

## When Britain Turned Inward: The Impact of Interwar British Protection<sup>†</sup>

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*International trade collapsed, and also became much less multilateral, during the 1930s. Previous studies, looking at aggregate trade flows, have argued that trade policies had relatively little to do with either phenomenon. Using a new dataset incorporating highly disaggregated information on the United Kingdom’s imports and trade policies, we find that while conventional wisdom is correct regarding the impact of trade policy on the total value of British imports, discriminatory trade policies can explain the majority of Britain’s shift toward Imperial imports in the 1930s. (JEL F13, F14, F54, N74)*

In a recent survey paper, Goldberg and Pavcnik (2016) note that trade economists have moved away from studying the impact of trade policy. They point out that this may partly reflect a belief that trade policy no longer matters, since by and large it has become so liberal.<sup>1</sup> But they also note that studies estimating the impact of trade policies in the 1970s and 1980s, when these were not so uniformly liberal, suggest that they had no big effect then either. Does trade policy matter, they ask. Did it ever matter?

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<sup>1</sup>However, Bown and Crowley (2016) argue that substantial trade barriers in fact remain in place today.

TABLE 1—SHARE OF FORMAL AND INFORMAL EMPIRE IN TRADE, 1929–1938 (PERCENT)

Trade of	Share of	In imports			In exports		
		1929	1932	1938	1929	1932	1938
United Kingdom	British Commonwealth, colonies, protectorates, etc.	30.2	36.4	41.9	44.4	45.4	49.9
United States	Philippines	2.9	6.1	4.8	1.6	2.8	2.8
France	French colonies, protectorates, and mandated territories	12	20.9	25.8	18.8	31.5	27.5
Belgium	Belgian Congo	3.9	3.8	8.3	2.6	1.3	1.9
Netherlands	Netherlands overseas territories	5.5	5	8.8	9.4	5.9	10.7
Italy	Italian colonies and Ethiopia	1.5	1.1	1.8	2.1	3.6	23.3
Portugal	Portuguese overseas territories	7.9	10.4	10.2	12.7	13.9	12.2
Japan	Korea and Formosa	12.3	26.2	30	16.8	21.6	32.9
	Kwantung	6	4	1.6	4.8	6.8	13.7
	Manchuria	1.9	2.7	9	2.5	1.5	8.1
	Rest of China	5.8	4	4.4	10.9	7.3	8
	Total Japanese sphere of influence	26	36.9	45	35	37.2	62.7
Germany	Bulgaria, Greece, Hungary, Romania, Turkey, and Yugoslavia	4.5	5.5	12	5	3.9	13.2
	Latin America	12.2	11.2	15.6	7.8	4.3	11.5
	Total German sphere of influence	16.7	16.7	27.6	12.8	8.2	24.7

Source: League of Nations (1939, pp. 34–35)

If trade policy ever mattered, it surely did so during the 1930s. This paper examines the dramatic shift toward protection which occurred in the United Kingdom from 1931 onward. It asks whether tariffs and quotas can help to explain the British import collapse of the period. It also asks whether trade policy contributed to one of the most notable features of interwar trade, namely its decreasingly multilateral nature. Table 1 documents an increasing share of empires, or informal spheres of influence, in the trade of several leading countries between 1929 and 1938. The British Empire accounted for 30 percent of UK imports in 1929, but 42 percent in 1938. How much of this shift was due to discriminatory British trade policies?

Contemporary and subsequent observers thought that increasingly bilateral trade not only reflected, but potentially exacerbated, the international tensions of the period. According to Hilgerdt (1935, p. 188), “As bilateralism particularly renders the supply of raw materials to certain countries difficult, it threatens to lead to an intensified fight for influence upon (or the domination of) the undeveloped countries, and thereby to political controversies, which may adversely affect all forms of peaceful collaboration between nations.” During the war, J. B. Condliffe wrote that “it is now so obvious as to hardly need statement that bilateral trade took on aggressive and destructive aspects as international rivalries were sharpened in the era of what is now known as pre-belligerency” (Condliffe 1941, p. 287). After the war, Article 1 of the General Agreement on Tariffs and Trade (GATT) banned discriminatory trade policies, subject to a number of well-known exceptions. But did discriminatory interwar trade policies actually play an important role in making world trade less multilateral, and more focused on imperial blocs, as was widely assumed at the time?

The academic literature of recent decades has tended to downplay the impact of protectionism on overall trade flows during the Great Depression.<sup>2</sup> World income and output fell so much during this period that this can plausibly account for the majority of the 1929–33 trade collapse, leaving relatively little for rising trade barriers to explain. The literature has also concluded that trade policies played only a minor role in driving the balkanization of trade during the 1930s. These studies use data on aggregate trade flows, average measures of protection (in particular, the trade-weighted average tariff), and trade bloc dummies. In contrast, we use disaggregated, commodity and country-specific information on both trade flows and trade policies for one major economy, the UK. Using contemporary sources, we hand-collected data on United Kingdom imports of 258 goods from 42 countries over the 15 years 1924–38. This required typing information on imports of 847 individual product categories from 49 countries and subregions. We also collected granular, commodity, and country-specific information on tariffs and non-tariff barriers to trade. Both the original dataset involving the 847 product categories, and the 258-good dataset, are freely available online for other researchers to use.<sup>3</sup>

We find that the conventional wisdom is correct when it comes to the impact of protection on overall trade flows: it only accounted for around one-quarter of the 1929–33 UK import collapse. However, we also find that tariffs and quotas were the major reason why the share of UK imports coming from the British Empire increased during the 1930s. Having disaggregated data on trade and trade policy turns out to be relatively unimportant when it comes to estimating the impact of protection on the aggregate value of UK imports. However, we show that it is crucial when it comes to estimating the impact of protection on the geographical composition of trade.

Our use of disaggregated trade data mirrors the approach taken by Anderson and Yotov (2016) and Baier, Bergstrand, and Clance (2017), but whereas these authors use “economic integration agreement” or “free trade agreement” dummies as explanatory variables, we use information on commodity-specific tariffs and quotas that explicitly discriminated between Empire and “foreign” imports. Goldberg and Pavcnik (2016, p. 181) comment that “given the central role that trade elasticity plays in a number of trade models and in welfare analysis, it is surprising that trade policy has not been exploited to a larger extent to identify this crucial parameter”: we identify trade elasticities by exploiting the fact that the UK shift to protection increased tariffs on foreign imports of particular goods more than it increased the tariffs facing imports of the same goods coming from the Empire. Our paper is thus related to Caliendo and Parro (2015), who estimate sectoral trade elasticities using information on the tariff reductions associated with the North American Free Trade Agreement (NAFTA). Our decision to focus in detail on the experience of one (very important) country responds to the appeal of Goldberg and Pavcnik (2016) for more context-specific evidence on the impact of trade policies; our granular approach reveals a large impact of interwar trade policy that previous aggregate studies did not detect.

<sup>2</sup>Madsen (2001) is an exception; see footnote 5.

<sup>3</sup>They can be accessed at <https://cepr.org/content/trade-depression/uk-interwar-trade-data>.

### A. Relationship to Previous Literature and Road Map

*Interwar Protection and the Total Value of Trade.*—Despite the reputation of interwar protectionism, the quantitative literature has not been kind to claims that the global trade collapse of 1929–33 was mainly due to trade policy.<sup>4</sup> In an influential contribution, Irwin (1998b) quantifies the impact of the Smoot-Hawley tariff, using quarterly aggregate US import data to estimate a partial equilibrium US import demand equation. His measure of trade policy is the trade-weighted average tariff, i.e., tariff revenue as a share of dutiable imports. He finds that even in the absence of any change in ad valorem tariff rates (but accounting for the income declines of the period), US imports would have declined by 31.9 percent between 1930:II and 1932:III, as compared with the 41.2 percent reduction that actually took place: the vast majority of the US import collapse was due to falling income. The conclusion that frictions were much less important than collapsing income and output in lowering trade during the 1930s is generally accepted, though there have been some dissenting voices.<sup>5</sup>

A frequently cited dissenting voice, in the context of the United Kingdom, is Kitson and Solomou (1990). They estimate ordinary least squares (OLS) regressions for 1924–38, in which the log of manufactured imports are a function of the log of real gross domestic product (GDP), the log of the relative price of British and foreign manufactured goods, and the ad valorem tariff rate, assumed to be equal to zero between 1924 and 1931. Their tariff coefficient implies that the tariff increase between 1930 and 1933 lowered UK manufactured imports by 48 percent. Other contributors to the UK debate have similarly used aggregate time series methods rather than gravity methods, and often rather crude measures of protection.<sup>6</sup>

*Interwar Trade Policies and the Decline of Multilateral Trade.*—To date, the literature using gravity methods to estimate the impact of interwar trade policies on the geographical pattern of trade has focused on the impact of trade bloc membership. Eichengreen and Irwin (1995) estimate cross-sectional gravity equations for 1928, 1935, and 1938, using aggregate trade data for 34 countries (and 561 bilateral flows). While they find that pairs of countries that both belonged to the British Commonwealth traded more with each other, this effect was already present in 1928, before Britain moved to protection, and before the Ottawa agreements set in place preferential trade policies within the Empire (see Section I). The coefficient on bilateral Commonwealth membership was higher in the 1930s than in 1928, but

<sup>4</sup>Irwin (2012) provides an excellent survey of the literature.

