London School of Economics and Political Science

The course and character of late-Victorian British exports

Brian Douglas Varian

Submitted to the Department of Economic History of the London School of Economics and Political Science for the degree of Doctor of Philosophy

London

June 2017

Declaration

I certify that the dissertation I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work.

A modified version of chapter II of this dissertation is forthcoming in the *Economic History Review* under the title 'Anglo-American trade costs during the first era of globalization: the contribution of a bilateral tariff series'. A modified version of chapter III of this dissertation is forthcoming in the *Australian Economic History Review* under the title 'British capital and merchandise exports, 1870-1913: the bilateral case of New Zealand'. I thank Wiley-Blackwell Publishers for the permission to reproduce this content here.

I declare that my dissertation consists of 47,920 words, excluding front matter, bibliography, and appendices.

Abstract

In this dissertation, I examine the inter-temporal variation (course) and the composition (character) of late-Victorian British exports.

The first substantive chapter focuses specifically on Anglo-American trade, which was the largest bilateral flow of trade during the first era of globalization, and finds that tariffs were the sole inter-temporal determinant of Anglo-American trade costs. The determinacy of tariffs for Anglo-American trade costs only becomes apparent when the tariff variable incorporates a measure of the bilateral American tariff toward Britain, which I purposely reconstruct. I conclude that Anglo-American trade represents a major qualification to any emerging consensus that foreign tariffs were of minor significance to the trade of late nineteenth-century Britain.

The next chapter reassesses the empirical validity of the Ford thesis, which argued that a short-term causal relationship between British *ex ante* lending and British merchandise exports operated in the late nineteenth century. Using more recent data on bilateral British lending, I find evidence of a 'lending-export loop', with British *ex ante* lending preceding merchandise exports by a period of two years. A case study of New Zealand, which had an extraordinarily high share of Britain in its imports, reveals that the relationship was conditional upon the lending being allocated to social overhead capital.

In the final substantive chapter, I construct indicators of revealed comparative advantage for British manufacturing industries for the years 1880, 1890, and 1900. In contrast with previous research, I argue that the manufacturing comparative advantages of late-Victorian Britain rested in the relatively labour non-intensive industries, and this finding remains robust even after controlling for human capital intensity. Furthermore, the manufacturing comparative advantages were neutral with respect to material intensity. While the share of inter-industry (Heckscher-Ohlin) trade in Britain's total manufacturing trade declined throughout the late-Victorian era, it still accounted for the majority of Britain's manufacturing trade in the 1890s.

Contents

List of Tables

* Indicates regression table.

List of Figures

Acknowledgements

It was a brilliant decision to write a doctoral dissertation on late-Victorian British exports. Writing this dissertation afforded me the opportunity to examine a subject matter fascinating in its own right, and it continually invited me to learn more about the economic histories of various countries and industries. Along the way, I encountered a breathtaking array of scholarship, which has been an inspiration to my research. It was, in every moment, a wholly enjoyable undertaking.

I am tremendously grateful to my supervisors, Chris Minns and Joan Rosés, for their guidance and support during the past four years. Through his generous intellect, Chris has exemplified the very best of economic history. Joan has encouraged me to research at the frontier of the discipline. To them both, I cannot sufficiently express my gratitude. I am also grateful to Max Schulze and Andy Seltzer, who have been especially encouraging of my development as an economic historian. Of course, I thank my PhD student colleagues, who took interest in my research and kept things always cheerful.

I have benefitted from comments received at the 2015 and 2016 annual conferences of the Economic History Society and the 2015 annual conference of the Economic History Association. Additionally, presentations at Cambridge University, the European University Institute, the Institute of Historical Research, the London School of Economics and Political Science, Lund University, and Oxford University also elicited many helpful suggestions, for which I am grateful.

I wish to thank my examiners, Stephen Broadberry and Douglas Irwin, both for their careful reading of this dissertation and for their many useful recommendations on how to further advance my research.

My research has been fully funded by an LSE PhD Studentship, for which I express my utmost appreciation. Modified versions of chapters II and III of this dissertation are forthcoming in the *Economic History Review* and *Australian Economic History Review*, respectively. I thank Wiley-Blackwell Publishers for the permission to reproduce this content here.

In closing, I wish to thank my family, especially my mother, to whom I dedicate this dissertation.

To my mother, Roxanne Varian

I: Introduction

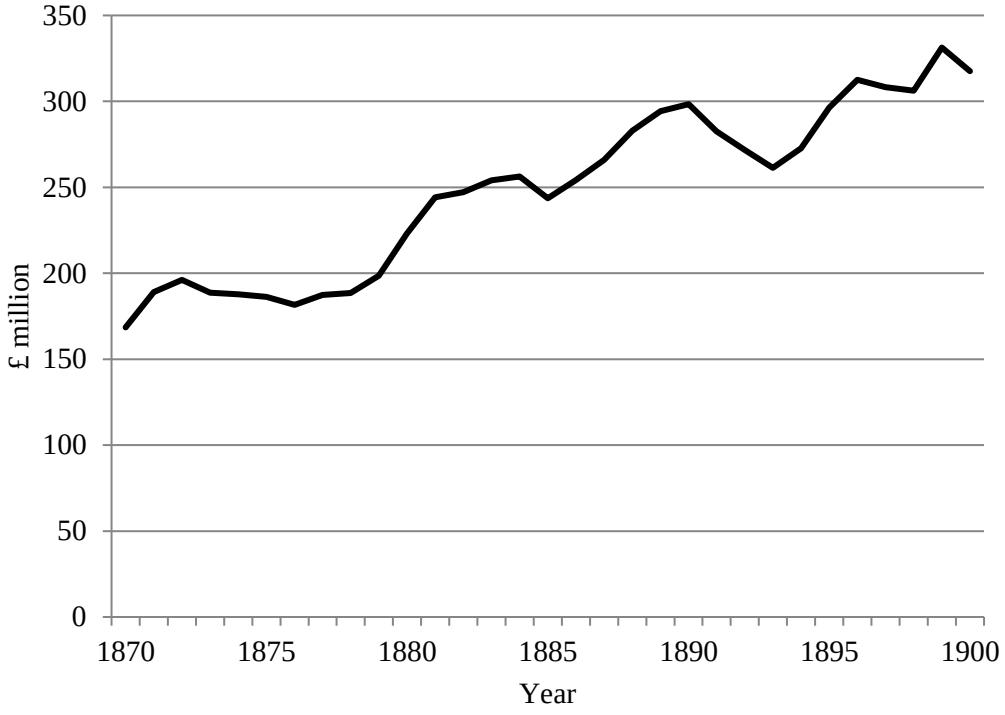
Aims and scope

Late-Victorian Britain was the 'workshop of the world'. Sayers observed that 'around 1880 the British economy was geared to the ability to sell to the outside world the output of one worker in every five'.[1] Indeed, the export sector was of fundamental importance to the economy of late-Victorian Britain. For this reason alone, it is imperative that economic historians arrive at an accurate understanding of late-Victorian British exports. Yet, the significance of this subject matter extends well beyond the economic history of just Britain. British exports were perhaps the closest nexus between the first industrial nation and the newly industrializing countries across the Channel and across the Atlantic. In these industrial countries, British exports competed against domestic manufactures. And in the periphery, they were the engines, figuratively and literally, of economic integration. To no small extent, the essence of the world economy is reflected in late-Victorian British exports, in both their 'course and character'. Still, despite a voluminous literature on the subject, there are several inadequately answered questions about late-Victorian British exports, questions which this dissertation addresses.

Chapters II and III of this dissertation concern the 'course', or the inter-temporal variation in the volume of British exports, which is plotted in Figure 1.1. These chapters examine, respectively, foreign tariffs and British overseas lending as possible determinants of the demand for British exports. Recent literature has suggested against the determinacy of foreign tariffs for the volume of British exports, but this literature relies upon an empirically incorrect measure of the tariff levels that British exports encountered in foreign markets. Similarly, it has been argued that British overseas lending was not a short-term determinant of the volume of British exports, but this argument is based upon data that has been superseded in recent times. Both chapters remedy major shortcomings in the existing literature. It should be emphasized that the implications of these chapters reach farther than just the volume of British exports. Notably, these chapters stand to inform the climacteric debate, which concerned the existence and timing of a structural break in the British

[1] Sayers, *The vicissitudes*, p. 4.

Figure 1.1. *Volume of British exports, 1870-1900*



Source: Imlah, *Pax Britannica*, pp. 96-7.
Note: The volumes are expressed in 1880 values.

economy during the late-Victorian or Edwardian eras.[2] Insofar as British economic growth depended upon export growth, the proximate determinants of export growth were ultimate determinants of Britain's rather lacklustre economic growth during this period.

Chapter IV concerns the 'character', or the industrial composition of British exports. In particular, it reassesses the claim by Crafts and Thomas that the manufacturing comparative advantages of late-Victorian Britain rested in industries that were relatively intensive in capital and labour, but not in human capital.[3] It also considers the association between comparative advantage and the factor proportion of material inputs. Unlike Crafts and Thomas, however, this chapter makes use of indicators of revealed comparative advantage (RCA), which are purposely constructed for this analysis. The RCA indicators represent a great improvement over the proxy for comparative advantage that Crafts and Thomas used in their study.

[2] The climacteric debate concerned structural breaks in the growth rates of, alternately, GDP and industrial output.

[3] Crafts and Thomas, 'UK manufacturing trade', p. 637.

Economically, late-Victorian Britain was, in many ways, different from mid-Victorian Britain. The economic historian Ashworth wrote that 'nothing contributed more to the air of prosperity in mid-Victorian Britain than the expansive condition of so many export markets'.[4] Surely, no such characterization could be made of late-Victorian Britain, however. In the 1870s, British economic growth decelerated, and so too did British export growth. Britain's export volume growth rate halved from 4.1 per cent per annum (1853-72) to 2.0 per cent per annum (1872-96).[5] The mid-Victorian 'air of prosperity' had succumbed to an air of depression, and contemporaries came to regard exports as a leading cause.

The relative stagnation of British exports after 1872 contrasts significantly with the impressive growth during the years immediately preceding. From 1868-72, the volume of British exports increased by more than a third.[6] Contributing to this increase was a spate of railway construction in the United States, which engendered a tremendous demand for British iron and steel exports.[7] These propitious circumstances were not to last indefinitely. Export growth was checked by the Financial Crisis of 1873, the effects of which were most acute in Britain's largest export market, the United States.[8]

The year 1873 marks the beginning of Britain's so-called Great Depression, which was to last until the mid-1890s.[9] The Great Depression was a depression in neither production nor exports, but rather in prices. Throughout the period, British export prices steadily declined, punctuated by only two brief intervals of rising prices in the early and late 1880s.[10] Yet, the volume of British exports continued to grow, albeit slowly and subject to cyclical variation. Nevertheless, the rise in volumes was outpaced by the fall in prices, resulting in a declining total value of exports. The peak value of British exports in 1872 was not surpassed until 1890, and not consistently surpassed until 1899. In an era when export volume indices were unavailable, the

[4] Ashworth, *Economic history*, p. 138.

[5] Calculated from Imlah, *Pax Britannica*, pp. 96-7.

[6] Imlah, *Pax Britannica*, pp. 96-7.

[7] Saul, *British overseas trade*, p. 95. During the interval from 1868-72, iron and steel constituted 27% of British exports to the United States.

[8] Lewis, *Growth and fluctuations*, p. 36.

[9] For a general account of the Great Depression, including an evaluation of the appropriateness of this phrase for the period from 1873-96, readers are referred to Saul, *The myth*. Beales, 'Great Depression', offered some of the earliest criticisms against applying this phrase to the economy of late-Victorian Britain.

[10] Imlah, *Pax Britannica*, p. 97.

declining value of exports occasioned real concern and, indeed, an air of depression amongst the industrial interests of Britain.

This concern culminated, in 1885, in the Royal Commission on the Depression of Trade and Industry. The Commission undertook an exhaustive inquiry into the state of British manufacturing industries, particularly as they compared to the manufacturing industries of foreign countries.[11] Questionnaires were sent to chambers of commerce and trade unions. Representatives of the Board of Trade, the Foreign Office, the Board of Inland Revenue, and the Board of Customs spoke before the Commission. Witnesses from the iron and textile industries provided oral testimony, as well. The final report of the Commission, delivered in 1886, put forward several causes of the 'depression' in trade and industry, such as diminishing returns to capital and the monopoly power of the railways. However, of all the causes referenced in the report, the most resounding was the emergence of foreign competition, and Germany was explicitly identified as its greatest embodiment.[12] The final report concluded 'that our position as the chief manufacturing nation of the world is not so undisputed as formerly, and that foreign nations are beginning to compete with us in many markets of which we formerly had a monopoly'.[13]

The emergence of foreign competition was nowhere more evident than in the performance of British exports, which confronted increasing protection in many markets. The reports of the Royal Commission abound with references to the curtailment of British exports to protected markets. When the Commission concluded in 1886, Britain still had yet to encounter the barrage of foreign tariffs that would come in the late 1880s and early 1890s. The McKinley Tariff of 1890 raised the *ad valorem* equivalent bilateral American tariff toward Britain from (an already high) 35 to 43 per cent, according to the bilateral tariff series that I reconstruct in the next chapter. France's Méline Tariff of 1892 raised the duties on many manufactured imports, including textiles, and therefore was particularly punishing toward Britain.[14] Even within the Empire, there was a ratcheting-up of protection, the Canadian Tariff

[11] It should be observed that the purview of the Commission also extended to agriculture and shipping.

[12] *Final report of the Royal Commission on the depression of trade and industry*, p. xx, noted, 'A reference to the reports from abroad will show that in every quarter of the world the perseverance and enterprise of the Germans are making themselves felt'.

[13] *Final report of the Royal Commission on the depression of trade and industry*, p. xxiii.

[14] Ashley, *Modern tariff history*, p. 333.

Amendment Act of 1887 being one of the most outstanding examples.[15] Yet, despite the testimony recorded in the reports of the Royal Commission, and despite the protectionist legislation that followed, economic historians have suggested against the determinacy of foreign tariffs for the aggregate volume of British exports during the period from 1870-1913, often called, somewhat paradoxically in this regard, the first era of globalization. Saul observed that 'it seems unlikely that in the period before 1914 tariffs seriously hindered the development of [British] trade, taken as a whole'.[16] More recent scholarship by Jacks et al. found that tariffs were not a statistically significant determinant of Britain's 'trade costs', a concept which I address in due course.[17] Given the inconsistency between the historical record and the scholarly literature, I examine the effect of foreign tariffs on the volume of British exports in chapter II.

Any analysis, especially econometric analysis, of the effect of foreign tariffs on the aggregate volume of British exports is necessarily complicated, owing to the immense number of tariff-imposing markets to which Britain exported its wares. Precisely for this reason, Hatton was unable to include a variable for foreign tariffs in his demand function for British exports during the period from 1870-1913.[18] Confronting the same problem, I have decided to consider the determinacy of tariffs for the volume of British exports to just one market, the United States. The United States is a singularly deserving case to consider because it was one of Britain's largest export markets—in some years, it was *the* largest export market—and because it offers substantial inter-temporal variation in the tariff level. By focusing upon just one bilateral flow of British exports, I can pursue an econometric analysis that relies upon an empirically correct measure of the tariff level that British exports encountered, that is, the bilateral tariff toward Britain. Indeed, a major contribution of this chapter is a reconstructed annual series of the *ad valorem* equivalent bilateral American tariff toward Britain. In this chapter, the econometric analysis takes the form of a time-series adaptation of the trade-costs framework of Jacks et al.

---

[15] Beaulieu and Cherniwchan, 'Canadian protectionism', p. 157.

[16] Saul, *British overseas trade*, p. 165.

[17] Jack, Meissner, and Novy, 'Trade costs', p. 135.

[18] Hatton, 'British exports', p. 583. In recognition of the heightening of protection in several of Britain's largest export markets in the late 1880s and early 1890s, Hatton tested for a structural break between 1890 and 1891, but found no statistically significant break; see p. 585.

The Royal Commission directly preceded a crescendo of British overseas lending in the late 1880s, with annual foreign portfolio investment rising from £69.8 million in 1886 to £122.9 million in 1889.[19] In that year, British foreign portfolio investment amounted to no less than 9 per cent of GNP.[20] Most of this investment was allocated to social overhead projects, such as the construction of railways and bridges. Throughout the late nineteenth century, Britain was the world's foremost creditor, but it is worth observing that the volume of its overseas lending exhibited long swings that alternated with domestic investment.[21] In the decade following the Baring Crisis of 1890, capital otherwise invested abroad was instead invested domestically, creating what has been referred to as the 'home boom' of the 1890s.[22] In short, the volume of British overseas lending was hardly constant, or even linear.

While the effect of overseas lending on the volume of British exports went entirely unaddressed by the Commission, economic historians have devoted considerable attention to the relationship between British capital exports and British merchandise exports during the late nineteenth century. A positive effect of British overseas lending on the demand for its merchandise exports was articulated at least as early as 1904 in Hobson's *International Trade*, but it was not until the 1950s and 60s that such a relationship was given an empirical foundation by Ford.[23] Ford, who was primarily concerned with explaining the working of the classical gold standard, argued for a short-term causal relationship between British *ex ante* lending and British merchandise exports, operating with a one-year or two-year lag.[24] Social overhead projects overseas raised demand for British capital *goods* exports, while higher incomes arising from these projects raised demand for British consumption goods exports.[25] The Ford thesis offered an elegant and not unreasonable equilibrating mechanism that could accommodate, at least partially, Britain's overseas lending in its balance of payments. However, Ford's proposed relationship

[19] Simon, 'Portfolio foreign investment', p. 38.

[20] Calculated from Simon, 'Portfolio foreign investment', p. 38; Feinstein, *National income*, p. T5.

[21] Cairncross, *Home and foreign investment*, especially ch. 7.

[22] The origins and nature of this boom are detailed in Blackman and Sigsworth, 'Home boom'.

[23] Hobson, *International trade*, pp. 106-7.

[24] Ford's argument was explicated over the course of several articles: Ford, 'British foreign lending'; Ford, 'Gold standard'; Ford, 'British economic fluctuations'.

[25] Ford, 'British foreign lending', p. 305.

between British capital and merchandise exports was discredited by, separately, Hatton and Eichengreen.[26]

Did overseas lending determine the course of late-Victorian British exports? In chapter III, I endeavour to answer this question using Stone's annual series of bilateral British lending, which had been unavailable to Hatton and Eichengreen.[27] Stone's series permit me to exploit the large cross-sectional variation in British overseas lending that is evident in any given year. In contrast, Hatton and Eichengreen were reliant upon an aggregate series of British lending (to all countries) and, therefore, were confined to time-series analysis.

In this chapter, I complement my empirical test of the Ford thesis with a case study of bilateral British capital and merchandise exports to New Zealand. The extremely high share of Britain in the country-composition of New Zealand's imports renders this case ideal for identifying the precise channel through which the causal relationship operated. Was the 'lending-export loop', as I shall refer to it, conditional upon the lending being allocated to a particular purpose, such as a social overhead project? Did lending raise demand for both British capital goods exports and British consumption goods exports? These are the more refined questions which, I maintain, are best answered by means of a carefully formulated case study. Ultimately, the bilateral case study of New Zealand leads to a more qualified judgment on the validity of the Ford thesis than would have been concluded otherwise.

Turning now to the character of late-Victorian British exports, the aim of chapter IV is to identify the factor determinants of Britain's within-sector manufacturing comparative advantages. In order to measure the presence and extent of comparative advantage, I estimate indicators of revealed comparative advantage (RCA) using a modified version of the method proposed by Balassa.[28] I estimate RCA indicators for 17 manufacturing industries for the years 1880, 1890, and 1900. These indicators represent the earliest systematic measurements of the relative performance of individual British manufacturing industries.[29] Indeed, it is my hope

[26] Hatton, 'British exports', pp. 584-5; Eichengreen, 'Alec Ford', p. 66.

[27] Stone, *Global export*.

[28] Balassa, 'Trade liberalisation', pp. 105-6.

[29] These RCA indicators predate Crafts's 1899 RCA indicators for British manufacturing industries; see Crafts, 'Revealed comparative advantage', p. 130. They also predate Broadberry's 1907 estimates of US-UK and Germany-UK comparative

that historians of British industries will find these indicators eminently useful. Here, however, I employ the RCA indicators for the more concerted purpose of identifying the factor determinants of Britain's manufacturing comparative advantages, and I do so using the Heckscher-Ohlin (H-O) model of trade.

In examining the pattern of specialization within the British manufacturing sector, this chapter finds little historical context in the final report of the Commission, which merely identified the causes of the Great Depression, and even then, largely irrespective of individual industries.[30] Yet, the earlier reports of the Commission, particularly the testimony from industry witnesses, offer some indication of the relative scarcity of factors in the British manufacturing sector. One of the most common points raised by the industry witnesses was the higher wages that prevailed in British manufacturing, compared to Continental European (though not American) manufacturing. As one of the witnesses from the silk industry of Macclesfield stated, 'It would cost about 8s. for labour to make 20s. of goods in Lyons. Whereas, for every 20s. worth I make, it costs 12s. to produce them'.[31] It would follow that late-Victorian Britain's relative scarcity of labour, vis-à-vis Continental Europe, was most injurious to those industries with a high factor proportion of labour, such as the silk industry.[32]

However, Crafts and Thomas argued that late-Victorian Britain's manufacturing comparative advantages rested in the relatively labour-intensive industries.[33] This argument is difficult to reconcile with the lower wages in Continental Europe, which supplied 52 per cent of world manufactured exports in 1899.[34] It is therefore an argument worth reassessing, and I do so using superior data. Whereas Crafts and Thomas relied upon gross exports in just the year 1880 as a proxy for comparative advantage, I rely upon actual measurements of comparative

---

manufacturing labour productivity, disaggregated by industry; see Broadberry, *Productivity race*, pp. 28-32.

[30] One exception was the iron and steel industry. In enumerating the causes of the depression, the Commission cited the decline in global railway construction in the mid-1880s as uniquely injurious to this industry. *Final report of the Royal Commission on the depression of trade and industry*, p. xxiii.

[31] *Second report of the Royal Commission on the depression of trade and industry*, p. 285.

[32] My RCA indicators for the silk industry do, in fact, reveal that Britain was at a consistent and marked comparative disadvantage in the silk industry; see table 4.1.

[33] Crafts and Thomas, 'UK manufacturing trade', p. 637.

[34] Calculated from Tyszynski, 'Manufactured commodities', p. 277.

advantage for three decennial years in the late-Victorian era.[35] My measurements normalize for the composition of world exports, including the exports of relatively labour-abundant Continental Europe.

In chapter IV, I also consider the extent to which Britain's manufacturing trade was factor-determined at all. I decompose the manufacturing trade of late-Victorian Britain into inter-industry trade, as explained by the H-O model, and intra-industry trade, as explained by new trade theory (NTT). I stress that the analysis in this section of the chapter is of a more preliminary nature. Nevertheless, it is one of the first applications of NTT to the nineteenth century, and it lays a foundation for much future research.

This dissertation answers three questions. First, were tariffs an inter-temporal determinant of bilateral Anglo-American trade costs? Second, was there a short-term causal relationship between British capital and merchandise exports? Third, what were the factor determinants of Britain's manufacturing comparative advantages? I have settled upon these particular questions, largely because they address apparent inconsistencies between the historical record and the scholarly literature or, in the case of the Ford thesis, a debate within the literature itself. In all three analyses, I utilize new data: my reconstructed annual series of the bilateral American tariff toward Britain, Stone's annual series of bilateral British overseas lending, and my estimated decennial RCA indicators for British manufacturing industries.

In this dissertation, I do not purport to offer a comprehensive historical overview of late-Victorian British exports. For such a text, I refer readers to Saul's *Studies in British Overseas Trade, 1870-1914*. In this classic text, Saul discusses each of the main commodities in each of the sub-intervals of the late-Victorian era. He also gives thorough treatment to the shifts in the geographical markets for British exports. While I hardly seek to emulate Saul's work, I do make frequent use of it throughout this dissertation, especially when I believe that readers would benefit from historical context. Saul's text remains, in my estimation, the single best narrative account of British exports (and imports) during this period, and its value is uncompromised in this respect. Nevertheless, I do dispute Saul's assessment of the overall effect of foreign tariffs on the volume of British exports.

[35] Crafts and Thomas, 'UK manufacturing trade', p. 636.

Studies in British Overseas Trade, 1870-1914 is now more than a half-century old, and, in this regard, it is not untypical of much of the literature on the subject matter. Some of the most pertinent sources are from the 1950s, 60s, and 70s. The vintage of this literature should hardly come as a surprise. A long tradition of economic history within Britain, a tendency toward the study of domestic economic history, and the cohesion of the late nineteenth century—conveniently, there were no major wars—all conspired to bring the economy of late-Victorian Britain to the early attention of economic historians.[36] And the centrality of trade to the British economy meant that the subject of late-Victorian British exports was high on their agendas. The early attention to this subject is, I have found, more of an opportunity than an impediment. Older arguments about late-Victorian British exports stand to benefit greatly from more recent literature, particularly in the area of tariffs. Additionally, older arguments can be reassessed using econometric methods, which were mostly unavailable to the first generation of post-war economic historians. Altogether, there is the scope for a revival of interest in the economy of late-Victorian Britain! While it would be audacious and, more than likely, incorrect for me to suggest that this dissertation marks the beginning of such a revival, I nevertheless maintain that this dissertation does offer significant 'value-added' to a not recent (but not irrelevant) subject matter.

Regrettably, the imports of late-Victorian Britain fall outside the scope of this dissertation. Of course, imports cannot be avoided entirely. In chapter II, British imports from the United States figure into my econometric analysis, as bidirectional bilateral trade costs are the unit of analysis in the framework of Jacks et al. And in chapter IV, the quality of Britain's intra-industry exports can only be ascertained relative to the quality of Britain's intra-industry imports. Still, imports are peripheral to my work here. To be sure, the course and character of late-Victorian British *imports* would make for a fascinating dissertation, but one perhaps better written by another PhD student.

This introductory chapter to the dissertation includes both historical background and a survey of the literature. As for the historical background, the next two sections of this chapter cover, respectively, late-Victorian Britain's terms of

[36] It was in the early 1930s when academic interest in the economy of late-Victorian Britain began in earnest; see Silverman, 'Monthly index numbers'; Silverman, 'International trade factors'; Beales, 'Great Depression'.

trade and the geographical markets for its exports. These two topics are not directly addressed in any of the substantive chapters, but I believe they are of sufficient importance to warrant discussion here. Knowledge of these topics will assist the reader in evaluating the contributions of the substantive chapters. For example, knowledge of the share of the United States in the country-composition of British exports will help the reader to contextualize the significance of American tariffs for the British export sector as a whole. In these two sections, I mostly draw upon the standard descriptive texts, notably *Studies in British Overseas Trade, 1870-1914*, but I do intersperse some original insights throughout the discussion.

The next two sections of the introduction offer a survey of the literature, which I have opted to divide along broadly chronological lines. First, I address the older literature, specifically that literature which forms the British climacteric debate, or, as I shall later suggest, climacteric *debates*. Here, I limit my discussion to only that literature which examines the contribution of exports to the (debated) British climacteric. Second, I address the newer literature. Altogether, the literature which I cover in these two sections of the introduction is supplemented by more topic-specific literature which I have reserved for the appropriate substantive chapters.

This dissertation concerns the late-Victorian era, which I define as the period from 1870-1900. It encompasses the Great Depression of 1873-96, plus some more prosperous years on both ends.[37] I have mostly refrained from considering Edwardian British exports. Although the interval from 1870-1913 is now an almost conventional periodization, there was once a tendency amongst economic historians to treat the Edwardian era as a period apart.[38] Especially with respect to the course and character of British exports, the late-Victorian and Edwardian eras were distinct, and I have decided to direct my focus to the former. I devote the final section of this introductory chapter to explaining my choice of periodization. In this section, I enumerate those elements of Edwardian British exports which contrast with late-Victorian British exports. The differences are many.

---

[37] Though the period from 1896-1900 was far more prosperous for the domestic sector than for the export sector. In 1900, real GDP was 11% higher than in 1896; calculated from Feinstein, *National income*, p. T14. Meanwhile, in 1900, the export volume was only 2% higher than in 1896; calculated from Imlah, *Pax Britannica*, p. 97.

[38] Some notable examples include Ford, 'British export performance'; Harley, 'Edwardian industry'. Still, studies of the Edwardian British economy have not vanished altogether; see Dilley, 'London finance'.

It should not, however, be assumed that the year 1900 marks some strict dividing line. It does not. The years 1896 and 1899 are also good candidates for the terminal year of this study, for reasons I shall explain. In short, there is no ideal ending point. Rather, it should simply be emphasized that the course and character of British exports were more fundamentally altered between 1895 and 1905 than, say, between 1885 and 1895. That is not to deny the existence of change within the late-Victorian era. Indeed, by focusing on the late-Victorian era exclusively, I can examine these changes against a backdrop of constants.

In chapters II and III, which address the course of British exports, it is necessary that I defer, to a degree, to the conventional periodization of 1870-1913. In chapter II, this decision is motivated by the desire to situate my findings alongside those of Jacks et al., whose period is the first era of globalization, i.e. 1870-1913. In chapter III, this decision is motivated by the need to obtain a sufficient number of annual observations for export markets that only joined the gold standard in the late 1870s.[39] Yet, even in these two chapters, the emphasis is on the late-Victorian era. In chapter II, most of the discussion of the bilateral American tariff toward Britain necessarily focuses on the 1890s, when the tariff exhibited its greatest variation. In chapter III, the bilateral case study of New Zealand is limited to the period before 1901, when there was an abrupt decline in the foreign share of New Zealand's public capital formation.

Before proceeding any further, it is appropriate that I briefly note my principal source for data on British exports: the *Annual Statements of the Trade of the United Kingdom*. Unless otherwise noted, it should be assumed that all trade figures referenced in the text were obtained from this source. The main exception is chapter II, in which the *Foreign Commerce and Navigation of the United States* is relied upon for data on American imports from Britain. In those instances where the source of data might be ambiguous to the reader, I cite the source explicitly in a footnote.

[39] Importantly, the United States did not *de facto* adopt a gold standard until 1879.

Terms of trade

The net barter terms of trade, or more commonly just 'terms of trade', is arrived at by dividing a country's export price index by its import price index.[40] Changes in a country's terms of trade can be interpreted as changes in the quantity of imports that can be obtained per unit of exports. One early terms of trade series for late-Victorian Britain was produced by Silverman in 1930.[41] However, the Silverman series presents a couple of disadvantages. First, it only commences in 1880. Second, in constructing the underlying import price index, Silverman excludes finished manufactured commodities, which accounted for a substantial (and increasing) share of Britain's imports during this period.[42] Still, in spite of these disadvantages, the Silverman series remains the only available monthly terms of trade series for late-Victorian Britain, as the two subsequently produced series are of an annual periodicity.

In 1938, Schlote produced the first long-run terms of trade series for Britain, spanning the period from 1814-1933 and, therefore, the entirety of the late-Victorian era.[43] Schlote's method requires some explanation, as it departs from the more traditional method of constructing Laspeyres export and import price indices. Instead, Schlote constructs Laspeyres export and import *quantity* indices, in which there are fixed commodity prices taken from base years. The export and import quantity indices are first constructed for shorter intervals; the two relevant intervals for the late-Victorian era happen to be 1869-81 and 1881-1902, and the corresponding base years are 1880 and 1902.[44] The quantity indices for the shorter intervals are then spliced together in the overlapping years (e.g. 1881) to form continuous, long-run export and import quantity, or volume, indices. The volume indices are then simply calibrated to the values of trade (exports and imports) in

[40] In some early studies, the terms of trade were calculated by dividing the import price index by the export price index; see Taussig, *International trade*, pp. 252-3; Silverman, 'International trade factors', p. 115.

[41] Silverman, 'Monthly index numbers'.

[42] Ibid., pp. 140-1. The exclusion of manufactured commodities from the import price index is not altogether trivial. According to Schlote, *Overseas trade*, p. 68, the share of finished manufactured commodities in British imports rose from 14% in the 1880s to 17% in the 1890s.

[43] I have relied upon the 1952 English translation of this text by Henderson and Chaloner.

[44] Schlote, *Overseas trade*, p. 27.

1913, resulting in a series of '*volumes based upon value*' [emphasis in original].[45] Export and import price indices are obtained from the division of trade values by trade volumes. Finally, the terms of trade is calculated as the ratio of the export price index to the import price index.[46]

It is worth emphasizing that Schlote does not rely upon a single base year for the construction of his export and import quantity indices. Rather, he constructs chained Laspeyres quantity indices with multiple base years, in order to accommodate longer-term shifts in the relative economic significance of individual commodities within the composition of British trade. [47] Consider cotton manufactures. Assigning a constant price to cotton manufactures for the whole period from 1814-1933 would fail to account for the fact that, by the twentieth century, cotton manufactures had become a fundamentally cheaper commodity relative to other commodities in Britain's export basket.[48]

Imlah produced an improved terms of trade series for nineteenth-century Britain. His method was essentially identical to Schlote's: constructing chained Laspeyres quantity indices for exports and imports, obtaining the price indices through the division of values by volumes, and then, of course, taking the ratio of the export price index to the import price index. Nevertheless, there are two main distinguishing features of the Imlah series. First, the Imlah series is superior on account of its coverage of commodities, which is around 90 per cent for the late-Victorian intervals (1865-88 and 1887-1901).[49] In contrast, Schlote does not state his coverage rate, causing Imlah to question the representativeness of the Schlote series. Second, Imlah objects to the base years which Schlote chooses for deriving the commodity price weightings. In particular, Imlah points to the atypically low prices

---

[45] Ibid., pp. 28-9. It should be stressed that these series are fundamentally volumetric.

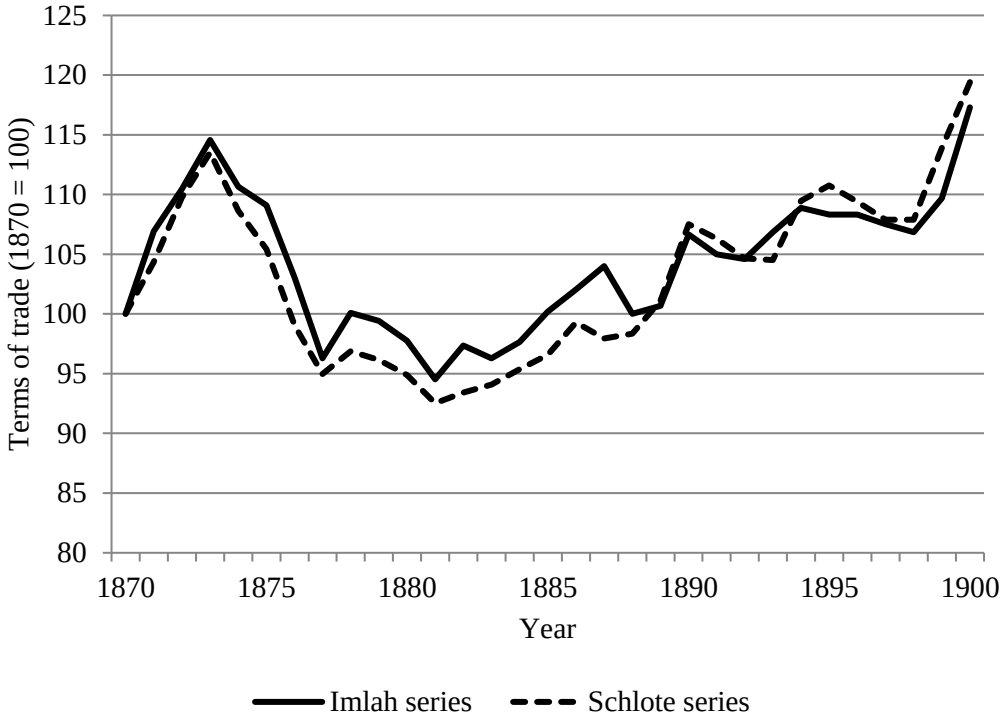
[46] Schlote does not present the terms of trade series itself in tabular form, although it can easily be calculated from the export and import price indices on pp. 175-8. A diagram depicting the terms of trade does appear on p. 47.

[47] Schlote, *Overseas trade*, p. 14.

[48] In fact, Imlah published an export price index for, specifically, British cotton manufactures. In 1880, the export price index for cotton manufactures was at 16% of its 1814 level; calculated from Imlah, *Pax Britannica*, pp. 208-10. In 1880, the export price index for total exports was at 30% of its 1814 level; calculated from Imlah, *Pax Britannica*, pp. 94-7. Thus, a constant price weighting for cotton manufactures would be distorting.

[49] Imlah, *Pax Britannica*, p. 90. It should also be observed that, whereas Schlote splices the quantity indices using a single overlapping year, Imlah splices the quantity indices using two overlapping years, to reduce the error propagated in the splicing process. The base years for Imlah's intervals are 1880 (1865-88) and 1892 (1887-1901).

Figure 1.2. *Britain's terms of trade, 1870-1900*



Sources: Imlah, *Pax Britannica*, pp. 96-7; calculated from Schlote, *Overseas trade*, pp. 176-7.
Notes: Both terms of trade series have been recalibrated to a reference year of 1870.

in 1902, which render it unsuitable to function as the base year for the 1881-1902 interval in the Schlote series.[50] All in all, it is reasonable to conclude that the Imlah series represents a modest improvement over the Schlote series. Both series, recalibrated to a reference year of 1870, are depicted in Figure 1.2. For ease of reference throughout this dissertation, Imlah's export volume and price indices are reproduced, along with the current values of British exports, in Appendix 1.1.

The main turning points are similar in both the Schlote and Imlah terms of trade series: a peak in 1873 and a trough in 1881. The terms of trade follow a noticeably pro-cyclical course in the 1870s, and this pattern can be explained by the concentration of (relatively income-elastic) manufactured commodities in Britain's exports. The global upswing of the early 1870s and global depression beginning in 1873 are borne out in Britain's terms of trade. Between 1870 and 1873, the export price of pig iron increased by 111 per cent, railway iron by 56 per cent, and coal by 116 per cent. By comparison, the import price of wheat, assumed to be less elastic to income, only increased by 24 per cent. Beginning in 1873, the global depression and

[50] Ibid., pp. 200-1.

slowdown in railway construction—New Zealand bucked the trend—set off a decline in Britain's terms of trade that persisted until 1881.[51]

After 1881, Britain realized a mostly consistent improvement in its terms of trade until 1900, which is, coincidentally, the ending point of this study. From 1881-1900, the Schlote series increases by 29 per cent, the Imlah series by 24 per cent. This two-decade improvement in Britain's net barter terms of trade was a signature feature of the late-Victorian economy. Meier put forward what might be considered the generally accepted explanation for this occurrence, which was later subscribed to by such scholars as O'Rourke and Williamson.[52] He argued that, beginning in the 1880s, the development of a transport infrastructure in the periphery, largely the outcome of Britain's immense export of capital, contributed to a sharper decline in the import price index than in the export price index.[53] It should be remembered that the prices of almost all commodities, imports and exports, were declining during the Great Depression.[54] Additionally, Meier identified the fall in ocean freight rates as another factor contributing to Britain's improving terms of trade. With respect to the fall in ocean freight rates, Meier's argument speaks to the distinction between the f.o.b. (free on board) valuation of exports and the c.i.f. (cost, insurance, and freight) valuation of imports used in the construction of both the Schlote and Imlah terms of trade series.[55] Simply on account of falling ocean freight rates, Britain could have realized an improvement in its terms of trade, as measured.

The economic historian should be cautious not to attach too great a significance to the effect of falling ocean freight rates on the terms of trade of late-Victorian Britain. Certainly, nominal and real ocean freight rates were generally declining from 1881-1900, but they were also declining before and after these decades, during periods of deterioration in Britain's terms of trade.[56] Moreover, Shah Mohammed and Williamson's nominal freight index for the important trans-Atlantic grain trade, which accounted for 9 per cent of Britain's imports by value in 1881, is stationary

[51] The history of railway construction in New Zealand will be covered in ch. III. Here, it might be speculated, in passing, how much New Zealand gained from expanding its railway network in the mid and late 1870s, when capital goods were cheap.

[52] O'Rourke and Williamson, *Globalization and history*, pp. 88-9.

[53] Meier, 'Long period determinants', p. 121.

[54] After the Great Depression, from 1896-1900, British export prices increased faster than imports prices; see Imlah, *Pax Britannica*, p. 97.

[55] Meier, 'Long period determinants', p. 115.

[56] Shah Mohammed and Williamson, 'Freight rates', p. 188.

during the period from 1881-1900.[57] This finding is consistent with Harley's data on wheat prices, which reveal no convergence between the Chicago and British prices of grain between 1880/4 and 1895/9.[58] In short, the 1880s and 1890s were two decades on a continuum of generally, though not universally, declining ocean freight rates, and a more compelling explanation for Britain's improving terms of trade must be sought elsewhere.

Meier did offer another explanation. He claimed that labour deepening in the periphery, i.e. migration to there, raised the supply of primary-sector commodities, which were subject to inelastic demand.[59] In contrast, Britain's secondary-sector exports enjoyed a more elastic demand. Historical price data does not contradict this explanation. In 1900, the British export price index was at 96 per cent of its 1881 level.[60] In that same year, the Chicago price of wheat, which is net of trans-Atlantic shipping costs, had declined all the way to 69 per cent of its 1881 level.[61] Similarly, the American export price of cotton, also net of trans-Atlantic shipping costs, was at 68 per cent of its 1881 level.[62]

Musson mostly reiterated Meier's explanations for the improvement in late-Victorian Britain's terms of trade, though he did name one additional contributing factor, and that was the buoyant price of Britain's only notable (domestically produced) primary-sector export: coal.[63] Coal was basically immune from the declining prices of the late nineteenth century. During the 1880s and 1890s, there was a growing demand for coal in industrial Europe. Italian industry became extremely dependent upon coal imported from Britain; and for this reason, there was a great improvement in Britain's bilateral terms of trade with Italy during the closing decades of the nineteenth century.[64] It can be argued that coal was one of the few British industries that benefitted *directly* from overseas industrialization, the other being the machinery industry. In the 1880s and 1890s, increased demand for coal

[57] Ibid., pp. 182-3. The null hypothesis of a unit root is rejected at the 5% level. The figure of 9% includes imports from Canada and the United States of wheat, maize, wheat meal, and flour.

[58] Harley, 'World wheat trade', p. 221

[59] Meier, 'Long period determinants', p. 122.

[60] Calculated from Imlah, *Pax Britannica*, p. 97.

[61] Calculated from Harley, 'World wheat trade', pp. 246-7.

[62] Calculated from *Foreign commerce and navigation of the United States* (1900), p. 178.

[63] Musson, 'Great Depression', p. 218.

[64] Glazier, Bandera, and Berner, 'Terms of trade', p. 18.

acted to prevent a fall in its price. Another trend that helped to maintain the price of coal was the declining productivity of Britain's collieries.[65] A number of explanations have been advanced for this trend, which began in the 1880s. One of the more plausible explanations is that the most accessible coal faces had already been worked by this period, with the consequence that both the miners and their output had to travel a greater distance underground.[66] It should be observed that, in relatively labour-scarce late-Victorian Britain, the higher costs of coal production were not met with a reduction in wages. Even the nominal wages of coal miners rose in the late nineteenth century.[67] To an extent, the higher costs of production were passed on to consumers in the form of higher prices.

