

THE RECONSTRUCTION OF BRAZIL'S FOREIGN TRADE SERIES, 1821-1913*

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ABSTRACT

To date, research on the economic history of Brazil during the 19th century has relied on official foreign trade statistics, the accuracy of which has repeatedly been put into question. This paper provides insights into the accuracy of the official series by examining the accuracy of the export and import series for Brazil during the 19th century. We re-estimate the official import series using trading partner sources, and find that the official series was marginally under-valued during certain periods of the 19th century. Furthermore, we provide new upper- and lower-bound estimates of the export series by testing different assumptions regarding the size of the cost, insurance and freight to free on board factor adjustments. Finally, we introduce a new import price index for the period 1827-1913.

Keywords: Brazil, imports, exports, price indices

JEL Code: F14, N76

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RESUMEN

Hasta la fecha, la investigación sobre la historia económica de Brasil durante el siglo XIX ha dependido de las estadísticas oficiales del comercio exterior, cuya precisión se ha puesto en entredicho reiteradamente. Este trabajo proporciona una visión más profunda de la serie oficial, examinando la fiabilidad de las series de importaciones y exportaciones brasileñas durante el siglo XIX. Reestimamos la serie oficial de importaciones con las fuentes de los socios comerciales, y sostenemos que la serie oficial era marginalmente infravalorada durante ciertos periodos del siglo XIX. Además, ofrecemos nuevas estimaciones de alto y bajo límite de la serie de exportaciones mediante la prueba de diferentes suposiciones con respecto al tamaño de los ajustes de factor CIF-FOB. Finalmente, introducimos un nuevo índice de precios de importaciones para el periodo 1827-1913.

Palabras clave: Brasil, Importaciones, Exportaciones, Índices de precios

1. INTRODUCTION

Foreign trade statistics are perhaps among the most useful — not to mention plentiful — sets of data available to economic historians. For this reason, issues regarding the accuracy of these statistics have long been discussed. The case of Brazil is not much different. Although the weaknesses of the foreign trade statistics were well known by the government officials who elaborated and applied them, a lack of resources and the fiscal exigencies of the state delayed the modernisation of the statistical apparatus until around the turn of the 19th century. Perhaps the first systematic attempt to examine the accuracy of the foreign trade series was the work of Wileman (1896), who concluded in his *Brazilian Exchange* of 1896 that the official statistics were under-valued. Almost a century later, other scholars, including Luiz Aranha Corrêa do Lago and Gustavo Henrique Barroso Franco, provided further corrections to the series (Lago 1982, 1986; Franco 1988). As both Corrêa do Lago and Franco argued when reassessing the Brazilian balance of payments during the 19th century, the correction of the foreign trade series can lead to a considerable re-interpretation of historical events.

This paper follows these attempts to correct the official series. In a previous paper (Absell and Tena-Junguito 2016), we provided a reconstruction of the export series, comparing the official prices of Brazil's principal export commodities with their corresponding international prices. The results demonstrated that there remains much work to be done with respect to the reconstruction of the official series for the 19th century, and much to be learnt from this exercise for Brazilian historiography. For reasons mentioned

below, the official export series was found to be considerably under-valued during certain periods. The correction of the export series highlighted a key insight not adequately explored by the literature: Brazilian export growth was more positive during the post-independence period than any other time in the 19th century. As we argue in this paper, this result is robust to changes in the assumptions underlining the methodology used in the reconstruction.

To our knowledge, this paper also provides the first attempt to comprehensively evaluate the official import series. The aforementioned scholars highlighted the failings of the official series, and made important corrections regarding the inclusion of specie movements. Here we examine the accuracy of both the geographical distribution and value of the import series. The results show that Brazil's official import series was also under-valued during certain key periods, most likely due to the use of official prices. These results suggest that the accuracy of the official series should be at the centre of any discussion regarding the revision of Brazil's trade balance and balance of payments during the 19th century.

This paper also provides estimates of Brazil's export and import price indices. This is an important contribution, given that the pre-existing indices either use official price data or do not refer explicitly to the prices of Brazil's exports or imports. Instead of using official price data, we present new export and import price indices using international and domestic market price data. The case of imports is especially important, given that the literature has principally relied on Albert Imlah's (1958) British export price index to study the long-term trend of Brazil's import prices. The improvement of Brazil's price indices will serve to clarify the debate regarding the secular decline in the terms of trade during the 19th century (Gonçalves and Barros 1982; Leff 1982; Kannebley and Gremaud 2003).

The weight of the paper is necessarily placed on the accuracy and correction of the import series, as the export series has been dealt with by the authors in previous work. We re-estimate the official import series using trading partner sources, and construct a new import price index for the period 1827-1913. We then reconsider the reliability of the corrected export series by questioning several of the assumptions regarding trade costs. The final section concludes with a brief discussion of the future direction of work on the Brazilian foreign trade series.

2. AN OVERVIEW OF BRAZIL'S HISTORICAL FOREIGN TRADE SERIES

The official series of Brazil's exports and imports begins in 1821¹. It remains unclear what the sources were for the period from independence in 1822 to the 1840s, although the government's reliance on — and thus

¹ The source for the official import by value and export by value and quantity series is IBGE (1990), compiled by Gustavo Henrique Barroso Franco, which contains the series originally printed

constant preoccupation with the calculation of — the fiscal revenues derived from the taxation of commerce resulted in the reorganisation of the customs house in the 1830s. The increased dynamism of foreign trade after independence led to organisational changes and investment in maritime infrastructure (Brazil. Ministério da Fazenda 1835, pp. 57-64). Over time, these changes seemingly generated the demand for the organisation of a statistical apparatus. In 1845, the Imperial government created the first Imperial statistical commission with the explicit intention of organising and publishing the foreign trade statistics for the fiscal years spanning the period 1830-1831 to 1844-1845. The commission soon admitted that the period prior to 1840 was beyond its technical reach (or, as the 1846 report of the commission drily put it, «... the elements do not yet exist to form a complete collection»), and committed itself to elaborating annual series of exports and imports by product, origin and destination (Brazil. Ministério da Fazenda 1846, pp. 34-36; Brazil. Ministério da Fazenda 1848, pp. 27-28). To assemble the statistics on a national level, the commission relied upon the customs houses to provide the information on quantities, values, origins and destinations of imports, exports and internal trade. Officials complained repeatedly about the quality of the information supplied by customs houses; products of diverse qualities were often included in a single category, old official price lists were used, customs officials deliberately misreported quantities and values, and sometimes the paperwork containing this information (the *mappas parciaes*) did not arrive at all (Brazil. Ministério da Fazenda 1894; Brazil 1853). To obviate the latter problem, the commission calculated missing import and export values using the available information on fiscal revenue. The fruit of the commission's work is compiled in the *Collecção de Mappas Estatísticos do Commercio e Navegação do Império do Brasil*, of which the fiscal years 1841-42, 1842-43, 1846-47, 1848-49 and 1849-50 have been digitised².

During the period encompassing the fiscal years 1853-1854 to 1867-1868 the Finance Ministry reported the official value of bilateral trade in its Ministerial Reports, the data being provided by the *Diretoria Geral das Rendas Publicas*. The detailed work of the first commission, however, was discontinued until 1870, when the government created a second statistical commission headed by Sebastião Ferreira Soares³. Much like its predecessor, the role of the second commission was to organise the country's statistics on maritime commerce that had fallen into disrepair since the 1850s (Brazil. Ministério da Fazenda 1885, p. 39). Soares and team's work yielded the publication of a series of volumes of *Estatística do Commercio*

(footnote continued)

in the *Anuário Estatístico* of 1939-1940 and updated to include the previously mentioned revisions by Luiz Aranha Corrêa do Lago.