<sup>5</sup>Madsen (2001) finds sizable effects for protectionist policies in the context of panel regressions where the dependent variable is individual countries' aggregate imports and exports. He also uses the average tariff, and interprets the time dummies he estimates as representing the impact on trade of non-tariff barriers. Esteveadoral, Frantz, and Taylor (2003) estimate a gravity model, using aggregate data on bilateral trade flows, tariffs, and other variables for 1913, 1928, and 1938. Their bilateral tariff measure for countries  $i$  and  $j$  is simply  $\ln(1 + t_i) + \ln(1 + t_j)$ , where  $t_i$  and  $t_j$  are once again the two countries' average tariff rates. They therefore cannot account for discriminatory trade policies or non-tariff barriers to trade. Esteveadoral, Frantz, and Taylor find a large and negative, but often statistically insignificant, tariff effect. Their results suggest that trade in the 1930s would have been around 50 percent higher had 1913 tariffs continued to apply, but they do not calculate the share of the Great Depression trade collapse that was due to the increase in tariffs after 1929.

<sup>6</sup>See, for example, Dimsdale and Horsewood (1995) and Horsewood, Sen, and Voicu (2010), whose measure of tariffs is simply a dummy variable which switches on in 1932.

not greatly so. Eichengreen and Irwin conclude that “the tendency toward regionalization commonly ascribed to the formation of trade and currency blocs was already evident prior to the regional policy initiatives of the 1930s; to a considerable extent it is attributable to ongoing historical forces such as commercial and financial linkages between countries forged over many years” (p. 21).

Subsequent literature has largely reinforced this view. Wolf and Ritschl (2011) emphasize the fact that trade blocs, as well as the currency blocs that are the major focus of their paper, are endogenous; controlling for a bloc fixed effect, they find that the formation of the Ottawa trade bloc had no additional impact on trade flows between members.<sup>7</sup> Gowa and Hicks (2013, p. 440), who use a much larger dataset on aggregate trade flows than the previous two studies, also conclude that “blocs made much less difference to trade than commonly assumed.” They do find that the British Imperial Preference System is a partial exception to this general rule, in that while it had no impact on trade between British Dominions, it increased trade between the United Kingdom and the Dominions. (However, their analysis is potentially subject to the aforementioned objection that bloc membership was not randomly assigned across countries.) Surveying the literature, Irwin (2012, p. 141) concludes that “while discriminatory policies succeeded in shifting the pattern of trade, they may have been less important than might appear to be the case from table 3.2” (his version of Table 1).

*What We Do.*—Previous papers have thus related aggregate trade flows (either country-specific total imports and exports, or bilateral trade flows) to average measures of protection, notably the average tariff,<sup>8</sup> or to dummy variables indicating whether both countries were members of the same trade bloc. However, tariffs varied greatly across commodities during this period, while quotas became extremely important during the 1930s, and by definition were applied to imports of particular commodities. In addition, countries such as the United Kingdom pursued explicitly discriminatory trade policies. We therefore study the impact of the trade policies pursued by one country, the United Kingdom, in granular detail, using information on imports, tariffs, and non-tariff barriers to trade, all of which vary at the commodity-country-year level. Rather than looking at whether trade blocs existed or not, we look at what one key member of one trade bloc actually did, and at what the effects of its policies were.

We digitized data on imports into the United Kingdom of 847 products from 42 countries between 1924 and 1938. These were then aggregated up, allowing us to construct an import database for 258 product categories that are consistently defined over time. We also collected bilateral, commodity, and country-specific data on tariff and non-tariff barriers to trade for the same countries, products, and years. The result is a dataset with 162,540 potential observations (imports of 258 commodities coming from 42 countries in 15 years), although the value of many of these is of course 0.<sup>9</sup>

<sup>7</sup> They use the same aggregate trade data as Eichengreen and Irwin (1995).

<sup>8</sup> For a critique of this measure, see Anderson and Neary (1996).

<sup>9</sup> 87 percent of all observations are 0; the share ranges from 85 to 90 percent in individual years.

We then estimate three types of elasticities: elasticities of substitution between different varieties of the same imported good; the elasticity of substitution between different imported goods; and the elasticity of substitution between imported goods and domestic output. Armed with these elasticities, we use computable general equilibrium (CGE) models to calculate counterfactual “constant trade policy” equilibria for individual years in the 1930s, which can be compared with the actual trade data. In order to focus on the impact of the shift in trade policy which occurred in the United Kingdom from 1931 onward, our counterfactuals assume that ad valorem tariff rates and quotas were held at their 1930 levels between 1931 and 1938.<sup>10</sup> The models we use to calculate these counterfactual equilibria are straightforward: on the demand side we assume nested utility functions as in Broda and Weinstein (2006), while on the supply side a single production sector transforms the sole factor of production into domestically consumed output and exports via a constant elasticity of transformation (CET) production function.<sup>11</sup> By comparing actual imports with counterfactual “constant trade policy” imports, we obtain estimates of the impact of post-1930 protection on both the total value of UK imports, and the share of those imports coming from the British Empire.

We find that while the increase in protection lowered UK imports, it only accounted for around one-quarter of the decline experienced between 1929 and 1933. In contrast, we also find that the majority of the increase in the Empire’s share of UK imports can be attributed to trade policy. Our mean estimates suggest that trade policy accounted for over 70 percent of the increase between 1930 and 1933. While our results are consistent with the views of Irwin regarding the relative importance of trade frictions in explaining the Great Depression trade collapse, they are also a vindication of traditional historical accounts which argue that the increasingly bilateral nature of interwar trade was largely due to government policies. When it came to the geographical pattern of trade, British trade policy mattered, a lot, during the 1930s.

Section I describes the dramatic shift in British trade policy which occurred between 1931 and 1933. The subsequent section describes our dataset. Section III outlines our theoretical framework, while Section IV derives the key trade elasticities embedded in our model. Section V estimates the impact of British trade policies on the value and composition of British imports, and Section VI concludes.

<sup>10</sup>There were no quotas in 1930. The United Kingdom imposed both specific and ad valorem tariffs during this period. In 1928, before the switch to protection, of the 474 items for which we collected tariff information (that were then matched onto our 258 goods) 410 were duty-free, 16 faced ad valorem tariffs, and 48 faced specific tariffs. By 1935, of the 475 items for which we have tariff information, just 86 were exempt, while 269 faced ad valorem tariffs, 62 faced specific tariffs, and 58 product categories (mostly in iron and steel) faced a mixture of specific and ad valorem rates. The overwhelming majority of tariffs introduced after the switch to protection were thus ad valorem. By holding ad valorem tariff rates fixed in our counterfactual analysis, we are computing the effects of all increases in protection post-1930, including those due to the interaction between price deflation and specific tariffs. See Crucini (1994) and Irwin (1998a) on the US experience.

<sup>11</sup>The model is thus similar to that used by Anderson and Neary (1996) to calculate their Trade Restrictiveness Index, and like theirs it can be calibrated using information on just GDP and imports. It is simpler in that it only includes one, domestic input into production; it is more complicated in that there is a three-tier nesting structure on the demand side, to take account of the fact that trade policies varied not only by good but also by country.

## I. British Interwar Trade Policy

The United Kingdom moved decisively toward free trade from the mid-nineteenth century onward. Tariffs were retained for revenue-raising purposes, on goods that were subject to domestic excise duties (notably alcoholic drinks) or that were not produced at all domestically (notably tea and tobacco). Tobacco, tea, spirits, and wine accounted for more than 95 percent of British tariff revenue in 1880: Irwin describes British tariffs during the period as “the natural extension of domestic excise taxes to foreign goods” (Irwin 1993, p. 147). “Fiscal” or “revenue” tariffs on inelastically-demanded goods such as tea, coffee, cocoa, sugar, and tobacco were an important source of government revenue in many other European countries during the period as well (Tena-Junguito 2006): a sugar tariff was reintroduced in the United Kingdom in 1901 due to the fiscal pressures created by war in South Africa (Rutter 1902).

Conservatives traditionally represented agricultural interests and many opposed the shift to free trade. Many late nineteenth century Conservatives advocated both imperialism and tariffs. In 1903, the former Colonial Secretary and convinced imperialist Joseph Chamberlain launched a campaign for “Tariff Reform”: he sought tariffs which would both protect British industries against supposedly unfair foreign competition, and allow the United Kingdom to offer trade preferences to her Empire (something which her unilateral free trade policy made impossible). The hope, both then and later, was that an Imperial trade bloc would be better able to compete with great powers such as Germany and the United States, and be more self-sufficient, seen as advantageous in the event of war. The campaign ended when the pro-free-trade Liberals decisively won the 1906 general election.

Britain’s long-standing free trade policy was abandoned during World War I, and free trade did not resume in 1918. The 1915 McKenna Duty imposed a 33 and one-third percent ad valorem tariff on cars, clocks and watches, films, and musical instruments, and was retained after the war. The 1921 Safeguarding of Industries Act introduced not only anti-dumping duties but tariffs, again usually 33 and one-third percent ad valorem, on imports of “key” goods considered to be essential for national security (including some chemicals, optical glass, magnets, and tungsten) (Gordon 1941).<sup>12</sup> New revenue duties on silk and petroleum were introduced in 1925 and 1928, respectively (National Institute of Economic and Social Research 1943). In 1926, pork imports from the European Continent were embargoed on veterinary grounds (Ashby and Jones 1938b, p. 225).

There was a modest degree of Imperial Preference during this period: revenue duties were one-sixth lower on goods produced in the Empire, McKenna duties were one-third lower, “key” goods from the Empire were exempt from the 1921 duties, and safeguarding duties were also lower on Imperial products (Richardson 1936, National Institute of Economic and Social Research 1943).<sup>13</sup>

Notwithstanding these departures from nineteenth century practice, British trade policy remained predominantly liberal until 1930. The change that occurred

<sup>12</sup>The Act also allowed industries to apply to the Board of Trade for “safeguarding” protection, although there were strict conditions attached and few industries benefited from this provision.

