratio would underestimate (overestimate) openness if the country’s GDP at market prices is lower (higher) than the GDP at PPPs - i.e. when the relative price of non tradables was lower (higher) than in the United States in 1990. Out of a total 54 polities, 17 advanced ones have ratio over 1 (average 1.28) and 37 poor ones less than 1 (average 0.49) (the Balassa-Samuelson effect) On the other hand, the procedure assumes the polity-specific ratio to be constant throughout the whole period and thus it neglects the effects of economic growth on relative prices.

iii) last but not least, for comparative purposes, we use also the series of GDP at current prices for 61 countries from 1870 to 1949 by Klasing-Millionis (2014). They convert the Maddison (2010) data from constant PPPs to current prices with polity-specific coefficients, which they obtain by running a panel regression, with the ratio of nominal GDP per capita relative to the United States as dependent variable, explained by the ratio of GDP per capita at 1990\$ PPP from Penn World tables, plus controls, for the period 1950-1990⁸.

3) Two centuries of world trade

As said, before 1850 the coverage of our series is incomplete: do gaps bias results? The (unknown) total trade (W) at time t ($t < 1850$) can be written as the sum of trade according to the sample available in that year (W^{St}) and of the missing polities (W^{Mt})

$$\sum T_i = \sum T_j + \sum T_l = W^{St} + W^{Mt} = W \quad (1)$$

where T refers to exports of a polity, and the subscripts respectively to all polities ($i=1..n$), to polities present in each sample ($j=1..m$) and to the missing polities ($l=n-m$). In principle, one could test two different null hypotheses i) that the rates of growth of trade are equal between each sample and the sum of the missing polities (i.e. $w^{St}=w^{Mt}$) or ii) that rates of growth are equal between each sample and the full sample ($w=w^{St}$)⁹. Table 2 reports the results of these tests for the period 1850-1913, the earliest available data for w or w^{Mt} .

Table 2
The biases from missing polities

	w^{St}	w^{Mt}	i)	ii)
1800 sample	3.02***	3.52***	R***	FR
1823 sample	3.24***	3.41***	R***	FR
1830 sample	3.21***	4.07***	R***	FR
Full sample	3.22***			

Sources sample series (1800,1823,1830) Federico-Tena (2015) ; Full sample Statistical Appendice.

* significant at 10%; ** significant at 5%; *** significant at 1%; R rejected FR failed to reject

All tests reject the null hypothesis in its ‘strong’ version (i) but not in the ‘weak’ one (ii). In other words, at least after 1850, the missing polities grew faster than the available ones, but the difference is not large enough to bias significantly the aggregate long-term rates¹⁰. One might however argue that trends after 1850 are not representative of trends in the first half of the century. For instance, exports of missing polities might have grown faster after 1850 because they had been growing more slowly before 1850. In this case, the rate w^{St} would overstate the increase in trade. If exports of the missing polities had not grown at all (i.e. $w^{Mt}=0$) our series would overestimate the growth of trade by one third

⁸ Cf. for a similar approach for benchmark years Prados de la Escosura (2000).

⁹ Whenever possible (i.e. if the number of the observations exceed 25-30), we compute the rate of change of the i -th series as $w = -\beta/\psi$, where β and ψ are coefficients from a regression (Razzaque et al 2007) $\Delta \ln W_t = \alpha + \beta \text{ TIME} + \psi \ln W_{t-1} + \phi \ln \Delta \ln W_{t-1} + u$. Otherwise we use a log-linear specification. Null hypotheses about rates (equal to zero or equal to rates in other periods) are tested with a standard Wald restriction. We compute the cumulated change as $\text{Total} = [\exp(w)^n] - 1$.

¹⁰ The coefficients of correlation between each sample and the sum of the corresponding missing polities (i.e. between W^{St} and W^{Mt}) in 1850-1913 are extremely high (0.988 for the 1800 sample, 0.995 for the 1823 sample, 0.990 for the 1830 sample).

in the whole period 1800-1850 and by a half in 1800-1823¹¹. However this hypothesis seems very implausible. It implies that i) the whole increase in exports of covered polities was absorbed by other polities in the sample and ii) the exports of the missing polities (including Italy, Germany and Austria-Hungary before 1823) started to grow as soon as they entered the data-base. Summing up, we cannot rule out that the long run series overstates somewhat the growth in the first quarter of the 19th century but the difference is likely to be small¹². Anyway, any bias would affect our analysis of trade but not our estimates of openness or of gains from trade, as both refer to time-invariant samples of polities.

As a first step, we look for structural breaks in the series. The two world wars and 1929 surely qualify, while Bai-Perron (2003) tests single out as breaks the years 1817 and 1865 in the period 1800-1913 and, less clearly, 1970 or 1980 after World War Two. We thus compute rates of change for these periods (Table 3)

Table 3
Rates of growth of world trade, 1800-2010

	Rates (*100)	Cumulated change (%)
1800-2007	4.22***	6437.1
1800-1817 §	0.49	8.7
1817-1865	3.97***	598.6
1866-1913	3.07***	310.1
1817-1913	3.62**	3215.9
1919-1938 §	0.10	2.0
1950-1973	8.08***	541.3
1973-1980 §	3.96***	32.0
1980-2007	5.86***	386.9
1950-2007	5.10***	1823.6

Sources. Statistical Appendices.

* significant at 10%; ** significant at 5%; *** significant at 1%

§ log-linear estimate.

The first row shows how impressive the growth of trade has been in the last two centuries, but all other rows show how irregular this growth has been. It started after the end of the French Wars, which had reduced world trade by perhaps two fifths (O'Rourke 2006)¹³. However the recovery accounts for less than 7% of the whole growth in the next half a century (and less than 2% of the growth to 1913). The difference between rates in 1817-1866 and in 1867-1913 is significant at 1% and if cumulated over the whole period is rather large: without the slow-down after 1867, exports in 1913 would have been 55%

¹¹ World trade would have grown only by 95% (rather than by 157%) and by 21% (rather than by 44%) respectively. We obtain these figures by splicing together series for 1800-1822, 1823-1829 and 1830-1850, which we compute as $W_t^C = W_{t-n} \cdot \pi_j^{1850} \cdot (1/\exp(w^{St} \cdot (t-n)) + (1 - \pi_j^{1850}))$ where π_j^{1850} is the share of the j-th sample from table 1 in 1850 and time t refers to the final year of each period.

¹² The rate of growth of the 47 polities included in the 1823 sample but not in the 1800 sample in 1823-1850 is 3.04%.

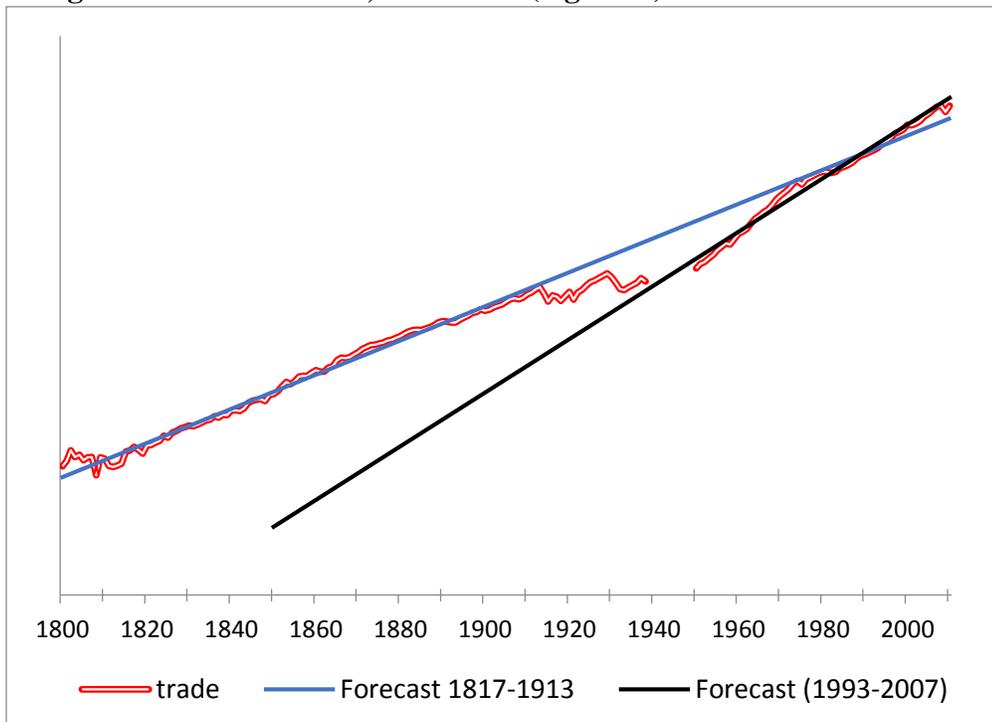
¹³ Exports in 1815 were equal to the pre-war level in Sweden, a third lower in the United Kingdom and in the United States and half in France. If in 1815 exports of all other polities had been hit as badly as the French ones, world trade would have been about 42% lower than before the war. This is in all likelihood an upper bound

higher¹⁴. The outbreak of World War One caused trade to fall by about a quarter and it remained depressed until 1918, in spite of a small rebound in 1916 and 1917. Our estimate of the losses is only a shade lower than the estimate by Glick and Taylor (2010), probably reflecting differences in geographical coverage¹⁵ World exports returned to their 1913 level (at current borders) in 1924 and went on growing until 1929. By then, world trade was about third higher than in 1913. At the trough of the Great Depression, in 1933, it was 5% below, and at their pre-war peak (1937) exports were still below the 1929 level by 10%. World trade recovered quite fast after World War Two, and in 1950 it was already 25% higher than before the war. Exports grew at breakneck speed during the golden age, slowed down markedly in the 1970s and accelerated again since 1980. The rate for the whole period 1950-2007 exceeds significantly the 1817-1866 one. Figure 4 shows that world trade returned close to its pre-1913 growth path (dotted blue line) briefly in the 1970s and exceeded it permanently since the mid-1990s.

¹⁴ This difference does not appear in the series by Lewis (1981), which grows almost as fast before and after 1866, respectively at 3.18% (log-linear estimate) and 3.25%. The difference with rates from our series (4.20% in 1850-1866 and 3.04% in 1867-1913) are significant at 1% and 5% respectively.

¹⁵ They estimate losses with a gravity equation, using the data by Barberi and Keschk on bilateral trade, which over-represent European countries.

Figure 4
The growth of world trade, 1800-2010 (log scale)



Sources. Statistical Appendices.

It can be argued that our series at current borders does not measure accurately the change in trade, as any increase (decrease) in the number of polity is bound to augment (reduce) trade. Before 1913, boundary changes, such as the Italian Unification (1861) and the custom unification of Canada (1), Australia (?) and South Africa (?), reduced trade, but the total effect was negligible: the largest gap between the series of world trade and our estimate at 1913 borders, in 1860, is a mere 0.57%¹⁶. In contrast, the changes in political map after Versailles had a sizeable impact on trade. World exports were 3.1% higher at current borders than at constant ones in 1924 and still 1.5% higher in 1938. In other words, the series at current borders overvalues the level of trade in interwar years relative to its pre-war level but understates its growth¹⁷. The effect was similar, if not larger, for the changes after World War Two, such as the partition of British India (and the secession of Bangladesh from Pakistan) and the division of some British and French colonies in Africa and above all the fragmentation of Soviet Union and Yugoslavia in the 1990s. According to Lavallée and Vicard (2010 tab 4), border changes accounted for 6.6% of the growth of trade during the Golden Age and for about a sixth of the overall rise of trade from 1950 to 2007. This is equivalent to a third of a point of growth rate – i.e. about a fifth of the difference between 1817-1913 and 1950-2007.

