The rise of coffee in the Brazilian southeast: agricultural efficiency vs. foreign market potential, 1827-1840

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Abstract

During the period spanning independence in 1822 to mid-century, Brazil's southeast shifted from specializing in the export of cane sugar to coffee. This paper explores the mechanism underlying this shift by exploiting a new monthly database of international prices and exports from Rio de Janeiro. While the direction of the southeast's export specialization was determined by relative agricultural efficiency, the timing of the boom was driven by a rapid increase in the foreign market potential of coffee. The abolition of tariffs on coffee in the United States and the subsequent increase in import demand, together with the relatively limited market access for sugar, generated price signals in the local market that incentivized producers to switch to coffee. The subsequent export boom converted Brazil into the principal world coffee supplier during the nineteenth century.

Keywords: Brazil; Rio de Janeiro; exports; market potential; prices.

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By the final decade of the nineteenth century, Brazilian coffee occupied 70 per cent of the country's composition of exports and over half of the world export market share (Absell and Tena-Junguito 2016). Over the nineteenth century, coffee had stimulated investment in the railroads, monopolized slavery, attracted hundreds of thousands of Southern European immigrants, and provided the Brazilian southeast increased purchasing power to obtain imported goods, including inputs for nascent industrial activity (Leff 1982; Summerhill 2003; Corrêa do Lago 2014; Absell and Tena-Junguito 2017a). Coffee's spectacular rise came at the expense of the southeast's traditional colonial export commodity, cane sugar, which declined from being the principal export to a minor position in the region's export composition.

This paper empirically explores the origins of the nineteenth century Brazilian coffee boom. By exploiting a new database of monthly exports and prices for the period from 1827 to 1840, it is shown that changes in the export structure of Brazil's southeast during the first half of the nineteenth century accorded with improvements in the foreign market potential of coffee. Concretely, an import demand shock driven by the removal of tariffs on coffee in the United States led to a skew in the geographical distribution of the southeast's exports of coffee in favor of the American market. This resulted in increased market integration and a shift of relative prices in the southeast in favor of coffee.

Explanations of the rise of coffee in the southeast have implicitly reflected a supply-side comparative advantage narrative, whereby the region's specialization in coffee was the result of lower unit costs. This supply-side view emphasizes the relative efficiency of coffee cultivation (Medeiros Lima 2012; Klein and Vidal Luna 2010; Viotti da Costa 1998, p. 67; Marcondes 1998). Most importantly, coffee production was characterized by lower unit labor requirements. Additionally, coffee required a relatively lower initial investment, permitting entry for those who could not afford the fixed costs of establishing a sugar mill. Other characteristics of production and distribution, such as fuel requirements, mixed cropping, transport costs and perishability, favored coffee over sugar.

The supply-side explanation for the rise of coffee, however, is essentially static; it does not explain the timing of the shift in specialization. If conditions were ripe for coffee cultivation, why did its rise to dominance as the southeast's principal export commodity not occur earlier? Certain authors have observed that prices shifted in favor of coffee in the Brazilian southeast during the early nineteenth century (Petrone 1968a, 1968b; Dean 1976). This apparently had much to do with external conditions: that Brazilian coffee emerged at a time when world demand, especially in the United States and Central Europe, was expanding, and that the composition of world supply, from Haiti, the British and Spanish West Indies, was undergoing profound changes (Topik 2004; Klein and Vidal Luna 2010; Corrêa do Lago 2014, pp. 110-111; Marquese 2015a). The effect of demand-side conditions on southeastern coffee production, however, has not yet been quantified.

Advances in international trade theory have augmented the neo-classical production-side approach of the factor proportions model with insights from firm-level studies and economic geography. While factor proportions may define the commodity structure of production and trade, geography-specific trade costs, home market effects,

and foreign demand define the intensity and direction of trade (Romalis 2004; Davis and Weinstein 2003; Krugman 1980). The reduction of trade costs may result in commodity- and destination-specific demand shifts, expanding the foreign market potential of exports and driving market integration in terms of commodity price convergence (Redding and Venables 2004, pp. 97-100; Head and Mayer 2011; O'Rourke and Williamson 2001, p. 65).

This paper shows that foreign market potential matters for explaining the direction of southeastern Brazil's export specialization. In July of 1832, coffee was granted duty-free status in the United States. The resulting expansion of the potential of the American coffee market led to a shift in the southeast towards the relatively more efficient sector – coffee – and a rapid shift in the geographical distribution of the southeast's exports towards the American market. These factors, together with declining trade costs, produced the increased integration of the Brazilian and American coffee markets. The shift in relative prices provided an incentive for entry into the coffee market back home in southeastern Brazil. The potential of the sugar market in the United States, and the coffee and sugar markets in other important markets, such as Great Britain and Hamburg, were lower, due to higher barriers produced by tariffs, geography, and market distortions derived from monopolistic forms of competition.

The principal contribution of this paper is empirical. I construct a new database of monthly exports of coffee and sugar from Rio de Janeiro for the period from 1827 to 1840. This is supplemented by monthly price data for Rio de Janeiro and four consumer markets (Hamburg, Liverpool, London, and New York), as well as monthly imports of coffee and sugar in New York and Liverpool. The latter series are combined with data on outgoing freight rates from Rio de Janeiro, insurance rates and tariffs to quantify the foreign market potential effect. Using the new bilateral series, the determinants of the geographic distribution of the southeast´s exports of coffee and sugar are studied in the context of a reduced-form gravity model. Results show that the geographical distribution of coffee exports partly accorded with the logic of gravity during the period 1827 to 1840. Market size in terms of population was a significant determinant of the distribution of exports, while cross-sectional heterogeneity was also large, indicating that unobserved factors that impeded or facilitated trade (tariff or non-tariff barriers, consumer preferences, or price effects) were decisive. While geography was an important barrier to trade, the presence of colonial trading networks was more significant, suggesting that trade costs for southeastern producers during this period depended less on distance than on entry costs. These entry costs came predominantly in the form of tariffs on non-colonial product in Imperial Europe, which served to bar Brazilian coffee and sugar from some of the world´s largest markets. Barriers were higher for sugar, due to both colonial preferences and nascent infant industry in the United States and Europe, and thus sugar did not follow the logic of gravity, instead travelling to smaller, relatively distant markets.

The structure of the paper is as follows. The next section describes the direction and timing of the southeast's export specialization. I then introduce the new series, present growth rates, and discuss corrections made to the geographical distribution of exports. The following section estimates the determinants of the geographic distribution of exports. An aggregate market potential effect is then calculated for New York, Liverpool and Hamburg, and a simple differences-in-differences estimator is used to ascertain the

impact of the abolition of American tariffs on southeastern exports to the United States. The final section concludes.

SPECIALIZATION, AGRICULTURAL EFFICIENCY AND RELATIVE PRICES

Table 1 provides a rough periodization of the rise of coffee, including benchmark estimates of coffee and sugar exports from Rio de Janeiro, São Paulo, Bahia and Pernambuco during the first half of the nineteenth century. Coffee was a minor export commodity during the period from 1796-1811, occupying around two per cent of Brazil's total export value. Sugar and cotton remained the most important exports of the late-colonial period, holding shares of 35 and 24 per cent of the composition of exports, respectively. Rio de Janeiro occupied one third of Brazil's total exports, followed by Bahia (22 per cent) and Pernambuco (19 per cent). The leading exporter of sugar was Bahia, followed by Rio de Janeiro and Pernambuco.[2] Evidence for the period from the liberalization of Brazil's ports in 1808 to political independence in 1822 is fragmentary, but allow for a descriptive sketch. Coffee exports seem to have grown rapidly in Rio de Janeiro with the end of the Napoleonic Wars: the exports of 1,574 metric tons in 1807, the highest for the period 1796-1811, rose to 7,885 on the eve of independence (Corrêa do Lago 2014, p. 460). Sugar, however, also followed similar growth tendencies, and the quantum of exports in Rio de Janeiro, Bahia and Pernambuco remained around twice that of coffee.

The definitive shift in the southeast's export composition occurred during the period 1825-1836. Between these years, coffee exports from both Rio de Janeiro and São Paulo quadrupled. In fact, the 1820's and 1830's were the most dynamic decades in terms of nineteenth century coffee export growth (Absell and Tena-Junguito 2016). Exports of sugar from these regions, however, declined to pre-independence levels by mid-century. In Bahia and Pernambuco, on the other hand, sugar exports increased. In the Bahian case, coffee exports also showed a rapid increase from late-colonial levels, although the volume shipped remained dwarfed by that of sugar.

Although factor endowments adequately explain Brazil's specialization in agricultural commodities, they fail to explain the shift in specialization in the southeast. Land was cheap and widely available in both cases. Soil quality was apt for both sugar and coffee production. An elastic supply of slave labor was available for both industries. Capital was equally as scarce for both coffee and sugar planters. In some cases, planters in the same region used the same resources to produce both commodities (Klein and Vidal Luna 2003; Marcondes and Motta 1999). The explanation for the shift in specialization must be found not in coffee's natural comparative advantage derived from Brazil's given factor endowments, but rather in relative levels of profitability. The profitability of each commodity was determined by changes in the marginal cost and revenue curves over the period under analysis. As Nathaniel Leff (1972, p. 252) succinctly hypothesized, "Brazilian comparative advantage and the rates of return available in the country's different export activities during the nineteenth century favored coffee as against sugar and cotton."

[2] These figures are taken from Arruda 1980, pp. 292, 353-354, 359, 374, 417. The underlying data from this work is derived from the *Balança Geral do Commercio do Reyno de Portugal com as Nações Estrangeiras*, various years.

Table 1: Exports (metric tons) of coffee and sugar from Rio de Janeiro, São Paulo, Bahia and Pernambuco, selected years.

	Rio de Janeiro		São Paulo		Bahia		Pernambuco
	Coffee	Sugar	Coffee	Sugar	Coffee	Sugar	Sugar
Av. 1796-1811	642	7,809	-	-	72	9,577	6,791
1817	4,672	-	-	4,323	-	14,838	7,369
1825	13,447	22,939	2,081	5,046	-	20,401	7,099
1836	52,582	17,989	8,640	8,272	757	18,693	26,743
1848	95,569	8,814	19,547	4,096	1,280	49,165	61,286

Sources: 1796-1811: Arruda 1980, pp. 359, 374, 417. Rio de Janeiro: 1817 Coffee: Soares 1860, p. 208. 1825 Coffee and Sugar and 1848 Coffee: Corrêa do Lago 2014, p. 460. 1836 Coffee: Maxwell, Wright & Co. 1841, p. 87. 1836 Sugar: *Jornal do Commercio*, Edição 3, 1840. 1848 Sugar: Soares 1860, p. 216. São Paulo: 1817 and 1825 Sugar: Petrone 1968a, p. 156. 1825, 1836 and 1848 Coffee and Sugar: Corrêa do Lago 2014, pp. 156, 483-485. 1836 Coffee and Sugar: Müller 1838, p. 129. Bahia: 1825, 1836, 1848 Coffee and Sugar: Soares 1860, pp. 228, 241. Pernambuco: 1825 and 1848 Sugar: Soares 1860, pp. 254-255. 1836 Sugar: Eisenberg 1974, p. 15. Notes: São Paulo 1817 sugar is the export volume for the year 1818. Pernambuco 1836 sugar is the average annual quantity of exports for the period 1836-1840. The 1836 figure for sugar from Rio de Janeiro is an upper bound estimate; estimates by Soares and Maxwell, Wright & Co. being 16,312 and 17,175 metric tons, respectively. Figures for coffee for São Paulo include exports from Rio de Janeiro, as most of the exports from the Paraíba Valley were not shipped from Santos. Figures for Bahian sugar are production, not export, estimates. The same can be said for São Paulo 1836 coffee and sugar.

