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Distance, Empire, and British Exports Over Two Centuries

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DISTANCE, EMPIRE, AND BRITISH EXPORTS OVER TWO CENTURIES ⋆

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Abstract

We introduce a new dataset on British exports at the bilateral, commodity-level from 1700 to 1899. We then pit two primary determinants of bilateral trade against one another: the trade-diminishing effects of distance versus the trade-enhancing effects of the British Empire. We find that the impact of gravity fell by a factor of roughly three between the 1780s and 1850s. The impact of empire on British exports was extremely large throughout, but the impact of 18th century mercantilism was much higher than that of empire in the liberal late 19th century.

JEL classification codes: F1, N7
Keywords: Long run historical data, distance, empire, gravity, international trade

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1 Introduction

There is a vast literature on the impact of distance on long-distance trade, but little evidence on how this impact has evolved over the very long run. There is also a literature on the erosion of colonial trade relationships post-independence (Head, Mayer, and Ries, 2010), but little evidence on how these empire effects emerged in the first place.

This gap in our knowledge persists for a simple reason: the scarcity of high quality, sufficiently detailed trade data prior to the mid-19th century. In this paper, we introduce an extensive new hand-collected dataset on English/British/UK exports at the bilateral commodity-level for the two centuries from 1700 to 1899.[1] We can thus estimate both the trade-diminishing effects of bilateral distance, and the trade-enhancing effects of membership in the British Empire, as far back as 1700 – more than a century earlier than any existing study to date (Mitchener and Weidenmier, 2008; Jacks, Meissner, and Novy, 2011; Fouquin and Hugot, 2016).

This was a period of momentous and almost continuous change. Technologically, iron steamships were crossing the English Channel by the 1820s, and a regular trans-Atlantic steam service was in place by 1838. Railway construction progressively linked ports to their hinterlands from the 1830s. Politically, the 18th century saw Britain fighting wars in Europe, India, and the Americas, culminating in the American Revolutionary War and the quarter century struggle against France that only ended in 1815. While the loss of the United States was a major blow, the Empire resumed its expansion in the 19th century in Africa and Asia, while settler colonies were established in Oceania and consolidated in what remained of British North America. Economically, the 18th century was the era of mercantilism, with commerce tightly regulated by the Navigation Acts while the East India Company controlled British trade with India and China.[2] The EIC lost its Indian and Chinese trade monopolies in 1813 and 1833 respectively, while the UK adopted a free trade policy in 1846 and abolished the Navigation Acts three years later. By this stage it had undergone an industrial revolution, and was at the heart of the nascent global economy. Were the determinants of trade constant across these two centuries that saw such dramatic shifts in the geopolitical environment, trade policies, and transport costs?

We find that the impact of gravity fell by a factor of three or more between the 1780s

[1] England and Wales were united with Scotland in 1707, forming the new state of Great Britain. In 1801 Britain and Ireland merged to form the United Kingdom.

[2] Dal Bó et al., forthcoming, discuss the importance of trade-related taxes for British government revenue during this period.

and 1850s, with the distance coefficient declining from somewhere between -1 and -0.75 to roughly -0.25. The impact of empire on British exports was extremely large throughout, but the impact of mercantilism was substantially higher than that of empire in the liberal late 19th century: the empire coefficient was roughly 2 in the early 18th century, rose to roughly 3 in the late 18th century, and then fell to slightly over 1 in the late 19th century.

Section 2 introduces the new data underlying this paper, Section 3 introduces our empirical specifications, Section 4 presents our results, and Section 5 concludes.

2 Data

Subsection 2.1 discusses how we constructed our dataset, and subsection 2.2 offers a brief overview of British exports during the period 1700-1899.

2.1 A new British export dataset

Our main contribution is a new and comprehensive dataset of bilateral, commodity-level British exports from 1700 to 1899. All related image files, files used for the raw data entry, and the cleaned and consolidated data used in this paper are available at: https://davidjacks.org/british-trade-data/. The primary sources of the data are the export ledgers compiled by the Customs and Excise Department under various titles from 1697 to 1899 (see Appendix A). These were entirely hand-written until the mid-19th century, and remained partly hand-written thereafter, thus precluding the use of optical character recognition software.

424,551 lines of raw data from over 7,000 pages of ledgers were scanned, digitized, and (painstakingly) cleaned by hand. For our present purposes we focus our attention on British exports. Our reasons for doing so relate to: (i) concerns over smuggling activity and under-reporting which primarily apply to imports and re-exports; and (ii) potential concerns over market versus official valuations of trade flows which ease considerably earlier in the case of exports than of imports (see below).

The ledgers contain a line-by-line account of Britain's commodity-level bilateral trade flows with locations in the rest of the world. Both the primary and secondary literature provide reassurance that the ledgers represent the full population of British trade flows. They are, however, presented in an inconsistent welter of detail – in some years, for instance, distinguishing between trade with London versus "outports", trade carried out on British versus foreign ships, or the trade of sub-national units like England versus Scotland. There are also changes over time with respect to the reporting unit: thus, trade flows are captured for England and Wales up to 1780, for Great Britain up to 1830, and for the United Kingdom up to 1899.[3]

The ledgers are the sources underlying such classic studies of British trade as Schlote (1958) and Schumpeter (1960). However, this pioneering work was mostly concerned with computing aggregate trade statistics, reflecting the scholarly interest of the period in macroeconomic aggregates, as well as technological constraints on data storage. In consequence, despite the tremendous time and effort which was expended on compiling and aggregating these statistics, most of the resultant figures gave little sense of the important shifts in the commodity-by-country composition of British trade which occurred over this period.

A notable advance came with the lifelong work of Ralph Davis, summarized in Davis (1979). In this slim but dense volume, Davis details British exports and imports using a classification scheme of roughly 20 commodity groups across 15 geographical designations between 1785 and 1855. This is one of the only attempts to provide early British trade data at the commodity-country level, with most studies reporting total trade figures for a particular commodity or a particular geographic entity, but not their cross-tabulation. Our project is thus a continuation of and improvement on the path-breaking work of Davis, with no further systematic evidence having been collected over the past four decades.

Our goal was to digitize the export ledgers at 10 year intervals from 1700 to 1899.[4] However, in any project like this there are a number of caveats regarding the data which should be addressed head-on:

1. Going back as far as Clark (1938), commentators have questioned the reliability of these statistics due to the lack of effort by and misaligned incentives of government agents, smuggling activity, and the under-reporting of imports in particular. Although such concerns are undoubtedly valid, the scale of this type of activity was almost certainly dominated by the volume of trade legitimately recorded and is more likely even smaller in the case of export activity. Furthermore, there is nothing in the

[3] In 1790, the first year in which exports are reported for England and Scotland, the former accounted for 95% of all British exports. In 1840, the first year in which exports are reported for England, Ireland, and Scotland, the first accounted for 90% of all UK exports.

[4] The full set of years in the final dataset are 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1800, 1807, 1820, 1830, 1840, 1850, 1860, 1869, 1880, 1890, and 1899. The inclusion of “off years” like 1807 was driven by data availability in particular benchmark years.

historical record suggesting any systematic bias across countries, industries, or industry-by-country combinations (which will form our basic observational unit).

2. Before 1904 (that is, during our entire period of interest), British exports were reported for those countries to which they were directly shipped. Thus, trans-shipment trade went unreported (and, as a consequence, land-locked nations are absent in the data). Additionally, while the goods categories reported in the ledgers were generally becoming more aggregated, the level at which destinations were reported was generally becoming more disaggregated. What this means is that in using the most geographically disaggregated data available in any given year to examine the extensive margin of British exports we run the risk of conflating the "real" extensive margin with changes in the process of data collection and coding.

   We thus aggregate the bilateral, commodity-level export data up to the smallest areas which can be consistently tracked through time. For example, we merge all observations on China and Hong Kong. In what follows, this amounts to having 86 geographic destinations (or "countries") for every year in our gravity regressions. Appendix B describes the geographic distribution of the 86 destinations in our final dataset.

3. The evolving structure of the British economy over these two centuries implied corresponding changes in the structure of the trade data reported in the ledgers. Some goods categories suddenly emerge in the data (like railway carriages) while others disappear (like human hair). The chief problem this raises is how to assign consistent goods categories across years.

   From the original 424,551 raw observations of disaggregated exports from 1700 to 1899, we arrive at 254,998 observations of exports for the whole of England, Britain or the UK (depending on the year being considered), rather than from individual ports or sub-national units. To these observations, we assign consistent country identifiers as described above. We then assign SITC-2 codes to each observation: given that the commodity headings that were used were often quite imprecise, it is easier to assign exports to broader than to narrower categories. Thus, we obtain:

   - 254,998 observations that can be classified at the 1-digit level (e.g, beverages & tobacco);
   - 250,511 observations that can be classified at the 2-digit level (e.g, beverages);

- 231,503 observations that can be classified at the 3-digit level (e.g, alcoholic beverages).