Export markets

Scarcely a corner of the world was untouched by British exports during the first era of globalization. The vast number of Britain's export markets makes difficult the task of abstracting the essential changes in the geographical distribution of British exports. Nevertheless, I have endeavoured to do so, and the results of this effort are presented in Table 1.1. This table presents the decennial shares of categories of countries (colonies) in the composition of Britain's domestically produced exports, i.e. excluding Britain's entrepôt trade.[68] Britain's larger export markets, defined as those countries which took at least 1 per cent of exports in at least one of the decennial years, are enumerated individually. All other countries are included in the classification of 'other' within the appropriate category.

While there is no inherently correct way to categorize Britain's exports markets, I have done so in a manner that is broadly consistent with the literature on international trade in the late nineteenth century. Following the division in the British trade statistics, I have categorized the markets as either non-Empire or Empire. I

[65] Taylor 'Coal industry', p. 46, reported that output per man-year of miners employed below and above ground declined from 319 tonnes in 1879-83 to 289 tonnes in 1899-1903. Church, *British coal industry*, p. 480, estimated that the inter-cycle growth in TFP for the British coal industry was 0.2% (in total) from 1874/80-1881/90 and -16.4% (in total) from 1881/90-1891/1900. Broadly, these figures accord with Feinstein, Matthews, and Odling-Smee, 'Timing of the climacteric', p. 178, who reported low and sometimes negative intra-cycle TFP growth rates for the mining and quarrying sector in the late-Victorian era.

[66] Mitchell, *Economic development*, p. 322.

[67] Church, *British coal industry*, p. 561.

[68] The share of re-exports in the combined total of re-exports and domestic exports was as follows: 18% (1870), 22% (1880), 20% (1890), and 18% (1900).

Table 1.1. *Britain's export markets, 1870-1900*

	1870	1880	1890	1900
Non-Empire				
Industrial Europe				
Belgium	2.2	2.6	2.9	3.7
France	5.8	7.0	6.3	6.9
Germany	10.2	7.6	7.3	9.6
Holland	5.6	4.1	3.8	3.8
Industrial Europe total	*23.9*	*21.3*	*20.3*	*23.9*
European periphery				
Denmark	1.0	0.9	1.0	1.5
Italy	2.6	2.4	2.9	3.0
Norway	0.5	0.6	0.7	1.1
Russia	3.5	3.6	2.2	3.8
Spain	1.3	1.4	1.9	1.9
Sweden	0.5	0.9	1.2	1.9
Turkey (European)	2.8	1.8	1.3	0.8
Other	2.3	2.1	2.2	2.2
European periphery total	*14.5*	*13.6*	*13.4*	*16.1*
Industrializing non-Europe				
Japan	0.8	1.5	1.5	3.4
United States	14.2	13.8	12.2	6.8
Industrializing non-Europe total	*15.0*	*15.3*	*13.7*	*10.2*
Non-European periphery				
Argentine Republic	1.2	1.1	3.2	2.5
Brazil	2.7	3.0	2.8	2.0
Chile	1.3	0.9	1.2	1.1
China	3.1	2.3	2.5	1.9
Egypt	4.4	1.4	1.3	2.1
Spanish West Indies	1.3	0.7	0.7	0.4
Turkey (Asiatic)	1.1	1.3	1.2	1.0
United States of Colombia	1.1	0.5	0.4	0.1
Other	4.6	5.0	5.9	6.3
Non-European periphery total	*20.6*	*16.0*	*19.3*	*17.3*
Non-Empire total	*74.0*	*66.2*	*66.8*	*67.6*
Empire				
Dominions				
Australia	4.2	6.3	7.5	7.4
Canada and Newfoundland	3.4	3.5	2.7	2.8
Cape Colony and Natal	0.9	3.0	3.5	4.4
New Zealand	0.8	1.3	1.3	1.9
Dominions total	*9.3*	*14.0*	*14.9*	*16.5*
Low-income Empire				
India and Ceylon	10.1	14.1	13.1	11.0
Hong Kong	1.7	1.7	1.0	0.9
British West Indies	1.2	1.0	1.0	0.6
Straits Settlements	1.2	1.0	1.1	1.1
Other	2.4	2.0	2.1	2.3
Low-income Empire total	*16.7*	*19.7*	*18.2*	*15.9*
Empire total	*26.0*	*33.7*	*33.2*	*32.4*

Source: Calculated from *Annual statements of the trade of the United Kingdom*.
Notes: All values are expressed in %. In 1870 only, Egypt includes exports to India routed through the Suez Canal.

have further divided the non-Empire markets into four categories: industrial Europe, European periphery, industrializing non-Europe, and non-European periphery. I have divided the Empire markets into two categories: Dominions and low-income Empire.[69] In the process of categorizing countries, ambiguities often arose. For example, should Italy be assigned to industrial Europe or to the European periphery? In view of these ambiguities, not too great an emphasis should be placed upon the export shares of each category, and only the most pronounced trends should be taken as indicative.

There are three additional reasons why Table 1.1 should be approached with caution. First, at any point in time, Britain's export markets were in differing phases of the business cycle.[70] For this reason, a cross-country comparison of export shares in any single year is somewhat distorted. Second, the territorial changes of the late nineteenth century are internalized in the export shares. One major territorial change was the German annexation of Alsace-Lorraine between 1870 and 1880. Third, before 1904, the British trade statistics reported export values according to the 'country of destination', or the country to which the merchandise was shipped, not the 'country of consignment', or the country in which the merchandise was ultimately consumed.[71] Hence, landlocked countries, such as Switzerland, are absent from the late nineteenth-century British trade statistics. Another important implication of this statistical convention is that the export shares of those countries with large entrepôt trades are overstated. This issue is very apparent in the export shares of the Cape Colony and Natal, through which British exports to the Orange Free State and the Transvaal were routed. In 1904, the *Annual Statement of the Trade of the United Kingdom* reported export values according to both country of destination and country of consignment. In this year, destination exports to the Cape Colony and Natal exceeded consignment exports to there by £2.5 million. A smaller discrepancy of £1.2 million between destination and consignment exports to Belgium

[69] In the late-Victorian context, the use of the term Dominion is anachronistic for all but Canada, which adopted the title of Dominion upon Confederation in 1867. Australia, New Zealand, and South Africa did not acquire Dominion status until the first decade of the twentieth century. Still, these colonies were uniformly marked by higher incomes and, beginning in the mid-nineteenth century, responsible self-government.

[70] This point is especially relevant for the late nineteenth century, when international business cycles were highly desynchronized; see Bordo and Helbling, 'International business cycle', p. 212.

[71] Schlote, *Overseas trade*, pp. 6-7.

reveals that some of Britain's exports to Central Europe, mainly Switzerland, were routed through this country.

Despite these caveats, some observations about the geographical distribution of British exports can be made. Foremost, there was a remarkable degree of constancy in the share of exports going to industrial Europe.[72] The region of the world that posed the greatest competition to the British manufacturing sector also remained the core of its export markets. That there was no diminution of the export share of industrial Europe, even despite further industrialization there, is suggestive of the emergence of intra-industry trade in differentiated manufactures. Assuming increasing returns to scale, a single firm situated in Britain would satisfy total demand (British and Continental) for one variety of a manufactured commodity, whilst another firm situated on the Continent would satisfy total demand for another variety of that same commodity. The matter of intra-industry trade is taken up more fully in chapter IV. Suffice it now to state that Continental industrialization did not spell the demise of this regional market—far from it.

Nevertheless, the constant export share of industrial Europe did conceal an important shift in the commodity composition of Britain's exports across the Channel, and that was the falling share of manufactures and the rising share of coal. France, much more so than Germany, came to rely upon imported British coal.[73] Between 1870 and 1900, the share of coal in the value of bilateral British exports to France increased from less than one-twelfth to more than one-third.[74] France's endowment of coal was poor relative to the needs of its industries and railways, but it was not entirely alone in this respect. Nascent industrializers in the European periphery were also constrained by deposits of coal that were either insufficient or simply unprofitable to extract. Italy represents the proverbial case of a country wholly dependent upon imported coal. The share of coal in the value of bilateral British exports to Italy was at 49 per cent in 1900. Still, other countries in the

[72] To be sure, I am not the first economic historian to make such an observation; see Saul, 'Export economy', p. 6.

[73] Clapham, *France and Germany*, p. 234.

[74] The rising share of coal in bilateral British exports to France far exceeded what would have been explained by the appreciation in the price of coal relative to the price of British manufactured exports. Assuming that the export price of coal was the same in 1900 as in 1870, the share of coal in bilateral British exports to France would still have risen greatly: from 8% to 21%.

European periphery, especially the Scandinavian countries, were also quite dependent upon imported British coal.

The export shares of most of the countries of the European periphery increased during the late nineteenth century, and not always on account of the coal trade. Between 1870 and 1900, the export share of the Scandinavian countries increased from 2.0 to 4.5 per cent. The share of British non-coal exports going to the Scandinavian countries still increased, though from 1.8 to 3.1 per cent. Indeed, Scandinavia is a fascinating case to consider, and one which offers some insights about British exports to the European periphery more generally.

The rising share of British exports going to the Scandinavian countries should not be misinterpreted as a strengthening of Britain's competitive position in this region. After 1880, Scandinavia consistently imported more from Germany than from Britain, and Germany's lead began to widen in the late 1890s.[75] Scandinavia was falling ever more under the commercial influence of Germany. Some traditional explanations for the rising competitiveness of Germany, in Scandinavia and elsewhere, were the greater adaptiveness of German manufacturing firms to consumer demand and the greater effort applied toward developing channels of distribution.[76] Hoffman noted that, in Norway, there was 'a swarm of persevering German commercial travellers, speaking a fluent Norwegian and not infrequently offering more skilful imitations of the more salable English wares'.[77] Nevertheless, the within-sector specializations of British and German manufacturing were borne out in the Norwegian market, even if Germany was making inroads in some traditionally British industries. In 1890, Norway imported three times as many cotton manufactures, by value, from Britain as from Germany.[78] Yet, with respect to silk manufactures, imports from Germany exceeded imports from Britain by a factor of ten.[79] The reasons behind this difference are addressed in chapter IV.

The rising share of British exports going to Scandinavia is attributable, quite simply, to the economic growth of this region. As in other parts of the European

---

[75] Hoffman, *German trade rivalry*, p. 128.

[76] The classic articulation of this argument is in Aldcroft, 'The entrepreneur', pp. 123-7. Although, this argument did not go unchallenged; see Nicholas, 'Overseas marketing performance'. The adaptiveness of German cotton textile industry to foreign consumer demand is discussed in Brown, 'Cotton textiles', pp. 512-13.

[77] Hoffman, *German trade rivalry*, p. 127.

[78] *Tabeller Norges handel i aaret 1890*, p. 63.

[79] Ibid.

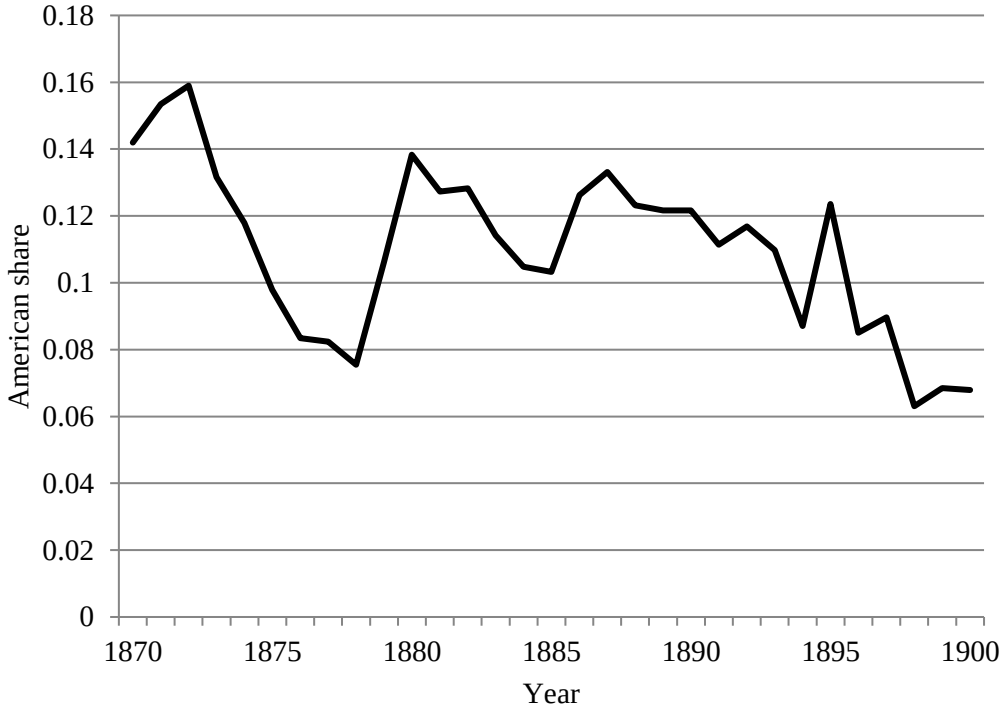
periphery, real wages in Scandinavia were converging upon those of industrial Europe. [80] Scandinavia was becoming wealthier indeed. As Williamson has estimated, the Norwegian real wage rose from 41 to 65 per cent of the British real wage between 1870 and 1900.[81] An even more impressive rate of convergence was realized by Denmark and Sweden, where unskilled real wages were not much less than those in Britain by the end of the century.[82] The development of manufacturing, particularly forward industrial linkages from the primary sector, raised incomes and, consequently, the demand for British consumption goods exports. One such forward industrial linkage was the Norwegian fish-canning industry, which really only came into existence in the 1880s, but quickly tapped into the large foreign demand for this commodity. [83] In Denmark, mechanization in the production of butter had a measurable effect on national income in the closing decades of the nineteenth century.[84]

Of all export markets, the share of British exports going to the United States underwent the greatest change throughout the late-Victorian era, declining from 14 to 7 per cent. Figure 1.3 depicts the annual American share of British exports. It should be emphasized that the export share of the United States was quite variable.[85] In the United States, the Depression of 1873-9 was bracketed by railway booms, during which the American share of British exports swelled, owing to demand for British iron and, in the boom of the early 1880s, steel. In the quarter century from the Civil War until the 1890s, the United States imported substantial quantities of iron and steel from Britain during periods of peak demand, when domestic capacity was strained to its utmost, and when the British price *plus* the cost of shipment *plus* the duty imposed was still beneath the domestic American price.[86]

By 1898, the American share of British exports fell to the very low level of 6 per cent, and not because of the American business cycle. Two forces in the 1890s conspired to reduce, on a more permanent basis, the share of British exports going to the United States. First, American protection of manufacturing intensified, and the bilateral American tariff toward Britain peaked in 1893/4. The tariff revisions of the

[80] Spain was a notable exception; see Williamson, 'Global labor markets', pp. 154-5.
[81] Ibid.
[82] Ibid.
[83] Hodne, *Economic history of Norway*, pp. 89-90.
[84] Henriksen, Lampe, and Sharp, 'Danish creameries', p. 490.
[85] Saul, 'Export economy', p. 6.
[86] Saul, *British overseas trade*, pp. 141-2.

Figure 1.3. *American share of British exports, 1870-1900*



Source: Calculated from *Annual statements of the trade of the United Kingdom*.

1890s hit the British alkali, woollen, and tinplate industries particularly hard. Discussion of these matters is reserved for chapter II. The second force that reduced the American share of British exports was the Anglo-American relative price of iron ore shifting further in favour of the United States.[87] Not only did this shift strengthen the competitive position of the American iron and steel industries in the domestic market, it was also responsible for the emergence of the United States as a major exporter of iron, steel, and manufactures thereof, as Irwin has argued.[88] Thus, the United States came to compete more strenuously against Britain in third markets, notably Canada.[89]

The decline in the American export share was almost exactly offset by the growth in the Dominion share. In effect, the market share was transferred from one high-income area of recent settlement to a collection of other high-income areas of recent settlement. The Dominions were characterized by much extensive growth in

[87] Allen, 'Iron and steel', p. 928-9; Irwin, 'America's surge', p. 369.

[88] Irwin, 'America's surge', p. 372.

[89] In 1896, the last year before Canada extended preference to imports from Britain, the value of Canadian imports of iron, steel, and manufactures thereof from the United States was more than double the value of these imports from Britain; see *Statistical year-book of Canada for 1896*, p. 174.

the late-Victorian era. An increasing and wealthy population of consumers loyal, though not unfalteringly loyal, to British manufactures was a boon to the British export sector. In 1900, the value of British exports to Australia, on the eve of its Federation, had already surpassed the value of British exports to the United States. Yet, the population of Australia was less than one-twentieth in size.[90] The contribution of consumption patterns to the high demand for British exports in the Dominions is a point that is revisited throughout this dissertation.

Canada, however, was the exception. Here, distance worked to the disadvantage of the British manufacturer and to the advantage of the American manufacturer. Moreover, with respect to trade policy, Canada was moving ideologically closer to the United States. Canadian protection was increased in 1879 and 1887, and these reforms were effective in stimulating domestic production. Inwood and Keay estimated that Canadian production of pig iron in the 1890s would have been 70 per cent lower if the tariff was removed.[91] On the whole, Canada was more protectionist than the other Dominions. In 1890, the Canadian average *ad valorem* equivalent tariff was 22 per cent.[92] Lloyd estimated that, in the same year, the trade-weighted average *ad valorem* equivalent tariff of pre-Federation Australia was 8 per cent.[93] Although the average *ad valorem* equivalent tariffs of Canada and Australia should not be regarded as the level of protection that the British export sector encountered in each of these markets, the large disparity is nevertheless suggestive that British exports were excluded more from the Canadian market than from the Australian.[94]

---

[90] Calculated from Maddison, *World economy*, p. 82.

[91] Inwood and Keay, 'Industrial development', p. 1289.

[92] Beaulieu and Cherniwchan, 'Canadian protectionism', p. 157. The actual level of protection was higher, as the trade restrictiveness index was 30% in 1890, according to their estimate.

[93] Lloyd, 'Tariffs in Australia'. Curiously, the relative positions of Canada and Australia, with respect to tariff policy, would reverse in the interwar era, with Australia emerging as the more protectionist country; see Pomfret, 'Trade policy', pp. 115-20.

[94] There is evidence that the bilateral Canadian tariff toward Britain greatly exceeded the bilateral Australian tariff toward Britain. In 1903, the Board of Trade estimated the bilateral tariffs of 11 countries toward Britain for the year 1902. In 1905, the Board of Trade expanded these estimates to include the bilateral tariffs of 15 additional countries (colonies), including Canada and Australia, again for the year 1902. The estimated bilateral Canadian tariff toward Britain was 17%, while the estimated bilateral Australian tariff toward Britain was only 6%. *British and foreign trade and industry (second series)*, p. 292. The Board of Trade's method for estimating the bilateral tariffs is described at length in the next chapter.

As Canada introduced preferences for imports from Britain in 1897, these preferences are reflected in the estimated bilateral Canadian tariff toward Britain for 1902. In 1902,

Finally, no overview of the geographic destinations of late-Victorian British exports would be complete without reference to India, which was the largest market for British exports at the close of the nineteenth century. In certain respects, the Indian market was a microcosm of the world market for British exports. The Indian market posed a large demand for British cotton textiles, albeit the cheaper grades.[95] As Saul observed, the share of cotton textiles in the value of bilateral British exports to India was rarely less than half in the late-Victorian era.[96] And during episodes of railway construction, India purchased its capital goods mainly from the 'workshop of the world'.[97] In the late nineteenth century, India was a slowly expanding economy, but its extreme and continued reliance upon imported manufactured commodities meant that its share in the country-composition of British exports remained stable.

Exports and the climacteric debate

The climacteric debate was never well defined. The climacteric debate centred upon the vague proposition that, at *some* point in the late nineteenth century, for *some* reason, there was *perhaps* a structural break in the trend rate of growth of *some* macroeconomic series for Britain. Was the break in income or industrial output? Did it occur in the 1870s, 1880s, or 1890s?[98] Why did it occur? Was there a climacteric at all?[99] Given the many possible combinations, it may be more accurate to refer to the climacteric *debates*, but that too is problematic, as it still implies a directionality that was noticeably absent from the literature. Summarizing the climacteric debate (or debates) is an exercise in making order out of chaos. In the decades since Phelps Brown and Handfield-Jones proposed the notion of a British climacteric, countless scholars have weighed in on the debate to some extent or another. Here, only those contributions to the climacteric debate that pertain to exports are considered. In fact,

---

Australia had yet to introduce preferences for imports from Britain. Thus, prior to 1897, the disparity between the Canadian and Australian bilateral tariffs toward Britain was likely even greater.

[95] Although, as Broadberry and Gupta, 'Shifting competitive advantage', p. 300, have noted, the British share of the Indian market for cotton textiles began to decline in the 1870s, as the falling factor price of labour-saving machinery finally made mechanized production competitive in India.

[96] Saul, *British overseas trade*, p. 198.

[97] Ibid. Although, Belgium was making an incursion into the Indian market for iron and steel manufactures.

[98] Greasley, 'Paradox of the 1880s', offered the sole argument implicating the 1880s as the decade of the British climacteric.

[99] See Crafts, Leybourne, and Mills, 'The climacteric'.

in their foundational article published in 1952, Phelps-Brown and Handfield Jones were silent on the matter of exports; they mainly ascribed the British (income) climacteric of the 1890s to the declining rate of productivity growth that followed the full adoption of steam and steel in the British economy.[100] However, it would not be long before economic historians would associate the deceleration of the late-Victorian economy with the lethargic growth of British exports.[101]

Meyer, writing just three years after Phelps Brown and Handfield-Jones, argued that the growth in British industrial output was retarded by the slow growth in the volume of exports after 1872. For each of the major British industries, Meyer calculated hypothetical export volumes in the year 1907 by extrapolating forward the 1854-72 per-industry export volume growth rates. Substituting hypothetical for actual export volumes in a Leontief input-output table for the British economy in 1907, Meyer estimated a hypothetical level of industrial output in that year. The result of Meyer's counterfactual exercise is striking. If the mid-Victorian per-industry export volume growth rates were maintained until 1907, then the imputed hypothetical growth rate of British industrial output would have been 4.10 per cent per annum from 1872-1907, or well in excess of the realized 1.75 per cent per annum.[102]

There are a number of problems with Meyer's fanciful counterfactual. Even assuming perfectly elastic foreign demand, it remains uncertain how Britain could have sustained such a growth in output—through factor accumulation, total factor productivity (TFP) growth, or some combination thereof? Could gross output really have exceeded £1 billion in the British textile industry in 1907?[103] McCloskey would challenge Meyer on the basis of Britain's factor constraints, and this critique is addressed shortly. Still, despite its several outlandish assumptions, Meyer's article is nonetheless meaningful. Leaving the numbers aside, even a slightly faster-than-

[100] Phelps Brown and Handfield-Jones, 'Expanding economy', pp. 282-3.

[101] There were some earlier articles that examined the relationship between exports and output during the late-Victorian era. For example, Pesmazoglu, 'British cyclical fluctuations', p. 128, observed that the quarterly turning point in the export cycle tended to precede the quarterly turning point in the business cycle.

[102] Meyer, 'Input-output approach', p. 17.

[103] Meyer's hypothetical gross output of £1.1 billion in the British textile industry is not, *individually*, wholly unreasonable. In 1907, the share of net output in the gross output of the textile industries was 30%; calculated from *Final report of the first census of production of the United Kingdom, 1907*, p. 285. Thus, assuming a constant ratio of net output to gross output, the net output of the hypothetically large textile industry would have amounted to only 15% of actual GDP; calculated from Feinstein, *National income*, p. T10.

Table 1.2. *Britain's export volume growth rates, 1853-96*

Mid-Victorian trade cycles (peak-to-peak)	Growth rate (per cent per annum)	Late-Victorian trade cycles (peak-to-peak)	Growth rate (per cent per annum)
1853-7	4.5	1872-84	2.2
1857-60	4.0	1884-90	2.6
1860-72	4.0	1890-6	0.8
1853-72	*4.1*	*1872-96*	*2.0*

Source: Calculated from Imlah, *Pax Britannica*, pp. 96-7.
Notes: The trade cycles in this table are inferred from Imlah's annual export *volume* series. These trade cycles differ from the trade cycles reported in Rostow, *British economy*, p. 33, which were determined on the basis of quarterly export *value* data.

actual growth in the volume of late-Victorian exports could still have resulted in a faster-than-actual growth in industrial output. The question of whether industrial output could have increased by 4.10 per cent per annum is unimportant (the answer is almost certainly no). The more important question is whether industrial output could have increased at a rate greater than 1.75 per cent per annum, or at least sufficiently greater to dispel the claim of a climacteric in late-Victorian industry.

In fact, Coppock pointed to a climacteric in British industrial output occurring in the 1870s, and he implicated slow export volume growth as the main cause. It is undisputable that, after 1872, the export volume growth rate was substantially less than it had been. Table 1.2 lays out the average annual intra-cycle export volume growth rates, as well as the growth rates for the broader mid-Victorian and late-Victorian intervals. According to Coppock, slow export growth retarded industrial output growth via the channel of capital accumulation. He argued that there was an exogenous deceleration in the growth of Britain's export markets and that this deceleration was attended by a lower rate of capital accumulation in manufacturing.[104] As each addition to the manufacturing capital stock embodied the newest technology, the slow growth of Britain's manufacturing capital stock caused its average technological vintage to fall behind those of other industrial countries,

[104] Coppock, 'Climacteric of the 1890's', pp. 27-8. It is worth calling attention to the subtle difference between industrial output and manufacturing output. Coppock distinguished industrial output from manufacturing output, noting that the production of coal was included in the former but not the latter. He claimed that his argument applied to both industry and manufacturing; see pp. 12-13. It should also be commented that Coppock's article provoked a lively debate with Musson in the *Manchester School* and *Economic History Review*: Musson, 'Great Depression'; Coppock, 'The causes'; Musson, 'Some comments'; Coppock, 'A pessimist's view'; Musson, 'A balanced view'.

where the rate of capital accumulation in manufacturing was higher.[105] Thus, the climacteric in industrial output came as a consequence of the slow growth of capital, which functioned as both a factor input and a vehicle for TFP growth. The growth of industrial output was reduced on both accounts beginning in the 1870s, or so it has been traditionally thought.[106]

Coppock acknowledged that the slow export volume growth rate in the late-Victorian era was not wholly exogenous: 'Exports react on productivity and productivity reacts on exports to explain a generalised climacteric of the 1870's'.[107] Still, at least in part, the export volume was determined exogenously. As evidence for the exogeneity of the slow export volume growth rate, Coppock cited the high levels of foreign protection that Britain confronted in the late nineteenth century.[108] Indeed, one of the opportunities of this dissertation is to establish whether the British export volume was determined exogenously by foreign tariffs.

Coppock's theory that an export-induced break in TFP growth contributed to a climacteric in industrial output in the 1870s is not corroborated by the more recent estimates of TFP growth in British manufacturing put forward by Matthews et al. TFP in British manufacturing increased at an average rate of 0.9 per cent per annum during both the mid-Victorian (1856-73) and late-Victorian (1873-99) intervals.[109] TFP growth in British manufacturing had been slow since the 1850s; it was not a new phenomenon in the 1870s. After 1899, however, TFP growth in British manufacturing fell to an average rate of 0.3 per cent per annum, or essentially nil,

---

[105] Ibid., p. 30. A comparison of manufacturing capital accumulation in Britain and the United States is revealing. In Britain, the manufacturing capital input increased at an average rate of 3.4% p.a. from 1873-82, as noted in Feinstein et al., 'Timing of the climacteric', p. 178. In the United States, the manufacturing capital input increased at an average rate of 5.6% p.a. from 1869-79, as calculated from Kendrick, *Productivity trends*, p. 464. Furthermore, in the 1880s, the rate of manufacturing capital accumulation slowed in Britain, but accelerated in the United States.

[106] The dual functions of capital accumulation were eloquently restated, with respect to late-Victorian Britain, by Lewis, *Growth and fluctuations*, p. 116:

> For our purposes it suffices to note that in so far as each generation of machines is more productive than its predecessor, a country with a high investment ratio will, other things being equal, have higher productivity than a country with a low investment ratio, because a greater proportion of its machines will be of the latest designs. So what we are saying is that British productivity was diminished not merely by the small amount of capital, but also by the extent to which its capital was out of date; and both these resulted from the low investment ratio.

[107] Coppock, 'Climacteric of the 1890's', p. 31.

[108] Ibid.

[109] Matthews, Feinstein, and Odling-Smee, *British economic growth*, p. 607.

from 1899-1913.[110] It would be tempting, then, to apply Coppock's theory—slow export growth, retarding capital accumulation, retarding TFP growth, retarding industrial output—to the Edwardian era. However, Britain's export volume growth rate actually increased during this period. The collapse of TFP growth in British manufacturing, alongside an acceleration of export volume growth, was a sort of paradox of the Edwardian British economy. It represents an important reason why the course of Edwardian exports should be considered separately from the course of late-Victorian exports.

McCloskey's landmark article, 'Did [late] Victorian Britain fail?', was primarily a response to Meyer. McCloskey claimed that the slow growth of late-Victorian industrial output was not the consequence of sluggish growth in foreign demand for British exports, but rather an inevitable outcome of highly inelastic domestic supplies of capital and labour.[111] Moreover, McCloskey claimed that (economy-wide) TFP growth in Britain was essentially the same as TFP growth in the United States.[112] Hence, relative productivity was blameless.[113] Quite simply, supply constraints were the explanation for Britain's slow growth. Precisely how inelastic was the domestic supply of capital was the subject of a later debate.[114] All in all, on whether Britain suffered from export-retarded growth, McCloskey's conclusion was clear: 'It is implausible, then, to draw the lines of causation in late Victorian England from export demand to the output of the economy'.[115]

Feinstein rendered the final words on the existence of export-retarded growth in late-Victorian Britain, and they were very much in opposition to McCloskey. Feinstein deconstructed the export-retarded growth hypothesis into four main propositions:

> 1) that the changes which initiated this deceleration in export growth rates had their origin in the process of foreign industrialization, and were essentially

[110] Ibid.
[111] McCloskey, 'Victorian Britain', p. 455.
[112] Ibid., p. 458.
[113] Aldcroft, 'Victorian growth', challenged McCloskey's exoneration of a productivity-based explanation for the slow growth of late-Victorian Britain. See also McCloskey, 'Victorian growth'.
[114] See Crafts, 'Victorian Britain'; McCloskey, 'Reply to Crafts'.
[115] McCloskey, 'Victorian Britain', p. 459.

> independent of developments within Britain (or, to use an economists' term, the causes of deceleration were exogenous);
>
> 2) that the dominant effect of this extension of industrialization to other countries was increased competition for Britain, and a resultant loss of markets;
>
> 3) that, if this had not occurred, it would have been possible to expand output to meet a hypothetically higher level of overseas demand without a corresponding reduction in production for the home market;
>
> 4) that a consequence of the slower growth of exports was a deterioration in Britain's performance in relation not only to output but also to productivity.[116]

Feinstein affirmed the first proposition and, like Coppock, pointed to the myriad instances of foreign protective tariffs as evidence of exogeneity.[117] Feinstein also affirmed the second proposition that the dominant effect of foreign industrialization was increased competition. This proposition invoked the framework of complementary and competitive effects of foreign industrialization that was originally articulated by Sayers.[118] The complementary effect was that, as foreign countries industrialized, rising income raised demand for British exports. The competitive effect was that these countries began to produce commodities that had been supplied by Britain previously. Feinstein argued that the competitive effect was dominant, and he took the declining share of British exports going to industrial countries as *prima facie* evidence in support of the second proposition.[119] However, as already discussed, but worth reiterating here, the declining share of British exports going to industrial countries is almost wholly explained by the American market, before 1900.

In affirming the third proposition, Feinstein was rebutting McCloskey. While McCloskey argued that the labour stock *or* the capital stock *or* TFP would have needed to grow at an unattainably fast rate in order to sustain the mid-Victorian growth of industrial output through 1907, Feinstein argued that moderately higher-than-actual growth rates of the labour stock *and* the capital stock *and* TFP, collectively, would have produced a late-Victorian industrial output growth rate not

[116] Feinstein, 'Exports and economic growth', pp. 80-1.
[117] Ibid., pp. 87-8.
[118] Sayers, *The vicissitudes*.
[119] Feinstein, 'Exports and economic growth', pp. 88-90.

much less than the 3.7 per cent per annum achieved during the mid-Victorian era.[120] Feinstein was not too specific on how the growth rates of factor inputs would have been higher; he stated that there was some additional scope for reduction in unemployment and in consumption.[121]

Was Feinstein right to affirm the proposition that output could have been expanded to meet foreign demand, had foreign demand been greater? This proposition is the crux of the export-retarded growth hypothesis. Here, there is a lingering uncertainty which this dissertation can work toward resolving. Chapter II reveals that the *ad valorem* equivalent bilateral American tariff toward Britain fell from 45 per cent in 1893/4 to 31 per cent in 1894/5, following the enactment of the Wilson-Gorman Tariff. This was a tremendous decline in the bilateral tariff that Britain encountered in one of its largest export markets. If British exports responded elastically to this reduction in the bilateral tariff, then it is reasonable to infer that the supply constraints of labour and capital were not so binding, or that manufacturing capacity was substantially underutilized. American imports from Britain did increase between these years, from $107.4 million in 1893/4 to $159.1 in 1894/5. The difference, $51.7 million or £10.6 million, amounted to nearly 5 per cent of British exports to all markets in 1895.[122] If Britain was, as McCloskey wrote, 'growing as rapidly as permitted by the growth of its resources', then how were exports so responsive to a sudden increase in demand?[123]

Three years later, when the Dingley Tariff raised the bilateral American tariff toward Britain from 23 per cent in 1896/7 to 36 per cent in 1897/8, the value of American imports from Britain declined from $167.9 million to $108.9 million. As McCloskey claimed that Britain was supply constrained, should it then be assumed that Britain simply redirected the lost exports to different markets? The answer is probably not. Even moving beyond the partial equilibrium of bilateral trade would likely not vindicate McCloskey's rejection of the export-retarded growth hypothesis. Here, an illustrative example would be the Dingley Tariff of 1897, which raised the duty on soda ash, the principal variety of alkali, from 0.25¢ to 0.375¢ per pound. Between 1897 and 1898, British exports of alkali to the United States declined by

[120] Ibid., pp. 86-7.
[121] Ibid., p. 86.
[122] Calculated using the exchange rate reported in Mitchell, *British historical statistics*, p. 702.
[123] McCloskey, 'Victorian Britain', p. 459.

108 million pounds (from 193 million to 85 million). British exports of alkali to all markets declined by a similar amount: 120 million pounds (from 497 million to 377 million).

Altogether, there was not a surfeit of foreign demand for British exports. As export markets were closed off by protective tariffs, aggregate demand for British exports was reduced, *ceteris paribus*. Indeed, the volume of British exports was determined exogenously by foreign tariffs. Chapter II finds that tariffs were the sole inter-temporal determinant of Anglo-American bilateral 'trade costs'. While this finding represents a major contribution to another strand of literature, its implications certainly extend to the export-retarded growth hypothesis and to the climacteric debate more generally. This dissertation helps to rehabilitate demand-side interpretations of late-Victorian growth.

Feinstein was hesitant to affirm the fourth proposition that the slower growth of exports engendered slower growth of output and productivity. His main concern was productivity. Feinstein pointed to the purely domestic reasons for the slow productivity growth in certain export industries, such as the textile industry, which was early to mechanize, and thus presented little scope for further TFP growth after the 1860s. [124] Feinstein concluded his analysis of the export-retarded growth hypothesis by calling for further research into the relationship between exports and productivity growth in individual industries.

Before concluding my discussion of the climacteric debate, it is important that I stress that this dissertation does not hazard any formal argument about the relationship between exports and growth, either of industrial output or of income, in late-Victorian Britain. The connection between exports and growth is a tenuous one. Any research into this connection would require consultation of a large and separate literature. Still, it should be recognized that the proximate determinants of the volume of British exports were, more than likely, ultimate determinants of British economic growth. The effects of foreign tariffs, covered in chapter II, and British overseas lending, covered in chapter III, were farther reaching than just British exports alone.

Without delving into the effect of exports on growth, it may briefly be noted that the income of nineteenth-century Britain was very dependent upon trade. Clark

[124] Feinstein, 'Exports and economic growth', p. 93.

et al. recently claimed that, if Britain became autarkic in 1850, welfare would have been 25 to 30 per cent lower.[125] The increasing cost of autarky throughout the early nineteenth century was mostly due to the changing relative factor endowments of Britain; it became increasingly capital-abundant relative to the rest of the world.[126] There is no reason to believe that Britain would have been less dependent upon trade in the late nineteenth century than in 1850. Insofar as foreign tariffs and overseas lending determined the volume of British trade, so too did they determine the income level.

The newer literature

The beginning of the 'newer literature' on British exports can be dated to Hatton's article, 'The demand for British exports, 1870-1913', published in 1990. This article was the first thoroughgoing econometric analysis of late nineteenth-century British exports. Hatton estimated a demand function for the annual volume of British exports. In the main specification of the export demand function, the coefficient of the explanatory variable for British overseas lending was statistically insignificant.[127] This finding, which undermined the Ford thesis, is the main motivation of the third chapter of this dissertation, and a more comprehensive discussion is deferred to then.

Nevertheless, Hatton drew several other conclusions from his demand function, based upon the other explanatory variables. He found that the greatest contribution to the growth in the volume of British exports was the growth in world trade.[128] The long-run elasticity of British exports to world trade was 0.83, or less than unit-elastic.[129] Another statistically significant determinant of the volume of British exports was the relative price of British exports, which Hatton calculated as the British export price index divided by a trade-weighted index of the export price indices of other industrial countries, specifically France, Germany, and the United States.[130] Yet, compared to the growth in world trade, the contribution of relative

[125] Clark, O'Rourke, and Taylor, 'Growing dependence', p. 111.
[126] Ibid., p. 126.
[127] Hatton, 'British exports', pp. 584-5.
[128] Ibid., p. 591.
[129] Ibid., p. 586.
[130] Ibid., p. 584.

prices—not to be confused with the terms of trade—to British export volume growth was minor, and virtually nil during the sub-interval from 1891/3-1911/3.[131]

Hatton's export demand function presents several shortcomings. First, as previously noted, there was no explanatory variable for foreign tariffs. Second, there was likely a lack of stationarity in a number of variables. Even after taking the natural logarithm of the volume of British exports, which Hatton did, the null hypothesis of a unit root cannot be rejected at any conventional level for this variable. The R^2 values of 0.99 in every specification of the demand function are symptomatic of econometrical problems.[132] Third, the central finding of the article that the growth of world trade was the principal determinant of the growth of British exports dodges a more meaningful identification of the determinants of British export volume growth. If British exports were less than unit-elastic to world exports, was this difference due to slower income growth in Britain's principal export markets, foreign tariffs that disproportionately discriminated against British exports, or perhaps the more limited scope for Britain to further integrate into world commodity markets after 1870?

Atlantic commodity market integration was the focus of O'Rourke and Williamson. They argued that declining transport costs produced an Anglo-American commodity-price convergence, with British manufacturing prices and American agricultural prices rising, and with British agricultural prices and American manufacturing prices falling, *ceteris paribus*, between 1870 and 1913.[133] Rising manufacturing prices in Britain prompted a shift of labour out of agriculture and into manufacturing, the sector in which labour was used more intensively. In short, O'Rourke and Williamson depicted an Atlantic economy specializing along H-O lines—the Old World in the manufacturing sector, the New World in the agricultural sector. Although, it should be observed that agricultural tariffs in the Old World and manufacturing tariffs in the New World militated against this process of specialization.[134]

---

[131] Ibid., p. 591.

[132] For example, the null hypothesis of a unit root cannot be rejected at any conventional level for the log of the volume of British exports (1871-1913), the dependent variable in the demand function.

[133] O'Rourke and Williamson, *Globalization and history*, pp. 43-53.

[134] Ibid., ch. 6.

O'Rourke and Williamson documented Britain's specialization at the sectoral level, i.e. in manufacturing. The H-O model can explain Britain's specialization in manufacturing, but can the H-O model explain Britain's specializations *within* manufacturing, or among industries? A crude attempt at answering this question was made by Crafts and Thomas. Chapter IV improves upon the work of Crafts and Thomas through the construction and use of superior data, specifically RCA indicators for individual British manufacturing industries.

These RCA indicators complement Broadberry's analysis of comparative *labour productivity* in British manufacturing industries, vis-à-vis the United States and Germany, prior to the First World War. The earliest year for which Broadberry was able to estimate the comparative labour productivity levels of individual industries was 1907, when output data first became available.[135] For the late nineteenth century, Broadberry's examination of individual industries was necessarily reliant upon an array of industry-specific secondary literature. Nevertheless, several patterns emerge, including that Britain tended to realize its highest levels of comparative labour productivity in those industries with a high factor utilization of human capital.[136] Chapter IV of this dissertation offers a systematic quantification of Britain's manufacturing comparative advantages. In this respect, the chapter can inform, albeit imperfectly, Broadberry's account of comparative labour productivity in late-Victorian British industries.

In the first decade of the twentieth century, there were several applications of the gravity model to nineteenth-century trade. The fundamental proposition of the gravity model is that the volume of (bidirectional) bilateral trade is positively associated with the economic size of the trading partners and inversely associated with the distance between them. Alongside the all-important variables for the economic size of the trading partners and the distance between them, gravity models can include additional explanatory variables for other potential determinants of bilateral trade. The gravity models of nineteenth-century trade offer rather limited insights about the determinants of the volume of bilateral British exports, for a couple of reasons. First, in all but one of these gravity models, the samples include mostly non-British country pairs. Second, because the unit of analysis in gravity models is bidirectional bilateral trade (or trade costs), it is not possible to identify the

[135] These estimates are reported in Broadberry, *Productivity race*, pp. 28-31.
[136] Broadberry, *Productivity race*, p. 158.

determinants of Britain's bilateral exports as separate from the determinants of bilateral imports; one of the assumptions of gravity models is a bilateral balance of trade.

Still, these gravity models provide a loose set of expectations about what economic factors might have determined the volume of bilateral British exports. As several of these models will be addressed later in the dissertation, the discussion here is limited to the most novel findings from each model. In their foundational article, Estevadeordal et al. found that distance, gold standard adherence, and tariffs were all statistically significant determinants of bilateral trade during the first era of globalization and the interwar era.[137] Focusing exclusively on the period from 1870-1910, López-Córdova and Meissner provided additional quantification of the effect on bilateral trade when both trading partners adhered to the gold standard or had entered into a monetary union. In the baseline specification of their model, gold standard adherence raised bilateral trade by 62 per cent, and entering into a monetary union more than doubled bilateral trade, even after controlling for empire.[138] These findings can offer some explanation for the trade-orientation of Britain, which had functioned as the centrepiece of the classical gold standard, and which had entered into a monetary union with many of its imperial possessions. Relying on a very large sample of annual observations, Mitchener and Weidenmier found that an imperial connection between trading partners roughly doubled bilateral trade.[139]

Using a trade-costs framework, Jacks et al. estimated gravity models for the first era of globalization. In one of their gravity models, the sample consisted of only those country pairs that included Britain. In some respects, the determinants of Britain's bilateral trade costs differed from the determinants of world bilateral trade costs.[140] Railway density and tariffs were statistically significant determinants of world bilateral trade costs, but not specifically Britain's bilateral trade costs.[141] The gravity model of Jacks et al. is explored in greater depth in the next chapter.