The fixed and variable cost structure of coffee and sugar production differed in important ways that made coffee production attractive when relative prices shifted in favor of the latter. In both cases, production was extensive and unsustainable in the long-run. Land was cleared using slash and burn techniques, virgin forests were not replanted, and ploughing was the exception to the norm. Sugar cane was generally harvested between 12 and 18 months after plantation. A sugar crop typically produced for two to three years, and then the land was either laid fallow for six to eight years, or abandoned, depending on the fertility of the soil. In the best lands, such as Campinas, cane could be grown for up to 20 years, before a necessary fallow period of three years. Coffee, on the other hand, once planted the seedlings, yielded fruit in around three to four years, a delay in initial return to investment three times longer than that for sugar. However, the duration of the return on initial investment was longer for coffee. Mature trees could continue producing annually, with declining yields and fruit quality, for close to 20 years, without the need for fallow periods. Like sugar, planters used the return from a crop to expand plantations and stagger the gaps between plantation and harvest, thus ensuring a regular income stream.

While the cost of land was probably similar for both commodities, other fixed operating costs were seemingly higher for sugar than for coffee. Sugar required investments in rudimentary technology for cane juice extraction, evaporation, and crystallization. After harvesting, cane juice was extracted by crushing the cane with (mostly wooden) rollers. These rollers were generally ox driven, with marginal use of water wheels, the latter being more expensive to install (Petrone 1968a, p. 97). Next, the

cane juice was boiled in a series of large copper kettles, fueled by firewood obtained from the clearing of the land for plantation. The syrup was then cooled, and molasses purged by sprinkling clay over the surface of the sugar loaf. The most expensive part of the process was reportedly the investment in "*cobres*," the kettles used in the second stage of manufacture. Of course, these processes required additional slave labor, outside of that required for the cultivation and harvesting of sugar cane and other foodstuffs for local consumption. The initial investment served to bar many producers from entry, and output increased not with the rise of the number of plantations, but rather with the increased size of pre-existing ones.

Coffee, on the other hand, did not require such a large fixed investment. It was customary to cultivate the coffee seedlings alongside corn, beans and mandioca. This at once aided the growth of the coffee trees, employed the slaves, and provided the planter with an additional source of income during the initial growth period. Other tasks included regular pruning of the trees and weeding, at least tri-annually. Once harvested, the beans were sun-dried in patios. Marginal investment was required in the hulling process, using large wooden pestles – o *monjollos* – but this process could also be accomplished with the use of sticks (Ferreira de Aguiar 1836; Marquese 2015b; Stein 1957, pp. 21-38). The lower cost of entry for coffee is attested to by the fact that, at least in São Paulo, early coffee growing was a somewhat more egalitarian affair than sugar cultivation. As Francisco Vidal Luna and Herbert Klein (2003, p. 58) showed, during the period when coffee was becoming the major export commodity, only half of the producers were employing slave labor. This situation changed rapidly after 1836, however, as slaveholdings came to resemble those of sugar.

Other variable costs were important for the shift to coffee. The evaporation of water from cane juice required prodigious quantities of wood fuel. The source of this fuel was the Atlantic rainforest. While the wood available, at least within the area owned by the producer, was free, it required a considerable investment in labor and time to acquire. Slaves had to be engaged to clear the forests, and transportation had to be arranged to ensure a steady stream of fuel to the *engenho*. Reforestation was not actively pursued, and local fuel sources were rapidly diminished, requiring either the purchase of new land or firewood from surrounding areas. Increasing production implies and contemporary reports suggested that sugar planters in the southeast were not immune to the problems associated with deforestation. In 1820, an observer lamented the destruction of the forests in Itu, São Paulo due to the expansion of sugar production (Petrone 1968, p. 82). Fuel consumption depended on the productive capacity of the *engenho* and the availability of wood fuel, making it difficult to estimate the average costs associated with the consumption of wood fuel. In the case of colonial Bahia, Shawn Miller estimated that sugar production required at least half the output volume in wood, and that wood fuel contributed to around 20 per cent of operating costs (Miller 1994, p. 183). Warren Dean suggested that the ratio of wood to sugar output was around 7 to 1 (Dean 1995, pp. 176-77). The shift to coffee took the burden of procuring supplies of wood fuel off the shoulders of producers. Apart from the heating requirements of the habitants of the farms, the production of coffee was free from the need for constant supplies of wood fuel.

Table 2: Slaves and output (in metric tons) per production unit, and output per slave, sugar and coffee, São Paulo and Cuba, 1822-1854.

	São Paulo			Cuba		
			Sugar			
	Slave/ engenho	Output/ engenho	Output/ slave	Slave/ Engenho	Output/ engenho	Output/ slave
1822	22	8.5	0.4	68	104.5	1.5
1836	41	11.7	0.3	90	103.1	1.2
1854	24	19.8	0.8	95	328.8	3.5
			Coffee			
	Slave/ farm	Output/ farm	Output/ slave	Slave/ farm	Output/ farm	Output/ slave
1822	9.0	1.5	0.2	25-72	3.2-7	0.1-0.2
1836	13.2	3.0	0.3	44	10	0.2
1854	21.4	20.1	0.9	33	10.8	0.3

Sources: São Paulo: Luna and Klein 2003, pp. 43-45, 60, 65-67, 71. Cuba: Sugar 1860 from Santamaría García and García Álvarez 2004, p. 198. 1822, Matanzas, from Bergad 1990, pp. 34-35, 41-43. Coffee: 1822 same as sugar, 1862: Cuba 1862, pp. 26, 73, 77; 1846: Cuba 1846. Notes: Sugar and coffee data for São Paulo correspond to Jundiaí and Areias, respectively. The Cuban *Cuadro* for 1846 is calculated using total population of *engenhos* and *cafetales*, so figures most likely overestimate slaves per production unit and underestimate output per slave. Coffee 1836 Cuba is 1846. 1854 is 1862. Sugar, 1836 is 1846, 1854 is 1860.

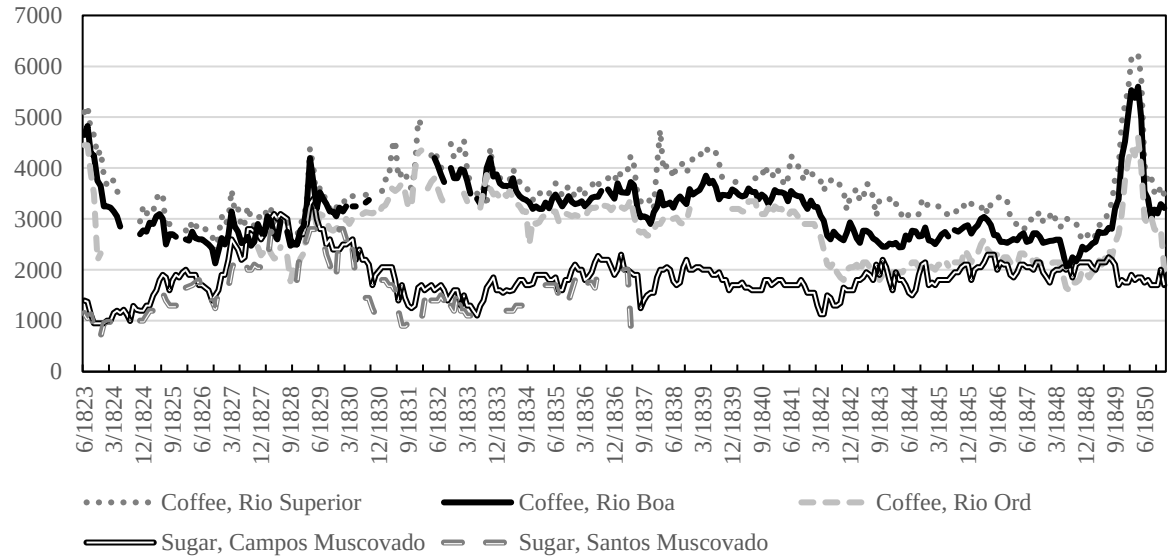
Transport costs were high for both products. This being before the arrival of the railroads, final product was transported by mules, which might be contracted on a seasonal basis, or come from the planter's livestock. The innate qualities of sugar, however, made it more liable to damage than coffee. Humidity or rainfall could easily soil both the wooden boxes that transported sugar and their load, reducing the quality of the product that arrived at the port. The quality of transportation routes did not help. Paulista planters transporting sugar from the hinterland to the port of Santos faced the formidable task of descending the Serra do Mar (Momsen Jr. 1963). The slave troops that transported product by mule from the hinterland of Rio de Janeiro enjoyed marginal improvements during the colonial period, although conditions in the first quarter of the nineteenth century were still detrimental to the transportation of agricultural goods (Nogueira de Matos 1949). As in the second half of the nineteenth century and the coming of the railroads, improvements in transportation routes were closely linked to the various cycles of the export economy. In the southeast, sugar paved the way for the expansion of coffee.

Indicators of relative agricultural efficiency reveal much about the nature of both sectors. Table 2 displays estimates of output and slaves per production unit, and output per slave for São Paulo and, as a point of comparison, Cuba. In São Paulo, the rise of sugar output was driven by the increased use of slave labor. Although coffee plantations did not catch up with sugar plantations in terms of average number of slaves until mid-century, output per slave was comparable by the mid-1830's. Not only was coffee efficient in terms of marginal product when compared to Paulista sugar, but also when compared to Cuban coffee. Cuban coffee plantations produced marginally less output per slave than their Paulista counterparts, despite slave holdings of over twice the size. The same could not be said for sugar. By 1836, Cuban sugar plantation slave holdings were

over twice as large, output per production unit was nine times larger and marginal product four times larger. The relative efficiency of southeastern coffee in terms of marginal output was no doubt reinforced by trends in slave prices. While the supply of African slave labor increased rapidly over the period, prices also followed an upward trend. According to David Eltis' (1987, p. 263, Table C.1) estimates, the average price of a prime male slave (in constant dollars) in the Brazilian southeast doubled during the period spanning 1821/25 to 1841/45. Thus, the lower unit labor requirements of coffee meant that the rising real cost of maintaining a slave labor force was less for coffee producers than for their sugar-producing counterparts.

Besides cost considerations, returns to coffee producers were higher for the simple reason that prices were more favorable for coffee than for sugar. Figure 1 displays the nominal tendencies of three qualities of coffee from Rio de Janeiro - Ordinary, Good, and Superior - and muscovado sugar from Campos in Rio de Janeiro and Santos in São Paulo for the period from June of 1823 to December of 1850. After converging in early 1827, coffee and muscovado prices diverged from 1829 onwards. It is no coincidence that the shift in specialization in southeastern Brazil from sugar to coffee occurred during a period when prices were extremely favorable for the latter product. In fact, from January 1829 until January 1842, prices of ordinary quality Rio coffee in réis were on average twice as high as those for muscovado sugar from Campos. Those for good and superior varieties were even higher. While this differential declined after 1843, coffee maintained its price advantage.

Figure 1: Monthly prices of coffee and sugar exports from Brazilian southeast, in réis per arroba, 6/1823 to 12/1850.



Sources: 6/1823-5/1824: *Semanario Mercantil*; 11/1824-10/1827, 7/1830-7/1833: *Diario Mercantil*; 11/1827-5/1830, 8/1833-4/1840, 9/1848: *Jornal do Commercio*; 5/1840-10/1847, 1/1848, 10/1848-3/1849, 5/1849, 8/1849-12/1849, 7/1850, 12/1850: *Diario de Rio de Janeiro*; 11/1847-12/1848, 4/1849, 6-7/1849: *Rio Mercantile Journal*; 1-6/1850, 8-11/1850: *Correio Mercantil*. Note: These are nominal prices.

Wholesale market prices in the port of Rio de Janeiro reflected price trends in the international market for both commodities. Southeastern producers were price-takers during this period; national figures for total exports of coffee and sugar averaged around 29 and 10 per cent of the world market share for each commodity, respectively (Absell and Tena-Junguito 2016, pp. 700-703). Thus, the trend of domestic prices relative to those in foreign markets is fundamental for understanding the sources and timing of the shift in relative prices. Figure 2 displays indices of the unweighted average of monthly price quotations of coffee and brown sugar in five markets (Amsterdam, Hamburg, Liverpool, New York, and Philadelphia), together with the price series for southeastern Brazil presented in Figure 1.[3] After the century-long peaks observed during the Napoleonic Wars, prices in consumer markets generally declined for both commodities. As the figure shows, this decline was more dramatic for coffee than it was for sugar. The post-Napoleonic War peak for both commodities was reached in the final months of 1818. Prices then fluctuated around a declining trend, following supply trends that were characteristic of each market. Perhaps the most noticeable deviation from this trend was the effect of slave emancipation in the British West Indies on sugar cane prices in Liverpool (and London) after 1838. From 1841 onwards, however, British prices continued the century-long downward trend alongside prices in other consumer markets. Furthermore, American coffee prices did not reach the same post-Napoleonic lows as observed in Europe during the late-1820's, and thus the post-1830 recovery was not as abrupt. The same cannot be said for the American sugar market, however, which largely corresponded with the European trend in prices. The prices of coffee from Rio de Janeiro and brown sugar from Campos appear to follow international trends throughout the period.