² See the digitised publication list at memoria.org.br.

³ Soares (1865) provided the outlines of the organisation of the nation's statistical apparatus.

Marítimo do Brasil covering the early 1870s⁴. As Gustavo Henrique Barroso Franco observed, the period from the death of Soares in 1887 to the reconfiguration of the statistical apparatus around the turn of the century by British civil engineer J. P. Wileman is *terra incognita* as far as the origin of the available national totals of exports and imports is concerned (Franco 1990, p. 559). However, government officials did show concern regarding the disorder of the country's statistics. In 1895 Honorio Alonso Baptista Franco, member of the commission for the revision of the Brazilian tariff, was sent to inspect the workings of the Rio de Janeiro customs house. In an account published in the annual report of the Finance Ministry in 1896, Baptista Franco observed that «It is physically and morally impossible that work of such a scope ... referring to not only the biggest customs house in Brazil, but also in all of South America ... can be elaborated by only six employees, two of which were sometimes distracted by other tasks» (Brazil. Ministério da Fazenda 1896, anexo, p. 23). Customs house officials continually justified delays in the elaboration of statistics by a lack of resources and specialised personnel (Brazil. Ministério da Fazenda 1896, p. 224). In response to these calls and to cover required expenses, the government created a «statistics tax» (*imposto de estatística*) in 1897 that provided enough revenue to cover the salary and rent expenses of the newly created *Serviço Especial de Estatística* (Brazil. Ministério da Fazenda 1901, p. 47). Wileman was appointed as director of the *Serviço* in 1900, and from 1901 onwards, Brazil's trade statistics were reported annually in *Commercio Exterior do Brasil*, which, like Wileman's previous work, explicitly concerned itself with the mirror comparison of Brazil's trade records with those of its principal trading partners in an effort to improve the accuracy of the data.

The results of one such mirror comparison for the period 1902-1914, incorporating the export statistics of Great Britain, the United States and Germany, and the corresponding official Brazilian import statistics, provided grounds for celebrating the success of the modernisation of Brazil's statistical apparatus. The report concluded that «...the differences between the totals ... are not important ... and are sometimes even trifling» (Brazil 1915, p. LXX)⁵. This accords with the recent evaluation of the export series, which tended towards accuracy after 1901 (Absell and Tena-Junguito 2016). Nevertheless, it remains to be seen whether such conclusions apply to the 19th century statistics.

⁴ The years 1870-1871 to 1872-1873 have been digitalised. According to official reports (Brazil. Ministério da Fazenda 1885, p. 40): «The work done by the Commission, and by the current *Repartição de Estatística*, form 44 volumes, of which only 19 have been printed». This work covered the period 1869-1870 to 1877-1878, although it is unclear which of these volumes were eventually published.

⁵ Carreras-Marín and Badia-Miró (2008), however, found that in the case of coal imports from Great Britain and the United States for the period 1908-1930, Brazilian records were consistently under-valued, indicating the inclusion of transit in trading partner records.

There are two possibilities regarding the bias of the official statistics: one concerning quantities, the other prices. The accuracy of the first may be affected by several causes, the most common being smuggling, misreporting and incorrect classification of merchandise. If these were truly problems, then one would assume that the series would be biased downwards, as the official statistics under-report the true quantity imported. Officials were only too aware of these problems, however, and the use of specific rates (*taxas fixas*) to tax imports was justified on the grounds that they reduced the incidence of fraudulent activity (Fontoura 1889, p. 47). The second potential source of bias concerns the official prices. These were defined principally for fiscal reasons, given that taxes on trade (mostly imports) were Brazil's principal source of fiscal revenue during most of the 19th century⁶. In the case of imports, tariff commissions defined the classification scheme and official price of each product based on an average of market prices. Specific rates were then calculated by applying an ad valorem tariff to the corresponding official prices⁷. Similarly, in the case of exports, the official values were fixed by a weekly price list (the *pauta*), meant to reflect the average market prices of each commodity. Customs officials used this information, together with the quantities registered of incoming and outgoing merchandise, to calculate the weight of the tax and the corresponding values, which were included in the *mappas* sent to the statistical agency to calculate the aggregate statistics. As we shall see below in the case of imports, these official prices were liable to diverge from market prices, whether due to strategic overvaluation for fiscal reasons, or delays in updating the official price lists⁸. From 1901 onwards, import values were listed as declared values in cost, insurance and freight (c.i.f.) form, while export values relied principally on market prices and included export duties but not freight, insurance or landing costs (Brazil 1915, p. XXI).

3. THE IMPORT SERIES

Here we seek to examine the accuracy of Brazil's official import series. The standard procedure for assessing the accuracy of the import series is to compare the official prices and quantities of Brazil's import statistics with those of its principal trading partners. Unfortunately, a complete series of official import prices and quantities do not exist, so we are unable to

⁶ As Manuel Alves Branco observed in 1844, «...the first object of the tariff is to correct the deficit from which the country has long suffered...» (Fontoura n/d, p. 34).

⁷ For an example of this process see the *Tabella de direitos* in Brazil (1853).

⁸ Rui Barbosa, writing in the 1889-1890 annual report of the Finance Ministry observed that «... almost always the national products exported and foreign products imported are sold ... at higher or lower prices than those calculated and used by the customs houses to collect customs duties». «Thus, one cannot trust the value of imports and exports of this country listed in the statistical tables of commerce and navigation...» (Brazil. Ministério da Fazenda 1891, p. 341).

implement such a procedure. Instead, we estimate a new import series based on the existing partner statistics and compare this to the official series. Thus, the methodology adopted here is to take the sum of the trading partner statistics and to add a «residual» that corresponds with the percentage of imports not covered by our trading partner sample. The coverage is calculated as the percentage of each trading partner in total import value according to official Brazilian sources. As previously mentioned, we possess only a broken series of bilateral observations from Brazilian sources for the 19th century, including the information compiled in the *Collecção de Mappas Estatísticos*, the bilateral data published in the *Relatorios* of the Finance Ministry, a set of years from the *Estatística do Commercio Marítimo*, and the period from 1901 onwards given in *Commercio Exterior do Brasil*. We fill in the gaps by taking several benchmark years for imports into Rio de Janeiro from the *Mappas estatísticos do commercio e navegação do Porto do Rio de Janeiro* (Brazil. Alfândega do Rio de Janeiro, Various years). Furthermore, we add a benchmark for Rio de Janeiro in 1836 from Sturz (1837, p. 100). We assume that the geographical distribution of imports into Rio de Janeiro was representative for these benchmark years. For those periods in which the geographical distribution of imports is not available, we construct a time series by way of interpolation. We additionally assume that interpolation is an acceptable practice in this context given that there were no sudden changes in the geographical composition of Brazil's imports. To this effect, we use data from eight of Brazil's principal trading partners (Great Britain, the United States, France, Spain, Portugal, Chile, Belgium and Hamburg/Germany), adjusted for insurance and freight costs. Table 1 displays the descriptive statistics of this sample. Unfortunately, for the first 5 years of the period (1821-1826) we can only include the United Kingdom and the United States. However, these two countries alone constituted around 54 per cent of Brazil's imports by value. Over the following few decades the sample expands to include eight countries and to represent over 90 per cent of Brazil's imports by value.

We construct the new import series using the formula:

$$M_{br,t} = \sum X_{i,t} \left(\frac{1}{\sum c_{i,t}} \right)$$

where Brazil's imports (M) in year t are calculated by taking the product of the sum of the exports (X) of each trading partner i in the sample and the inverse of the sum of the percentage of trading partner c_i in total import value.