<sup>13</sup>The 1927 Cinematograph Films Act included minimum quotas for British (or British Empire) films (Plant et al. 1939, Miskell 2005).

in 1931 and 1932 was therefore all the more dramatic. As elsewhere, the Great Depression increased the demand for protection in the United Kingdom: in October 1931 a new “national government” was elected, dominated by protectionist Conservative politicians. Joseph Chamberlain’s son Neville was appointed Chancellor of the Exchequer on November 5, and later that month the Abnormal Importations Act was introduced. This allowed the Board of Trade to impose tariffs of up to 100 percent ad valorem on manufactured goods from outside the Empire, and tariffs of 50 percent were immediately imposed on many of these. The Horticultural Products (Emergency Duties) Act soon followed, allowing the Minister of Agriculture to impose similar duties on non-Empire fruit, flowers, and vegetables.

In February 1932 an Import Duties Act imposed a general 10 percent tariff on goods not already subject to duties, though some important primary imports were exempted. These included not only raw materials such as raw cotton, raw wool, hides and skins, iron ore, and scrap iron, but also tea, animals, and foodstuffs such as meat and wheat. Goods from British colonies were exempted, while imports from the self-governing Dominions were temporarily exempted pending the outcome of the next Imperial Economic Conference, due to begin in Ottawa in July.<sup>14</sup> The 10 percent general tariff was a minimum tariff, in the sense that a new Import Duties Advisory Committee (IDAC) could impose additional duties.<sup>15</sup> They did so beginning in April and continued to do so subsequently, with Imperial goods generally being exempted.

The Ottawa conference opened on July 21, and negotiations continued for roughly a month. The Dominions’ aim was to secure and if possible to improve their margin of preference for goods where preference had already been secured; and to establish a margin of Imperial Preference in markets for goods, such as meat and wheat, which were still admitted duty-free into the British market, and were of particular importance to them. The British wished to improve their access to Dominion markets, and retain a margin for maneuverer when it came to potential future trade agreements with foreign countries.

The outcome was a series of bilateral trade agreements between the participants, the UK signing agreements with Canada, Australia, New Zealand, South Africa, Newfoundland, India, and Southern Rhodesia.<sup>16</sup> In broad terms, Britain agreed to maintain or raise tariffs imposed on foreign imports under the terms of the 1932 Import Duties Act, and not to reduce the 10 percent ad valorem tariff without the consent of the Dominions; to continue to exempt Empire products from these tariffs; and to introduce or enhance Imperial Preference on a wide range of agricultural commodities and raw materials of special interest to the Dominions, by raising duties or protecting goods that had previously been duty free such as wheat (Drummond 1974, pp. 266–68).

<sup>14</sup> Imperial conferences regularly brought together representatives of the British Dominions and India. Previous postwar meetings had been held in 1921, 1923, 1926, and 1930.

<sup>15</sup> The IDAC had to consult with the Board of Trade, and its decisions had to be sanctioned by the Treasury and Parliament (National Institute of Economic and Social Research 1943).

<sup>16</sup> Good accounts of the Ottawa negotiations and the eventual agreements are to be found inter alia in Drummond (1974), Gordon (1941), Richardson (1936), Richardson (1938), and Rooth (1993), on whom this account draws.



Quotas were introduced for several agricultural commodities, on the basis that policy needed to serve the interests of “the home producer first, Empire producers second, and foreign producers last” (Richardson 1936, p. 138). Imports from foreign countries of frozen mutton and lamb, and frozen and chilled beef, were to be subject to quotas from January 1, 1933 (with total quantities reduced by 10 percent in the first year and 35 percent from 1934 to 1937, and then slightly increased), while Australia and New Zealand agreed to voluntarily restrain their exports to a certain extent.<sup>17</sup>

A report issued soon after the passage of the 1932 Import Duties Act on the future of the British pig industry recommended that imports of bacon and ham also be regulated, and quantitative restrictions came into force during 1932: first via voluntary export restraint agreements with the 11 major supplying countries, notably Denmark, and from December 1933 onward via quotas (Murphy 1957, Cohen 1934, Plant et al. 1939). These restrictions were only enforced for non-Empire countries.<sup>18</sup>

There were several other commodity-specific schemes introduced during the next few years following the introduction of the Agricultural Marketing Acts of 1931 and 1933.<sup>19</sup> The 1933 Act permitted the regulation of imports, and this was done in some cases (hops, potatoes, and cured pork).<sup>20</sup> In 1935, imports of frozen and chilled pork became subject to quantitative controls under the terms of the Pork (Import Regulation) Order of 1935, based on the 1933 Agricultural Marketing Act (quotas in the case of foreign countries, and voluntary export restraints in the case of Australia, Canada, and New Zealand).<sup>21</sup> Imports of fish became subject to quantitative restrictions under the terms of the 1933 Sea Fishing Industry Act (Plant et al. 1939). There was some “voluntary” restriction of dairy products by some exporters “with the shadow of the 1933 Act behind them” (Sorenson and Cassels 1936, p. 277).<sup>22</sup>

From 1933 onward there was a series of trade agreements with various foreign countries, notably the Scandinavian countries and Argentina. These typically secured trade concessions for Britain in return for her not worsening the positions of these countries any further in the British market. In most cases agreements also included clauses regarding specific goods, in order to ensure that Britain would not discriminate in the future against important treaty partner export commodities. These clauses generally remained ineffective since Britain did not greatly extend its quota and tariff system after 1932–1933.

<sup>17</sup> Both agreed to restrain their 1933 exports of frozen mutton and lamb to the level prevailing in the previous year, while New Zealand “estimated” that its frozen beef exports would increase by no more than around 10 percent. Initially not subject to the restrictions, imports of beef offal soon became subject to the beef quota system, so as to combat evasion of the quotas (National Institute of Economic and Social Research 1943).

<sup>18</sup> An agreement with Canada in 1932 fixed a limit of 2.5 million cwt per year, but the limit never became binding, since Canadian exports to Britain remained below that quantity. Due to the Anglo-Irish trade war substantial duties were imposed on Irish bacon between 1932 and 1938 (National Institute of Economic and Social Research 1943).

<sup>19</sup> There were actually two such Acts in 1933, although the second introduced “only minor modifications” (Cohen 1934).

<sup>20</sup> On hops and potatoes, which are not in our sample, see National Institute of Economic and Social Research (1943) and Wheeler (1937).

<sup>21</sup> Ashby and Jones (1938b), National Institute of Economic and Social Research (1943).

<sup>22</sup> The items concerned included condensed milk (whole and skimmed), milk powder, and cream (Ashby and Jones 1938a).

Imports were sometimes blocked for political reasons. Britain participated in the ill-fated League of Nations sanctions campaign against Italy, as a result of which imports from that country were banned between November 1935 and June 1936 (Ristuccia 2000). Mention should also be made of the Anglo-Irish trade war which began in 1932, and which led to the imposition of emergency duties on imports of Irish agricultural commodities, notably cattle; duties were reduced in 1934, and the dispute ended in 1938 on terms highly favorable to the Irish (O'Rourke 1991).<sup>23</sup>

## II. Data

Our source was the Annual Statement of Trade of the United Kingdom (Statistical Office, H. M. Customs and Excise Department 1929, 1935, 1939). The basic problem with historical trade data is that the trade classifications used by national authorities are consistent neither across countries nor over time. We collected import values for 847 individual product categories from 42 countries between 1924 and 1938.<sup>24</sup> We had to exclude 35 of these items because of a variety of data problems, which left a total of 812 products, not all of which were reported in each year because of classification changes. However, we were able to aggregate these 812 items to produce import data for 258 product categories which are consistently defined over time. For example, our good number 255, "Wool. Raw. Sheep's and lambs' wool," was constructed using data for 24 separate items that appear in the trade statistics between 1924 and 1938.<sup>25</sup>

As Figure 1 indicates, our sample tracks aggregate UK imports faithfully over time. The size of our sample, relative to the total value of UK trade, reflects above all the share of our 258 commodities in total trade (see online Appendix 1 for details of how those 258 goods were chosen): our 42 countries accounted for the bulk of UK imports. On average, our 258 commodity sample accounts for about 58 percent of British imports during the period, while imports of these 258 commodities from our 42 country sample account for roughly 51 percent. Figure 2 shows that the sample does a good job of tracking the British Empire's share of UK imports over time. Online Appendix Table 6 shows that our sample roughly matches the aggregate data in terms of its percentage breakdown between 4 broad categories: agricultural products such as wheat or meat; manufactured goods such as copper or machinery; raw materials such as coal, fertilizers, raw cotton, or oilseeds; and goods on which revenue tariffs were lev-

<sup>23</sup> In our econometric specifications we will also control for various cartel agreements that restricted imports, albeit as a result of private sector rather than government decisions. The best known of these cartels is the European Steel Cartel, which British iron and steel manufacturers joined in 1935. As a result of Britain's joining the cartel, iron and steel imports were limited, although cartel members benefited in that they did not have to pay the higher tariffs imposed on the exports of non-cartel members (Richardson 1938, Benham 1941). Details of the cartels in operation during this period, of relevance to our sample of commodities, are given in online Appendix 5.

<sup>24</sup> For 3 of these countries (Spain, Malaysia, and the Dutch East Indies), we had to type in data for a total of 10 subregions, implying that we entered data for a total of 49 countries or subregions. In addition, imports from Burma were shown separately from 1937, and had to be added to imports from British India so as to produce consistent series. Online Appendix 3 lists the countries in our sample.

<sup>25</sup> In turn, these 258 product categories can if desired be aggregated up to provide data for 38 consistently defined 3-digit Standard International Trade Classification (SITC) categories. (Full details are provided in online Appendix 1.)