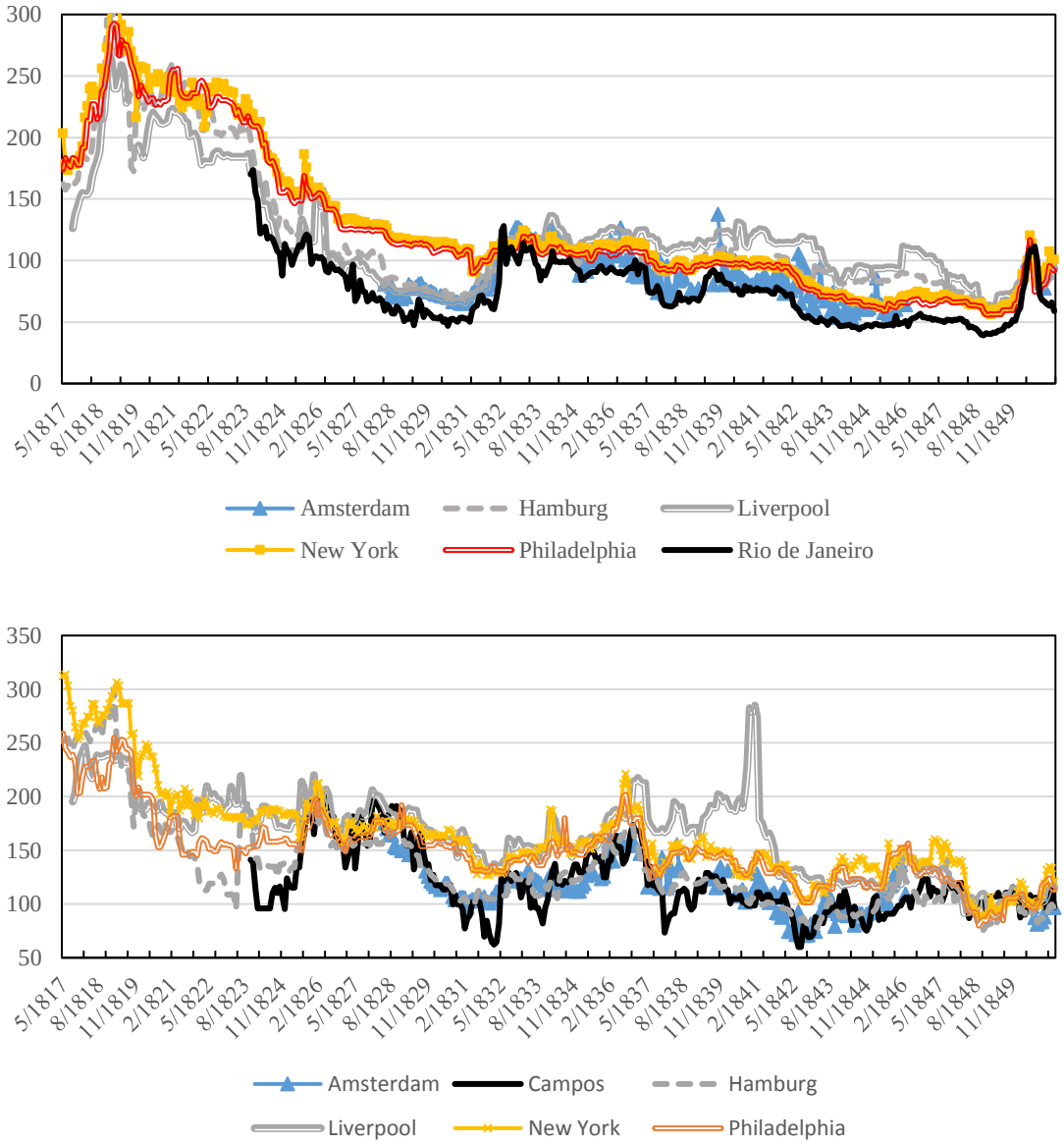
The sharp rise in the Rio coffee index during 1831 corresponds with a major convergence event between prices in Rio de Janeiro and the United States. The Rio-New York price gap for coffee rapidly decreased from around 60 per cent in 1830 to 20 per cent two years later and hovered around 30 per cent until mid-century.[4] The same was not true for the price gap for sugar, which remained around 10 per cent higher than that of coffee. Trends in Hamburg and Great Britain were similar, given that the former was directly connected to British ports via the re-export trade. The decline of coffee production in the British West Indies and the prohibitive tariff on non-colonial produce served to widen the price gap between Rio de Janeiro and these ports until mid-century.

[3] The data presented here are nominal, wholesale prices. Wholesale prices are useful indicators of pricing information for several reasons: 1) Wholesale prices are relatively easy to come by, given that the commercial and mercantile newspapers of most major importer and exporter markets published updated prices when information became available. This allows for the calculation of a series of prices at a relatively high frequency. Moreover, given that these newspapers were important sources of market price information for members of the commercial community, the veracity of such information is assumedly greater than that derived from official sources. 2) Unit values, derived from official trade statistics, can be biased for several reasons, which may affect both values and quantities. Thus, they may not reflect market trends. Furthermore, unit values can only be calculated on an annual basis. A proper study of price fluctuations requires data of a higher frequency. 3) Retail prices are difficult to come by for the early nineteenth century. Retail prices are only preferable, however, if one seeks to examine the consumption effect of price fluctuations. Prices have not been deflated due to the absence of monthly series of consumer price indices for each market. Since the objective is to compare tendencies and not levels, however, this does not pose a problem.

[4] See Figure A.4 in appendix.

Price gaps for sugar in these markets were lower than those for New York and fluctuated around a downward trend. Such differentials suggest the segmentation of the geographical distribution of the southeast's exports across destination markets, which I will now explore with the aid of a new series of exports.

Figure 2: Indices of average monthly prices of coffee (above) and brown sugar (below) for six markets (1/1850=100), in shillings per hundredweight, 5/1817-12/1850.



Sources. Amsterdam: *Börsen-Halle*, *Handelblad* and *Nieuw Rotterdamsche Courant*, various years. Campos and Rio de Janeiro: same as Figure 1. Hamburg: *Börsen-Halle*, various years. Liverpool: *Liverpool Mercury*, various years; 1836: *The Manchester Times and Gazette* (for Liverpool); 1836, 1838, 1843, 1844: *North Wales Chronicle*. New York: *Shipping and Commercial List and New-York Price Current*, various years. Philadelphia: Bezanson et al. 1936, pp. 47-52, 222-226. Notes: This figure displays the unweighted average of monthly price quotations of each commodity in each market, indexed to 12/1850. Prices are included in bond. The country composition of each index is given in appendix A.3. Campos represents the series for muscovado sugar. Rio de Janeiro represents the arithmetic average of ord, boa and superior varieties. Prices and weights in Rio de Janeiro, Campos, Amsterdam, Hamburg, New York and Philadelphia, have been converted to shillings per hundredweight to permit comparability. Exchange rates are taken from Denzel 2010.

ANATOMY OF AN EXPORT BOOM: RIO DE JANEIRO, 1827-1840

Rio de Janeiro was the centre of the export boom. The port exported the lion's share of coffee to the world market and, until the 1830's, closely trailed the north-east in the export of cane sugar. Thus, the analysis of the mechanisms underlying the shift in specialization from sugar to coffee must focus on what was occurring in the Rio de Janeiro export market. To capture the subtleties of this shift, high frequency data are necessary. Here I introduce a new database of monthly exports of coffee and sugar from Rio de Janeiro to foreign ports spanning the period from July of 1826 to December of 1840.

The series is taken from contemporary periodicals widely read by the mercantile community in Rio de Janeiro, the principal source being the *Jornal do Commercio*. These newspapers reported the daily movements of the port, including imports and exports within and outside of the Empire, as well as the nationality and destination of the ships. Although never explicitly stated, this information was presumably gleaned from the *Mesa do Consulado*, which reported the volume of commodities entered for export, and used these volumes, along with a list of official prices, to collect export taxes. The fact that these volumes were the basis of the calculation of the government's fiscal revenue derived from exports, and that the movement of commodities was so widely disseminated in the press, lends confidence to the quality of the data.[5] For much of the period under analysis, the *Jornal* conveniently published monthly summaries of foreign trade, from which much of the series is taken. In some years, these reviews were not published, and instead the daily data has been collected.

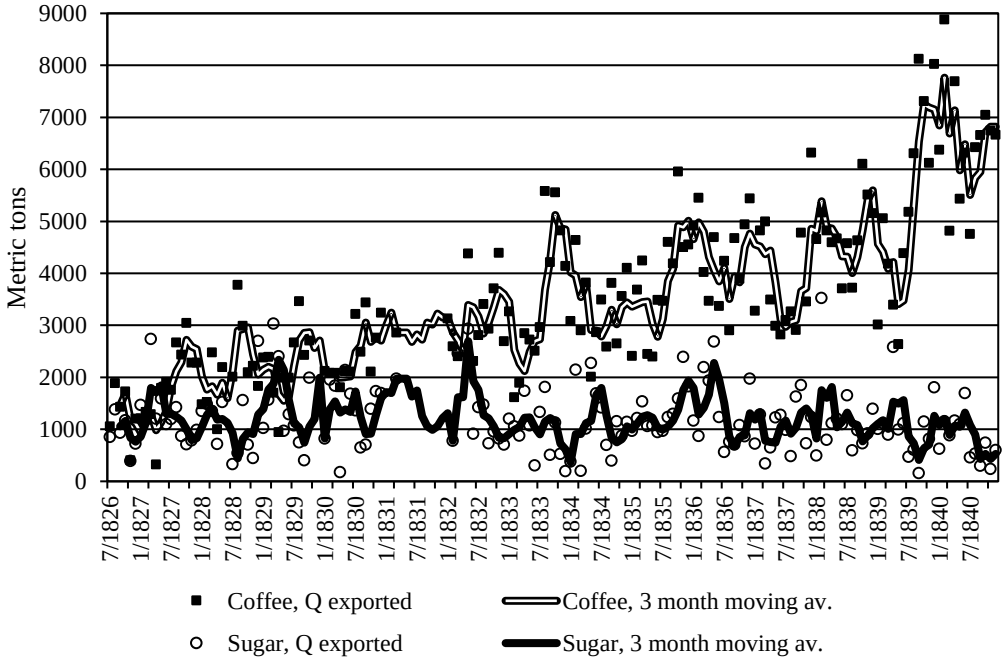
There are several problems with the data. Firstly, there are gaps in the series, including months in 1828, 1829, 1832, 1829, the first seven months of 1830 and all but March of 1831. While the nationality and destination of the ships leaving port were listed during these years, the commodities and volume exported were not included. In order to calculate the continuous series of export shares used in the following section, I have interpolated the missing months using previous and following year observations, when available. Another important problem is the source of exports. Being the southeast's principal port, Rio de Janeiro exported coffee and sugar from other provinces, including Minas Gerais and São Paulo. Given the nature of the data, it is impossible to confirm the true origin of the export data presented here (Corrêa do Lago 2014, p. 518). Thus, the data should be interpreted as representing regional (southeastern) exports, rather than exports strictly from Rio de Janeiro. Additionally, the sources do not specify the quality of commodity exported, especially a problem for sugar, which might have arrived in the muscovado, yellow, or white forms. We know, however, that American and European importers preferred muscovado, as subsequent refining was undertaken by national industry. Thus, it is likely that most of the sugar exported was of the lower quality. Furthermore, the destinations listed may have been merely entrepôts, such as Cowes, the Cape of Good Hope, Açores or Madeira. This is particularly a problem for the British series. On paper, the United Kingdom received an average of 23 per cent of coffee and 19 per cent of sugar exports over the period. Brazilian exports that did arrive to mainland British ports (London or Liverpool) were subjected to prohibitive tariffs, and thus were

[5] What's more, the fact that the *Jornal do Commercio* published an apology in June of 1832 for not publishing its monthly review shows that export data was in high demand by the mercantile community. See *Jornal do Commercio*, ed. 251, 1832.

most likely re-exported to the Continent. This seriously distorts the geographical distribution of exports and warrants correction, to which I return shortly.