When attempting to estimate the import series, an important assumption is the size of the freight factor. Like the export series, existing outgoing freight data (from Europe and the United States) either does not cover the whole period under study, is for destinations other than Brazil, or does not cover the entire composition of Brazil's imports. For these reasons, again,

TABLE 1
 TRADING PARTNER SAMPLE AND TEMPORAL AND IMPORT VALUE COVERAGE,
 BRAZIL, 1821-1913

Country	Period	Missing years
United Kingdom	1821-1913	
United States	1821-1913	
France	1827-1913	
Hamburg	1831-56	38
Belgium	1834-1913	
Portugal	1837-1913	38-41, 45-47, 49-50, 52-54, 57-60, 62-64
Chile	1843-1913	49, 55, 69, 07
Spain	1849-1913	69
Germany	1880-1913	
Coverage	Year	% Total import value
Minimum	1821	54
Mean	1821-1913	76
Median	1821-1913	77
Maximum	1880	94

Sources: Belgium (Various years), France (Various years), Chile (Various years), Germany (Various years), Germany. Hamburg (Various years), Lains and Silva (1992), Spain (Various years), United Kingdom (Various years), United Kingdom. Board of Trade (Various Years), United States. Treasury Office (Various Years). Complemented by data taken from RICardo database, see <http://ricardo.medialab.sciences-po.fr/#/>; Dedinger and Girard (2017). Exchange rates from Federico and Tena-Junguito (2016). Coverage taken from Brazil (Various years); Brazil. Sebastião Ferreira Soares (Various years), Brazil. Ministerio da Fazenda (Various years); Brazil. Alfândega do Rio de Janeiro (Various years), Brazil (1915), Sturz (1837).

like the export series, we calculate a lower and upper bound estimate of the freight factor used to adjust the partner statistics from c.i.f. to free on board (f.o.b.) values. The lower bound is the weighted average of the freight factor of 11 of Brazil's principal import commodities⁹. A number of these freights are for different routes and are adjusted for the corresponding distance differential. Furthermore, we chain several of these series to existing freight indices to overcome the problem of temporal coverage. The lower-bound

⁹ These commodities include beer and ale, coals, cotton manufactures (plain, printed, dyed, bleached and unbleached), beef (salted or cured), wheat flour, iron bars, and petroleum. See Online Appendix for the series and sources.

factor ranges from 6 to 15 per cent, averaging 12 per cent over the period. Although freights were generally higher than 12 per cent of the import price, especially for the period before the dominance of steam, this estimate is biased downwards by the preponderance of cotton manufactures in Brazil's import composition and the corresponding low freight factor of this product. The upper bound estimate attempts to balance this downwards bias by taking an unweighted average of the same sample of commodities. The upper bound factor ranges from 18 to 30 per cent, averaging 23 per cent. Estimates of the freight factor given in *Comercio exterior do Brasil* (Brazil 1915, pp. 9-13) for the period 1901-1914 lie in between our lower- and upper-bound estimates. We also assume a 2 per cent insurance cost, in line with existing data for the period (Schöller 1951; Llorca-Jaña 2011).

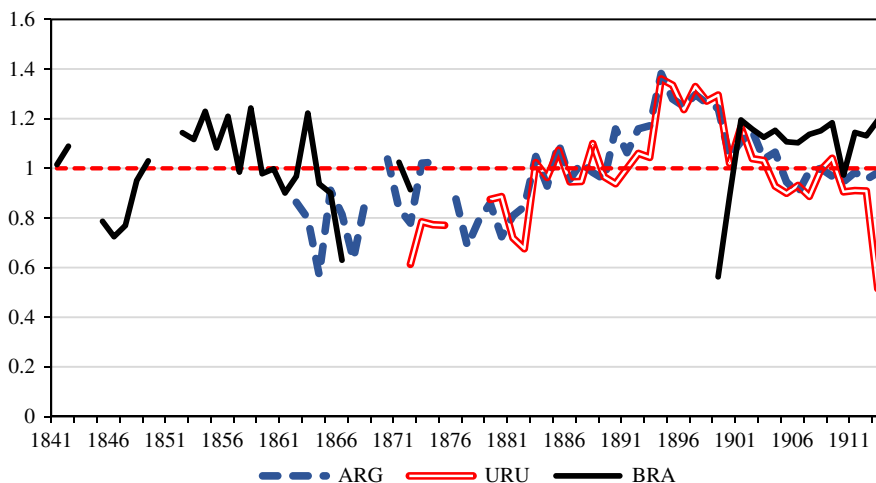
A further consideration is the inclusion of transit trade in the trading partner records. Given that Brazil, and especially Rio de Janeiro, was an important port of call for the transit trade, the geographical assignment of the partner series to Brazil may include commodities ultimately destined for the Rio de la Plata¹⁰. If this is the case, the geographical distribution of Brazil's imports should appear as under-valued when compared to the trading partner statistics. On the other hand, the Argentine and Uruguayan statistics, where available, should be over-valued when compared to the corresponding partner records. We test this hypothesis by running a mirror comparison of the sums of the value of exports of the Rio de la Plata's principal trading partners with the official values listed in Brazilian, Argentine and Uruguayan sources. We include the trading partners mentioned previously, excepting Portugal for which we lack sufficient bilateral data in the case of Uruguay. We adjust these partner records by the lower-bound freight factor and insurance estimate as described above. As previously mentioned, the construction of a continuous time series is restricted by the paucity of sources. Although this prevents us from undertaking a precise evaluation of the accuracy of the geographical distribution of Brazil's bilateral series, it allows us to evaluate the degree and tendency of the bias in the statistics. An additional restriction is the temporal coverage of Argentine and Uruguayan official sources: these are limited until the period from 1870 onwards. We have extended the Argentine series by using import data for Buenos Aires for several years. This is justified by the fact that Buenos Aires was the principle Argentine receiving port for trade during these years¹¹.

Figure 1 displays the results of our test of geographical distribution. Although it is difficult to draw conclusions due to the paucity of data, it is not immediately obvious that trading partner statistics were overwhelmingly

¹⁰ For example, the British geographical assignment of exports did not register the country of final destination until 1904. Prior to this year, it only registered the country to which exports were directly shipped (Stafford *et al.* 1953, p. 290).

¹¹ Buenos Aires accounted for 81 per cent of imports in 1864, according to official sources (Argentina, 1867, p. 331).

FIGURE 1
ACCURACY TEST OF GEOGRAPHICAL DISTRIBUTION OF IMPORTS, BRAZIL
(BRA), ARGENTINA (ARG), URUGUAY (URU), 1841-1913 (1 = ACCURATE)



Sources: Same as Table 1.

biased by the mis-specification of exports. To begin with, the period when Brazil's geographical distribution tends towards under-valuation (seemingly from 1862 until the reorganisation of the statistical apparatus around the turn of the century) corresponds with the under-valuation of the Argentine and Uruguayan records. The only period that may lend weight to the argument is the 1890s, when both the Argentine and Uruguayan records were around 20 per cent over-valued with respect to partner records. Unfortunately, we only possess official Brazilian bilateral data from 1899 onwards, and thus are unable to confirm or reject this hypothesis for this period. For the purposes of our re-estimate, however, we assume that the trading partner statistics are not biased beyond remedy by the incorrect specification of the geographical distribution of exports.