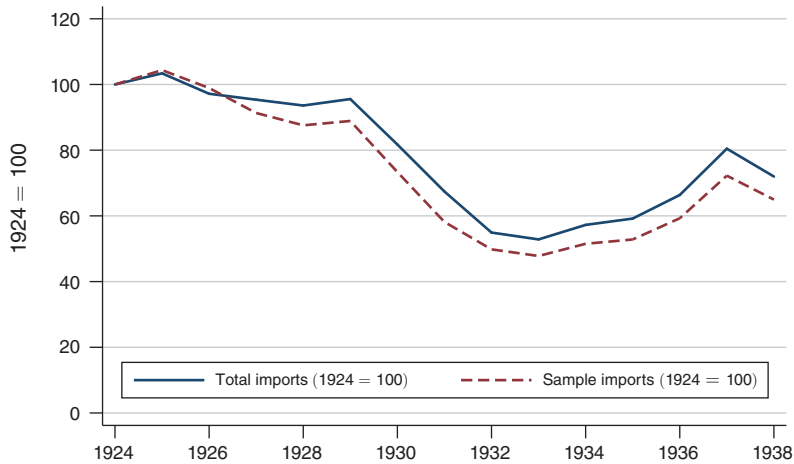


FIGURE 1. TOTAL AND SAMPLE UK IMPORTS, 1924–1938

Source: Statistical Office, H.M. Customs and Excise Department (1929, 1935, 1939)

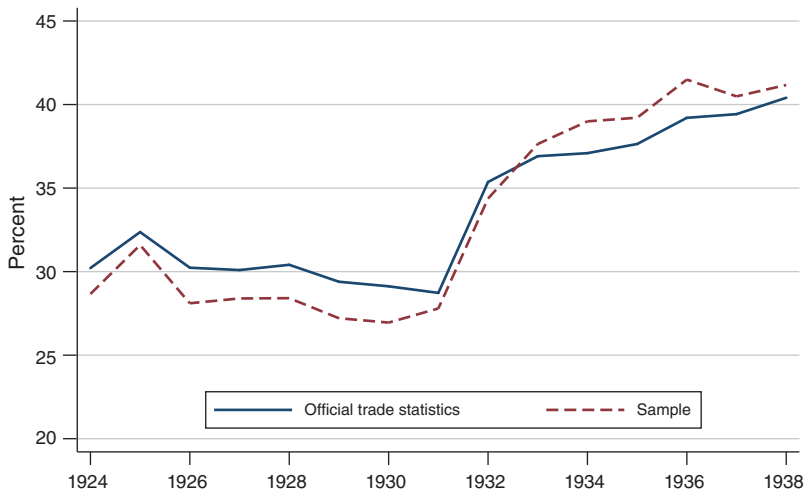


FIGURE 2. TOTAL AND SAMPLE EMPIRE SHARE OF UK IMPORTS, 1924–1938

Source: Statistical Office, H.M. Customs and Excise Department (1929, 1935, 1939)

ied.<sup>26</sup> Online Appendix Sections 1 and 3 list the top commodities and trading partners in our sample.

Following Broda and Weinstein (2006), we will refer in what follows to each of our 258 product categories as a *good*, and to imports of each of these goods from a particular country as a *variety*. Unfortunately, successive volumes of the British trade statistics seem to have differed in the extent to which they separated

<sup>26</sup> Full details of this four-category classification are provided in online Appendix 1. We are slightly under-sampling manufactured imports, and to a lesser extent raw materials, and over-sampling revenue imports. This is because imports of manufactures are extremely heterogeneous, and disaggregated into a large number of individual items in the trade statistics. This is also the case for some raw materials (e.g., there are many varieties of medicinal plants and chemical substances). On the other hand, revenue goods are rather concentrated.

out imports of particular goods from marginal suppliers; over time they seem to have increasingly lumped these into the “other countries” category. This makes it impossible to replicate Broda and Weinstein’s analysis of the evolution of the intensive and extensive margins. The number of goods imported into the United Kingdom from our 42 countries diminished over time: from 255–258 in 1924–1928, to 245–247 in 1929–1932, to 236 or 237 in 1934–1938. Again, these successive declines correspond with successive volumes of the trade statistics.

Nonetheless, it seems that the intensive margin accounted for essentially all of the trade collapse and subsequent recovery. For example, take the volume of trade statistics covering the years 1929–1933: within this volume, the reporting of countries and goods was consistent over time. The number of varieties imported into the UK was 1,338 in 1929, 1,354 in 1930, 1,339 in 1931, 1,319 in 1932, and 1,298 in 1933. The total number of varieties imported thus fell by only 3 percent between 1929 and 1933.<sup>27</sup> More systematically, we can decompose the decline in UK imports between 1929 and 1933 in the manner of Kehoe and Ruhl (2013, p. 380). When we compute the log change of the total imports of those varieties that are traded in both years, which we take to be the intensive margin, and compare this with the log change in the total value of all imports, we find that the intensive margin can account for the entire decline in trade. When we repeat the exercise for 1929–1936, we find that the intensive margin can still account for 99.4 percent of the decline in trade, despite the classification problems associated with moving across volumes. Our modeling strategy will thus focus on the intensive margin.

Tariff information was also reported in the Annual Statement, but in a different table from the trade data, and unfortunately not at as disaggregated a level as the 847-product import data. Additional information on rates of duty and exemptions was obtained from schedules included in National Institute of Economic and Social Research (1943) and H. M. Customs and Excise (1933, 1938). Some matching of tariff rates to individual products was required, which was done at the closest level possible to the import data. For example, tariff information was given for “cotton linters and cotton waste.” This rate was applied to all individual series covered by this category (e.g., cotton linters, bleached) unless a specific exemption was identified.

To calculate ad valorem tariff rates, two approaches were implemented. Where possible, the tariff rate was calculated as the total amount of duty raised, divided by the value<sup>28</sup> of goods charged with duty as recorded in the Annual Statement. In the small number of cases where the rate could not be determined by this method, it was calculated as the specific duty rate divided by the unit value (import value divided by import quantity).

Quantitative restrictions, including the veterinary embargoes from 1926 and the ban on imports from Italy in 1935–1936,<sup>29</sup> were coded based on National Institute of Economic and Social Research (1943). We also used this source to code voluntary export restraints, alongside the more detailed sources given in Section I. In all cases quantitative restrictions were coded simply as dummy variables, indicating

<sup>27</sup> In the 1924–1928 volume, the number of varieties ranged from 1,605 to 1,645; in the 1934–1938 volume, it ranged from 1,107 to 1,127.

<sup>28</sup> Or the quantity subject to duty multiplied by the average price.

<sup>29</sup> Except for gold, silver, bullion, books, magazines, and newspapers.

whether a particular restriction affected imports of a particular good from a particular country in a particular year. Details are given in online Appendix 4.

As mentioned in Section I, Britain signed a number of trade treaties with countries such as Argentina and Denmark. We therefore coded two variables relating to these treaties. The first simply indicates whether a trade treaty had been signed and was in force between the United Kingdom and the country concerned in a particular year (it thus varies across countries and years, but not across commodities). The second indicates whether such a treaty explicitly mentioned a commodity, imports of which from that country were subject to British quota restrictions in that year. It therefore varies across countries, years, and commodities, and is designed to test whether treaties muted the impact of quotas on imports. Full details of these two variables, and the sources used to code them, are given in online Appendix 6.

In our regressions we also control for exchange rates and nominal GDP. Nominal exchange rates were calculated as annual averages of closing daily exchange rates, and were taken from Global Financial Data.<sup>30</sup> Nominal GDP was taken from Klasing and Milionis (2014), adjusted for interwar borders using the adjustment coefficients from Broadberry and Klein (2012).<sup>31</sup> Online Appendix 2 provides summary statistics for all variables.

### III. Theoretical Framework

As Broda and Weinstein (2006) (whose notation we largely use) and others do, we consider a representative agent with a nested constant elasticity of substitution (CES) utility function (see Figure 3). At the top level, utility in period  $t$ ,  $U_t$ , depends on the consumption of a domestic good  $D_t$ , and of an aggregate imported good  $M_t$ ,

$$(1) \quad U_t = \left( \alpha_{Dt} D_t^{(\kappa-1)/\kappa} + (1 - \alpha_{Dt}) M_t^{(\kappa-1)/\kappa} \right)^{\kappa/(\kappa-1)},$$

where  $\kappa$  is the elasticity of substitution between the 2 goods.

At the second level, the aggregate imported good is defined as being a CES composite of imported goods  $g \in G_t$  where  $G_t$  is the set of all goods imported in period  $t$ ,

$$(2) \quad M_t = \left( \sum_{g \in G_t} \alpha_{gt} M_{gt}^{(\gamma-1)/\gamma} \right)^{\gamma/(\gamma-1)}.$$

Here,  $\gamma$  is the elasticity of substitution between imported goods, while  $M_{gt}$  represents total imports of good  $g$  in year  $t$ .

<sup>30</sup> <https://www.globalfinancialdata.com/index.html> (accessed June 2013).

<sup>31</sup> Because we lacked GDP data for Cuba, the Dutch West Indies, and Luxembourg, as well as for Austria and Czechoslovakia in 1938, we had to drop these observations from our regressions, leaving us with 150,414 observations with which to estimate elasticities. However, imports from all five countries in all years were taken account of in the CGE analysis.