An important issue regarding the comparability of the data is the conversion of original weights and measurements. The volume of coffee and sugar was listed in units of bags (*saccos*) and boxes (*caixas*), respectively, standard units of measurement at the time that seemingly suffered little variation.[6] However, coffee was also given in barrels (*barritas*), boxes (*caixas* or *caixotes*), and bales (*feixes*), while sugar was listed in bags, barrels, bales, and tins or cans (*latas*). In some instances, several listings provided the *arroba* equivalent of a measure.[7] In other instances, assumptions had to be made. In 1840, the accountant William Waterston published a useful *Manual of Commerce* in which he included the customary weights for a variety of commodities imported into the United Kingdom (Waterston 1840, pp. 147-48). These weights have been adopted for those measurements not found in Brazilian sources.[8] All weights have then been converted to metric tons.

Figure 3: Volume (in metric tons) of coffee and sugar exported from the port of Rio de Janeiro, and three-month moving averages, 7/1826 to 12/1840.



Sources: 1826: *Diario Mercantil*; 1827-6/1840 *Jornal do Commercio*; 7-12/1840: *O Despertador*.

Figure 3 displays the resulting series of the total volume of coffee and sugar exported outside of the Empire from the port of Rio de Janeiro from July of 1826 to December of 1840. The figure shows both the monthly observations of total volumes and

[6] As the commercial guide to Rio de Janeiro by American trading firm Maxwell, Wright & Co. observed with respect to coffee: 'It is purchased from the planters by a class of traders, who pack it in bags containing, without variation, five arrobes, or one hundred and sixty pounds Portuguese, and by whom it is sold to the shippers. Full confidence is placed in the weight, as frauds have scarce ever been detected; where however, any doubt may exist, some bags are reweighed upon delivery.' The same source observed that sugar was packed in boxes '…containing from 1200 to 2000 pounds.' Maxwell, Wright & Co 1841, pp. 79, 88.
[7] See, for instance, *Jornal do Commercio* 1832, eds. 5 and 71, in the cases of Gothenburg and Harlingen.
[8] For a detailed list of weights and measures, see Appendix B.1.

a three-month moving average. In terms of total volume, coffee overtook sugar from mid-1827 onwards. This accords with the series by Robert Walsh published in 1830, and reproduced by Luiz Aranha Corrêa do Lago (2014, pp. 459-60), which showed that coffee had already overtaken sugar by 1828. The divergence in export performances, however, did not become sustained until around 1833, when the ratio of coffee to sugar exports began to climb steadily higher. This trend is further illustrated by the calculation of average growth rates over the period, as shown in table 3. The volume of coffee exported during the period grew by an average of 12 per cent, while that of sugar contracted by two per cent. Average growth was extremely rapid for coffee during the late-1820's, dropping off and picking up again in the mid-1830's. While the first half of the 1830's was good to sugar, growth declined from 1835 onwards. The 1830's were years of rapid growth for coffee (at an average of nine per cent) and moderate contraction for sugar (at three per cent). Years of contraction were far more frequent for sugar than for coffee, and the average degree of contraction far greater (15 and seven per cent negative growth rates, respectively). It is evident that the shift from sugar to coffee was in full swing by the mid-1830's.

Table 3: Average mid-point growth rates and net margins' contributions to export growth, Rio de Janeiro, percentages.

	Coffee			Sugar		
	Growth	Margins		Growth	Margins	
		Ext.	Int.		Ext.	Int.
1827/30	22.7	9.7	13.0	3.2	5.2	-1.9
1830/35	6.4	-1.0	7.4	8.6	9.2	-0.5
1835/40	10.7	4.1	6.6	-3.8	-4.4	0.5
1827/40	12.4	4.7	7.7	-1.8	-1.2	-0.6
1830/40	8.8	2.7	6.1	-3.2	-3.0	-0.2

Sources: same as Figure 3. Notes: Mid-point growth rates are calculated as the sum of net extensive and intensive margins. The net extensive margin is the sum of the growth rates of entries and exits between t and t-12. The net intensive margin is the sum of the growth rates of increases and reductions in existing flows. Growth rates are weighted by shares in total exports. The sum of extensive and intensive margins might not equal the growth rate, due to rounding. See Appendix B.2 for methodology.

Table 3 also shows estimates of the net contributions of the extensive and intensive margins to the growth of exports. In other words, this provides an indication of whether growth (or contraction) was fueled by a sustained increase (decrease) in the number of Brazil's trading partners, or rather merely by the increase (decrease) of exports to pre-existing ones. It is perhaps unsurprising that on the eve of the first globalization the growth of coffee occurred principally on the intensive margin. The extensive growth that did occur was driven by the addition of ports on pre-existing trading routes (as, for example, the increased number of destinations on the East Coast of the United States, along the route from Rio de Janeiro to New York and Boston). In the case of sugar, initial growth and later contraction were due to additions and losses on the extensive margin. A possible reason for this is that as the extensive margin for coffee grew, ships carried both commodities to the same destination. As the supply of sugar declined, however, ships

filled orders only for coffee. The average number of destinations increased over time for coffee, while it decreased for sugar.

Table 4: Average percentage share of British re-exports of "foreign" coffee and raw sugar, 1827-1840.

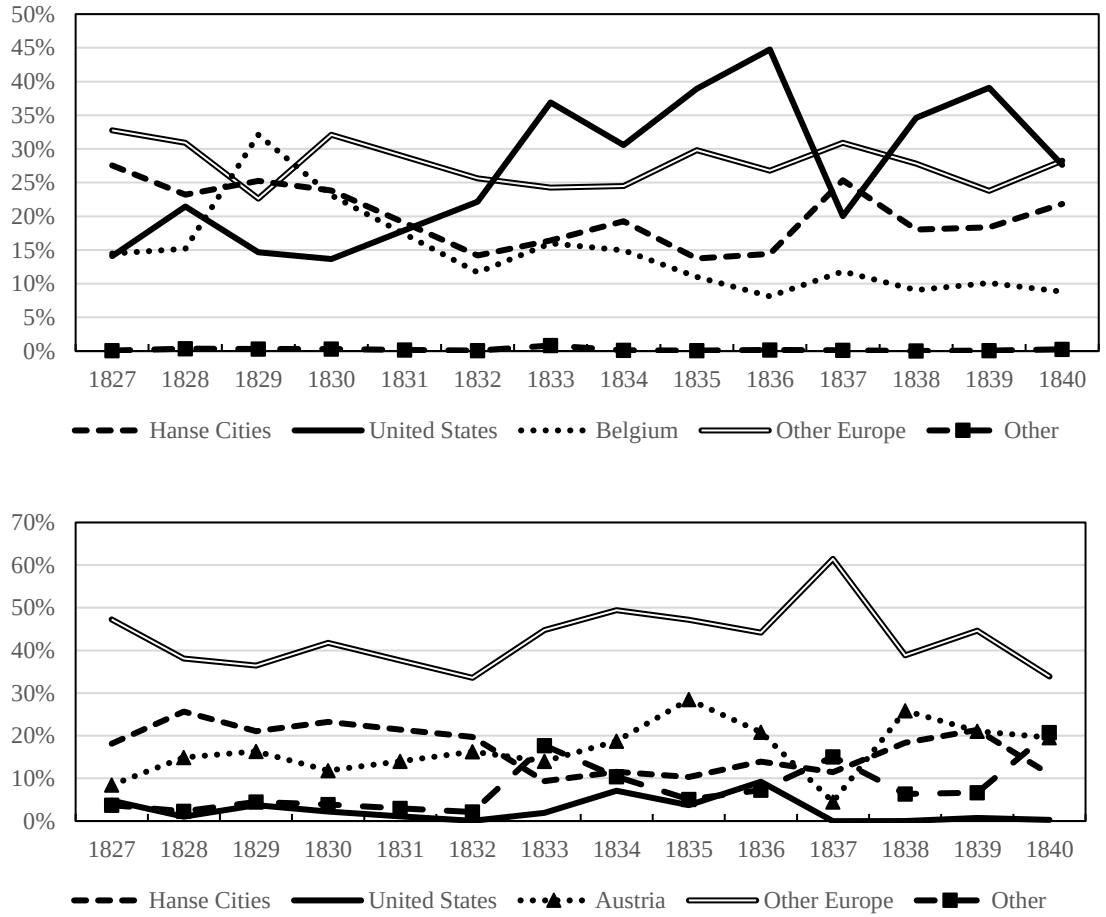
	Coffee	**Raw Sugar**
	Europe	
Germany	14.7	10.1
Belgium*	32.3	26.8
Italy	10.3	12.3
Portugal	0.1	0.3
	Imperial Europe	
United Netherlands*	36.3	29.7
Holland*	10.4	11.2
Spain	0.0	0.8
United Kingdom	0.2	0.1
Denmark	2.8	1.8
Sweden	1.1	1.5
France	0.7	0.8
	Americas	
United States	0.6	0.4
Rio de la Plata	0.0	0.0
Chile	0.0	0.0

Sources: Notes: Imports and retained consumption: Sugar: United Kingdom 1846; Coffee: United Kingdom 1849. Geographical distribution of re-exports: 1827-1831: United Kingdom, *Sugar*…, various years; United Kingdom, Coffee…, various years. 1832-1833: United Kingdom 1842. 1834-40: United Kingdom, *Tables of the revenue*…, various years. * United Netherlands aggregates Belgium and Holland until 1830. 1832 and 1833 include total re-exports of coffee and raw sugar, thus include product from the British colonies.

As mentioned, the geographical distribution of the original series is distorted by the presence of British re-exports. An examination of the data on the distribution of British re-exports provides insight into how these might be redistributed across the sample. Table 4 displays the average shares of the main destinations of southeastern exports (excepting Austria) in total British re-exports of foreign (non-colonial) coffee and sugar from 1827 to 1840. The estimate for the United Kingdom is the average share retained for consumption of total foreign coffee and sugar imports. Virtually all non-colonial produce imported was promptly re-exported. Re-exports were principally shipped to non-colonial Europe, apart from Holland after 1830, which possessed a notable share of both coffee and sugar re-exports. The main destinations were Belgium, "Germany" (most likely the Hanseatic provinces, the principal destination being Hamburg), "Italy" (mainly Genova) and Holland for sugar. The shares of these markets in total southeastern coffee and sugar exports were undoubtedly higher than those gleaned from the original series. To correct the bias in the geographical distribution of the series, I take the portion of foreign exports to the United Kingdom not retained for consumption and distribute it across the sample according to the destination shares of British re-exports. This is then added to the Brazilian series. As Table 4 indicates, Holland and Belgium are aggregated as the United Netherlands until 1830. I derive a separate series for each by applying the share of British re-exports to Antwerp (the principal Belgian port) to the total United Netherlands figure. British data on re-exports to the Austrian Empire did not exist at the time (MacGregor, 1850, p. 22) and re-exports probably arrived

from other European ports, which might bias the geographical distribution of the Continental European countries included in the sample. The figure below and the results in the following section should be interpreted with these caveats in mind.

Figure 4: Shares of destinations in total volume exported of coffee (above) and sugar (below) from Rio de Janeiro, 1826-1840.



Sources: same as figure 3. Notes: These shares are corrected for missing observations and the presence of British re-exports. See text for full explanation.