Given the rather large reduction in the number of observations when we move from the 2-digit to the 3-digit level, we settle on the 2-digit level as our preferred level of analysis as it provides the best compromise between disaggregation and observation count. We then aggregate the monetary value of individual observations at the 2-digit level to form our measure of exports at the country-industry level. We interpret the ledgers as representing the universe of British trade and rectangularize the data by assigning zero values to observations for particular country-industry combinations for which there are no recorded values.

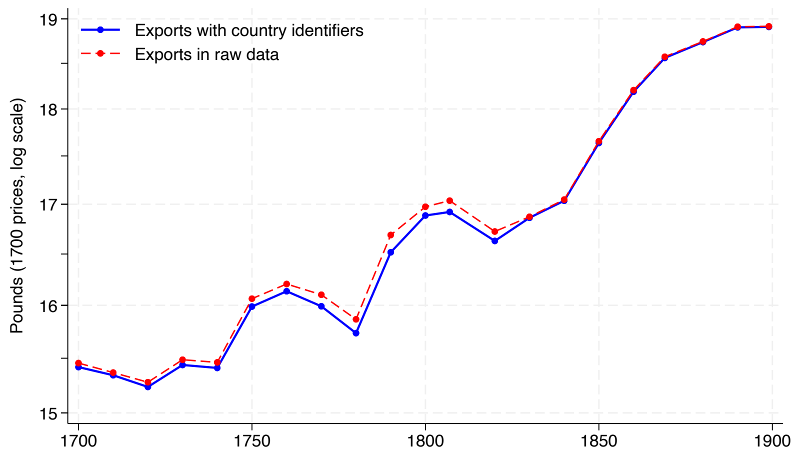
4. Another obstacle to the use of the ledgers is the aforementioned fact that the underlying prices used to value bilateral trade flows were initially fixed – from 1702 to 1813 in the case of exports and from 1702 to 1853 in the case of imports. These "official prices" were based on average prices prevailing in or around 1694 and were presumably used in an attempt to minimize bargaining over customs valuations and, thereby, maximize compliance. For many researchers, this implicit fixed price index was seen as a chief attraction of the data, in that it provided a consistent measure of real quantities exported and imported. For example, Deane and Cole (1962) famously used these data to construct their indices of industrial production. On the other hand, aggregating across such real quantities to obtain aggregate export values – required in order to estimate standard gravity models – is clearly problematic. In order to address this issue we estimate gravity models using industry-time fixed effects, thus capturing changing relative prices over time.

Our final dataset thus consists of English/British/UK exports to 86 consistently-defined "countries" from 58 2-digit industries in 21 years between 1700 and 1899. The final observation count is 104,748 (4,988 observations for each of the 21 years).

2.2 Overview of British exports

As stressed above, the use of constant official prices to value exports prior to 1813 means that aggregating trade figures is not ideal. Nevertheless, creating such an aggregate can give a rough indication of overall export trends. Figure 1 thus plots the log of real aggregate British exports (in pounds sterling) by year from 1700 to 1899. Up to 1813 these are the

Figure 1: Aggregate British exports, 1700–1899



Notes: See text.

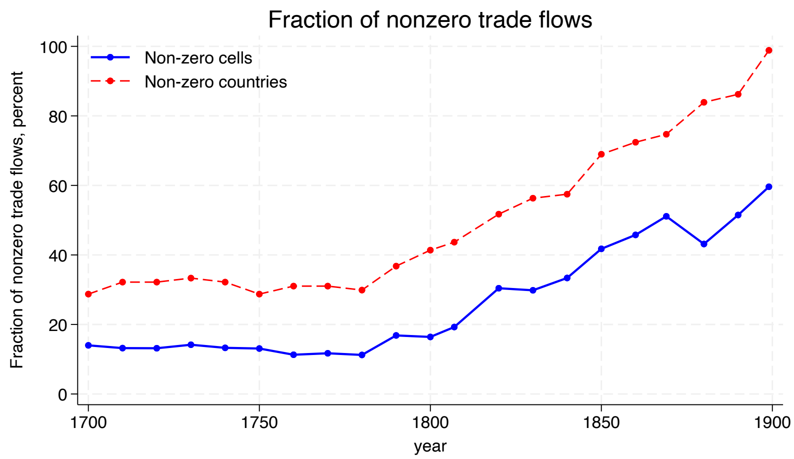
sum of all exports, valued at official (fixed) prices. From then on they are the sum of all exports valued at market prices, but deflated by the Bank of England's composite price index.[5] The two series represent the sum of all observations in the raw data (the dotted red line) and the sum of all observations for which we can assign commodity and country identifiers and which we use in the analysis below (the solid blue line). The very high degree of correspondence between the two series is reassuring.

The solid blue line suggests that British exports increased by 1.47 log points or by a factor of 4.4 in real terms between 1700 and 1800. Much of this increase occurred between 1740 and 1750, and again after the independence of the United States in 1783. Likewise, the figure suggests that British exports increased by 2.02 log points or by a factor of 7.27 in real terms between 1800 and 1899. The vast majority of this export growth is concentrated in the period from 1840 to 1869 (1.52 log points or 380%), with relatively modest growth in real exports between 1869 and 1899 (0.34 log points or 33%).

Figure 2 turns to the extensive margin of trade, where the use of official prices prior to 1813 is not an issue. The solid blue line depicts the share of non-zero cells in our matrix of 86 countries by 58 industries. The dotted red line depicts the share of 86 countries for which British exports (in any industry) were positive in a given year. Both series are relatively flat between 1700 and 1780 (averaging 12.8% for the solid blue series and 28.7% for the dotted red series), suggesting that most of the export growth depicted in Figure 1

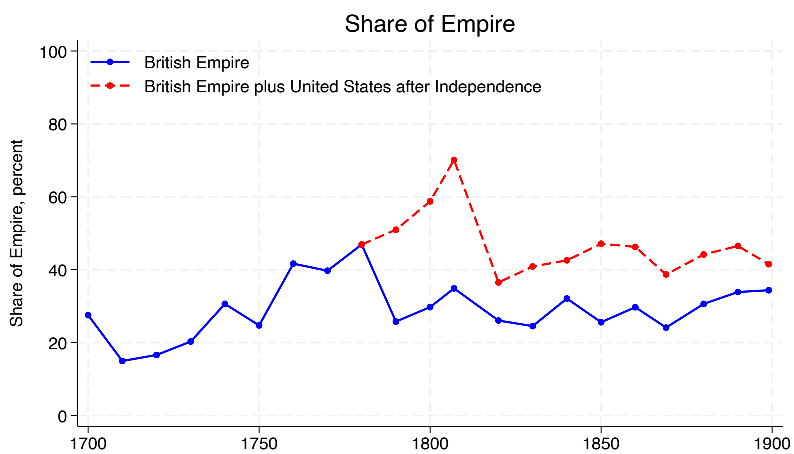
[5] https://www.bankofengland.co.uk/monetary-policy/inflation/inflation-calculator

Figure 2: The extensive margins of British exports, 1700–1899



Notes: The solid blue line depicts the share of non-empty cells in our matrix of 86 countries by 58 industries recorded at the SITC 2-digit level on a year-by-year basis. The dotted red line depicts the share of 86 countries for which British exports (in any industry) are positive on a year-by-year basis.

Figure 3: British export share with the Empire, 1700–1899



Notes: The solid blue line represents the share of British exports going to destinations in the contemporaneously-defined British Empire. The dotted red line represents this share plus the share of the United States after Independence.

occurred on the intensive margin, that is, within a relatively fixed set of importer-industry combinations. In contrast, the period from 1780 to 1899 was marked by a steady increase in both the share of non-zero cells (from 11.2% in 1780 to 59.6% in 1899) and the share of non-zero countries (from 29.9% in 1780 to 98.9% in 1899), suggesting that British exports grew on the extensive as well as the intensive margin after 1800.

Finally, Figure 3 depicts the importance of trade with the British Empire over these two hundred years. The solid blue line represents the share of observed exports going to destinations in the contemporaneously-defined British Empire.[6] The dotted red line adds the post-independence United States to the total. The difference between the two lines after 1783 thus represents the US share of British exports. The share of the British Empire rose until 1780 (from 27.6% in 1700 to 46.9% in that year). US independence initiated a precipitous decline in the empire share to 25.8% in 1790. There followed a partial recovery over the 19th century, to 34.4% in 1899. Exports to what would become the United States had been very important prior to independence. They represented on average 9.3% of the total between 1700 and 1780, peaking at 19.9% in 1760. The dramatic rise in the US share between 1790 and 1807 reflects the resumption of normal trading relationships between ex-colony and coloniser, as well as the diversion of British exports in light of the war with France (at least until the US Embargo Act came into effect in December 1807). The figure also highlights the importance of the United States as a destination for British exports after 1815 (representing on average 13.7% of the total between 1820 and 1899).