To what extent did polities share the overall growth in trade? Some polities, most notably oil exporters, did experience huge variations in their shares, but the coefficient of correlation between shares (at current prices) in 1850 and 2007 is fairly high (0.59) and changes in the overall map of world trade are comparatively modest, as Figures 5 and 6 show¹⁸. The former groups polities by continents, the latter by level of development, distinguishing ‘advanced’ or ‘old rich’ countries (defined as having a GDP per capita over a half the British one in 1870), ‘other OECD countries (all other OECD members as of 1971, including Japan and Italy), the ‘rest of Asia’ (including Korea and Turkey) and the ‘rest of the world’¹⁹. The two figures tell a similar story. The first globalization did not feature big changes. In the early 1830s, Europe accounted for 62% of world exports and the advanced countries for about a half. This latter share increased by ten points in the 1850s and then remained around 60% until the war, while the share of Europe was drifting slightly downwards to 56%. The shares moved a lot in the following fifty years, but by the early 1970s they were almost back to their pre-1913 levels: Europe accounted for 52% of world exports and the ‘old rich’ for 57%. In contrast, the distribution of world exports changed dramatically during the second globalization. The share of Asia rose from about a sixth in the mid-1970s to a third in the late 2000s. All other continents lost market shares, but Europe fared comparatively better than America and Oceania. Until the early 1990, the fall in the share of ‘old rich’, from 56% to about 40% of world exports, was compensated by the relative increase of exports from the ‘other OECD’ countries. In the last fifteen years, exports from the ‘advanced countries’ decreased further to slightly over a third, the ‘other OECD’ countries returned to a sixth, their level of the 1970s and the ‘rest of Asia’ – i.e. mostly China- jumped to a quarter of world market.

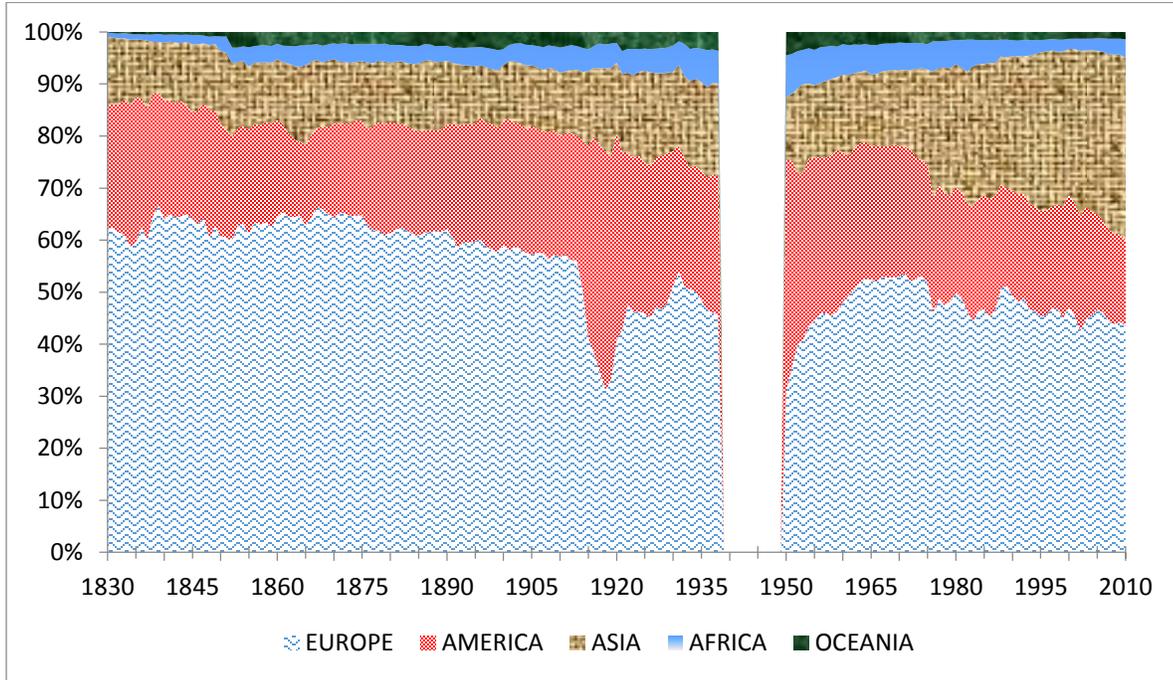
¹⁶ The German unification does not affect our series, which refer to Zollverein before 1870.

¹⁷ From 1924 to 1938 trade at constant prices increased by 9.7% if measured at current borders but by 11.1% if estimated at 1913 borders.

¹⁸ Some Asian and African polities are missing before 1850, and thus the shares of these two continents (and of rich countries) are correspondingly undervalued. However, the bias is very small (cf. Table 1) and it is a price worth to be paid to extend the series back to 1830.

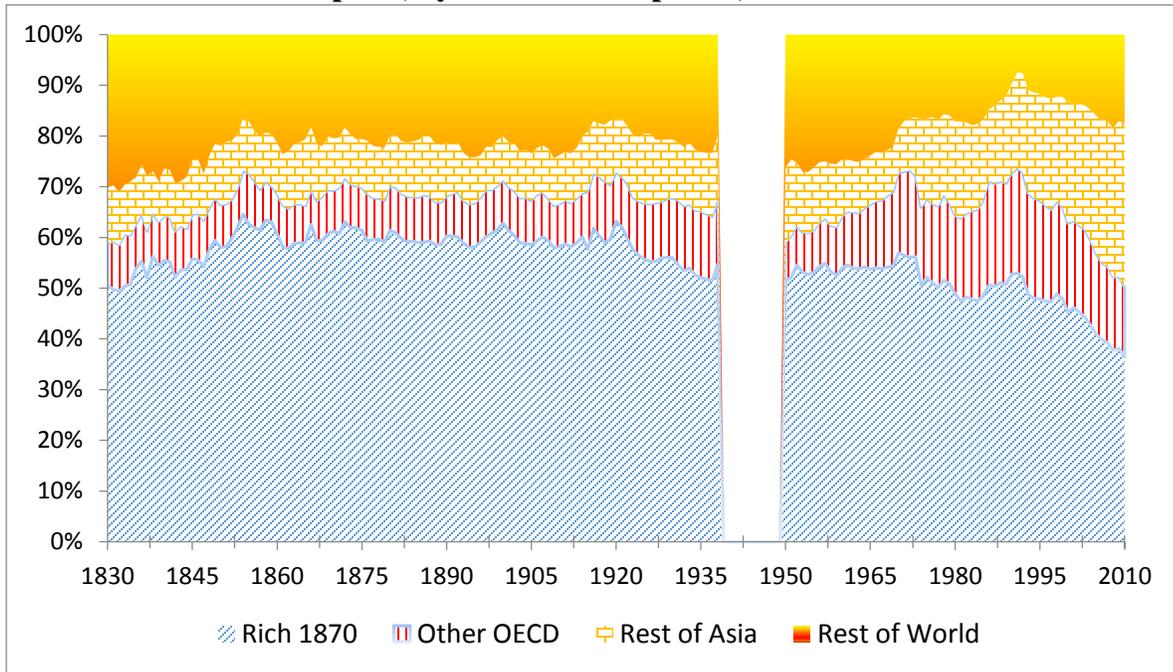
¹⁹ The advanced countries are Australia, Belgium, Canada, Denmark, France Germany, Netherlands, New Zealand, Switzerland, United Kingdom and the United States. Using the GDP of the United States in 1913 as the yardstick, the group of rich countries would include also Sweden and Argentina. The ‘other OECD’ series includes Austria, Greece, Finland, Ireland, Iceland, Italy, Japan, Norway, Turkey (Ottoman Empire before 1918), Portugal, Spain and Sweden.

Figure 5
Distribution of world exports, by continent, 1830-2010



Sources. Statistical Appendices.

Figure 6
Distribution of world exports, by level of development, 1830-2010



Sources: Statistical Appendices.

Summing up, the analysis of changes in trade has highlighted some relevant differences between the two globalizations, both in the rates of growth and in the distribution of exports. What about openness?

4) The change in world openness and its proximate causes

Openness is meant to measure the overall involvement of an economy in the world market and thus for the i -th polity can be written as

$$O_i = (\sum X^{VA_j} + \sum M^{VA_j}) / \sum VA_j \quad (2)$$

Or, equivalently,

$$O_i = (\sum X_j + \sum M_j) / \sum GO_j = (\sum X_j + \sum M_j) / \sum VA_j g_j \quad (3)$$

where the subscript J refers to goods and services, X and M are exports and imports, X^{VA} and M^{VA} their respective value added content, GO the gross output – i.e. the Value added plus purchases of inputs and services and g_j its ratio to VA ($g_j = GO_j / VA_j$). The corresponding world-wide measure is the sum of imports and exports of all polities to the sum of their GDP (or gross output). This measure is arguably biased upwards, as imports include transportation and related costs and the bias changes whenever these cost change. A fall in transportation costs would reduce openness, *ceteris paribus*²⁰. Thus, we measure world openness, or O_w , as

$$O_w = \sum \sum X^{VA}_{ij} / \sum \sum VA_{ij} = \sum \sum X^{VA}_{ij} / \sum GDP_i \quad (4)$$

if expressed in terms of VA , or

$$O_w = \sum \sum X_{ij} / \sum GO_i = \sum \sum X_{ij} / \sum \sum VA_{ij} g_{ij} \quad (5)$$

if expressed in terms of gross output.

Equations 4) can be re-written as

$$O_w = \sum X^{VA}_{ij} / GDP_i * GDP_i / \sum GDP_i = \sum X^{VA}_{ij} / VA_{ij} * VA_{ij} / GDP_i * GDP_i / \sum GDP_i \quad (6)$$

The first term is the ratio of the (VA content of) export for the j -th good or service to the Value Added in its production, and thus it depends on trade costs only. The second term, the share of Value Added in the production of the j -th good or service on total GDP of the i -th polity, measures the effect of changes in the composition of VA of the polity (or structural change within). The third term, the share of the i -th polity on world GDP, measures the effect of changes in the location of world GDP (or structural change across)²¹. The gross output version of eq. 6) is

$$O_w = \sum \sum X_{ij} / (VA_{ij} g_{ij}) * (VA_{ij} g_{ij}) / \sum (VA_{ij} g_{ij}) * \sum (VA_{ij} g_{ij}) / \sum \sum VA_{ij} g_{ij} \quad (7)$$

²⁰ Imports are usually included in country measures because their omission would underestimate (overestimate) openness if the country runs a deficit (surplus) in its trade balance. This argument, however does not hold at world-wide level because surpluses and deficits cancel each other out.

²¹ In principle, one could take into account also changes in the destination of exports, by substituting X^{VA}_{ij} / VA_{ij} with $^{VA}_{ijl} / VA_{ij} * X^{VA}_{ijl} / X^{VA}_{ij}$, where l refer to countries.

Where the ratio g_{ij} adds a further source of change.

Unfortunately, the historical data are not sufficient for a comprehensive analysis of openness. Data on trade in services are available only since 1980 in the United Nations website, while data on gross output can be computed since 1972, but only for fifteen advanced countries²². Thus our baseline measure of world openness is the ratio

$$O_w^* = \frac{\sum \sum X_{ij}}{\sum GDP_i} \quad (8)$$

This measure is subject to two conflicting biases. From one hand, the use of GDP rather than gross output as denominator overestimates the level of openness (as $g_{ij} > 1$) and, more importantly, it would also overestimate (underestimate) its growth, if g_{ij} increases (decreases). On the other hand, the omission of exports of services from the numerator is bound to underestimate openness in any given year and to bias downward its growth if, as likely, exports of services grows faster than total GDP.

The data constraint affects also the analysis of proximate causes of changes in openness (eqs 6) or 7)). A division in the economy in three sectors only (Section Two) is bound to underestimate the contribution of composition effects to changes in openness. Thus, we prefer to compute separately openness for tradables

$$O_T = \frac{\sum \sum X_{ij}}{\sum VA_{ij}} \quad (9a)$$

where j refers to agriculture and manufacturing, and openness for services

$$O_S = \frac{\sum \sum X_{ij}}{\sum VA_{ij}} \quad (9b)$$

where j refers to services.