Figure 4 provides the resulting series of the geographical distribution of coffee and sugar exports. Before the abdication of Pedro I in 1831, around 60 per cent of Rio de Janeiro's coffee was shipped to ports in the United States, Belgium (Antwerp), and the Hanseatic Cities (Hamburg). The remainder was shipped to destinations in Europe, the most important being the Austrian Empire (Trieste). Minor shipments were also made to ports in Africa (principally Angola) and the Rio de la Plata. The 1830's witnessed a considerable shift in the composition of coffee exports in favor of the United States. In the early-1830's, the share of the United States rocketed from around 15 per cent to occupy almost half of total exports. In fact, from 1831 onwards, the United States and Hanseatic Cities alone occupied over half of all coffee exports. The geographical profile of sugar exports was considerably distinct. Exports to the United States were relatively

unimportant. The Austrian Empire, Portugal, and the Hanseatic Cities imported most of Rio de Janeiro's sugar, while Buenos Aires and Montevideo became important destinations after 1832.

EMPIRE, TARIFFS AND THE DISTRIBUTION OF EXPORTS

During the period under analysis, Southeastern producers operated in an international market that was severely distorted by strategic trade policy. Market access was limited by colonial trading networks and, in the case of sugar, by the protection of infant industry in the United States and Continental Europe. "Foreign," non-colonial coffee and sugar was effectively barred from the largest markets in Europe by prohibitive tariffs. Free trade was the exception to the rule. Brazilian coffee gravitated to those markets with expanding world population shares and little or no barriers to entry, while Brazilian sugar remained excluded from all but a few minor markets.

Here I examine the determinants of the geographical distribution of exports outlined in the previous section. Given the limited sample size (14 countries over 14 years; 196 observations) as well as the limited availability of continuous cross-sectional data on explanatory variables (such as historical estimates of aggregate expenditure or GDP), I use a reduced-form version of the gravity model that relates the geographical distribution of exports to market size (proxied for by population shares), sea distance, and the presence of colonial trading networks. A sizable literature (cf. Mitchener and Weidenmeir 2008; Sousa and Lochard 2012; Berthou and Ehrhart 2017) has established the link between bilateral trade flows and the so-called "empire effect" during the first globalization and twentieth century, which is all the more relevant for the period under study, when a number of the largest markets in Europe (the United Kingdom, France, and Spain) imported their coffee and sugar almost exclusively from colonial possessions.

The base-line estimating equation takes the form:

$$x_{ijct} = \beta_0 + \beta_1 pops_{jt} + \gamma_1 dist_{ij} + \gamma_2 empire_j + \alpha_j + \varepsilon_{ijct},$$

where x_{ijt} is the share of country *j* in total exports of commodity *c* from the southeast, $pops$ is the share of country *j* in world population, $dist$ is the average of the distance between Rio de Janeiro and the traded ports of country *j*, $empire$ is a dummy variable taking the value of one if country *j* obtained its coffee and sugar from colonial suppliers, α is a country fixed effect that controls for unobserved cross-sectional heterogeneity, and ε is a residual (error) term. Additionally, year fixed effects are included to control for longitudinal trends common to all clusters.[9] Table 5 displays the results of pooled OLS regressions with robust standard errors clustered at the country-level for both coffee and sugar. To ascertain the importance of cross-sectional unobserved heterogeneity, I present results with and without (columns 1 and 4) country fixed effects.

[9] Augmented versions of the gravity model conventionally include other proxies for transaction costs, such as the presence of a shared border or common language. These aren´t included here due to the restricted sample size and lack of variation across the cross-section (Brazil shared a language with one country, Portugal, and a border with one region, the Rio da Prata).

Table 5: The determinants of the geographical distribution of coffee and sugar exports from Rio de Janeiro, pooled OLS and fixed effects estimates, 1827-1850.

	Coffee			Sugar		
	1	2	3	4	5	6
	Pooled OLS	Country FE	Country FE	Pooled OLS	Country FE	Country FE
Population	.32	5.63	5.63	.07	-.32	-.32
	(1.64)	(2.24)**	(2.24)**	(0.44)	(-0.37)	(-0.37)
Distance	.06	-.60	-60	.03	1.26	1.26
	(2.99)***	(-1.61)	(-1.61)	(1.53)	(9.83)***	(9.83)***
Empire	-.09	-.96		-.08	-.31	
	(-2.84)**	(-2.32)**		(-3.58)***	(-2.17)**	
British			-.72			-.26
			(-2.43)**			(-2.59)**
Danish			.27			-.59
			(1.63)			(-10.27)***
Dutch			.18			-.43
			(1.71)			(-11.59)***
French			-.96			-.31
			(-2.32)**			(-2.17)**
Spanish			-.33			-.23
			(-2.58)**			(-4.85)***
Swedish			.27			-.61
			(1.64)			(-10.85)***
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	196	196	196	196	196	196
R^2	.37	.88	.88	.34	.76	.76

Sources: Export shares: same as Figure 3. Pops: Bolt et al 2018. Notes: *** p< .01, ** p<.05, *p<.10. Robust standard errors clustered at country-level. The dependent variable is the log of export shares of the sample. Population is the log of the population share of the sample. Distance is log of average sea distance in nautical miles to national ports weighted by exports. Empire is a dummy variable that takes the value of 1 if a country possesses colonial suppliers.

Columns 2 and 5 display the results of the base-line specification with country fixed effects for coffee and sugar, respectively. The results for coffee accord with the logic of gravity and those for sugar do not. Coffee was exported to those markets that possessed growing relative population shares over time, were relatively closer in terms of sea distance (although the coefficient on distance is only significant at the 15 per cent level) and did not possess colonial suppliers of coffee or sugar. Sugar, on the other hand, was not significantly correlated with relative population shares, was positively correlated with distance and, like coffee, suffered from the presence of colonial trading networks. This suggests that the international market for independent (non-colonial) sugar producers was extremely restrictive during the period, more so than the market for coffee.

The empire effect is statistically and economically significant for both commodities and is important for understanding the geographical distribution of exports. The estimated coefficients correspond with a reduction of 62 and 27 per cent of the market share of Imperial Europe of coffee and sugar exports from southeastern Brazil,

respectively. There was, however, considerable heterogeneity of effect across Empires. Columns 3 and 6 show the empire effect disaggregated by Empire. In the case of coffee, the effect was negative and significant for the French, British, and Spanish Empires, but positive and insignificant for the Swedish, Danish, and Dutch. With the exception of Javanese expansion later in the period, these latter countries did not possess important suppliers of coffee, and thus were forced to quench their thirst with non-colonial product. This was not the case of sugar. The empire coefficients for sugar, while being smaller than those of coffee, were negative and significant across the board. While the effect was smaller in absolute terms, it is evident that the exclusion of Brazilian sugar was larger in geographical scope than that of coffee.

Table 6: Tariffs on non-colonial imports of coffee and brown sugar, ad valorem equivalent (% of price), 1841.

	Coffee	**Sugar**
	Europe	
Hanse Cities	0.5	0.5
Belgium	16.7	2.9
"Italy"	46.8	27.7
Austrian Empire	68.5	48.0
Portugal	17.7	21.7
	Imperial Europe	
Netherlands	6.7	37.3
Spain	84.3	191.6
United Kingdom	264.3	233.2
Denmark	14.2	23.3
Sweden	21.0	46.1
France	68.3	91.7
	Americas	
United States	0.0	41.2
Uruguay	24.5	24.5
Chile	35.0	35.0

Sources: MacGregor 1850. Notes: the price used to calculate the ad valorem equivalent is the unweighted average of average prices in New York, Philadelphia, Liverpool, Hamburg and Amsterdam in 1841, sources from Figure 2. In some cases, different tariffs were given for national and foreign vessels. I have taken the average of these. “Italy” is the average of Sardinia, the Papal States, and Tuscany.

In a study on the effect of empire on bilateral trade during the first globalization, Mitchener and Weidenmeir (2008) found that trade preferences and customs unions were key instruments of imperial exclusion. Indeed, for producers in southeastern Brazil on the eve of the first globalization, tariffs on non-colonial coffee and sugar were the principal barriers to entry in several of the most important European markets. Table 6 shows the ad valorem equivalent of tariffs on non-colonial coffee and brown sugar in 1841 for the cross-section of countries included in the sample.[10] As most tariffs were given as specific duties (that is, duty per weight), I convert all duties to British shillings per hundredweight and apply this to the unweighted average of monthly prices for 1841 from the sources in Figure 2. For both coffee and brown sugar, the tariffs in core Imperial Europe (the United

[10] A continuous series of tariffs is unavailable for inclusion in the gravity model, so I assume that tariffs did not change over the period, with the exception discussed in the following section.

Kingdom, Spain and France) were truly prohibitive. However, both within and outside of Imperial Europe, there was considerable heterogeneity of tariff levels. The tariff on coffee in the Netherlands was seven per cent, while that for non-Imperial Austria was 69 per cent. In terms of observable entry costs, the freest market in the world for coffee was the United States, followed by Hamburg for both coffee and sugar. Generally, with a few exceptions (Belgium, "Italy", and the Austrian Empire) tariffs for brown sugar were higher than those for coffee. This fact, coupled with its lower relative price, surely served to discourage producers in the southeast.

To gauge whether tariffs were an important channel for the empire effect, I instrument the empire dummy for the effective tariff in the reduced-form gravity equation. This serves to capture the cross-sectional effect of tariff differentials. Table 7 displays the results. While the coefficient on population shares remains unchanged, the effect of distance is considerably reduced. This indicates that effective tariffs accounted for some of the cross-sectional variation captured by the distance variable. Columns 1 and 3 displays the aggregate effect and columns 2 and 4 the effect separated into Imperial and non-Imperial countries. In the case of coffee, the coefficient for Imperial countries is negative and significant, while that for non-Imperial countries is positive. Thus, tariffs served as an important barrier to exports of southeastern coffee, at least to core Imperial Europe. In the case of sugar, the effect of tariffs was negative and significant for both Imperial and non-Imperial countries. This further demonstrates that southeastern sugar producers suffered from a higher degree of protectionism than their coffee producing counterparts.

Table 7: The determinants of the geographical distribution of exports with tariffs as a proxy for empire, fixed effects estimates, 1827-1840.

	Coffee		Sugar	
	1	2	3	4
	Country FE	Country FE	Country FE	Country FE
Population	5.63	5.63	-.32	-.32
	(2.24)**	(2.24)**	(-0.37)	(-0.37)
Distance	-.14	-.14	.47	.47
	(-0.85)	(-0.85)	(9.98)***	(9.98)***
Tariff	.36		-.83	
	(2.21)**		(-9.75)***	
Empire		-1.89		-.49
		(-2.32)**		(-2.28)**
No empire		.36		-.83
		(2.21)**		(-9.75)***
Year dummies	Yes	Yes	Yes	Yes
Obs.	196	196	196	196
R^2	.88	.88	.76	.76

Sources: see Tables 5 and 6. Notes: *** p< .01, ** p<.05, *p<.10. Robust standard errors clustered at country-level. Tariff is the effective ad valorem tariff, included in regressions as ln(1+ad valorem tariff).

The jump in the R-squared that occurs with the addition of country fixed effects in Table 5 indicates that unobserved cross-sectional heterogeneity is an important characteristic of the structure of the data. As the vast literature on panel and time series

cross sectional econometrics has pointed out, incorrect treatment of this cross-sectional heterogeneity may lead to faulty inferences regarding the size, direction, and significance of the coefficients. Generally, the assumptions of each estimator regarding the treatment of unobserved heterogeneity revolve around the degree of expected correlation between the independent variables and the unit effects α. Thus, incorrect treatment of α may lead to biased βs and γs. Pooled OLS assumes that the error term is independently and identically distributed across clusters: clearly an erroneous assumption in the context of a high level of cross-section variation. The fixed effects estimator generates unbiased estimates of βs and γs at the cost of unconstrained variance across the unit effect. In the context of high variability across clusters – which is the case here – an alternative estimator that constrains such variability is desirable as a point of comparison and as a robustness check of the results obtained with the fixed effect estimator. Table 8 presents results for the above regressions using random effects with maximum likelihood. While the random effects model produces biased estimates of β and γ, it constrains cross-sectional variance by estimating the unit intercepts α from a finite, within-sample distribution (Bartels 2008; Bell and Jones 2015). Furthermore, the random effects model partitions the residual term ε_{ijct} into cross-sectional (μ_{ijc}) and longitudinal (v_{ijct}) parts. This is useful for the examination of the cross-sectional distribution of unobserved heterogeneity.