3 Gravity in the very long run

Guided by theory, taking into account the specifics of our data, and capitalizing on developments in the empirical gravity literature (Larch et al., 2025), we specify the following econometric model as the benchmark for our estimation analysis:

$$x^k_{j,t} = \exp[\alpha_1 \ln(DIST_{j,t}) + \alpha_2 EMPIRE_{j,t} + \alpha_3 WAR_{j,t} + \alpha_4 \ln(GDP_{j,t}) + \psi^k_t + \gamma_j] \times \epsilon^k_{j,t}. \quad (1)$$

The dependent variable in equation (1), $x^k_{j,t}$, denotes British exports in industry k to destination j in year t.[7] To take full advantage of the rich dimensions of our data, and consistent with the theoretical foundations that motivate disaggregated and dynamic gravity models, we will obtain our main results by pooling the data across industries and over time.[8] $x^k_{j,t}$ is in levels because we will estimate our model in multiplicative form with the Poisson Pseudo Maximum Likelihood (PPML) estimator, which has established itself

[6]The figures prior to 1813 come with the same caveat as before: they are based on trade flows valued at fixed official prices.

[7]Since our data only cover one exporter, we have simplified notation by omitting the exporter subscript in equation (1). Alternatively, we could have added subscript UK to all variables, except for $GDP_{j,t}$.

[8]In the robustness analysis, we experiment with cross-section data and we obtain sectoral estimates too. Appendix D includes our sectoral estimates and Appendix E includes the cross-section results.

as the leading gravity estimator mainly due to its ability to account for heteroskedasticity and zeros in the trade data (Santos Silva and Tenreyro, 2006).[9]

Turning to the covariates in equation (1), $\ln(DIST_{j,t})$ is the logarithm of bilateral distance between Britain and each of the export destinations in our sample. This is computed as the minimum distance between either London or Liverpool and the nearest relevant port in each destination.[10] Note that the distance variable in our model varies over time, due to the opening of the Suez canal in November 1869. The implication for our econometric analysis is that the distance variable will not be absorbed by the destination-specific fixed effects that will be included in some of our specifications. We will begin by obtaining a single estimate of the impact of distance across industries and over time. However, our main estimates of the impact of distance will vary over time.

The other main covariate of interest to us is $EMPIRE_{j,t}$ - an indicator variable that takes a value of one if destination j is a contemporaneous member of the British Empire, and equal to zero otherwise. Similar to the analysis of the impact of distance, we will first obtain a single estimate of the 'Empire' effect that is common across years and industries. However, our main analysis will explore the evolution of the Empire effects over time.

In addition to the two most important variables in our model, we also will control for the presence of wars with an indicator variable ($WAR_{j,t}$) that takes a value of one for the duration of each of the wars between Britain and the destinations in our sample, and is equal to zero otherwise.[11] Finally, we will control for the size of the destination countries by using the logarithm of real destination-specific GDPs in each year $t - \ln(GDP_{j,t})$. Ideally, and consistent with theory, we would have liked to use industry-specific expenditure for each destination. However, since such data do not exist for our period, we will rely on aggregate country-specific real GDP data as the best available proxy for the spending capacity at each destination.[12]

[9]Larch et al. (2025) offer a detailed discussion of seven properties of the PPML estimator that make it attractive for gravity estimations. In Appendix E, we also obtain OLS estimates for robustness.

[10]Distances in nautical miles were obtained from searoutes.com, in all cases specifying that the Kiel and Panama canals were blocked. For pre-1870 distances we further assumed that Suez Canal was blocked. A list of the ports concerned, together with the distances, is provided in Appendix C.

[11]The wars considered are the Great Northern War 1700-1721, the War of the Spanish Succession 1701-1714, the War of the Quadruple Alliance 1718-1720, the War of Jenkins Ear 1739-1748, the War of the Austrian Succession 1740-1748, the Seven Years War 1756-1773, the U.S. revolutionary and associated wars 1774-1784, the French Revolutionary and Napoleonic (and associated) Wars, 1792-1816, the War with the Kingdom of Italy, Etruria, and Naples 1805-1815, the Anglo-Spanish Wars 1796-1802 and 1804-1808, the Anglo-Turkish war 1807-1809, the Anglo-Russian war 1807-1812, the U.S. War of 1812, the Battle of Navarino 1827, and the Crimean War 1853-1856.

[12]Country-specific real GDP is constructed as the product of national GDP per capita taken from the

The last two terms in equation (1) denote fixed effects. Specifically, ψ_t^k denotes a set of industry-time fixed effects, which will fully control for and absorb all determinants of British exports that vary across the industry, time, and industry-time dimensions. The industry-time fixed effects are very important in the context of the specific structure of our data, which includes a mix of observations of UK exports that are expressed in official prices (that is, in real terms until 1813) and market prices (that is, in nominal terms from 1814). The industry-time fixed effects will absorb and fully control for these changes in industry-specific price levels. Therefore, industry-time fixed effects will be included in our main specifications.

In some specifications we also include destination fixed effects, γ_j, which will control for any destination-specific determinants of British exports. A limitation of the single-country data is that we will not be able to fully control for the multilateral resistance terms (Anderson and van Wincoop, 2003). However, in combination with the GDP variable, the fixed effects in our model should account for most of the variation in multilateral resistances, thereby assigning any residual variation to the error term ($\epsilon_{j,t}^k$). Finally, in all of our specifications, we will cluster the standard errors by industry-destination.

4 Empirical findings

Our analysis proceeds in two steps. First, we obtain panel estimates of the effects of distance and empire that are constrained to be common across the years and the industries in our data. Then, we explore the evolution of the distance and empire effects over the course of the 18th and 19th centuries.[13]

Common panel gravity estimates. Table 1 includes panel estimates obtained from variants of equation (1). The three columns of Table 1 differ in their use of fixed effects. This analysis serves three purposes. First, it provides benchmark estimates of the effects of the key covariates in our model. Second, it clarifies some features of the data. Third, it illustrates the benefits and costs of using different sets of fixed effects in our model.

The results in column (1) of Table 1 are obtained without any fixed effects. Encouragingly,

Maddison Project Database 2020 and population drawn from the Our World in Data website. Those countries with insufficient data for the former were assigned the world average instead. In Appendix E, we further experiment by allowing the coefficients on the GDP variable to be industry-specific, and this does not affect our main findings.

[13] In Appendix D, we obtain estimates of the heterogeneous effects of distance and empire across 10 broad sectors in our data.

Table 1: Panel Gravity Estimates, 1700-1900

	(1) No FEs	(2) k,t FEs	(3) k,t & j FEs
$\ln(DIST_{j,t})$	-0.367	-0.293	-1.370
	(0.079)**	(0.063)**	(0.388)**
$EMPIRE_{j,t}$	1.332	1.211	0.429
	(0.359)**	(0.166)**	(0.168)*
$WAR_{j,t}$	-1.779	0.081	0.139
	(0.236)**	(0.406)	(0.322)
$\ln(GDP_{j,t})$	0.633	0.549	0.238
	(0.073)**	(0.033)**	(0.129)$^{+}$
$Constant$	-2.197		
	(1.919)		
N	104748	80840	80840

Notes: This table reports estimates that are obtained from equation (1). The estimator is PPML and the dependent variable is industry-level trade, in levels, over ten years during the period 1700-1900. The differences between the three columns are in the fixed effects. Specifically, no fixed effects are used in column (1). Column (2) uses industry-time fixed effects. Finally, column (3) uses industry-time and country fixed effects. The standard errors in each specification are clustered by industry-destination and are reported in parentheses. $^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$.

the coefficients on all four covariates are statistically significant and have the expected signs. Specifically, we obtain negative, sizable, and statistically significant estimates of the effects on trade of distance and wars, and positive, sizable, and statistically significant estimates of the effects of empire and size.

The results in column (2) of Table 1 are obtained with industry-time (k,t) fixed effects. As discussed earlier, these fixed effects can account for the change in reporting from official prices (until 1813) to market prices (from 1814), and must be therefore included in our baseline specifications. The main implication of their inclusion is that the estimate on $WAR_{j,t}$ becomes economically very small and no longer statistically significant. A specification with only time fixed effects, which is included in Appendix E, delivers a virtually identical estimate of the effect of $WAR_{j,t}$, confirming that there is not enough variation in the data to identify the impact of wars once time fixed effects are included.[14]

The results in column (3) of Table 1 are obtained with industry-time (k,t) and destination (j) fixed effects. Three main changes in the results stand out. First, the estimate of the impact of distance is still negative and statistically significant, but is much larger than in column (2). This estimate should be interpreted with caution because, by construction, it is identified exclusively from the time-variation of the distance variable for those 25

[14] In the robustness analysis in Appendix E, we re-estimate the specification from column (1) based on the sample from column (2), and confirm that the differences between the two columns are indeed driven by the industry-time fixed effects and not by the different number of observations.

destinations in our sample whose trade with Britain was affected by the opening of the Suez canal. Consequently, the related standard errors are also larger in magnitude.