In practice, given the available data for the denominator, we can compute openness in four different definitions

- i) world openness at current prices, with GDP from country-specific sources
- ii) world openness at current prices, using the GDP estimates by Klasing-Millionis (2014)²³
- iii) openness tradables at current prices, with GDP and share of tradables from country-specific sources
- iv) world openness at constant prices with GDP at 1990\$ from the Maddison project.

Many series of GDP start in the second half of the 19th century, and thus we face a trade-off between representativeness and length of our openness series. We tackle it by computing them for three different time-invariant samples, an extended one, only for world openness at current prices (i.e. i) in

²² The fifteen countries (Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Korea, Mexico, the Netherlands, Norway, Sweden, the United Kingdom and the United States) accounted for two thirds of world export in 1973 and about half in 2007. We estimate separately the gross output of agriculture and manufacturing in current dollars by multiplying the Value Added (from UN data) by sector-specific Gross Output/VA ratios. Since 1990, we compute these ratios with the data from the on-line STAN data base, while from 1972 to 1989 we get the ratio for manufacturing from OECD 1994, assuming that the ratio for agriculture to have remained constant at its 1990 level (the first available year). Data on the value added content of trade are available from a OECD-WTO joint data-base for the same countries, but for few benchmark years only.

²³ This series differs from the original one because it refers to a time-invariant sample of polities, it omits imports from the numerator and uses our series of exports rather than the Barberi-Keshk data.

1913 and 2007, which maximizes the coverage, and two yearly series, starting in 1830 (the first year with a sufficient coverage) and in 1870. Table 4 reports the key information on the underlying samples.

Table 4
Information on openness data

	i) current prices specific GDP	ii) current prices Klasing et al.	iii) tradable current prices specific GDP	iv) constant prices Maddison GDP
All available series				
Number of polities	39	61	21	51
Share of world trade in 1913	91.6	96.1	74.0	86.8
Share of world trade in 2007	73.4	84.7	58.8	62.9
1830 sample				
Number of polities	17		7	37
Share of world trade in 1913	51.2		30.4	82.8
Share of world trade in 2007	27.7		15.6	51.0
1870 sample				
Number of polities	27	44	14	42
Share of world trade in 1913	77.6	92.6	65.6	86.5
Share of world trade in 2007	47.2	74.8	39.4	59.9
Extended sample				
Number of polities	38			
Share of world trade in 1913	91.7			
Share of world trade in 2007	73.9			

Source: Appendix A, Federico-Tena 2015a and United Nations

The samples at constant prices (column iii) are more numerous than the corresponding samples at current prices (column i), but the difference in terms of coverage of world trade is not so large, especially for the 1870 samples. The 1870 sample at current prices covers very well Oceania, well Europe and America, poorly Asia (with India and the Ottoman Empire) and misses Africa altogether. The openness tradable samples (col iv) are decidedly less representative: the 1830 one includes only European countries and Australia and the 1870 sample, although larger, remains heavily skewed towards the Atlantic economy, with only India to represent poor countries.

The more abundant data during the second globalization make it possible to compute three additional measures (Table 5)

v) the ratio of export of goods to gross output of tradables (i.e. $\sum \sum X_{ij} / \sum \sum VA_{ij}$, with j=agriculture, mining and manufacturing) since 1972

vi) the ratio of export of services to Value added of non tradables (i.e. $\sum \sum X_{ij} / \sum \sum VA_{ij}$, with j=services), or openness services since 1980

vii) the ratio of export of goods and services, to GDP (i.e. $\sum X_i/\sum VA_i$), since 1980.

Table 5
Rates of change in openness, 1972-2007

All countries		Fifteen OECD countries	
World openness (i)	1.49***	World openness (i)	0.97**
Openness tradables (iii)	2.98***	Openness tradables (iii)	2.31***
Openness services ° (vi)	4.01**	Export goods/gross output tradables (v)	2.66***
Total exports/GDP ° (vii)	1.99***		

° log-linear regression 1980-2007

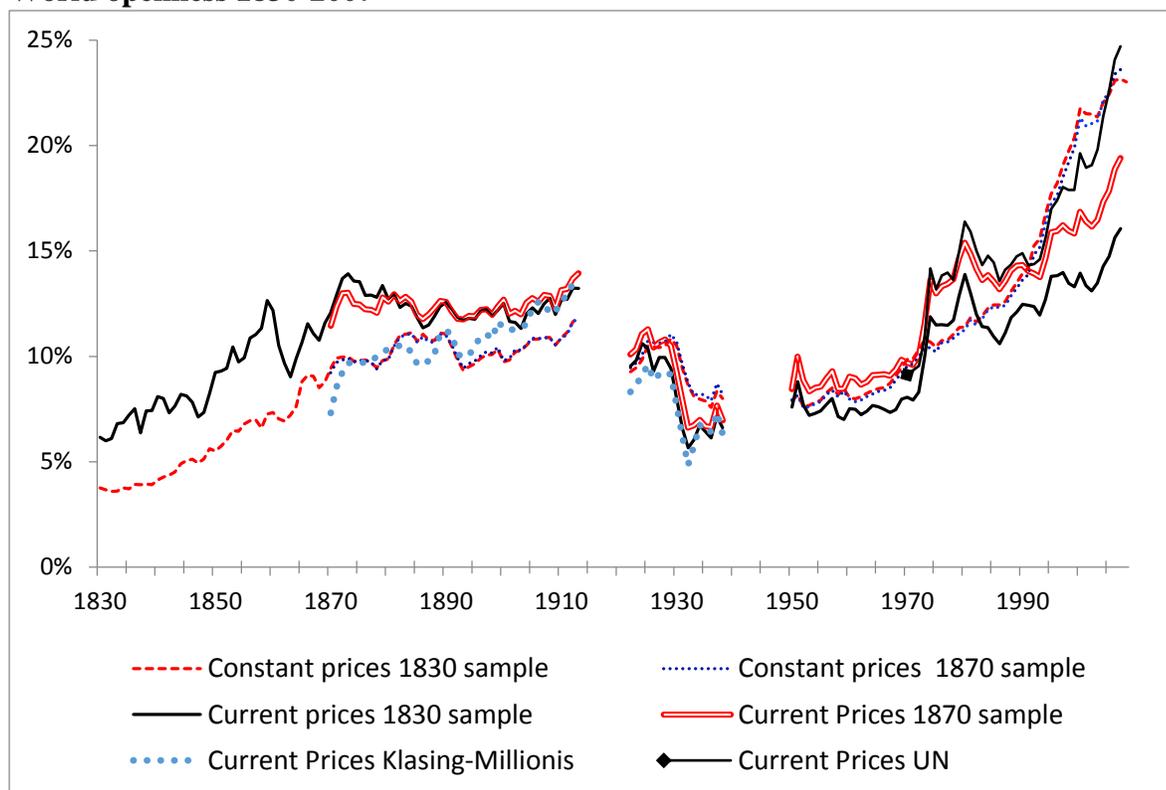
Sources:

The left-hand part of the table highlights two key stylized facts. First and foremost, world openness increased a lot: the export/GDP ratio for all countries more than doubled, from less than 10% to almost 25% in 2007. Second, trade in services grew faster than trade in goods (compare rows vii) and i), which share the same denominator) although the difference is not significant. Finally, openness by sector (rows iii) and vi) grew much more than total (i), suggesting a massive composition effect. The right-hand part of the table deals with gross output, and thus on few advanced countries. One may note that rates for these countries are lower than the overall rates in the left-hand part of the table – a pattern we will return to in Section Seven. The key message is that the difference between the rates of growth of openness tradables (iii) and of the export/gross output ratio for tradables (v) is small and not significant. In other words, the changes in the ratio g , at least for advanced countries after 1972, were not large enough to bias systematically the change in our baseline measures of openness. We cannot prove that this statement holds true before 1972, but we can estimate by how much the ratio g had to change in order to explain the whole gap between world openness and openness tradables. The average ratio was about 2.30 in 1972-2007: it should have been around 1.50 in 1830-1832 or around 1.90 in 1870-1872. Such an increase seems too large to be plausible. Actually, one cannot rule out that raw material saving technical progress caused the ratio to decline. From 1850 to 1913 the energy intensity of GDP declined in several European countries, including the United Kingdom (Kander et al 2013). We are thus confident that our world openness and openness tradables, although theoretically imperfect, capture sufficiently well long term trends.

There is no doubt that the world was much more open in 2007 (and thus nowadays) than at the peak of the first globalization in 1913. Exports accounted respectively for 22.5% and 12.5% of GDP at current prices (the extended sample) and for 24.3% and 11.8% of GDP at constant prices, 1870 sample. The extended sample is fairly representative (Table 4) and anyway the world would have been more open in 2007 than in 1913 even if all the omitted polities had not exported anything. This hypothesis is clearly absurd: the share of missing polities increased in the long run (Table 4) and in 2007 the export/GDP ratio is higher for all countries than for the extended sample (24.7% rather than 22.5%).

We plot all available series of openness in Figure 7 and we report the corresponding rates of change in Table 6 (Table 6) ²⁴.

Figure 7
World openness 1830-2007



Sources: Statistical Appendices.

Table 6
Rates of change, total openness and openness tradables, 1830-2007

	Total openness						Openness tradables	
	Current prices				Constant prices		Current prices	
	1830 sample	1870 sample	1870 sample population-weighted	Klasing-Millionis	1830 sample	1870 sample	1830 sample	1870 sample
1830-1870	1.56***				2.63***		2.76***	
1870-1913	-0.13	0.16	0.45*	0.81***	0.24	0.32*	0.31	0.28**
1924-1938§	-3.88**	-4.33***	-4.06***	-3.36*	-2.88**	-2.85**	-6.10***	-5.84***

²⁴ The series of openness at current prices for the 1830 sample shows break points in 1876, 1885 and 1901, the series for the 1870 sample in 1892 only. The series of openness at constant prices for the 1830 sample has a break in 1881 and 1892, that for the 1870 sample has no breaks. We prefer to omit war years 1914-1920 because some GDP series at current prices are missing and the data are inflated by the inclusion of war-related expenditures

1950-1972	0.14**	0.47**	-1.67***		2.12*	1.83**	0.22	1.86***
1972-2007	0.89***	1.00**	1.69***		2.84***	2.05***	0.73	2.37***
1950-2007	1.52***	1.57***	1.81***		2.60***	2.77***	1.12***	2.83***

*significant at 10%; ** significant at 5%; *** significant at 10% § log-linear specification

All rates differ significantly between periods, but they tally only partially with the conventional wisdom. Total openness collapsed during the Great Depression and increased fast since the early 1980s as expected but, in contrast with the conventional wisdom, it grew very little or not at all from 1870 to 1913 and from 1950 to 1972. Furthermore, the data show a massive increase in openness from 1830 to 1870, which has so far been neglected by historian for lack of trade data before 1850. This growth can be related to the liberalization of trade policies after 1846 (Tena et al 2012) and it tallies well with the independent evidence about the market integration in Europe (Federico 2011) and in transatlantic trade (Sharp and Weisdorf 2013, Chilosi-Federico forthcoming).

A comparison of rates across series for the same period highlights three additional points:

i) openness increases more if measured at constant prices than at current prices – i.e. domestic prices rose relative to prices of exports²⁵. This increase may reflect a Baumol effect (an increase in domestic prices of not-tradables relative to prices of tradables) as well changes in relative prices of tradables, possibly related to growing protection. This trend has briefly reversed in the 1970s, when the boom in oil prices caused a spike in openness at current prices (Figure 7).

ii) the ‘Klasing-Millions’ series grows much more than our comparable series at current prices (but also than series at constant prices)²⁶. The numerator is the same and thus the Klasing-Millions method seems to underestimate systematically the growth in GDP at current prices relative to the national accounts, although we cannot speculate on the reasons of the difference²⁷.