The random effect form of the estimating equation is:

$x_{ijct} = \beta_0 + \beta_1 pops_{jt} + \gamma_1 dist_{ij} + \gamma_2 empire_j + \varepsilon_{ijt}$, where

$\varepsilon_{ijct} = \mu_{ijc} + v_{ijct}$.

The results displayed in Table 8 highlight the importance of unobserved heterogeneity and the robustness of the population, empire effect, and tariff estimates previously discussed. Generally, the model fit is better for coffee than for sugar. However, standard likelihood ratio (LR) tests indicate that unobserved variance at the country-level (σ_u) is significant and warrants the specification of random effects in both cases. Rho (ρ) reports the share of σ_u in total error variance and indicates that for both coffee and sugar over half the error variance (75 to 79 per cent and 58 to 64 per cent, respectively) is accounted for by the cross-sectional residual term. The size and significance of population is robust to the change of model assumptions. Distance is not, indicating that it is correlated with the cross-sectional residual term. The size of the empire effect is reduced considerably, although it remains negative and statistically significant. The empire effect estimates by country are also reduced, although the distribution of this effect across countries is similar and the coefficients are negative and statistically significant in most cases. The effect of Imperial tariffs remains negative and statistically significant, indicating that they are useful (albeit imperfect) instruments for the empire effect. Given that the random effects model constrains the unit effects towards the mean, it is not surprising that the estimates on the cross-sectional variables are smaller than those derived from the fixed effects specification.

Table 8: The determinants of the geographical distribution of coffee and sugar exports from Rio de Janeiro, random effects with maximum likelihood estimates, 1827-1840.

	Coffee			Sugar		
	1	2	3	4	5	6
		REML			REML	
Population	5.63	5.63	5.63	-.32	-.32	-.32
	(6.26)***	(6.26)***	(6.26)***	(-0.31)	(-0.31)	(-0.31)
Distance	.08	.06	.04	.04	.03	.02
	(2.15)**	(1.62)	(1.01)	(1.37)	(0.94)	(0.63)
Empire	-.10			-.07		
	(-3.34)***			(-3.22)***		
British		-.14			-.10	
		(-2.37)**			(-2.21)**	
Danish		-.08			-.08	
		(-1.39)			(-1.85)*	
Dutch		-.06			-.05	
		(-1.03)			(-1.12)	
French		-.13			-.09	
		(-1.92)**			(-1.76)*	
Spanish		-.10			-.09	
		(-1.97)**			(-2.11)**	
Swedish		-.07			-.03	
		(-1.25)			(-0.71)	
Tariff						
Empire			-.14			-.08
			(-2.79)***			(-2.29)**
No empire			-.07			.02
			(-0.71)			(0.20)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	196	196	196	196	196	196
X^2	47.23***	48.24***	45.27***	12.42	14.05	11.04
σ_u	.05	.05	.05	.04	.04	.04
σ_e	.03	.03	.03	.03	.03	.03
ρ	.77	.75	.79	.61	.58	.64
LR	232.63***	222.62***	252.52***	142.31***	129.56***	153.48***

Sources: same as Tables 5 and 7. Notes: *** p< .01, ** p<.05, *p<.10. X^2 is the likelihood ratio chi-squared test, given alongside the probability that the regression coefficients in the model ≠ 0. σ_u is the variance in the cross-sectional error term. σ_e is the variance in the longitudinal error term. $\rho = \sigma_u/(\sigma_u + \sigma_e)$, the share of cross-sectional error variance in total error variance. LR is the likelihood ratio test for significance of cross-sectional variation.

To provide a complete narrative of the determinants of the distribution of southeastern coffee and sugar exports during this period, it is instructive to examine the distribution of the unobserved heterogeneity over the cross-section derived from the random effects estimation. To ascertain the relative importance of the explanatory variables and unobserved heterogeneity, I disaggregate the predicted values derived from

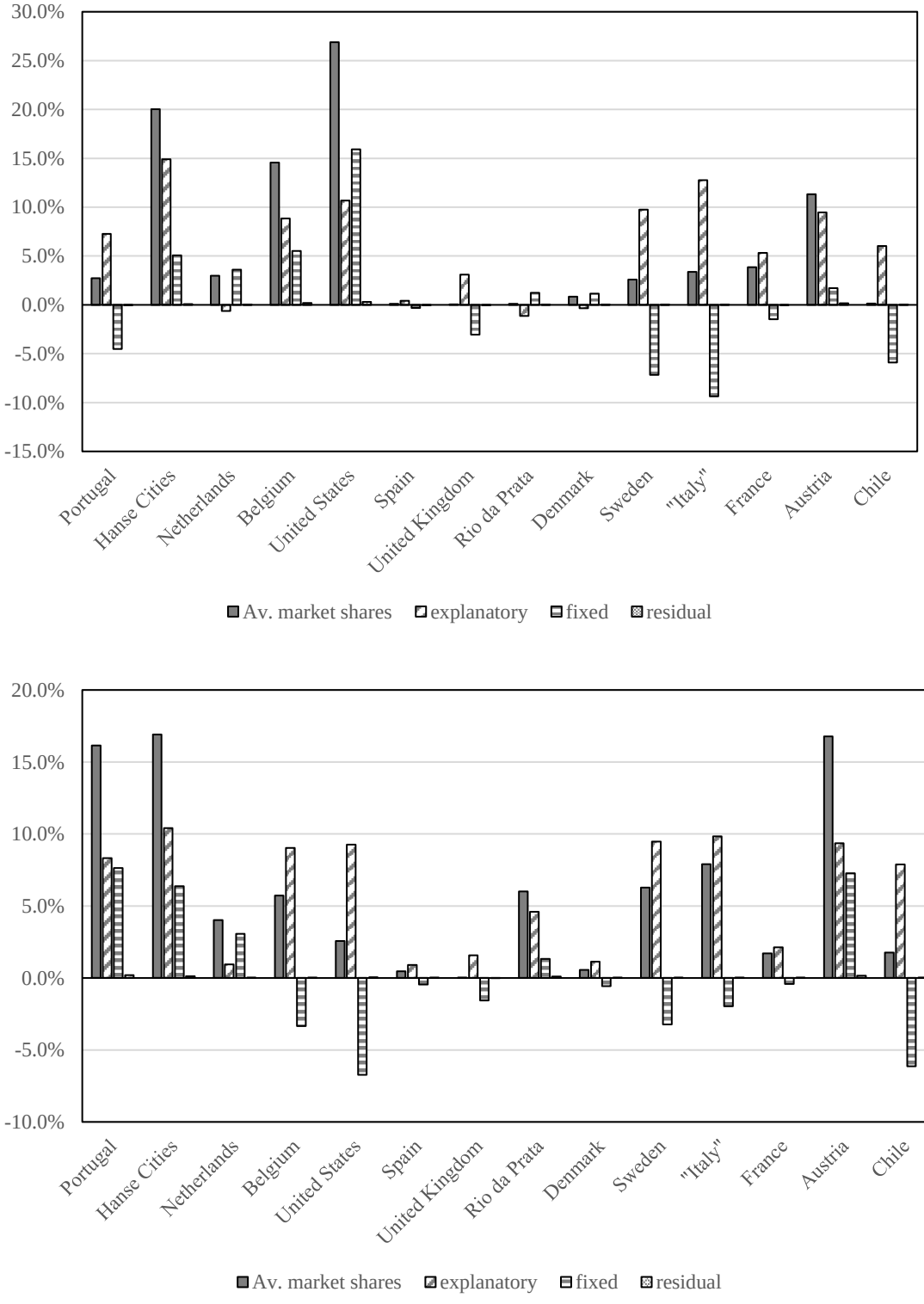
the model into three portions: that predicted by the explanatory variables, that accounted for by unobserved heterogeneity, and the remaining error term. This takes the form:

$$\widehat{ms_{\imath jct}} = \left[\widehat{\beta_0} + \beta_1 \widehat{pops}_{jt} + \gamma_1 \widehat{dist}_{\imath j} + \gamma_2 \widehat{empire}_j\right] + \mu_{ij} + v_{ijct},$$

where $v_{ijct} = ms_{ijct} - \widehat{ms_{\imath jct}}$.

Figure 5 displays the relative contributions of these portions together with predicted average market shares over the cross-section for coffee (above) and sugar (below). The size of the residual term v_{ijct} is negligible, indicating that the predicted average market share is for all purposes identical to the actual one. The size of the unobserved heterogeneity captured by the fixed term is useful, as it can be interpreted as including variables other than population, distance, and the presence of colonial trading networks that influenced the geographical distribution of exports not included in the estimating equation. Here these are interpreted as unobserved characteristics of each market that contributed to the overall market potential for Brazilian coffee and sugar. These might include tariff effects not captured by the empire term, non-tariff barriers, expenditure effects omitted by the use of population as a proxy for market size, country-specific preferences (such as the preference for tea, chicory, mate, or liquor as a substitute for coffee, or beet as a substitute for cane sugar), or any other trade costs not captured by the independent variables. The direction of the fixed term is also telling; a positive term indicates that these characteristics served to increase the potential for coffee and sugar in any given market, a negative term the opposite. As can be seen in Figure 5, this effect was large and positive for the United States in the case of coffee. In fact, this potential effect was larger than that predicted using population, distance and the empire effect. What´s more, the effect was larger than any other country for coffee, and for all countries for sugar. The fixed effect for the United States effectively captures the abolition of tariffs and subsequent rapid increase in the market potential of coffee during the 1830´s. This is the key to understanding the skew in the geographical distribution of exports towards the United States during the 1830´s, and the rise of coffee in the Brazilian southeast.

Figure 5: The distribution of unobserved heterogeneity for coffee (above) and sugar (below) export shares: the contribution of explanatory variables and country fixed effects to predicted average market shares, random effects with maximum likelihood, coffee 1827-1840.



Sources: same as Table 5.

THE FOREIGN MARKET POTENTIAL OF BRAZILIAN COFFEE AND SUGAR

The timing of the abolition of tariffs on coffee in the United States is fundamental for understanding the subsequent commodity boom that took place on the other side of the Atlantic. The abolition of tariffs, and its consequent effect on import demand, converted the United States into perhaps the largest country in the world in terms of market potential for coffee. What's more, the abolition of tariffs on coffee is strongly and positively correlated with the timing of the export boom in Rio de Janeiro. In this section, I provide empirical support to these arguments. Firstly, I construct a simplified market potential measure for New York, Liverpool and Hamburg using a new database of monthly bilateral coffee and sugar imports into New York and Liverpool as well as data on bilateral transaction costs. Secondly, using a simple difference-in-difference framework, I show that – regardless of the control group or estimator - the abolition of tariffs was positively and significantly associated with the growth of exports from southeastern Brazil to the United States.

The simplified market potential measure takes the form:

$$MP_{jct} = \frac{lnY_{jct}}{ln(t_{ijct}+I_{ijct}+T_{jct}+1)},$$

where the market potential of commodity *c* in country *j* at time *t* is calculated as the total demand for commodity *c* in country *j* at time *t* (Y_{jct}), discounted by several observable barriers to trade, being freight rates (t_{ijct}), insurance rates (I_{ijct}), and import tariffs (T_{jct}). This is a version of Harris' (1954) classic formulation of the market potential function. While Harris, and much of the literature that followed, weighted economic size by distance as a proxy for trade costs, the empirical reality is that trade costs were not constant over time. Important aspects of these costs, such as freight and insurance rates, tariffs, and market efficiency, were historical products of technological change and trends in the supply and demand for shipping.