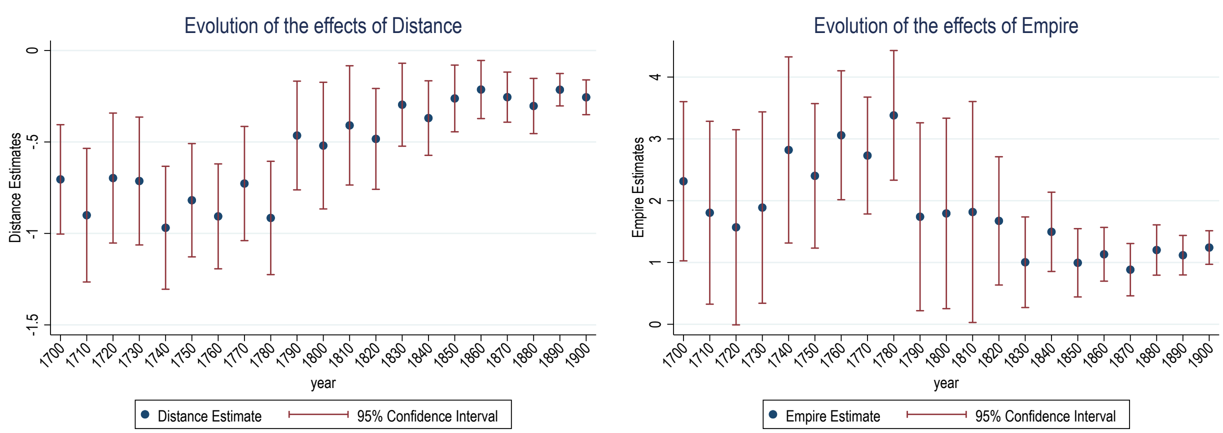
The other two notable differences between the estimates in columns (2) and (3) are that, once the destination fixed effects are added, the coefficients on $EMPIRE_{j,t}$ (now identified exclusively from entries into and out of empire) and $\ln(GDP_{j,t})$ (as well as their precision) become significantly smaller. The implication is that the destination fixed effects absorb most of the variation in these variables. We will therefore obtain our main results without destination fixed effects, but will include these in robustness exercises in Appendix E.

Evolution of the impact of distance and empire over time. The results in Figure 4 are obtained from the following version of specification (1), which includes industry-time fixed effects and allows for the estimated effects of distance and empire to vary over time:

$$x_{j,t}^{k} = \exp[\sum_{T=1700}^{1900} \alpha_{1,T} \ln(DIST_{j,T}) + \sum_{T=1700}^{1900} \alpha_{2,T} EMPIRE_{j,T} + \alpha_3 WAR_{j,t} + \alpha_4 \ln(GDP_{j,t}) + \psi_t^k] \times \epsilon_{j,t}^{k}. \quad (2)$$

The left panel of Figure 4 reports the evolution of the estimated distance effects and the right panel reports the corresponding empire effects. Each of the two panels plots the coefficient point estimates and associated 95% confidence intervals.

Figure 4: Evolution of the Distance v. Empire effects on British exports over time



Notes: This figure reports estimates of the evolution over time of the effects of distance and empire that are obtained from equation (2). The estimator is PPML and the dependent variable is industry-level trade, in levels, over ten years during the period 1700-1900. The left panel of the figure reports the evolution of the estimates of the effects of distance and the right panel of the figure reports the corresponding empire effects, and each of the two panels includes the coefficient point estimates and associated 95% confidence intervals. The standard errors are clustered by industry-destination.

Two findings stand out from the distance estimates in the left panel of Figure 4. First, the distance estimates are all negative and statistically significant, as expected. Second, our distance coefficients can be grouped into three eras. During the first period, 1700-1780, the effects of distance are the largest, and are relatively stable. During the second period, 1780-1850, we observe a significant decrease in the distance effect, with the impact of distance in 1850 more than three times smaller than the corresponding effect in 1780. This is a remarkable result, especially given that our specification controls for and simultaneously allows for time-varying empire effects. The negative distance effects remain stable during the third era, i.e., between 1850 and 1900, albeit at a rather low level (the coefficient is roughly -0.25).[15]

The estimated empire coefficients in the right panel of Figure 4 are all large, positive, and statistically significant.[16] We again identify three eras in their evolution. The first period, 1700-1780, sees a gradual increase in the empire effect. It then declined dramatically in 1790, presumably as a result of American independence, and remained stable until 1820, before declining again. The empire effects remained stable between 1850 and 1900. The empire effect was huge throughout these two centuries. The early 18th century coefficients, around 2, imply a roughly six-fold increase in exports to empire destinations, and the late 18th century coefficients of around 3 imply a 19-fold increase. Even the late 19th century coefficients of around 1 imply an increase of roughly 170 percent: nowhere near as high as during the heyday of mercantilist regulation, but hardly insignificant.[17]

5 Conclusion

Drawing on a new dataset on British exports at the bilateral, commodity-level for the period from 1700 to 1899, we have documented three striking empirical patterns. First, the British Empire was a powerful export-promoting force throughout these two centuries. Second, the impact of empire was much stronger under mercantilism than subsequently. And third, the negative impact of distance fell sharply in the 19th century.

These two centuries saw enormous changes in commercial policy, geopolitics, and the

[15]The sectoral results that we provide in Appendix D show that the distance effects are largest for food and live animals, food oils, crude materials, and mineral fuels.

[16]The sectoral results that we provide in Appendix D show that the empire effects are largest for food and live animals, beverages and tobacco, miscellaneous manufactured goods, and other commodities.

[17]Calculated as $[exp(\hat{\beta}_{Empire})-1]*100$, where $\hat{\beta}_{Empire}$ is the empire coefficient in question. As demonstrated in Appendix E, the time pattern of the empire effects remains the same if we added destination fixed effects to our model, but the whole distribution of estimates shifts down in this case, with the largest estimates remaining large and statistically significant (i.e., between 1.6-1.7 during the period 1760-1780) while the estimates in the early 1700s and the 1800s become small and statistically insignificant.

technology of maritime transport. Perhaps it would have been more surprising if the impact of distance and Empire had remained constant throughout such a period of flux. An economist estimating gravity models in 1700 would have been wrong to assume that their lessons would hold a century later, and there may be a lesson there for economists today.

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Online Appendices

A Sources of British trade dataset by year

All sources are held by UK National Archives, as follows:

1700:	Ledgers of Imports and Exports, CUST 3/4
1710:	Ledgers of Imports and Exports, CUST 3/13
1720:	Ledgers of Imports and Exports, CUST 3/22
1730:	Ledgers of Imports and Exports, CUST 3/30
1740:	Ledgers of Imports and Exports, CUST 3/40
1750:	Ledgers of Imports and Exports, CUST 3/50
1760:	Ledgers of Imports and Exports, CUST 3/60
1770:	Ledgers of Imports and Exports, CUST 3/70
1780:	Ledgers of Imports and Exports, CUST 3/80
1790:	States of Navigation, Commerce and Revenue, CUST 17/12
1800:	States of Navigation, Commerce and Revenue, CUST 17/22
1807:	States of Navigation, Commerce and Revenue, CUST 17/26-29
1820:	Ledgers of Exports of British Merchandise under Countries, CUST 8/11 Ledgers of Imports under Countries, CUST 4/15
1830:	Ledgers of Exports of British Merchandise under Countries, CUST 8/31-32 Ledgers of Imports under Countries, CUST 4/25
1840:	Ledgers of Exports of British Merchandise under Countries, CUST 8/51-52 Ledgers of Imports under Countries, CUST 4/35
1850:	Ledgers of Exports of British Merchandise under Countries, CUST 8/71-72 Ledgers of Imports under Countries, CUST 4/45
1860:	Ledgers of Exports of British Merchandise under Countries, CUST 8/91-92 Ledgers of Imports under Countries, CUST 4/55
1869:	Ledgers of Exports of British Merchandise under Countries, CUST 8/109-110 Ledgers of Imports under Countries, CUST 4/64
1880:	Ledgers of Exports of British Merchandise under Countries, CUST 8/121 Ledgers of Imports under Countries, CUST 4/75
1890:	Ledgers of Exports of British Merchandise under Countries, CUST 8/131 Ledgers of Imports under Countries, CUST 4/85
1899:	Ledgers of Exports of British Merchandise under Countries, CUST 8/140 Ledgers of Imports under Countries, CUST 4/94

Sample ledger pages are shown in Figure A1 to Figure A4. A total of 424,551 raw lines of entries from over 7,000 such ledger pages were scanned and digitized.