---

[137] Estevadoerdal, Frantz, and Taylor, 'Rise and fall', p. 374. Though, the actual contribution of tariff changes to the growth in the volume of world trade between 1870 and 1900 was nil; see p. 395.

[138] López-Córdova and Meissner, 'Exchange-rate regimes', p. 348.

[139] Mitchener and Weidenmier, 'Trade and empire', p. 1812.

[140] Their full sample included 48 country pairs, and each pair included either Britain, France, or the United States as a trading partner.

[141] Jacks et al., 'Trade costs', p. 135.

Britain's export of goods to the Dominions has received substantial attention from Magee and Thompson. They argued that the high levels of British exports to the Dominions were sustained by common consumption patterns and well-developed commercial and personal networks within the Empire.[142] Their analysis is laden with many commodity-specific examples, such as the penchant of Dominion consumers for specifically British-made decorative tiles.[143] The analysis by Magee and Thompson represents the microeconomic complement to the gravity literature. However, it falls short of providing any quantitative measure of the relative importance of consumption patterns and networks in explaining the high levels of British exports to the Dominions.

Periodization

The year 1870 offers a somewhat conventional starting point for this dissertation. If the periodization was determined along strictly monarchical lines, the dissertation might begin in 1869, the mid-point of Queen Victoria's reign. In that same year, the Suez Canal was opened, greatly facilitating trade between Britain and India.[144] The Franco-Prussian War of 1870-1 and the Financial Crisis of 1873 helped to render the early 1870s as a sort of watershed in the development of the world economy. Thus, the year 1870 is taken as the starting point for this dissertation.

In a departure from the textbook periodization of 1870-1913, the year 1900 is taken as the endpoint point for this dissertation. With respect to British exports, the late-Victorian and Edwardian eras were dissimilar. Whether these eras should be divided in precisely the year 1900 is of little importance. Rather, what is important is to acknowledge that the course and character of British exports entered a fundamentally different phase during the years surrounding the beginning of the twentieth century. What follows is an enumeration of the eight distinctive features—many are interrelated—of Edwardian British exports.

1. Britain's export volume growth rate registered an improvement during the Edwardian era. From 1896-1913, the export volume growth rate was 3.3 per cent per annum, compared to 2.0 per cent per annum from 1872-96.[145] While the Edwardian

[142] Magee and Thompson, *Empire and globalisation*, ch. 4.
[143] Ibid., p. 158.
[144] O'Rourke and Williamson, *Globalization and history*, pp. 33-4.
[145] Calculated from Imlah, *Pax Britannica*, pp. 97-8.

export sector did not quite contribute to an 'air of prosperity' in the British economy, it was during this era that an air of depression began to lift, and the higher export volume growth rate was one of the causes.[146]

2. As already mentioned in the context of the climacteric debate, there was a collapse of TFP growth in Edwardian manufacturing. The collapse was starkest between the 1889-99 and 1899-1907 business cycles, when the manufacturing TFP growth rate declined from 1.1 to 0.1 per cent per annum.[147] There was a slight improvement in the later Edwardian era, when the growth rate increased to 0.3 per cent per annum during 1907-13 business cycle.[148] Phelps Brown and Handfield-Jones interpreted the near cessation of TFP growth during the Edwardian era as arising from a lull between general purpose technologies, with the widespread adoption of electricity not being realized until the interwar era, at least in Britain.[149] The collapse of TFP growth in Edwardian manufacturing should have acted to retard Britain's export volume growth rate (and vice versa), just as Coppock claimed it did beginning in the 1870s.[150] Thus, the increase in the export volume growth rate was entirely in spite of productivity trends in the British manufacturing sector. Other economic factors must have more than compensated for the TFP collapse to cause an acceleration of the export volume growth rate.

3. One of the most evident changes in the geographical composition of late-Victorian British exports was the rising share going to the Dominions. During the Edwardian era, the large share of British exports going to the Dominions was maintained partly on account of policies of imperial preference, which were adopted in all four of the Dominions during the decade between 1897 and 1907. Canada was at the vanguard of this movement. In 1897, Canada enacted a preference for imports from Britain (only), taking the form of a one-eighth reduction of the customs duties collected on imports from the mother country.[151] This reduction was subsequently increased to one-quarter in 1898 and to one-third in 1900.[152] Policies of imperial

---

[146] Ashworth, *Economic history*, p. 138.

[147] Feinstein et al., 'Timing of the climacteric', p. 178.

[148] Ibid.

[149] Phelps-Brown and Handfield Jones, 'Expanding economy', p. 283. Though, it should be noted that their argument concerned the effect of general purpose technologies on total output, not just on manufacturing output.

[150] Coppock, 'Climacteric of the 1890's', p. 31.

[151] Knowles, *Overseas empire*, p. 382.

[152] Ibid.

preference were adopted in the South African Customs Union in 1903, New Zealand in 1903, and Australia in 1907.[153] Among the Dominions, the policies of imperial preference differed considerably, and such differences included whether the preference was extended to the entire Empire or just Britain, and whether preference involved reducing the duties on preferred imports or raising the duties on non-preferred imports. Regardless of these differences, by the close of the Edwardian era, the British export sector enjoyed some degree of preference in all four of the Dominion markets. Late-Victorian British exports, before 1897, were not accorded preferential treatment in any Dominion market.

Yet, Magee and Thompson have argued that Edwardian policies of imperial preference *per se* did not raise the volume of British exports to Dominion markets.[154] Instead, they emphasized that common consumption patterns and commercial networks within the Empire sustained the high demand for British exports into the Edwardian era. Their dismissiveness of the efficacy of Edwardian imperial preference was too hasty and probably incorrect. In this matter, the unique case of New Zealand is illuminative. New Zealand's policy of imperial preference, codified in the Preferential and Reciprocal Trade Act of 1903, extended preference to just a subset of three dozen mainly manufactured commodities.[155] For these commodities, preference took the form of increased duties on imports originating from outside the Empire. The act went into effect on 24 November 1903, but certain exemptions were granted until 31 March 1904. For a number of commodities subject to imperial preference, the shares imported from Britain increased markedly between 1902 and 1905, the full years immediately preceding and following the act. The share of bicycles imported from Britain increased from 49 to 92 per cent, boots and shoes from 50 to 68 per cent, iron and steel rails from 58 to 77 per cent, and pianos from 38 to 52 per cent.[156]

The preliminary evidence is that some British export industries did benefit from policies of imperial preference. In Dominion markets, imperial preference would have, for certain commodities, rendered British exports marginally more competitive than American or Continental manufactured exports. Edwardian imperial

[153] Russell, *Imperial preference*, p. 17.
[154] Magee and Thompson, *Empire and globalisation*, p. 128.
[155] *Preferential and reciprocal trade act*.
[156] *Official statistics of the colony of New Zealand*.

preference prefigured the much more decisive (and researched) system of imperial preferences that emerged during the interwar era. Without any substantial research indicating otherwise, it would be premature to deny that policies of imperial preference, even as early as the Edwardian era, raised the volume of British exports, *ceteris paribus*. Edwardian imperial preference is an underexplored topic and, hence, one ripe for future research.[157]

4. The world tariff toward Britain, not that it has ever been quantified, likely crested as the late-Victorian era gave way to the Edwardian era. Irwin has observed that the American, French, and German tariff levels remained mostly constant throughout the Edwardian era.[158] The bilateral American tariff toward Britain, reconstructed in the next chapter, reached a peak immediately following the passage of the Dingley Tariff in 1897, but declined rather persistently thereafter. An important force acting to depress tariff levels during the Edwardian era was the worldwide trend of rising prices, which diminished the *ad valorem* equivalent of specific duties. Irwin has documented this relationship for the American case. Based upon his estimates, the rising price of American imports reduced the *ad valorem* equivalent average American tariff by fully 10 per cent between the Dingley Tariff of 1897 and the Underwood-Simmons Tariff of 1913.[159] Altogether, the falling prices of the late-Victorian era served to raise tariffs, while the rising prices of the Edwardian era served to reduce them.

5. In 1897, the British export price index reached its lowest point for the entire nineteenth century.[160] Throughout the Edwardian era, the British export price index increased, as did world prices in general. The reversal in the directional movement of the British export price index is an important reason for distinguishing between late-Victorian and Edwardian British exports, even apart from the effect of this reversal on the world tariff toward Britain. For example, a trend of rising prices carried implications for the investment decisions undertaken by firms. The reasons for the late 1890s reversal in the directional movement of world prices are the subject of an old debate, which has been nicely summarized by Rostow.[161] The debate falls well outside the scope of this dissertation.

---

[157] I am presently doing research in this area.
[158] Irwin, 'Lion's share', p. 105.
[159] Irwin, 'Import prices', p. 1023.
[160] Imlah, *Pax Britannica*, p. 97.
[161] Rostow, *British economy*, ch. 7.

6. The period from the late 1890s through 1913 was marked by vigorous economic growth in the world economy and, in many parts of the world economy, the beginnings of sustained economic growth. By some accounts, Italian economic growth did not even begin until this period.[162] During the first decade of the twentieth century, the European and non-European periphery was growing wealthier, and at a fast pace. The improving terms of trade in much of the periphery raised its capacity to purchase British exports.[163] In short, there was considerably greater demand for British exports in the Edwardian era.

7. The Edwardian era was when the Second Industrial Revolution first became apparent in world trade. These were the years when automobiles, electrical goods, and synthetic chemicals entered the scene. While automobiles and electrical goods accounted for only 1 per cent of world *manufactured* exports in 1899, they accounted for 6 per cent of world manufactured exports in 1913.[164] Although, the rise of these industries in the composition of British manufactured exports was somewhat less impressive, as automobiles and electrical goods were 4 per cent of British manufactured exports in 1913.[165] To be sure, there were shifts in the industrial composition of British exports during the late-Victorian era; the relative decline of textiles in British exports was one of the most prominent.[166] However, during the Edwardian era, the compositional shifts were prompted by the emergence of wholly new industries. These new industries altered the character of British exports not inconsiderably, even if Britain was lagging behind certain other countries in the Second Industrial Revolution.

8. Lastly, the United States emerged as a major world exporter of manufactured commodities, especially metal-intensive commodities, beginning in the final few years of the nineteenth century. This occurrence has been discussed already, and it is revisited in chapter IV. For now, it should simply be observed that the Edwardian era was marked by an intensified competition between Britain and the United States in third markets. It was during the Edwardian era, rather than the late-Victorian era, when Britain's claim to the title of 'workshop of the world' was most credibly challenged.

---

[162] Toniolo, *Liberal Italy*, p. 99.
[163] Lewis, *Growth and fluctuations*, p. 118.
[164] Calculated from Tyszynksi, 'Manufactured commodities', pp. 6-7.
[165] Calculated from ibid., p. 7.
[166] See Schlote, *Overseas trade*, p. 74.

II: Anglo-American trade costs during the first era of globalization: the contribution of a bilateral tariff series

Introduction

In the first era of globalization, the largest bilateral flow of trade was between Britain and the United States. This chapter examines Anglo-American trade during the period from 1870-1913, the so-called first era of globalization. Specifically, the aim of this chapter is to identify the determinants of Anglo-American bilateral trade costs, paying special attention to tariffs. Bilateral trade costs are a standardized measure of the difference between the actual and frictionless volumes of bilateral trade. In a recent study, Jacks et al. calculated annual series of bilateral trade costs for a large number of country pairs and then proceeded to estimate the determinants thereof using a gravity model. They found that tariffs were not a statistically significant determinant of the bilateral trade costs of those country pairs that included Britain.[167] This finding is consistent with earlier literature claiming that British trade was generally unaffected by foreign tariffs.[168] But were tariffs a non-determinant of Anglo-American bilateral trade costs in particular? There are two important reasons why this question warrants consideration.

First, as already mentioned, the scale of Anglo-American trade was unsurpassed, comprising 7 per cent of world exports between 1870 and 1913.[169] Britain was consistently the foremost export market of the United States, owing primarily to the trade in cotton. Likewise, the United States was an important export market for Britain, though the share of the United States in the country-composition

[167] Jacks et al., 'Trade costs', p. 135.

[168] See Saul, *British overseas trade*, p. 165; Hatton, 'British exports', p. 585.

[169] To arrive at this figure, the values of British exports to the United States (1870-1913) and American exports to Britain (1869/70-1912/3) are deflated and expressed in 1913 prices. The combined volume of British exports to the United States and American exports to Britain is then divided by the volume of world exports in 1913 prices, as estimated in Lewis, 'World trade', pp. 60-5. Nominal values of annual British exports to the United States are reported in *Annual statements of the trade of the United Kingdom*. Sterling values are converted to dollar values using the exchange rates reported in Mitchell, *British historical statistics*, pp. 702-3. The deflator for British exports is taken from Imlah, *Pax Britannica*, pp. 96-8. Nominal values of annual American exports to Britain are reported in *Foreign commerce and navigation of the United States*. The deflator for American exports is taken from Lewis, 'World trade', p. 60, for 1869/70-1878/9, and from Lipsey, *Price and quantity*, p. 413, for 1879/80-1912/3.

of British exports was, according to Saul, 'volatile'.[170] Especially during the early years of the first era of globalization, periods of expansion in the American economy closely corresponded to increases in British exports to the United States, oftentimes resulting in the United States assuming the largest share in the country-composition of British exports.[171] Indeed, Anglo-American trade was of an immense scale. For this reason, if the determinants of Anglo-American trade (or trade costs) were exceptional, then the general conclusions drawn from gravity models for the first era of globalization are compromised, as these models do not weight the various country pairs.

Second, Anglo-American trade was unique in that it was characterized by quite divergent commercial policies, with Britain notoriously pursuing (practically) free trade and the United States espousing one of the most highly protectionist tariff regimes in the world.[172] Still, American commercial policy, though protectionist by almost any standard, was hardly unchanging throughout the course of the late nineteenth century, most notably during the 1890s when the McKinley Tariff (1890), Wilson-Gorman Tariff (1894), and Dingley Tariff (1897) followed in rapid succession. A substantial literature, addressed shortly, has examined the effect of American tariffs on British exports of certain commodities. Yet, no study has explicitly and econometrically considered the aggregate role of American tariffs in the context of Anglo-American trade.

One deficiency of gravity models is the tariff measurement assigned to each country pair.[173] The tariff measurement is usually some combination (product or sum) of the average tariffs of the two countries, rather than a combination of the bilateral tariffs of the countries toward each other. Taking an average tariff as an approximation of a bilateral tariff is a precarious practice, especially when the composition of bilateral imports differs substantially from the composition of total imports, as in the case of bilateral American imports from Britain. Thus, in order to

---

[170] Saul, 'Export economy', p. 6.

[171] Williamson, 'Long swing', pp. 34-40. The United States accounted for the largest share in the country-composition of British exports in the years 1870-4, 1880, 1882, 1888, and 1895.

[172] For a comparison of the average tariff levels of industrial countries for the period from 1875-1914, see table 1 in O'Rourke, 'Tariffs and growth', p. 461. If Russia were included in this comparison, its average tariff may well have exceeded the average tariff of the United States (25%); see Knowles, *Nineteenth century*, pp. 283-5.

[173] For example, see Estevadeordal et al., 'Rise and fall', p. 373.

properly ascertain whether tariffs determined Anglo-American trade costs, this chapter reconstructs an annual series of the (unidirectional) bilateral American tariff toward Britain for 1870/1-1912/3. The product of the bilateral American tariff toward Britain and the average British tariff—so low that British commercial policy was considered free trade—represents a greatly improved tariff measure for Anglo-American trade.[174] This improved tariff measure is then considered alongside other potential determinants of Anglo-American trade costs.

This chapter proceeds as follows. The next section situates this study within three recent scholarly debates: trade (and trade costs) during the first era of globalization, the effect of American tariffs on selected British commodity exports, and lastly the measurement and application of bilateral tariffs. The next section reconstructs an annual series of the bilateral American tariff toward Britain, relying on a method best described as a current-year weighted average of per-industry *ad valorem* equivalent tariffs. This section also reconstructs an alternative, substitution-adjusted series of the bilateral American tariff toward Britain, relying on a method suggested by Federico and Tena. The next section comments on the course of the bilateral American tariff toward Britain, explaining why it differed from the average American tariff. The penultimate section estimates the determinants of Anglo-American trade costs in a manner broadly consistent with Jacks et al. The final section offers brief concluding remarks.

Literature

Gravity models

Estevadeordal et al. put forward a gravity model of trade for the period from 1870-1939, spanning the first era of globalization and the interwar globalization backlash. They estimated the direct effect of trade barriers on bilateral trade, using data taken from the years 1913, 1928, and 1938. In the most advanced specification of their gravity model, which included country fixed effects, the variables for payments frictions (gold standard adherence), policy frictions (tariffs), and transport frictions (distance) were all statistically significant determinants of the volume of bilateral

[174] The extent to which Britain pursued a commercial policy of free trade in the mid-nineteenth century has provoked debate; see Nye, 'Free-trade Britain'; Irwin, 'Comment on Nye'.

trade.[175] Statistical significance aside, the actual contributions of these frictions to prewar globalization varied greatly. The pervasion of the gold standard and the decline in transport costs were major drivers of the volume of world trade and, therefore, globalization.[176] However, as Estevadoerdal et al. argued, tariffs exerted little effect on the volume of world trade between 1870 and 1913, since the trade-weighted world tariff level remained practically unchanged throughout this period, at least judging by the benchmark years of 1870, 1900, and 1913.[177]

Jacks et al. focused on the first era of globalization specifically. Their approach departed from the approach undertaken by Estevadeordal et al. in one crucial respect. While Estevadeordal et al. estimated the *direct* effect of individual barriers on bilateral trade, Jacks et al. estimated the *indirect* effect of individual barriers on bilateral trade, via trade costs. Trade costs are a standardized measure of the difference between the actual volume of bilateral trade and the volume of bilateral trade in the absence of any trade barriers. Although a theoretical discussion of trade costs is beyond the scope of this present chapter, it should be noted that the calculation—not estimation—of bilateral trade costs for a given country pair is based upon the countries' export volumes (bilateral and total) and real GDPs.[178] Trade costs encompass all barriers to trade, including measurable barriers, such as transport costs, as well as not so readily measurable barriers, such as the reach of distribution channels. In this way, bilateral trade costs capture the aggregate barriers to bilateral trade. This chapter follows the example of Jacks et al. in estimating the determinants of bilateral trade costs, rather than of the bilateral trade volume, for the Anglo-American country pair. This strategy permits a better identification of the individual barriers to Anglo-American trade, as separate from the effects of income and relative prices on bilateral trade.

Jacks et al. examined the determinants of bilateral trade costs in both a large and small sample. For the large sample, which contained 48 country pairs, they found that distance, tariffs, adherence to the gold standard, membership in the British

---

[175] Estevadeordal et al., 'Rise and fall', p. 374. Without country fixed effects, however, the coefficient of tariffs was not statistically significant at a conventional level.

[176] Ibid., pp. 394-5.

[177] Ibid., p. 391.

[178] Additionally, it is necessary to assume the elasticity of substitution and the share of tradable goods in economic output. For a theoretical discussion of trade costs, see Novy, 'Gravity redux'.

Empire, and railway density were all statistically significant determinants.[179] Based upon the standardized coefficients of these variables, distance emerged as the primary determinant of bilateral trade costs, while the other variables were of secondary importance.[180] In recognition of the well-documented decline in ocean freight rates that occurred during the first era of globalization, Jacks et al. sought to estimate the effect of freight rates, rather than (time-invariant) distance *per se*, on bilateral trade costs. They therefore reduced the sample to only those country pairs that included Britain, which were the country pairs for which bilateral ocean freight indices were available. The results were quite different. The most noteworthy difference was that tariffs were not a statistically significant determinant of bilateral British trade costs, of which Anglo-American trade costs were a subset.[181] Ocean freight rates, the variable of interest in the reduced sample, took on a statistically significant coefficient, though it should be observed that the standardized coefficient of this variable was especially small.[182]

Iron, steel, and tinplate

Whereas the general literature on the first era of globalization suggests a diminished role for tariffs, the commodity-specific literature on Anglo-American trade during this same period suggests that British exports to the United States were elastic to American tariffs. It should be observed that this literature was primarily intended to assess whether American tariffs fostered certain domestic manufacturing industries. Still, the conclusions reached in this literature can rightly be extended to Anglo-American trade, since the manufactured commodities were previously supplied by Britain, and often to a great extent. While for the antebellum period, the debate was focused on the American cotton textile industry, for the late nineteenth century, the pig iron and tinplate industries have received the most attention.[183]

Sundararajan was the first to examine econometrically the relationship between American tariffs and domestic pig iron production for the late nineteenth and early

[179] Jacks et al., 'Trade costs', p. 135.

[180] Ibid., pp. 134-5. It should be noted that membership in the British Empire greatly reduced trade costs for these bilateral pairs, *ceteris paribus*.

[181] Ibid., p. 135.

[182] Ibid.

[183] For the debate on the dependence of the antebellum cotton textile industry on protection, see Harley, 'International competitiveness'; Irwin and Temin, 'Antebellum tariff'; Harley, 'Different products'.

twentieth centuries. What distinguished his approach was the calculation of an annual series of the effective tariff for pig iron, that is, the protection extended to the domestic value added in the pig iron industry, after accounting for the share of imported material inputs and the duties imposed upon these inputs.[184] He found that the effective tariff, though not the nominal tariff, was a statistically significant determinant of pig iron production in the seaboard states of New York and New Jersey, where production was not insulated from international competition by the cost of inland transport.[185] Irwin, proceeding on a better econometric footing, revisited the American pig iron industry and the extent to which it depended upon protection. He found that domestic production and imports were responsive to the (nominal) tariff. In the most extreme of his three counterfactual scenarios, the complete elimination of the duty on pig iron in 1869, the volume of pig iron imports would have risen by 172 per cent in the short run and 489 per cent in the long run, though it should be emphasized that the share of imports in domestic consumption would have remained small.[186] A very recent study by Inwood and Keay explored several potential determinants of British pig iron exports to the United States and Canada during the period from 1870-1913. They found consistent evidence for a negative association between tariffs and pig iron.[187] Based on their estimated coefficient, a 10 per cent decrease in the duty on pig iron, such as occurred under the Tariff Act of 1872, would have corresponded to a 7 per cent increase in British pig iron exports to the United States, *ceteris paribus*.[188]

In contrast to pig iron, American consumption of tinplate was satisfied wholly through imports from Britain, prior to the McKinley Tariff.[189] Using a probit model, Irwin found that the McKinley Tariff initiated the domestic production of tinplate, which displaced the majority of imports by the close of the century.[190] Had the McKinley Tariff not raised the duty on tinplate, domestic production would probably

---

[184] In his calculations, Sunadararajan had to assume that the factor shares of material inputs remained constant over specified intervals.

[185] Sundararajan, 'Iron and steel industry', pp. 602-3.

[186] Irwin, 'Iron industry', p. 292.

[187] Inwood and Keay, 'Iron trade', p. 112.

[188] For a record of changes in the American duty on pig iron, refer to Taussig, *Tariff question*, p. 139.

[189] A small amount of tinplate was produced in the United States in the mid-1870s, when the relative price of iron and steel declined in favour of domestic production; see Irwin, 'Tinplate industry', pp. 338-9.

[190] Between 1889/90 and 1899/1900, the annual value of tinplate imports fell from $20.1 million to $4.8 million.

not have commenced until sometime between 1898 and 1903, by which time the relative price of material inputs—the main material inputs were iron and steel—would have declined enough to permit domestic production.[191]

Bilateral tariffs

The literature on historical bilateral tariffs includes one outstanding and recent example. Dedinger reconstructed the late nineteenth-century bilateral French tariff toward Germany for the period from 1857-1913. In this endeavour, she benefitted from the unique arrangement of the French trade statistics, which enabled her to identify, for each product class, the value of French imports from Germany and the customs revenue collected thereon. Dedinger then used this bilateral tariff series to argue that French protection did not systematically discriminate against imports from Germany and that French protection had little bearing upon the German share of French imports.[192]

The British Board of Trade actually estimated the bilateral American tariff toward Britain, along with the bilateral tariffs of ten other countries, but for just the year 1902.[193] The Board of Trade's estimate of 73 per cent for the bilateral American tariff toward Britain greatly exceeds this chapter's main estimate of 33 per cent. The discrepancy arises from the dissimilar methods used to estimate the tariff. In this chapter, the main method entails a weighted average of per-industry *ad valorem* equivalent tariffs, with the weights derived from the composition of bilateral trade. However, the method employed by the Board of Trade used weights derived from the composition of British exports to all countries. The Board of Trade summarized this distinguishing feature of its method as follows: 'the basis of the calculation is *not* the classes of British goods which we actually sell to each particular country, but those which we sell to the world in general' [emphasis in original].[194]

The Board of Trade settled on this method for calculating bilateral tariffs because the resulting estimates are not diminished by the imposition of prohibitive

[191] Irwin, 'Tinplate industry', pp. 351-2.

[192] Dedinger, 'Franco-German', pp. 1044-5.

[193] *British and foreign trade and industry*, p. 171. The ten other countries and corresponding bilateral tariffs are as follows: Russia (131%), Austria-Hungary (35%), France (34%), Italy (27%), Germany (25%), Canada (16%), Belgium (13%), New Zealand (9%), Australian Commonwealth (6%), and South African Customs Union (6%).

[194] Ibid., p. 169.

tariffs on classes of British exports.[195] Prohibitive tariffs, which are high enough to block imports entirely, are the most extreme case of the substitution effect, whereby an increase in the tariff on a given class of exports causes the value *and share* of that class of exports to decline. By fixing the shares according to the composition of British exports to all countries, the Board of Trade attempted to ensure that the substitution effect did not erode its estimates of bilateral protection. The main series of the bilateral American tariff toward Britain, reconstructed in the next section of this chapter, does not adjust for the substitution effect. Not adjusting for the substitution effect preserves the comparability between the bilateral tariff series and the average tariff of the United States, thereby allowing for the calculation of the relative bilateral American tariff toward Britain.

Nevertheless, the substitution effect cannot be wholly ignored, at least insofar as this chapter aims to examine closely the relationship between tariffs and Anglo-American trade costs. Hence, the next section of this chapter also reconstructs an alternative series of the bilateral American tariff toward Britain that adjusts, however imperfectly, for the substitution effect. The method for estimating the alternative series is an unweighted average of per-industry *ad valorem* equivalent tariffs. This method, suggested by Federico and Tena as one possible option for handling the substitution effect, has the advantage of being easily implemented given the data available.[196] Of course, the equal weights implicit in an 'unweighted' average underweight (overweight) what would be the relatively large (small) industries in the hypothetical free-trade composition of bilateral imports.

Estimates of bilateral tariffs, rare in their existence, are practically absent from gravity models of trade. This very topic was recently addressed by Hayakawa in an article titled 'How serious is the omission of bilateral tariff rates in gravity?'. Using the World Integrated Trade Solution database, he calculated annual bilateral tariff series for a large number of country pairs for the years 1996-2007. These bilateral tariffs pertained only to trade in manufactures. In the gravity model, the coefficient of the bilateral tariff variable was statistically significant.[197] However, the inclusion of this variable had hardly any effect on the magnitudes of the other coefficients and

[195] Ibid.
[196] Federico and Tena, 'Protectionist country', pp. 75-6.
[197] Hayakawa, 'Bilateral tariff rates', p. 89.

had no effect on the explanatory power of the model.[198] Hayakawa's finding deserves mention, but should not be taken as indicative of what the econometric analysis in this chapter may reveal. Tariffs during the first era of globalization were quite different from (manufactured) tariffs at the turn of the millennium, which were much lower and generally declining.

Reconstructing the bilateral American tariff toward Britain

The source used in reconstructing the bilateral American tariff toward Britain is the *Foreign Commerce and Navigation of the United States*, a series of reports issued annually by the United States Treasury Department. The only other potential source, the *Annual Statements of the Trade of the United Kingdom*, enumerates British exports to the United States, but does so in a manner inconsistent with the classification of articles in the American tariff schedule. Accordingly, this study relies on the American trade statistics. Each annual report of the *Foreign Commerce* covers the fiscal year ending 30 June, rather than the calendar year. For the purposes of this chapter, 1870/1 means the year beginning 1 July 1870 and ending 30 June 1871. The bilateral tariff series reconstructed here spans the 43 years from 1870/1-1912/3 and is therefore in keeping with the conventional periodization of the first era of globalization.

The *Foreign Commerce* treats dutiable and non-dutiable imports entirely separately. With regard to the dutiable imports, the two relevant sections of the *Foreign Commerce* for reconstructing the bilateral American tariff toward Britain are the article-country disaggregation and industry-tariff disaggregation sections. The article-country disaggregation section records, for example, the value of pig iron imported from Britain. The industry-tariff disaggregation section records, for example, the total value of all iron, steel, and manufactures thereof imported from all countries and the customs revenue collected thereon, which thus enables the calculation of the per-industry *ad valorem* equivalent tariff that the United States imposed upon imports from all countries.

In order to calculate the main series of the bilateral American tariff toward Britain ($MAIN_{b,t}$), it is first necessary to calculate the industry-composite bilateral American tariff toward Britain ($COMPOSITE_{b,t}$):

[198] Ibid.

$$COMPOSITE_{b,t} = \sum_{i=1}^{16}\left(\frac{IMPORTS_{b,i,t}}{\sum_{i=1}^{16} IMPORTS_{b,i,t}}\right)\left(\frac{REVENUE_{a,i,t}}{IMPORTS_{a,i,t}}\right) \quad (2.1)$$

Here, *IMPORTS* represents the value of *dutiable* imports, while *REVENUE* represents the customs revenue accruing to the United States from those dutiable imports. The subscripts denote American imports from Britain (*b*), American imports from all countries (*a*), the particular industry (*i*), and the year (*t*).[199] Taking $COMPOSITE_{b,t}$ from equation 2.1, it is next possible to calculate the bilateral American tariff toward Britain ($MAIN_{b,t}$):

$$MAIN_{b,t} = \frac{(COMPOSITE_{b,t})(DUTIABLE_{b,t})}{DUTIABLE_{b,t}+FREE_{b,t}} \quad (2.2)$$

In equation 2.2, *DUTIABLE* represents the total value of dutiable imports and *FREE* the total value of non-dutiable imports. The meanings of the subscripts are retained from equation 2.1.

The industry-composite bilateral American tariff toward Britain, represented in equation 2.1, is a weighted average of the per-industry *ad valorem* equivalent tariffs that the United States imposed upon dutiable imports from all countries, taken from the industry-tariff disaggregation section of the *Foreign Commerce*. The weights, calculated from the article-country disaggregation section, are the per-industry shares of dutiable imports from Britain within a composite basket of dutiable imports from Britain spanning 16 industries: alkali; books; cement; clocks and watches; (bituminous) coal; cotton manufactures; earthenware and chinaware; flax and manufactures thereof; fur and manufactures thereof; iron, steel, and manufactures thereof; leather and manufactures thereof; salt; silk manufactures; tinplate; wool; and wool manufactures. Table 2.1 presents the weights and per-industry *ad valorem* equivalent tariffs for four benchmark years: 1870/1, the initial year of the series; 1889/90, the last full year preceding the McKinley Tariff; 1898/9, the first full year following the Dingley Tariff; and 1912/3, the final year of the series. The weights and per-industry ad valorem equivalent tariffs are reported for all years in Appendix 2.1. Because the article-country disaggregation section does not explicitly record the total value of dutiable imports from Britain for each industry, it is necessary to sum

[199] Prior to 1890/1, the *Foreign Commerce* does not record imports from Britain as a whole, but instead from England (including Wales), Scotland, and Ireland. Between 1890/1 and 1908/9, the *Foreign Commerce* records imports from Britain as a single country, after which it reverts to the earlier convention of recording imports from three separate countries. Accordingly, for the years 1870/1-1889/90 and 1909/10-1912/3, the total value of dutiable imports per industry for each of England, Scotland, and Ireland are calculated separately and then added together so as to obtain $IMPORTS_{b,i,t}$.

Table 2.1. *Industry weights and tariffs, 1870/1-1912/3*

Industry	1870/1	1889/90	1898/9	1912/3
Alkali	2.0 (35.1)	3.9 (32.9)	1.0 (52.3)	--
Books	0.7 (25.0)	1.2 (25.0)	1.7 (25.0)	3.0 (29.7)
Cement	--	0.9 (20.0)	0.7 (24.0)	0.0 (21.9)
Clocks and watches	1.8 (23.3)	0.1 (26.0)	0.2 (35.8)	0.1 (35.8)
Coal	0.2 (47.5)	0.1 (22.2)	0.5 (22.0)	0.0 (14.8)
Cotton manufactures	14.4 (40.5)	9.5 (39.9)	22.1 (56.0)	20.5 (55.0)
Earthenware and chinaware	2.2 (41.3)	3.2 (57.1)	5.1 (58.8)	2.5 (58.2)
Flax and manufactures thereof	10.4 (33.7)	14.7 (33.9)	28.3 (42.0)	29.7 (33.2)
Fur and manufactures thereof	0.8 (19.8)	2.0 (20.2)	2.4 (20.9)	1.0 (26.2)
Iron, steel, and manufactures thereof	22.0 (43.1)	9.9 (38.0)	8.1 (38.1)	12.9 (26.1)
Leather and manufactures thereof	3.5 (35.4)	1.9 (31.7)	4.3 (35.7)	5.4 (27.9)
Salt	0.5 (101.6)	0.6 (41.3)	0.7 (46.7)	0.3 (40.7)
Silk manufactures	12.0 (57.8)	5.4 (49.5)	4.0 (54.0)	3.0 (51.4)
Tinplate	6.2 (22.7)	16.7 (32.5)	4.5 (62.4)	1.0 (29.9)
Wool	1.9 (45.6)	6.7 (33.8)	5.6 (47.3)	13.9 (44.7)
Wool manufactures	21.4 (67.7)	23.2 (69.1)	10.9 (94.9)	6.8 (81.8)

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

the values of the dutiable articles imported from Britain for each of the 16 industries, in order to obtain $IMPORTS_{b,i,t}$. In other words, it is necessary to sum the values of (dutiable) pig iron, (dutiable) bar iron, and so forth, imported from Britain, in order to obtain the total value of (dutiable) iron, steel, and manufactures thereof imported from Britain.

The assumption implicit in equation 2.1 is that, within each industry, the intra-industry composition of dutiable articles that the United States imports from Britain mirrors the intra-industry composition of dutiable articles that the United States

imports from all countries. Indeed, the danger of this assumption is best conveyed by a simple example. Suppose there is an industry that includes only two articles, X and Y, which the United States imports in equal values. The *ad valorem* equivalent tariff is 20 per cent for article X, 40 per cent for article Y, and 30 per cent for the industry as a whole. However, the United States imports article X exclusively from country A and article Y exclusively from country B. In this example, the true bilateral tariff toward country A is 40 per cent for this industry, but the calculation of $COMPOSITE_{b,t}$ inappropriately relies on an *ad valorem* equivalent tariff of 30 per cent.

The delicate nature of this assumption factors heavily into the selection of the 16 industries listed earlier. For each of these 16 industries, the intra-industry composition of dutiable articles imported from Britain broadly approximates the intra-industry composition of dutiable articles imported from all countries. Since some industries encompass many individual articles of importation, especially the industry of iron, steel, and manufactures thereof, and since the intra-industry compositions of dutiable articles approximate each other to varying extents, the decision to settle on the 16 aforementioned industries is inevitably a discretionary one. The glass industry offers an example of an industry excluded from the calculations for this reason. In 1889/90, the article-country disaggregation section classifies 21 per cent of dutiable glass imports from all countries as 'cylinder and crown glass, polished and silvered', whereas less than 1 per cent of dutiable glass imports from Britain fall under this classification.[200] Because certain industries, such as the glass industry, are excluded from equation 2.1, it is essential to observe that $\Sigma IMPORTS_{b,i,t}$ from equation 2.1 is always less than $DUTIABLE_{b,t}$ from equation 2.2, as the latter value includes all dutiable imports from Britain across all industries, including the excluded industries.

For the industry of flax and manufactures thereof, the intra-industry compositions of dutiable articles imported from Britain and from all countries are roughly similar until 1883/4, when the *Foreign Commerce* merges the industries of flax and manufactures thereof; hemp and manufactures thereof; and jute and manufactures thereof. The consolidated industry of flax, hemp, jute, and manufactures thereof encompasses raw hemp and raw jute, the vast majority of

[200] The United States imported almost all of its 'cylinder and crown glass, polished and silvered' from Germany.

which the United States imported from countries other than Britain. Consequently, the introduction of this consolidated industry into the American trade statistics causes the intra-industry composition of dutiable articles imported from Britain to differ considerably from the intra-industry composition of dutiable articles imported from all countries. For this reason, the industry of flax and manufactures thereof would ordinarily be excluded from equation 2.1, just as the glass industry is excluded from equation 2.1. However, whereas the glass industry constitutes a relatively minor share of American imports from Britain, the industry of flax and manufactures thereof constitutes a quite large share; flax and manufactures thereof accounted for fully 10 per cent of American imports from Britain in 1882/3. No truly representative series of the bilateral American tariff toward Britain can neglect this important industry.

A third section of the *Foreign Commerce*, the article-tariff disaggregation section, provides an acceptable solution to the problem created by the merger of flax and manufactures thereof; hemp and manufactures thereof; and jute and manufactures thereof. For the purpose of equation 2.1, the industry of flax and manufactures thereof is redefined to include just burlaps and linens for the years from 1883/4-1889/90. Burlaps and linens are two dutiable articles of importation listed congruently in the article-country disaggregation and article-tariff disaggregation sections of the *Foreign Commerce*. For the years 1883/4-1889/90, equation 2.1 weights the *ad valorem* equivalent tariff that the United States imposed upon burlaps and linens (combined) by the share of burlaps and linens (combined) within the composite basket of dutiable imports from Britain. It is noteworthy that, in 1883/4, the value of burlaps and linens imported from Britain was $14.7 million, while the total value of all flax, hemp, jute, and manufactures thereof imported from Britain was $19.1 million. Seen in this light, redefining the industry as just burlaps and linens still maintains a high degree of representativeness in the calculations.

Yet another classificatory change in the *Foreign Commerce* requires another redefinition of the industry of flax and manufactures thereof, for the purpose of equation 2.1. Beginning in 1890/1, the article-country disaggregation section shifts linens to the ubiquitous classification of ‘all other manufactures of flax, hemp, or jute’, a classification without any equivalent in the article-tariff disaggregation section. Since the article-country disaggregation and article-tariff disaggregation sections now differentiate between raw and manufactured flax, hemp, and jute, and

since the article-tariff disaggregation section lists an overall *ad valorem* equivalent tariff for all dutiable manufactures of flax, hemp, and jute, the industry is redefined to include all manufactures of flax, hemp, and jute from 1890/1 until the conclusion of the series. In summary, this industry includes flax and manufactures thereof for 1870/1-1882/3, burlaps and linens for 1883/4-1889/90, and all manufactures of flax, hemp, and jute for 1890/1-1912/3. While redefining this industry at two junctures (1883/4 and 1890/1) introduces a small element of inconsistency to the tariff series being constructed here, doing so ensures that the intra-industry compositions of dutiable articles from Britain and from all countries broadly approximately each other, and that the redefined industry matches an *ad valorem* equivalent tariff ascertainable from the *Foreign Commerce*.

The chemical industry, as designated in the American trade statistics, embodies highly discrepant intra-industry compositions of dutiable articles, with the United States importing dyestuffs predominantly from Germany and alkali almost exclusively from Britain. This problem is resolved by employing, in equation 2.1, a purposely crafted 'alkali industry' in place of the chemical industry. The alkali industry, as defined here, includes just three dutiable articles of importation, which are congruently listed in the article-country disaggregation and article-tariff disaggregation sections: caustic soda, sal soda, and soda ash. Therefore, equation 2.1 weights the *ad valorem* equivalent tariff that the United States imposed upon caustic soda, sal soda, and soda ash (combined) by the share of these three articles (combined) within the composite basket of dutiable imports from Britain.

Starting in 1883/4, the *Foreign Commerce* incorporates the tinplate industry, formerly treated as distinct, into the industry of iron, steel, and manufactures thereof. Yet, owing to the identical recording of tinplate in the article-country disaggregation and article-tariff disaggregation sections, it is possible to remove tinplate from iron, steel, and manufactures thereof, and continue treating tinplate as its own industry for the duration of the series. Obviously then, $REVENUE_{a,i,t}$ and $IMPORTS_{a,i,t}$ for the industry of iron, steel, and manufactures thereof are adjusted to exclude tinplate between 1883/4 and 1912/3. More than for the sake of consistency, the rationale for keeping tinplate as a distinct industry lies in the tremendous value of tinplate that the United States imported from Britain, as well as the atypical treatment of tinplate in

the American tariff legislation, specifically the provision of the McKinley Tariff of 1890 that delayed an increase in the tariff on tinplate until 1 July 1891.[201]

In a strict sense, the *Foreign Commerce* treats wool and manufactures thereof as a single industry. Yet, the article-country disaggregation section unambiguously notes which dutiable articles are wool and which dutiable articles are wool manufactures. Likewise, the industry-tariff disaggregation section decomposes the *ad valorem* equivalent tariff for wool and manufactures thereof into separate *ad valorem* equivalent tariffs for wool and wool manufactures. Altogether, it is not difficult to treat wool and wool manufactures as distinct industries in equation 2.1. Yet, simplicity itself does not justify this decision; there are important historical reasons calling for the segregation of these two classes of articles. First, wool and wool manufactures, even when treated separately, rank among the largest of the 16 industries. Second, the United States levied much higher duties on wool manufactures than on wool, in keeping with the compensating system of duties, whereby American tariff legislation set the tariff on wool manufactures high enough to offer domestic wool manufacturers both an element of protection and a 'compensation' for the higher price of wool that resulted from there being a tariff on this material input.[202]

An important point germane to the (raw) wool industry is that the fleeting Wilson-Gorman Tariff of 1894 removed all duties on wool imports. Recall that, in equation 2.1, $IMPORTS_{b,i,t}$ represents the value of only the dutiable imports from Britain per industry. Therefore, the value of $IMPORTS_{b,i,t}$ is nil for the wool industry in the years 1895/6 and 1896/7. Since the Wilson-Gorman Tariff did not become law until 28 August 1894, $IMPORTS_{b,i,t}$ takes on a small value for the wool industry in 1894/5, representing the value of the dutiable wool imported from Britain during the brief interval from 1 July 1894 to 28 August 1894.

Of the 16 industries covered in equation 2.1, several come with a few minor qualifications. The cement industry is introduced into the calculation of equation 2.1 beginning in 1883/4, when the article-country disaggregation section of the *Foreign Commerce* first accords it separate treatment. In 1906/7, a classificatory change in the article-country disaggregation section makes impracticable the continued

[201] Irwin, 'Tinplate industry', p. 340.