An additional question concerns the inclusion of foreign re-exports. Re-exports were an important component of the exports of Brazil's principal trading partners. In the case of the United States, re-exports averaged around 17 per cent of the country's total exports to Brazil during the period 1821-1850, declining to an average of 2 per cent during the rest of the century. Great Britain's exports of colonial and foreign merchandise accounted for a lesser share, averaging 4 per cent of exports from 1854 to 1913. The value of the French *commerce général*, which included both French and foreign exports, was 38 per cent higher on average over the century than

France's exports of domestic merchandise, or *commerce spécial*¹². A key question is whether the official series reflected these additional trade flows. The period before the modernisation of Brazil's statistical apparatus around the turn of the century is ambiguous, given the general paucity of information regarding the elaboration of the import series. The introductory notes to the *Collecção de Mappas Estatísticos* defined general imports as including «... all categories and merchandise of foreign production and manufacture imported directly from the country of origin» («dos proprios paizes») (Brazil, Various years). A similar definition appeared in Soares' glossary included in the *Estatística do Commercio Marítimo* (Brazil. Sebastião Ferreira Soares, Various years). After 1901, the Brazilian import statistics explicitly included «... both direct imports, and those that arrive in transit from other countries» (Brazil 1904). Here we seek to confirm whether re-exports were included in the official imports series. If so, then the official series should be over-valued when compared to our estimate without re-exports. Likewise, the addition of re-exports to the trading partner statistics should bring our estimate closer to parity with the official series. We include the re-exports of the above-mentioned three countries, given their primacy as trading partners and the availability of data on re-exports for most of the period under question.

Table 2 shows the ratio of the official import series, at current prices, to our re-estimate, considering the above-mentioned issues. We present the ratio adjusted for (a) the weighted, or lower bound, estimate of the freight factor, (b) the unweighted, or upper bound, estimate of the freight factor and (c) the latter as well as the inclusion of re-exports from the United States, Great Britain and France. For the whole period (1821-1913), the official series is surprisingly accurate. The results, however, indicate a certain degree of under-valuation during most of the 19th century. This is especially evident when re-exports are included. As expected, the new estimate corresponds closely to the official series after 1901, reflecting the improved accuracy of the Brazilian statistics.

Figure 2 displays the official series alongside the sum of our trading partner series and the re-estimate including the lower-bound freight factor and re-exports, in current US dollars. Since the coverage of the sum of our sample of trading partners does not reach 100 per cent, this sum should always lie below the official series. With few exceptions, however, we observe that this is not the case. The degree of under-valuation of the official series is particularly notable during the period immediately following independence (1822-1840), and during the period spanning the Paraguayan War (1864-1870) to the fall of the Empire and founding of the First Republic (1889).

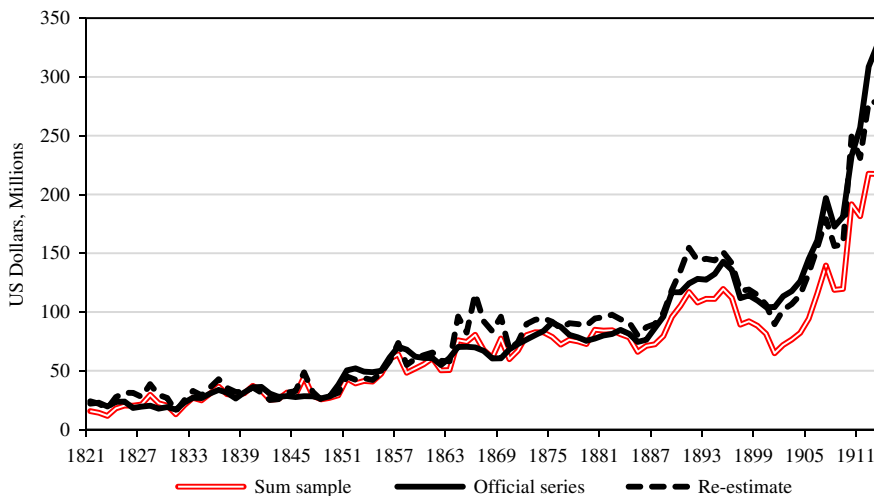
¹² We do not adjust the French *commerce général* for the inclusion of transit trade. While there is a risk of double-counting, the proximity of our re-estimate to the official series during the period 1901-1913 shows that the transit trade occupied a minor share of total French exports.

TABLE 2
RATIO OF OFFICIAL BRAZILIAN IMPORT SERIES TO RE-ESTIMATE UNDER
ALTERNATIVE ASSUMPTIONS, 1821-1913

Assumptions	Weighted (lower bound) freight factor	Unweighted (upper bound) freight factor	Weighted (lower bound) freight factor and re-exports
1821-50	0.98	0.83	0.88
1850-70	1.08	1.00	0.95
1870-90	0.98	0.87	0.89
1890-1913	1.08	0.99	0.99
1821-1913	1.02	0.91	0.92
1850-1913	1.05	0.95	0.94
1870-1913	1.08	0.99	0.94

Source: See text.

FIGURE 2
SUM OF TRADING PARTNER SAMPLE, OFFICIAL IMPORT SERIES AND
RE-ESTIMATE OF TOTAL IMPORTS, CURRENT PRICES, BRAZIL, 1821-1913



Sources: Sum sample and new estimate: see Table 1; official series: IBGE (1990).

Here, we briefly explore two possible explanations for the under-valuation of the official series, one concerning quantities, the other official prices. The former may be under-counted due to the presence of contraband.

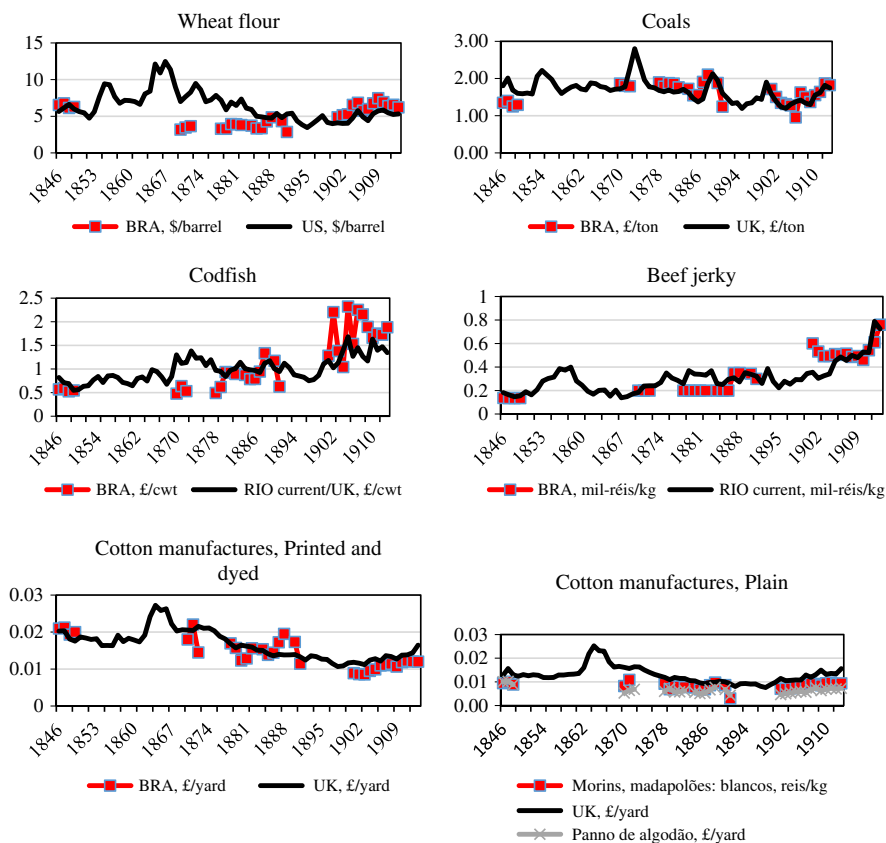
While contemporary reports suggest that certain regions, such as Rio Grande do Sul, were characterised by an active contraband trade, it is difficult to calculate precisely what percentage of total trade this represented¹³. In the case of Rio Grande do Sul, the nature of the local economy determined that smuggling focussed predominantly on cattle rustling (Flores da Cunha Thompson Flores 2012; Pereira 2016, p. 9; Bonino-Gayoso *et al.* 2015, p. 18). While important on a local level, it is likely that the impact on aggregate statistics would be small. Moreover, the under-valuation of the import series suggests a more systematic explanation that lies in the procedure used to elaborate the statistics, rather than quantities missing due to the contraband trade. The use of partner statistics effectively obviates the problem of contraband by including what might be missing trade on the Brazilian side.