Figure A1: Sample ledger page: 1700, exports to France, all handwritten

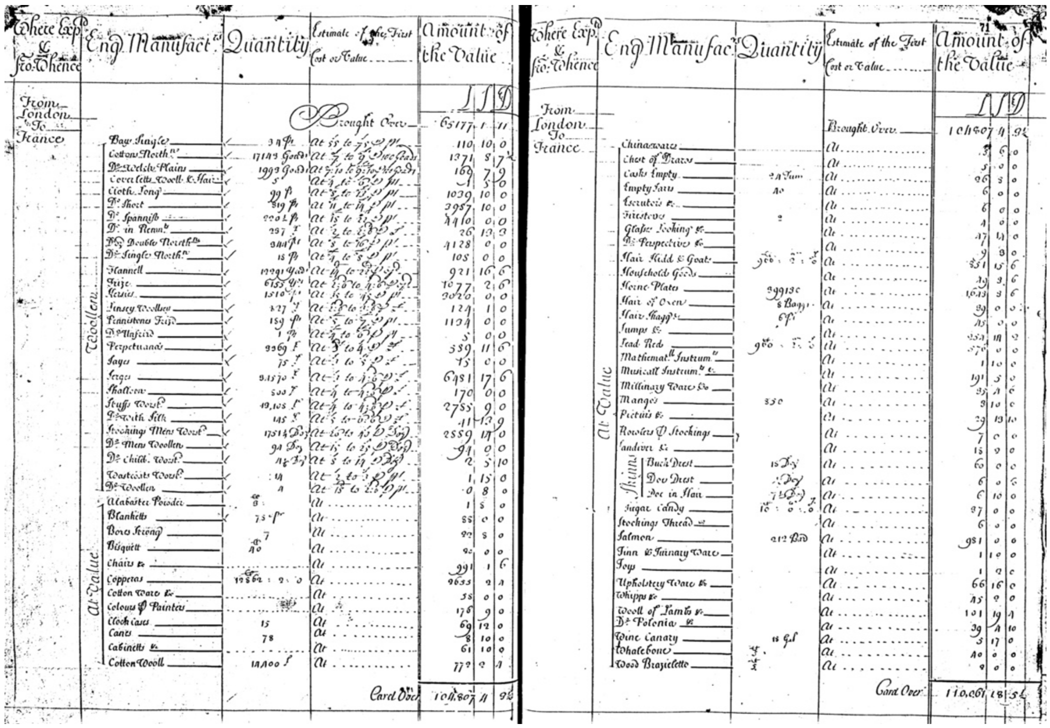


Figure A2: 1820, exports to Hudson's Bay, all handwritten

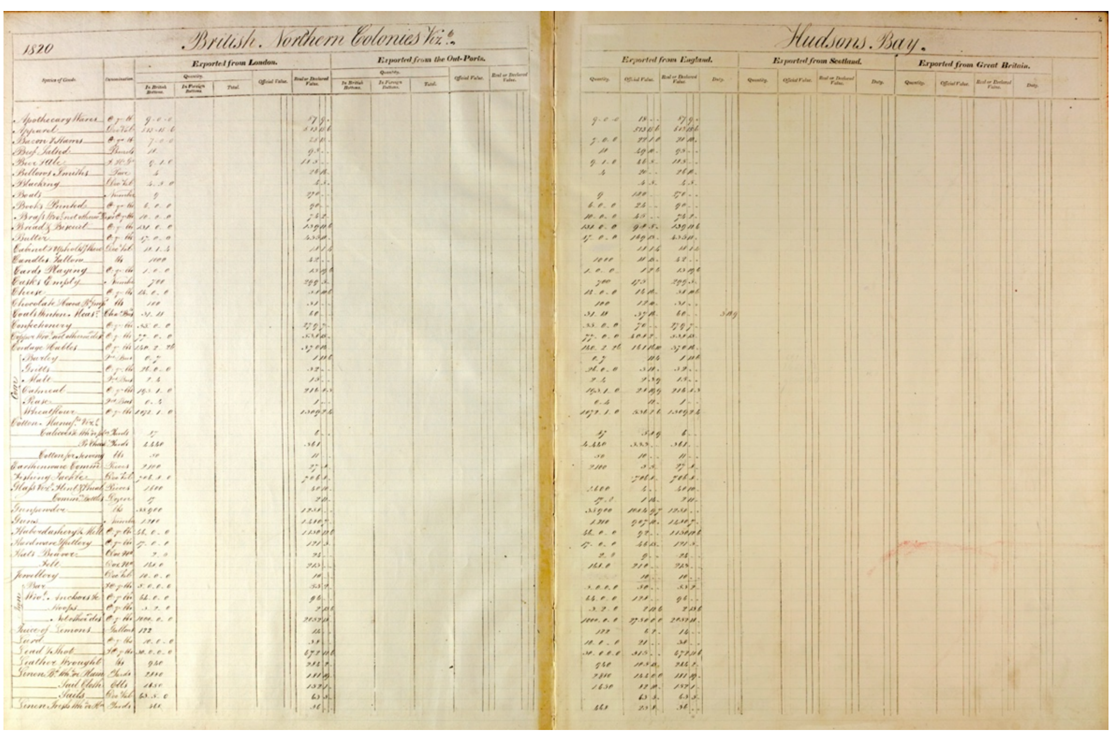


Figure A3: 1869, exports to Bolivia, mix of printed and handwritten

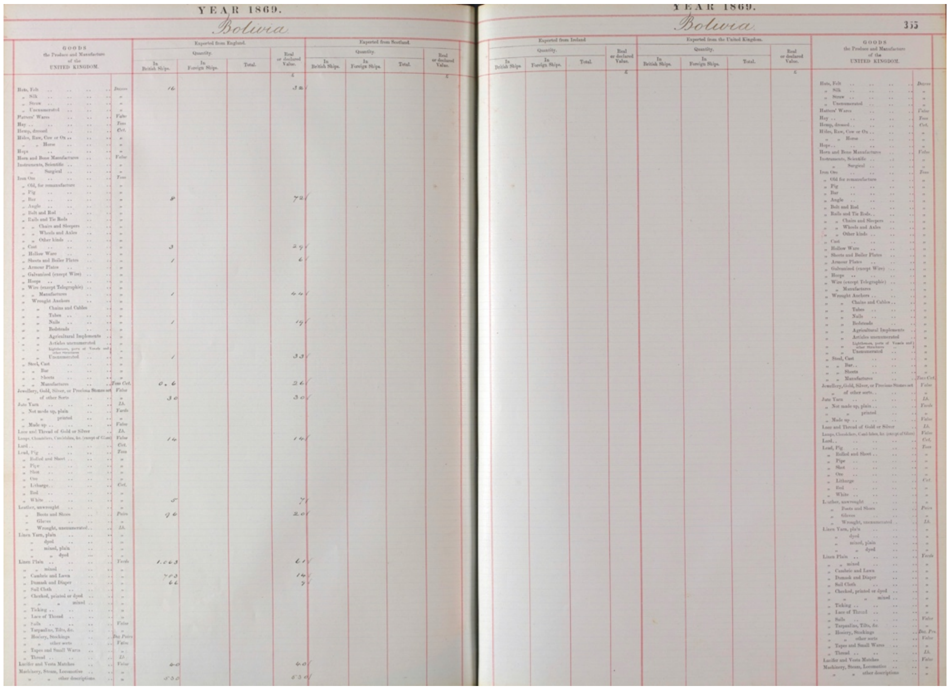
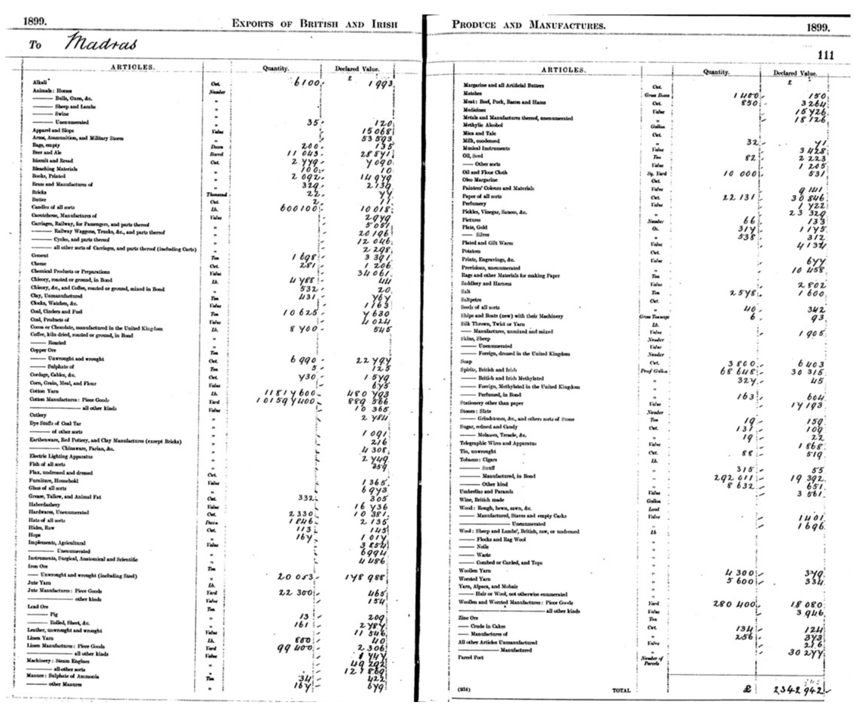