Trade costs are calculated in effective terms; that is, as a percentage of the destination price. The freight data is taken from the same sources as the export data. While data on freights from Rio de Janeiro to key European destinations are available for most of the period, they do not differentiate between commodities. Thus, to calculate the freight factor, I have applied the same specific freight rate to both coffee and sugar. Furthermore, the insurance rate series is for Antwerp, although partial evidence suggests that insurance rates to the United States, Great Britain and the Hamburg were similar.[11] The total import of coffee and brown sugar from all destinations is used as a proxy for Y_{jct}, being the closest indicator of product-specific demand available. Given that a monthly series of imports is not available for Hamburg, I present annual estimates from 1831 onwards. Generally, the sources of the import data for New York and Liverpool are the same as the sources of the price data presented previously. In the case of New York, the *Shipping and Commercial List* published monthly statements of imports by product and origin. In the case of Liverpool, both the *Mercury* and the *General Advertiser* included weekly summaries of arrivals at the port. Thus, a monthly series has been assembled by summing the weekly

[11] Rates for the Atlantic routes most likely hovered around two per cent for most of the period.

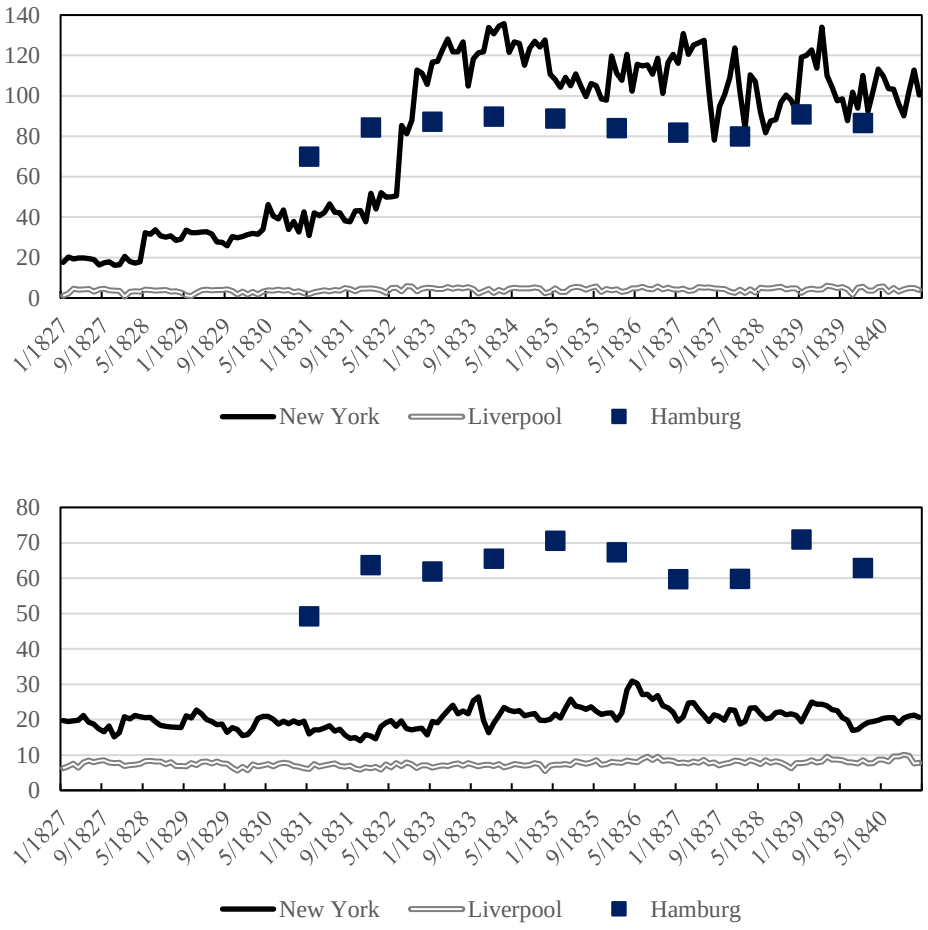
observations. In both cases, the series represent gross imports, and do not account for re-exports. In the case of New York, this is not such a problem, as most re-exports were most likely domestic in character. This was not the case for Liverpool. As previously discussed, due to extremely restrictive colonial preferences, a large part of non-colonial product was re-exported to Continental Europe. The ideal solution would be to correct the import data with re-export data, yielding a monthly series of net imports. Unfortunately, the port-level data for re-exports were not published consistently during the period. Thus, the series for Liverpool will have to be interpreted as including a part of Continental European supply.

Figure 6 presents the results for coffee (above) and brown sugar (below) for the three markets. Prior to 1832, Hamburg was the leading market for Brazilian coffee and sugar in terms of market potential. Between June and November of 1832, however, the market potential of coffee in New York rapidly increased, maintaining the lead for the rest of the period. This was not the case of the market potential of Brazilian sugar in New York, which remained constant. Liverpool was by far the market with the lowest market potential for both commodities.

The interplay of trade cost reductions and subsequent increase in import demand in the American market were key for understanding the trends in market potential. Between 1821 and 1840, freight rates declined from an average of 78 to 53 shillings per hundredweight. Insurance rates followed a similar tendency. The absolute decline in transport costs, however, does not explain the geographically specific character of the expansion of coffee's market potential. The geographical and temporal variation in effective tariffs does. In the United States, tariffs on coffee were gradually reduced from five cents per pound (an ad-valorem equivalent of 34 per cent in 1827) to duty-free status during the period 1828 to 1832.[12] Tariffs on muscovado sugar were reduced from three to two and a half cents during the same period although, as prices were also falling, the ad-valorem equivalent remained steady (at around 37 per cent). Tariffs on non-colonial coffee and sugar in Great Britain were for all purposes prohibitive. The duty of 63 shillings per hundredweight on "foreign" brown sugar represented an average ad-valorem equivalent of 173 per cent; the duty of 140 shilling per hundredweight on coffee, an average of 248 per cent. Coffee and sugar entered virtually duty-free to the Hamburg market, being subjected to an ad valorem tariff of ½ per cent.

[12] The motivation behind the abolition of the tariff on coffee has not been adequately explored by the literature. W. J. Rorabaugh (1981) observed that coffee became increasingly used as a remedy for the rampant alcoholism of the period. During a Congressional hearing regarding the tariff in January of 1833, a representative of Massachusetts highlighted two reasons for the abolition, arguing that "The great and glorious temperance reformation … will greatly increase the use of tea and coffee as a substitute for ardent spirits … I hope that we may not … check a reformation essential to national honor, character, and salvation." Furthermore, he observed that "…coffee and tea do not come in competition with any production of our country… They are of great value; may be safely kept for a long time; and coffee improves by age" (United States 1833, p. 1184).

Figure 6: Foreign market potential of Brazilian coffee (above) and brown sugar (below) in New York, Liverpool and Hamburg, 1/1827-12/1840.



Sources: Imports: New York: *Shipping and Commercial List and New York Price Current*, various years. Liverpool: 1/1827-11/1834, 3/1835-8/1835, 10/1835-12/1835, 1837-1840: *Liverpool Mercury*; 12/1834, 1/1835-2/1835, 9/1835, 1836: *Gore's Liverpool General Advertiser*. Hamburg: Hamburg *Tabellarische* various years. Freight rates: Absell and Tena-Junguito 2017b. Insurance rates: Schöller 1951. Tariffs: United States 1884, pp. 136-37, 156-57; United Kingdom 1843; 1846. Notes: Volumes have been converted to metric tons to provide comparability. The price series used in the calculation of effective trade costs as per Figure 2.

The abolition of the tariff on coffee was, until then, an unprecedented moment in the international market for coffee. The high frequency nature of the bilateral export data provides an opportunity to ascertain the effect of the abolition of tariffs on exports of southeastern coffee to the United States. I perform a simple differences-in-differences estimation that takes the form:

$$x_{jt} = \alpha + \alpha_1 d_t + \alpha^1 d^j + \beta d_t^j + \varepsilon_t^j,$$

where x_t^j is the log of exports to country j at time t, d_t is a dummy that takes the value of one for the treatment period (7/1828 to 12/1840), d^j is a dummy that takes the value of one for the treatment country (the United States), d_t^j is the interaction term that measures the causal effect of treatment, and ε_t^j is the error term. The treatment period is defined as the period following the month of abolition (July of 1832). As previously mentioned, there are several gaps in the series, but these are uniform and do not affect the precise moment when treatment occurs. As the data is monthly and coffee shipments were not received every month, there is a substantial number of zeros in the series. Thus, I present results using both OLS and PPML. I define five control groups: World, which includes 14 countries from Europe, Africa and the Americas; Europe; Non-Imperial Europe, which includes those countries that did not possess colonial suppliers of coffee; Imperial Europe, which includes those that did; and Core, which includes the principal consumers of the southeast´s coffee: the Hanse Cities, Belgium, Austria, and the United Kingdom.[13] Table 9 displays the results. All coefficients bar the PPML estimate for Imperial Europe are positive and statistically significant. There is, however, considerable deviation in the size of the coefficient across control groups. The significant PPML estimates range from a 14 per cent increase (World) to a 30 per cent increase (Non-Imperial Europe) of exports. OLS estimates are on the scale of a 200 (Imperial Europe) to 400 (Non-Imperial Europe) per cent increase. While such deviations make it difficult to define a precise estimate of the impact, it is evident that the abolition of tariffs on coffee in the United States and the subsequent increase of market potential had a significant effect on the volume of exports from southeastern Brazil.

Table 9: The effect of tariff abolition on exports of southeastern coffee to the United States, difference-in-difference estimator, 1/1827-12/1840.

Control Group	DiD coefficient		Obs.	No. of control countries
	OLS	PPML		
World	1.29 (5.08)***	.13 (2.10)**	2,284	14
Europe, all	1.32 (4.98)***	.16 (2.52)***	1,827	11
Europe, non-imperial	1.60 (5.47)***	.26 (4.15)***	911	5
Europe, imperial	1.10 (3.77)***	.01 (0.11)	1,068	6
Core	1.48 (5.19)***	.24 (4.49)***	760	4

Sources: same as Figure 3.

[13] The differences-in-differences estimation is undertaken on the uncorrected data, given that British re-exports were not presented on a monthly basis. This might bias downwards the coefficient of the Non-Imperial Europe control group.

CONCLUDING REMARKS

For sugar producers in the southeast of Brazil facing the international market in the 1830's, times were tough. Given lower fixed costs and labor requirements, barriers to entry were lower for novice (or expanding) coffee producers. With a few exceptions in Continental Europe, tariffs were high, and non-colonial sugar was all but prohibited entry to the most important market for sugar at the time, Great Britain. Coffee, on the other hand, enjoyed duty-free status in one of the most rapidly expanding economies in the world. Market potential mattered for southeastern agricultural producers' investment decisions, and determined what they produced, when they produced it and, once harvested, where they sold it.

This paper represents an empirical rejoinder to traditional supply-side interpretations of the rise of coffee in Brazil's southeast. Yes, non-price factors were important for the direction of southeastern Brazil's export specialization, but they fail to explain its timing. Price signals provided the incentive, and these price signals were determined by forces outside of Brazil. In a sense, this is a nuanced take on some of the claims that the dependency school were making during the last half of the nineteenth century: that peripheral economies were structured by the mechanisms of international capitalism in such a way so that they would supply the raw materials necessary for core capitalist development. However, it wasn't merely agricultural specialization in the periphery that the institutions of the core countries fostered, but also the direction of that specialization. In southeastern Brazil during the 1830's, price signals worked in such a way that over time Brazilian producers were incentivized to quench a particular thirst in a particular market at a particular historical juncture. Brazilian producers were by no means passive agents, however, as the subsequent social and political reactions to the expansion of the coffee sector all clearly demonstrate.

REFERENCES

Absell, Christopher David, and Antonio Tena-Junguito. "Brazilian export growth and divergence in the tropics during the nineteenth century." *Journal of Latin American Studies* 48, no.4 (2016): 677-706.

Absell, Christopher David, and Antonio Tena-Junguito. "The Brazilian export economy, 1822-1913." In Sandra Kuntz Ficker (ed.), *The First Export Era Revisited: Reassessing its Contribution to Latin American Economies*. London: Palgrave Macmillan, 2017a: 113-152.

Absell, Christopher David, and Antonio Tena-Junguito. "The reconstruction of Brazil's foreign trade series. 1821-1913." *Revista de Historia Económica - Journal of Iberian and Latin American Economic History* 36, no. 1 (2017b): 87–115.

Arruda, José Jobson de Andrade. *O Brasil no Comércio Colonial*. São Paulo: Ática, 1980.