The second explanation that official prices were the principal determinant of the observed under-valuation is evident in contemporary reports on the elaboration of the country's tariff schedule. In fact, it seems that official prices were only changed by infrequent tariff commissions. A tariff commission report in 1871 observed that «The tariff that currently regulates the collection of customs house revenues, with a few small exceptions, is that of 1860 ... Not having elevated the official prices, and raising them alongside events in the market, resulted in ... a percentage of fiscal revenue less than the rightful amount...» Citing the report, the Viscount of Rio Branco recommended that the situation be rectified by way of the updating of official prices (Fontoura n/d, pp. 60-61). The issue was not only one of official prices, but also of the corresponding classification scheme, as Francisco Belisario Soares de Souza argued in his report to the Finance Ministry in 1887: «Effectively, since the last tariff was enacted [in 1881] ... the industrial method of production of certain products has undergone important transformations ... rest assured that it is not small the number of official prices ... that presently diverge from the real average market price of the products to which they correspond...» (Fontoura n/d, p. 84). Given that (until 1901) the values that appear in the available sources for import by product are aggregates of such official prices, we are able to test this hypothesis by comparing the trend of official import prices against that of corresponding trading partner export prices¹⁴. If official import prices were fixed for long periods, then this should appear in the evolution of these prices over time when compared to trading partner export prices.

¹³ See Brazil. Ministério da Fazenda (1875, p. 69). The Rio Grande customs house was also the subject of a scandal in the nineties when it was found that a clerk and dispatcher for various merchant firms had defrauded the public treasury «... by classifying goods with a high tax as those with a low tax, by manifesting goods liable to duty as samples of little or no value, by giving a fictitiously low value to those goods which are liable to *ad valorem* duty, and by declaring false weights of packages». See *Rio News*, 3 September 1895, p. 4. See also the discussion in Brazil (1853, pp. 92-101).

¹⁴ This «price» is technically the unit value.

FIGURE 3
OFFICIAL IMPORT PRICES AND TRADING PARTNER EXPORT PRICES OF SIX
IMPORT COMMODITIES, 1846-1913



Sources: BRA: Brazil (Various years), Brazil (Sebastião Ferreira Soares, Various years), Brazil (1939). US: United States. Treasury Office (Various years). UK: United Kingdom (Various years), United Kingdom. Board of Trade (Various Years). RIO: *Jornal de Commercio* (Various years).

Figure 3 compares the official prices of six commodities with the corresponding prices of the principal supplier of that commodity. We include cotton manufactures (plain and printed or dyed), dried and salted codfish, and coals from Great Britain, wheat flour from the United States, and beef jerky from Uruguay. In the cases of wheat flour, coals, codfish and beef jerky it is evident that, until the turn of the century, official prices remained fixed and did not reflect the trend of international prices. What's more, perhaps apart from coals, the official prices of these commodities remained under-

valued for much of the century. From 1901 onwards, however, the prices of these commodities (reflecting the declared value instead of the official value) changed according to fluctuations in international prices, and the strong degree of under-valuation that characterised the previous century disappeared. In the case of the official prices of cotton manufactures, while these also showed fixed properties, they seem to exhibit more frequent fluctuations. However, this could simply reflect changes in the composition of this import category (which included multiple types of cotton textiles) rather than alterations in the official price. In any case, it is clear that the trend and level of the official prices used to calculate the official statistics aid us in understanding the under-valuation of the official import series.

4. THE EXPORT SERIES

As mentioned above, the historiography of Brazil's export economy during the 19th century has been primarily based on the official statistics, calculated using a list of official prices (the *pauta*) that was based on the average of market prices. In a previous paper, we showed that the official prices, when compared to corresponding international prices, were generally under-valued. This under-valuation was found to be greater during the decades following independence. We then went on to correct the official series using international prices and official quantities, adjusting the international price by subtracting trade costs. The results revealed a dynamic post-independence period. Figure 4 displays the corrected and official series in current United States dollars.

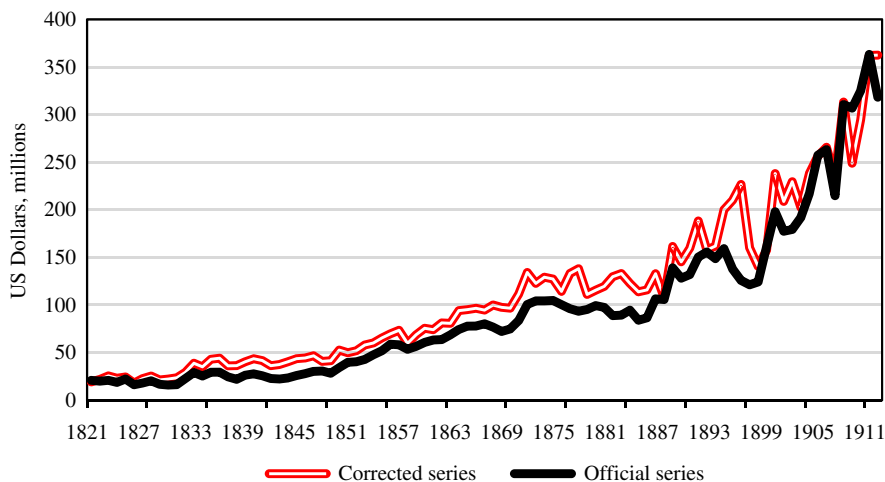
When undertaking these corrections, we made several assumptions regarding the weight of trade costs that are sensitive to the data being used. Specifically, we rely on estimates of freight rates and export taxes that are perhaps not totally representative¹⁵. Here we confront each of these issues in turn.

For the period before 1870, there is a general scarcity of freight rate data for Brazil. Juan Oribe Stemmer's (1989) seminal study of Latin American freights during the 19th century included Brazilian coffee, although only provided a graphical series for the North American route and from 1845 onwards. Other authors provided other series, but with varying degrees of temporal, commodity and geographic coverage (see, e.g. Angier 1920; Harley 1988; Klovland 2009). To cover the first two decades of the post-independence period, we used Paul Schöller's (1951) index for freights from Antwerp to Rio de Janeiro, referenced by freight rate data for Brazil from various sources¹⁶. However, the use of Schöller's index may exaggerate the average level of rates when other routes are included. Antwerp, although an important destination for Brazil's products, was by no means the only destination. Furthermore,

¹⁵ Thanks to Thales Zamberlan Pereira for pointing this out.

¹⁶ For a full explanation, see Absell and Tena-Junguito (2016).