[202] The mechanics of the compensating system of duties, as applied to wool and woollens, are detailed in Taussig, *Tariff question*, pp. 322-4.

inclusion of the alkali industry in equation 2.1; in this year, the alkali industry is dropped from the calculation.[203] Other industries are characterized by minor internal discontinuities. The industry of iron, steel, and manufactures thereof includes iron ore starting in 1883/4. From 1909/10 to 1912/3, the book industry also includes paper and manufactures thereof.

Moving from equation 2.1, the industry-composite bilateral American tariff toward Britain ($COMPOSITE_{b,t}$), to equation 2.2, the bilateral American tariff toward Britain ($MAIN_{b,t}$), entails the assumption that the dutiable imports from Britain falling outside of the 16 industries are subject to the industry-composite American tariff toward Britain. The dutiable imports accounted for in equation 2.1 represent anywhere between 65 and 86 per cent of total dutiable imports from Britain, depending upon the year.[204] There are three categories of dutiable imports excluded from equation 2.1. The first category, already described at length, includes the dutiable imports of those industries exhibiting highly discrepant intra-industry compositions, such that the corresponding *ad valorem* equivalent tariff for that industry would grossly misrepresent the true bilateral American tariff toward Britain for that industry. The second category includes dutiable imports from Britain classified in the *Foreign Commerce* as 'all other dutiable articles'.[205] The third category includes dutiable imports that the *Foreign Commerce* enumerates separately, but that are largely inconsequential, such as artificial feathers and smokers' pipes. Equation 2.2 applies the industry-composite tariff to these three categories of dutiable imports. Additionally, equation 2.2 incorporates the non-dutiable imports from Britain, with the result being annual estimates of the *ad valorem* equivalent tariff that the United States levied upon the whole basket of imports from Britain.

In reconstructing the main series, one final adjustment is necessary. Prior to 1879/80, the *Foreign Commerce* follows the convention of recording specie, specifically gold and silver bullion and coin, as non-dutiable articles of importation in the article-country disaggregation section. In 1879/80, the American trade statistics cease recording specie as non-dutiable articles of importation and begin

[203] In 1905/6, American alkali imports from Britain amounted to a paltry $0.2 million.

[204] Since the coverage rate for $FREE_{b,t}$ is 100%, the coverage rate is higher for $MAIN_{b,t}$ than for $COMPOSITE_{b,t}$.

[205] 'All other dutiable articles' imported from Britain usually amounted to 1% of total imports from Britain.

recording specie flows in an entirely separate section.[206] The consequence of this change in accounting is an inconsistent tariff series, broken between 1878/9 and 1879/80. To make the tariff series consistent, equation 2.2 is adjusted for the years 1870/1-1878/9 by subtracting from the denominator the value of specie imported from Britain ($SPECIE_{b,t}$):

$$MAIN_{b,t} = \frac{(COMPOSITE_{b,t})(DUTIABLE_{b,t})}{DUTIABLE_{b,t}+FREE_{b,t}-SPECIE_{b,t}} \quad (2.3)$$

The annual values of specie, dutiable, and free American imports from Britain are presented in Appendix 2.2. The first column of Table 2.2 reports the main series of the bilateral American tariff toward Britain corrected for specie flows. Since the average tariff of the United States, as recorded in the *Foreign Commerce*, embodies the same inconsistency as just described, it is also adjusted for specie flows prior to 1879/80. The second column reports the average American tariff corrected for specie flows. Inasmuch as the British share of total American imports ranged between 16 and 45 per cent throughout the 43 years covered in this study, the average American tariff is heavily influenced by imports from Britain. Thus, the third column presents the average American tariff excluding Britain. The fourth column presents the relative bilateral American tariff toward Britain, as determined by dividing the bilateral American tariff toward Britain (column 1) by the average American tariff excluding Britain (column 3).[207] It should be observed that the relative bilateral American tariff toward Britain exceeds 1 entirely because of the composition of bilateral imports, not because the United States explicitly discriminated against imports from Britain.

Following the suggestion of Federico and Tena, the alternative series of the bilateral American tariff toward Britain ($ALTERNATIVE_{b,t}$) is calculated as an unweighted average of the per-industry *ad valorem* equivalent tariffs:[208]

---

[206] A note on p. 557 of *Foreign commerce and navigation of the United States* (1880) states, 'This table embraces only merchandise, specie having been omitted. This fact should be observed in comparisons made with the data in corresponding tables for previous years, which tables include both merchandise and specie'.

[207] This method of calculating a relative bilateral tariff differs from Dedinger's. She calculated the relative bilateral French tariff toward Germany by dividing the bilateral French tariff toward Germany by the average French tariff toward all countries *including* Germany.

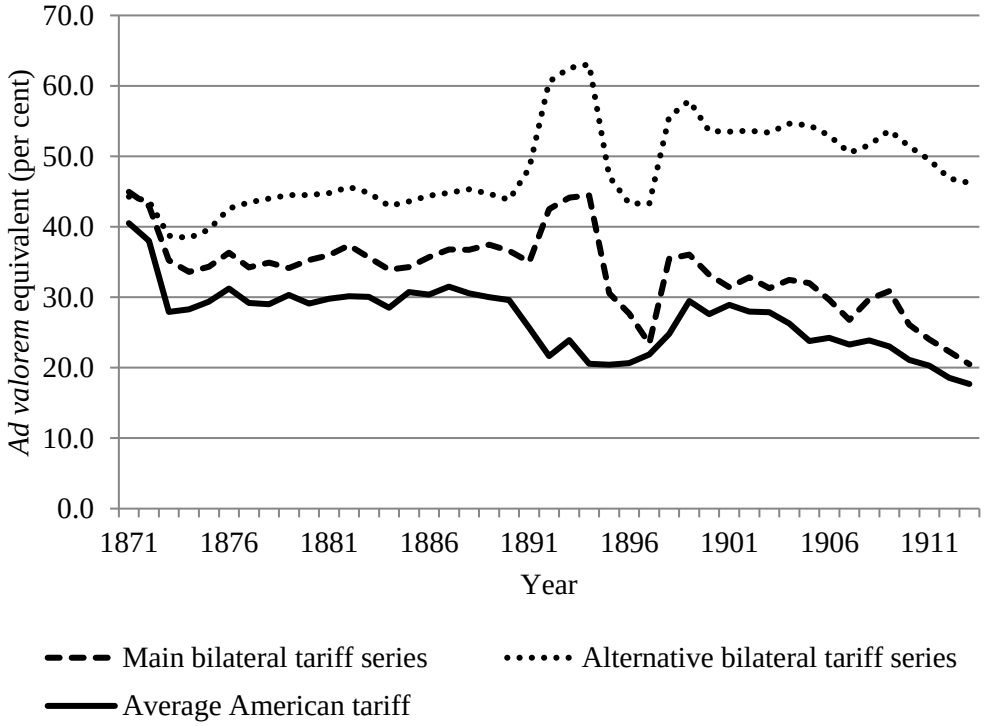
[208] Other studies that have calculated tariff levels using unweighted averages include Tena-Junguito, 'Bairoch revisited'; Tena-Junguito, Lampe, and Tâmega Fernandes, 'Cobden-Chevalier'.

Table 2.2. *Bilateral American tariff toward Britain, 1870/1-1912/3*

	(1)	(2)	(3)	(4)	(5)
Year	Main series	Average American tariff	Average American tariff excluding Britain	Relative bilateral tariff	Alternative series
1870/1	45.0	40.5	37.0	1.22	44.3
1871/2	42.9	38.0	34.0	1.26	43.6
1872/3	35.2	27.9	23.8	1.48	38.7
1873/4	33.6	28.3	25.8	1.30	38.4
1874/5	34.3	29.4	27.3	1.26	39.6
1875/6	36.3	31.3	29.4	1.24	42.6
1876/7	34.3	29.2	27.4	1.25	43.5
1877/8	34.9	29.0	27.1	1.29	44.0
1878/9	34.2	30.3	29.1	1.18	44.5
1879/80	35.3	29.1	26.0	1.36	44.5
1880/1	36.0	29.8	27.5	1.31	44.8
1881/2	37.4	30.2	27.4	1.36	45.7
1882/3	35.7	30.0	28.0	1.27	44.8
1883/4	33.9	28.5	26.8	1.27	43.0
1884/5	34.3	30.8	29.7	1.16	43.6
1885/6	35.7	30.4	28.6	1.25	44.4
1886/7	36.8	31.5	29.8	1.23	44.8
1887/8	36.7	30.6	28.5	1.29	45.3
1888/9	37.4	30.0	27.6	1.35	44.7
1889/90	36.6	29.6	27.3	1.34	43.8
1890/1	35.0	25.7	22.9	1.53	48.3
1891/2	42.5	21.6	16.6	2.56	60.6
1892/3	44.1	23.9	18.2	2.42	62.6
1893/4	44.5	20.6	15.6	2.84	63.1
1894/5	30.6	20.4	17.6	1.73	47.1
1895/6	27.7	20.7	18.6	1.49	43.3
1896/7	23.4	21.9	21.5	1.09	43.3
1897/8	35.5	24.8	22.3	1.59	55.6
1898/9	36.0	29.5	28.1	1.28	57.9
1899/00	33.2	27.6	26.3	1.26	53.6
1900/1	31.4	28.9	28.4	1.11	53.5
1901/2	32.8	27.9	26.8	1.22	53.7
1902/3	31.3	27.9	27.1	1.16	53.4
1903/4	32.4	26.3	25.0	1.30	54.6
1904/5	32.0	23.8	22.2	1.44	54.4
1905/6	29.6	24.2	23.1	1.28	53.0
1906/7	26.8	23.3	22.5	1.19	50.5
1907/8	29.8	23.9	22.8	1.31	51.6
1908/9	30.9	23.0	21.5	1.44	53.7
1909/10	26.1	21.1	20.0	1.30	51.4
1910/1	24.0	20.3	19.5	1.23	49.5
1911/2	22.3	18.6	17.8	1.25	46.9
1912/3	20.5	17.7	17.1	1.20	46.2

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: All figures, except those in col. 4, are in expressed in %. Col. 1 does not adjust for the substitution effect, whereas col. 5 does.

Figure 2.1. *Bilateral American tariff toward Britain, 1870/1-1912/3*



Note: The underlying data is presented in table 2.2.

$$ALTERNATIVE_{b,t} = \sum_{i=1}^{6}\left(\frac{REVENUE_{a,i,t}}{IMPORTS_{a,i,t}}\right)/6 \qquad (2.4)$$

Rather than include all 16 industries, the alternative series is calculated using the six largest industries, defined as those industries for which American imports from Britain exceeded $20 million in at least one year between 1870/1 and 1912/3. This approach adjusts for the substitution effect, but ensures that the *ad valorem* equivalent tariffs of relatively minor industries in the composition of American imports from Britain do not distort the resulting series. The six industries are cotton manufactures; flax and manufactures thereof; iron, steel, and manufactures thereof; silk manufactures; tinplate; and wool manufactures. The last column of Table 2.2 reports the alternative series of the bilateral American tariff toward Britain. Figure 2.1 illustrates both the main and alternative series of the bilateral American tariff toward Britain, as well as the average tariff of the United States.

The main and alternative series exhibit similar inter-temporal variation during the capricious decade in American tariff history, the 1890s. However, there is also a divergence between these series beginning in the 1890s and continuing through the early twentieth century. The divergence between the main and alternative series is

the consequence of a rapidly increasing non-dutiable share of bilateral imports from Britain. As equation 2.4 indicates, non-dutiable imports are excluded from the calculation of the alternative series, whereas these imports are included in the calculation of the main series. The growth of non-dutiable imports from Britain is addressed in the next section.

The course of the bilateral tariff

In the early 1870s, growth in American imports resulted in a perceived excess of customs revenues, and this situation elicited calls for a reduction in duties.[209] The Tariff Act of 1872 decreased the duties on most manufactured imports by 10 per cent, in addition to more substantial decreases in the duties on coal and salt.[210] Between 1871/2 and 1872/3, the main series of the bilateral American tariff toward Britain declines from 43 to 35 per cent. However, the relative bilateral tariff remains fairly constant, partly because the 10 per cent reduction in the duties on manufactured imports was accompanied by an elimination of the duty on coffee, which the United States did not import from Britain.[211] Neither the Tariff Act of 1875 nor the Mongrel Tariff of 1883 caused any discernible change in the bilateral American tariff toward Britain.

The McKinley Tariff of 1890 represents an abrupt departure from the *status quo* of American tariff policy during the 1870s and 1880s, having raised the duties on manufactured imports across a range of industries. Cotton manufactures, wool manufactures, and tinplate, all major British exports to the United States, suddenly fell subject to much higher duties. As for cotton manufactures, the United States imported hardly any of the cheaper grades by the late nineteenth century, but continued to import the more expensive grades.[212] The McKinley Tariff raised the duties on these more expensive grades of cotton manufactures, causing the *ad valorem* equivalent tariff for this industry to increase from 40 to 51 per cent. Yet, the additional protection that the McKinley Tariff extended to cotton manufacturers was not nearly as great as the additional protection that it extended to wool manufacturers. When the McKinley Tariff was being crafted in Congress, moderate

[209] Ashley, *Modern tariff history*, p. 188.
[210] Taussig, *Tariff history*, p. 185.
[211] Ibid., p. 186.
[212] Saul, *British overseas trade*, p. 145.

upward revisions in the duties on wool were proposed and eventually enacted.[213] These proposed upward revisions provided wool manufacturers an occasion to demand greater duties on wool manufactures, in accordance with the principle of compensating duties, as discussed in the previous section of this chapter. However, so generous were the assumptions about the factor proportion of wool in wool manufactures, and so byzantine was the schedule of duties devised for wool manufactures, that the wool manufacturers ultimately obtained far more than mere compensation for the higher price of wool.[214] By 1891/2, the *ad valorem* equivalent tariff for wool manufactures had reached 96 per cent, compared to an already high 69 per cent in 1889/90.

Given that the McKinley Tariff went into effect on 6 October 1890, the main series of the bilateral American tariff toward Britain ought to register a marked increase between fiscal years 1889/90 and 1890/1, but no such increase is evident. The reason lies in the McKinley Tariff's postponement of an increase in the tariff on tinplate until 1 July 1891. In expectation of the duty on tinplate rising from $0.01 to $0.022 per pound on 1 July 1891, American firms imported an unusually large amount of tinplate during 1890/1. Whereas the United States imported $20.9 million of British tinplate in 1889/90, it imported $35.6 million of British tinplate in 1890/1.[215] In 1890/1, the *ad valorem* equivalent tariff for tinplate was, at 29 per cent, less than the bilateral American tariff toward Britain. Thus, in the calculation of equation 2.1 for 1890/1, increases in the per-industry *ad valorem* equivalent tariffs for cotton manufactures and wool manufactures—increases that otherwise would yield a higher bilateral tariff for 1890/1—are counterbalanced by the much greater weight given to the comparatively low *ad valorem* equivalent tariff for tinplate. Because of the delayed increase in the tariff on tinplate, the main series of the bilateral American tariff toward Britain does not reflect the fullness of the McKinley Tariff until 1891/2, when it rises from 35 to 43 per cent. Interestingly, this increase in the bilateral tariff amounted to an exact reversal of the decrease in the bilateral tariff that followed the Tariff Act of 1872.

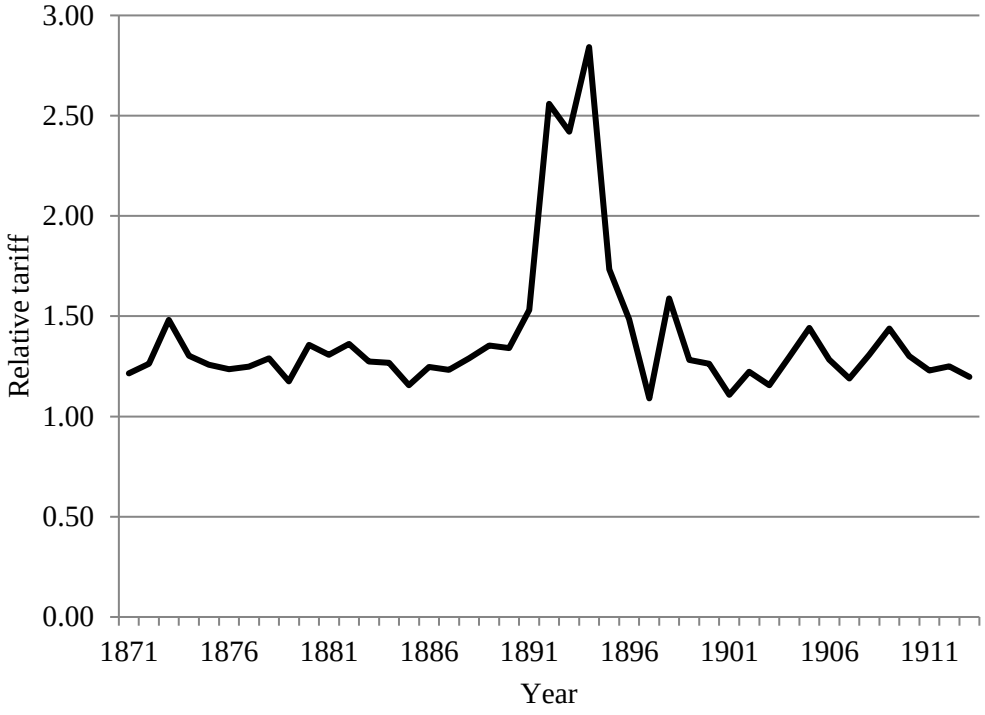
---

[213] Taussig, *Tariff history*, pp. 256-9.

[214] Ibid., pp. 259-66. The schedule of duties on wool manufactures was byzantine because individual articles of importation were subject to both specific and *ad valorem* duties, which together often disguised the actual extent of protection.

[215] In 1890/1, tinplate accounted for 18% of American imports from Britain.

Figure 2.2. *Relative bilateral American tariff toward Britain, 1870/1-1912/3*



Note: The underlying data is presented in table 2.2.

Between 1870/1 and 1889/90, the relative bilateral tariff, depicted in Figure 2.2, fluctuates within the narrow range of 1.2 and 1.5. In 1891/2, the relative bilateral tariff swells to 2.6, and remains at a similarly elevated level through 1893/4. This pronounced increase in the relative bilateral tariff is partly attributable to a higher absolute bilateral tariff, but also attributable to a lower 'average American tariff excluding Britain'. The McKinley Tariff was noteworthy for reducing the duties on certain primary-sector imports, few of which came from Britain. The duty on sugar, which regularly comprised over one-tenth of total American imports, was lifted altogether.

The Wilson-Gorman Tariff of 1894 lowered the *ad valorem* equivalent tariffs for many industries well represented within the composition of imports from Britain. Between 1893/4 and 1894/5, the *ad valorem* equivalent tariff for cotton manufactures declined from 56 to 47 per cent; earthenware and chinaware from 58 to 35 per cent; iron, steel, and manufactures thereof from 50 to 39 per cent; leather and manufactures thereof from 33 to 26 per cent; tinplate from 82 to 57 per cent; and wool manufactures from 97 to 57 per cent. Moreover, the Wilson-Gorman Tariff removed all duties on wool. Indeed, with respect to the bilateral American tariff

toward Britain, the claim of the early tariff historian Ashley that the Wilson-Gorman Tariff was one of 'relatively little change' simply cannot apply.[216] Moving from 1893/4 to 1894/5, the absolute bilateral American tariff toward Britain falls from 45 to 31 per cent—a much sharper movement than occurs following the McKinley Tariff. The relative bilateral tariff gradually returns to its pre-McKinley level, assisted in this trend by the reimposition of duties on sugar.

With the passage of the Dingley Tariff of 1897, the pendulum swung back in the direction of protectionism. As with the McKinley Tariff, cotton manufactures, silk manufactures, tinplate, and wool manufactures were subjected to higher duties. Furthermore, the Dingley Tariff also greatly increased the *ad valorem* equivalent tariff for the alkali industry, from 31 to 50 per cent. This increase had the effect of excluding British alkali exports from the American market swiftly and conclusively.[217]

Although both the McKinley and Dingley Tariffs sharply raised the *ad valorem* equivalent tariff for wool manufactures, the substitution away from imports of British wool manufactures was much greater following the latter act. Whereas between 1889/90 and 1890/1, American imports of British wool manufactures decreased from $29.1 to $19.5 million, between 1896/7 and 1897/8, American imports of British wool manufactures decreased from $23.0 to $7.0 million. The post-Dingley falloff in American imports of British wool manufactures can largely be explained by developments within one particular branch of this industry: worsteds, which are manufactures of combed wool. American manufacturing of worsteds grew by leaps and bounds in the 1880s and 1890s, with Clapham noting that, during these two decades, the number of worsted combs increased by a factor of three, and the number of worsted spindles by a factor of six.[218] Unfortunately, the American trade statistics do not provide a separate classification for worsted imports in their article-country disaggregation section. However, the British trade statistics do, in fact, distinguish worsted exports in their article-country disaggregation section. Considering the category of 'worsted tissues, coatings, broad, all wool', the value of British exports to the United States proceeded as follows: £1.1 million (1896), £1.1

[216] Ashley, *Modern tariff history*, p. 217.
[217] Haber, *Chemical industry*, p. 148.
[218] Clapham, *Woollen and worsted*, p. 253.

Table 2.3. *Dutiable and non-dutiable American imports from Britain, 1898/9 and 1912/3*

	1898/9	1912/3
Bilateral imports ($ million)		
Dutiable	82.2	143.0
Non-dutiable	36.3	152.5
Total	118.5	295.6
Bilateral tariff (per cent)		
Main series (actual non-dutiable share)	36.0	20.5
Main series (counterfactual 1898/9 non-dutiable share)	--	29.4
Alternative series	57.9	46.2

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: The dutiable and non-dutiable bilateral imports do not sum exactly to the total in 1912/3 due to rounding error. The counterfactual main series assumes a constant 1898/9 non-dutiable share of 30.6% of bilateral imports.

million (1897), £0.2 million (1898), and £0.2 million (1899).[219] Here, the impact of the Dingley Tariff is unmistakable. Due to the expanding capacity of American worsted factories, especially in the 1890s, the nearly complete substitution away from imports of British worsteds was possible.

The Dingley Tariff was the longest-governing tariff act in American history, remaining in effect until the Payne-Aldrich Tariff of 1909. During the first decade of the twentieth century, a time of stability within the American tariff regime, the bilateral American tariff toward Britain, expressed as an *ad valorem* equivalent, slowly diminishes, partly due to a trend of rising import prices. Because many duties were imposed on a specific basis (e.g. $0.015 per pound of tinplate), rising import prices reduced the *ad valorem* equivalent of the specific duties.

Another reason for the sustained decline in the main series of the bilateral American tariff toward Britain was the growing non-dutiable share of bilateral imports. As evident from Table 2.3, the value of non-dutiable imports from Britain increased by 320 per cent from 1898/9-1912/3, while the value of dutiable imports increased by only 74 per cent in the same period. As has been previously noted, the growing non-dutiable share results in a divergence between the main and alternative series of the bilateral American tariff toward Britain, since non-dutiable imports are included in the calculation of the main series only. Table 2.3 presents an illustrative counterfactual; if the 1898/9 non-dutiable share (31 per cent) of bilateral imports remained constant, then the main series would have declined by only 7 per cent from 1898/9-1912/3, rather than by 16 per cent. The relative growth of non-dutiable

[219] 'All wool' indicates that the worsted is composed solely of wool, as opposed to a mixture of wool and some other textile material.

imports accounts for the majority of the post-Dingley decline in the main series of the bilateral American tariff toward Britain.

The increasing non-dutiable share was not because the Dingley Tariff reclassified dutiable imports as free imports; indeed, the movement was generally in the reverse direction. Rather, the increasing non-dutiable share was due to the extraordinary growth of certain bilateral imports that had traditionally been admitted free of duty. Many of these non-dutiable bilateral imports were primary-sector imports that did not originate in Britain, but formed part of Britain's entrepôt trade.[220] Nevertheless, the *Foreign Commerce* treats these British re-exports as bilateral imports from Britain, not bilateral imports from the country or colony of origin. India-rubber and tin, two commodities prominent in Britain's entrepôt trade, contributed greatly to the rising share of non-dutiable imports from Britain.[221] India-rubber enjoyed applications in the American automobile industry, and bilateral imports of this commodity increased from $7.0 million in 1898/9 to $33.6 million in 1912/3. The continued expansion of the American tinplate industry in the early twentieth century necessitated greater imports of tin, and bilateral imports of this commodity increased more than tenfold during the same interval, amounting to $24.7 million in 1912/3.

Though obvious, it is equally appropriate to attribute the decline in the main series to the decreasing share of dutiable imports. Undoubtedly, the growth of dutiable bilateral imports was hampered by an ongoing substitution in favour of domestic commodities. Alkali and worsteds were subject to a sudden foreign-domestic substitution in the wake of the Dingley Tariff. Other industries, such as the silk textile industry, were subject to a more gradual foreign-domestic substitution commensurate with the more gradual expansion of domestic production.[222]

---

[220] For a discussion of the rapid growth in British re-exports to the United States, see Saul, *British overseas trade*, p. 59. He attributed this growth, in part, to the 'poor condition of the American merchant marine'.

[221] These commodities were mostly re-exported from British colonial possessions in Southeast Asia.

[222] Despite the Dingley Tariff raising the *ad valorem* equivalent tariff on silk manufactures, there was no immediate decline in the value of silk manufactures imported from Britain. In the first decade of twentieth century, the value imported from Britain remained stagnant, while the gross value of silk manufactures produced domestically nearly doubled between the census years of 1899 and 1909. *Census of manufactures, 1909*, p. 151.

Estimating the inter-temporal determinants of Anglo-American trade costs

To estimate the determinants of Anglo-American trade costs, the panel regression employed by Jacks et al. is adapted for a single bilateral trade flow, resulting in the following time-series regression equation (with time subscripts suppressed):

$$\Delta\, ln(COSTS) = \beta_0 + \beta_1 \Delta\, ln(TARIFF) + \beta_2 \Delta\, ln(EXCHANGE) + \beta_3 \Delta\Delta\, ln(FREIGHT) + \beta_4 (GOLD) + \beta_5 \Delta\, ln(RAILWAY) + \epsilon \qquad (2.5)$$

COSTS are Anglo-American trade costs, as calculated by Jacks et al. Recall that trade costs are a standardized measure of the difference between the actual volume of bilateral trade and the volume of bilateral trade in the absence of any trade barriers. *TARIFF* is a measure of the tariff level in bidirectional Anglo-American trade, and the calculation of this variable is discussed shortly. *EXCHANGE* is the exchange rate volatility between the dollar and sterling. *FREIGHT* is a semi-parametric index of Anglo-American ocean freight rates, as estimated by Jacks and Pendakur.[223] *GOLD* is a dummy variable taking a value of 1 for the years 1879-1913, when both Britain and the United States were on the gold standard. *RAILWAY* is a measure of railway density, calculated as the product of the ratios of railway length per land surface area in Britain and the United States. All continuous variables are expressed in natural logarithms. The data source for all variables, except for certain measures of *TARIFF*, is the same as for Jacks et al.[224]

Equation 2.5 resembles the panel regression of Jacks et al. in all but two respects. First, most of the variables are further transformed to eliminate unit roots. An Augmented Dickey-Fuller test indicates that *COSTS*, *TARIFF*, *EXCHANGE*, and *RAILWAY* are integrated of the first order, and so these variables are differenced once, whilst *FREIGHT* is integrated of the second order, and so this variable is differenced twice.[225] As a time-series regression, equation 2.5 cannot exploit the variation across country pairs, as was done in Jacks et al. Thus, the second discrepancy between equation 2.5 and the panel regression of Jacks et al. is, inevitably, the exclusion of time-invariant variables. To be clear, the analysis here can only identify the inter-temporal determinants of Anglo-American trade costs. As a consequence, the effect of distance, a variable of fundamental importance to

[223] Jacks and Pendakhur, 'Transport revolution'.

[224] I thank David Jacks for making this data available on his website: http://www.sfu.ca/~djacks/data/publications/.

[225] After this differencing, the null hypothesis of a unit root is rejected at the 1% level for all variables.

Table 2.4. *Determinants of Anglo-American trade costs, 1872-1913*

	(1)	(2)	(3)	(4)	(5)	(6)
TARIFF1	4.66*			3.95		
	(2.69)			(2.62)		
TARIFF2		7.10***			6.07**	
		(2.27)			(2.26)	
TARIFF3			9.87***			7.96***
			(2.89)			(2.82)
EXCHANGE	0.49	0.56	0.96			
	(0.70)	(0.65)	(0.65)			
FREIGHT	31.57	37.53	44.36*			
	(25.55)	(23.67)	(23.54)			
GOLD	-1.08	-1.20	-1.05			
	(0.89)	(0.82)	(0.80)			
RAILWAY	-8.13	-10.47	-5.97			
	(11.12)	(10.31)	(10.13)			
Constant	1.57	1.85*	1.41	0.28	0.34	0.23
	(1.03)	(0.95)	(0.92)	(0.31)	(0.30)	(0.29)
R^2	0.13	0.26	0.29	0.05	0.15	0.17
DW statistic	1.92	1.83	1.75	1.98	1.84	1.91
Observations	42	42	42	42	42	42

Sources: The source for all variables, except *TARIFF2* and *TARIFF3*, is the data underlying Jacks et al., 'Trade costs', located at: http://www.sfu.ca/~djacks/data/publications/. For the sources for *TARIFF2* and *TARIFF3*, see text.

Notes: All coefficients and standard errors have been rescaled by a factor of 100. Standard errors are noted in parentheses. * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

gravity models, cannot be estimated directly. Instead, the effect of distance is estimated indirectly by exploiting the inter-temporal variation in the costliness of distance, as measured by ocean freight rates.

Three different calculations of *TARIFF* are considered in the estimation of the regression. *TARIFF1* is the product of the average British tariff and the average American tariff. This variable represents the standard measure of the tariff level used in gravity models. *TARIFF2* is the product of the average British tariff and the main series of the bilateral American tariff toward Britain ($MAIN_{b,t}$). *TARIFF3* is the product of the average British tariff and the alternative series of the bilateral American tariff toward Britain ($ALTERNATIVE_{b,t}$), which accounts for the substitution effect.

The results of the regression are reported in Table 2.4. In every specification of the regression, all of the coefficients take on the expected sign, which is positive for *TARIFF*, *EXCHANGE*, and *FREIGHT*, and negative for *GOLD* and *RAILWAY*. However, most of the coefficients are statistically insignificant at conventional

levels. Of particular surprise is the statistical insignificance of the coefficient of *FREIGHT* in all but the third specification, in which case the coefficient is significant only at the 10% level. Given what has already been mentioned, the appropriate inference here is not that distance was meaningless in Anglo-American trade, but rather that it is ambiguous whether or not the declining costliness of distance exerted an effect on trade costs. The recent work of Inwood and Keay may provide one possible explanation for this finding. They emphasized the importance of total transport costs, including both ocean freight rates and inland transport costs, in determining the volume of British pig iron exports to the United States and Canada.[226] Most pig iron exports to these countries were destined for Pittsburgh and Hamilton for further processing. For this single commodity, therefore, the cost of inland transport is measurable. However, for entire bilateral trade flows encompassing diverse commodities destined for diverse locations, the cost of inland transport is not directly measurable.

The coefficient of *TARIFF1* is barely statistically significant at the 10% level (p-value = 0.092). By comparison, the coefficients of *TARIFF2* and *TARIFF3* are statistically significant at the 1% level. Moreover, the second and third specifications of the regression provide twice the explanatory power of the first specification. These improvements in the outcome of the regression are achieved solely through calculations of *TARIFF* that include a bilateral measurement of the tariff level for just one of the directions of Anglo-American trade, that is, British exports to the United States.[227] The fourth through sixth specifications, which isolate the effect of *TARIFF* on Anglo-American trade costs, are generally consistent with the first through third specifications, although the coefficients are slightly diminished.

The coefficient of *TARIFF3*, which accounts for the substitution effect, expectedly exceeds that of *TARIFF2*, which does not. Still, the coefficients of both *TARIFF2* and *TARIFF3* are greater than the coefficient of *TARIFF1*. In view of these differences, there arises the question of how to interpret the coefficients in a meaningful way. Recall the log-difference expression of both *COSTS* and *TARIFF*. In lieu of a theoretical interpretation of the coefficient, this chapter offers an

[226] Inwood and Keay, 'Iron trade', p. 118-19.

[227] In general, bilateral measurements of the tariff level for both directions of bilateral trade would be preferable. However, this consideration is less pressing for country pairs that include Britain, given its unique adherence to a policy of free trade.

interpretation of the coefficient grounded in historical events, specifically the principal American tariff acts of the late nineteenth century. Based upon the more conservative coefficient of *TARIFF2* (0.071) and the annual changes in the main series of the bilateral American tariff toward Britain, the one-period effects of the McKinley, Wilson-Gorman, and Dingley Tariffs on bidirectional Anglo-American trade costs were +1.4 per cent, -2.7 per cent, and +2.9 per cent, respectively.[228] The two-period effects were +1.6 per cent, -3.4 per cent, and +3.1 per cent. Altogether, changes in American commercial policy during the first era of globalization altered the wedge between the actual and frictionless volumes of Anglo-American trade to a degree that was modest, but hardly negligible. In comparison, Anglo-American trade costs declined by only 8.0 per cent between 1870 and 1890.[229]

Did the determinants of Anglo-American trade costs conform to the determinants of bilateral trade costs in general? To answer this question involves comparing the inter-temporal determinants of Anglo-American trade costs with the inter-temporal *and* cross-sectional determinants of bilateral trade costs in general. Though such a comparison is admittedly imperfect, it will nonetheless be made. When Jacks et al. considered the bilateral trade costs of only the country pairs that included Britain, they found that tariffs were not a statistically significant determinant. In this respect, Anglo-American trade represents a departure from the normal pattern of British trade, which was generally unaffected by foreign protection. Jacks et al. found that *EXCHANGE*, *FREIGHT*, and *GOLD* were determinants of bilateral British trade costs, but the analysis here finds that these variables were not inter-temporal determinants of the subset Anglo-American trade costs. Finally, in neither case does the variable *RAILWAY* take on a statistically significant coefficient, which Jacks et al. speculated may have been attributable to the greater importance of ocean freight rates in determining bilateral British trade costs.[230]

[228] These figures adjust for the slight annual variation in the average British tariff, so as to isolate fully the effects of the respective American tariff acts. The figures for the McKinley Tariff assume an imposition year of 1891, for reasons already described.

[229] This figure was calculated using the data underlying Jacks et al., 'Trade costs'.

[230] Jacks et al., 'Trade costs', p. 135.

Conclusion

In *Studies in British Overseas Trade, 1870-1914*, Saul wrote that 'it seems unlikely that in the period before 1914 tariffs seriously hindered the development of [British] trade, taken as a whole'.[231] Similarly, the econometric analysis of Jacks et al. revealed that tariffs were not a statistically significant determinant of Britain's trade costs. However, it is crucial that any emerging consensus that British trade was unaffected by tariffs be qualified to exclude Anglo-American bilateral trade. As this chapter has proven, tariffs were an inter-temporal determinant—the sole inter-temporal determinant—of Anglo-American trade costs during the first era of globalization.

The determinacy of tariffs for Anglo-American trade costs only became apparent once the variable for tariffs incorporated a measure of the bilateral American tariff toward Britain. The contribution of a bilateral tariff series was nothing less than an altered understanding of the largest bilateral flow of trade in the first era of globalization. With empirically correct tariff variables, it is possible that even the general understanding of trade during this period may be altered. Such an alteration would be likely to attribute greater importance to the effect of tariffs on trade.

[231] Saul, *British overseas trade*, p. 165. This passage was reproduced in Hatton, 'British exports', p. 583.

III: British capital and merchandise exports, 1870-1913

Introduction

One of the main contributions of the Ford thesis was to identify a causal relationship between British capital and merchandise exports during the late nineteenth century, whereby British *ex ante* lending to a given country preceded an increase in British merchandise exports to that country by a period of one or two years.[232] Ford specified two channels of causation. First, since the majority of British overseas lending was allocated to social overhead projects, these projects required capital goods, such as machinery and steel, which Britain exported in abundance.[233] Second, lending tended to increase the income of the borrowing country and thus raise its demand for manufactured consumption goods, which Britain also exported.

According to Ford, the causal relationship between British capital and merchandise exports functioned as an important equilibrating mechanism in the gold standard regime of the late nineteenth century.[234] Increased demand for merchandise exports diminished the extent to which overseas lending was settled in Britain's multilateral balance of payments through a transfer of specie, *ceteris paribus*. As the historical record indicates, the outflow of specie from Britain, even during peak periods such as the late 1870s, remained only a small component of the balance of payments.[235] Equilibrating mechanisms operated to prevent the acute outflow of specie from Britain, but was Ford's proposed relationship between British capital and merchandise exports one of these mechanisms? Subsequent scholars have expressed their doubts.

For the purposes of this chapter, it will prove convenient to conceptualize Ford's argument as a lending-export loop, albeit an imperfect loop, since borrowed British capital was oftentimes diverted toward the purchase of imports from countries other than Britain. On this point, Brown argued that borrowing countries had, on average, low marginal propensities to import either capital or consumption goods

[232] Ford, 'British foreign lending', p. 305. *Ex ante* lending occurred when a creditor country committed to exporting capital, with the commitment usually taking the form of a primary security issue. The lending became *ex post* when the creditor country actually exported merchandise, services, or specie.

[233] Simon, 'Portfolio foreign investment', p. 25. Between 1865 and 1914, nearly 70% of British portfolio foreign lending was directed toward social overhead capital.

[234] Ford, 'Gold standard', p. 59.

[235] Imlah, *Pax Britannica*, pp. 72-4.

from Britain.[236] In other words, the diversion of capital from the lending-export loop was significant. In support of this assertion, he invoked Tinbergen's finding that the marginal effect of British capital exports on British capital *goods* exports was just one-quarter during the period from 1880-1908. [237] Nevertheless, Brown acknowledged that there was likely considerable variation among the bilateral marginal propensities to import from Britain.

Brown identified New Zealand as a colony with a 'high' marginal propensity to import from Britain.[238] Because New Zealand relied on Britain for more than three-fifths of its imports during the late nineteenth century, the likelihood is that the marginal propensity of New Zealand to import from Britain was quite high, certainly higher than the cross-country average of one-quarter.[239] Even within the context of the British Empire, New Zealand stands out for its atypically strong bilateral trade with Britain.[240] In 1890, New Zealand obtained 67 per cent of its imports from Britain, compared to other high-income colonies of the British Empire: Canada (38 per cent), New South Wales (38 per cent), and Victoria (42 per cent).[241] The discrepancy between New Zealand and Canada was largely due to the latter importing manufactured goods from the neighbouring United States. As for the Australian colonies, inter-colonial trade amongst each other reduced the share of Britain within the country-compositions of imports, since the trade statistics of these colonies treat inter-colonial trade as external. Adjusting for this convention by treating all Australasian inter-colonial trade as internal, New Zealand still had the highest share of Britain in imports (82 per cent), followed by New South Wales (74 per cent) and Victoria (66 per cent).[242]

---

[236] Brown, 'World economy', p. 52.

[237] See Tinbergen, *Business cycles*, p. 41.

[238] Brown, 'World economy', p. 52.

[239] Between 1870 and 1914, the total nominal value of New Zealand's imports was £428.4 million, of which £263.4 million came from Britain; calculated from *Official statistics of the colony (dominion) of New Zealand*.

[240] On this point, Platt, 'Recent settlement', p. 112, was even more emphatic: 'Britain's competitive position in New Zealand was almost absurdly strong'.

[241] Calculated from *Statistical year-book of Canada for 1890*; *New South Wales statistical register for 1890*; *Statistical register of the colony of Victoria for the year 1890*.

[242] Treating the trade between New Zealand and the six Australian colonies as internal is quite appropriate for the period prior to the Australian Federation (1901), which New Zealand considered joining. The seven Australasian colonies were New South Wales, New Zealand, Queensland, South Australia, Tasmania, Victoria, and Western Australia.

Several factors contributed to the exceedingly high share of Britain within the country-composition of New Zealand's imports. The comparatively small domestic market of New Zealand offered limited economies of scale for a manufacturing sector and, in this way, helped to ensure that the colony continued to import manufactured goods from the 'workshop of the world'.[243] Another explanation for the high share of Britain in imports is the high share of Britain in exports, and vice versa. Ships carrying manufactured goods to New Zealand returned to Britain with cargoes of primary goods, in a mutually reinforcing system that maintained the high share of Britain in New Zealand's total trade. As for New Zealand's leading export, wool enjoyed a growing demand from the textile mills of Yorkshire.[244] In the 1880s, when the advent of refrigerated shipping made possible the export of meat and dairy, high-income Britain once again proved an eager customer. Further strengthening bilateral commerce was regular steamship service between London and New Zealand, which began in the 1870s.[245] Moreover, as Hawke observed, merchant firms dealt in both imports and exports and, therefore, served as important 'institutional links' between Britain and New Zealand.[246]

Indeed, New Zealand presents an ideal case for ascertaining the presence of a causal relationship between British capital and merchandise exports, since the lending-export loop would have been little attenuated by demand for merchandise imports from countries other than Britain. In this respect, New Zealand surpasses even Argentina, which figures most prominently in Ford's empirical test of his theory. However, the validity of the Ford thesis should not rest upon the case of New Zealand (or Argentina) alone. Accordingly, this chapter follows a twofold approach for assessing the empirical validity of the Ford thesis. The first part involves estimating a regression for a panel of countries (colonies). In this endeavour, the analysis benefits from Stone's numerous series on bilateral British overseas lending that had been unavailable to those scholars critical of Ford's argument. The second

[243] See, for example, Schedvin, 'Staples and regions', p. 544, which attributed the absence of a wool textile industry in New Zealand to the limited domestic market there, compared to in Britain. Partly for this reason, Schedvin considered New Zealand as having become caught in a staple trap in the late nineteenth century. See also Watkins, 'Staple theory'.

[244] Between 1870 and 1913, British imports of wool increased by 204%, while imports of cotton increased by only 82%; calculated from *Annual statements of the trade of the United Kingdom*.

[245] Simkin, *Dependent economy*, p. 154.

[246] Hawke, *The making*, p. 60.

part involves a bilateral case study of New Zealand, which should allow for a more granular understanding of whether and how the lending-export loop operated. Neither the first nor second parts of the approach should be regarded as superior to the other. A more representative sample inevitably entails the inclusion of countries with lower shares of Britain in the country-compositions of their imports. Finally, while this chapter primarily aims to determine whether there existed a causal relationship between British capital and merchandise exports in the late nineteenth century, it also looks to gauge the magnitude of such a relationship, provided one existed.

The findings of this chapter should appeal to monetary and trade historians alike. For monetary historians, the absence of a Fordian lending-export loop would imply that other equilibrating mechanisms accommodated Britain's overseas investment in the balance of payments.[247] For trade historians, the absence of this loop would imply that British *ex ante* lending was not a proximate determinant of British merchandise exports. For instance, the post-Baring falloff in British overseas lending in 1891 would not have resulted in any discernible decrease in British merchandise exports in 1892, assuming a one-year correspondence, or in 1893, assuming a two-year correspondence.[248]

This chapter proceeds as follows. The next section discusses the Ford thesis in greater detail, as well as its subsequent treatment in the literature. This section also relates Ford's argument to some more recent research on the effect of empire on capital and commodity flows. The chapter then proceeds to an empirical test of the Ford thesis, taking advantage of Stone's data on bilateral British overseas lending. The next section offers a case study of British capital and merchandise exports to New Zealand. The final section offers some concluding remarks.