Bartels, Brandon L. "Beyond "Fixed versus Random Effects": A Framework for Improving Substantive and Statistical Analysis of Panel, Time-Series Cross-Sectional, and Multilevel Data." Paper presented at the Political Methodology Conference, 2008. Available at https://cpb-us-e1.wpmucdn.com/blogs.gwu.edu/dist/1/170/files/2016/10/bartels_cluster_confounding-1s24lhf.pdf.

Bell, Andrew, and Kelvyn Jones. "Explaining Fixed Effects: Random Effects Modeling of Time-Series Cross-Sectional and Panel Data." *Political Science Research and Methods* 3, no. 1 (2015): 133-153.

Bergad, Laird W. *Cuban Rural Society in the Nineteenth Century: The Social and Economic History of Monoculture in Matanzas.* Princeton: Princeton University Press, 1990.

Berthous, Antoine, and Hélène Ehrhart. "Trade networks and colonial trade spillovers." *Review of International Economics* 24, no. 4 (2017): 891-923.

Bezanson, Anne, Robert D. Gray, and Miriam Hussey. *Wholesale prices in Philadelphia, 1784-1861*. Philadelphia: University of Pennsylvania Press, 1936-37.

Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten Van Zanden. *Maddison Project Database*, version 2018.

Bricongne, Jean-Charles, Lionel Fontagné, Guillaume Gaulier, Daria Taglioni, and Vincent Vicard. "Firms and the global crisis: French exports in the turmoil." *Journal of International Economics* 87, no. 1 (2012): 134-146.

Corrêa do Lago, Luiz Aranha. *Da Escravidão ao Trabalho Livre. Brasil, 1550-1900*. São Paulo: Companhia das Letras, 2014.

Davis, Donald R., and David E. Weinstein. "Market access, economic geography and comparative advantage: an empirical test." *Journal of International Economics* 59 (2003): 1-23.

Dean, Warren. *Rio Claro: A Brazilian Plantation System, 1820-1920.* Stanford: Stanford University Press, 1976.

Dean, Warren. *With Broadax and Firebrand: The Destruction of the Brazilian Atlantic Forest*. Berkeley: University of California Press, 1995.

Denzel, Markus A. *Handbook of World Exchange Rates, 1590-1914.* Surrey: Ashgate, 2010.

Eisenberg, Peter L. *The Sugar Industry in Pernambuco: Modernization without change, 1840-1910*. Berkeley: University of California Press, 1974.

Eltis, David. *Economic Growth and the Ending of the Transatlantic Slave Trade*. Oxford: Oxford University Press, 1987.

Ferreira de Aguiar, João Joaquim. *Pequena Memoria sobre a Plantação, Cultura e Colheita do Café*, Rio de Janeiro: Imprensa Americana de I. P. da Costa, 1836.

Harris, C. C. "The market as a factor in the localization of industry in the United States." *Annals of the Association of American Geographer* 44 (1954): 126-142.

Head, Keith, and Thierry Mayer. "Market potential and the location of Japanese Investment in the European Union." *The Review of Economics and Statistics* 86, no. 4 (2011): 959-972.

Klein, Herbert S., and Francisco Vidal Luna. *Slavery and the economy of São Paulo, 1750-1850.* Stanford: Stanford University Press, 2003.

Klein, Herbert S., and Francisco Vidal Luna. *Slavery in Brazil.* Cambridge: Cambridge University Press, 2010.

Krugman, Paul. "Scale Economies, Product Differentiation, and the Pattern of Trade." *The American Economic Review* 70, no. 5 (1980): 950-959.

Leff, Nathaniel H. "Economic Development and Regional Inequality: Origins of the Brazilian Case." *The Quarterly Journal of Economics* 86, no.2 (1972): 256-257.

Leff, Nathaniel H. *Underdevelopment and Development in Brazil. Volume 1: Economic Structure and Change, 1822-1947.* London: Allen & Unwin, 1982.

Marcondes, Renato Leite. *A arte de acumular na economia cafeeira: Vale do Paraíba, século XIX*. São Paulo: Editora Stiliano, 1998.

Marcondes, Renato Leite, and José Flávio Motta. "Preços e comercialização do café no vale do Paraíba paulista: Bananal em inícios do século XIX." *Revista Brasileira de Economia* 53, no. 2 (1999): 183-209.

Marquese, Rafael de Bivar. “As origens de Brasil e Java: trabalho compulsório e a reconfiguração da economia mundial do café na Era das Revoluções, c.1760-1840.” *História* 34, no. 2 (2015a): 108-127.

Marquese, Rafael de Bivar. “Paisaje, esclavitud y médio ambiente em la economia cafetalera brasileña: Vale do Paraiba, siglo XIX.” *Asclepio. Revista de Historia de la Medicina y de la Ciencia* 67, no. 1 (2015b): 1-15.

Maxwell, Wright & Co. *Commercial Formalities of Rio de Janeiro*. Baltimore: Sherwood & Co., 1841.

Miller, Shawn W. “Fuelwood in Colonial Brazil: The Economic and Social Consequences of Fuel Depletion for the Bahian Recôncavo, 1549-1820.” *Forest & Conservation History* 38, no. 4 (1994): 181-192.

Mitchener, Kris James, and Marc Weidenmier. “Trade and Empire.” *The Economic Journal* 118, no. 553 (2008): 1805-1834.

Medeiros Lima, Carlos Alberto. “Cafeicultores, productores de açucar e tráfico de escravos na província de Sao Paulo (1825-1850).” *Revista de História Comparada* 6, no. 2 (2012): 168-199.

Momsen Jr., Richard P. “Routes Over the Serra do Mar: The Evolution of Transportation in the Highlands of Rio deJaneiro and São Paulo.” *Revista Geográfica* 32, no. 58 (1963): 5-167.

Müller, Daniel Pedro. *Ensaio D’um Quadro Estatístico da Provincia de São Paulo, ordenado pelas leis provinciaes de 11 de A bril de 1836, e 10 de Março de 1837*. São Paulo: Costa Silveira, 1838.

Nogueira de Matos, Odilon. “Evolução das vías de comunicação no Estado do Rio de Janeiro.” *Boletim Paulista de Geografia* 3 (1949): 51-75.

O’Rourke, Kevin H., and Jeffrey G. Williamson. *Globalization and History: The evolution of a nineteenth-century Atlantic economy*. Cambridge: MIT Press, 2001.

Petrone, Maria Thereza Schorer. *A Lavoura Canavieira em São Paulo*. São Paulo: Difusão Européia do Livro, 1968a.

Petrone, Maria Thereza Schorer. “Um comerciante do ciclo do açúcar paulista: Antônio da Silva Prado (1817-1829).” *Revista de História* 36, no. 73 (1968b): 115-138.

Redding, Stephen, and Anthony Venables. “Geography and Export Performance: External Market Access and Internal Supply Capacity.” In Robert E. Baldwin and L. Alan Winters (eds.), *Challenges to Globalization: Analyzing the Economics*. Chicago: University of Chicago Press, 2004: 95-130.

Romalis, John. "Factor Proportions and the Structure of Commodity Trade." *American Economic Review* 94, no.1 (2004): 67-97.

Rorabaugh, W. J. *The Alcoholic Republic: An American Tradition*. Oxford: Oxford University Press, 1981.

Santamaría García, Antonio, and Alejandro García Álvarez. *Economía y colonia. La economía cubana y la relación con España (1765-1902)*. Madrid: CSIC, 2004.

Schöller, P. “L'évolution séculaire des taux de fret et d’assurance maritimes 1819-1940.” *Bulletin de l’Institut de Recherches Économiques et Sociales* 17, no. 5 (1951): 519-557.

Soares, Sebastião Ferreira. *Notas Estatisticas sobre a Producção Agricola e Carestia dos Generos Alimenticios no Imperio do Brazil*. Rio de Janeiro: Typ. Imp. e Const. de J. Villeneuve e Comp, 1860.

Sousa, José de, and Julie Lochard. “Trade and Colonial Status*.” Journal of African Economies* 21, no. 3 (2012): 409-439.

Stein, Stanley J. *Vassouras: A Brazilian Coffee County, 1850-1900: The Roles of Planter and Slave in a Plantation Society.* New Jersey: Princeton University Press, 1985.

Summerhill, William R. *Order Against Progress: Government, Foreign Investment, and Railroads in Brazil, 1854-1913.* Stanford: Stanford University Press, 2003.

Topik, Steven. "The World Coffee Market in the Eighteenth and Nineteenth Centuries, from Colonial to National Regimes." LSE Working Paper No. 04/04, 2004.

Viotti da Costa, Emília. *Da Senzala à Colônia*. São Paulo: UNESP, 1998.

Waterston, William. *A Manual of Commerce*. Edinburgh: Oliver & Boyd, 1840.

OFFICIAL SOURCES

Cuba. *Noticias estadísticas de la Isla de Cuba en 1862. Dispuestas y publicadas por el Centro de Estadística. Conforme a ordenes e instrucciones del Excmo. Sr. Intendente de Hacienda, Conde Armildez de Toledo*. Habana: Imprenta del Gobierno, Capitania General y Real Hacienda por S. M., 1864.

Cuba. *Cuadro estadístico de la siempre fiel Isla de Cuba, correspondiente al año de 1846 / formado bajo la dirección y protección del Escmo. Sr. gobernador y capitán general Don Leopoldo O-Donnell, por una comisión de oficiales y empleados particulares*. Habana: Imprenta del Gobierno y Capitania General, 1847.

Hamburg. *Tabellarische Übersichten des Hamburgischen Handels im Jahre*. Hamburg: Kümpel, various years.

United States. *Register of Debates in Congress: Comprising the Leading Debates and Incidents of the Second Session of the Eighteenth Congress*. Washington: Gales and Seaton, 1833.

United States. *The existing tariff on imports into the United States, etc., and the free list, together with comparative tables of present and past tariffs, and other statistics relating thereto. Prepared by the Committee on finance, United States Senate. January 7, 1884. Reported by Mr. Morrill and ordered to be printed*. Washington: Government Printing Office, 1884.

United Kingdom. *Tables shewing the trade of the United Kingdom with different foreign countries and British possessions, in each of the ten years from 1831 to 1840*. House of Commons Parliamentary Papers Online, 1842.

United Kingdom. *Coffee.—Cocoa.—Cheese and butter. Accounts of the quantities of coffee imported into the United Kingdom, entered for home consumption, &c., from 1820 to 1842;--of cocoa, from 1832 to 1842;--and, of cheese and butter, from 1830 to 1842*. House of Commons Parliamentary Papers Online, 1843.

United Kingdom. *Sugar. An account of the quantities of sugar imported into the United Kingdom; the quantities retained for actual consumption; the rates of duty charged on the home consumption, and net revenue accruing therefrom; with a comparative statement of the average prices of British and foreign plantation sugar in each year from 1815 to 1840*. House of Commons Parliamentary Papers Online, 1846.

United Kingdom. *Chicory and coffee. Copies of Treasury minutes, &c., relative to the use and sale of chicory, as a substitute for or mixed with coffee; and account of coffee imported and entered for consumption*. House of Commons Parliamentary Papers Online, 1849.

United Kingdom. *Sugar. Accounts of the quantity of sugar imported and exported into and from Great Britain and Ireland; and amount of duties received*. House of Commons Parliamentary Papers Online, various years.

United Kingdom. *Coffee. Accounts of the quantity of coffee imported and exported into and from Great Britain and Ireland; and amount of duties received*. House of Commons Parliamentary Papers Online, various years.

United Kingdom. *Tables of the revenue, population, commerce, &c. of the United Kingdom, and its dependencies*. House of Commons Parliamentary Papers Online, various years.

NEWSPAPERS AND PRESS

Börsen-Halle.

Correio Mercantil.

Diario Mercantil.

Diario de Rio de Janeiro.

Gore's Liverpool General Advertiser.

Handelblad.

Jornal do Commercio.

Liverpool Mercury.

The Manchester Times and Gazette.

Nieuw Rotterdamsche Courant.

North Wales Chronicle.

O Despertador.

Rio Mercantile Journal.

Semanario Mercantil.

Shipping and Commercial List and New-York Price Current