FIGURE 4
TOTAL EXPORTS, CORRECTED AND OFFICIAL SERIES, CURRENT PRICES,
BRAZIL, 1821-1913



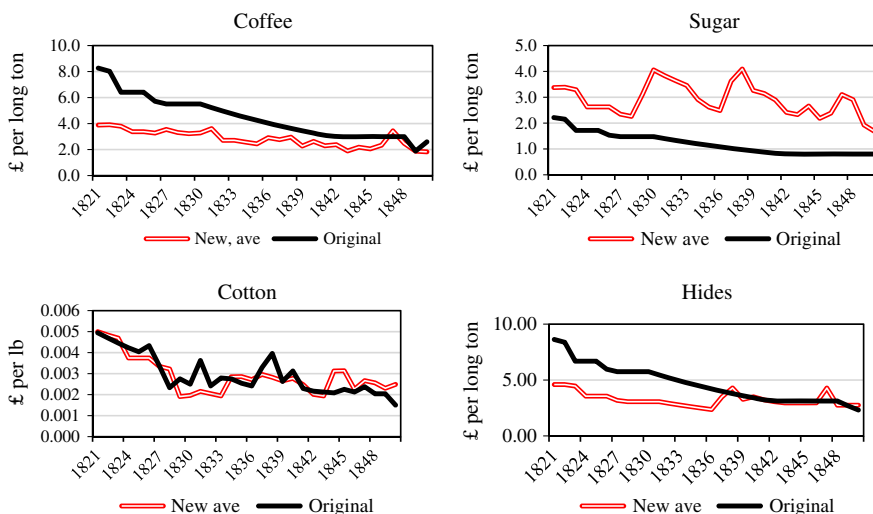
Sources: Absell and Tena-Junguito (2016) and IBGE (1990).

Schöller's was an outgoing index, and thus may be unrepresentative of the commodity composition of homeward freights for Brazil's commodities. As the freight rates were deducted from the international prices used to reconstruct the new exports series, the use of our previous freight series might have served to distort the correction of the official export series, and thus the calculation of the growth rates that our argument hinged upon.

To test the robustness of our original correction, we have constructed a new database of freight rates from Brazilian primary sources¹⁷. The new database consists of monthly observations of freights from Brazilian to foreign ports for Brazil's principal export commodities. The data from the period before 1840 is less frequent although it is sufficient to construct an average that reflects the level and trend of prices. For coffee, we include quotations from Rio de Janeiro to Liverpool, London, Hamburg, Le Havre and Marseilles; the rates for sugar are from Rio de Janeiro, Pernambuco and Bahia to Liverpool, the British Channel, Hamburg and Le Havre; cotton quotations are from Rio de Janeiro, Pernambuco and Maranhão to Liverpool, Le Havre and Lisbon; and quotations for hides are from Rio de Janeiro and Pernambuco to Liverpool.

¹⁷ The database is an ongoing project. The periodicals used in the construction of the database are listed in the bibliography of the paper. These sources are available in the Hemeroteca Digital of the Brazilian National Library (<http://bndigital.bn.br/hemeroteca-digital/>).

FIGURE 5
ORIGINAL AND NEW FREIGHT RATE SERIES FOR SELECTED EXPORT
COMMODITIES, BRAZIL, 1821-1850



Sources: Original: Absell and Tena-Junguito (2016); New average: see footnote 17.

Figure 5 displays the arithmetic average of the available routes for each year for the three commodities, alongside the original series used to convert the international prices from c.i.f. to f.o.b. values. In the cases of coffee and hides, it is evident that the use of Schöller's series exaggerates the average level of freights, especially during the first decade of independence, although the series converge with the original estimates around mid-century. The original sugar series, however, under-values the true level of average freight rates. The difference in the tendencies and levels of the two estimations for the cotton series is trifling.

A second point is the weight of export taxes. The original estimate used the export tax average (export tax fiscal revenue/total export value in current prices) as a proxy for taxation rates. This approach, however, disregards the provincial rates that were also charged on exports, most of which were higher than the Imperial government rates. The current price list given in the *Correio Mercantil* of 1827, for example, listed an export tax from the port of Rio de Janeiro for coffee of 8 or 9 per cent (the *dízimo*), depending on origin («Serra acima» or «Serra abaixo»), plus *80 réis per arroba* (equal to 2 to 3 per cent of the average market price) if the average price dropped below 4,000 réis/arroba, 2 per cent otherwise. Thus, the total weight could sum to 12 per cent of the market price, much higher than the 3.6 per cent implied by the fiscal data for that year. The same can be observed for sugar and cotton exports from Pernambuco in 1840,

which were 10 and 12 per cent, respectively, higher than the 7.1 per cent given by the export tax average (*Diário de Pernambuco*, 15 January 1840). The ideal solution to this problem would be an average for the provincial export taxes for each commodity weighted by principal exporting regions. Data scarcity prohibits us, for the moment, from elaborating such a series. We thus add an additional 15 per cent to the export tax average, resulting in an average of 20 per cent per annum for the period from 1821 to 1850. We also consider the possibility that export taxes were included in the final prices. In the commodity chain from plantation to port, producers were subjected to export taxation before the product was sold to the export houses. This would indicate that the market prices that the official prices were based upon already included the export tax. Although the evidence indicates otherwise, it is also useful to provide an estimate without taxation to show their impact on growth.

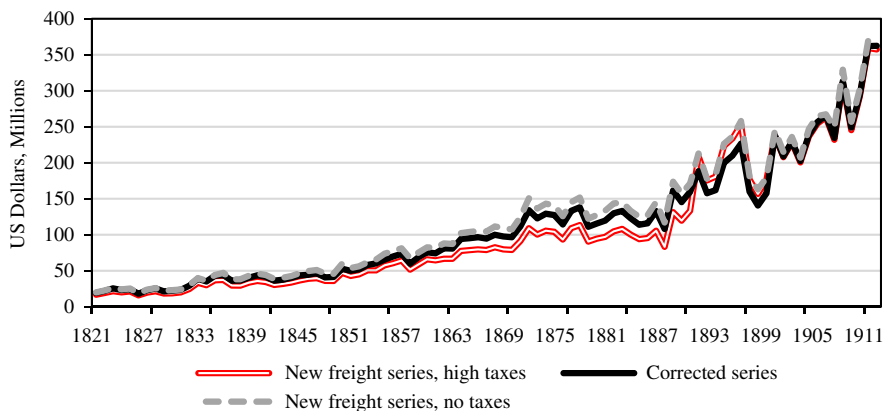
Using these revised data and assumptions, we re-estimate the growth rates to ascertain whether the overall results and subsequent historical interpretation of Brazil's export growth are sensitive to these assumptions. Here, we present three growth estimates: estimate A is the original as presented in Absell and Tena-Junguito (2016), estimate B includes the new freight series and higher export taxes, and estimate C includes the new freight series but does not include export taxes. As can be seen in Table 3,

TABLE 3
EXPORT GROWTH RATES (% PER ANNUM), UNDER ALTERNATIVE TRADE COST ASSUMPTIONS, CONSTANT 1913 PRICES, BRAZIL, 1821-1913

Estimates	A Original	B New freights, high tax	C New freights, no tax
1821-50	5.89	5.94	5.95
1821-70	4.55	4.57	4.59
1821-90	3.57	3.57	3.58
1821-13	3.70	3.73	3.72
1850-70	2.82	2.80	2.84
1850-90	1.99	1.96	1.97
1850-13	2.77	2.79	2.78
1870-90	1.27	1.23	1.21
1870-13	2.81	2.86	2.82
1890-13	4.28	4.39	4.34

Sources: Export value: Absell and Tena-Junguito (2016); Freights: see footnote 17.