Literature

Ford presented his argument for a causal relationship between late nineteenth-century British capital and merchandise exports in several articles published during the late 1950s and early 1960s. The initial articulation of his argument in 1958 states

[247] One such equilibrating mechanism was the 'rules of the game'; see Whale, 'Pre-war gold standard'.

[248] Between 1890 and 1891, British overseas lending contracted by just over half; calculated from Simon, 'Portfolio foreign investment', p. 38.

that British *ex ante* lending, usually taking the form of a primary security issue in London, preceded an increase in British merchandise exports to the borrowing country.[249] Social overhead projects in the borrowing country raised demand for British capital goods exports, whilst higher income arising from the social overhead projects raised demand for British consumption goods exports. The demand for capital goods exports can be regarded as the direct channel of the lending-export loop, whilst the demand for consumption goods exports can be regarded as the indirect channel.[250] Although Ford focused on Argentina, he maintained that the relationship between lending and exports was 'typical of a large part of British investment overseas'.[251]

In a subsequent article, Ford considered whether the relationship between British capital and merchandise exports held in aggregate, and not just in the case of Argentina. Visually inspecting the deviations of aggregate *ex ante* lending and aggregate merchandise exports from their respective nine-year moving averages, Ford established that the inter-temporal relationship between lending and exports was either one or two years.[252] Backed by only this crude evidence, Ford's argument nevertheless persisted within the discipline of economic history for several decades.[253]

Hatton found only the weakest possible empirical support for Ford's argument. He estimated a demand function for total, i.e. not bilateral, British exports during the period from 1870-1913 that included an explanatory variable for British *ex ante* lending. In the initial specification of the regression, which included explanatory variables for the main potential determinants of the demand for British exports, lending was the only explanatory variable without a statistically significant coefficient.[254] When Hatton omitted the explanatory variable for the growth of industrial production in advanced economies, only then did lending acquire a statistically significant, though very small coefficient.[255] Although this finding casts

---

[249] Ford, 'British foreign lending', p. 305.

[250] It should be noted that Ford did not use this exact terminology.

[251] Ford, 'British foreign lending', p. 305.

[252] Ford, 'British economic fluctuations', pp. 335-6.

[253] See, for example, Kennedy, 'Foreign investment', p. 436; Lewis, *Growth and fluctuations*, p. 119.

[254] Hatton, 'British exports', pp. 584-5. Hatton also tried leading British overseas lending by one and two years, but doing so did not alter his results.

[255] Ibid.

doubt upon the existence of a causal relationship between British capital and merchandise exports at the aggregate level, there remains the possibility that such a relationship existed at the disaggregated (bilateral) level, especially for countries with strong financial and trade links to Britain, such as New Zealand.

Like Hatton, Eichengreen too assessed whether a Fordian lending-export loop operated, though with the broader objective of identifying equilibrating mechanisms during the classical gold standard, rather than identifying a determinant of British merchandise exports *per se*. Toward this end, Eichengreen estimated a battery of regressions, each with a different dependent variable. When the dependent variable was British merchandise exports, the joint significance of the three variables for British overseas lending, led by one, two, and three years relative to the dependent variable, failed to indicate a causal relationship between lending and exports.[256] Later in his analysis, Eichengreen found that a positive shock to lending did not induce any substantial short-term increase in exports, but did raise exports above the steady-state level in the longer term.[257] Differentiating between short-term and long-term causal relationships between British capital and merchandise exports is important. Certainly, British overseas investment in social overhead projects, such as railways, could have facilitated a long-term structural increase in British merchandise exports. However, it should be emphasized that the scope of Ford's own argument did not extend beyond the short term.

Situating Ford's argument within economic theory is a difficult task, partly because it pertains specifically to late nineteenth-century Britain, which was far-and-away the foremost supplier to the international markets for both credit and manufactured goods. The Fordian lending-export loop therefore attempts to characterize an economically exceptional country during the period when its exceptionality was most pronounced. Given Mundell's finding that, in a 2x2x2 Heckscher-Ohlin model, the movement of factors and the movement of goods are usually substitutes for each other, Ford's argument describes an unusual economic case.[258] Yet, the nature of British overseas lending in the late nineteenth century helps to explain why British capital and merchandise exports were complements,

[256] Eichengreen, 'Alec Ford', p. 66.

[257] Ibid., p. 68.

[258] Mundell, 'International trade'. He found that factor immobility increases trade flows, due to commodity price equalization, and that trade restriction increases factor mobility, due to factor price equalization.

rather than substitutes. The majority of British overseas lending took the form of social overhead capital: railways, tramways, bridges, ports, etc. In this respect, the movement of a factor (capital) did not directly induce the development of manufacturing in borrowing countries, but instead facilitated greater economic integration. British overseas investment funded the creation of a transport infrastructure and, consequently, the geographic expansion of the market for British exports.

To a great extent, Ford's argument is one about the British Empire, which absorbed nearly two-fifths of British capital exports during the half-century before the First World War.[259] To be sure, the vast sums that London channeled to the Empire were the response of a well-functioning capital market to the infrastructural needs of (more often than not) settler colonies. However, recent research suggests that the large share of lending to the Empire was partly attributable to the penchant that British investors exhibited for the Empire. Ferguson and Schularick estimated that membership in the British Empire conferred, on average, an approximately 100 basis-point reduction in the cost of capital borrowed in London, even after controlling for factors such as gold standard membership.[260] This preference for the Empire was hardly irrational, however. The common British investor, facing information asymmetries, readily identified the Empire with British legal institutions and commercial policies, that is to say, the underpinnings of secure and profitable investment.[261]

As with capital exports, British merchandise exports also exhibited a distinct empire effect during this period. Mitchener and Weidenmier quantified this effect using a gravity model. They found that membership in the British Empire alone more than doubled intra-Empire bilateral trade.[262] This finding was reinforced by Jacks et al., who estimated the determinants of bilateral trade costs, a standardized measure of the difference between actual and frictionless bilateral trade. When both trading

[259] Simon, 'Portfolio foreign investment', p. 24. This figure excludes Argentina, which is often treated as part of the informal Empire.

[260] Ferguson and Schularick, 'Empire effect', p. 297.

[261] Ibid., p. 284. For a discussion of the information asymmetries that British investors confronted, see Magee and Thompson, *Empire and globalisation*, pp. 180-98.

[262] Mitchener and Weidenmier, 'Trade and empire', pp. 1813-4.

partners were members of the British Empire, bilateral trade costs were halved, *ceteris paribus*.[263]

Long before it was quantified, the powerful effect of empire on trade had caused some scholars to regard Britain's imperial markets as soft, which generally meant that British exporters did not have to compete against foreign exporters either to secure or maintain these markets. Thompson and Magee challenged the so-called 'soft market' thesis.[264] According to them, three criteria must be satisfied in order for a market to be considered soft.[265] First, per-capita spending on British exports must increase over time. Second, the share of per-capita income spent on British exports must increase over time. And third, the growth rate of per-capita spending on British exports must meet or exceed the growth rate of per-capita spending on the exports of other countries. Thompson and Magee, who focused their analysis on the Dominions, found that neither Australasia nor Canada satisfy all three criteria, although Australasia had debatable soft-market tendencies in the 1870s.[266] The implication of this finding for the Ford thesis is that the marginal effect of British capital exports on British merchandise exports varied, not only across countries and colonies, but also across time, and it depended upon how successfully British firms competed in each particular imperial market.

Empirical analysis

The method for testing the empirical validity of the Ford thesis is a country (colony) panel regression for the period from 1870-1913. The main specification of the regression equation can be written as follows:

$$ln\left(\frac{EXPORTS_t}{EXPORTS_{t-1}}\right) = C + \alpha_0\, ln\left(\frac{LENDING_t}{LENDING_{t-1}}\right) + \alpha_1\, ln\left(\frac{LENDING_{t-1}}{LENDING_{t-2}}\right) + \alpha_2\, ln\left(\frac{LENDING_{t-2}}{LENDING_{t-3}}\right) + \beta\, ln\left(\frac{GDP_t}{GDP_{t-1}}\right) + \gamma\, ln\left(\frac{TERMS_t}{TERMS_{t-1}}\right) + \epsilon \qquad (3.1)$$

The dependent variable is real bilateral British merchandise exports. The explanatory variables of interest are real bilateral British *ex ante* lending led by one and two years relative to the dependent variable. This involves, for example, pairing merchandise

[263] Jacks et al., 'Trade costs', p. 135.

[264] Thompson and Magee, 'Soft touch'. They acknowledged that previous scholars have not agreed upon a formal definition of a 'soft market', which remains a somewhat vague term, although tends to imply some lack of competition.

[265] Ibid., p. 701.

[266] Ibid., pp. 703-5.

exports in 1902 with lending in the years 1901 (one-year lead) and 1900 (two-year lead). Other explanatory variables are current-year lending, real GDP, and the terms of trade. The sources of data, including the deflators used, are noted in Appendix 3.1.

The panel includes five countries: Australia, Canada, New Zealand, Uruguay, and the United States, which are selected largely on account of their non-negligible borrowings from Britain and their adherence to the gold standard for uninterrupted intervals of sufficient length.[267] Because a currency revaluation would have affected the volume of bilateral British exports, the panel excludes those countries that either abandoned the gold standard or joined too late to exhibit enough inter-temporal variation, as did many of the Latin American countries.[268] Since Uruguay and the United States joined the gold standard in 1876 and 1879, respectively, the panel is slightly unbalanced by the exclusion of annual observations for these countries prior to their joining the gold standard. Even though the panel includes only five countries, together these countries represent 43 per cent of British overseas lending during the period from 1880-1913.[269] British lending and merchandise exports to these five countries, collectively, are plotted in Figure 3.1. Because Stone does not report any lending for New Zealand in 1870 and for Uruguay in 1877, 1879, 1892-4, 1898, and 1903-4, £0.1 million is added to every observation in the sample, so as to permit a log-difference expression of the variable. All variables are expressed in log differences in order to make the series stationary.[270] Augmented Dickey-Fuller test statistics for all variables are reported in Appendix 3.2.

Before proceeding to the results of the panel regression, some attention must be given to Stone's annual series of bilateral British *ex ante* lending. Stone constructed these series using the data on London capital calls that Jenks and Simon assembled

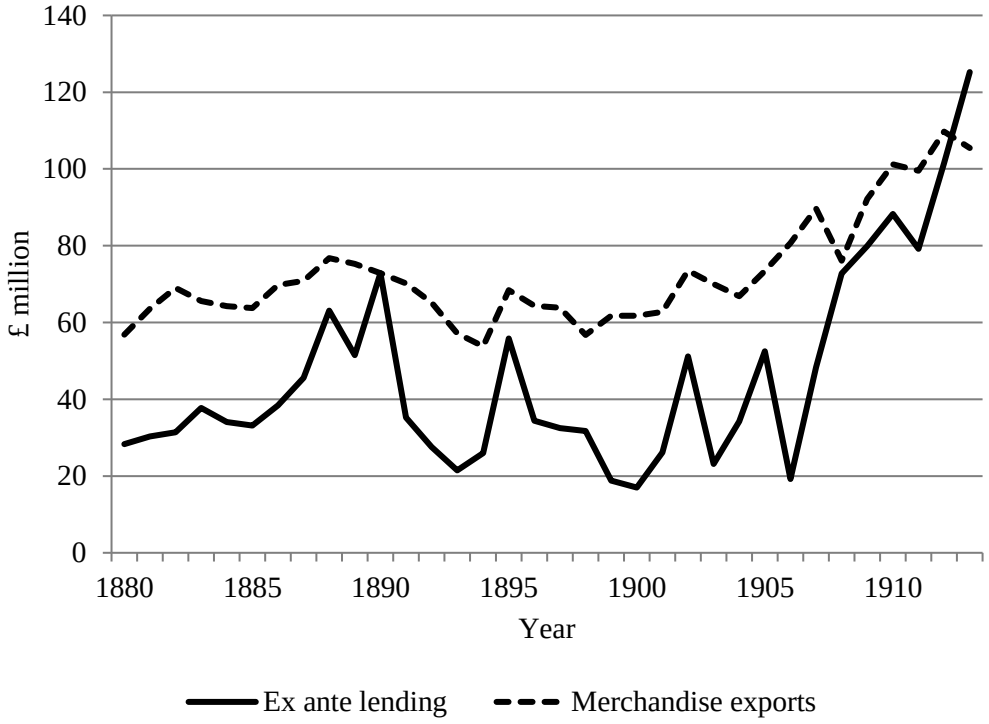
[267] It should be noted that these phenomena are related, as the creditworthiness of the borrowing country was enhanced by adherence to the gold standard; see Bordo and Rockoff, 'Seal of approval'.

[268] Notably, the panel excludes Argentina, which had a chequered participation in the classical gold standard.

[269] Calculated from Stone, *Global export*. The shares of the countries are as follows: Australia (9%), Canada (10%), New Zealand (2%), Uruguay (1%), and the United States (21%).

[270] The log-difference expression of the variables prevents the inclusion of (time-invariant) distance. In other words, the empirical strategy cannot take the form of a gravity model. Most gravity models in economic history use time fixed effects, which is not a feasible approach here, given the small number of countries in the panel.

Figure 3.1. *British lending and exports to five countries, 1880-1913*



Sources: See appendix 3.1.
Notes: The five countries are Australia, Canada, New Zealand, Uruguay, and the United States. Both series have been deflated, as noted in appendix 3.1, and are expressed here in 1880 values.

from more than forty sources, the *Investor's Monthly Manual* chief among them.[271] However, whereas Simon's (published) series are disaggregated by continent, Stone's series are disaggregated by country. Simply put, Stone's series represent a reclassification of the original Jenks-Simon data. In a temporal sense, capital calls are consistent with Ford's notion of *ex ante* lending, since both evidence a commitment to transfer capital, which precedes an *ex post* transfer of capital in the balance of payments, either through the export of merchandise, services, or specie.[272] For the purposes of the analysis here, capital calls and *ex ante* lending are interchangeable terms. However, Stone's series encompass just British portfolio foreign lending, whilst excluding foreign direct investment and other forms of lending conducted through the international banking system.[273] Moreover, there is

[271] Simon, 'Portfolio foreign investment', p. 18. These sources are listed in Stone, *Global export*, pp. 419-20.
[272] For a discussion of what constitutes a capital call, see Stone, *Global export*, p. 4.
[273] Stone, *Global export*, p. 423.

Table 3.1. *Bilateral British merchandise exports, 1871-1913*

	(1)	(2)	(3)	(4)	(5)
Lending	0.81	0.78	0.88	0.76	1.58
	(1.43)	(1.42)	(1.42)	(1.42)	(1.44)
Lending, one-year lead	0.16	0.12		0.27	1.00
	(1.46)	(1.44)		(1.44)	(1.44)
Lending, two-year lead	2.73*	2.69*		2.91**	3.29**
	(1.40)	(1.38)		(1.38)	(1.41)
Cumulative lending			1.48		
			(1.14)		
GDP	57.74***	58.07***	58.34***	55.08***	
	(18.30)	(18.13)	(18.19)	(18.03)	
Terms of trade	21.75	22.21	23.10		16.80
	(16.96)	(16.76)	(16.80)		(17.01)
Constant	0.81	0.80	0.73	1.09	2.93**
	(1.33)	(1.32)	(1.32)	(1.30)	(1.15)
Country fixed effects	YES	NO	NO	NO	NO
Overall R^2	0.08	0.08	0.07	0.07	0.04
Observations	200	200	200	200	202

Sources: See appendix 3.1.

Notes: All variables are expressed in log differences. All coefficients and standard errors have been rescaled by a factor of 100. Standard errors are noted in parentheses. * indicates statistical significance at 10%, ** at 5%, and *** at 1%.

the problem of double counting British overseas lending.[274] Take the case of the Wellington and Manawatu Railway Co., incorporated in 1881 and capitalized—the former premier of New Zealand traveled to Britain to arrange the financing—at £850,000.[275] In 1908, New Zealand nationalized the railway at a cost of £900,000 and borrowed the funds necessary for doing so.[276] Whereas the first instance of lending would be expected to raise the demand for British merchandise exports, the second instance would not. Without denying that Stone's series present certain shortcomings with respect to the present exercise, these series are nevertheless used in the foregoing analysis, as they remain the only series of bilateral British *ex ante* lending.

The results of the panel regression are presented in Table 3.1. The first two specifications are identical, except for the use of country fixed effects in column 1 and random effects in column 2. Because the Hausman test indicates that there are no systematic differences in the coefficients, column 2 represents the preferred

[274] Stone mitigated this problem by excluding from his series those capital calls arising from debt consolidations; see ibid., p. 426.

[275] Le Rossignol and Stewart, 'Railways in New Zealand', p. 663.

[276] Ibid., pp. 664-5.

specification, and all further specifications employ random effects. The notable finding in column 2 is that lending (two-year lead) takes on a positive and statistically significant coefficient. It is also reassuring that GDP is statistically significant at the 1% level. In column 3, the variables for lending (one-year lead) and lending (two-year lead) are 'cumulated' in such a manner that the resulting variable is the log difference of lending between periods $t - 3$ and $t - 1$. If a Fordian lending-export loop operated with a one-year lead on some occasions and with a two-year lead on other occasions, then the division of British *ex ante* lending between two separate explanatory variables could obfuscate the relationship between British capital and merchandise exports. However, such is not the case, as indicated by the statistically insignificant coefficient of the variable for cumulative lending. Columns 4 and 5 exclude GDP and the terms of trade, respectively. Excluding these explanatory variables increases the magnitude and statistical significance of lending (two-year lead).

In many respects, the model presented here is reminiscent of the model put forward by Hatton. Both are export demand functions for Britain during the period from 1870-1913. What then explains the stronger showing of British *ex ante* lending (two-year lead) in this model than in Hatton's model? One potential explanation lies in what Edelstein describes as 'short bursts' in bilateral British lending.[277] For New Zealand, this burst came in the 1870s. For Uruguay, it came in the late 1880s. Other countries realized their short bursts at different times. Such country-specific episodes of British overseas lending are dampened in Hatton's model, but are exploited in the panel regression here. To provide a sense of how much variation is lost through the aggregation of bilateral lending, Table 3.2 presents the correlation coefficients of bilateral British lending to all of the countries (colonies) included in the panel. None of the coefficients is statistically significant at any conventional level, reaffirming the desynchronized nature of bilateral lending.

The meaningful interpretation of the coefficient of lending (two-year lead) is made challenging by the log-difference expression of the variables. Because log differences can be treated as approximations of growth rates, the regression equation can be interpreted as a weighted average of growth rates, with the coefficients functioning as the weights. As such, column 2 implies that a one per cent increase in

[277] Edelstein, 'Accumulation and empire', pp. 195-6.

Table 3.2. *Correlation coefficients of bilateral British lending, 1880-1913*

	Australia	Canada	New Zealand	Uruguay	United States
Australia	--	-0.01	0.08	0.24	0.11
Canada	-0.01	--	0.11	-0.19	-0.17
New Zealand	0.08	0.11	--	0.02	0.03
Uruguay	0.24	-0.19	0.02	--	-0.02
United States	0.11	-0.17	0.03	-0.02	--

Sources: See appendix 3.1.
Notes: All variables are expressed in log differences. No correlation coefficient is statistically significant at the 10% level.

GDP would have been 22 times more of a determinant of bilateral British merchandise exports than would have been a one per cent increase in lending (two-year lead).

Eschewing this more abstract interpretation in favour of a historically founded one, consider the Baring Crisis, which resulted in the decline of foreign capital calls from £116.6 million in 1890 to £57.6 million in 1891.[278] This 50.6 per cent decline in British *ex ante* lending would have caused British merchandise exports to decline by 1.4 per cent, or £3.1 million, between 1892 and 1893. To place this figure in context, the total value of Britain's steam engine exports (to all countries) was £3.2 million in 1892. Though the marginal effect of British capital exports on British merchandise exports was small, it was hardly trivial.

The bilateral case of New Zealand

British lending to New Zealand

New Zealand imported capital on a grand scale in the 1870s. Under the premiership of Julius Vogel, the colonial government undertook an ambitious programme of infrastructure building, the centrepiece of which was the construction of a colonial railway system.[279] Other infrastructural projects included roads, telegraph lines, and waterworks.[280] Vogel's programme was financed through the issuance of debt, which was overwhelmingly purchased by British investors. Rosenberg estimated that, over the course of the decade, the nominal value of the external debt of the colonial government increased from £7.0 million to £25.4 million.[281] Yet, it should be

[278] Stone, *Global export*, p. 377. In real terms, the decline in lending was nearly identical at 50.1%, as calculated using the deflator noted in appedix 3.1. The Baring Crisis was one of the few instances in which bilateral lending was more synchronized.
[279] Simkin, *Dependent economy*, pp. 146-50.
[280] Mackay, 'Public finance', p. 57.
[281] Rosenberg, 'Capital imports', p. 109.

observed that the pace of borrowing was inconsistent, as there are clearly identifiable peaks in public capital calls for New Zealand in 1875 and 1878.[282]

A considerable portion of public borrowing in the 1870s was not allocated to social overhead projects, but instead to purchasing Maori lands and providing immigrants free passage to the colony. Collectively, the Immigration and Public Works Loan Acts of 1870, 1873, and 1874 authorized the borrowing of £0.7 million for land acquisition and £1.5 million for assisted immigration. Whether borrowing for these purposes resulted in a short-term increase in British merchandise exports is a question this chapter addresses shortly. In the case of assisted immigration, British lending would more likely have raised demand for British shipping services than for merchandise exports.

The profusion of British capital that New Zealand borrowed during the 1870s was achieved through the centralization of public finance at the colonial level. Through the 1860s, the provincial governments made recourse to the London capital market.[283] However, as Attard described, the provinces encountered increasing difficulty in attracting external capital, as both British investors and the London Stock Exchange doubted the creditworthiness of the provinces.[284] The centralization of public finance at the colonial level effectively occurred in 1867, when the colonial government guaranteed and consolidated the provincial debts.[285] In 1876, the provinces were abolished altogether. Attard argued that the strengthening of the colonial government of New Zealand can be explained by its ability to raise capital for economic development, whereas the provincial governments ultimately proved deficient in this endeavour.[286]

Indeed, the central government of New Zealand was successful in attracting external capital during the 1870s. While public borrowing abated somewhat in the early 1880s, it resumed again in 1883 to finance another, fainter round of

[282] Stone, *Global export*, pp. 123-5. Stone further disaggregated each series of bilateral capital calls into public and private capital calls.

[283] Provincial borrowing in the 1860s was not altogether minor, with Simkin, *Dependent economy*, p. 142, having noted that provincial debt increased by over £2 million between 1860 and 1868.

[284] Attard, 'Colonial state', p. 118.

[285] Ibid., p. 119.

[286] Ibid., p. 122.

infrastructure building.[287] By this point, the burgeoning public debt had become an acute fiscal concern, especially as New Zealand was amid a depression.[288] In 1887, the newly elected Atkinson ministry adopted a policy of ending railway construction (and its finance) as swiftly as practicable.[289]

The central government made a distinct return to borrowing in 1895. Some of the borrowing was undertaken to fund the Government Advances to Settlers Act of 1894—yet another instance of borrowing directed toward something other than a social overhead project. The act, intended to promote capital-intensive family farming, empowered the government to provide mortgages to small landowners for less than the market rate of interest. In 1895, the government issued £1.5 million worth of 3 per cent bonds in the London capital market, which investors purchased at an average price of £94 8s. 9d.[290] This capital was then re-lent to current and prospective small landowners at an interest rate of 5 per cent, undercutting the prevailing interest rates of 6-8 per cent for private mortgages.[291] Most of the original mortgages granted through this scheme represented the refinancing of pre-existing mortgages, rather than the financing of land purchases.[292] The Government Advances to Settlers Act was liberal in its extension of credit, as it permitted the issuance of mortgages to both freeholders and, interestingly, leaseholders. Many of the latter held 'leases-in-perpetuity' from the state, a system of land tenure introduced under the Land Act of 1892.[293] Throughout the early twentieth century, the popularity of the Advances to Settlers scheme continued to grow, and the colony continued to borrow commensurately. By 1913, the nominal value of mortgages owned by the central government of New Zealand amounted to £7.7 million.[294]

Insofar as the Government Advances to Settlers Act permitted landowners and leaseholders to refinance their pre-existing mortgages through the government, this act brought about a private-to-public debt conversion. Private mortgages were

---

[287] Simkin, *Dependent economy*, p. 150. This second round of infrastructure building was largely and characteristically presided over by Vogel, who served as Colonial Treasurer in the ministry of Robert Stout.

[288] According to Coghlan, *Statistical account*, p. 702, New Zealand had the highest (colonial) public debt per capita of all seven Australasian colonies in 1881.

[289] Dowie, 'New Zealand investment', p. 264. Railway construction did continue past 1887, but only in order to render nearly completed lines usable.

[290] Mackay, 'Public finance', p. 254.

[291] Ibid.

[292] Condliffe, *In the making*, p. 191.

[293] Stewart, 'Land tenure', pp. 84-5.

[294] *Official statistics of the dominion of New Zealand for the year 1913*.

provided through New Zealand's banks, which intermediated between depositors and borrowers, though the depositors were oftentimes Britons seeking to take advantage of more attractive rates.[295] However, circumstances changed following the Baring Crisis of 1890 and the Australian Banking Crisis of 1893, which caused British depositors to become fearful about the stability of overseas banks and to withdraw their deposits.[296] Hawke argued that the objective of the Government Advances to Settlers Act was to prevent the flight of British capital, transmitted through the international banking system, from hampering the availability of mortgages and, by extension, the economic development of the colony.[297]

New Zealand also imported private capital in the late nineteenth and early twentieth centuries, and the corresponding private capital calls are included in Stone's series. Some examples of private capital calls included the financing of the Wellington and Manawatu Railway Co. and the New Zealand Midland Railway Co. Still, the majority (64 per cent) of capital calls for New Zealand were public.[298] The large share of public capital calls for New Zealand is easily explained by the interventionist role that the central government played in building infrastructure.[299]

Testing for the lending-export loop

Given the diversity of purposes for which New Zealand borrowed capital from Britain, this chapter now proceeds to test the applicability of the Ford thesis to the bilateral case of New Zealand. The regression equation from the previous section is estimated as a time-series for just New Zealand. All of the sources of data remain the same. The results are presented in Table 3.3. In column 1, the surprising finding is that the coefficients of the lending variables are all statistically insignificant. This finding challenges the applicability of the Ford thesis to the case of New Zealand, which was expected to provide the most patent evidence for the operation of a lending-export loop. The outcome of the time-series regression for New Zealand

[295] Hawke, *The making*, p. 64.
[296] Simkin, *Dependent economy*, p. 167.
[297] Hawke, *The making*, p. 107.
[298] Calculated from Stone, *Global export*, p. 131. This high public share in total capital calls for New Zealand contrasts with the low public share in total capital calls for all countries, which was 36%.
[299] See Le Rossignol and Stewart, *State socialism*.

Table 3.3. *British merchandise exports to New Zealand, 1871-1913*

	(1)	(2)	(3)
Lending	-0.63 (2.37)	0.73 (3.57)	
Lending, one-year lead	-1.82 (2.49)	-0.37 (3.47)	
Lending, two-year lead	-0.21 (2.33)	-2.37 (3.52)	
Railway capital formation			17.48** (7.86)
GDP	80.34* (45.51)	160.45** (69.29)	134.13** (53.71)
Terms of trade	75.30*** (26.25)	89.92** (32.51)	83.71*** (28.26)
Constant	0.86 (2.70)	-3.15 (3.95)	-3.08 (3.37)
Interval	1871-1913	1872-1900	1872-1900
DW statistic	1.77	1.71	2.08
Adjusted R^2	0.17	0.25	0.41

Sources: See appendix 3.1.
Notes: All variables are expressed in log differences. All coefficients and standard errors have been rescaled by a factor of 100. Standard errors are noted in parentheses. * indicates statistical significance at 10%, ** at 5%, and *** at 1%.

further contrasts with the outcome of the panel regression in that the coefficient of the terms of trade is statistically significant at the 1% level.

The statistical significance and magnitude of the coefficient of the terms of trade are not entirely surprising. The lack of diversity in New Zealand's exports—wool comprised 49 per cent in 1883—left the economy predisposed to fluctuations in the prices of a narrow range of commodities, specifically wool and, later on, meat and dairy.[300] In general, New Zealand's terms of trade improved until 1883 and then remained mostly stationary for the next three decades.[301] Still, there were occasional sharp movements in the terms of trade, and these movements often corresponded with movements in real British merchandise exports to the colony. The single largest percentage change in both the terms of trade (27 per cent) and real British merchandise exports (52 per cent) came in 1872. Following the Franco-Prussian War, industrial dislocation on the European Continent left Yorkshire in the position of satisfying a greater demand than usual, with British exports of woollens increasing from 293 million to 413 million linear yards per annum between 1870 and 1872.[302]

[300] Calculated from Condliffe, *In the making*, p. 131.
[301] Easton and Wilson, 'N. Z.'s terms', pp. 36-7.
[302] Jenkins and Ponting, *Wool textile industry*, pp. 222-3.

The elevated demand for woollens exerted backward pressure along the supply chain, with the consequence that the price of wool increased from 9¼d. to 15d. per pound.[303] Yet, the strength of the relationship between New Zealand's terms of trade and its merchandise imports from Britain cannot account for the absence of an observable lending-export loop, since the terms of trade and British *ex ante* lending are not mutually exclusive determinants.

Was the absence of an observable lending-export loop in the bilateral case of New Zealand due to the fact that not all borrowing was allocated to social overhead projects? Recall the difference between the direct and indirect channels of the Fordian lending-export loop. The direct channel involved an increase in demand for British capital goods exports, whereas the indirect channel involved an increase in the demand for British consumption goods exports. Lending for a social overhead project would have stimulated demand for capital goods exports via the direct channel and, by raising the income of the borrowing country, would have also stimulated demand for consumption goods exports via the indirect channel. However, lending for some purpose other than a social overhead project, such as land reform, would have confined the operation of the lending-export loop to the indirect channel, presumably. Given the possibility that higher incomes were subject to consumption smoothing, a short-term causal relationship between British capital and merchandise exports via the indirect channel seems not especially likely.

The objective now is to determine whether the bilateral case of New Zealand exhibited a causal relationship between British capital and merchandise exports through the direct channel, that is to say, when lending was allocated to social overhead projects. Unfortunately, Stone's series on capital calls for New Zealand do not differentiate between social overhead lending and other lending. This study therefore employs Dowie's annual estimates of real gross railway capital formation in New Zealand as a proxy for social overhead lending.[304] The Dowie series for gross railway capital formation is preferable to the more recently produced Mulcare series, since the latter excludes private railway capital formation.[305] This difference is

[303] McIlraith, *Course of real prices*, p. 52.

[304] Dowie, 'New Zealand investment', pp. 39-40. I thank Jack Dowie for generously making available a copy of his long-since-completed PhD dissertation.

[305] Mulcare, 'Capital formation', p. 78. A related concern is that the Mulcare series treats the nationalization of a private railway as public railway capital formation, whereas the Dowie series does not; see Dowie, 'New Zealand Investment', p. 48. Thus, the spike in the

particularly important in the 1880s and early 1890s, when most of the private railway capital formation occurred.

There remains the question of the extent to which railway capital formation was actually financed through external borrowing in London, as opposed to through domestic borrowing. Private railway capital formation was effectively limited to the Wellington and Manawatu Railway Co. and the New Zealand Midland Railway Co., and these companies were financed by British investors.[306] It is assumed that nearly all public railway capital formation was financed externally before 1900. The *New Zealand Official Year-book, 1900* is the first volume in this annual series to decompose the public debt into the amounts raised in London and domestically. Of the £47.9 million of central government debt outstanding in 1900, £43.3 million (90 per cent) had been raised in London.[307] However, after 1900, there was a marked decline in the dependence of the New Zealand central government upon the London capital market.[308] On this point, Simkin makes reference to the strained credit conditions that prevailed in the London capital market during the British economic downturn of 1900-4.[309] Of the additional debt incurred by the central government from 1900-13, only 61 per cent was issued in London.[310] The public finances of Edwardian New Zealand were becoming an increasingly domestic affair, and New Zealand broadly resembled Australia in this respect. Attard found that the domestically *owned* share of the long-term debt of the six Australian colonies increased more than threefold from 1900-13.[311] Though, it should be observed that this increase was not due to a locational change in the placement of new debt, but instead to a net repatriation of outstanding debt. Of course, New Zealand may have realized a net repatriation of its outstanding debt, as well.

Mulcare series of public railway capital formation in 1895 is likely attributable to the nationalization of the New Zealand Midland Railway Co. in this year.

[306] Le Rossignol and Stewart, 'Railways in New Zealand', pp. 663 and 665.

[307] *New Zealand official year-book, 1900*, p. 401. The high share of the public debt raised externally was likely constant prior to 1900. In reconstructing New Zealand's balance of payments, Rosenberg, 'Capital imports', p. 109, assumed this share was 90% in every year from 1862-1900.

[308] Mackay, 'Public finance', p. 139.

[309] Simkin, *Dependent economy*, p. 182.

[310] Calculated from *New Zealand official year-book*. Not all of the remainder was raised domestically, as a substantial portion was raised in Australia during the early twentieth century. Until the twentieth century, however, a mere £0.2 million of New Zealand's public debt had been raised there.

[311] Attard, 'Australian public borrowing', pp. 166-7.

The growing reliance of the New Zealand central government on domestic sources of credit is perhaps best explained by the economic circumstances within New Zealand itself. The *New Zealand Official Year-book, 1913* offers some insights: 'This remarkable change in the relative positions of the State creditors may be partly ascribed to the ability of the mass wage-earning population in the Dominion to save, and to the general appreciation of the manner in which their savings are invested'.[312] Public capital formation through domestic savings was greatly facilitated by growth in real per-capita income, which recommenced in the 1890s following two decades of stagnation.[313] According to Greasley and Oxley, 70 per cent of the growth in real per-capita income during New Zealand's pastoral boom (1890-1914) was due to the rising rental value of cultivated land.[314] To some extent, therefore, the refrigeration-driven pastoral boom was responsible for the increasing domestic share of public capital formation, which was most noticeable after 1900.

In recognition of the apparent turn-of-the-century break in the externally financed share of New Zealand's public capital formation, the proxy variable of gross railway capital formation is not extended beyond the nineteenth century. Hence, the interval is truncated to 1872-1900 for the remaining specifications of the regression in Table 3.3.

One further matter related to the proxy variable requires discussion, and that is the *a priori* inter-temporal relationship between railway capital formation and British merchandise exports, which would differ from Ford's proposed inter-temporal relationship between British *ex ante* lending and British merchandise exports. The sequence of these three events (lending, exporting, and capital formation) would proceed generally as follows. British investors would lend *ex ante* to the New Zealand central government via a primary security issue, with the funds deposited into a bank account. Sometime thereafter, the government would draw upon this account to purchase British capital goods exports. Dowie estimates capital formation using the 'flow of funds' method, whereby capital formation coincides with capital expenditure.[315] Thus, the *a priori* inter-temporal relationship between British merchandise exports and railway capital formation is a contemporaneous one.

---

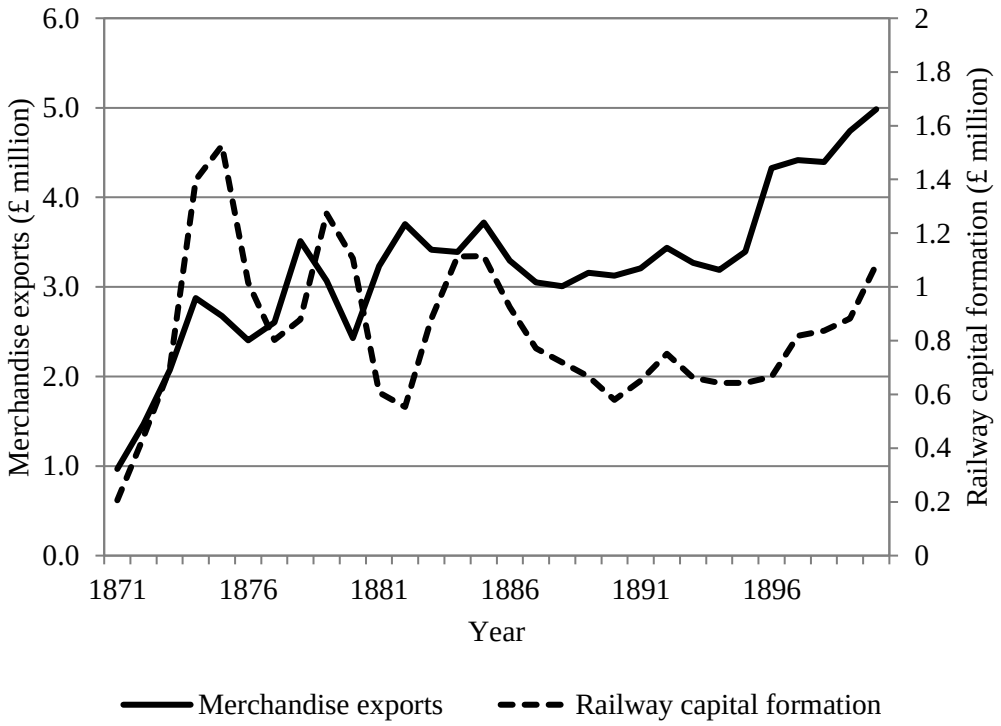
[312] *New Zealand official year-book, 1913*, p. 792.

[313] For the latest reconstructions of New Zealand's real GDP per capita, see Greasley and Oxley, 'Cointegration-based approach', pp. 365-6.

[314] Greasley and Oxley, 'Pastoral boom', p. 335.

[315] Dowie, 'New Zealand investment', p. 21.

Figure 3.2. *British exports to and railway capital formation in New Zealand, 1871-1900*



Sources: Merchandise exports: see appendix 3.1. Railway capital formation: Dowie, 'New Zealand investment', pp. 39-40.
Notes: Both series have been deflated and are expressed here in 1886-8 values. The deflator for merchandise exports to New Zealand is noted in appendix 3.1. Railway capital formation has already been deflated by Dowie.

Merchandise exports to and railway capital formation in New Zealand are depicted in Figure 3.2.

Column 2 of Table 3.3 replicates the initial specification, but for the truncated interval of 1872-1900. Once again, the coefficients of the lending variables are all statistically insignificant. Column 3 replaces the lending variables with current-year railway capital formation, the proxy for social overhead lending. The coefficient of railway capital formation is positive and statistically significant at the 5% level. In the case of British lending for social overhead projects, a Fordian lending-export loop emerges. Moreover, the coefficient of railway capital formation in Table 3.3 is many times greater than the coefficient of lending (two-year lead) in Table 3.1.

A comparison of columns 2 and 3 suggests that the lending-export loop operated when British overseas lending was allocated to social overhead projects, but not otherwise. Social overhead lending likely stimulated demand for British merchandise exports via the direct channel. But is there empirical evidence for an

Table 3.4. *British capital and consumption goods exports to New Zealand, 1872-1900*

	Iron exports (tonnes)		Cotton textile exports (yards)	
	(1)	(2)	(3)	(4)
Lending	2.98		-0.32	
	(7.31)		(4.47)	
Lending, one-year lead	2.49		-7.16	
	(7.09)		(4.34)	
Lending, two-year lead	-6.10		-6.12	
	(7.21)		(4.41)	
Railway capital formation		50.73***		-10.18
		(14.79)		(11.27)
GDP	325.36**	260.32**	235.42**	169.87**
	(141.83)	(101.10)	(86.71)	(77.02)
Terms of trade	139.51**	126.13**	66.51	60.51
	(66.55)	(53.19)	(40.69)	(40.52)
Constant	-9.80	-9.80	-2.73	-0.28
	(8.09)	(6.35)	(4.95)	(4.84)
Interval	1872-1900	1872-1900	1872-1900	1872-1900
DW statistic	1.70	2.08	2.06	2.19
Adjusted R^2	0.19	0.46	0.18	0.15

Sources: See appendix 3.1.
Notes: All variables are expressed in log differences. All coefficients and standard errors have been rescaled by a factor of 100. Standard errors are noted in parentheses. * indicates statistical significance at 10%, ** at 5%, and *** at 1%.

indirect channel of the lending-export loop, whereby social overhead lending raised demand for British consumption goods exports in the short term? To answer this question, the direct and indirect channels are isolated by changing the dependent variable to capital goods exports and consumption goods exports, respectively. Iron is considered a representative capital good. Cotton textiles are considered a representative consumption good. Iron and cotton textiles are well suited to this exercise because the *Annual Statements of the Trade of the United Kingdom* report the quantities of these commodities exported to New Zealand, thus obviating the need for deflators.

The results of these time-series regressions are presented in Table 3.4. Columns 1 and 2 of Table 3.4 replicate columns 2 and 3 of Table 3.3, but with a dependent variable of iron exports. The coefficient of railway capital formation is now statistically significant at the 1% level. This outcome suggests, even more clearly than before, that the direct channel was the *modus operandi* of the Fordian lending-export loop. In columns 3 and 4, with a dependent variable of cotton textile exports, the coefficient of railway capital formation is statistically insignificant.

British *ex ante* lending to New Zealand, whether for all purposes or for just social overhead projects, did not cause any short-term increase in British consumption goods exports to the colony.

Conclusion

This chapter has revisited one of the main arguments of the Ford thesis: a causal relationship between British capital and merchandise exports during the late nineteenth century. The availability of annual data on bilateral British *ex ante* lending permitted the estimation of a country panel regression, which proved more conclusive than the econometric tests employed by Hatton and Eichengreen. The coefficient of British *ex ante* lending (two-year lead) was statistically significant at either the 10% or 5% level, depending upon the specification of the regression. The magnitude of this coefficient was small, but far from negligible. Indeed, it was estimated that the Baring Crisis, which precipitated a sharp decline in British overseas lending, curtailed British merchandise exports by several million pounds.

For monetary historians, the magnitude of the coefficient implies that the lending-export loop only minimally offset overseas lending in Britain's multilateral balance of payments. In this sense, Ford's argument does little to advance an understanding of how the classical gold standard worked, at least in the short term. As Eichengreen argued, there was likely a long-term causal relationship between British capital and merchandise exports. Certainly, the role that British capital exports played in the geographic expansion of the market for British exports is a subject ripe for future consideration. The specific focus of this chapter, though, has been on Ford's argument, which was concerned with just the short term.

The high share of Britain in the country-composition of New Zealand's imports rendered this bilateral case especially appropriate for better understanding the operation of the lending-export loop. Surprisingly, there was no initial evidence for the operation of a lending-export loop in New Zealand. However, when only British *ex ante* lending for social overhead projects was considered, there emerged an obvious lending-export loop. Furthermore, by distinguishing between capital goods exports and consumption goods exports, it became clear that the operation of the Fordian lending-export loop was due to the direct channel. In this sense, the Ford thesis has been qualified.