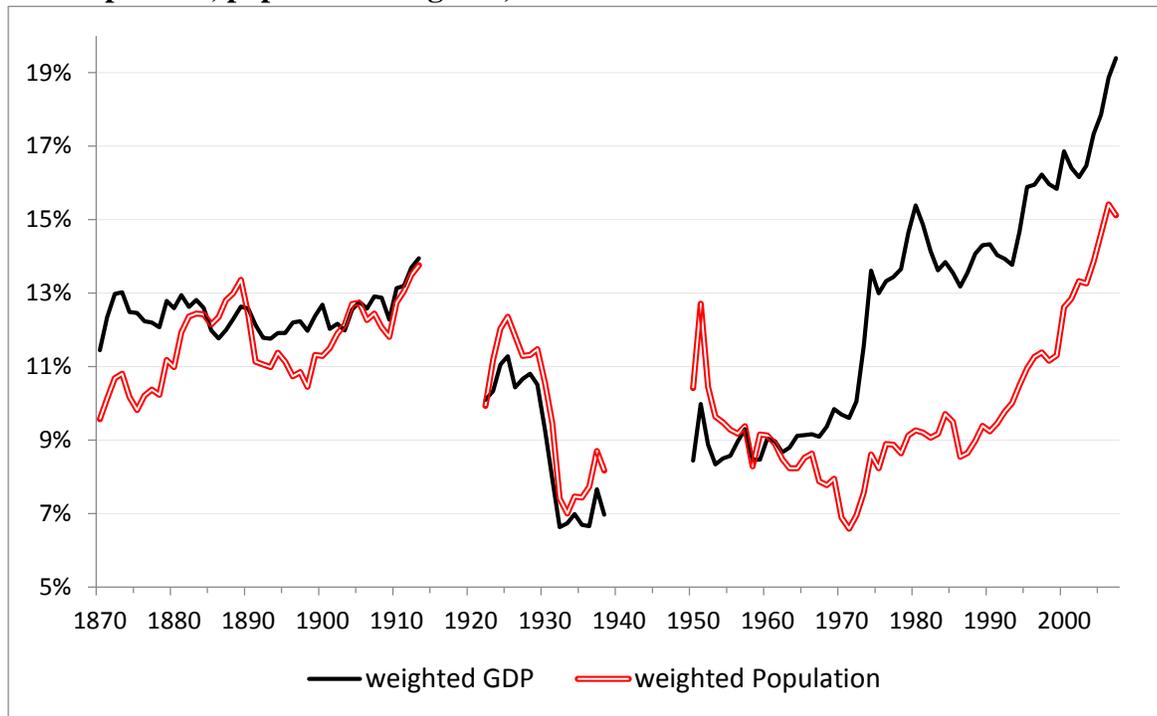
iii) weighting openness by polity with shares on the cumulated population, rather than on cumulated GDP, yields quite different results (Figure 8).

²⁵ Let's write openness at current prices as $\alpha = X/(T+NT)$ and at constant prices as $\beta = X/P_X/[T/P_T + NT/P_{NT}] = X/T * P_T/P_X + X/NT * P_{NT}/P_X$ where X exports, T VA tradables, NT VA not tradables and P price indexes. In any baseline year, all price indexes are 1 and thus $\alpha = \beta$. Ceteris paribus, openness at constant prices would rise more than at current prices ($\beta > \alpha$ at time t) if $P_T/P_X > 1$ and/or $P_{NT}/P_X > 1$

²⁶ The null of equal rates is rejected for 1870-1913 both with the total series and for a comparable series of 25 polities (equivalent to our 1870 sample without Cuba). The rates are not significantly different in 1922-1938.

²⁷ Between 1870-1872 and 1911-1913, the Klasing-Millions (2014) GDP series increase less than the polity-specific ones in 22 countries out of 25. The three exceptions are Argentina, Belgium, where the difference is minimal, and the Ottoman Empire, which lost all its Balkan territories in that period.

Figure 8
Total openness, population weighted, 1870-2007

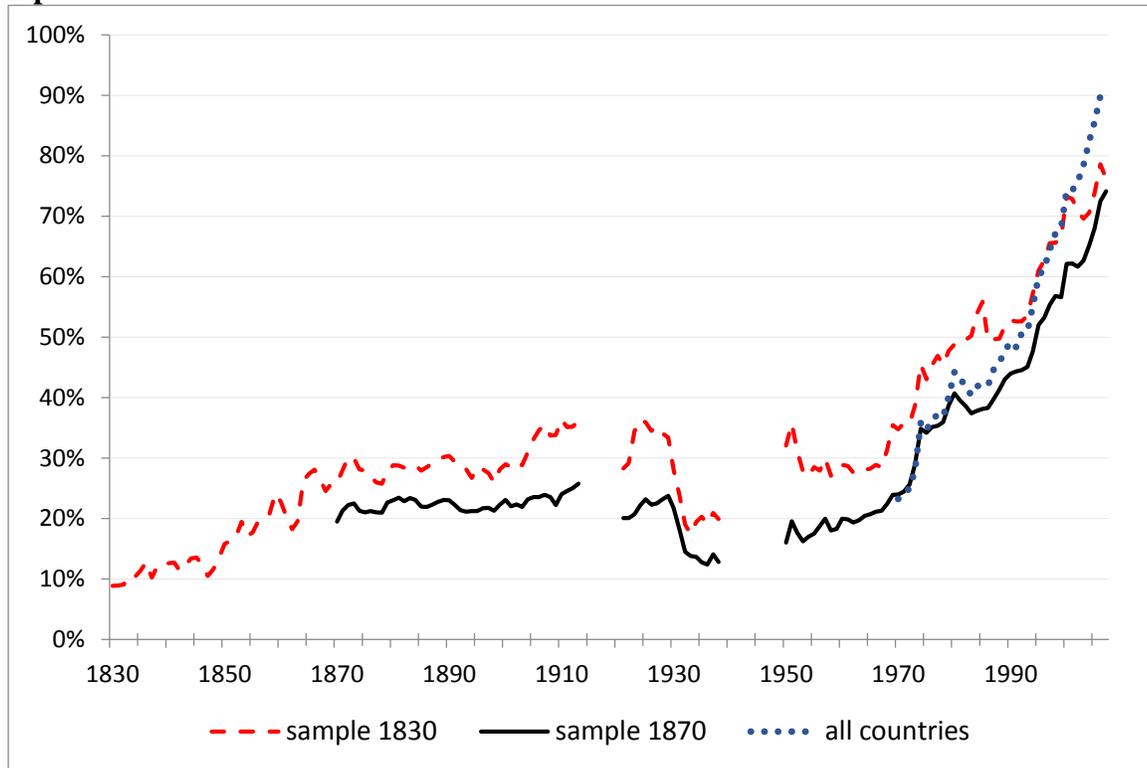


The population-weighted openness increased before 1913 and declined during the Golden Age, instead of remaining roughly constant in both periods as the GDP weighted one. It did recover after 1973 but by 2007 it was still 4.2 points below the GDP weighted series and only 1.5 above its level in 1913. In this sample, the divergence reflects the movements of India, which accounted for about half the population of the sample but for less than 5% of the GDP. However, as we will discuss in Section Six, this pattern is common to many poor countries.

5) Structural change and the rise in openness

By definition, openness tradables is bound to be higher than world openness, but broad trends are similar (Figure 9). It rose fast before 1870, stagnated in the following century and grew fast again since the early 1970s (Table 5 and 6).

Figure 9
Openness tradables 1830-2007

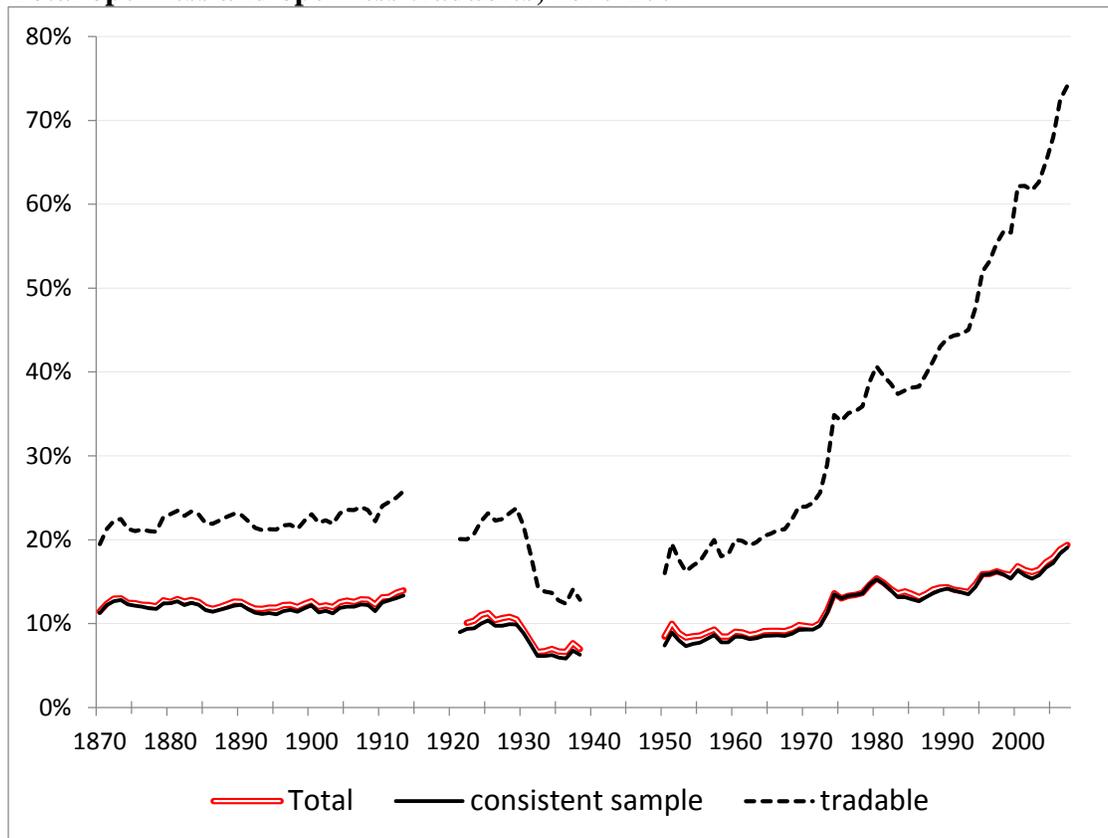


However, the key fact is the growing size of the gap, which is already evident in Figure 1, which refers to seven countries only, excluding the United States. Thus, Figure 10 compares openness tradables for the larger 1870 sample (17 polities) with world openness for the same polities as well as for the whole 1870 sample (27 polities). Openness tradables was about 70% higher than world openness in 1870, double in 1913 and 1938, 160% higher in 1972 and almost four times higher in 2007 (74.1% vs 19.5)

²⁸.