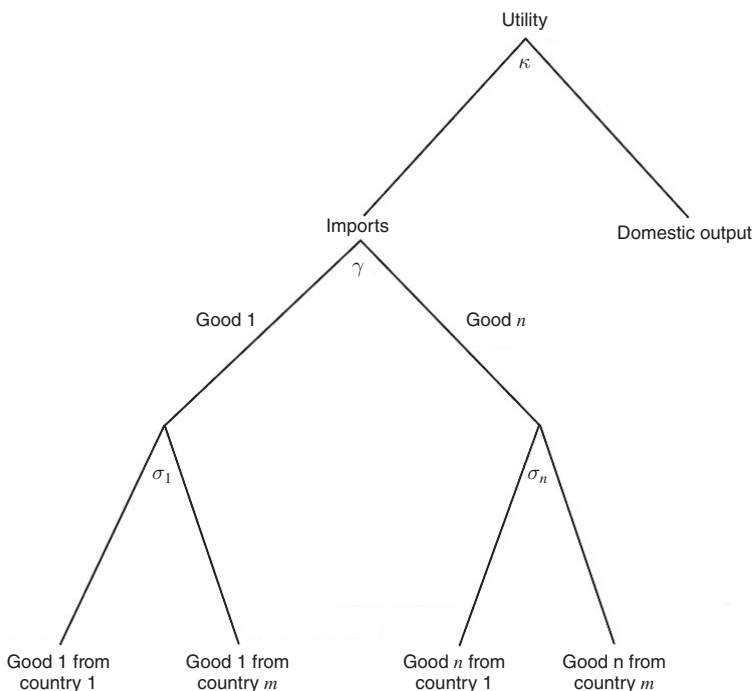


FIGURE 3. NESTED UTILITY FUNCTION

Finally,  $M_{gt}$  is defined as an Armington aggregate of imports of good  $g$  from different countries  $c$ , each of which (following Broda and Weinstein) we refer to as a variety:

$$(3) \quad M_{gt} = \left( \sum_{c \in I_{gt}} \beta_{gct} m_{gct}^{(\sigma_g - 1)/\sigma_g} \right)^{\sigma_g / (\sigma_g - 1)}.$$

Here  $m_{gct}$  represents imports of good  $g$  from country  $c$  in year  $t$ ;  $I_{gt} \subset C$  is the subset of all countries  $C$  supplying good  $g$  to the United Kingdom in year  $t$ ; the  $\beta_{gct}$ s are taste parameters; and  $\sigma_g$  is the Armington elasticity of substitution between different varieties of good  $g$ . For the sake of simplicity, we will assume that  $I_{gt}$  (and also  $G_t$ ) is fixed  $\forall g, t$ : we are therefore holding the extensive margin of trade fixed. This should not greatly influence our results, given that, as Section II showed, Britain’s trade collapse and subsequent recovery occurred almost entirely along the intensive margin.

On the supply side we adopt a simplified version of the model suggested by Anderson and Neary (1996). The economy is endowed with just one factor of production labeled  $GDP_t$ . This is transformed into two goods, an export good  $X_t$  and the domestic good  $D_t$ , via a constant elasticity of transformation production function:

$$(4) \quad GDP_t = \left( \alpha^D D_t^{(1+\eta)/\eta} + (1 - \alpha^D) X_t^{(1+\eta)/\eta} \right)^{\eta / (1+\eta)},$$

where  $\eta$  is the elasticity of transformation between the two outputs, and  $\alpha^D$  is the benchmark share of domestic good production in GDP. We assume that the United Kingdom takes world import prices, inclusive of non-policy-related transport costs,  $p_{gct}^W$ , as given.<sup>32</sup> Domestic prices are then given by

$$(5) \quad p_{gct}^D = \tau_{gct} \times p_{gct}^W$$

where  $(\tau_{gct} - 1)$  is the ad valorem policy-related trade cost (that is to say, costs associated with tariff and non-tariff barriers to trade) applying to imports of good  $g$  from country  $c$  in year  $t$ . Let these policy-related trade costs be defined as follows:

$$(6) \quad \tau_{gct} = \left( \prod_{i=1}^n b_i^{\delta_{igct}} \right) \times (1 + t_{gct}),$$

where  $b_i - 1$  is the ad valorem equivalent of facing non-tariff barrier  $i$ ;  $\delta_{igct}$  is an indicator variable taking the value 1 if imports of good  $g$  from country  $c$  face barrier  $i$  in year  $t$ , and 0 otherwise; and  $t_{gct}$  is the ad valorem tariff imposed on imports of good  $g$  from country  $c$  in year  $t$ .

Given domestic prices  $p_{gct}^D$ , it is straightforward to derive prices of the Armington aggregates  $M_{gt}$ ,  $p_{M_{gt}}$ , and of the composite aggregate imported good  $M_t$ ,  $p_{M_t}$ . The representative agent is endowed with  $GDP_t$  and receives all tariff revenue, as well as any rents associated with non-tariff barriers to trade (i.e., quota rents). He/she maximizes utility given by equation (1) subject to the usual budget constraint, while producers maximize  $p_{D_t} D_t + p_{X_t} X_t$  subject to (4).<sup>33</sup>

When solving the CGE model, it is convenient to define units so that all domestic prices are initially 1, implying that world prices are equal to  $1/\tau_{gct}$ . Given data on  $\tau_{gct}$ ,  $m_{gct}$ , and  $GDP_t$ , all remaining parameters in the model (in particular the  $\beta_{gct}$ s,  $\alpha_{gt}$ s,  $\alpha_{Dt}$ , and  $\alpha^D$ ) can be pinned down, and the general equilibrium for the economy solved. For example, this can be done for a year when protection was in place, say 1935. We can then compute counterfactual equilibria. For example, we could set  $\tau_{gc1935} = \tau_{gc1930} \forall g, c$  and  $\delta_{gc1935} = \delta_{gc1930} \forall g, c$ , and compute the counterfactual equilibrium that would have obtained in 1935, had protection been the same in 1935 as in 1930. Comparing that counterfactual 1935 equilibrium with

<sup>32</sup> This amounts to assuming that the United Kingdom did not have sufficient market power to influence world prices. McCloskey (1980) argues that mid-nineteenth century Britain had sufficient market power that it could have levied an optimal tariff, and Irwin (1988) finds evidence of less than perfectly elastic import and export supply and demand elasticities, based on data for 1820–1846. Nye (1991) finds that while British demand for French exports was inelastic prior to 1850, the elasticity increased steadily as the nineteenth century progressed. Authors concur that as the industrial revolution spread around the world, and Britain's share of world trade fell, it steadily lost market power: while the United Kingdom accounted for 24 percent of world imports in 1850, this share had dropped to 16 percent in 1913. It rose during the war but then resumed its decline, standing at 17 percent in 1924 and 15 percent in 1928. The United Kingdom's share of world exports was lower: 13 percent in 1924 and 11 percent in 1928 (Federico and Tena-Junguito 2016). McCloskey (1980, p. 318) writes that "In the 1930s Britain herself finally did abandon free trade, but by then, alas, the dominant position that would have enabled her over the preceding century to exploit the rest of the world was gone"; Harley (2004, p. 202) that "Paradoxically, protection began to recover its political appeal only at the end of the century, when potential monopoly was gone forever." de Bromhead et al. (forthcoming) find that the prices of UK imports from the Empire and the rest of the world fell by very similar amounts between 1931 and 1933, despite the fact that foreign imports were subject to higher tariffs than goods from the Empire. This suggests that our assumption is not unreasonable.

<sup>33</sup> We let  $X_t$  be the numéraire good, and set its price  $p_{X_t}$  equal to 1.

the actual one would then give us an estimate of the impact of the post-1930 trade policy shift in 1935.

We are interested in two questions: the impact of protectionism on total UK imports; and the impact of protectionism on the share of imports coming from the Empire. Given our nested CES demand structure, the only elasticities that matter for the latter question are  $\sigma_g$  and  $\gamma$ . These also matter for the total level of imports, but so do  $\kappa$  and  $\eta$ . The next section discusses how we estimated the various elasticities in our model.

#### IV. Estimating the Elasticities

Since most of our elasticities are estimated econometrically, we want to take account of the fact that they are imprecisely measured. We thus perform systematic sensitivity analysis, as described by Hillberry and Hummels (2013). We repeatedly draw elasticity values from normal distributions, whose means are the point estimates of the elasticity in question, and whose standard deviations are the standard errors of the elasticity coefficient. In what follows, we are therefore interested in both the point estimates of the elasticities, and the standard errors.

##### A. Estimating the $\sigma_g$ s

In order to estimate the  $\sigma_g$ s in equation (3), we begin with the structural gravity equations (4)–(6) presented in Anderson and Yotov (2010), bearing in mind that in all cases the destination country is the United Kingdom. Using our notation, their equation (4) becomes (for each of our 258 goods  $g$ , 42 countries  $c$ , and 15 years  $t$ ):

$$(7) \quad V_{gct}^D = \frac{M_{gt} \times Y_{gct}}{Y_{gt}} \times \left( \frac{\tau_{gct}}{P_{gt} \times \Pi_{gct}} \right)^{1-\sigma_g},$$

where  $V_{gct}^D = p_{gct}^D \times m_{gct} = \tau_{gct} \times p_{gct}^W \times m_{gct}$  is the value of imports of good  $g$  from country  $c$  in year  $t$ , measured in domestic (UK) prices;  $Y_{gct}$  is the output of good  $g$  in country  $c$  in year  $t$ ;  $Y_{gt}$  is world output of good  $g$  in year  $t$ ;  $P_{gt}$  is the inward multilateral resistance term for good  $g$  in the United Kingdom in year  $t$ ; and  $\Pi_{gct}$  is the outward multilateral resistance term for good  $g$  in country  $c$  in year  $t$ .