Figure A4: 1899, exports to Madras, mix of printed and handwritten



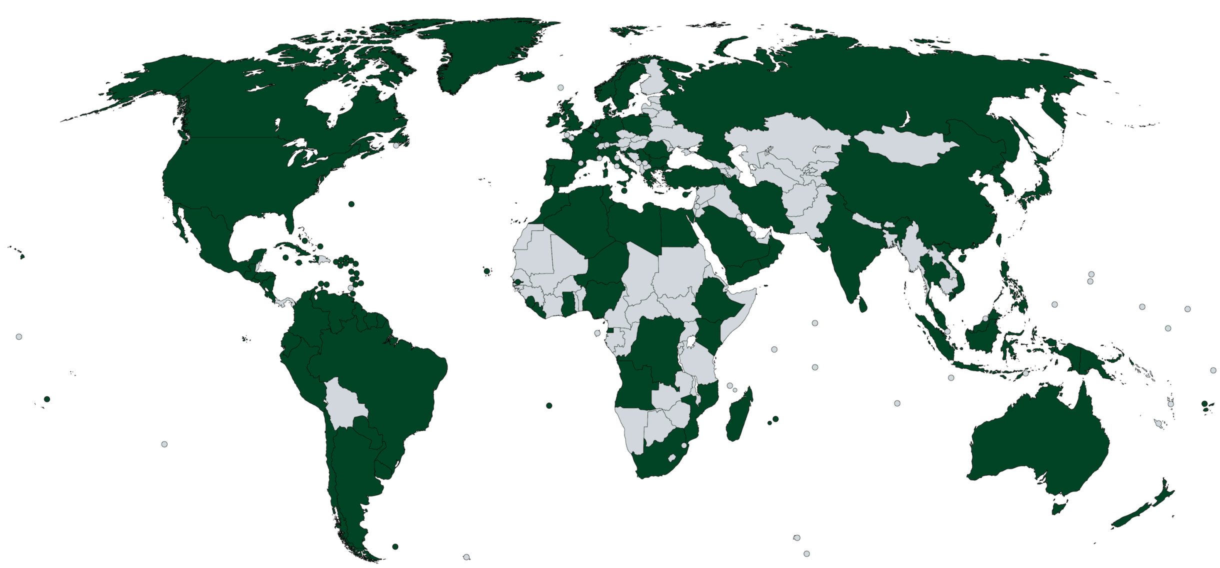
B Coverage of British trading partners in the dataset

Our sample includes the following 86 trading partners recorded as export destinations in the British customs ledgers from 1700 to 1899:

Abyssinia, Aden, Algeria, Arabia, Argentina, Australia, Austria-Hungary, Belgium, Bermuda, Bolivia, Brazil, British Borneo, British East Africa, British Guiana, British Honduras, British India, British New Guinea, British South Africa, British West Africa, British West Indies, Bulgaria, Canada, Central America, Chile, China, Colombia, Congo Free State, Cyprus, Danish West Indies, Denmark, Dutch East Indies, Dutch Guiana, Dutch West Indies, Ecuador, Egypt, Falkland Islands, Fiji Islands, France, French Guiana, French India, French Indochina, French West Africa, French West Indies, German East Africa, German New Guinea, German West Africa, Germany, Gibraltar, Greece, Haiti and Dominican Republic, Italy, Japan, Korea, Liberia, Madagascar, Malta, Mauritius, Mexico, Montenegro, Morocco, Netherlands, New Zealand, Norway, Paraguay, Persia, Peru, Philippine Islands, Portugal, Portuguese East Africa, Portuguese India, Portuguese West Africa, Reunion Island, Romania, Russia, Siam, Spain, Spanish Africa, Spanish West Indies, Straits Settlements, Sweden, Tripoli and Tunis, Turkey, United States, Uruguay, Venezuela, and Zanzibar.

The map in Figure A5 shows these destinations.

Figure A5: British export destinations, 1700–1899



C Distances

The table below gives, for each destination in our sample, the port we consider, and the distance in nautical miles to London or Liverpool (whichever is shorter), before and after the opening of the Suez Canal.