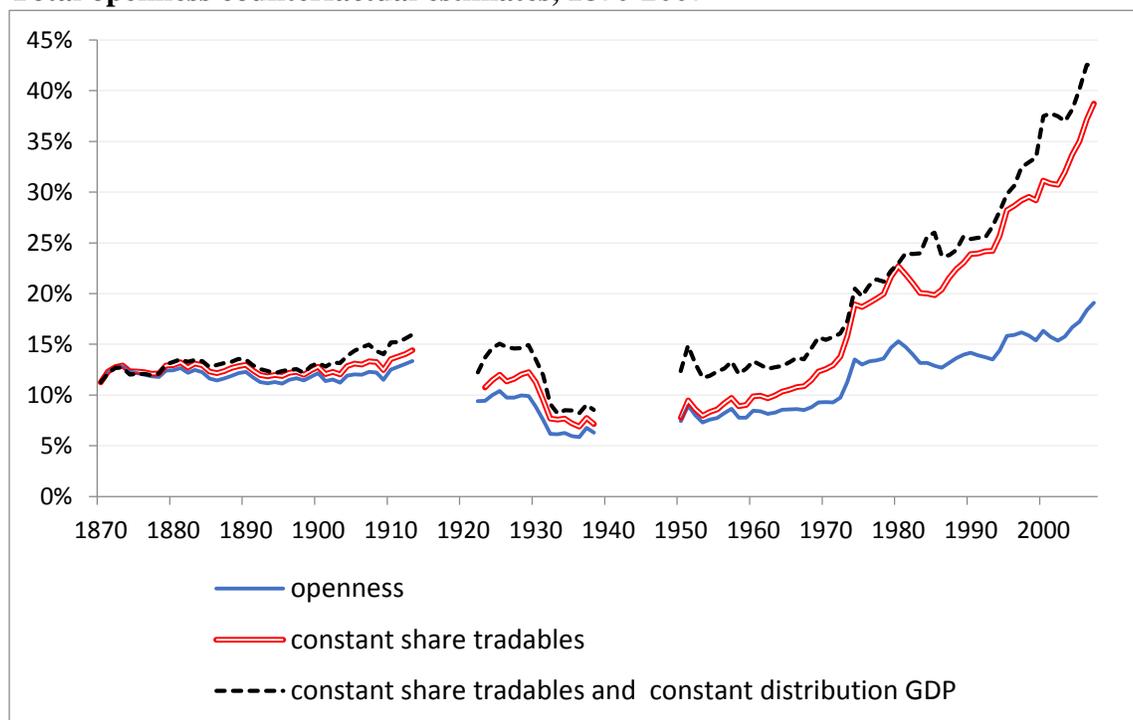
²⁸ The differences between rates of growth in the two series for the same polities are not significant in 1870-1913 and in 1922-1938 and significant at 1% in 1952-2007.

Figure 10
Total openness and openness tradables, 1870-2007



This widening gap reflects mostly the structural change within countries—the increase in the share of services. Figure 11 highlights its impact on world openness by comparing the actual series for the 1870 sample at current prices with a counterfactual openness series, computed assuming constant composition of GDP in every polity since 1870 (i.e. no structural change within countries)

Figure 11
Total openness counterfactual estimates, 1870-2007



The gap between the actual and the counterfactual series remained very small during the first globalization, increased a little in the interwar years but then declined again and as late as the mid-1960s it was still below two points. Since then, the gap soared, up to over 15 points in 2007. Without structural change, total openness in 2007 would have been almost 40%, rather than only 22.5%. The effect is not limited to the polities of the 1870 sample: if the composition of GDP in all countries had remained constant at its 1973 level, openness would have risen from 10.8% to 38.9% rather than to 24.3%. In a nutshell, the rise of services dampened very much the effect of growing openness in tradables during the second globalization – i.e. without structural change the difference between the two globalizations would have much wider.

The effect of structural change can explain also the puzzling difference between the growth in openness and the stagnation of estimated trade costs, in spite of trade liberalization, during the second globalization. In fact, bilateral trade costs are computed as

$$T_{ij} = (X_{ii} * X_{jj}) / (X_{ij} * X_{ji})^{-1/2\epsilon} \quad (10)$$

where ϵ is the elasticity of trade to trade costs, X_{ij} and X_{ji} are trade flows between the two countries, X_{ii} and X_{jj} are trade flows within each country. Both Jacks et al (2011) and Hugot (2014) proxy these latter with the difference between GDP and exports. Thus, an increase in the share of non tradables would, ceteris paribus, increase the numerator and thus the estimate of costs. Indeed, trade costs fall if

computed using in the denominator the difference between gross output, rather than GDP, and export (Jacks et al 2011 Figure A4.b and Hugot 2014 Figure 31). These estimates refer to advanced countries only, but it is likely that a more precise measure of domestic trade flows exclusive of non-tradables would reconcile quantity-based and cost-based estimates of openness.

The dotted line of Figure 11 hypothesizes that also the distribution by country of world GDP remained constant since 1870. Thus, the vertical distance between the double red and the black dotted lines measures the additional contribution of structural change across. In most periods, with the exception of the Golden Age, the contribution to total change is fairly small and it reinforces the effects of structural change within. We highlight this point by computing counterfactual openness if the shares by polity of the total GDP had remained constant since the beginning of each period (e.g. in 1830, 1870 etc.). The results are reported, as absolute changes in each period, in the column ‘other effects’ in Table 7, and the residual is by definition the contribution of change in location of GDP. For instance, from 1830 to 1870 (first line) total openness rose by almost six points, but if the distribution of world GDP had remained constant, it would have increased by 7.5 points.

Table 7
The distribution of world GDP and change in openness

	Sample	Initial openness	Total Change	Other effects	Change share world GDP
1830-1870	1830	6.16	5.91	7.51	-1.60
1870-1913	1870	11.45	2.50	3.28	-0.78
1913-1950	1870	13.95	-5.50	-2.62	-2.88
1950-1972	1870	8.44	1.62	-0.29	1.91
1972-2007	1870	10.05	9.35	9.10	0.25
1913-2007	1870	13.95	5.45	5.90	-0.45
1870-2007	1870	11.45	7.95	9.12	-1.11
1913-2007	extended	12.46	10.02	11.80	-1.77

The changes in the location of GDP reduced total openness also from 1870 to 1950, and from 1913 to 2007, while their contribution was positive from 1950 onwards. The effect was very small after 1972, but it accounted for all the (modest) increase in world openness during the Golden Age.

6) How global were the two globalizations?

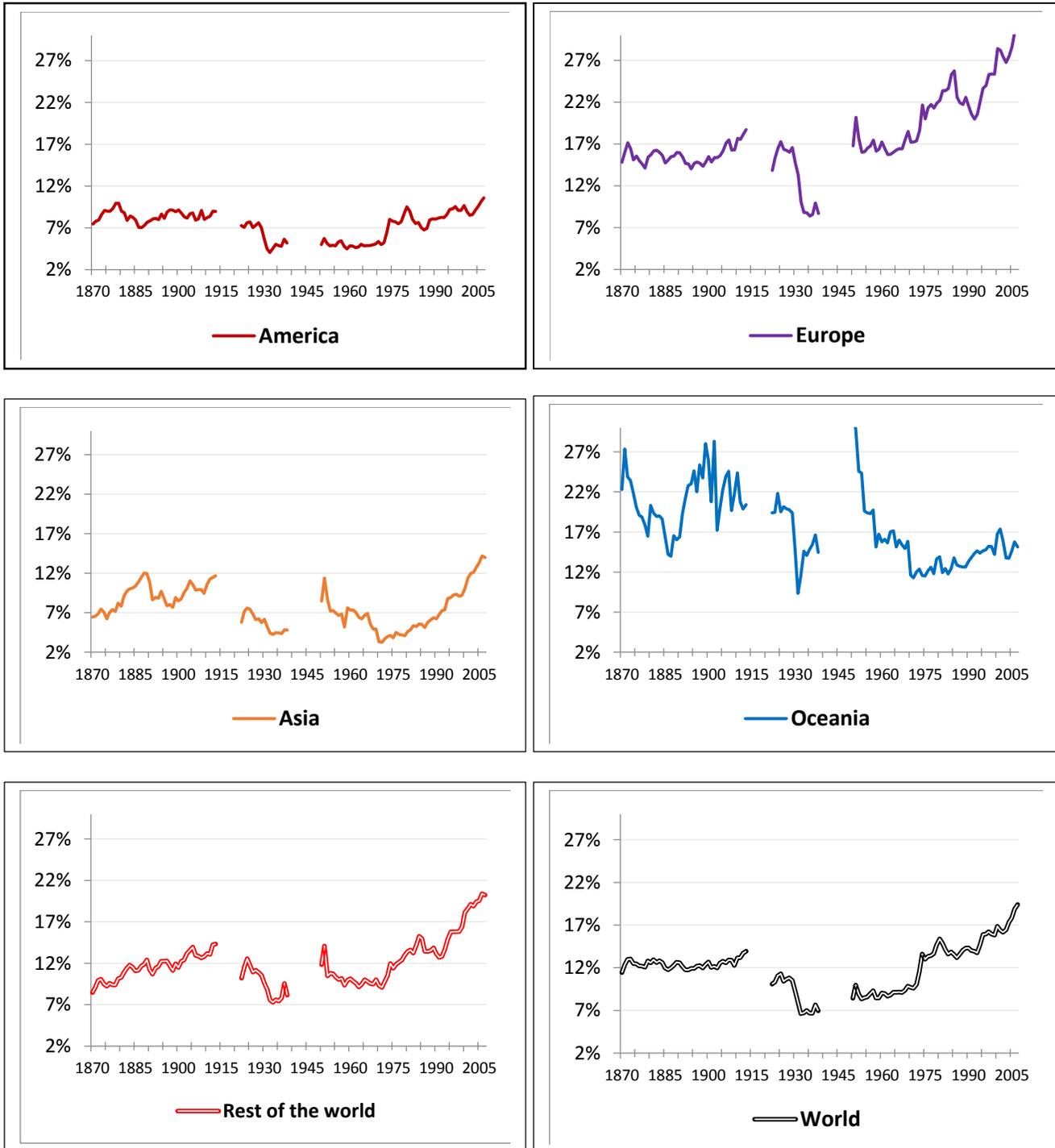
The aggregate measures are dominated by few big countries and thus they are bound to conceal movements in openness of smaller polities whenever they diverged from the big beasts. Such divergences were indeed quite common: from 1913 to 2007 openness fell in nine out of the 38 polities

of the extended sample and the simple coefficient of variation of changes is as high as 1.93. We plots trends in openness by continent and by level of income in Figure 12 and we report the changes in points of openness in Table 8

Table 8
Change in total openness, by continent and level of development

	Sample	Africa	America	Asia	Europe	Oceania	Rich	ROW	World
1830-1870	1830		-0.6	3.4	10.2	11.6	6.0	5.1	5.9
1870-1913	1870		1.5	5.2	3.9	-1.9	1.0	5.9	2.5
1913-1950	1870		-3.9	-3.2	-1.9	10.6	-6.1	-2.5	-5.5
1950-1972	1870		0.2	-4.8	0.6	-19.0	2.4	-2.1	1.6
1972-2007	1870		5.4	10.3	13.2	3.1	9.0	10.5	9.3
1913-2007	1870		1.6	2.3	11.8	-5.3	5.3	5.9	5.5
1870-2007	1870		3.1	7.5	15.7	-7.2	6.3	11.8	8.0
1913-2007	extended	-14.6	1.7	19.7	15.8	-5.3	5.3	16.3	10.1

Figure 12
Total openness, current prices, by continent and level of development 1870-2007



The average levels of openness over the whole period 1870-2007 were almost identical for rich countries and the rest of the world (12.1% and 12%), while they differed substantially between continents. Oceania and Europe (averages respectively 17.9 and 17.6%) were much more open and Asia and America decidedly less open (7.7% and 7.4%) than the world (12%). Figure 12 omits Africa, as we lack sufficiently long series of GDP at current prices. However, according to the (admittedly small) 1870 sample at constant prices, Africa was the most open continent throughout the whole period. Most groups of polities share the world-wide trends, with coefficients of correlation with the world openness series in excess of 0.80, but there are two notable exceptions, Asia (coefficient 0.51) and Oceania (-0.124)²⁹. The boom and bust pattern of the Australian economy was unusually large (Mc Lean 2013), but differences in movements were widespread. The average coefficient of correlation between world openness and each polity was a mere 0.37 and it was negative for seven other polities out of 27.