FIGURE 6
TOTAL EXPORTS, UNDER ALTERNATIVE TRADE COST ASSUMPTIONS,
CURRENT PRICES, BRAZIL, 1821-1913



Sources. Same as Table 3.

changing the assumptions for the initial period does not radically change the story. In fact, the revised series with higher taxes and the new freight series is almost identical to the original estimate, since freights for coffee have been reduced by a larger factor than taxes have been increased. In the year 1821, for example, our export tax rate has been increased by 15 per cent, while the freight for coffee has been reduced from 8.26 to 3.88 pounds per ton, a reduction of 53 per cent. Estimate C demonstrates that growth rates were not particularly sensitive to changes in the size of the trade cost factor. Figure 6 displays the levels of the three estimates in current US dollars. In this context, estimates B and C can be interpreted as lower and upper bound estimates, respectively. While the different assumptions do not change the story in terms of constant prices, there is considerable divergence in terms of current prices during the period 1860-1890. In fact, the lower-bound estimate closely corresponds with the official series during this period. Thus, the altering of these assumptions might seriously affect the interpretation of indicators requiring the use of current values during this period (such as the trade balance). The results for the post-independence period to 1860 and the first decade of the First Republic, however, remain considerably different from the official series.

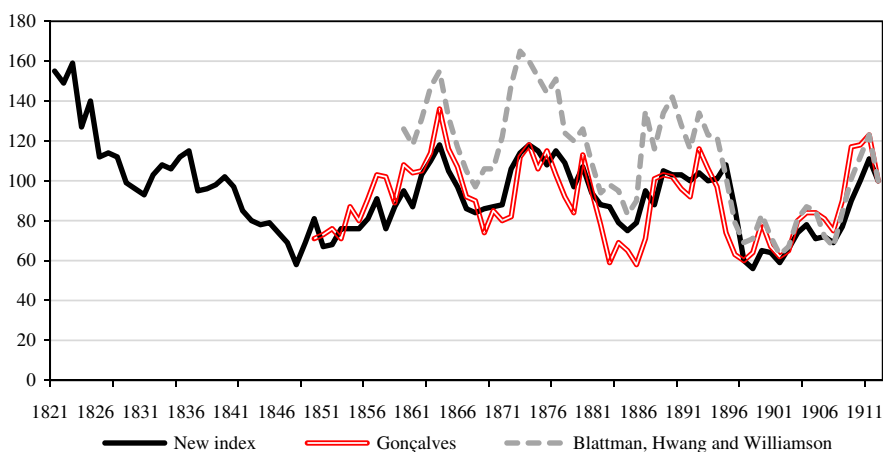
Of course, any exercise in the reconstruction of historical statistics must make assumptions based on the availability and reliability of the empirical evidence at hand. Accounting of this sort should not be interpreted as a precise calculation, but rather as being merely indicative of the actual trend.

It is evident, however, that the post-independence period was the most dynamic in terms of export growth in 19th century Brazil. This dynamism extended until the mid-century but disappeared alongside the consolidation of the coffee sector. This result is robust to the assumptions made regarding the adjustment of international prices used to correct the under-valued official series. It remains the work of scholars to explore the significance of these results.

5. PRICE INDICES

Here, we review the work performed on price indices for Brazil's export commodities and introduce a new import price index. Figure 7 displays three estimates of Brazil's export price index. The first, presented in Absell and Tena-Junguito (2016) is a Fisher index spanning the period 1821-1913 that uses the corrected prices of a sample of six of Brazil's principal export commodities (cacao, coffee, cotton, hides, rubber and sugar) and moving weights, as outlined in the previous section. The second, constructed by Reinaldo Gonçalves (1981), is also a Fisher index for the period 1850-1913 that uses the official unit values of eight commodities (cacao, coffee, cotton, herva mate, hides, rubber, sugar and tobacco) and moving weights. The third, an index commonly used in the literature on export growth presented by Christopher Blattman *et al.* (2004), is a

FIGURE 7
EXPORT PRICE INDICES (1913 = 100), BRAZIL, 1821-1913



Sources: Absell and Tena-Junguito (2016), Blattman *et al.* (2004), Gonçalves (1981).

chained Laspeyres index for the period 1860-1913 that uses the British c.i.f. unit values and a sample of five commodities (cocoa, coffee, cotton, rubber and sugar) and fixed weights, changing every 20 years. We present each index to compare the aggregate price trends generated using differing methodologies.

Despite being constituted by a reduced commodity composition, the Absell and Tena-Junguito (2016) index is unique in the sense that it covers the entire period. Furthermore, the omission of tobacco and herva mate does not change the overall tendency of the price index, due to the overbearing weight of coffee and, later, rubber in the commodity composition. Overall, Brazil's export price index declined from a century-long high generated by the Napoleonic Wars to follow the cyclical price trend of coffee until the crisis of oversupply in the 1890s.

Regarding the import prices, we elaborate a new index using the international price data available for Brazil. This is especially constructive for the period before 1850, for which much of the previous work has relied on the general British export price index constructed by Albert Imlah (1958, pp. 94-98) (see, e.g. Leff 1982, Ch. 5; Goldsmith 1986, p. 31). The most widely used index for the period from 1850 to 1913 is that elaborated again by Reinaldo Gonçalves (1981), who constructed a Fisher index using British exports to Brazil¹⁸. However, the commodity composition of Gonçalves' index was not specified. This is important when the issue of quality is considered. The official British sources of bilateral trade include general categories such as machinery and cotton manufactures that incorporate a wide range of heterogeneous commodities. The use of such aggregate categories thus forsakes homogeneity in the interests of commodity coverage. Changes in the composition of these categories might distort the index by exaggerating or understating the weights of such categories in the overall index. Furthermore, as previously stated, Great Britain was not Brazil's only trading partner during the 19th century. Important commodities such as wheat flour and beef jerky were sourced almost exclusively from other markets (the United States and Uruguay, respectively).

We thus construct an index for the period 1827-1913 using three principal sources: the British and American bilateral data available from official sources, and current wholesale prices of imported goods listed in contemporary Brazilian periodicals. The index begins in 1827 as the declared values and quantities of British exports to Brazil are unavailable for most commodities before this year. We forsake commodity coverage for homogeneity to capture the long-run price movements of a select sample of homogeneous products. This is, however, only a problem after the turn

¹⁸ Gonçalves (1981) presents three indices for the periods 1850-1913, 1914-1945 and 1946-1979. This followed on from Hélio Schlittler Silva's (1952) work, which spanned the period 1901-1950, using official sources.

of the century when the commodity composition of Brazil's imports diversified considerably. Apart from the current wholesale prices, we then adjust for freight and insurance costs. Our final index includes a minimum of ten and a maximum of sixteen products, accounting for between 50 (in 1841) and 27 (in 1913) per cent of Brazil's import value¹⁹. As weights, we use a series of benchmarks of import values by product from the above-mentioned official sources. Table 4 displays the weighting system and the percentage of the sample in total import value. As we do not have a time series of weights, we construct a series of chained Laspeyres indices, using each of the six benchmarks as reference years. We then take the geometric mean of these indices.

Figure 8 displays the new index, alongside the Gonçalves index of British imports, and Imlah's British export price index. The new series shows that import prices, weighted heavily by cotton manufactures in the early years, followed the general decline of British textile prices during the first half of the century, moderated slightly by the prices of foodstuffs. The second half of the century was dictated by fluctuations in the prices of raw materials (the most important of which being British coals) and foodstuffs. Inspection of the new index raises a number of interesting points. First, by ignoring the weight of foodstuffs (particularly American wheat flour), the reliance on the Imlah index prior to 1860 exaggerates the price level. Second, the price shocks of the American Civil War in the 1860's and the rise of the price of British coals in the 1870s are accentuated in the new series due to the inclusion of American foodstuffs and the relatively greater weight of coals in the weighting system. Finally, the new series converges with the Gonçalves series towards the end of the period, indicating that the lower coverage of the later benchmarks does not affect the representativeness of the index to any great degree.