Table A1: Ports and distances before and after the opening of the Suez Canal

Country	Pre-Suez	PortCode	Distance	Post-Suez	PortCode	Distance	Difference
Abyssinia	Massawa	ERMSW	10645.1	Massawa	ERMSW	4314.3	-6330.8
Aden	Aden	YEADE	10297.2	Aden	YEADE	4720.8	-5576.4
Algeria	Algiers	DZALG	1755.3	Algiers	DZALG	1755.3	0.0
Arabia	Muscat	OMMCT	10594.2	Jeddah	SAJED	3974.4	-6619.8
Argentina	Buenos Aires	ARBUE	6294.9	Buenos Aires	ARBUE	6294.9	0.0
Australia	Perth	AUPER	10908.6	Perth	AUPER	9599.6	-1309.0
Austria Hungary	Split	HRSPU	2865.6	Split	HRSPU	2865.6	0.0
Belgium	Antwerp	BEANR	193.3	Antwerp	BEANR	193.3	0.0
Bermuda	Hamilton	BMBDA	2975.3	Hamilton	BMBDA	2975.3	0.0
Bolivia	Antofagasta	CLANF	9355.7	Antofagasta	CLANF	9355.7	0.0
Brazil	Belem	BRBEL	4053.9	Belem	BRBEL	4053.9	0.0
British Borneo	Muara	BNMUA	12176.3	Muara	BNMUA	9058.2	-3118.1
British East Africa	Mombasa	KEMBA	8605.1	Mombasa	KEMBA	6507.7	-2097.4
British Guiana	Georgetown	GYGEO	3918.0	Georgetown	GYGEO	3918.0	0.0
British Honduras	Belize	BZBZE	4540.0	Belize	BZBZE	4540.0	0.0
British India	Colombo	LKCMB	10466.6	Mumbai	INBOM	6342.9	-4123.8
British New Guinea	Port Moresby	PGPOM	13271.8	Port Moresby	PGPOM	11077.4	-2194.4
British South Africa	Cape Town	ZACPT	6082.1	Cape Town	ZACPT	6082.1	0.0
British West Africa	Banjul	GMBJL	2604.0	Banjul	GMBJL	2604.0	0.0
British West Indies	Kingston	JMKIN	4104.6	Kingston	JMKIN	4104.6	0.0
Bulgaria	Varna	BGVAR	3310.1	Varna	BGVAR	3310.1	0.0
Canada	Halifax	CAHAL	2486.8	Halifax	CAHAL	2486.8	0.0
Central America	Puerto Barrios	GTPBR	4636.9	Puerto Barrios	GTPBR	4636.9	0.0
Chile	Valparaiso	CLVAP	8819.6	Valparaiso	CLVAP	8819.6	0.0
China	Canton	CNCAN	13043.2	Canton	CNCAN	9787.3	-3255.9
Colombia	Cartagena	COCTG	4379.0	Cartagena	COCTG	4379.0	0.0
Congo Free State	Matadi	CDMAT	4851.8	Matadi	CDMAT	4851.8	0.0
Cyprus	Larnaca	CYLCA	3298.4	Larnaca	CYLCA	3298.4	0.0
Danish West Indies	Charlotte Amalie	VICHA	3617.3	Charlotte Amalie	VICHA	3617.3	0.0
Denmark	Copenhagen	DKCPH	737.0	Copenhagen	DKCPH	737.0	0.0
Dutch East Indies	Jakarta	IDJKT	11284.8	Jakarta	IDJKT	8593.8	-2691.0
Dutch Guiana	Paramaribo	SRPBM	3877.9	Paramaribo	SRPBM	3877.9	0.0
Dutch West Indies	Willemstad	CWWIL	4100.4	Willemstad	CWWIL	4100.4	0.0
Ecuador	Guayaquil	ECGYE	10666.4	Guayaquil	ECGYE	10666.4	0.0
Egypt	Alexandria	EGALY	3133.2	Alexandria	EGALY	3133.2	0.0
Falkland Islands	Port Stanley	FKPSY	6968.6	Port Stanley	FKPSY	6968.6	0.0
Fiji Islands	Suva	FJSUV	12938.1	Suva	FJSUV	12938.1	0.0
France	Dunkirk	FRIRK	111.4	Dunkirk	FRIRK	111.4	0.0
French Guiana	Cayenne	GFCAY	3856.5	Cayenne	GFCAY	3856.5	0.0
French India	Pondicherry	INPNY	10843.7	Pondicherry	INPNY	7241.3	-3602.4
French Indochina	Saigon	VNSIT	12267.6	Saigon	VNSIT	8948.4	-3319.2
French West Africa	Dakar	SNDKR	2509.9	Dakar	SNDKR	2509.9	0.0
French West Indies	Pointe-à-Pitre	GPPTP	3743.0	Pointe-à-Pitre	GPPTP	3743.0	0.0
German East Africa	Dar es Salaam	TZDAR	8466.2	Dar es Salaam	TZDAR	6598.3	-1867.9
German New Guinea	Finschhafen	PGFIN	13985.3	Finschhafen	PGFIN	11321.7	-2663.6
German West Africa	Lomé	TGLFW	4014.8	Lomé	TGLFW	4014.8	0.0
Germany	Bremerhaven	DEBRV	412.9	Bremerhaven	DEBRV	412.9	0.0
Gibraltar	Gibraltar	GIGIB	1339.8	Gibraltar	GIGIB	1339.8	0.0
Greece	Piraeus	GRPIR	2780.7	Piraeus	GRPIR	2780.7	0.0
Haiti & Dominican Republic	Port-au-Prince	HTPAP	4005.8	Port-au-Prince	HTPAP	4005.8	0.0
Italy	Genoa	ITGOA	2204.3	Genoa	ITGOA	2204.3	0.0
Japan	Nagasaki	JPNGS	14010.2	Nagasaki	JPNGS	10755.7	-3254.5
Korea	Busan	KRPUS	14115.2	Busan	KRPUS	10839.0	-3276.1
Liberia	Monrovia	LRMLW	3211.2	Monrovia	LRMLW	3211.2	0.0
Madagascar	Toamasina	MGTOA	8233.9	Toamasina	MGTOA	6966.3	-1267.6
Malta	Valletta	MTMLA	2321.8	Valletta	MTMLA	2321.8	0.0
Mauritius	Port Louis	MUPLU	8380.7	Port Louis	MUPLU	7046.5	-1334.2
Mexico	Veracruz	MXVER	4808.2	Veracruz	MXVER	4808.2	0.0
Morocco	Safi	MASFI	1388.7	Safi	MASFI	1388.7	0.0
Montenegro	Bar	MEBAR	2745.7	Bar	MEBAR	2745.7	0.0
Netherlands	Amsterdam	NLAMS	208.3	Amsterdam	NLAMS	208.3	0.0
New Zealand	Auckland	NZAKL	12412.4	Auckland	NZAKL	12412.4	0.0
Norway	Bergen	NOBGO	634.2	Bergen	NOBGO	634.2	0.0
Paraguay	Asuncion	PYASU	7120.4	Asuncion	PYASU	7120.4	0.0
Persia	Bushehr	IRBUZ	11191.3	Bushehr	IRBUZ	6519.9	-4671.4
Peru	Callao	PECLL	10015.9	Callao	PECLL	10015.9	0.0
Philippine Islands	Manila	PHMNL	12819.0	Manila	PHMNL	9669.3	-3149.7
Portugal	Lisbon	PTLIS	1035.0	Lisbon	PTLIS	1035.0	0.0
Portuguese East Africa	Maputo	MZMPM	7189.8	Maputo	MZMPM	7189.8	0.0
Portuguese India	Panaji Port	INPAN	10587.8	Panaji Port	INPAN	6373.7	-4214.1
Portuguese West Africa	Mindelo	CVMIN	2467.5	Mindelo	CVMIN	2467.5	0.0
Reunion Island	Pointe des Galets	REPDG	8248.5	Pointe des Galets	REPDG	7069.9	-1178.6
Romania	Constanta	ROCND	3354.7	Constanta	ROCND	3354.7	0.0
Russia	Saint Petersburg	RULED	1441.7	Saint Petersburg	RULED	1441.7	0.0
Siam	Bangkok	THBKK	12456.6	Bangkok	THBKK	9136.0	-3320.6
Spain	Bilbao	ESBIO	719.0	Bilbao	ESBIO	719.0	0.0
Spanish Africa	Port Clarence	GQSSG	4414.6	Port Clarence	GQSSG	4414.6	0.0
Spanish West Indies	San Juan	PRSJU	3641.9	San Juan	PRSJU	3641.9	0.0
Straits Settlements	Singapore	SGSIN	11730.1	Singapore	SGSIN	8321.4	-3408.8
Sweden	Gothenburg	SEGOT	629.0	Gothenburg	SEGOT	629.0	0.0
Tripoli and Tunis	Tunis	TNTUN	2134.5	Tunis	TNTUN	2134.5	0.0
Turkey	Izmir	TRIZM	3013.9	Izmir	TRIZM	3013.9	0.0
United States	New York	USNYC	3040.0	New York	USNYC	3040.0	0.0
Uruguay	Montevideo	UYMVD	6183.2	Montevideo	UYMVD	6183.2	0.0
Venezuela	La Guaira	VELAG	4098.1	La Guaira	VELAG	4098.1	0.0
Zanzibar	Zanzibar	TZZNZ	8500.7	Zanzibar	TZZNZ	6632.9	-1867.9

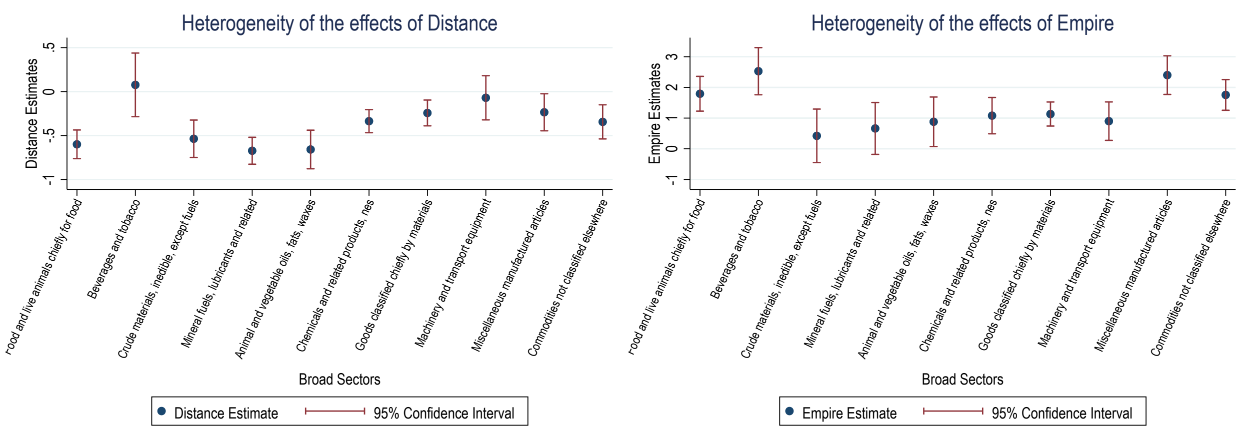
D Sectoral heterogeneity

The results in Figure A6 are obtained from the following version of specification (1) that includes industry-time fixed effects and allows for the estimates of the effects of distance and empire to vary across the ten broad sectors in our data:[18]

$$x_{j,t}^{k} = \exp[\sum_{S=1}^{10} \alpha_{1,S} \ln(DIST_{j,t}^{S}) + \sum_{S=1}^{10} \alpha_{2,S} EMPIRE_{j,t}^{S} + \alpha_3 WAR_{j,t} + \alpha_4 \ln(GDP_{j,t}) + \psi_t^k] \times \epsilon_{j,t}^{k}. \quad (3)$$

The left panel of Figure A6 depicts the sectorally disaggregated distance effects and the right panel reports the corresponding empire effects. Each of the two panels include the coefficient point estimates and associated 95% confidence intervals.

Figure A6: Heterogeneity of the Distance v. Empire effects on British exports across sectors



Notes: This figure reports estimates of the heterogeneous effects of distance and empire across the 10 broad sectors in our sample, which are obtained from equation (3). The estimator is PPML and the dependent variable is industry-level trade, in levels, over ten years during the period 1700-1900. The left panel of the figure reports the heterogeneous estimates of the effects of distance and the right panel of the figure reports the corresponding empire estimates. Each of the two panels includes the coefficient point estimates and associated 95% confidence intervals. The standard errors are clustered by industry-destination.

The main results from the left panel of Figure A6 can be summarized as follows. First, all but two of the estimates of the effects of distance are negative and statistically significant. The two exceptions with insignificant estimates are 'Beverages and tobacco' and 'Machinery and transport equipment'. The rest of the distance estimates can be split in two groups of four sectors each: large distance effects, including '1 Food and live animals chiefly for food', '3 Crude materials, inedible, except fuels', '4 Mineral fuels, lubricants and related', and '5 Animal and vegetable oils, fats, waxes'; and small distance effects, which includes '6 Chemicals and related products, nes', '7 Goods classified chiefly by materials', '9 Miscellaneous manufactured articles', and '10 Commodities not classified elsewhere'. Based on the fact that transportation costs are usually higher for sectors that are more resource oriented, we find the differences in the distance effects between the two groups intuitive.