At the risk of concluding on a speculative note, perhaps the most significant implications of this chapter are for imperial history. The existence of a causal relationship between British capital and merchandise exports may well alter the debate over the so-called balance sheet of empire.[316] Yes, the British Empire introduced a capital-market distortion—a liability—in favour of imperial borrowers. But any detrimental effect of this distortion, such as reducing otherwise profitable domestic investment (to say nothing of non-imperial overseas investment), was partly offset by a short-term increase in demand for British exports, provided the lending was directed toward social overhead capital. At the non-imperial cost of capital, would New Zealand have borrowed so liberally to finance railway construction in the 1870s? The same question can just as well be asked of Canada for the first decade of the twentieth century.[317] Britain lent more to its Empire and, consequently, exported more to its Empire, as well. In such a way, the lending-export loop supplements the more direct effects of empire on commodity trade.

[316] For one of the later contributions to this lengthy debate, see Offer, 'Waste of money'.

[317] The Edwardian boom in British lending to Canada is covered extensively in Dilley, 'London finance', pp. 1008-16.

IV: The manufacturing trade of late-Victorian Britain: how much can Heckscher-Ohlin explain?

Introduction

Economic historians have generally settled for the casual understanding that, according to Harley, 'the industries of the Industrial Revolution retained their comparative advantage until the First World War'.[318] Indeed, the staple industries of textiles and iron continued to dominate the composition of British exports through the late-Victorian era.[319] However, it remains uncertain whether Britain realized comparative advantages in the many other industries that characterized its manufacturing sector and, increasingly, the manufacturing sectors (and exports) of other industrial countries. Accordingly, this chapter contributes to the existing literature by calculating indicators of revealed comparative advantage (RCA) and revealed symmetric comparative advantage (RSCA) for 17 British manufacturing industries for the years 1880, 1890, and, 1900.

These indicators are then extended into the debate over the factor determinants of Britain's manufacturing comparative advantages. Here, the novel finding is that the manufacturing comparative advantages of late-Victorian Britain did not rest in the relatively labour-intensive industries. This finding is inconsistent with that of Crafts and Thomas, who estimated the factor determinants of just (non-normalized) British exports for the year 1880.[320] Even after controlling for human capital, it remains that the manufacturing comparative advantages of late-Victorian Britain were not relatively labour-intensive.

Broadberry attributed the comparative *labour productivity* levels of late nineteenth-century British manufacturing industries partly to relative factor endowments. One of the several patterns that emerged was that Britain tended to realize its highest comparative labour productivity levels (vis-à-vis the United States and Germany) in those manufacturing industries that used intensively Britain's relatively abundant supply of human capital.[321] Drawing upon a spectacular range of secondary sources, Broadberry explained the relative performance of various

[318] Harley, 'Early start', p. 6.

[319] The staple industries of textiles and iron accounted for fully 66% of British manufactured exports in 1902-4; see Schlote, *Overseas trade*, p. 74.

[320] Crafts and Thomas, 'UK manufacturing trade', p. 637.

[321] Broadberry, *Productivity race*, p. 158.

manufacturing industries during the period from 1850-1914. However, no systematic quantification of comparative labour productivity, disaggregated by industry, was possible for the period before 1907, due to a deficiency of output data.[322] Here, there emerges an opportunity for this dissertation. The trade statistics of industrial countries contain data sufficient for calculating RCA indicators of British manufacturing industries for the period before 1907. Of course, comparative advantage is not the same as comparative labour productivity; as Broadberry has observed, 'Clearly, there is no one-to-one mapping between variations in comparative labour productivity and comparative advantage, since labour is not the only factor of production'.[323] This dissertation avoids any conflation of the concepts. Still, measurements of comparative advantage can provide some numerical indication of the relative performance of British manufacturing industries during the late-Victorian era.

The factor proportions, or Heckscher Ohlin (H-O), model has been favoured by economic historians seeking to explain the pattern of nineteenth-century trade.[324] However, the H-O model does not account for the phenomenon of intra-industry trade, which occurs when a country imports and exports commodities within the same industry. A collection of models known as new trade theory (NTT) offers several explanations of intra-industry trade. There are hardly any applications of NTT to the nineteenth century, Brown being a rare example that evaluated British and German intra-industry trade in cotton textiles. With respect to NTT, this chapter finds that intra-industry trade accounted for an increasing share of Britain's total manufacturing trade throughout the late-Victorian era. Nevertheless, the majority of the manufacturing trade of late-Victorian Britain remained Heckscher-Ohlinian, i.e. factor-determined, into the 1890s. As might be expected, there was considerable variation among Britain's manufacturing industries, both with respect to the levels and trends in intra-industry trade, and this variation is discussed.

This chapter proceeds as follows. The first section presents a review of the literature. In the next section, RCA and RSCA indicators are calculated for Britain's

[322] For the details of the construction of his industry-disaggregated estimates, see Broadberry and Fremdling, 'British and German industry'; Broadberry, 'British and American manufacturing'.

[323] Broadberry, *Productivity race*, p. 26.

[324] For a noteworthy example, see O'Rourke and Williamson, 'Factor-price convergence'.

manufacturing industries. The next section identifies the factor determinants of Britain's manufacturing comparative advantages, initially using a three-factor H-O model, and subsequently using a four-factor H-O model that controls for human capital. The next section examines the levels and trends in the intra-industry trade of Britain's manufacturing industries. This analysis is further illuminated by means of a vignette of the British linen yarn industry. The last section concludes.

Literature review

Heckscher-Ohlin model

Under the H-O model of trade, a country exports those commodities which use intensively its relatively abundant factors of production.[325] Thus, relative factor endowments determine the comparative advantages of a country.[326] This model was used by Crafts and Thomas, who estimated the factor determinants of Britain's manufacturing comparative advantages in selected years from 1910-35, by which time there were regular censuses of production from which factor intensities could be calculated. The authors employed a three-factor H-O model, with the factors being (unskilled) labour, human capital, and capital. Throughout the period from 1910-35, the manufacturing industries in which Britain realized a comparative advantage were relatively intensive in labour, but not in human capital; comparative advantage was unaffected by the capital intensity of the industry.[327] The authors then applied the model to late-Victorian Britain, albeit using cruder data from the *Factory Inspectorate Returns* of 1870, and found similar results, except that capital was a statistically significant and positive determinant of Britain's manufacturing comparative advantages during this earlier period.[328]

Crafts and Thomas used the term 'comparative advantage' loosely. For the period from 1910-35, they estimated the factor determinants of British gross and net exports. For the late-Victorian era, they estimated the factor determinants of just British gross exports in the year 1880, using factor proportions inferred from 1870 data. The problem here is that the value of gross exports alone does not indicate the

[325] Ohlin, *International trade*.

[326] The H-O model departs from the earlier Ricardian model, which identifies technological differences between countries as the determinant of comparative advantage. Nevertheless, both models offer explanations for the occurrence of comparative advantages.

[327] Crafts and Thomas, 'UK manufacturing trade', p. 636.

[328] Ibid., p. 637.

presence of a comparative advantage. Consider the industries of silk manufactures and cement. In 1900, the value of British silk exports was more than double the value of British cement exports, yet Britain realized a comparative disadvantage in the former industry and a comparative advantage in the latter industry.[329] This chapter improves upon the work of Crafts and Thomas by normalizing British exports for the composition of world exports, that is to say, by calculating indicators of comparative advantage.

Crafts did, in fact, calculate RCA indicators for British manufacturing industries, along with the manufacturing industries of ten other mostly industrial countries, for the years 1899, 1913, 1929, 1937, and 1950. In doing so, he employed the method advanced by Balassa, which is discussed fully in the next section of this chapter. For the year 1899, Crafts observed that Britain's comparative advantages were greatest in the more mature industries of shipbuilding, iron, and textiles, rather than in the industries of the Second Industrial Revolution, which exhibited greater scope for new technology by the closing decades of the nineteenth century.[330] However, no factor-based explanation for the pattern of Britain's manufacturing comparative advantages was offered.

Crafts and Thomas's portrait of manufacturing in late-Victorian Britain as intensive in labour, but not in human capital, was the opposite of what Harley argued was true of manufacturing in (slightly later) Edwardian Britain. He argued that Britain was relatively abundant in skilled labour and that the United States, given its influx of migrants from southern and eastern Europe, was relatively abundant in unskilled labour.[331] The work of Harley is not, however, entirely comparable to the work of Crafts and Thomas. Whereas Crafts and Thomas were concerned with the pattern of specialization among industries, Harley was concerned with intra-industry differences between British and American manufacturing, specifically within the industries of shipbuilding, textiles, engineering, and iron and steel.

New trade theory

The phenomenon of intra-industry trade is explained by NTT, which comprises several models. Here, the discussion of NTT is limited to the essential elements of

[329] The RCA indicators for these industries are reported in table 4.1.
[330] Crafts, 'Revealed comparative advantage', p. 130.
[331] Harley, 'Edwardian industry', pp. 394-5.

two NTT models: the Chamberlinian-Heckscher-Ohlin (C-H-O) model, put forward by Helpman and Krugman, and the neo-H-O model, put forward by Falvey. Before proceeding to a discussion of these models, it is first necessary to differentiate between two sorts of intra-industry trade: horizontal (HIIT) and vertical (VIIT). HIIT involves commodities differentiated according to attribute, such as colour. VIIT involves commodities differentiated according to quality, such as durability.

The C-H-O model is consistent with the H-O model; inter-industry (net) trade still occurs between countries of differing relative factor endowments. [332] Additionally, however, intra-industry trade of horizontally differentiated commodities occurs between countries of similar relative factor endowments. According to the model, a firm realizing increasing returns to scale and operating under monopolistic conditions satisfies world demand for one variety of a horizontally differentiated commodity.[333] HIIT ensues, since firms producing the different attribute-varieties of the commodity are located in different, but similarly endowed, countries.

Like the C-H-O model, the neo-H-O model is also consistent with the H-O model, with inter-industry trade occurring as the result of differing relative factor endowments between countries. Even still, two countries with broadly similar factor endowments may exhibit moderate differences with respect to their relative endowments of a particular immobile factor, such as capital. If the quality of a commodity varies according to the capital intensity of its production, then VIIT occurs between countries.[334] Hence, large differences in relative factor endowments lead to increased inter-industry trade, while small differences in the relative endowments of the quality-determining factor lead to increased VIIT. Cabral et al. lent empirical support to these relationships using data on the trade of European Union (EU) member states with foreign countries. They found that the between-country difference in capital per worker was a statistically significant and positive determinant of VIIT between EU member states and other high-income countries, but that the difference was a statistically significant and negative determinant of VIIT between EU member states and middle-income and developing countries.[335]

---

[332] Helpman and Krugman, *Market structure*, p. 142.
[333] Ibid., pp. 131-58.
[334] Falvey, 'Commercial policy', pp. 497-503.
[335] Cabral, Falvey, and Milner, 'Endowment differences', pp. 409-11.

Brown undertook one of the only applications of NTT to the nineteenth century. He found that the share of intra-industry trade in the total cotton textile trades of Britain and Germany nearly tripled between 1883 and 1913.[336] In explaining this growth in intra-industry trade, Brown described, for example, how Britain imported from Germany cotton textiles in colours that were unavailable domestically.[337] Still, it remains uncertain whether the rising intra-industry trade in cotton textiles conformed more to the C-H-O or neo-H-O model.

Measuring comparative advantage

Balassa was interested in identifying the comparative advantages of industrial countries, not during the late nineteenth century, but rather during the period of trade liberalization that followed the Second World War. For Balassa to have determined comparative advantages directly would have required an enormous amount of systematically collected data on production costs for every industry-country pair. Instead, Balassa endeavoured to determine comparative advantages indirectly, based upon the pattern of world trade. Assuming that countries actually traded according to their comparative advantages, Balassa then argued that the pattern of world trade 'revealed' the comparative advantages of countries.[338]

Balassa's method for calculating an indicator of RCA is expressed as follows:

$$RCA_{c,i} = \frac{X_{c,i}}{X_{n,i}} \Big/ \frac{X_c}{X_n} \qquad (4.1)$$

Here, X refers to the current value of exports, i to the manufactured commodity, c to the industrial country, and n to the whole basket of industrial countries. The RCA indicator is therefore the country-share of world exports of the manufactured commodity normalized for the country-share of world exports of total manufactured commodities. An indicator greater than 1 implies a comparative advantage, an indicator less than 1 a comparative disadvantage. Theoretically, specialization according to comparative advantage would cause a country's RCA indicators to cluster around X_n/X_c ('complete' comparative advantage) and 0 ('complete'

[336] Brown, 'Cotton textiles', pp. 509-10. The share of intra-industry trade in the total cotton textile trades of Britain and Germany with other current OECD countries more than tripled.

[337] Ibid., p. 503.

[338] Balassa, 'Trade liberalisation', p. 103.

comparative disadvantage).[339] However, empirically, indicators fall anywhere between these two values, oftentimes quite close to the threshold value. One reason is that the manufactured commodity, as defined, encompasses enough heterogeneity such that a country may realize a comparative advantage in one variety of the commodity, but a comparative disadvantage in another variety of the commodity. This situation is especially likely when the RCA indicators are calculated at higher levels of aggregation, such as the industry level, as was done by Crafts, and as is done here. Another reason is that transport costs and preferential tariffs, which distort the pattern of trade, are internalized in the RCA indicator.

This last reason was addressed by Costinot et al., who sought to correct for such distortions in identifying comparative advantage. The main specification of their model took the form of a country-pair panel regression, in which the log of pairwise relative productivity in an industry predicts the log of bilateral exports in that industry.[340] An exporter-importer fixed effect accounts for trade costs, such as transport costs and preferential tariffs, among others.[341] The approach undertaken by Costinot et al. could be employed to identify Britain's comparative advantages, vis-à-vis each of its trading partners, for the late nineteenth century, provided bilateral trade data disaggregated by industry actually existed for the years 1880, 1890, and 1900, which is not the case. Furthermore, employing the approach of Costinot et al. would involve the precarious assumption that the elasticity of bilateral exports to pairwise relative productivity was the same in the late nineteenth century as in the late twentieth century.

This study therefore settles on Balassa's method for identifying comparative advantages. RCA indicators are calculated for 17 British manufacturing industries for the years 1880, 1890, and 1900. The industries—Balassa's method involved individual manufactured commodities—are beer; cement; chemicals; clocks and watches; copper manufactures; cotton manufactures; earthenware and chinaware; flax, hemp, and jute manufactures; glass; iron, steel, and manufactures thereof; leather and manufactures thereof; machinery; paper and manufactures thereof; rubber manufactures; silk manufactures; spirits; and woollen and worsted manufactures.

[339] In the case of complete comparative advantage, the RCA indicator may be less than X_n/X_c, if country *c* completely satisfies world demand.

[340] Costinot, Donaldson, and Komunjer, 'Ricardo's ideas', p. 595.

[341] Ibid., p. 602.

These 17 industries differ noticeably from the 16 industries for which Crafts calculated RCA indicators. Crafts's industries were largely predetermined in the sense that he relied solely on a statistical compilation by Tyszynski, rather than on the underlying government trade statistics, for data on manufactured exports. Crafts's industries are suitable for the period he considered, which was the early twentieth century. However, several of these industries are obviously unsuitable for the late nineteenth century, such as the electrical industry and the cars and aircraft industry. The textile industry also presents a problem. In 1899, textiles comprised 34 per cent of world manufactured exports and 46 per cent of British manufactured exports.[342] Earlier in the nineteenth century, the share of textiles in British manufactured exports was even higher, at 61 per cent in 1882-4.[343] Concentrating half of British manufactured exports and a third of world manufactured exports into a single industry obscures the actual comparative advantages held by countries, which differed based upon the particular class of textile. Therefore, for the purpose of calculating RCA indicators for the late nineteenth century, textiles are divided into four classes: cotton manufactures; flax, hemp, and jute manufactures; silk manufactures; and woollen and worsted manufactures. In general, the 17 industries included in this study mirror the industry classifications in the *Annual Statements of the Trade of the United Kingdom*, which is the source for data on the value of British manufactured exports.

It might be argued that these 17 industries do not sufficiently account for the newer manufactured commodities and, indeed, industries of the Second Industrial Revolution. Of course, such an argument would be more applicable to the year 1900 than the year 1880. Yet, it should be observed that many of the industries associated with the Second Industrial Revolution were still quite nascent by the close of the nineteenth century. In 1899, electrical goods and automobiles (combined) amounted to slightly more than 1 per cent of the *manufactured* exports of Britain and slightly more than 1 per cent of the *manufactured* exports of Germany, a leader in the Second Industrial Revolution.[344] On the whole, the 17 industries offer generally adequate

[342] Calculated from Tyszynski, 'Manufactured commodities', p. 277.

[343] Schlote, *Overseas trade*, p. 74.

[344] Calculated from Tyszynski, 'Manufactured commodities', p. 277. By 1913, the shares of these industries in the manufactured exports of Britain and Germany had increased to 4% and 7%, respectively.

coverage of world manufactured exports in 1900, even despite the emergence of some commodities that were inexistent in earlier decades.

Having obtained data on British manufactured exports per industry, the next step in calculating the indicators is to gather data on world manufactured exports per industry. This latter value is initially approximated by the manufactured exports, per industry, of Britain, Belgium, France, Germany, and the United States combined, as recorded in their respective trade statistics.[345] This step is immensely challenging due to the varying classifications of industries in the trade statistics of the different countries. Using British and American trade statistics, Crafts and Thomas matched British and American industries, in order to compare the factor determinants of British and American exports for a single benchmark year. They referred to this process as a 'problematic and protracted exercise'.[346] When the trade statistics of five countries are involved, the process of matching industries is considerably more problematic and protracted. For example, the British trade statistics keep leather and manufactures thereof separate from saddlery and harnesses, whereas the trade statistics of other countries do not. Such inconsistencies are, however, generally reconcilable, since the finest levels of disaggregation in the trade statistics usually permit the 'reconstruction' of industries. Where inconsistencies are ultimately irreconcilable, such inconsistencies are minor and do not materially alter the resulting RCA indicators. In order to add together the values of the manufactured exports, per industry, of the five industrial countries, these values are converted to sterling using the exchange rates reported in Mitchell.[347]

The manufactured exports of Britain, Belgium, France, Germany, and the United States accounted for most, though not all, manufactured exports in the late nineteenth century. In 1899, the manufactured exports of these five countries accounted for 87 per cent of the manufactured exports of the 11 countries considered

[345] Britain: *Annual statements of the trade of the United Kingdom*; Belgium: *Annuaire statistique de la Belgique*; France: *Tableau générale du commerce de la France*; Germany: *Statistisches jahrbuch für das Deutsche reich*; United States: *Foreign commerce and navigation of the United States*. The American data are for the years 1879/80, 1889/90, and 1899/1900, its statistical year having spanned from 1 July to 30 June.

[346] Crafts and Thomas, 'UK manufacturing trade', p. 632.

[347] Mitchell, *British historical statistics*, p. 702. Because the Belgian franc traded at par with the French franc during the classical gold standard, Belgian francs are converted to sterling using the (French) franc-sterling exchange rate.

by Tyszynski.[348] A coverage rate of 87 per cent would suggest a rescaling factor (γ) of 1.15 for the value of manufactured exports, per industry, of the five industrial countries ($X_{n,i}$). Balassa's original method, represented in equation 4.1, is therefore modified to include a rescaling factor:

$$RCA_{UK,i} = \frac{X_{UK,i}}{\gamma X_{n,i}} \Big/ \frac{X_{UK}}{X_n} \qquad (4.2)$$

However, a constant rescaling factor for all industries wrongly implies that the industry-composition of manufactured exports was identical between the basket of five industrial countries and the basket of excluded countries. The excluded countries were in an earlier stage of industrialization, which was often characterized by light manufacturing, particularly textiles.[349] Consequently, the five industrial countries likely accounted for more than 87 per cent of the exports of heavy manufacturing industries and less than 87 per cent of the exports of light manufacturing industries. A slightly reduced rescaling factor of 1.1 is applied to the heavy manufacturing industries of cement; chemicals; copper manufactures; iron, steel, and manufactures thereof; and paper and manufactures thereof. A slightly more generous rescaling factor of 1.2 is applied to the remaining industries. Although the rescaling factors of 1.1 and 1.2 are based upon data from 1899, these rescaling factors are applied to the calculations for 1880, 1890, and 1900, since annual data on world manufactured exports pre-1899 is not available.

The next step is to normalize the British share of world manufactured exports per industry ($X_{UK,i}/\gamma X_{n,i}$) by, according to Balassa's method, the British share of world manufactured exports in total (X_{UK}/X_n). Normalizing by the country-share of only secondary-sector world exports provoked criticism from Vollrath, who argued for the inclusion of the primary sector in determining comparative advantage.[350] Because the British share of secondary-sector world exports exceeded the British share of total world exports, the exclusion of the primary sector from the normalization factor reduces the levels of the RCA indicators for British manufacturing industries.[351] Balassa's procedure for normalization, which was

[348] The 11 countries include the five abovementioned industrial countries, as well as Italy, Sweden, Switzerland, Canada, India, and Japan.

[349] See Hoffman, *Industrial economies*; Maizels, *Industrial growth*, pp. 339-40.

[350] Vollrath, 'Theoretical evaluation', p. 269.

[351] In contrast, the American share of secondary-sector world exports (11%) was less than the American share of total world exports (14%) in 1899/1900. Thus, excluding the primary sector from the normalization factor increases the levels of the RCA indicators for

employed by Crafts, risks misidentifying a comparative advantage as a comparative disadvantage. Because the objective of this study is not to identify Britain's *intra-sector* industrial comparative advantages, but rather Britain's industrial comparative advantages in a *multi-sector* context, the normalization factor includes both the primary and secondary sectors. Of course, the choice of normalization factor only alters the levels of the indicators, not their rank order. Data on the value of total British exports for the years 1880, 1890, and 1900 come from the *Annual Statements of the Trade of the United Kingdom*. Data on total world exports for these years come from Lewis.[352]

Table 4.1 presents the resulting RCA indicators for British manufacturing industries, with their ranks indicated in parentheses. Given the data assembled, calculating indicators of RCA for the manufacturing industries of the other four industrial countries is simple. Since these indicators might be of interest to future economic historians, corresponding tables for Belgium, France, Germany, and the United States are supplied in Appendices 4.1-4.4.

As evident from the table, the RCA indicators for textiles differ greatly depending upon the particular class. By 1890, the industry of cotton manufactures held pride of place, not just among textiles, but among all British manufacturing industries. The industry of silk manufactures, on the other hand, was the only textile industry for which Britain realized a consistent comparative disadvantage. Other industries in which the 'workshop of the world' had a consistent comparative disadvantage were clocks and watches; glass; and leather and manufactures thereof. Of the 17 industries, the sharpest movements were in copper manufactures (downward) and spirits (upward).[353] Britain also advanced its comparative advantage in woollen and worsted manufactures considerably, even in spite of the heavy protection that this industry received in other industrial countries.[354]

American manufacturing industries. In 1899/1900, the primary sector contributed 68% of American exports; calculated from *Foreign commerce and navigation of the United States* (1900).

[352] Lewis, 'World trade', pp. 54-7.

[353] For some of the reasons behind these movements, consult Broadberry, *Productivity race*, pp. 174-5, 196-7.

[354] See especially Saul, *British overseas trade*, p. 151. While Britain's comparative advantage in woollen and worsted manufactures would not have been affected by foreign protection *per se*, if such protection enabled foreign manufactures to become internationally competitive, as per the infant industry argument, then Britain's comparative advantage would have been affected.

Table 4.1. *RCA indicators for Britain, 1880-1900*

Industry	1880	1890	1900
Beer	3.2 (5)	3.3 (3)	2.9 (3)
Cement	2.7 (7)	2.4 (8)	1.2 (12)
Chemicals, including dyestuffs, medicine, and paint	1.6 (11)	1.5 (11)	1.2 (11)
Clocks and watches	0.5 (15)	0.4 (17)	0.2 (17)
Copper manufactures	4.3 (1)	3.9 (2)	1.5 (10)
Cotton manufactures, including yarn	4.3 (2)	4.1 (1)	4.1 (1)
Earthenware and chinaware	2.4 (8)	2.4 (7)	1.8 (9)
Flax, hemp, and jute manufactures, including yarn and cordage	3.2 (4)	3.2 (5)	3.1 (2)
Glass	0.9 (13)	0.9 (14)	0.7 (15)
Iron, steel, and manufactures thereof, excluding machinery	3.6 (3)	3.3 (4)	2.6 (4)
Leather and manufactures thereof	0.8 (14)	0.9 (15)	0.9 (13)
Machinery, including steam engines and locomotives	3.0 (6)	2.8 (6)	2.2 (7)
Paper and manufactures thereof	1.0 (12)	1.0 (13)	0.8 (14)
Rubber manufactures	2.3 (9)	2.3 (9)	1.9 (8)
Silk manufactures	0.5 (16)	0.5 (16)	0.5 (16)
Spirits	0.5 (17)	1.2 (12)	2.3 (6)
Woollen and worsted manufactures, including yarn	1.9 (10)	2.1 (10)	2.5 (5)

Sources: See text.
Note: Rankings of indicators are noted in parentheses.

There is a well-defined scholarly debate over the international competitiveness of the British engineering (machinery) industry in the late 1890s, when the American engineering industry greatly increased its exports, especially its exports to Britain.[355] Nicholas argued that the rise in American machine exports to Britain resulted from a

[355] Though, Clapham, *Modern Britain*, p. 36, noted, 'Long before the 'nineties, exports of new American machinery, or of American mechanical notions, had affected the course and pace of industrial change in Britain'.

Table 4.2. *Spearman correlation coefficients of Britain's RCA indicators, 1880-1950*

	1890	1899/1900	1913	1929	1937
1880	0.95	0.66	--	--	--
1890	--	0.80	--	--	--
1899/1900	0.80	--	0.77	0.41	0.32
1913	--	0.77	--	0.76	0.70
1929	--	0.41	0.76	--	0.89
1937	--	0.32	0.70	0.89	--
1950	--	0.18	0.38	0.47	0.75

Sources: Coefficients for intervals spanning the years 1880, 1890, and 1900 are calculated using data constructed in this chapter. Coefficients for intervals spanning the years 1899, 1913, 1929, 1937, and 1950 are calculated using data from Crafts, 'Revealed comparative advantage', p. 130.

strong upswing in the British business cycle, which caused domestic demand to exceed domestic supply.[356] Irwin, however, attributed the phenomenon to the increasing international competitiveness of American machinery, driven by the declining price of American iron ore.[357] Although the RCA indicator for the British machinery industry erodes slightly between 1890 and 1900, the indicator for 1900 hardly suggests a loss of comparative advantage. Though, in fairness, the heightened level of American machine exports to Britain abated after 1899. If the indicator was calculated for a year between 1896 and 1899, it could be substantially lower.

In order to gauge the relative persistence of Britain's comparative advantages, Spearman correlation coefficients are calculated for various intervals, following the approach undertaken by Crafts. Table 4.2 presents coefficients for the intervals covered in this chapter, as well as for the intervals covered by Crafts. Different industry classifications prohibit the calculation of coefficients for intervals that span the turn of the twentieth century. Persistence during the late-Victorian era was roughly on par with persistence during the early twentieth century. The correlation coefficient is slightly lower for 1880-1900 than for 1899-1913, but this should be expected given the greater length of the former interval. What can be claimed with some certainty is that Britain's comparative advantages underwent a more substantial reordering during the 1890s than during the 1880s, when the comparative advantages were remarkably persistent. By the 1890s, the protectionist backlash in Continental Europe had been underway for a decade, and the reshuffling of Britain's comparative

[356] Nicholas, 'Export invasion', p. 581.

[357] Irwin, 'America's surge', p. 369. In turn, Irwin attributed the declining price of American iron ore to the opening of the Mesabi Range in 1892.

advantages in the 1890s may have been influenced by Continental infant industries having attained international competitiveness.

Before proceeding to the next section, it is necessary to recognize a certain fundamental feature of the RCA indicators. With Balassa's measurement, the range for comparative disadvantage is between 0 and 1, while the range for comparative advantage is between 1 and the reciprocal of the country-share of world exports, which would be 6.8 for Britain in 1900. Such asymmetry is benign when the objective is to ascertain whether or not a country had a comparative advantage, or when the objective is to rank the RCA indicators. However, as Laursen observed, this asymmetry would tend to violate the assumption in regression analysis of normally distributed error terms, and it must therefore be corrected.[358] Laursen proposed the following transformation to symmetrize the indicators:

$$RSCA = \frac{RCA-1}{RCA+1} \qquad (4.3)$$

The next section relies on Laursen's RSCA indicators, not Balassa's RCA indicators, when estimating the factor determinants of Britain's comparative advantages.

Factor determinants

Three-factor model

This section begins with a three-factor H-O model of Britain's comparative advantages, with the factors being capital, labour, and material inputs. Factor intensities or proxies thereof for the 17 British manufacturing industries are calculated from the *Census of Production* of 1907, which collected a limited amount of data on British manufacturing activity for the year 1906/7. Conveniently, the data is disaggregated at the industry and sub-industry levels, thereby permitting the 'reconstruction' of industries so that they are consistent with the industries in the previous section. The process is rather straightforward, and the exact components of the reconstructed industries are detailed in Appendix 4.5. One important assumption is that the sub-industry of (textile) bleaching, dyeing, printing, and finishing trades is allocated among the four classes of textiles proportionally, according to gross output.[359]

[358] Laursen, 'International specialization', p. 105.

[359] In 1906/7, the output of this sub-industry was £17.9 million, or about 6% of the entire textile industry; calculated from *Final report of the first census of production of the United Kingdom, 1907*, p. 285.

Table 4.3. *Factor intensities of British industries, 1906/7*

Industry	Capital intensity (horsepower per £1 million output)	Labour intensity (employees per £1 million output)	Material intensity (share of material inputs in output)
Beer	961	1,263	0.38
Cement	16,085	3,968	0.48
Chemicals, including dyestuffs, medicine, and paint	3,845	2,028	0.62
Clocks and watches	897	8,648	0.38
Copper manufactures	2,537	1,241	0.83
Cotton manufactures, including yarn	7,407	3,397	0.72
Earthenware and chinaware	10,360	8,659	0.36
Flax, hemp, and jute manufactures, including yarn and cordage	5,300	4,846	0.68
Glass	4,293	6,489	0.38
Iron, steel, and manufactures thereof, excluding machinery	8,688	3,863	0.63
Leather and manufactures thereof	992	3,994	0.68
Machinery, including steam engines and locomotives	3,218	4,485	0.47
Paper and manufactures thereof	11,080	3,957	0.64
Rubber manufactures	3,080	2,699	0.67
Silk manufactures	3,760	6,376	0.62
Spirits	1,768	865	0.79
Woollen and worsted manufactures, including yarn	4,472	3,607	0.71
Median	3,845	3,957	0.63
Coefficient of variation	0.81	0.56	0.26

Source: Calculated from *Final report of the first census of production of the United Kingdom, 1907*. See text and appendix 4.5.

Capital intensity is proxied by horsepower per £1 million of gross output. Labour intensity is proxied by employees per £1 million of gross output. Both of these proxies resemble the ones employed by Crafts and Thomas when they

estimated the factor determinants of British exports in 1880, although their source of data was the more rudimentary *Factory Inspectorate Returns* of 1870, as compiled by Musson.[360] Because the *Census of Production* reports the value of material inputs, material intensity is measured directly as the share of material inputs in gross output. Factor intensities per industry are reported in Table 4.3. It should be observed that the coefficient of variation differs considerably depending upon the factor, with capital intensity per industry being the most disperse of the factors.

Imposing Edwardian factor proportions on late-Victorian manufacturing industries is, recognizably, far from ideal. This approach is mostly necessitated by the availability of systematically collected data across a range of industries. Britain was a relative latecomer among industrial countries in collecting data on manufacturing output, and the *Census of Production* of 1907 was the first such exercise.[361] The error of backdating the factor proportions is perhaps not so grave in the context of mature industrial Britain, with its generally slow growth in output and inputs. From 1882-1907, manufacturing output grew at an average rate of 2.0 per cent per annum, while the rate was 2.4 per cent per annum for the capital input and 0.9 per cent per annum for the labour input.[362] Thus, the factor proportions of the manufacturing sector were changing, but not radically. Of course, the factor proportions of individual industries may have changed to a much greater extent than suggested by the manufacturing sector as a whole. Nevertheless, without dismissing the likelihood of such changes, the foregoing analysis relies on the data from the *Census of Production*, which represents the best available source for the given purpose.

The three-factor model takes the form of a semi-log OLS regression. The baseline specification of the regression equation can be expressed as follows:

$$RSCA = C + \alpha \ln(CAPITAL) + \beta \ln(LABOUR) + \gamma \ln(MATERIAL) + \epsilon \quad (4.4)$$

The results are reported in Table 4.4. Columns 1-3 pool the data for all three decennial years. Column 1, which is the baseline specification of the model, clearly

[360] See Musson, 'Motive power', pp. 437-9.

[361] By comparison, the United States was collecting such data nearly a century before Britain.

[362] These growth rates were calculated from the 1882-9, 1889-99, and 1899-1907 intra-cycle decompositions of manufacturing input and output growth, reported in Feinstein et al., 'Timing of the climacteric', p. 178.

Table 4.4. *Three-factor Heckscher-Ohlin model, 1880-1900*

	(1)	(2)	(3)	(4)	(5)	(6)
Capital intensity (1906/7)	0.20*** (0.05)	0.20*** (0.05)		0.22* (0.11)	0.22** (0.09)	0.17* (0.09)
Labour intensity (1906/7)	-0.28*** (0.08)	-0.35*** (0.09)		-0.23 (0.16)	-0.32** (0.13)	-0.30** (0.14)
Material intensity (1906/7)	-0.11 (0.17)	-0.32 (0.20)		-0.21 (0.36)	-0.16 (0.30)	0.02 (0.31)
Textile		0.20* (0.11)				
Capital/labour ratio (1870)			0.18*** (0.03)			
Constant	0.80 (0.57)	1.22** (0.60)	0.45*** (0.05)	0.18 (1.19)	0.96 (0.98)	1.27 (1.02)
R^2	0.33	0.38	0.44	0.26	0.42	0.40
Observations	51	51	48	17	17	17
Years	all years	all years	all years	1880	1890	1900

Sources: See text.
Notes: All variables, except for the dependent variable and the textile dummy, are expressed in natural logarithms. Standard errors are noted in parentheses. * indicates statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level. Col. 3 omits the cement industry, as it did not appear in the *Factory Inspectorate Returns* of 1870.

indicates that Britain's comparative advantages were in the relatively capital-intensive manufacturing industries and, inconsistent with Crafts and Thomas, in the relatively labour-economizing manufacturing industries. The coefficients imply that a doubling of the capital intensity in an industry would increase its RSCA indicator by 0.20, and that a doubling of the labour intensity of an industry would decrease its RSCA indicator by 0.28. Based upon these coefficients, Britain would have realized a comparative advantage in the glass industry in 1880, for example, if its capital intensity was at least 40 per cent higher or if its labour intensity was at least 29 per cent lower.

That the coefficient of material intensity is not statistically significant may seem surprising, given Britain's limited natural resource endowments. There are three potential explanations for this finding. First, Victorian Britain espoused a policy of free trade, which extended to raw materials and intermediate inputs. Unlike in other industrial countries, where a protectionist backlash had taken hold, the British manufacturing sector could obtain material inputs at the world price. The relatively material-intensive industry of woollen and worsted manufactures illustrates this point well. By the late nineteenth century, the majority of the raw wool used in the British woollen and worsted industry was imported, and this imported share

reached as high as four-fifths by 1895-9.[363] The American woollen and worsted industry also relied heavily on imported wool. However, whereas Britain imported wool free of duty, the United States imposed a considerable duty on this imported material input. Following the passage of the McKinley Tariff of 1890, the *ad valorem* equivalent tariff on wool exceeded 40 per cent.[364] The divergent trade policies of Britain and the United States may account, at least in part, for why the RCA indicator for the British woollen and worsted industry steadily increased throughout the late nineteenth century, whilst the American woollen and worsted industry remained at a nearly perfect comparative disadvantage.

In addition to wool, Britain imported a range of material inputs for its manufacturing sector, and many of these material inputs were sourced from the British Empire, which represents another potential explanation for the material neutrality of Britain's manufacturing comparative advantages. The recent gravity literature yields unambiguous evidence for an empire effect on commodity trade. Mitchener and Weidenmier estimated that membership in the British Empire alone more than doubled intra-Empire bilateral trade flows.[365] Following a different empirical strategy, Jacks et al. estimated that membership in the British Empire reduced intra-Empire bilateral trade costs by half.[366] Indeed, recourse to a resource-rich empire mitigated the effects of Britain's relatively unfavourable natural resource endowments on its manufacturing sector.

A third potential explanation lies in what lay beneath Britain: coal. Insofar as coal was a material input in the manufacturing sector, Britain's natural resource endowments were exceptionally favourable. Surely, the factor proportion of this material input varied greatly across industries. In the British iron and steel industry, it can be estimated that the factor proportion of this material input was on the order of 11 per cent in 1887.[367] While the factor proportion of coal would have been lower in most other industries, it was hardly negligible.[368]

---

[363] Deane and Cole, *British economic growth*, p. 196.

[364] *Foreign commerce and navigation of the United States* (1892).

[365] Mitchener and Weidenmier, 'Trade and empire', pp. 1813-4.

[366] Jacks et al., 'Trade costs', p. 135.

[367] The British iron and steel industry consumed an estimated 27 million tonnes of coal in 1887, as noted in Mitchell, *Economic development*, p. 12. In that year, the export price of coal was £0.41 per tonne, as calculated from *Annual statement of the trade of the United Kingdom* (1887). The estimated average annual gross output at current value of the British iron and steel industry was £103 million during the interval from 1885-9, as noted in Deane

Returning now to Table 4.4, column 2 includes a dummy variable for the four textile industries, in order to test whether factor endowments adequately explain Britain's notoriously persistent comparative advantages in these industries of the (First) Industrial Revolution, the silk industry notwithstanding. The coefficient of this dummy variable is expectedly positive, and it is statistically significant at the 10% level, suggesting some element of hysteresis in the textile industries.

As already mentioned, the regression imposes Edwardian factor proportions on late-Victorian comparative advantages. Given this inter-temporal mismatch, it is worth performing a robustness check using the earlier data from the *Factory Inspectorate Returns* of 1870. As was done for the *Census of Production*, industries are reconstructed to match the RSCA indicators, and the components are listed in Appendix 4.5. The *Factory Inspectorate Returns* report the amounts of horsepower and employees in each industry and sub-industry, but not the value of output. Thus, it is necessary to standardize capital and labour relative to each other. Column 3 regresses the RSCA indicators against the log of the 1870 capital-labour ratio. The coefficient is statistically significant and positive, as expected. However, the relative contributions of capital intensity and labour intensity cannot be discerned from this single variable.

Did the factor determinants of Britain's manufacturing comparative advantages change throughout the 1880s and 1890s? Does pooling the data for all three decennial years obscure an instability in the magnitudes (or possibly signs) of the factor coefficients? These questions are answered by estimating separate regressions for each of the three decennial years. The results are reported in columns 4-6. While the signs of the coefficients do not change, it is noteworthy that the coefficient of labour intensity increases (in absolute value) from 1880-90.

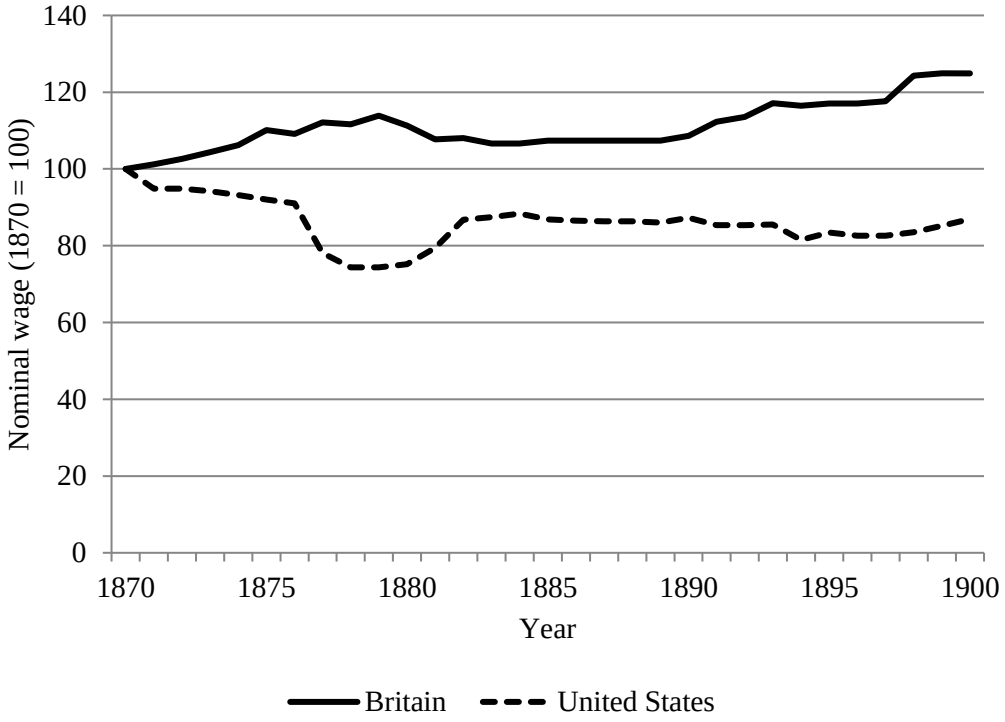
The increasing (in absolute value) coefficient of labour intensity reflects an increasing relative scarcity of labour in Britain. This relative labour scarcity has often been viewed in an American mirror. With respect to the late nineteenth century, Habakkuk stated, 'And if American labour was, except in the remoter parts of the country, no longer scarce, in England it was no longer as abundant as it had been

---

and Cole, *British economic growth*, p. 225. Accordingly, the factor proportion of coal in the British iron and steel industry is estimated to have been 11%.

[368] In 1887, the British iron and steel industry accounted for substantially less than half of the coal consumed in the manufacturing sector; see Mitchell, *Economic development*, p. 12.

Figure 4.1. *British and American nominal unskilled wages*



Sources: This figure presents the nominal wage series underlying the real wage series reported in Williamson, 'Global labor markets', p. 165. However, since Williamson relied upon unpublished nominal wage data, the nominal wage series have been obtained by reflating the real wage series using the same consumer price series that Williamson used. The source for the British consumer price series is Feinstein, *National income*, p. T140. The source for the American consumer price series is David and Solar, 'Cost of living', p. 16.
Note: Both nominal wage series have been recalibrated to a reference year of 1870.

earlier in the century'.[369] By the closing decades of the nineteenth century, the archetypes of labour-utilizing British manufacturing and labour-economizing American manufacturing had become compromised by an Anglo-American real *and nominal* wage convergence. For the tradable goods sector especially, the nominal wage represents the better indicator of comparative labour scarcity across countries. From 1870-1900, the nominal unskilled wage in Britain increased by 25 per cent—an increase all the more impressive in a period of falling prices.[370] Meanwhile, the nominal unskilled wage in the United States actually declined by 13 per cent. Figure 4.1 presents British and American nominal unskilled wages, indexed to their respective levels in 1870.

In the 1880 regression (column 4), the coefficient of labour intensity is statistically insignificant at any conventional level. The apparent labour neutrality of

[369] Habakkuk, *British technology*, pp. 194-5.
[370] See sources of fig. 4.1.