A short account of main trends shows how these differences concentrated in time

- i) The first globalization, from 1830 to 1870, left behind very few polities. The ratio remained constant in the United States, where the growth in GDP matched the fast increase in exports (the American share of world exports increased from about 6.5% to around 8%) and declined in Brazil, where a national economy was starting to develop (and the ratio fell from 40% to 25%). The export/GDP (at constant prices) declined in Jamaica, which, as other sugar-exporting islands of the Caribbean was hit hard by the abolition of slavery (Federico and Tena 2013). But these were exceptions. Total openness increased fast in exporters of primary products, such as Argentina (from 7.5% to over 11%) or Cuba, where slavery had not been abolished (from 18% to 26%), but also in industrializing countries such as France (from 4% to 12%) Belgium (from 8% to 14%) and above all the United Kingdom (from 10 to 18.5%).
- ii) the period 1870-1913 features a massive divergence between countries. Total openness continued to grow in the rest of the world, including Argentina (a further increase to 18%), India (from 7% to 11.7%) and the Ottoman Empire (from 5.7% to 11.6%). The series at constant prices show a massive increase in Africa as well. In contrast, openness increased very little or declined in all advanced countries, but Germany. The ratio increased by one percentage point in the United States, but in the United Kingdom it remained below the level of the early 1870s until a surge in the years immediately before the war. This surge disappears if we add exports of services to the numerator³⁰.
- iii) world openness did not recover in the 1920s and the collapse of world trade during the Great Depression caused a further sharp fall. Yet the picture at country level is not so uniformly bleak: about a third of the polities, including Australia, Canada, Belgium, Denmark and the United Kingdom were more open in 1950 than in 1913. Actually, the total decrease in openness depended on a composition effect. The growing weight of the United States, from 35% of the cumulated GDP of the 1870 sample in 1913, to 45% in 1929 and to 59% in 1950 accounts for about two thirds of the decrease in total openness from 1913 to 1929 and for more than half from 1913 to 1950.
- iv) from 1950 to 1972, trends in openness by country were very mixed. It jumped in Germany, from around 10%, historically quite a low level, to 18%, remained roughly constant in France, Japan and the

²⁹ The coefficients of correlation are 0.98 for the series of advanced countries, 0.86 for America and the rest of the world and 0.81 for Europe

³⁰ Data on export of services from Mitchell 1988 p.871. The ratio exports services/VA services remained constant as well.

United States and fell in the United Kingdom (from 24 to 15%) and in almost all poor countries of the sample. It halved in India (from about 9% to less than 4%) and Turkey (from 7.5% to 3%) and collapsed in Argentina (from 28% to 5%). In the overwhelming majority of polities (25, including all the large ones, out of 34), openness in 1972 was lower than in 1913. The structural change within explains much of the decline in total openness (or, in other cases, its failure to grow) but in some cases, such as India or the United Kingdom also openness tradables declined, respectively from 40% to 33%, and from 13% to 6%. As said, all the modest increase in world openness depends on changes in the distribution of GDP by country – i.e. on the decline of the United States (from 59% to 42% of the cumulated GDP of the countries of the 1870 sample) and on the rise of Europe (from 24% to 39%).

v) the last period, from 1972 to 2007, featured a widespread increase in total openness and, a fortiori, in openness tradables only. The export/GDP ratio declined only in Cuba, hardly a typical country. However, there were very sizeable differences by polity. For instance, in 2007 total openness was only marginally higher than in the late 1880s in India and only a couple of points higher than the pre-World War One peak in the United States (8%). In contrast, the export/GDP ratio soared in former Socialist countries, such as Russia (from 3% in 1972 to 31% in 2007) and China (from 2.5% to over 40%).

7) The two globalizations and the gains from trade

Arkolakis et al (2012) define the (static) gains from trade as the increase in income which would compensate the representative consumer from a move to autarky and show that in a wide range of models they can be measured as

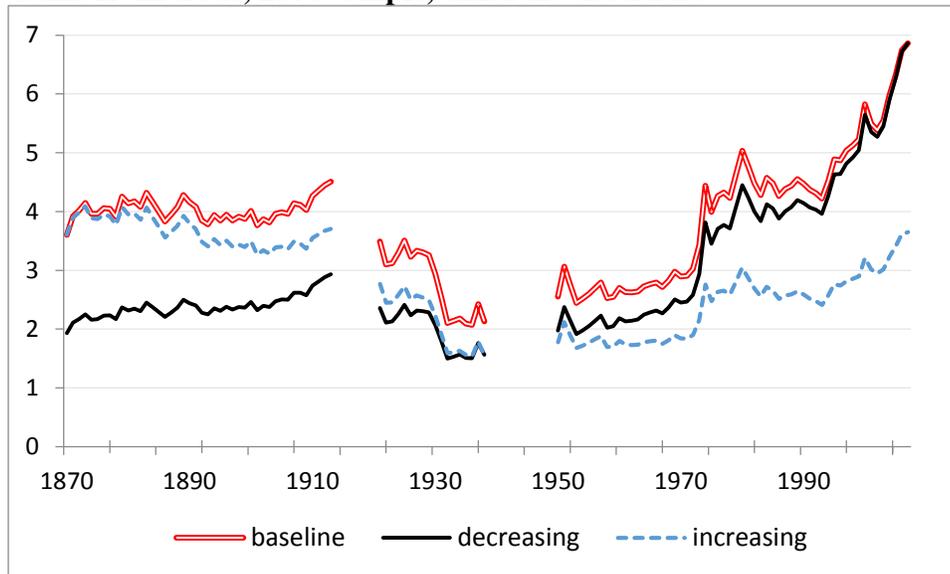
$$G = (\lambda)^{1/\varepsilon} - 1 \quad (11)$$

Where λ is the share of expenditures on domestic products and ε the elasticity of imports to trade costs. We obtain λ as one minus the ratio of imports to GDP and we assume as baseline $\varepsilon = -3.78$, the median value for structural gravity models, as surveyed by following Head and Mayer (2014). Gains in openness were much higher in 2007 (7.2% of GDP) than in 1913 (3.9%) for the extended sample and their movements trace quite closely trends in openness. They almost doubled to the early 1870s from a modest 2.3% from the early 1830s to 4.4% in the 1870s. In the next forty years, gains fluctuated around 4% ending, on the eve of World War One, slightly below the level of the 1870s according to the 1830 sample (4.3% vs. 4.6%) and slightly above for the 1870s sample (4.5% vs. 4.0% in the 1870s). During the 1920s, gains remained slightly above 3% of GDP, and they collapsed during the Great Depression to a minimum of 2% - i.e. below the level of the 1830s. As late as 1973 gains were still barely higher than in 1929 (3.4% vs. 3.2%). During the second globalization, they doubled for the 1870 sample and more than doubled for all countries, jumping from 2.7% to 7.8%. Trade in services added a further 0.3% of GDP in 1980 and 1.8% in 2007.

By definition, these figures would overestimate the gains if the true elasticity were higher than the assumed one. For instance, for $\varepsilon = -10$, at the upper bound of the plausible range, the gains for the extended sample would be only 1.5% in 1913 and 2.7% in 2007. However, the movements would be parallel, as long as the elasticity remained constant. This is not true if we relax the assumption of

constant elasticity (Figure 13). If ϵ increased linearly from -3.78 in 1870 to -7 in 2007, gains would be slightly lower in 2007 (3.65%) than in 1913 (3.70%)³¹.

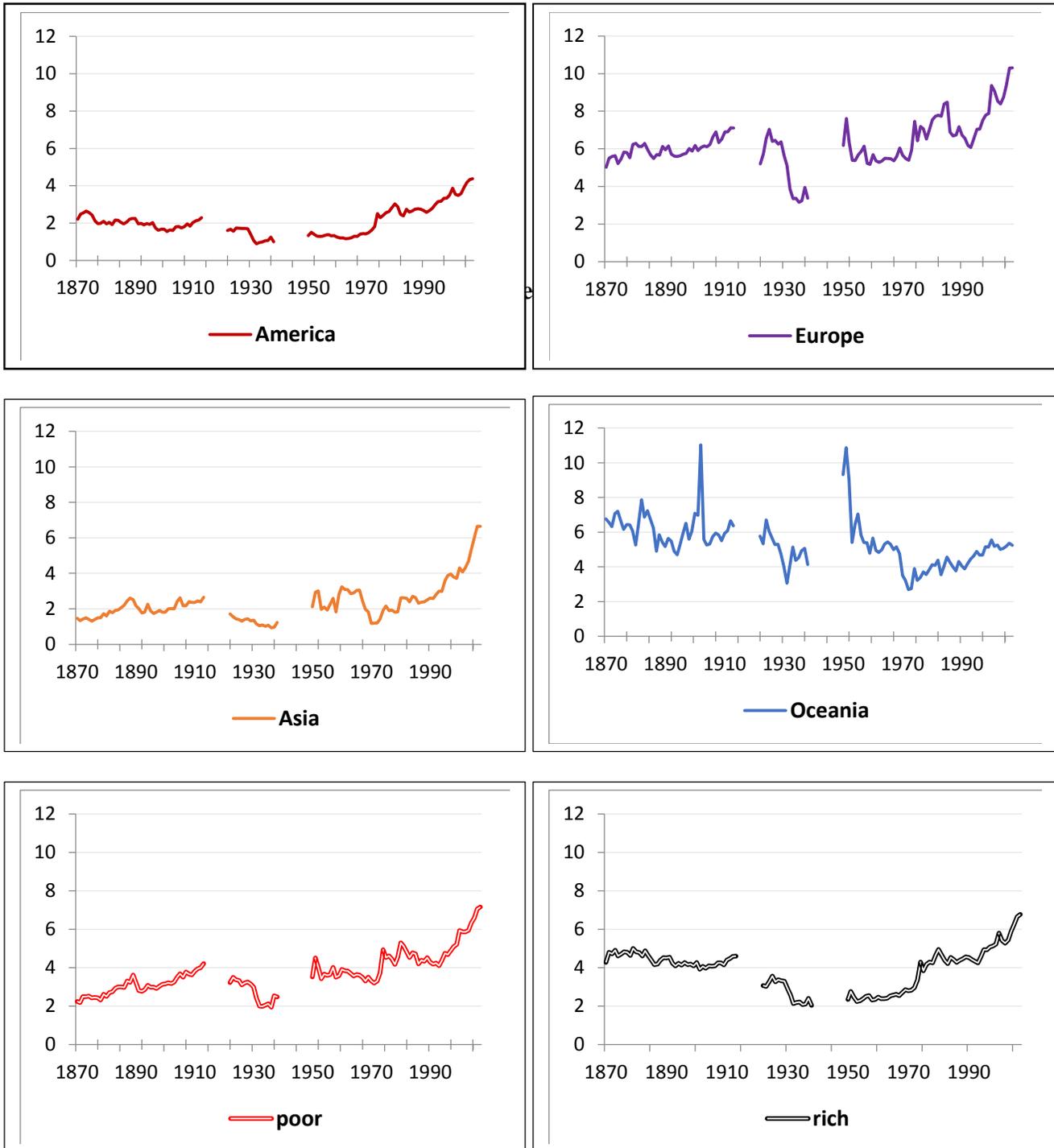
Figure 13
Gains from trade, 1870 sample, different elasticities



We do have any firm evidence about changes in the parameter, and thus in Figure 14 we return to the baseline value to explore the gains by group of polities

³¹ Change in elasticity affect also the estimate of trade costs from 10) – cf Hugot 2014 Figure 27.

Figure 14
Gains from trade, by continent and level of development, 1870-2007



Over the whole period, trade benefitted more Europe than the other continents (and Asia much more than America), and the rich more than the poor. These latter, however, gained more from the second globalization: in 2007 trade increased their GDP, relative to autarchy, by 7.15% and the GDP of the rest of the world by 6.7%. The variance around the sample average remained fairly wide but constant. As a rule, gains are negatively related to size of the country and to the share of non tradables on GDP. Thus, in 2007, the largest economy in the world, the United States gained only 4% from globalization, but three similarly sized (big) countries such as China, Germany, and the United Kingdom gained respectively 8.1%, 10.6% and 6.7%. Gains from were greater in 1913 than in 2007 in about a third of polities. Most of them were exporters of primary products turned inwards, such as Argentina, Brazil and Cuba or Western offshoots, but the gains of the second globalization come out to have been smaller in 2007 than in 1913 also in some advanced countries specialized in services, such as the United Kingdom and Switzerland.