¹⁹ While the historiography is replete with examples of the reconstruction of export statistics, the same cannot be said for imports. Examples of the meticulous reconstruction of the import series using unit values and market prices are very scarce. In the case of Spain, both Tena-Junguito (1985, p. 94) and Prados de la Escosura (1986, p. 100) attempted to reconstruct the import series, obtaining a sample coverage of 26 and 29 per cent of the value of imports, respectively. Our final benchmark falls within this range, and the scale and complexity of the task at hand prevents a larger sample coverage at this stage. Concretely, the low coverage of our final benchmark is principally due to the omission of iron and steel manufactures and machinery from the composition of the index. The omission of these categories is the unfortunate consequence of the paucity of a homogenous series of prices. The statistics of the principal suppliers of these commodities (France, Germany, the United Kingdom and the United States) either present the quantities and values of aggregated product categories (thus, failing our criteria of homogeneity), or only present the values of specific products (such as sewing machines or agricultural implements, in the cases of the United Kingdom and United States), making it impossible to calculate unit values. As mentioned in the text, however, the Gonçalves series includes the aggregated series of British iron and steel manufactures and machinery, and coincides with our estimate precisely when imports of these products were at their peak during the period under analysis.

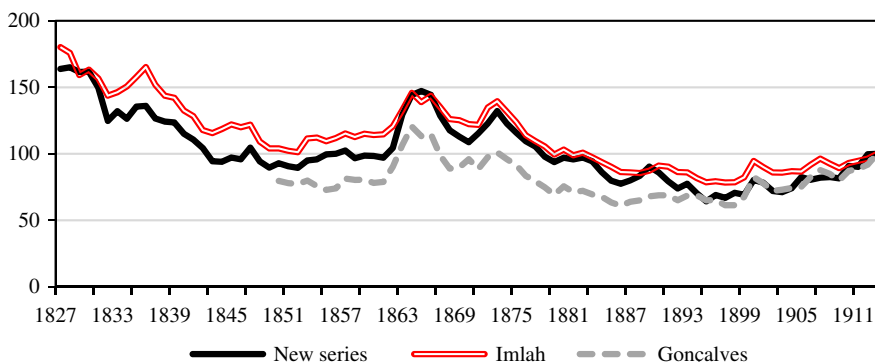
TABLE 4
WEIGHTING SYSTEM FOR IMPORT PRICE INDEX, BRAZIL, VARIOUS YEARS

	1841/ 42 (%)	1849/ 50 (%)	1871 (%)	1890 (%)	1901 (%)	1913 (%)
Manufactures						
Cotton manufactures, white or plain	37.8	38.7	30.8	17.5	5.5	7.4
Cotton manufactures, printed or dyed	33.9	26.8	32.9	13.3	17.4	14.1
Spermaceti candles	0.6	1.1	0.5	0.4	–	–
Iron bars	2.1	3.4	1.4	2.2	1.0	2.1
Iron rails (for railways)	–	–	0.5	3.0	2.6	12.7
Total	74	70	66	36	27	36
Foodstuffs						
Wheat flour	12.0	18.6	7.3	5.6	18.6	11.7
Beef jerky	6.0	1.9	9.9	29.4	21.2	4.0
Codfish	3.6	2.3	2.7	3.3	7.3	9.2
Beer and ale	1.5	1.0	1.7	1.5	0.3	0.2
Beef, salted or cured	1.5	1.9	0.6	0.1	0.4	0.3
Lard	–	0.2	0.3	6.5	3.1	0.2
Total	25	26	22	46	51	26
Raw materials						
Coals	0.9	4.0	8.2	12.2	16.3	22.0
Cement	–	–	0.9	1.8	1.3	8.0
Petroleum/Kerosene	–	–	2.3	3.0	5.1	8.1
Total	1	4	11	17	23	38
% of total import value	50.3	43.8	45.9	38.2	41.2	27.2

Notes: After 1888 the nomenclature of cotton manufactures changes to «bleached», «unbleached», «dyed» and «printed». In order to maintain a homogenous series, we have maintained the series «white or plain» and «printed or dyed» by averaging the prices of bleached and unbleached for the former, and printed and dyed for the latter. The generic category «coals» includes coke and cinders, which have been removed for the period 1833-1913 when differentiated data become available. The British series of iron bars begins in 1854; we thus chain the series with the available series of Rio de Janeiro current market prices for the earlier period. The prices for Petroleum/Kerosene are denominated «Petroleum, refined» until 1871 and «Oils, refined: illuminating» thereafter. The price series is consistent and corresponds with Brazilian imports of Kerosene. The Brazilian current wholesale prices are the arithmetic average of quarterly observations of imported goods in Rio de Janeiro. Due to missing observations, in a number of years the prices in Recife, Pernambuco were used. Although price quotations were not identical in both markets for obvious reasons of distance and supply, the differential is not so great in the given years to bias the series to a great degree. These prices are assumed to be in c.i.f. form, thus no adjustment for trade costs is necessary. All price series have been converted to British pounds sterling and indexed to 1913 to avoid problems of weight measurement conversion.

Sources: Brazil (Various years), Brazil. Sebastião Ferreira Soares (Various years), Brazil (1939).

FIGURE 8
IMPORT PRICE INDICES (1913 = 100), BRAZIL, 1827-1913



Sources: Great Britain: 1827-1852: United Kingdom (Various years). 1853-1913: United Kingdom. Board of Trade (Various Years). United States: 1827-1913: United States. Treasury Office (Various years). Rio de Janeiro current market prices: *Anglo-Brazilian Times*, *Correio Mercantil*, *Diario de Pernambuco*, *Diario do Rio de Janeiro*, *Diario Mercantil*, *Semanario Mercantil*, *Jornal do Commercio*, *O Cruzeiro*, *O Despertador*, *Retrospecto Commercial of the Jornal do Commercio*, *Rio Commercial Journal*, and *Rio Mercantile Journal*.

6. CONCLUSIONS

This paper has aimed to shed new light on the accuracy of Brazil's foreign trade series. As shown here, for various reasons both the export and import series are under-valued. We have endeavoured to correct these series using a range of methodologies and examining the assumptions of these methodologies. With respect to the export series, we have corrected the official series by using international prices and official quantities to re-estimate the current value of the series. We have performed a robustness test on our corrected series and it is evident that such tests do not alter the original results and their corresponding interpretation to any great degree. Regarding the import series, due to the lack of a time series of official import prices we have used the sum of available trading partner statistics plus the geographical distribution to re-estimate the official import series. A comparison with the sum of a sample of Brazil's principal trading partners shows that the official series was under-valued for much of the 19th century. We have shown that it was not the inclusion of transit trade in the trading partner statistics that was most likely the principal problem, but rather the reliance on under-valued official prices.

The reconstruction of Brazil's foreign trade series has numerous implications that future work might explore. To begin with, it would be instructive to re-evaluate the trade balance in light of the new series. Furthermore, the construction of the new export and import price indices allows for an

examination of the development of Brazil's terms of trade over the century. This is an important issue given the importance of the Prebisch-Singer debate on the secular deterioration of the terms of trade and subsequent deindustrialisation for the literature on the development of the Latin American economies. Last, but not least, the recognition that official import prices were under-valued raises the question regarding the actual rate of nominal protection. Import tariffs were in most part specific and based on official price lists that, as we have seen, differed from market prices. The under-valuation of official prices would thus mean that reported tariff levels (in ad valorem terms) were over-valued. This leads one to question whether Brazil was one of the most heavily protected economies of Latin America (Coatsworth and Williamson 2004), or whether our understanding of this issue is clouded by the bias present in the official series.

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit <https://doi.org/10.1017/S0212610917000143>

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