As is usual, our import data are c.i.f., and valued at world prices inclusive of transport and other trade costs not related to British trade barriers (in terms of the notation above, they are equal to  $p_{gct}^W \times m_{gct}$ ). We are not interested in these other trade costs, since we are holding them fixed in our analysis, and focusing instead on variations in trade-policy-related trade costs  $\tau_{gct}$ . We follow Baier, Kerr, and Yotov (2018) and work with

$$(8) \quad V_{gct}^W = p_{gct}^W \times m_{gct} = V_{gct}^D / \tau_{gct} = \frac{M_{gt} \times Y_{gct}}{Y_{gt}} \times \tau^{-\sigma_g} \times \left( \frac{1}{P_{gt} \times \Pi_{gct}} \right)^{1-\sigma_g}.$$



Substituting (6) into (8), and taking logs, we obtain

$$(9) \quad \ln(V_{gct}^W) = \ln(M_{gt}) + \ln(Y_{gct}) - \ln(Y_{gt}) - \sigma_g \ln(1 + t_{gct}) \\ - \sigma_g \sum_{i=1}^n \ln(b_i) \delta_{igct} - (1 - \sigma_g) \ln(P_{gt}) - (1 - \sigma_g) \ln(\Pi_{gct}) + u_{gct},$$

where  $u_{gct}$  is the error term. Good times year fixed effects can be used to control for  $M_{gt}$ ,  $Y_{gt}$ , and  $P_{gt}$ . Intuitively, by controlling in this manner for total imports of a given good in a given year (e.g., wheat in 1933), we are focusing on the choice between, say, Canadian and Argentinian wheat in 1933, which is what we want to do in order to estimate  $\sigma_g$ . Since we do not have data on foreign outputs of individual commodities, we are forced to use GDP instead (so we replace  $Y_{gct}$  with  $GDP_{ct}$  in equation (9)). We also control for the bilateral exchange rate,  $E_{ct}$ . Finally, since we only have data for one country, the United Kingdom, we are unable to include time-varying outward multilateral resistance terms. We therefore include good times country (i.e., variety) fixed effects, in the place of  $\Pi_{gct}$ . It is important to include these, since without variety fixed effects our estimated elasticities might be contaminated by any long run cross-variety correlation between average imports and average tariff rates. In particular, some of the United Kingdom's most important imports during this period (such as tobacco, silk, and petroleum) were inelastically demanded goods subject to very high revenue tariffs, especially on non-Empire goods. Not including variety fixed effects might lead to a spurious positive correlation between trade and tariffs. By including them we ensure that identification occurs along the time dimension alone.<sup>34</sup>

In principle we should estimate equation (9) for each of our 258 goods  $g$ , in which case the good times country, and good times year, fixed effects would collapse into country and year fixed effects. However, we lack sufficient observations to do this. We therefore estimate across nine categories of goods  $h$ , assuming a common elasticity  $\sigma_h$  for all goods  $g$  within this category (i.e.,  $\sigma_g = \sigma_h \forall g \in h$ ). The nine categories are grain, animal products, machinery, minerals, textiles, miscellaneous inputs, miscellaneous industry, food oils, and colonial goods.<sup>35</sup>

Our estimating equation is thus

$$(10) \quad \ln(V_{gct}^W) = \ln(GDP_{ct}) + \ln(E_{ct}) - \sigma_h \ln(1 + t_{gct}) \\ - \sigma_h \sum_{i=1}^n \ln(b_i) \delta_{igct} + d_{gt} + d_{gc} + u_{gct},$$

<sup>34</sup> In online Appendix 7 we try an alternative specification in which we replace good times country (i.e., variety) fixed effects with 3-digit-SITC times country times year fixed effects. In other words, rather than including good times country fixed effects  $d_{gc}$  as in our baseline equation (10), or good times country times year fixed effects  $d_{gct}$ , as we should in principle but cannot, we include  $d_{sct}$ , where  $s$  is the 3-digit SITC category (recall that we have 38 of these in our data) to which good  $g$  belongs. Once the small number of revenue goods in our sample have been eliminated the estimated elasticities look quite similar to our baseline results. Whether they are eliminated or not, our results regarding the impact of protection on the value and composition of trade are unchanged.

<sup>35</sup> Online Appendix 1 gives full details of how each category was constructed.

where good  $g$  is a member of goods category  $h$ ; and where  $d_{gt}$  and  $d_{gc}$  represent good times year, and good times country, fixed effects. We follow Santos Silva and Tenreyro (2006), and use a Poisson pseudo maximum likelihood (PPML) estimator to estimate (10). Since our 9 regressions include a total of both  $258 \times 42 = 10,836$  good times country fixed effects, and  $258 \times 15 = 3,870$  good times year fixed effects, we estimate the equations using the `poi2hdfe` estimator available in Stata (Guimarães and Portugal 2010; Figueiredo, Guimarães, and Woodward 2015).<sup>36</sup>

A potential concern might be that tariffs rose disproportionately on goods whose imports rose more, or fell less, during the preceding period. If rising imports prior to 1931 were for some reason correlated with import trends after 1931, our estimated trade elasticities would be biased. Online Appendix Table 14 shows that this is not an issue: there was absolutely no correlation between import trends during 1928–31 and the change in tariff rates after 1931. Note also that the United Kingdom does not fit the argument in Eichengreen and Irwin (2010) according to which countries that stayed on the gold standard longer were more protectionist. Online Appendix 7 also establishes that our econometric and simulation results are robust to using OLS.<sup>37</sup>

The results, given in Table 2, seem reasonable.<sup>38</sup> We control for the Italian trade sanctions of 1935–36, and the foot and mouth disease embargo instituted in 1926. Both had a severe negative impact on trade flows. Signing a trade treaty with the United Kingdom boosted exports of miscellaneous inputs and food oils to Britain, but otherwise had no direct impact on trade. As mentioned in Section II, we also coded a second variable relating to trade treaties: this was equal to 1 if a trade treaty that a country signed with the United Kingdom mentioned a good which was subject to quotas at that time. Neither this variable, which is something like an interaction effect between treaties and quotas,<sup>39</sup> nor a dummy indicating whether imports of commodities were subject to a voluntary export restraint, had any effect on trade flows.<sup>40</sup> Cartel membership significantly lowered imports of “mineral” products; curiously, the cartel coefficient is positive for colonial goods.<sup>41</sup>

Our main interest is in the impact of British trade policy. All the elasticities of trade with respect to tariffs are negative and (with one exception) statistically significant.<sup>42</sup> The fact that the elasticity is so low for colonial goods subject to revenue tariffs makes sense, as is the fact that the food oils and grain elasticities are so high. The coefficient on the animal tariff variable ( $-\sigma_g$ ) and on the quota

<sup>36</sup>Our standard errors are clustered by country. We also experimented by clustering at the commodity  $\times$  year  $\times$  Empire level, on the basis that this is the level at which trade policies varied. Those standard errors were generally smaller, and using them would not have affected our results.

<sup>37</sup>Another potential concern might be that changes in UK tariffs on particular goods could have been correlated with changes in tariffs on the same goods elsewhere. In general equilibrium, this might impact exports of the affected goods to the United Kingdom. The fact that we are including good times year fixed effects should help to allay this concern.

<sup>38</sup>While the coefficients on GDP are all positive, and in many cases statistically indistinguishable from one, they are very small for animal products in particular. GDP is a poor proxy for a country’s output of a particular good, given that countries specialize in very different products. For example, 46 percent of animal product imports came from just two small countries, Denmark and New Zealand.

<sup>39</sup>Although it is separately coded, rather than being mechanically computed as an interaction effect, since not all treaties mentioned the same goods.

<sup>40</sup>The coefficients are correctly signed, but small and statistically insignificant.

<sup>41</sup>The cartel in question was the Chadbourne sugar agreement, which the United Kingdom joined in late 1937.

<sup>42</sup>One of the coefficients is only statistically significant at the 10 percent level.

TABLE 2—PPML GRAVITY ESTIMATES BY CATEGORY, 1924–1938

	Grain (1)	Animal (2)	Machinery (3)	Minerals (4)	Textiles (5)	Misc. inputs (6)	Misc. industry (7)	Food oils (8)	Colonial (9)
log(1 + tariff)	-9.567 (4.829)	-3.908 (1.489)	-4.533 (1.951)	-2.477 (0.743)	-1.861 (3.350)	-4.905 (2.787)	-7.995 (2.509)	-23.47 (3.098)	-1.468 (0.533)
Quota		-0.900 (0.225)							
Embargo		-3.808 (0.684)							
VER		-0.0554 (0.193)							
Treaty	0.161 (0.263)	-0.0905 (0.194)	-0.0322 (0.0739)	-0.253 (0.328)	-0.121 (0.186)	0.222 (0.108)	-0.0906 (0.642)	0.777 (0.293)	-0.799 (0.530)
Quota × treaty		0.234 (0.216)							
Cartel			-0.123 (0.254)	-0.577 (0.347)	-0.0964 (0.583)				0.352 (0.131)
Italian sanctions	-7.174 (0.372)	-2.435 (0.172)	-2.581 (0.0700)	-21.43 (0.246)	-2.309 (0.227)	-3.952 (0.159)	-2.654 (0.233)	-3.526 (0.348)	-19.21 (0.418)
log(GDP)	1.287 (0.794)	0.106 (0.456)	0.996 (0.309)	1.508 (0.906)	1.766 (0.373)	0.620 (0.576)	0.953 (0.765)	0.429 (0.721)	1.590 (0.709)
log(exchange rate)	0.135 (0.367)	0.103 (0.153)	0.132 (0.167)	0.352 (0.202)	0.103 (0.257)	0.0622 (0.241)	0.542 (0.684)	0.0755 (0.310)	0.492 (0.354)
Observations	1,122	2,731	6,186	4,334	3,595	6,202	700	2,795	1,197

Notes: Dependent variable is the value of imports, by good, country, and year. Estimates control for good × country and good × year fixed effects. Estimates computed using `poi2hdfe`. Robust standard errors clustered by country in parentheses.

dummy variable in column 2 jointly imply (from equation (10)) that quotas on animal products were equivalent to a 25.9 percent ad valorem tariff. We will use the point estimates and standard errors of the elasticities in the first row of Table 2 when estimating our counterfactuals.