These figures are lower bounds of the total gains from globalization. In fact, they omit the benefits from variety of goods (possibly larger in more recent times than before World War One) and of course all the dynamic gains. One can estimate the total contribution of the exogenous growth of trade to overall economic growth as the change in the ratio of trade (imports plus exports) to GDP times $\delta=1.97$, the elasticity of GDP to trade according to Frenkel and Romer (1999). Needless to say, these figures are very tentative, if any because they rely on a point estimate of δ for 1985.

Table 9

Changes in world GDP and the contribution of growth of trade

	1830 sample		1870 sample		World	
	Trade	Total	Trade	Total	Trade	Total
1830 to 1870	163.4	91.6				
1870 to 1913	11.7	178.5	43.6	177.8		
1913 to 1950	-84.5	102.0	-78.3	103.0		
1950 to 1973	59.1	173.9	66.3	194.7		
1973 to 2007	148.7	172.4	150.6	174.3	232.8	208.5

Sources: see text

Yet, the overall message (Table 9) is clear, and quite consistent with previous results: globalization was a powerful source of growth before 1870 and after 1973, while it played a minor role during the Golden age and, somewhat surprisingly, from 1870 to 1913.

8) Conclusions

We can sum up the discussion so far in two statements First, the conventional periodization has to be revised. Most of the action of the first globalization pre-dated 1870, and the period 1870-1913 can be more accurately described as the first stage of a century long period of fluctuations in openness. It fell during the Great Depression and recovered marginally in the 1950s and 1960s, to start growing again only in the 1970s. The second globalization differed from the first one in four key features

- i) the growth of trade was faster, and since the mid-1990s it moved on a path which cannot be accounted for by the recovery after the shocks of the wars and the Great Depression
- ii) the second globalization, unlike the first, featured a massive change in the distribution of world exports, with the rise of poor Asian countries
- iii) the world-wide level of openness, and thus the gains from trade, was substantially higher at the end of the second globalization in 2007 than at the end of the first in 1913 (or in 1870), but there were quite a few exceptions at a country level
- iv) the growth of services during the second globalization reduced the economy-wide effect of the fast growth in openness in tradables and thus the potential for gains from trade

This last point relates to the current debate on the causes of the second globalization. The growth in openness for tradables since 1970 seems too fast to be explained only by changes in transportation costs and fall in barriers to trade for an invariant bundle of goods. It must reflect also the growing exchange of varieties of the same consumer goods and, above all, the development of international supply chains (Baldwin and Lopez-Gonzalez 2013). It is still debated whether these processes have peaked or not (Boz et al 2014, Costantinescu et al 2015) and consequently whether the level of openness of the late 2000s will prove to be a historical peak as it was the 1913 one, as recently suggested by the *Economist* (A troubling trajectory Dec 13th 2014). We will not speculate further on this. Suffice to say that the answer to our basic question is, at least for trade, a resounding yes. The second globalization is different.

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Appendix A

Sources of GDP data, polity series

A.1 Current prices, 1800-2010

After 1970, we use UN data (GDP 1970-2010 <http://unstats.un.org/unsd/snaama/resQuery.asp> accessed January 2014), already in million dollars. Before 1969 we estimate GDP at current prices from polity-specific sources. We convert local currencies, if not otherwise stated, with the rates from our trade data-base before 1938 and from the GlobalFinancial Database after 1950. The polity-specific sources are ³²

Argentina (1820) 1820-1869 we extrapolate the 1870 GDP with Bulmer Thomas (2014) on line Statistical Appendix tab A.3.4 times population (Federico and Tena 2015??); 1870-1969. Ferreres, O.,(2010).

Australia (1800) Mitchell table J1,

Austria: (1924) Mitchell J1

Austria-Hungary (1913): Schulze (2000) Table A1+A2

Belgium_(1835) Smits et al ³³

Bulgaria (1887-1938) Ivanov (2012) 1887-1924 and Chakalov (1946) 1925-1939

Brazil (1820) IPEADATA

Canada_(1870) 1870-1926 Urquhart 1993 table 1.1 1927-1969 Mitchell J1

Chile (1810) Braun et al 2000 Reflating data at 1995 prices (tab 1.1) with implicit deflator (Tab 4.2)

China (1840-1912) Ma et al 2014 per capita GDP in silver taels times population from (Federico and Tena 2015b)

Colombia (1820) 1820-1904 Bulmer Thomas (2014) on line Statistical Appendix tab A.3.4 times population (Federico and Tena 2015b); 1905-1969 GRECO 1999

Cuba (1820) 1820-1902 Bulmer Thomas (2014) on line Statistical Appendix tab A.3.4 times population (Federico and Tena 2015b) extrapolated to 1969 with the series by Mitchell J1

Denmark (1818) Mitchell tab J1

Egypt (1886) 1886-1945 Youssef 2002 Tab. A.1 1950-1969 Mitchell Tab J1

Finland (1860) Hjerrpe 1989

France (1815) Toutain, 1997 Series V41

French Indochina (1890): Series by Bassino and ??? ff from the GPIH data-base (accessed Nov 2014); scaled up with share Vietnam on the cumulated population of French Indochina in 1950-1852 (ca 80%) ³⁴

³² We add the starting and the final year of the series if different from 1969.

³³ We assume 1830-1834 constant level 1835-1837

³⁴ The data are in Vietnam piaster which before 1830 we assume to have been equal to Mexican peso, as suggested by the author

Germany (1850) 1850-1938 Hoffmann (1965) Tab. 248; 1950-1969 sum of East and West Germany from Mitchell Table J1

Greece (1833) 1833-1938 Kostelenos 2003 tab 2a 1950-1969 Mitchell Table J1

Korea (1911) 1911-1938 Smits, Woltjer and Ma (2009); 1953-1969 Mitchell Table J1 (South Korea only)

India (1870) 1870-1899 Goldsmith (1983) 1900-1946 Sivasubramonian 2000 tab. 6.9 and 1950-1969 Mitchell Tab J1

Italy (1861) Baffigi et al 2013

Japan (1885) 1885-1938 Okhawa and Shinohara (1979) tab A7; 1950-1969 Mitchell tab J1.

Netherlands (1815) 1815-1938 HNA and 1950-1969 Mitchell J1

New Zealand (1860) Statistics New Zealand table E1.1 column Z (consolidated)

Norway (1830) Grytten O. (2003) tab 4 and 5

Ottoman Empire and Turkey (1830) personal communication by S. Pamuk. He has provided a series of Turkish GDP after 1923 and export/GDP estimates for the Ottoman Empire 1820, 1840, 1860, 1880, 1900 and 1911-1913. We have interpolated these latter to get a continuous series and we have computed the GDP in dollars by dividing by our estimates of export at current prices

Peru (1820-1913) Bulmer Thomas Bulmer Thomas (2014) on line Statistical Appendix tab A.3.4 times population (Federico and Tena 2015b)

Portugal (1837) Valerio et al 2001 tab 6.6B and 6.6C

Russia (1885) 1885-1913 Gregory 1982 tab 3.2 and 1928-1969 Mitchell table J1³⁵

South Africa (1911) Mitchell J1 ³⁶

Spain (1850) Prados de la Escosura 2003 cuadro A.2.7

Sweden (1800) Krantz, O. and L. Schön (2012) table V (GDP market prices)

Switzerland (1851) Stohr 2014

United Kingdom (1830) Mitchell 1988 National Accounts series 5 (GDP at factor costs)

United States (1800) Mitchell tab J1 (GNP)

Uruguay (1870) Bonino et al 2012

Taiwan (1903-2007) Mitchell tab J1 ³⁷

A.2 Constant prices

As a rule, we compute GDP at 1990 Geary-Khamis \$ by multiplying GDP per capita by the population at current borders. We get population before 1938 from a newly compiled data-base (Federico and Tena 2015) and after

³⁵ The series of exchange rate of the paper ruble before 1913 is from GFD

³⁶ Before 1938, we assume the rand to have been equal to half the pound sterling

³⁷ The UN does not report data for Taiwan

1950 from the United Nations (2011). Most data on per capita GDP come from the Maddison project data-base. For African countries we have used the data from Prados de la Escosura (2012), while we have used specific sources for the following countries/periods

Bulgaria (1870-1945) Ivanovic (2012) tab.51

China 1800-1840 Broadberry et al (2014) 1840-1912 Ma et al (2014)

French Indochina (1870) Bassino and ?? GPIH data-base (accessed Nov 2014)

India 1820-1871 from Broadberry et al (forthcoming)

Switzerland Stohr 2014, extrapolated backwards to 1830 with the Maddison rate of change 1820-1830

United Kingdom (1820-1859), we extrapolate backwards the series to 1820 with the series by Broadberry et al (2015) which refers to England and Wales only

A.3 Share of tradables

For the years 1970-2012 we follow the series of the UNCTAD-STAT Database. <http://unctadstat.unctad.org/>. GDP by type of expenditure and Value Added by kind of economic activity, annual, 1970-2012. The share of each component of GDP/VA is derived on the basis of current price series in national currency. Service sector is estimated as a residual of the Total Valued Added minus Agricultural, hunting forestry, fishing (ISIC A-B) minus Mining, Manufacturing, Utilities (ISIC C-E). For previous years we follow mostly Mitchell (2007) where service sector is estimated as $1-(A+I)$. A: agriculture (usually including forestry and fisheries); I = manufacturing, mining and construction (usually including utilities). And J.P. Smits, P.J. Woltjer and D. Ma (2009) service sector is estimated as a residual of the total valued added: $1-(A+I)$. A: agriculture (usually including forestry and fisheries); I = manufacturing, mining and construction (usually including utilities). We use also other secondary national sources that are mentioned below following the list of countries and years used. In case of discrepancy of the historical series with the UNCTAD levels in 1970 we follow mostly historical levels but always the UNCTAD trends between 1970-2012.

Argentina 1900-1970 from Smits,J.P., Woltjer,P.J. and Ma, D. (2009) data base and 1970 to 2010 from UNCTAD-STAT Data base.

Australia 1800-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Austria 1910-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Belgium 1835-1970, from Smits,J.P., Woltjer,P.J. and Ma, D. (2009) data base and 1970 to 2010 from UNCTAD-STAT Data base.

Brazil 1920-1970, from Smits,J.P., Woltjer,P.J. and Ma, D. (2009) data base and 1970 to 2010 from UNCTAD-STAT Data base.

Bulgaria 1913 Ivanov (2012) tab 41 and 1936-1970 from Smits,J.P., Woltjer,P.J. and Ma, D. (2009) data base and 1970 to 2010 from UNCTAD-STAT Data base.

Canada 1925-1970, from Mitchell (2007) and 1970 to 2010 from UNCTAD-STAT Data base.

China, 1840-1912, from Tab, B12 of Ma, Y., de Jong, H. and Tianshu Chu, T. (2014). That is Service sector in current tael, as a percentage of current GDP in tael, 1913 extrapolated. For 1934 see Smits-Woltjer-Ma (2009). From 1970-2010 UNCTAD-STAT

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Czechoslovakia 1910-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.
Denmark 1818-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Finland 1860-1915, from Smits, J.P., Woltjer, P.J. and Ma, D. (2009) data base; 1920-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

France 1815-1938, from Smits, J.P., Woltjer, P.J. and Ma, D. (2009) data base; 1945-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Germany/Zollverein 1850-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Greece 1935-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Honduras 1925-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Hungary 1900-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Ireland 1926-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Italy 1861-1970 Baffigi et al 2011, and 1970 to 2010 from UNCTAD-STAT Data base.