[18]Specifically, the broad sectors are 1 Food and live animals chiefly for food, 2 Beverages and tobacco, 3 Crude materials, inedible, except fuels, 4 Mineral fuels, lubricants and related, 5 Animal and vegetable oils, fats, waxes, 6 Chemicals and related products, nes, 7 Goods classified chiefly by materials, 8 Machinery and transport equipment, 9 Miscellaneous manufactured articles, 10 Commodities not classified elsewhere. The concordance between the industries and the sectors can be found along with the dataset.

The results in the right panel of Figure 4 suggest that the empire effects are largest for '1 Food and live animals chiefly for food', '2 Beverages and tobacco', '9 Miscellaneous manufactured articles', and '10 Commodities not classified elsewhere', and that they are smaller for '3 Crude materials, inedible, except fuels', '4 Mineral fuels, lubricants and related', '5 Animal and vegetable oils, fats, waxes', '6 Chemicals and related products, nes', '7 Goods classified chiefly by materials', '8 Machinery and transport equipment'. British exports were boosted by Empire in all sectors, but particularly in '1 Food and live animals chiefly for food' and '2 Beverages and tobacco'.

E Robustness experiments

This section of the appendix includes all the robustness experiments that we referred to in the main text. Specifically:

- The first column of Table A2 replicates the results from column (2) of Table 1 but with only time fixed effects. The results demonstrate that there is not enough variation in the data to identify the impact of wars ($WAR_{j,t}$) once time fixed effects are included.

- The results in column (2) of Table A2 replicate the estimates from column (1) of Table 1 but based on the sample from column (2) of Table 1. These estimates confirm that the differences between the first two columns of Table 1 are indeed driven by the industry-time fixed effects and not by the different number of observations.

- Figure A7 replicates the results from Figure 4 but based on a series of cross-section estimates. The cross-section results are consistent with our main panel estimates.

- Figure A8 replicates the results from Figure 4 but after allowing for industry-specific GDP effects. Once again, the new results are consistent with our main estimates.

- The results in Figure A9 replicate the results from Figure 4 but after adding destination fixed effects. Two main messages stand out from Figure A9. First, the magnitudes of our estimates of the effects of distance and the empire change. This is consistent with the results from Table 1 and the accompanying discussion. Second, and more important for our purposes, the evolution over time of the distance and empire estimates remains similar to our main findings.

- Finally, Figure A10 replicates the results from Figure 4 but with OLS. In terms of average magnitude, the OLS estimates of the effects of distance are similar to our main results. However, their evolution over time is quite different. The evolution of the empire effects in Figure A10 is similar to our main findings, but the OLS empire estimates are significantly larger than the corresponding PPML estimates in the 1800s. As argued by Santos Silva and Tenreyro (2006), the OLS gravity estimates are inconsistent and, therefore, we rely on the PPML estimator to obtain our main results.

Table A2: Panel Gravity Estimates, 1700-1900

	(1) Time FEs	(2) Same Sample
$\ln(DIST_{j,t})$	-0.293	-0.360
	(0.088)**	(0.078)**
$EMPIRE_{j,t}$	1.211	1.328
	(0.320)**	(0.355)**
$WAR_{j,t}$	0.081	-1.651
	(0.344)	(0.237)**
$\ln(GDP_{j,t})$	0.549	0.630
	(0.071)**	(0.073)**
$Constant$	-0.341	-1.934
	(2.001)	(1.908)
N	104748	80840

$^{+}$ $p < 0.10$, * $p < .05$, ** $p < .01$

Figure A7: Evolution of the Distance v. Empire effects on British exports over time. Cross-section estimates.

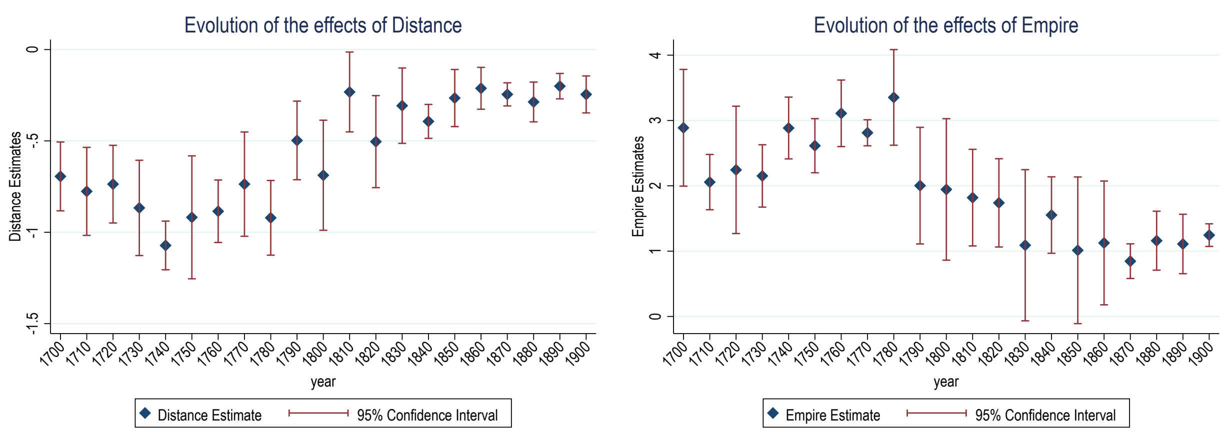


Figure A8: Evolution of the Distance v. Empire effects on British exports over time. Industry-specific GDP effects.

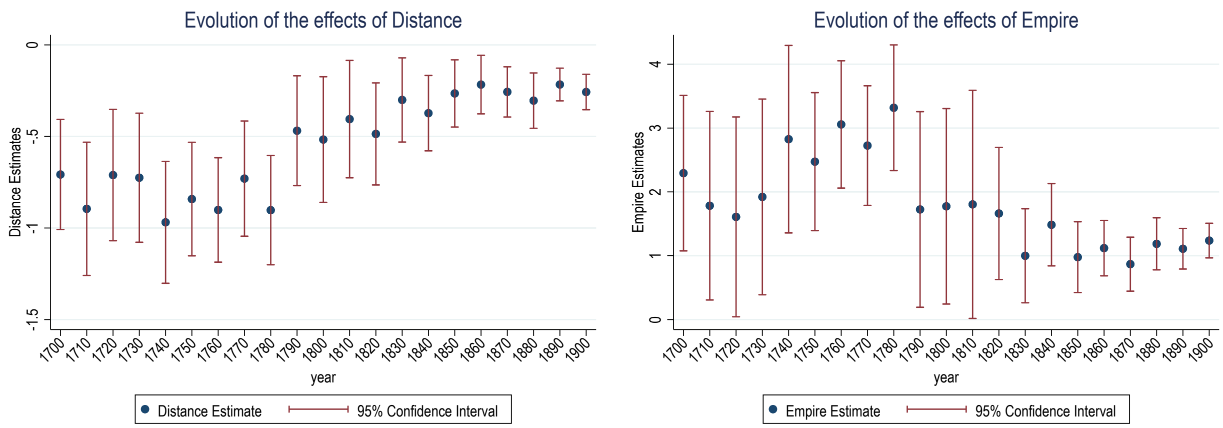


Figure A9: Evolution of the Distance v. Empire effects on British exports over time. Destination fixed effects.

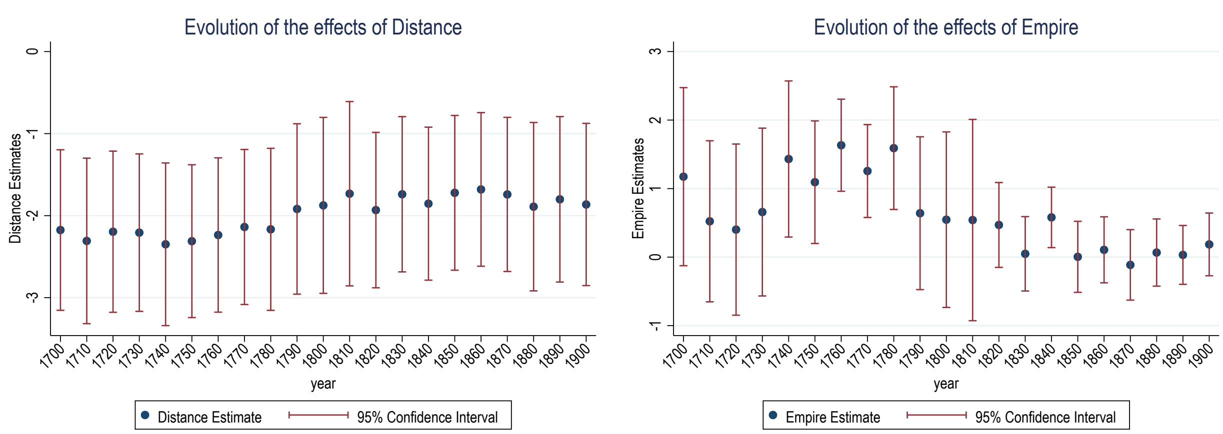


Figure A10: Evolution of the Distance v. Empire effects on British exports over time. OLS estimates.