### B. Estimating $\gamma$

When generating the baseline results presented in the body of the paper, we adopt the procedure outlined by Ottaviano and Peri (2012), and estimate  $\gamma$  econometrically via a two-step procedure. First, we estimate the  $\sigma_h$ s as before, using equation (10). The fact that equation (10) includes good times country (variety) fixed effects, rather than good times country times year fixed effects, is equivalent to assuming that the  $\beta_{gct}$ s in equation (3) are constant over time, i.e.,  $\beta_{gct} = \beta_{gc} \forall t$ . It can be shown that the estimated fixed effects  $d_{gc}$  are equal to  $\sigma_g \ln(\beta_{gc})$ , which allows us to recover the  $\beta_{gc}$ s. That in turn allows us to compute the CES quantity ( $M_{gt}$ ) and price ( $p_{M_{gt}}$ ) nests for each of our 258 imported goods  $g$  in all years, where the prices reflect the impact of both tariff and non-tariff barriers to trade. We then run the following regression:

$$(11) \quad \ln(M_{gt}) = -\gamma \ln(p_{M_{gt}}/p_{M_t}) + \theta \ln(I_t) + d_g + u_{gt}$$

where  $p_{M_t}$  is an aggregate import price index,  $I_t$  is an import volume index,  $d_g$  represents 258 good-specific fixed effects,  $u_{gt}$  is the error term, and  $\gamma$  is the elasticity being estimated.<sup>43</sup>

The problem with this procedure is that the price and quantity nests in equation (11) are based on prior econometric estimates, and the standard errors ought to reflect this. We therefore adopted a bootstrapping procedure, each time drawing new subsamples of the raw data, estimating equation (10), extracting the  $\sigma_h$ s and the fixed effects, estimating the CES quantity ( $M_{gt}$ ) and price ( $p_{M_{gt}}$ ) nests for each of our 258 imported goods, and finally estimating equation (11). This yielded a point estimate for  $\gamma$  of 1.245, with a standard error of 0.117.<sup>44</sup>

As a robustness check, we also simply assumed that the middle-tier nest in our nested utility function was Cobb-Douglas, and that  $\gamma$  was thus equal to 1 (with a corresponding standard error of zero). Doing so had no impact on our results, as online Appendix 7 shows. We acknowledge that we cannot convincingly rule out political-economy-related endogeneity concerns regarding our estimate of  $\gamma$ . Reassuringly, online Appendix 7 shows that the precise value used has very little impact on our results.

### C. Estimating $\kappa$

We also estimated  $\kappa$ , the upper level elasticity of substitution between imports and domestic expenditure.

The most straightforward method was simply to run the OLS regression

$$(12) \quad \ln(m_t) = \alpha_0 \ln(TE_t) + \alpha_1 \ln(E_t) - \kappa \ln(1 + t_t) + u_t,$$

where  $m_t$  is the value of imports in year  $t$ ,  $TE_t$  is total expenditure on both domestic and imported goods,  $E_t$  is the real effective exchange rate,  $u_t$  is the error term, and  $t_t$  is the unweighted average tariff estimated for our sample of goods.<sup>45</sup> Total expenditure is the sum of net imports and expenditure on domestic goods. Expenditure on domestic goods is calculated by taking Feinstein's GDP data (Feinstein 1972, Table 9, p. T27), multiplying this by the ratio of gross output to value added in 1935 (derived from the input-output tables given in Barna 1952), and subtracting exports of domestic produce. Estimating (12) yielded a point estimate for  $\kappa$  of 2.294, with a standard error of 0.854. We also estimated  $\kappa$  by using the same method as that adopted in Section IVB. Reassuringly, this yielded a very

<sup>43</sup> Both the aggregate import price index, and the import volume index, were taken from Bank of England (2017).

<sup>44</sup> We performed 250 replications, of which 238 were successful. An alternative might be to estimate all elasticities (including  $\kappa$ ) simultaneously, using a generalized method of moments (GMM) approach. The benefit of proceeding in stages, as do Ottaviano and Peri (2012), is that their approach is easier to implement and more transparent: at each stage we have log-linear estimating equations that can be estimated in the usual fashion. Given that we are bootstrapping, so as to take account of how lower level regressions affect the standard errors of higher level regressions, it is hard to see what the payoff would be of adopting the more complicated approach.

<sup>45</sup> For  $m_t$  we use imports net of re-exports of imported goods. Data on imports, exports, and re-exports are all taken from the Annual Statements.

similar point estimate (2.325).<sup>46</sup> With just 15 annual observations, we are unable to address potential political-economy-related endogeneity concerns regarding our OLS estimate, but online Appendix 7 shows that our results are not excessively dependent on the value of  $\kappa$ .

#### D. Choosing Values for $\eta$

Finally, we need to choose values for  $\eta$ , the supply-side elasticity of transformation between domestic output and exports. Let  $\varepsilon_S$  represent the own-price elasticity of export supply. In a world such as the one we are considering, where an economy produces 2 goods, an export good and a domestic good, and where the elasticity of transformation between these 2 goods is a constant parameter  $\eta$ , it can be shown that  $\eta = \varepsilon_S / (1 - \alpha^X)$ , where  $\alpha^X = 1 - \alpha^D$  is the share of exports in total production.

We assumed that the own-price export supply elasticity estimates for 27 OECD countries presented in Tokarick (2014, pp. 1083–85) represented draws from an underlying distribution. The distribution that fit the data best was log-normal, with the mean and standard deviation of the underlying normal distribution being 0.403 and 0.468, respectively. When calculating our trade policy counterfactuals we took repeated draws of the log of  $\varepsilon_S$  from this distribution, and then calculated the corresponding value of  $\eta$ .

#### V. Trade Policy Counterfactuals

Armed with the trade elasticities described in the previous section, we can now turn our attention to calculating the impact on British imports of Britain's shift to protection from 1931 onward using the model outlined in Section III. For each year, we first solve the model using the actual tariffs and quotas in place during that year. We then compute equilibria for a counterfactual, "no policy shift," set of tariffs and quotas.<sup>47</sup> Since we are interested in the impact of the changes made to British trade policy from 1931 onward, in our counterfactual scenarios we set tariffs and quotas equal to their actual values for every year between 1924 and 1930. However, in 1931 and subsequent years, ad valorem tariffs and quotas for each commodity and country are frozen at their 1930 values. By comparing these actual and counterfactual

<sup>46</sup> However, the bootstrapping procedure led to very large standard errors at the third (upper-level) stage, which is why we rely on the OLS results when simulating our model. Our preferred OLS estimate is presented in equation (1) of online Appendix Table 13. The table presents a range of alternative estimates, in particular expressing imports as a ratio of expenditure. We prefer not to constrain the coefficient on expenditure in this manner on a priori grounds, and also regard the estimates of  $\kappa$  obtained when we do so as implausibly high. The fact that the Ottaviano-Peri procedure produces a value for  $\kappa$  that is close to our preferred estimate is another reason for adopting the latter. Online Appendix 7 shows that while we would have estimated a larger impact of trade policy on the value of trade, had we chosen higher values for  $\kappa$ , they would not have been very much larger.

<sup>47</sup> Since we have 15 years of data, we construct 15 separate CGE models. In addition to our data on imports by commodity and country, we use the data on GDP and imports (net of re-exports) described in Section IVC when calibrating our models. Since we only have data on imports of 258 commodities, we scale GDP down so as to match the actual ratio of imports to GDP. The model is solved using Mathematical Programming System for General Equilibrium (MPSGE) as a subsystem of GAMS (Rutherford 1999). The GAMS code is available on request.

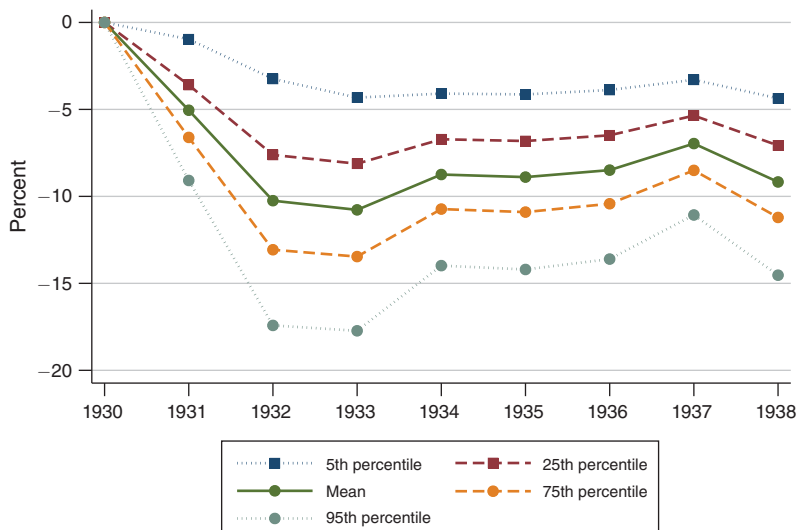


FIGURE 4. PERCENTAGE IMPACT OF POST-1930 SHIFT IN PROTECTION ON UK IMPORTS

Source: See text.

imports, we can calculate the impact of the shift in protection which took place from 1931 onward.

Since our elasticities are (mostly) estimated econometrically, we draw 1,000 separate values for each of them, from normal distributions whose means and standard errors were described in the previous section. We use these elasticities to estimate our counterfactual “no policy shift” equilibrium 1,000 times for each year.

#### A. The Impact of the Change in Trade Policy on the Total Value of Imports

First, we compute the total value of UK imports in our actual and counterfactual scenarios. Denote these by  $IM_{Actual}^{Total}$  and  $IM_{CF1930}^{Total}$ , respectively. Figure 4 plots the percentage impact of the post-1930 shift in trade policy, i.e.,  $100 \times (IM_{Actual}^{Total} - IM_{CF1930}^{Total}) / IM_{CF1930}^{Total}$ , for each year between 1930 and 1938. It plots not only the average impact across our 1,000 repetitions for each year, but the fifth, twenty-fifth, seventy-fifth, and ninety-fifth percentiles, giving a sense of how sensitive our results are to changes in the underlying elasticities.

As can be seen, the shift toward protection after 1930 reduced the value of British imports quite substantially, by about 9 or 10 percent on average. The greatest impact was in 1933: the mean estimated impact on imports in that year was 10.8 percent, with twenty-fifth and seventy-fifth percentile impacts of 8.1 and 13.5 percent respectively.<sup>48</sup> That 10.8 percent decline in UK imports due to increased protection was equivalent to 24.7 percent of the total fall in UK imports

<sup>48</sup>The fifth and ninety-fifth percentile impacts were 4.3 and 17.7 percent, respectively.