India, 1868, 1872, 1882, 1884 to 1889 from Heston (1983) tab 4.3.A (million rupees 1946-1947 prices) that includes small scale service plus house rent, plus government, plus other tertiary (includes railways, 'other commerce and transport', professions domestic services; estimated assuming constant 1900-2 share). For the years 1900-1946 Sivasubramonian (2000) (tab. 6.9, current prices) that includes small scale industry plus Government plus house rents (Heston and Sivasubramonian from 1868 to 1946. from 1946 to 1969.

Japan 1886-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Korea 1911-1938 from Smits, J.P., Woltjer, P.J. and Ma, D. (2009) data base, 1938-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Mexico 1895-1920 from Mitchell (2010) from 1908-1970, from Smits, J.P., Woltjer, P.J. and Ma, D. (2009) data base and 1970 to 2010 from UNCTAD-STAT Data base.

Netherlands 1807-1913, from Smits, J.P., Woltjer, P.J. and Ma, D. (2009) data base; 1935-1970 from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

Spain 1850-1950, Prados de la Escosura (2001) CUADRO A.8., 1950-1970 Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

South Africa 1910-1970, from Mitchell (2007) and 1970 to 2010 from UNCTAD-STAT Data base.

Sweden 1800-1970, from Mitchell (2010) and 1970 to 2010 from UNCTAD-STAT Data base.

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Appendix B

Composition of samples for openness measures

Current prices	Current prices	Constant prices	Tradables
	Klasing-Millionis		
1830 sample	1870 sample	1830 sample	1830 sample
Argentina	Algeria	Argentina	
Australia	Argentina	Australia	Australia
Belgium	Australia	Belgium	Belgium
Brasil	Belgium	Brasil	Denmark
Chile	Brasil	Canada	France
Colombia	British Malaya	Ceylon (Sri Lanka)	Netherlands
Cuba	Canada	Chile	Sweden
Denmark	Ceylon (Sri Lanka)	Colombia	United Kingdom
France	Chile	Cuba	
			1870 sample
Netherlands	China	Denmark	(additional)
Norway	Denmark	Dutch East Indies (Indonesia)	Finland
Ottoman Empire/Turkey	Dutch East Indies (Indonesia)	Ecuador	Germany
Portugal	Egypt	Finland	India
Sweden	Finland	France	Italy
United Kingdom	France	Germany	Norway
United States	Germany	India	Spain
Venezuela	Ghana	Italy	United States
1870 sample (additional)	Greece	Jamaica	
Canada	India	Mauritius	
Finland	Italy	Mexico	
Germany	Jamaica	Morocco	
Greece	Japan	Netherlands	
India	Morocco	New Zealand	
Italy	Mexico	Norway	
New Zealand	Netherlands	Ottoman Empire/Turkey	
Spain	New Zealand	Peru	
Switzerland	Norway	Philippines	
Uruguay	Ottoman Empire/Turkey	Portugal	
	Persia (Iran)	South Africa	
	Philippines	Spain	
Extended sample (1913 and 2007)			
Austria-Hungary *	Portugal	Sweden	
Bulgaria	Romania	Switzerland	
China	Russia/USSR	Tunisia	
	Serbia/Yugoslavia	United Kingdom	

Egypt	Siam (Thailand)	United States
French Indochina **	South Africa	Uruguay
Japan	Spain	Venezuela
Korea	Sweden	
Peru	Switzerland	1870 sample (additional)
Russia***	Tunisia	Egypt
South Africa	United Kingdom	Cameroon
Taiwan	United States	British Malaya
	Uruguay	Japan
	Venezuela	Siam

* in 2007 sum of Austria, Czech Republic, Croatia, Hungary, Slovenia and Slovakia

** in 2007 sum of Cambodia, Laos and Vietnam

*** in 2007 sum of former Soviet republics

Appendix C

World trade statistics after 1938

The United Nations has published series of trade by country in dollars since 1948 in its Yearbook of international trade statistics, and since 1980 in its website (UNCTAD-STAT). Some countries, such as China, USSR and the Socialist countries and Germany, are missing in the first two years, but since 1950 the coverage is complete. With few adjustments to take into account boundary changes, it is thus possible to build series by country at current borders and link to our series before 1938. The series of world trade at current prices is thus perfectly comparable with the pre-1938 series.

The case is somewhat different for the series at constant prices (or in the UN jargon the volume index), which is available since 1950 and can be linked to our series with the data from UN Historical 1962. Unfortunately, the description of the series in the early issues of the Yearbook is not very informative: ‘an estimate (as far as possible based on national quantum or unit value indices [emphasis ours]) of current exports at base year prices is divided by the value of the exports in the base period, yielding an approximation to the Laspeyres formula’ (Yearbook 1956 p. 16). The source does not list countries and a look at the data shows wide gaps, especially, but not exclusively, for African and Asian countries around the period of their independence. The series for (mainland) China starts only in 1991. The coverage improves since 1980: the UNCTAD-STAT reports volume indexes for 90-100 countries from 1980 to 2000 and for over 200 thereafter and an official methodological paper (United Nations 1991) states that the index covers all advanced countries (25) and 62 developing countries. It is thus likely, although by no means sure, that the sample underlying the series of world trade has changed in time.

As a whole, we have collected data from the Yearbooks for 92 countries, but we have been able to construct only 59 series from 1950 to 2007, and to link only 53 of them (corresponding to 51 polities at pre-war boundaries) to 1938³⁸. For his task, we have used the following sources

Coverage at constant prices

Sources for series

Argentina 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Austria 1938- 1959 UN 1962, 1960-1992 Quantum index UN Yearbook 1992, 1993-1999 Value exports from International trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014) deflated with Austrian export price indexes, 2000-2010 Volume exports from International trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)³⁹

Australia 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

³⁸ These 51 polities includes British Malaya and Rhodesia, which we estimate as sum of exports at 1990 prices respectively from Malaysia and Singapore and from Zambia and Zimbabwe. Thus, we have reconstructed 53 country series after 1951.

³⁹ Index prices 1992-1995 from Statistik Austria

(http://www.statistik.at/web_de/statistiken/aussenhandel/hauptdaten/index.html) and 1995-2000 Eurostat

- Belgium** 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Brazil** 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Cameroon** 1938-1950 Quantum index UN Yearbook 1959, 1951-1968 Quantum index UN Yearbook 1982, 1969-1977 IMF International financial statistics Yearbook 1979, 1978-79 Value from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014) deflated with **price of ?? /main export coffee and cocoa/ IMF** 1980-2010 Volume index from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Canada** 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Chile** 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Colombia** 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Cuba** 1938-1959 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1960-1999 Bulmer Thomas 2011 Statistical Appendix tab D 10 2000-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Costa Rica** 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Denmark** 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Dominican Republic** 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Ecuador** 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014); 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)
- Egypt** 1938-1958 quantum exports from UN Yearbook 1959; 1959-1963 Value exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014), deflated with a geometric average unit value indexes for Morocco and Tunisia (UN Yearbook 1982), 1964-1979 Volume index from UN Yearbook 1982; 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

El Salvador 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Finland 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)⁴⁰

France 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Germany 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Guatemala 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Haiti 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Honduras 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

India 1938-1949 Quantum index from UN 1962, 1951-1960 UN Yearbook 1981; 1961-1980 Volume index UN Yearbook 1992; 1981-2010 Volume index from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Indonesia 1938-1969 Quantum index from Rosendale, Phyllis (1978) 'The Indonesian Balance of Payments, 1950-1976 – Some New Estimates'. PhD thesis, Australian National University, pp.28-29 and Van der Eng personal communication; 1970-1979 Quantum index UN Yearbook 1982 and 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Ireland 1938-1950 Quantum index from UN Yearbook 1959, 1951-1960 Quantum index from UN Yearbook 1982, 1961-1992 Volume index from UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Italy 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Jamaica 1938-1949 Quantum index from UN Yearbook 1959, 1950-1978 Quantum index from UN Yearbook 1982, 1979-1980 Bulmer Thomas 2011 Appendix tab D.10; 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

⁴⁰ 1992 and 1993 unit value clearly wrong – interpolated with TRAMO routine

Japan 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Malaysia 1938-1950 Quantum index UN Yearbook 1959, 1951-1978 IMF International financial statistics Yearbook 1979, 1978-79 Value from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014) deflated with unit value index from UN Yearbook 1995, 1980-2010 Volume index as sum of trade for Malaysia and Singapore at 2000 prices, computed with data from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Mauritius 1938-1949 Quantum index from UN Yearbook 1959, 1950-1960 Quantum index from UN Yearbook 1982, 1961-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Mexico 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Morocco 1938-1950 Quantum index from UN Yearbook 1959 (assuming a 25% increase 1948-1949), 1951-1960 Quantum index from UN Yearbook 1982, 1961-1980 Quantum index from UN Yearbook 1992, 1981-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Netherlands 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

New Zealand 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Nicaragua 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Norway 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Panama 1938-1947 UN Yearbook 1959 1948-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Paraguay 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Peru 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Philippines 1938-1950 Quantum exports UN Yearbook 1959, 1951-1979 Quantum exports UN Yearbook 1982 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Poland 1938-1947 Quantum exports UN Yearbook 1950, 1948-1949 Quantum exports UN Yearbook 1952, 1950-1960 Quantum exports UN Yearbook 1982, 1960-1990 Quantum exports UN Yearbook 1993 1991-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Portugal 1938-1950 Quantum exports UN Yearbook 1959, 1951-1977 Quantum exports UN Yearbook 1982, 1978-1982 Value of exports, deflated with index of unit values from Spain, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014), 1983-1999 IMF International Financial Statistics 2000-2010, Volume index from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

South Africa 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Spain 1935-1950 Quantum exports UN Yearbook 1959 (adjusted to 1938 level with the Spain index in the data-base), 1951-1960 Quantum exports UN Yearbook 1982, 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Sri Lanka 1938-1949 Quantum exports UN Yearbook 1959, 1950-1959 Quantum exports UN Yearbook 1982, 1960-1979; 1980-2010 Volume index International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Sweden 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Switzerland 1938-1950 Quantum index from UN 1962, 1951-1960 Quantum exports UN Yearbook 1982, 1961-1989 Quantum exports UN Yearbook 1992, 1990-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Thailand Quantum exports 1938-1949 UN yearbook 1959 1950-1979 UN yearbook 1982 1980-2010 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Tunisia 1938-1949 Quantum exports UN Yearbook 1955, 1950-1979 Quantum exports UN Yearbook 1982 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Turkey 1938-1958 Quantum exports 1938-1958 UN yearbook 1959; 1959-1968 value of exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014) deflated with geometric average of unit value indexes for Greece, Spain and Portugal from UN Yearbook 1982; 1969-1979 Quantum exports from UN Yearbook 1992; 1980-2010 Volume index from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

United Kingdom 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1992 UN Yearbook 1992; 1993-2010 value exports deflated with Unit value index, both from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

United States 1938-1950 Quantum index from UN 1962; 1951-1960 UN yearbook 1982; 1961-1980 UN Yearbook 1992; 1981-2010 Volume index from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Uruguay 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Venezuela 1938-1979 Volume exports from MOXLAD ((<http://moxlad.fcs.edu.uy/en/databaseaccess.html> Accessed June 2014) 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Zambia 1939-1951 Quantum exports UN Yearbook 1955 (Rhodesia), 1952-1958 Quantum exports UN Yearbook 1959 (Rhodesia and Nyasaland); 1959-1964 IMF International financial statistics Yearbook 1979. 1965-1978 Quantum exports UN Yearbook 1981, 1979-1980 interpolated with series for Zimbabwe, 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)

Zimbabwe 1939-1951 Quantum exports UN Yearbook 1955 (Rhodesia), 1952-1958 Quantum exports UN Yearbook 1959 (Rhodesia and Nyasaland); 1958-1965 interpolated with series for Zambia; 1965-1979 Quantum exports UN Yearbook 1992; 1980-2010 Volume exports from International Trade Statistics (<http://unctad.org/en/pages/Statistics.aspx>, version 2013-07-25 Accessed April 2014)