Britain's manufacturing comparative advantages in 1880 might well be interpreted as a vestige of the repeal of the Corn Laws in 1846 and the increased imports of grain that followed. The grain imports displaced agricultural labourers, who formed a cheap supply of labour that the British manufacturing sector could draw upon. To be sure, this process was not an immediate one, and the share of labour employed in agriculture declined continuously for the remainder of the nineteenth century.[371] However, as Habakkuk noted, 'The rise of real wages of English agricultural labour in the 1880s and '90's certainly suggests that the surplus of agricultural labour had been absorbed in English industry or by emigration'.[372]

Emigration contributed to the increasing relative scarcity of labour in late-Victorian Britain, most acutely during the 1880s. Hatton and Williamson estimated that net emigration from Britain, almost entirely to the higher-wage Dominions and the United States, averaged 3.2/1,000 population per annum from 1880-9.[373] For the broader interval from 1870-99, net emigration from Britain averaged 1.9/1,000 population per annum, while the figures were 1.8/1,000 for Germany, 0.1/1,000 for France, and -1.3/1,000 for Belgium.[374] Within industrial Continental Europe, only Germany's net emigration rate approached that of Britain.

By the close of the late-Victorian era, a labour-economizing regime had clearly emerged in the British manufacturing sector. Figures 4.2 presents scatter-plots of the RSCA indicators and the logged labour-intensity proxies of British industries for the years 1880 and 1900. The labour-economizing regime of late-Victorian British manufacturing should be appreciated in a global context that includes the United States and, even more importantly, Continental Europe. Continental Europe supplied more than half of world manufactured exports in 1899.[375] There, labour was comparatively more abundant than in Britain. Given the Anglo-American nominal wage convergence of the late nineteenth century, it might be suggested that, in 1900, the starker contrast was not between the factor determinants of manufacturing

[371] Interestingly, O'Rourke and Williamson suggested that the contraction of British agriculture only began, in earnest, in the 1870s; see *Globalization and history*, p. 87. Although, the relative decline of the agricultural sector had been a longstanding trend by the 1880s. The share of labour in agriculture declined from 28% (1851) to 22% (1871) to 16% (1891); see Broadberry and Irwin, 'Labour productivity', p. 262.

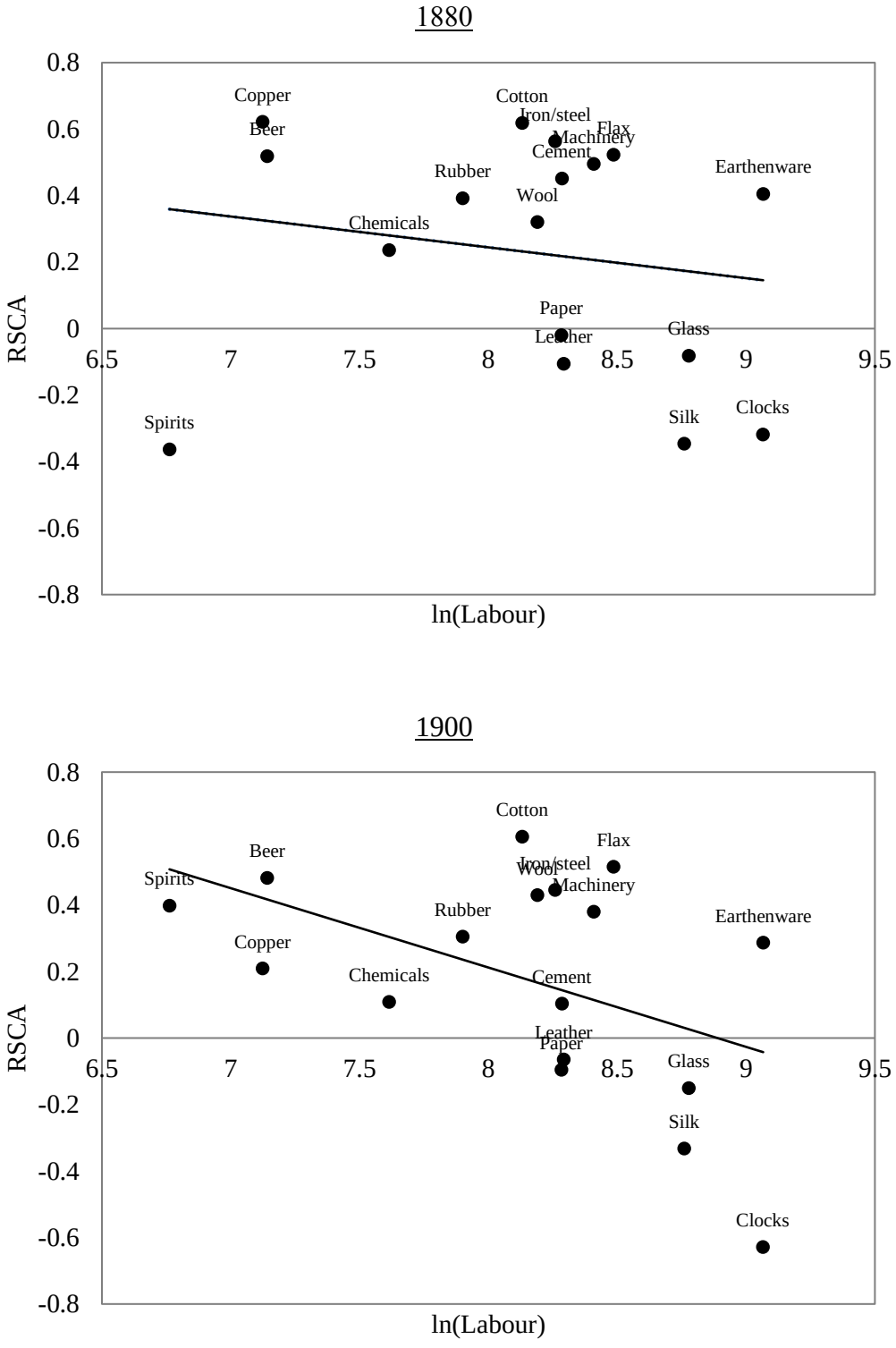
[372] Habakkuk, *British technology*, p. 195.

[373] Hatton and Williamson, *Mass migration*, p. 33.

[374] Calculated from ibid.

[375] Calculated from Tyszynski, 'Manufactured commodities', p. 277.

Figure 4.2. *Labour-intensity and RSCA indicators, 1880 and 1900*



Sources: See text.

comparative advantages in Britain and in the United States, but rather between the factor determinants of manufacturing comparative advantages in the Anglosphere and on the Continent.

Four-factor model

Harley argued that, for Edwardian Britain, labour as a single factor cannot sufficiently explain the pattern of comparative advantages. Rather, skilled labour ought to be differentiated from unskilled labour because Edwardian Britain was relatively abundant in the former and relatively scarce in the latter.[376] In this vein, the present study considers whether human capital was a determinant of Britain's manufacturing comparative advantages using a four-factor H-O model of trade.

Human capital intensity per industry is proxied by the industry wage standardized for the wage of unskilled labour. The source for data on industry wages is the *Returns of Wages*, published in 1887. This publication presents the weekly wage data that the British Board of Trade solicited from local chambers of commerce on an intermittent basis since 1830, the three most recent wage censuses having occurred in the years 1877, 1880, and 1883. Here, the analysis makes use of just the wage data from 1883. The wage observations are disaggregated by occupation, locality, and industry. For example, a 'mill man' in the Macclesfield silk manufacturing industry earned a (quite low) wage of 18s. per week. Occasionally, the *Returns of Wages* reports a range, rather than a single amount, for an occupation-locality-industry wage observation. In these instances, the midpoint is used. Additionally, only the wages of adult men are used in calculating the proxy. In total, there are 737 occupation-locality-industry wage observations across 13 industries. Some industries enjoy more observations than do others, and the numbers of wage observations per industry are reported in Appendix 4.6. There are no observations for the industries of cement; clocks and watches; copper manufactures; and rubber manufactures; and so these industries are unavoidably excluded from the four-factor H-O model.

[376] As Harley noted, the distinction between skilled and unskilled labour offered a potential resolution to the famous Leontief paradox in post-war American trade. He speculated that there might have been a Leontief paradox in Edwardian British trade, whereby labour-scarce Britain exported labour-intensive manufactured commodities. While he did not quite advance such an assertion, he did claim that the two-factor (capital and labour) H-O model was inadequate. Harley, 'Edwardian industry', pp. 411-13.

Table 4.5. *Four-factor Heckscher-Ohlin model, 1880-1900*

	(1)	(2)	(3)	(4)
Capital intensity (1906/7)	0.17** (0.08)	0.14* (0.08)	0.18** (0.08)	0.13 (0.08)
Labour intensity (1906/7)	-0.22** (0.10)	-0.20* (0.10)	-0.24** (0.10)	-0.22** (0.10)
Material intensity (1906/7)	-0.27 (0.20)	-0.35 (0.21)	-0.25 (0.20)	-0.30 (0.19)
Human capital intensity, first quartile (1883)		-0.71 (0.70)		
Human capital intensity, second quartile (1883)			0.42 (0.46)	
Human capital intensity, third quartile (1883)				0.83** (0.41)
Constant	0.43 (0.66)	0.82 (0.75)	0.27 (0.68)	0.14 (0.64)
R^2	0.16	0.18	0.18	0.25
Observations	39	39	39	39

Sources: See text.
Notes: All variables, except for the dependent variable, are expressed in natural logarithms. Standard errors are noted in parentheses. * indicates statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level.

Within each industry, which specific wage observation best captures the human capital attainment of its labour? Here, it is worth mentioning that almost all industries had high-paid foremen and low-paid warehousemen and general labourers. The variation in human capital attainment is unlikely to manifest itself at the upper and lower endpoints of the wage scale in each industry. Instead, the ideal proxy for human capital falls somewhere between these endpoints. Without any pre-existing knowledge of where along the wage scale human capital attainment is best captured, this study constructs three separate proxies for human capital intensity for each industry, corresponding to the first, second, and third-quartile wage observations. These three wage observations per industry are then each standardized by the unskilled wage, taken to be the lowest of the 737 wage observations. The lowest observation is 13s. per week, the wage of a general labourer in the Belfast linen textile industry. Appendix 4.6 presents all three proxies, as well as the occupation-localities to which the proxies correspond.

Table 4.5 presents the results of the four-factor H-O model. The first column of Table 4.5 simply reproduces the first column of Table 4.4, but for the reduced sample of 13 industries. The loss of four industries does not alter the signs of the coefficients, but does reduce their statistical significance from the 1% to 5% level.

Columns 2-4 introduce the proxies for human capital intensity. Only the coefficient of the third-quartile proxy for human capital intensity is statistically significant, and at the 5% level. This finding suggests that Britain's manufacturing comparative advantages were in those industries that required a high degree of human capital attainment to be possessed by a small share of labourers. To be sure, such an interpretation begs for qualitative substantiation, which would far exceed the scope of this dissertation. Nevertheless, this finding does call into doubt the assertion by Crafts and Thomas that Britain's manufacturing comparative advantages did not utilize human capital intensively. Rather, this finding more closely accords with Broadberry's generalization that Britain's *comparative labour productivity* tended to be higher in the relatively human capital-intensive manufacturing industries.[377]

What is perhaps more remarkable is how, even after controlling for human capital, Britain's manufacturing comparative advantages remain in the relatively labour-economizing manufacturing industries. The claim by Crafts and Thomas that Britain's manufacturing comparative advantages were labour-intensive finds no confirmation here. In using a dependent variable normalized for the composition of world exports, this study finds the opposite.

The rise of intra-industry trade

Grubel and Lloyd advanced what has become the conventional measure of intra-industry trade, the Grubel-Lloyd (G-L) index.[378] It is calculated as follows:

$$GL_i = 1 - \frac{|X_i - M_i|}{X_i + M_i} \qquad (4.5)$$

with X referring to exports, M to imports, and i to the industry. The index offers a standardized measure of intra-industry trade that is comparable across industries and time. Complete intra-industry trade, whereby per-industry exports equals per-industry imports, would yield an index of 1. Complete inter-industry (H-O) trade, involving an absence of either per-industry exports or per-industry imports, would yield an index of 0.

Here, annual G-L indices are calculated for 24 British manufacturing industries. Unlike the calculation of Balassa's RCA indicator, the calculation of the G-L index requires data from just a single country. Free from the need to reconcile

[377] Broadberry, *Productivity race*, p. 158.
[378] Grubel and Lloyd, 'Intra-industry trade', pp. 495-9.

the British trade statistics with the trade statistics of other countries, it is possible to expand the number of manufacturing industries under consideration from 17 to 24. Three of the additional industries result from the extrication of textile yarns from the textile industries, with the residual industries (cotton, linen, and woollen and worsted manufactures) now consisting mainly of cloth.[379] It is not possible to extricate silk yarn from silk manufactures. Due to inconsistencies between the export and import data reported in the British trade statistics, other industries are either redefined or excluded altogether, as evident from a comparison of Table 4.1 and Table 4.6.[380] One change worth mentioning explicitly is that the machinery industry is now included within the industry of iron, steel, and manufactures thereof, as necessitated by the more limited disaggregation of the import data for iron, steel, and manufactures thereof. Owing to a substantial rearrangement of the British trade statistics in 1895, the foregoing analysis is confined to the interval from 1870-94, which corresponds to the late-Victorian era *sans* the economic recovery of the late 1890s. The G-L indices for the 24 industries are reported annually in Appendix 4.7 and at eight-yearly intervals in Table 4.6.

A summary series of intra-industry trade, plotted in Figure 4.3, is calculated as the trade-weighted average of the per-industry G-L series. What is immediately observable is the increase in Britain's intra-industry manufacturing trade, with the summary series rising, without any major interruption, from 0.20-0.37 between 1870 and 1894. That intra-industry manufacturing trade increased at all in the late nineteenth century constitutes a novel finding. Yet, the magnitude of the increase was not especially great, as Britain realized a considerably greater absolute increase in its summary series of intra-industry manufacturing trade, from 0.51-0.75, in just the single decade (1962-72) prior to its entering the European Economic Community.[381] Of course, comparing the growth of intra-industry manufacturing

[379] The residual textile industries encompass a number of non-cloth manufactures, including, for example, carpets and laces. It should also be noted that the industry of linen manufactures excludes manufactures of hemp and jute.

[380] The industries of beer and cement are excluded because they are not disaggregated in the import data. These net-export industries were characterized by nearly complete inter-industry trade. Thus, the sample of 24 industries is slightly biased against Heckscher-Ohlinian industries.

[381] At best, it is only possible to offer an impressionistic comparison of Britain's manufacturing intra-industry trade between these two periods, given the immense changes in the composition of world trade in manufactured goods. Any such comparison would require that the industry definitions are of a broadly consistent degree of disaggregation in both

Table 4.6. *Grubel-Lloyd indices for British manufacturing indices, 1870-94*

Industry	1870	1878	1886	1894	1870-94 (mean)
Alkali	0.19	0.06	0.06	0.12	0.08
Books	0.32	0.31	0.34	0.35	0.32
Caoutchouc manufactures*	0.11	0.27	0.53	0.56	0.33
Chemical products and preparations, n.e.s.	0.65	0.96	0.95	0.79	0.86
Copper manufactures*	0.85	0.94	0.85	[0.85]	0.86
Cordage and twine*	[0.93]	[0.81]	[0.87]	[0.82]	0.86
Cotton manufactures, excluding yarn+	0.04	0.08	0.06	0.09	0.07
Cotton yarn+	0.02	0.09	0.08	0.08	0.06
Drugs and medicinal preparations	0.67	0.77	0.90	0.90	0.86
Earthenware and chinaware	0.17	0.39	0.54	0.49	0.38
Glass	[0.94]	[0.54]	[0.77]	[0.46]	0.73
Hats	0.82	0.28	0.24	0.29	0.27
Iron, steel, and manufactures thereof*	0.11	0.26	0.26	0.29	0.22
Jute yarn	0.49	0.27	0.63	0.25	0.45
Lead manufactures*	[0.96]	[0.52]	[0.60]	[0.51]	0.61
Leather manufactures	0.88	[0.93]	0.95	[0.91]	0.92
Linen manufactures, excluding yarn+	0.04	0.08	0.11	0.17	0.10
Linen yarn+	0.05	0.49	0.70	0.81	0.49
Painters' colours and materials	0.65	0.78	0.76	0.80	0.76
Paper and manufactures thereof	[0.95]	[0.92]	[0.99]	[0.69]	0.93
Silk manufactures+	[0.17]	[0.26]	[0.35]	[0.17]	0.30
Spirits	[0.11]	[0.29]	[0.58]	[0.76]	0.46
Woollens and worsteds, excluding yarn+	0.27	0.52	0.58	0.82	0.51
Woollen and worsted yarn+	0.49	0.58	0.72	0.54	0.59

Source: Calculated from *Annual statements of the trade of the United Kingdom.* See text.
Note: * indicates a capital goods industry. + indicates a textile industry. G-L indices for net-import industries are noted in brackets.

trade between the first and second eras of globalization is an exercise fraught with qualifications, including the emergence of new manufacturing industries, the dislocation of trade caused by the Second World War, multilateral trade

periods, as one frequently criticized feature of the G-L index is that it decreases at finer degrees of disaggregation.

The industry definitions employed in this section of the paper are well suited to the late nineteenth century. The 24 industries cover almost all of Britain's manufacturing trade. Furthermore, there is not an excessive concentration of trade in a small number of industries, although the industry of cotton manufactures represents an unavoidable exception in this regard. In terms of the degree of disaggregation, the industry definitions in this section roughly correspond to the two-digit level of the Standard International Trade Classification, which came into use after the Second World War.

Trade-weighted summary G-L indices of British manufacturing intra-industry trade are calculated for the years 1962 and 1972, using industries defined at the two-digit level of the 1st Rev. SITC. There are 26 two-digit manufacturing industries, or roughly the same number of industries as defined for the nineteenth century. The codes for the twentieth-century industries are as follows: 11, 51-6, 59, 61-9, 71-3, and 81-6. The export and import data are obtained from the United Nations Comtrade Database.

liberalization under GATT, and, due to the boundedness of the G-L index, the more limited potential for absolute increases at higher levels.

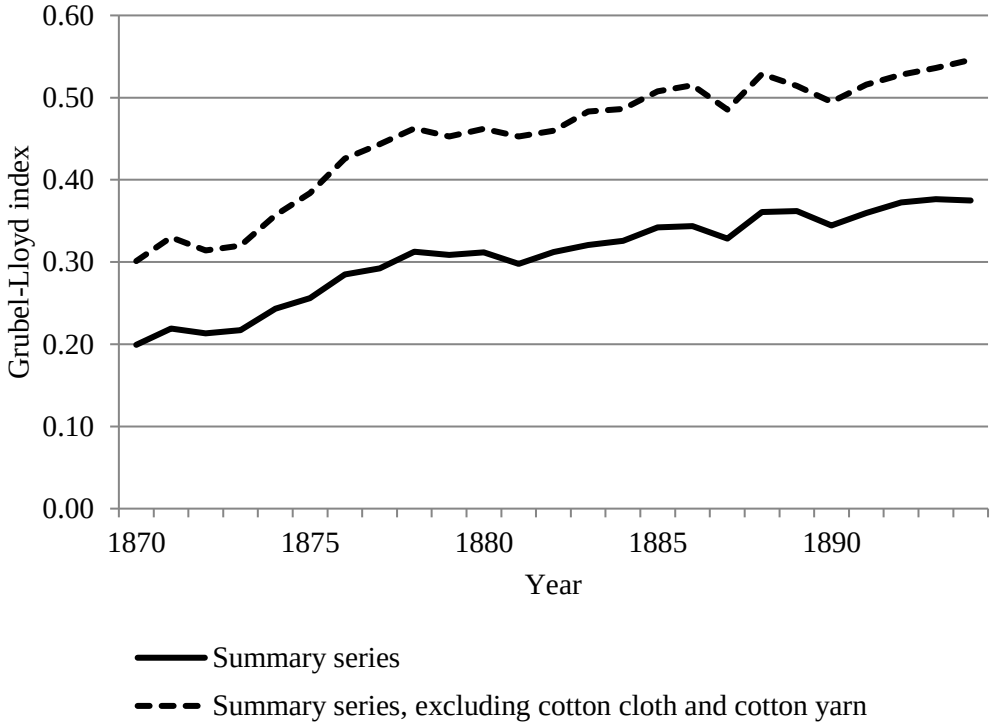
Evaluating the contours of late-Victorian Britain's growth in intra-industry manufacturing trade does not require an implicit standard for comparison, and can therefore be done with greater certainty. To what extent is the variation in the trends and levels of the per-industry G-L series explicable in terms of NTT? According to NTT, intra-industry trade occurs in products differentiated according to attribute (HIIT) or according to quality (VIIT). In general, it would be expected that consumption goods industries would present greater scope for product differentiation than would capital goods industries, as intra-industry trade in the latter category of industries would be mostly confined to VIIT. It would follow that the G-L indices for capital goods industries would be lower. However, the late-Victorian capital goods industries were not subject to systematically lower levels of intra-industry trade, and this finding is consistent with what Culem and Lundberg observed for the intra-industry trade of developed countries in 1980.[382] For the interval from 1870-94, the mean G-L indices for copper manufactures (0.86); cordage and twine (0.86); and lead manufactures (0.61) were among the upper half of industries, while the mean G-L indices for caoutchouc manufactures (0.33) and iron, steel, and manufactures thereof (0.22) were among the lower half.[383]

An even stronger expectation is that the textile industries would exhibit high levels of intra-industry trade, given the tremendous potential for product differentiation. Colour and pattern offer scope for HIIT. Thread-count and weave offer potential for VIIT. In explaining the nearly threefold increase in Britain's intra-industry trade in finished cotton cloth, from 0.05 in 1883 to 0.14 in 1913, Brown identified elements of both HIIT and VIIT, though he did not invoke these concepts explicitly. Compared to the other manufacturing industries in Table 4.6, however, the level of Britain's intra-industry trade in cotton manufactures was especially low. Thus, the large percentage increase in the G-L series for this industry did not amount to a large absolute increase.

[382] Culem and Lundberg, 'Product pattern', p. 118.

[383] While other industries contain capital goods, such as windows (glass) and machine belting (leather manufactures), these five industries are characteristically capital goods industries.

Figure 4.3. *Summary series of British intra-industry manufacturing trade, 1870-94*



Source: Calculated from *Annual statements of the trade of the United Kingdom*. See text.

Given the immense weight attached to cotton manufactures, the contribution of this industry to the trade-weighted summary series was to reduce its level and dampen its growth. If the industry of cotton manufactures was excluded, the summary series would have increased from 0.27-0.51, rather than from 0.20-0.37. If both the industries of cotton manufactures and cotton yarn were excluded, the summary series would have increased from 0.30-0.55. An alternative summary series, excluding cotton manufactures and cotton yarn, is plotted in Figure 4.3. In late-Victorian Britain, cotton manufactures and cotton yarn were overwhelmingly Heckscher-Ohlinian industries, despite the small increases in intra-industry trade documented, though not contextualized, by Brown.

Still, other textile industries presented similar potential for product differentiation. With respect to levels and growth, were the industries of cotton manufactures and cotton yarn representative of all textile industries? Is it possible to advance some generalizations about the textile industries, the mainstay of nineteenth-century British manufacturing? An industry-panel regression, with a dependent variable of $GL_{i,t}$ and with year fixed effects, is estimated for the entire sample of 24 industries. The results are presented in Table 4.7. In column 1, the first explanatory

Table 4.7. *Textile convergence in Grubel-Lloyd indices, 1870-94*

	(1)	(2)
Textile industry	-39.25***	-39.25***
	(12.27)	(12.27)
Textile industry x time	0.87***	0.88***
	(0.14)	(0.14)
Time		0.24***
		(0.08)
Constant	56.53***	55.12***
	(6.95)	(6.63)
Year fixed effects	YES	NO
Overall R^2	0.19	0.19
Observations	600	600

Notes: The dependent variable is expressed in levels. All coefficients and standard errors have been rescaled by a factor of 100. Standard errors are noted in parentheses. *** indicates statistical significance at the 1% level. There are seven textile industries: cotton manufactures (non-yarn); cotton yarn; linen manufactures (non-yarn); linen yarn; silk manufactures (including yarn); woollen and worsted manufactures (non-yarn); and woollen and worsted yarn.

variable is a textile dummy, assigned to the industries of cotton manufactures (non-yarn); cotton yarn; linen manufactures (non-yarn); linen yarn; woollen and worsted manufactures (non-yarn); woollen and worsted yarn; and silk manufactures (including yarn). The statistically significant and negative coefficient of the dummy variable indicates that the textile industries were, in fact, subject to systematically lower levels of intra-industry trade. The G-L index for the 'average textile industry' was less than one-third that of the 'average non-textile industry'.

The second explanatory variable interacts the textile dummy with time. The statistically significant and positive coefficient of the interaction variable indicates that intra-industry trade in the average textile industry grew faster than in the average non-textile industry. To determine how much faster, column 2 replaces the year fixed effects with a trend variable. In the average non-textile industry, the G-L series increased by 0.0024 per annum. Meanwhile, in the average textile industry, the G-L series increased by 0.0112 (0.0024+0.0088) per annum, or nearly five times as fast. With lower levels and faster growth, it is possible to discuss a late-Victorian 'textile convergence' in intra-industry trade. Such a phenomenon must be substantially qualified, however. Cotton manufactures, cotton yarn, and silk manufactures all contributed to the lower levels, but not to the faster growth.[384]

[384] The trend rates of growth for the per-industry G-L series are 0.0018 for cotton manufactures (non-yarn), 0.0031 for cotton yarn, and -0.0001 for silk manufactures. All trends are statistically significant at the 1% level, except the trend for silk manufactures, which is not statistically significant at any conventional level.

In the net-import industry of silk manufactures, there was no increase in intra-industry trade, whatsoever. Among the greatest casualties of nineteenth-century British manufacturing, the silk industry could barely withstand French competition following the elimination of duties on silk manufactures under the Cobden-Chevalier Treaty of 1860. Domestic output declined throughout the 1860s as imports from France flooded the British market.[385] That Britain exported silk manufactures at all was due to its competitiveness within a very narrow range of commodities. In the 1880s, Britain was early to implement the use of machinery in the formerly labour-intensive production of silk pile fabrics.[386] Additionally, Britain specialized in the production of silk fabrics that incorporated other textile yarns. In 1890, 48 per cent of Britain's exports of silk manufactures were composed 'of silk and other materials'. In this way, the proximity of the Cheshire silk textile industry to the (internationally competitive) Lancashire cotton textile industry helped Britain to retain a small niche in the world export trade of silk manufactures. Thus, a small degree of VIIT persisted in the British silk industry.

The textile convergence was due to the linen and woollen and worsted industries. The G-L series for the industries of linen manufactures (non-yarn); linen yarn; woollen and worsted manufactures (non-yarn); and woollen and worsted yarn all exhibit a statistically significant upward trend that exceeds the trend for the average non-textile industry (0.0024).[387] The most impressive trend rate of growth, 0.0375 per annum, was in the linen yarn industry, which is the subject of the next section of this chapter.

The rapidly increasing intra-industry trade in linens and woollens was due to HIIT and VIIT, certainly, but also to the moderate factor proportions that characterized these textile classes, compared to cottons and silks. As evident from Table 4.3, the industry of cotton manufactures had the highest capital intensity and the lowest labour intensity of the four textile classes. Conversely, the industry of silk manufactures had the lowest capital intensity and the highest labour intensity. Linen manufactures (including yarn) and the woollen and worsted manufactures (including

[385] For rough estimates of the declining output of the British silk industry in the wake of the Cobden-Chevalier Treaty, see Deane and Cole, *British economic growth*, p. 210.

[386] Rawlley, *Silk industry*, pp. 282-3.

[387] The trend rates of growth for the per-industry G-L series are 0.0051 for linen manufactures (non-yarn); 0.0375 for linen yarn; 0.0209 for woollen and worsted manufactured (non-yarn); and 0.0098 for woollen and worsted yarn. All trends are statistically significant at the 1% level.

yarn) were of intermediate factor intensity, both with respect to capital and labour.[388] The intermediate factor intensities of these industries made them amenable to increasing VIIT. Britain exported the more capital-intensive commodities within these industries and imported the less capital-intensive commodities within these industries, as per Falvey's neo-H-O model. Yet, in the cotton and silk industries, more extreme factor requirements militated against growth in intra-industry trade, and Britain's distinctly net-export position in cotton manufactures and net-import position in silk manufactures continued unaltered.

Given that late-Victorian Britain was a net exporter in the majority of manufacturing industries, it might be expected that the summary series of Britain's manufacturing intra-industry trade would follow a pro-cyclical course. As Bordo and Helbling have found, business cycles were highly desynchronized in the late nineteenth century, compared to in the late twentieth century.[389] Because late-Victorian Britain exported to numerous markets undergoing asynchronous business cycles, imports represent the channel through which the business cycle would have exerted its greatest affect upon intra-industry trade. Increased (decreased) imports during upswings (downswings) in the British business cycle would raise (lower) intra-industry trade. To determine whether such a pro-cyclical relationship existed, the cyclical components of the summary series and of real net national income per capita, as obtained using the Hodrick-Prescott filter, are correlated.[390] The correlation coefficient of the cyclical components is -0.40, and this coefficient is statistically significant at the 5% level.

The counter-cyclicality of the summary series is partly attributable to the phenomenon of the Long Depression of 1873-9, when the industrial economies of the world were in a generally protracted decline, but a decline that was less acute in

[388] Obviously, the factor intensities of yarn and cloth production, within the same textile industry, would differ. However, reliable proxies for the factor intensities of these different stages of textile production are unavailable. It is therefore unavoidable that comparisons of the factor intensities of the textile industries must aggregate the yarn-spinning and cloth-weaving stages of production.

[389] Bordo and Helbling, 'International business cycle', p. 212. From 1880-1913, the average bilateral output coefficient between countries was 0.03. From 1986-2008, this coefficient was 0.35, indicating a substantially higher degree of business cycle synchronization.

[390] The data for real net national income per capita are obtained from Mitchell and Deane, *British historical statistics*, p. 367.

Britain than elsewhere, at least until 1877.[391] During the years from 1873-7, Britain's export markets contracted severely, with exports to the United States declining by more than half, from £33.6 million to £16.4 million. Meanwhile Britain's imports of manufactured commodities actually increased, as capital otherwise invested overseas was instead invested domestically, financing a spate of residential construction.[392] Indeed, the fastest growth in Britain's manufacturing intra-industry trade occurred during the relatively mild, early depression years of 1873-7, when the summary series increased from 0.22-0.29. That the high level of manufacturing intra-industry trade continued to increase thereafter, however, was due to more fundamental causes, such as overseas industrialization and increasing demand for differentiated products.

The British linen yarn industry

The British linen yarn industry, as a component of the overall linen industry, had fallen into absolute decline during the late-Victorian era, with the peak of nineteenth-century production having occurred in 1871.[393] By 1900, Britain's output of linen yarn had fallen by nearly half.[394] There are two principal explanations for the decline. First, consumption of linen textiles was falling, as domestic and foreign consumers substituted toward cheaper cotton textiles.[395] Second, the British linen textile industry increasingly relied upon imported linen yarn, mainly from Belgium.

The decline in the British linen yarn, or flax-spinning, industry was most prominent in England, where the number of flax spindles fell from 270,000 to 118,000 between 1871 and 1885.[396] The demise of the English (and Scottish) flax-spinning industries was indicative of an emerging scarcity of labour in late-Victorian Britain, though not necessarily Ireland. The English flax-spinning industry, centred in Lancashire and Yorkshire, competed with the higher-productivity cotton and

[391] Rostow, *British economy*, pp. 179-80.

[392] Habakkuk, 'Fluctuations in house-building', p. 204. Consistent with the mid-1870s boom in residential construction, the G-L series for the industry of iron, steel, and manufactures thereof increased very rapidly, from 0.11 to 0.23 between 1873 and 1877.

[393] Hoffman, *British industry*, foldout appendix table.

[394] Ibid.

[395] Patterson, 'Linen industry', p. 135. Moreover, linen textiles were a victim of changes in fashion during the late nineteenth century.

[396] *Second report of the Royal Commission on the depression of trade and industry*, p. 261.

woollen industries for labour.[397] In Scotland, the flax-spinning industry of Dundee was largely displaced by the jute-spinning and jute-weaving industries, which catered to the large demand for burlaps in the United States.[398]

The British flax-spinning industry became consolidated in Ireland, where output remained generally stable. By 1890, 73 per cent of Britain's flax spindles were located in Ireland.[399] The consolidation of the British flax-spinning industry in Ireland, already well underway by the mid-nineteenth century, can be attributed to the relatively more abundant labour supply there. Whereas flax-spinning firms in England competed against other manufacturing industries for labour, flax-spinning firms in Ireland could draw upon a large supply of low-productivity agricultural labour. Though, as Boyer at al. have contended, Irish emigration from the middle of the nineteenth century onwards was a trend that rendered the factor price of Irish labour increasingly dear.[400] The Irish flax-spinning industry also enjoyed one slight advantage that the English flax-spinning industry did not, and that was the local production of flax. Flax was a labour-intensive crop, and its cultivation was therefore unprofitable in England. However, the lack of English flax was only a minor, if any, disadvantage to the English flax-spinning industry, which simply imported cheap flax from the Baltic region.[401] By the end of the nineteenth century, even Ireland had become a substantial net importer of flax.[402] Altogether, the British flax-spinning industry aligns with the material-neutral pattern of Britain's manufacturing comparative advantages, identified earlier in this chapter.

There is no indication that the Irish flax-spinning industry was unduly deprived of capital. Arguably, flax spinning in Ireland was more capital-intensive than in England. Whereas firms in England and Scotland remained small, firms in Ireland

---

[397] Ibid., p. 268. Mr. R. H. Reade, a managing director at a Belfast flax-spinning firm, stated in his testimony before the Royal Commission on the Depression of Trade and Industry, 'The linen manufacture was confined to the counties of Yorkshire and Lancashire, in both which you had got those other great textile industries of cotton and wool, which were very much larger, which expanded at a very much greater rate, and could afford to pay higher wages'.

[398] In 1885, 107 million of the 215 million yards of 'jute piece goods' exported by Britain were destined for the United States. Ironically, much of these exports to the United States returned to Britain in the form of burlap sacks containing raw cotton. In this way, the Scottish jute industry was bolstered by the success of the English cotton industry.

[399] Calculated from *Return of number of factories and workshops, 1890*.

[400] Boyer, Hatton, and O'Rourke, 'Real wages', p. 236.

[401] Rimmer, *Marshalls of Leeds*, p. 246.

[402] Patterson, 'Linen industry', p. 130.

were large, and their operation more closely resembled mass production. In 1890, the average flax-spinning firm in Ireland contained 14,070 spindles, compared to 7,857 in England and 3,158 in Scotland.[403] Undoubtedly, Irish firms realized economies of scale to a far greater degree than English and Scottish firms, of which the numbers were steadily declining.

The capital intensity of Irish flax spinning was manifest in the volume and type of machinery it employed. The flax-spinning firms of Belfast invested heavily in additional machinery during the Cotton Famine of the early 1860s, when substitution toward linen cloth engendered an extreme demand for linen yarn.[404] During the 1870s and 1880s, when leaner demand conditions prevailed, the Irish firms pulled technologically ahead of their English counterparts, which failed to adopt machine methods for heckling flax.[405] Altogether, the Irish flax-spinning industry was subject to a comparatively high degree of capital deepening and technological progress; incidentally, these were the main determinants of rising per-capita income in Ireland, according to Geary and Stark.[406]

Regardless of how well adjusted the Irish flax-spinning industry might have been, British weavers of linen cloth became increasingly reliant upon imported linen yarn throughout the late-Victorian era. The G-L series for linen yarn rose from a predominantly inter-industry level of 0.05 in 1870 to a predominantly intra-industry level of 0.81 in 1894. In 1894, 85 per cent of Britain's linen yarn imports came from Belgium. How did the Belgian linen yarn compare to the British linen yarn?

The textual evidence suggests that Britain's growing intra-industry trade in linen yarn was a growing VIIT, or trade in linen yarn differentiated by quality. Testimony before the Royal Commission on the Depression of Trade and Industry describes the pattern of Britain's intra-industry trade in linen yarn with Belgium: 'The exports to Belgium in 1885 had increased 25 per cent. over the preceding five years, and our imports from Belgium are also increasing…we spin a finer yarn than they do, and they spin the coarse yarns cheaper than we can'.[407]

---

[403] Calculated from *Return of number of factories and workshops, 1890*.
[404] Ollerenshaw, 'Industry, 1820-1914', pp. 77-8.
[405] Rimmer, *Marshalls of Leeds*, p. 252.
[406] Geary and Stark, 'Post-famine economic growth'.
[407] *Second report of the Royal Commission on the depression of trade and industry*, p. 268.

Table 4.8. *Unit-value dispersion of British linen yarn exports and imports, 1870-1900*

Year	Unit-value dispersion	VIIT
1870	+1.10	Yes
1875	+0.11	No
1880	+0.27	Yes
1885	+0.41	Yes
1890	+0.36	Yes
1895	+0.36	Yes
1900	+0.46	Yes

Note: A positive unit-value dispersion indicates that the price of British exports exceeds the price of imports.

One way to ascertain, quantitatively, whether Britain's intra-industry trade in linen yarn constituted VIIT is to impose a unit-value dispersion criterion, as was done by Greenaway et al. Assuming that price varies according to quality, then vertical intra-industry trade should exhibit different unit values of exports and imports. In their empirical analysis of British intra-industry trade in 1988, Greenaway et al. treated intra-industry trade as vertical when the unit value of exports deviated from the unit value of imports by +/-15%.[408] Since the British trade statistics report both quantities and values for both exports and imports of linen yarn, it is possible to calculate the unit-value dispersion for this industry. The unit-value dispersion is presented at quinquennial intervals in Table 4.8. Britain's intra-industry trade in linen yarn was, from the 1880s onward, a distinctly vertical one, in which Britain exported high-quality yarn and imported low-quality yarn.

The reason why the small amount of intra-industry trade prior to the 1880s was not vertical, i.e. the unit-value dispersion was less than +/-15%, was because Britain continued to export low-quality yarn to several traditional markets, including the United States and the Empire. In 1875, when the unit-value dispersion was less than 15 per cent, the average value of Britain's linen yarn exports was £0.067/lb (£0.059/lb for imports). However, the average values of bilateral linen yarn exports varied greatly: £0.076/lb for exports to Belgium, £0.092/lb for exports to Germany, but only £0.022/lb for exports to the United States. The British export of low-quality yarns to non-Continental markets caused the unit-value dispersion to fall under 15 per cent prior to the 1880s.

Surely by the 1890s, a pattern of linen yarn production (and trade) had established itself in Europe, with Britain producing and exporting fine yarn and the

[408] Greenaway, Hine, and Milner, 'Vertical and horizontal', p. 1508.

Table 4.9. *British and Belgian flax spindles per worker, 1878-96*

	Spindles	Workers	Spindles per worker	
			Absolute	Relative to Britain (1896)
Britain				
1878	922,693	46,983	19.6	0.92
1890	993,192	47,667	20.8	0.97
1896 (extrapolated)	--	--	21.4	1.00
Belgium				
1896	292,000	14,935	19.6	0.91

Sources: Britain: *Return of the number of factories and workshops, 1878* and *Return of the number of factories and workshops, 1890* for the numbers of spindles and workers. Belgium: Milward and Saul, *Continental Europe*, p. 161, for the number of spindles; (Belgian) *Recensement générale des industries et des métières en Belgique, 1896* for the number of workers.
Notes: For Britain, the numbers of spindles and workers consist only of those spindles and workers in mills engaged solely in flax spinning. The data excludes spindles and workers in the so-called integrated mills, though these mills were very few in number.

Continent producing and exporting coarse yarn.[409] This pattern conforms exactly to Falvey's neo-H-O model of trade. Recall that, in this model, VIIT results from quality differentials, which are determined by differing (though not extremely differing) relative endowments of a particular immobile factor of production.[410] Britain, with its greater relative endowment of capital, exported relatively capital-intensive, high-quality yarn. In contrast, Belgium, with its greater relative endowment of labour, exported relatively labour-intensive, low-quality yarn.

One crude proxy for comparing the factor proportions of the Belgian and British flax-spinning industries is spindles per worker, as presented in Table 4.9. The earliest reliable data for the Belgian flax-spinning industry is from the *Recensement Générale des Industries* of 1896, as earlier Belgian industrial censuses did not distinguish between spinning and weaving labourers. The latest reliable data for the British flax-spinning industry is the *Factory Inspectorate Returns* of 1890.[411] In 1896, the number of spindles per worker in Belgium was on par with the number of spindles per worker in Britain nearly two decades earlier in 1878. A rough comparison for the year 1896 can be made by extrapolating forward the growth in spindles per worker in Britain between the *Factory Inspectorate Returns* of 1878 and

[409] Outside of Belgium, Continental flax spinning was likely even more labour-intensive. In Germany, thousands of labourers continued to spin flax by hand, in a manner little changed since medieval times, into the 1870s. Clapham, *France and Germany*, p. 290.

[410] In Falvey, 'Commercial policy', the immobile factor of production was capital, but another factor (e.g. labour) could instead determine quality; see Greenaway and Milner, *Intra-industry trade*, pp. 10-11.

[411] The *Census of Production* of 1907 does not sufficiently distinguish between the spinning and weaving of flax.

1890. This extrapolation results in 21.4 spindles per worker in Britain, compared to 19.6 spindles per worker in Belgium. While these numbers should not be overemphasized, it is nevertheless unsurprising that they reveal modestly lower capital intensity in Belgian flax spinning.

Obviously, the findings of this chapter with respect to the linen yarn industry cannot possibly be generalized for Britain's manufacturing sector as a whole. Still, it can be claimed that late-Victorian Britain's manufacturing intra-industry trade was not wholly confined to HIIT. The linen yarn industry conformed to the neo-H-O model of intra-industry trade in products differentiated by quality, rather than the C-H-O model of products differentiated by attribute. Indeed, further exploration of VIIT in the late nineteenth century is certainly warranted, but very much complicated by the inadequate reporting of export and import quantities in the trade statistics of most countries.

Conclusion

In the 1890s, the manufacturing trade of late-Victorian Britain was mostly Heckscher-Ohlinian, even despite a persistent growth in intra-industry trade during the prior quarter-century. If the industries of cotton manufactures (non-yarn) and cotton yarn are excluded, then the composition of Britain's manufacturing trade would have been roughly balanced between inter-industry and intra-industry by the closing decade of the nineteenth century. The levels of intra-industry trade in the linen and woollen and worsted industries were initially low, but grew very rapidly throughout the late-Victorian era, resulting in a 'textile convergence' in intra-industry trade. Still, the cotton and silk industries did not contribute to this convergence, due to their more extreme factor requirements.