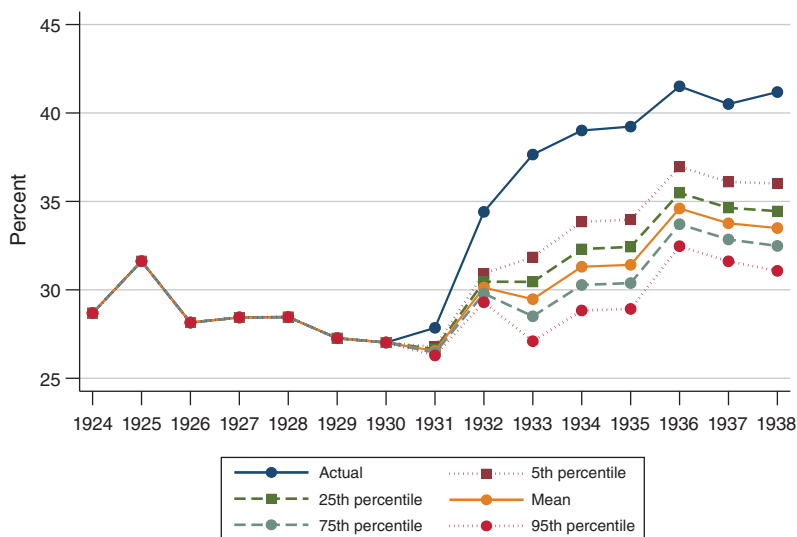


FIGURE 5. ACTUAL AND COUNTERFACTUAL SHARES OF BRITISH EMPIRE IN UK IMPORTS

Source: See text.

between 1929 and 1933 (the twenty-fifth and seventy-fifth percentile equivalents being 18.6 and 30.8 percent, respectively), and 31.1 percent of the decline in imports between 1930 and 1933 (the twenty-fifth and seventy-fifth percentile equivalents being 23.5 and 38.9 percent, respectively). These are substantial impacts, but they are smaller than the results implied by Kitson and Solomou (1990): our benchmark elasticities imply that the post-1930 shift to protection lowered UK manufactured imports by 12.6 percent, rather than the 48 percent implied by their results.<sup>49</sup> Our results are consistent with Irwin's (1998b) results for the United States, and suggest that, as in the United States, the majority of the decline in UK imports during this period was due to falling incomes.

### B. The Impact of the Change in Trade Policy on the Empire's Share of UK Imports

We next turn to the impact of protection on the share of UK imports coming from the British Empire. Figure 5 plots the actual share in our sample over time, as well as the counterfactual share that would have obtained had the UK not changed its trade policies after 1930. As before, we plot the mean estimated counterfactual share, along with the fifth, twenty-fifth, seventy-fifth, and ninety-fifth percentiles.

As can be seen, protection mattered a lot for the evolution of the Empire's share of British imports. For example, between 1930 and 1935 this share rose from 27 percent to 39.2 percent. However, if Britain had not adopted quotas and higher and more discriminatory tariffs from 1931 onward, it would only have increased to 31.4 percent using our mean estimate. (The twenty-fifth and seventy-fifth

<sup>49</sup> Using the same definition of manufactured imports as in Table 6; see online Appendix 1.

percentile counterfactual estimates for 1935 are 30.4 and 32.4, respectively.)<sup>50</sup> Our mean estimate implies that protection accounted for 77 percent of the shift toward Empire between 1930 and 1933 (the twenty-fifth and seventy-fifth percentile equivalents being 67.7 and 86.1 percent, respectively), and for 64 percent of the shift between 1930 and either 1934 or 1935. If we had simply assumed that  $\gamma$  was equal to 1, the estimated impact of protection on the share of UK imports coming from the Empire would have been slightly lower (see online Appendix 7), but it would still have accounted for 71.9 percent of the shift toward Empire between 1930 and 1933. These are large effects.

UK tariffs and quotas were not the only factor at work during this period influencing geographical patterns of trade. As Figure 5 shows, the Empire would have increased its share of British imports in the 1930s even had United Kingdom trade policy remained constant. Explaining this residual counterfactual increase is beyond the scope of this paper, but there are several obvious candidates. First, as other trade blocs adopted similar discriminatory trade policies, British Empire producers may have lost markets there and increased their exports to the UK in response. Second, UK policy promoted imports from the Empire in ways not taken account of by our tariff data: for example, Article 8 of the UK-Indian Ottawa agreement stated that “His Majesty’s Government in the United Kingdom undertake that they will co-operate in any practicable scheme that may be agreed between the manufacturing, trading and producing interests in the United Kingdom and India for promoting, whether by research, propaganda or improved marketing, the greater use of Indian cotton in the United Kingdom.” Newspapers such as the *Daily Mail* and *Daily Express* promoted intra-Imperial trade; a 1934 propaganda film made for the Conservative party argued that the Empire was a “great family linked together in a blood brotherhood of loyalty and service... by helping our Dominions, we are benefiting ourselves” (Thackeray and Toye 2012, pp. 5–6). As geopolitical tension rose during the 1930s, and the threat of war loomed larger, intra-Imperial trade came to seem even more desirable on security grounds. Despite all these other factors, UK trade policy still accounted for over half of Britain’s shift toward Empire as late as 1938.

## VI. Conclusion

Previous papers have looked at the interwar relationship between aggregate trade flows and the average tariff, and have found that interwar protection mattered less for the value of world trade than was traditionally thought. They have also explored the interwar relationship between trade bloc membership and bilateral trade flows, and concluded that trade blocs mattered less than traditionally thought as well.

In this paper we have estimated the impact of interwar UK trade policies on UK imports, using detailed information on trade and trade policy for 258 product categories. Our mean estimates suggest that the shift toward protection in 1931 and 1932 can account for about one-quarter of the decline in UK imports between 1929 and 1933, which is in line with previous results for the United States. However,

<sup>50</sup>The fifth and ninety-fifth percentile estimates are 28.9 and 34 percent, respectively.



TABLE 3—THE IMPACT OF DATA AGGREGATION

Number of goods in analysis	258	9	2	1
Fall in value of 1933 imports relative to “constant 1930 tariffs” counterfactual (percent)	−9.1	−8.4	−10.7	−12.1
Percentage of increase in Empire share 1930–1933 explained by post-1930 tariff shift	51.1	45.2	35.0	13.3

Source: See text.

we have also found that the shift toward protection, which was explicitly discriminatory, substantially increased the share of UK imports coming from the British Empire. Our mean estimates suggest that trade policy can explain over 70 percent of the increase in the Empire’s share of UK imports between 1930 and 1933. Other forces served to increase that share still further, but the impact of British protectionism was substantial. As late as 1938, trade policies can still account for over 50 percent of the shift toward Empire experienced since 1930.

What would we have found had we not had data on tariffs and trade for our 258 goods? What if we had only been able to calculate tariffs using more aggregate data? Calculating average tariffs by dividing tariff revenue by the value of imports is standard in the economic history literature, given the lack of uniform trade and tariff classifications in the past: as previously noted, it is what Irwin (1998a); Madsen (2001); and Estevadeordal, Frantz, and Taylor (2003) all do. Sometimes it has been done for broad categories of goods rather than imports as a whole (Lehmann and O’Rourke 2011); sometimes it has even been possible to calculate bilateral tariffs using the method (Albers 2017). Imagine that it were possible to compute such average tariff measures bilaterally, for each of our nine categories  $h$  used in the econometric analysis; or more realistically, given the data constraints of the period, for agricultural and non-agricultural goods;<sup>51</sup> or even more realistically, just for aggregate imports. Table 3 presents the results that we would have obtained for 1933, looking just at the impact of tariffs, if we had only had data on trade and trade-weighted average tariffs at these three higher levels of aggregation.<sup>52</sup> As can be seen, the results regarding the impact of tariffs on the total value of trade are essentially unaffected by the level of aggregation, since these depend above all on the upper level elasticity of substitution  $\kappa$ , which was in all cases estimated using aggregate data. However, the estimated impact of tariffs on the direction of trade falls as the level of aggregation increases: if we had used bilateral trade-weighted average tariff data in a one-good model we would have concluded that tariffs only

<sup>51</sup> Where agricultural goods comprise our “grain” and “animal” sectors.

<sup>52</sup> Measuring quotas and their impact using aggregate trade data raises a different set of issues, which is why we are focusing here on the impact of aggregation on the estimated impact of tariffs alone. The calculations all assume that  $\gamma = 1$ . In all cases we calculated tariffs by dividing the bilateral, commodity-specific tariff revenue by bilateral, commodity-specific imports (where the number of commodities was 9, 2, or 1); we then estimated the trade elasticities  $\sigma$ , where there were either 9, 2, or 1 of these depending on the level of aggregation; and finally we constructed CGE models incorporating 9, 2, or 1 goods, plugged our estimates of  $\sigma$  into these, and computed counterfactual equilibria keeping tariffs constant at their 1930 levels. In keeping with the spirit of the exercise, we used the trade-weighted average tariff data in Clemens and Williamson (2004) to estimate  $\kappa$ , rather than computing unweighted average tariffs using our disaggregated tariff data. The result was to raise the estimate of  $\kappa$  to 2.816. We continued to use our baseline estimates of  $\eta$ .

accounted for 13 percent of the shift toward Empire, whereas in fact they accounted for over 50 percent.

Methodologically, this paper suggests that there are advantages to using trade and trade policy data that are as disaggregated as possible, and looking at what trade blocs do, as opposed to simply looking at whether they exist. Historically, the paper suggests that discriminatory interwar trade policy mattered more for trade patterns than the previous cliometric literature has found. It certainly mattered a lot in the British case; whether what was true for the United Kingdom was true elsewhere is a question which we hope that future research will address.

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