Indeed, the cotton and silk industries are emblematic of the pattern of Britain's manufacturing comparative advantages in the late-Victorian era. In the relatively capital-intensive, labour non-intensive industry of cotton manufactures, Britain realized one of its greatest comparative advantages. In the relatively labour-intensive, capital non-intensive industry of silk manufactures, Britain was at a pronounced comparative disadvantage. The finding that Britain's manufacturing comparative advantages were labour non-intensive opposes the prevailing view advanced by Crafts and Thomas. Furthermore, this finding was unaffected after controlling for human capital. Another surprising finding was the material neutrality of Britain's

manufacturing comparative advantages, for which there are several possible explanations, including coal, free trade, and the Empire.

The effect of the Empire on the composition of Britain's manufacturing trade has gone largely unexamined in this chapter, and it represents a fascinating area for future research. Given the well-documented empire effect on trade, and given that Britain's trade with the Empire was largely an exchange of manufactured goods for primary goods, the Empire was tantamount to a H-O bias in Britain's manufacturing trade. Britain's largest bilateral trade, with the United States, conformed to the same pattern, although increasing American manufactured exports to Britain was a distinguishing feature of the Edwardian years.

V: Conclusion

Summary of findings

In this dissertation, I have revisited and revised the economic historian's understanding of late-Victorian British exports, in several essential respects. Prior to this dissertation, the prevailing scholarly understanding was that foreign tariffs and (recent) British overseas lending were not, in general, determinants of the annual volume of British exports. And with respect to the composition of exports, it was thought that Britain's manufacturing comparative advantages rested in relatively labour-intensive industries. Collectively, these notions amount to a significant misunderstanding of the course and character of late-Victorian British exports.

To be sure, the foremost determinant of bilateral British exports was the GDP of the respective foreign market, as was evident in chapter III. Additionally, gravity models of world trade in the nineteenth century have consistently revealed the significance of GDP for the volume of bilateral trade, and there is no reason to think that British trade, in particular, differed in this regard.[412] However, as this dissertation has argued, the course of late-Victorian British exports was rather more complicated, having also been determined by foreign tariffs and recent British overseas lending. Recall that Hatton's export demand function excluded foreign tariffs altogether, and the estimated coefficient for British *ex ante* overseas lending was statistically insignificant. Thus, this dissertation has both improved upon and revised the work of Hatton.

Tariffs were the sole inter-temporal determinant of Anglo-American bilateral trade costs. This finding represents a major caveat to the finding by Jacks et al. that tariffs were not a statistically significant (inter-temporal *and* cross-sectional) determinant of Britain's trade costs. Simply on account of the large share of the United States in total British exports, it can be reasoned that tariffs did indeed hinder the development of British trade, taken as a whole. Nevertheless, it must be acknowledged that the United States was just one of Britain's many export markets, and there remains ample scope for making an even more convincing case that foreign tariffs were a determinant of the total volume of British exports. Such an attempt

[412] Estevadeordal et al., 'Rise and fall'; López-Córdova and Meissner, 'Exchange-rate regime'. However, in Jacks et al., 'Trade costs', GDP is internalized in the trade cost measurement.

might involve an examination of bilateral exports to Germany, including the reconstruction of the bilateral German tariff toward Britain. Taking the United States and Germany together would capture, in 1870, one-quarter of Britain's export markets and the bulk of Britain's industrial export markets. A replication of chapter II for the case of Germany, along with chapter II itself, would enable economic historians to approach an even clearer understanding of the effect of foreign protection on the first industrial nation.

The findings from chapters II and III are most meaningful when they are used in concert to explain the course of exports. In light of these findings, the McKinley Tariff of 1890 and the decline in British capital exports after 1889 conspired to produce a miniature crisis in British exports during the early 1890s. It is hardly surprising that the weakest intra-cycle export volume growth rate (0.8 per cent per annum from 1890-6) of either the mid or late-Victorian eras occurred just at the time when foreign protection was heightened and overseas lending fell sharply.[413] Of course, the poor condition of British exports in the early 1890s does not necessarily imply that the British economy was performing poorly at the time. Capital otherwise exported was instead invested domestically.[414] Yet, domestic demand for commodities like tinplate was only so elastic, and the rise of foreign protection spelled real consequences for both the British export sector and the economy at large.

Chapter IV fully revised Crafts and Thomas's argument that the manufacturing comparative advantages of late-Victorian Britain rested in relatively labour-intensive industries. By the 1890s, a labour-economizing regime had emerged in British manufacturing. Indeed, Britain was at a measurable comparative disadvantage in such relatively labour-intensive industries as clocks and watches; glass; and silk manufactures. One implication of this finding is to render the British manufacturing sector closer to the labour-economizing archetype of the United States than had previously been thought. Additionally, this dissertation has also shown that the manufacturing comparative advantages of late-Victorian Britain were neutral with respect to material intensity, and it has pointed to Britain's free trade policy and the Empire as likely explanations. Ostensibly, the comparative advantages were also neutral with respect to human capital intensity, although much additional research is warranted in this area.

---

[413] Calculated from Imlah, *Pax Britannica*, p. 97.
[414] Cairncross, *Home and foreign investment*, ch. 7.

Overall, the Heckscher-Ohlin model does offer an explanation for the within-sector pattern of British manufacturing trade. Nevertheless, throughout the late-Victorian era, inter-industry manufacturing trade was declining in favour of intra-industry manufacturing trade. But still, Britain's manufacturing trade remained mostly Heckscher-Ohlinian through the 1890s, with the colossal cotton textile industry exhibiting the most extreme degree of inter-industry trade.

Areas for further research

The application of new trade theory (NTT) to economic history represents one of the most promising areas for further research. The finding that intra-industry trade was increasing throughout the late-Victorian era beckons the question: when did the take-off of intra-industry trade occur? Perhaps it began to rise in the mid-Victorian era, or maybe even earlier. Of equal interest is the progression of Britain's manufacturing intra-industry trade in the Edwardian and interwar eras. Did the abandonment of free trade with the Import Duties Act of 1932 recast British manufacturing trade along more Heckscher-Ohlinian lines? Altogether, backward and forward extensions of the summary series of Britain's manufacturing intra-industry trade would be insightful.

Decomposing Britain's manufacturing intra-industry trade into horizontal intra-industry trade (HIIT) and vertical intra-industry trade (VIIT) would also be important, as these different sorts of intra-industry trade are explained by different models within NTT. Isolating the HIIT component of Britain's manufacturing intra-industry trade would be essential for understanding when, and to what extent, the pattern of trade was scale-determined, per the Chamberlinian-Heckscher-Ohlin model. However, the relatively poor reporting of quantities in the British trade statistics likely rules out the use of a unit-value dispersion criterion in any sector-wide study. A more productive approach toward understanding the origins, development, and nature of Britain's manufacturing intra-industry trade would involve additional industry-specific studies, and the groundwork for this approach has already been laid. Brown examined the intra-industry trade in cotton cloth. This dissertation has provided a vignette of Britain's intra-industry trade in linen yarn. An assemblage of industry-specific studies, drawing upon both statistical and textual evidence, is in order.

Another worthy area for future research is British exports to the Empire, both during the late-Victorian and Edwardian eras. The literature on British trade with the

Empire during this period is highly bifurcated. On the one hand, the gravity models simply relegate the imperial connection to a dummy variable, and the coefficient is (unsurprisingly) always statistically significant, even after controlling for factors commonly associated with the imperial connection, such as a common language.[415] On the other hand, the more narrative accounts of British trade with the Empire provide a cornucopia of illustrative examples of common consumption patterns. With respect to Dominion imports of railway equipment, Platt observed, 'Naturally as managers and engineers of the great railway systems of the world, British-trained personnel preferred, if at all possible, to work with the materials and equipment with which they were already familiar'.[416] Other examples abound throughout the literature. By now, the literature has well established that the imperial connection raised the volume of bilateral trade and that common consumption patterns were partly the cause.

Currently, a more meaningful direction for this debate is to consider the causal mechanisms, other than common consumption patterns, between membership in the British Empire and the elevated levels of bilateral British exports to these markets. The question should be asked: how much of the empire effect did not operate through the mechanism of common consumption patterns? Mitchener and Weidenmier have already made a considerable amount of progress in this direction, having identified imperial currency unions and preferential trade policies as some of the channels through which the empire effect operated, although it should be observed that their analysis did not focus exclusively upon the British Empire.[417] Still, their work can be improved upon. One way to improve upon their work would be to consider other causal mechanisms, such as the extent of distribution networks and the presence of a common legal framework.

One serious shortcoming of the work of Mitchener and Weidenmier is that their gravity model did not exploit the inter-temporal variation in preferential trade policies. The trade policies of the Dominions were classified as preferential, even though the Dominions did not actually adopt policies of imperial preference until the final years of the first era of globalization, Australia not until 1907. Related to this

[415] Estevadeordal et al., 'Rise and fall'; López-Córdova and Meissner, 'Exchange-rate regime'; Mitchener and Weidenmier, 'Trade and empire'; Jacks et al., 'Trade costs'.

[416] Platt, 'Recent settlement', p. 101.

[417] Mitchener and Weidenmier, 'Trade and empire', pp. 1825-7.

point, there is uncertainty about the effect of Edwardian imperial preference on the volume of British exports to the Dominions. Did Edwardian imperial preference raise the volume of British exports to the Dominions? Was, in fact, the course of British exports altered between the late-Victorian and Edwardian eras as a consequence of trade policy? Very recent research by de Bromhead et al. has identified a policy-induced reorientation of British imports towards the Empire, following the Ottawa agreements of 1932.[418] Upon further research, it might be concluded that Britain's reorientation toward the Empire, with respect to exports, began around the turn of the twentieth century, perhaps with Canada's implementation of a preferential trade policy in 1897.

The effect of empire on the 'character' of British exports also presents questions. Did the Empire, whether through common consumption patterns or through preferential trade policies, help to sustain Britain's comparatively disadvantaged manufacturing industries? It should be observed from chapter IV that the revealed comparative advantage indicators for even Britain's most comparatively disadvantaged industries were nowhere close to nil, and it is likely that the exports of these industries were disproportionately destined for Empire markets. In 1900, more than three-fifths of the exports of the comparatively disadvantaged British glass industry were sold to the Empire. Indeed, it might be asked: did the Empire thus function to mitigate the degree of within-sector specialization?

The usefulness of bilateral case studies

One prominent feature of this dissertation has been the use of bilateral case studies to inform debates within economic history. Any case study will invariably raise concerns about the generalizability of its findings. These concerns should not be dismissed lightly. Nonetheless, carefully devised and contextualized case studies can yield unique and meaningful insights. In this dissertation, the case studies have focused upon Britain's bilateral trade with the United States and New Zealand in chapters II and III, respectively.

In the late nineteenth century, Anglo-American bilateral trade was of intrinsic importance to the world economy. The large share of the United States in British exports made this particular bilateral case generalizable, to some degree. And the

[418] de Bromhead, Fernihough, Lampe, and O'Rourke, 'Shift towards empire'.

variation in American tariff policy also made this case worth considering. The advantage gained from focusing on one bilateral case was the ability to employ the empirically correct tariff measure in the econometric analysis. Ultimately, the use of the empirically correct tariff measure resulted in an altered interpretation of the inter-temporal determinants of Anglo-American trade costs. Moving beyond a bilateral case study would have entailed the use of inferior data in an analysis that would have largely amounted to a replication of the pre-existing gravity models for the period.

In contrast with the United States, New Zealand was not analyzed on account of the relative importance of this market for British exports, but rather on account of the extraordinarily high share of Britain in the country-composition of its imports. This fact made the bilateral case of New Zealand uniquely amenable to identifying the channel of causality in the Fordian lending-export loop, whereby British capital exports raised demand for British merchandise exports in the short term.

Bibliography

Official publications

Belgium, *Annuaire statistique de la Belgique* (various issues).

Belgium, *Recensement générale des industries et des métières en Belgique, 1896*.

Canada, *Statistical year-book of Canada for 1890*.

Canada, *Statistical year-book of Canada for 1896.*

France, *Tableau générale du commerce de la France* (various issues).

Germany, *Statistisches jahrbuch für das Deutsche reich* (various issues).

New South Wales, *New South Wales statistical register for 1890*.

New Zealand, *New Zealand official year-book* (various issues).

New Zealand, *Official statistics of the colony (dominion) of New Zealand* (various issues).

New Zealand, *Preferential and reciprocal trade act* (1903, no. 78).

Norway, *Tabeller norges handel i aaret 1890*.

United Kingdom, *Annual statement of the trade of the United Kingdom* (various issues).

United Kingdom, *British and foreign trade and industry* (P.P. 1903, LXVII).

United Kingdom, *British and foreign trade and industry (second series)* (P.P. 1905, LXXXIV).

United Kingdom, *Final report of the first census of production of the United Kingdom, 1907* (P.P. 1912-3, CIX).

United Kingdom, *Final report of the Royal Commission on the depression of trade and industry* (P.P. 1886, XXIII).

United Kingdom, *Second report of the Royal Commission on the depression of trade and industry* (P.P. 1886, XXI-XXII).

United Kingdom, *Return of number of factories and workshops, 1878* (P.P. 1878-9, LXV).

United Kingdom, *Return of number of factories and workshops, 1890* (P.P. 1890, LXVII).

United Kingdom, *Returns of wages published between 1830 and 1886* (P.P. 1887, LXXXIX).

United States, *Census of manufactures, 1909*.

United States, *Foreign commerce and navigation of the United States* (various issues).

Victoria, *Statistical register of the colony of Victoria for the year 1890*.

Secondary sources

Aldcroft, D. H., 'The entrepreneur and the British economy, 1870-1914', *Economic History Review*, 2nd ser., 17 (1964), pp. 113-34.

Aldcroft, D. H., 'McCloskey on Victorian growth: a comment', *Economic History Review*, 2nd ser., 27 (1974), pp. 271-4.

Allen, R. C., 'International competition in iron and steel, 1850-1913', *Journal of Economic History*, 39 (1979), pp. 911-37.

Ashley, P., *Modern tariff history: Germany—United States—France* (London, 3rd edn., 1920).

Ashworth, W., *An economic history of England, 1870-1939* (London, 1960).

Attard, B., 'New estimates of Australian public borrowing and capital raised in London, 1849-1914', *Australian Economic History Review*, 47 (2007), pp. 155-77.

Attard, B., 'Making the colonial state: development, debt, and warfare in New Zealand, 1853-76', *Australian Economic History Review*, 52 (2012), pp. 101-27.

Balassa, B. 'Trade liberalisation and "revealed" comparative advantage', *Manchester School*, 33 (1965), pp. 99-123.

Beales, H. L., 'The "Great Depression" in industry and trade', *Economic History Review*, 5 (1934), pp. 65-75.

Beaulieu, E. and Cherniwchan, J., 'Tariff structure, trade expansion, and Canadian protectionism, 1870-1910', *Canadian Journal of Economics*, 47 (2014), pp. 144-72.

Blackman, J. and Sigsworth, E. M., 'The home boom of the 1890's', *Yorkshire Bulletin of Economic & Social Research*, 17 (1965), pp. 75-97.

Bordo, M. and Helbling, T., 'International business cycle synchronization in historical perspective', *Manchester School*, 79 (2011), pp. 208-38.

Bordo, M. D. and Rockoff, H., 'The gold standard as a "good housekeeping seal of approval"', *Journal of Economic History*, 56 (1996), pp. 389-428.

Boyer, G. R., Hatton, T. J. and O'Rourke, K., 'The impact of emigration on real wages in Ireland, 1850-1914', in T. J. Hatton and J. G. Williamson, eds., *Migration and the international labor market, 1850-1939* (London, 1994), pp. 221-39.

Broadberry, S. N., 'Comparative productivity in British and American manufacturing during the nineteenth century', *Explorations in Economic History*, 31 (1994), pp. 521-48.

Broadberry, S. N., *The productivity race: British manufacturing in international perspective, 1850-1990* (Cambridge, 1997).

Broadberry, S. N. and Fremdling, R., 'Comparative productivity in British and German industry, 1907-37', *Oxford Bulletin of Economics and Statistics*, 52 (1990), pp. 403-22.

Broadberry, S. N. and Irwin, D. A., 'Labor productivity in the United States and the United Kingdom during the nineteenth century' *Explorations in Economic History*, 43 (2006), pp. 257-79.

Broadberry, S. and Gupta, B., 'Lancashire, India, and shifting competitive advantage in cotton textiles, 1700-1850: the neglected role of factor prices', *Economic History Review*, 62 (2009), pp. 279-305.

de Bromhead, A., Fernihough, A., Lampe, M. and O'Rourke, K. H., 'When Britain turned inward: protection and the shift towards empire in interwar Britain', NBER Working Paper, No. 23164 (2017).

Brown, A. J., 'Britain in the world economy, 1870-1914', *Yorkshire Bulletin of Economic & Social Research*, 17 (1965), pp. 46-60.

Brown, J. C., 'Imperfect competition and Anglo-German trade rivalry: markets for cotton textiles before 1914', *Journal of Economic History*, 55 (1995), pp. 494-527.

Butlin, N. G., *Australian domestic product, investment and foreign borrowing, 1861-1938/39* (Cambridge, 1962).

Cabral, M., Falvey, R. and Milner, C., 'Endowment differences and the composition of intra-industry trade', *Review of International Economics*, 21 (2013), pp. 401-18.

Cairncross, A. K., *Home and foreign investment, 1870-1913* (Cambridge, 1953).

Church, R., *The history of the British coal industry*, vol. III, *Victorian pre-eminence, 1830-1913* (Oxford, 1986).

Clapham, J. H., *The woollen and worsted industries* (London, 1907).

Clapham, J. H., *An economic history of modern Britain*, vol. III, *Machines and national rivalries, 1887-1914* (Cambridge, 1938).

Clapham, J. H., *Economic development of France and Germany, 1815-1914* (Cambridge, 1966).

Clark, G., O'Rourke, K. H. and Taylor, A. M., 'The growing dependence of Britain on trade during the Industrial Revolution', *Scandinavian Economic History Review*, 62 (2014), pp. 109-36.

Coghlan, T. A., *A statistical account of Australia and New Zealand, 1903-4* (Sydney, 1904).

Condliffe, J. B., *New Zealand in the making* (London, 1930).

Coppock, D. J., 'The climacteric of the 1890's: a critical note', *Manchester School*, 24 (1956), pp. 1-31.

Coppock, D. J., 'The causes of the Great Depression, 1873-96', *Manchester School*, 29 (1961), pp. 205-32.

Coppock, D. J., 'British industrial growth during the "Great Depression" (1873-96): a pessimist's view', *Economic History Review*, 2nd ser., 17 (1964), pp. 389-96.

Costinot, A., Donaldson, D. and Komunjer, I., 'What goods do countries trade? A quantitative exploration of Ricardo's ideas', *Review of Economic Studies*, 79 (2012), pp. 581-608.

Crafts, N. F. R., 'Victorian Britain did fail', *Economic History Review*, 2nd ser., 32 (1979), pp. 533-7.

Crafts, N. F. R. and Thomas, M., 'Comparative advantage in UK manufacturing trade, 1910-35', *Economic Journal*, 96 (1986), pp. 629-45.

Crafts, N. F. R., 'Revealed comparative advantage in manufacturing, 1899-1950', *Journal of European Economic History*, 18 (1989), pp. 127-37.

Crafts, N. F. R., Leybourne, S. J. and Mills, T. C., 'The climacteric in late Victorian Britain and France: a reappraisal of the evidence', *Journal of Applied Econometrics*, 4 (1989), pp. 103-17.

Culem, C. and Lundberg, L., 'The product pattern of intra-industry trade: stability among countries and over time', *Weltwirtschaftliches Archiv*, 122 (1986), pp. 113-30.

David, P. A. and Solar, P., 'A bicentenary contribution to the history of the cost of living in America', *Research in Economic History*, 2 (1977), pp. 1-80.

Deane, P. and Cole, W. A., *British economic growth, 1688-1959* (Cambridge, 1964).

Dedinger, B., 'The Franco-German trade puzzle: an analysis of the economic consequences of the Franco-Prussian War', *Economic History Review*, 65 (2012), pp. 1029-54.

Dilley, A., '"The rules of the game": London finance, Australia, and Canada, c.1900-14', *Economic History Review*, 63 (2010), pp. 1003-31.

Dowie, J. A., 'Studies in New Zealand investment, 1871-1900' (unpub. Ph.D. thesis, Australian National University, 1965).

Easton, B. and Wilson, N., 'An investigation of the data base of N. Z.'s terms of trade', NZIER Working Paper, No. 84/10 (1984).

Edelstein, M., 'Foreign investment, accumulation and empire, 1860-1914', in R. Floud and P. Johnson, eds., *The Cambridge economic history of modern Britain*, vol. II, *Economic maturity, 1860-1939* (Cambridge, 2004), pp. 190-226.

Eichengreen, B., 'The gold standard since Alec Ford', in S. N. Broadberry and N. F. R. Crafts, eds., *Britain in the international economy, 1870-1939* (New York, 1992), pp. 49-79.

Estevadeordal, A., Frantz, B. and Taylor, A. M., 'The rise and fall of world trade, 1870-1939', *Quarterly Journal of Economics*, 118 (2003), pp. 359-407.

Falvey, R. E., 'Commercial policy and intra-industry trade', *Journal of International Economics*, 11 (1981), pp. 495-511.

Federico, G. and Tena, A., 'Was Italy a protectionist country?', *European Review of Economic History*, 2 (1998), pp. 73-97.

Feinstein, C. H., *National income, expenditure and output in the United Kingdom, 1855-1965* (Cambridge, 1972).

Feinstein, C., 'British exports and economic growth (1850-1914)', in P. Mathias and J. A. Davis, eds., *International trade and British economic growth from the eighteenth century to the present day* (Oxford, 1996), pp. 76-95.

Feinstein, C. H., Matthews, R. C. O. and Odling-Smee, J. C., 'The timing of the climacteric and its sectoral incidence, 1873-1913', in C. P. Kindleberger and G. di Tella, eds., *Economics in the long view*, vol. II, *Applications and cases, part I* (London, 1982), pp. 168-85.

Ferguson, N. and Schularick, M., 'The empire effect: the determinants of country risk in the first age of globalization, 1880-1913', *Journal of Economic History*, 66 (2006), pp. 283-312.

Ford, A. G., 'The transfer of British foreign lending, 1870-1913', *Economic History Review*, 2nd ser., 11 (1958), pp. 302-8.

Ford, A. G., 'Notes on the working of the gold standard before 1914', *Oxford Economic Papers*, 12 (1962), pp. 52-76.

Ford, A. G., 'Notes on the role of exports in British economic fluctuations', *Economic History Review*, 2nd ser., 16 (1963), pp. 328-37.

Ford, A. G., 'A note on British export performance, 1899-1913', *Economic History Review*, 2nd ser., 22 (1969), pp. 120-1.

Geary, F. and Stark, T., 'Examining Ireland's post-famine economic growth performance', *Economic Journal*, 112 (2002), pp. 919-35.

Glazier, J. A., Bandera, V. N. and Berner, R. B., 'Terms of trade between Italy and the United Kingdom, 1815-1913', *Journal of European Economic History*, 4 (1974), pp. 5-48.

Greasley, D., 'British economic growth: the paradox of the 1880s and the timing of the climacteric', *Explorations in Economic History*, 23 (1986), pp. 416-44.

Greasley, D. and Oxley, L., 'Measuring New Zealand's GDP, 1865-1933: a cointegration-based approach', *Review of Income and Wealth*, 46 (2000), pp. 351-68.

Greasley, D. and Oxley, L., 'The pastoral boom, the rural land market, and long swings in New Zealand economic growth, 1873-1939', *Economic History Review*, 62 (2009), pp. 324-49.

Greenaway, D. and Milner, C., *The economics of intra-industry trade* (Oxford, 1986).

Greenaway, D., Hine, R. and Milner, C., 'Vertical and horizontal intra-industry trade: a cross industry analysis for the United Kingdom', *Economic Journal*, 105 (1995), pp. 1505-18.

Grubel, H. G. and Lloyd, P. J., 'The empirical measurement of intra-industry trade', *Economic Record*, 47 (1971), pp. 494-517.

Habakkuk, H. J., *American and British technology in the nineteenth century* (Cambridge, 1962).

Habakkuk, H. J., ‘Fluctuations in house-building in Britain and the United States in the nineteenth century’, *Journal of Economic History*, 22 (1962), pp. 198-230.

Haber, L. F., *The chemical industry during the nineteenth century* (Cambridge, 1958).

Harley, C. K., ‘Skilled labour and the choice of technique in Edwardian industry’, *Explorations in Economic History*, 11 (1974), pp. 391-414.

Harley, C. K., ‘Transportation, the world wheat trade, and the Kuznets cycle, 1850-1913’, *Explorations in Economic History*, 17 (1980), pp. 218-50.

Harley, C. K., ‘International competitiveness of the antebellum American cotton textile industry’, *Journal of Economic History*, 52 (1992), pp. 559-84.

Harley, C. K., ‘The antebellum tariff: different products or competing sources? A comment on Irwin and Temin’, *Journal of Economic History*, 61 (2001), pp. 799-805.

Harley, K. ‘The legacy of the early start’, in R. Floud, J. Humphries and P. Johnson, eds., *The Cambridge economic history of modern Britain*, vol. II, *1870 to the present* (Cambridge, 2014), pp. 1-25.

Hatton, T. J., ‘The demand for British exports, 1870-1913’, *Economic History Review*, 2nd ser., 43 (1990), pp. 576-94.

Hatton, T. J. and Williamson, J. G., *The age of mass migration* (New York, 1998).

Hawke, G. R., *The making of New Zealand: an economic history* (Cambridge, 1985).

Hayakawa, K., ‘How serious is the omission of bilateral tariff rates in gravity?’, *Journal of the Japanese and International Economies*, 27 (2013), pp. 81-94.

Helpman, E. and Krugman, P. R., *Market structure and foreign trade: increasing returns, imperfect competition, and the international economy* (Cambridge, Mass., 1985).

Henriksen, I., Lampe, M. and Sharp, P., ‘The role of technology and institutions for growth: Danish creameries in the late nineteenth century’, *European Review of Economic History*, 15 (2011), pp. 475-93.

Hobson, J. A., *International trade* (London, 1904).

Hodne, F., *An economic history of Norway, 1815-1970* (Trondheim, 1975).

Hoffman, J. S., *Great Britain and the German trade rivalry* (Philadelphia, 1933).

Hoffman, W. G., *British industry, 1700-1950* (Oxford, 1955).

Hoffman, W. G., *The growth of industrial economies* (Manchester, 1958).

Imlah, A. H., *Economic elements in the Pax Britannica: studies in British foreign trade in the nineteenth century* (Cambridge, Mass., 1958).

Inwood, K. and Keay, I., 'Trade policy and industrial development: iron and steel in a small open economy, 1870-1913', *Canadian Journal of Economics*, 46 (2013), pp. 1265-94.

Inwood, K. and Keay, I., 'Transport costs and trade volumes: evidence from the trans-Atlantic iron trade, 1870-1913', *Journal of Economic History*, 75 (2015), pp. 95-124.

Irwin, D. A., 'Free trade and protection in nineteenth-century Britain and France revisited: a comment on Nye', *Journal of Economic History*, 53 (1993), pp. 146-52.

Irwin, D. A., 'The lion's share: Britain's export performance revisited, 1899-1929', *Structural Change and Economic Dynamics*, 6 (1995), pp. 97-109.

Irwin, D. A., 'Changes in U.S. tariffs: the role of import prices and commercial policies', *American Economic Review*, 88 (1998), pp. 1015-26.

Irwin, D. A., 'Could the United States iron industry have survived free trade after the Civil War?', *Explorations in Economic History*, 37 (2000), pp. 278-99.

Irwin, D. A., 'Did late-nineteenth-century U.S. tariffs promote infant industries? Evidence from the tinplate industry', *Journal of Economic History*, 60 (2000), pp. 335-60.

Irwin, D. A. and Temin, P., 'The antebellum tariff on cotton textiles revisited', *Journal of Economic History*, 61 (2001), pp. 777-98.

Irwin, D. A., 'Explaining America's surge in manufactured exports, 1880-1913', *Review of Economics and Statistics*, 85 (2003), pp. 364-76.

Jacks, D., Meissner, C. M. and Novy, D., 'Trade costs in the first wave of globalization', *Explorations in Economic History*, 47 (2010), pp. 127-41.

Jacks, D. S. and Pendakur, K., 'Global trade and the maritime transport revolution', *Review of Economics and Statistics*, 92 (2010), pp. 745-55.

Jenkins, D. T. and Ponting, K. G., *The British wool textile industry, 1770-1914* (London, 1982).

Kendrick, J. W., *Productivity trends in the United States* (Princeton, 1961).

Kennedy, W. P., 'Foreign investment, trade and growth in the United Kingdom, 1870-1913', *Explorations in Economic History*, 11 (1974), pp. 415-44.

Knowles, L. C. A., *The economic development of the British overseas Empire*, vol. II, *Comparative view of Dominion problems, Canada* (London, 1930).

Knowles, L. C. A., *Economic development in the nineteenth century* (London, 1932).

Laursen, K., 'Revealed comparative advantage and the alternatives as measures of international specialization', *Eurasian Business Review*, 5 (2015), pp. 99-115.

Le Rossignol, J. E. and Stewart, W. D., 'Railways in New Zealand', *Quarterly Journal of Economics*, 23 (1909), pp. 652-96.

Le Rossignol, J. E. and Stewart, W. D. *State socialism in New Zealand* (New York, 1910).

Lewis, W. A., *Growth and fluctuations, 1870-1913* (London, 1978).

Lewis, A., 'The rate of growth of world trade, 1870-1973', in S. Grassman and E. Lundberg, eds., *The world economic order: past and prospects* (London, 1981), pp. 11-81.

Lipsey, R. E., *Price and quantity trends in the foreign trade of the United States* (Princeton, 1963).

Lloyd, P., 'The first 100 years of tariffs in Australia: the colonies', *Australian Economic History Review*, forthcoming.

López-Córdova, J. E. and Meissner, C. M., 'Exchange-rate regimes and international trade: evidence from the classical gold standard era', *American Economic Review*, 93 (2003), pp. 344-53.

Mackay, A. R. F., 'New Zealand public finance' (unpub. Ph.D. thesis, University of London, 1936).

Maddison, A., *The world economy: historical statistics* (Paris, 2003).

Magee, G. B. and Thompson, A. S., *Empire and globalisation: networks of people, goods and capital in the British world, c. 1850-1914* (Cambridge, 2010).

Maizels, A., *Industrial growth and world trade* (Cambridge, 1965).

Matthews, R. C. O., Feinstein, C. H. and Odling-Smee, J. C., *British economic growth, 1856-1973* (Oxford, 1982).

McIlraith, J. W., *The course of real prices in New Zealand* (Wellington, 1911).

Meier, G. M., 'Long period determinants of Britain's terms of trade, 1880-1913', *Review of Economic Studies*, 20 (1952), pp. 115-30.

Meyer, J. R., 'An input-output approach to evaluating the influence of exports on British industrial production in the late 19th century', *Explorations in Entrepreneurial History*, 8 (1955), pp. 12-34.

McCloskey, D. N., ‘Did Victorian Britain fail?’, *Economic History Review*, 2nd ser., 23 (1970), pp. 446-59.

McCloskey, D. N., ‘Victorian growth: a rejoinder’, *Economic History Review*, 2nd ser., 27 (1974), pp. 275-7.

McCloskey, D. N., ‘No it did not: a reply to Crafts’, *Economic History Review*, 2nd ser., 32 (1979), pp. 538-41.

Millward, A. S. and Saul, S. B., *The development of the economies of Continental Europe, 1850-1914* (London, 1977).

Mitchell, B. R., *Economic development of the British coal industry, 1800-1914* (Cambridge, 1984).

Mitchell, B. R., *British historical statistics* (Cambridge, 1988).

Mitchell, B. R. and Deane, P., *Abstract of British historical statistics* (Cambridge, 1962).

Mitchener, K. J. and Weidenmier, M., ‘Trade and empire’, *Economic Journal*, 118 (2008), pp. 1805-34.

Mulcare, T. ‘Capital formation in transport infrastructure in New Zealand to 1950’, *Australian Economic History Review*, 36 (1996), pp. 77-101.

Mundell, R. A., ‘International trade and factor mobility’, *American Economic Review*, 47 (1957), pp. 321-35.

Musson, A. E., ‘The Great Depression in Britain, 1873-1896: a reappraisal’, *Journal of Economic History*, 19 (1959), pp. 199-228.

Musson, A. E., ‘British industrial growth during the “Great Depression” (1873-96): some comments’, *Economic History Review*, 2nd ser., 15 (1963), pp. 529-33.

Musson, A. E., ‘British industrial growth, 1873-96: a balanced view’, *Economic History Review*, 2nd ser., 17 (1964), pp. 397-403.

Musson, A. E., ‘Industrial motive power in the United Kingdom, 1800-70’, *Economic History Review*, 2nd ser., 29 (1976), pp. 415-39.

Nicholas, S. J., ‘The American export invasion of Britain: the case of the engineering industry, 1870-1914’, *Technology and Culture*, 21 (1980), pp. 570-88.

Nicholas, S. J., ‘The overseas marketing performance of British industry, 1870-1914’, *Economic History Review*, 2nd ser., 37 (1984), pp. 489-506.

Novy, D., ‘Gravity redux: measuring international trade costs with panel data’, *Economic Inquiry*, 51 (2013), pp. 101-21.

Nye, J. V., ‘The myth of free-trade Britain and fortress France: tariffs and trade in the nineteenth century’, *Journal of Economic History*, 51 (1991), pp. 23-46.

Offer, A., ‘The British empire, 1870-1914: a waste of money?’, *Economic History Review*, 2nd ser., 46 (1993), pp. 215-38.

Ohlin, B., *Interregional and international trade* (Cambridge, Mass., 1933).

Ollerenshaw, P., ‘Industry, 1820-1914’, in L. Kennedy and P. Ollerenshaw, eds., *An economic history of Ulster, 1820-1939* (Manchester, 1985), pp. 62-108.

O’Rourke, K. H., ‘Tariffs and growth in the late 19th century’, *Economic Journal*, 110 (2000), pp. 456-83.

O’Rourke, K. and Williamson, J. G., ‘Late nineteenth-century Anglo-American factor-price convergence: were Heckscher and Ohlin right?’, *Journal of Economic History*, 54 (1994), pp. 892-916.

O’Rourke, K. H. and Williamson, J. G., *Globalization and history: the evolution of a nineteenth-century Atlantic economy* (Cambridge, Mass., 1999).

Patterson, R. L., ‘The British flax and linen industry’, in W. J. Ashley, ed., *British industries* (London, 1903), pp. 120-49.

Pesmazoglu, J. S., ‘Some international aspects of British cyclical fluctuations, 1870-1913’, *Review of Economic Studies*, 16 (1949), pp. 117-43.

Phelps Brown, E. H. and Handfield-Jones, S. J., ‘The climacteric of the 1890’s: a study in the expanding economy’, *Oxford Economic Papers*, 4 (1952), pp. 266-307.

Platt, D. C. M., ‘Trade competition in the regions of recent settlement’, in D. C. M. Platt, ed., *Decline and recovery in Britain’s overseas trade, 1873-1914* (London, 1993), pp. 91-138.

Pomfret, R., ‘Trade policy in Canada and Australia in the twentieth century’, *Australian Economic History Review*, 40 (2000), pp. 114-26.

Rankin, K., ‘New Zealand’s gross national product: 1859-1939’, *Review of Income and Wealth*, 38 (1992), pp. 49-69.

Rawlley, R. C., *Economics of the silk industry: a study in industrial organisation* (London, 1919).

Rimmer, W. G., *Marshalls of Leeds, flax spinners, 1788-1886* (Cambridge, 1960).

Rosenberg, W., ‘Capital imports and growth—the case of New Zealand—foreign investment in New Zealand, 1840-1958’, *Economic Journal*, 71 (1961), pp. 93-113.

Rostow, W. W., *British economy of the nineteenth century* (Oxford, 1948).

Russell, R. S., *Imperial preference* (London, 1947).

Saul, S. B., *Studies in British overseas trade, 1870-1914* (Liverpool, 1960).

Saul, S. B., 'The export economy, 1870-1914', *Bulletin of Economic Research*, 17 (1965), pp. 5-18.

Saul, S. B., *The myth of the Great Depression, 1873-1896* (London, 1969).

Sayers, R. S., *The vicissitudes of an export economy: Britain since 1880* (Sydney, 1965).

Schedvin, C. B., 'Staples and regions of the Pax Britannica', *Economic History Review*, 2nd ser., 43 (1990), pp. 533-59.

Schlote, W., *British overseas trade from 1700 to the 1930s*, trans., W. O. Henderson and W. H. Chaloner (Oxford, 1952).

Shah Mohammed, S. I. and Williamson, J. G., 'Freight rates and productivity gains in British tramp shipping, 1869-1950', *Explorations in Economic History*, 41 (2004), pp. 172-203.

Silverman, A. G., 'Monthly index numbers of British export and import prices, 1880-1913', *Review of Economics and Statistics*, 12 (1930), pp. 139-48.

Silverman, A. G., 'Some international trade factors for Great Britain, 1880-1913', *Review of Economics and Statistics*, 13 (1931), pp. 114-24.

Simkin, C. G. F., *The instability of a dependent economy: economic fluctuations in New Zealand, 1840-1914* (London, 1951).

Simon, M., 'The pattern of new British portfolio foreign investment, 1865-1914', in A. R. Hall, ed., *The export of capital from Britain, 1870-1914* (London, 1968), pp. 15-44.

Stewart, W. D., 'Land tenure and land monopoly in New Zealand: I', *Journal of Political Economy*, 17 (1909), pp. 82-91.

Stone, I., *The global export of capital from Great Britain, 1865-1914* (London, 1999).

Sundararajan, V., 'The impact of the tariff on some selected products of the U.S. iron and steel industry, 1870-1914', *Quarterly Journal of Economics*, 84 (1970), pp. 590-610.

Sutch, R. and Carter, S. B., eds., *Historical statistics of the United States: millennial edition* (New York, 2006).

Taussig, F. W., *International trade* (New York, 1928).

Taussig, F. W., *Some aspects of the tariff question* (Cambridge, Mass., 3rd edn., 1931).

Taussig, F. W., *The tariff history of the United States* (New York, 8th edn., 1931).

Taylor, A. J., 'The coal industry', in D. H. Aldcroft, ed., *The development of British industry and foreign competition, 1875-1914* (London, 1968), pp. 37-70.

Tena-Junguito, A., 'Bairoch revisited: tariff structure and growth in the late nineteenth century', *European Review of Economic History*, 14 (2010), pp. 111-43.

Tena-Junguito, A., Lampe, M. and Tâmega Fernandes, F., 'How much trade liberalization was there in the world before and after Cobden-Chevalier?', *Journal of Economic History*, 72 (2012), pp. 708-40.

Thompson, A. and Magee, G., 'A soft touch? British industry, empire markets, and the self-governing dominions, c. 1870-1914', *Economic History Review*, 2nd ser., 56 (2003), pp. 689-717.

Tinbergen, J., *Business cycles in the United Kingdom, 1870-1914* (Amsterdam, 1951).

Toniolo, G., *An economic history of liberal Italy, 1850-1918* (London, 1990).

Tyszynski, H., 'World trade in manufactured commodities, 1899-1950', *Manchester School*, 19 (1951), pp. 272-304.

Urquhart, M. C., *Gross national product, Canada, 1870-1926: the derivation of the estimates* (Kingston, Ont., 1993).

Urquhart, M. C. and Buckley, K. A. H., *Historical statistics of Canada* (Cambridge, 1965).

Vollrath, T. L., 'A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage', *Weltwirtschaftliches Archiv*, 127 (1991), pp. 265-80.

Watkins, M. H., 'A staple theory of economic growth', *Canadian Journal of Economics and Political Science*, 29 (1963), pp. 141-58.

Whale, P. B., 'The working of the pre-war gold standard', *Economica*, 11 (1937), pp. 18-32.

Williamson, J. G., 'The long swing: comparisons and interactions between British and American balance of payments, 1820-1913', *Journal of Economic History*, 22 (1962), pp. 21-46.

Williamson, J. G., ‘The evolution of global labor markets since 1830: background evidence and hypotheses’, *Explorations in Economic History*, 32 (1995), pp. 141-96.

Wilson, R., *Capital imports and the terms of trade* (Melbourne, 1931).

Appendices

Appendix 1.1. *Values, volumes, and prices of British exports, 1870-1900*

Year	Current value (£ million)	Volume index	Price index
1870	199.6	75.5	118.5
1871	223.1	84.7	118.0
1872	256.3	87.9	130.6
1873	255.2	84.6	135.2
1874	239.6	84.1	127.7
1875	223.5	83.5	120.0
1876	200.6	81.4	110.5
1877	198.9	84.0	106.2
1878	192.8	84.4	102.3
1879	191.5	89.0	96.4
1880	223.1	100.0	100.0
1881	234.0	109.5	95.8
1882	241.5	110.8	97.7
1883	239.8	113.9	94.4
1884	233.0	114.8	90.9
1885	213.1	109.2	87.4
1886	212.7	114.0	83.6
1887	221.9	119.2	83.4
1888	234.5	126.8	82.9
1889	248.9	131.9	84.6
1890	263.5	133.8	88.3
1891	247.2	126.6	87.5
1892	227.1	121.8	83.6
1893	218.1	117.2	83.4
1894	215.8	122.2	79.2
1895	225.9	132.9	76.2
1896	240.2	140.1	76.9
1897	234.2	138.1	76.0
1898	233.4	137.2	76.2
1899	264.5	146.1	79.8
1900	291.2	140.0	91.7

Source: Imlah, *Pax Britannica*, pp. 96-7.
Notes: The volume index is expressed in 1880 prices.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3*

Industry	1870/1	1871/2	1872/3	1873/4	1874/5
Alkali	2.0 (35.1)	2.4 (30.2)	3.4 (15.1)	4.2 (17.0)	4.7 (19.9)
Books	0.7 (25.0)	0.7 (25.0)	0.8 (22.9)	1.1 (22.5)	1.2 (24.5)
Cement	--	--	--	--	--
Clocks and watches	1.8 (23.3)	1.0 (26.1)	0.3 (25.3)	0.3 (24.8)	0.3 (25.3)
Coal	0.2 (47.5)	0.3 (47.2)	0.3 (23.9)	0.4 (19.0)	0.5 (18.3)
Cotton manufactures	14.4 (40.5)	14.5 (41.0)	14.2 (36.3)	14.8 (36.3)	16.1 (37.4)
Earthenware and chinaware	2.2 (41.3)	2.2 (41.6)	2.5 (41.6)	2.9 (43.7)	2.9 (41.7)
Flax and manufactures thereof	10.4 (33.7)	11.2 (33.1)	10.8 (33.2)	12.9 (33.1)	14.5 (33.9)
Fur and manufactures thereof	0.8 (19.8)	0.8 (20.6)	0.8 (20.8)	0.8 (21.0)	1.2 (20.8)
Iron, steel, and manufactures thereof	22.0 (43.1)	24.9 (41.4)	25.7 (31.8)	20.3 (31.5)	12.9 (33.3)
Leather and manufactures thereof	3.5 (36.4)	3.4 (37.1)	2.5 (31.6)	1.7 (31.9)	1.7 (33.0)
Salt	0.5 (101.6)	0.5 (98.4)	0.7 (41.7)	1.3 (36.7)	1.1 (40.2)
Silk manufactures	12.0 (57.8)	9.3 (57.7)	6.2 (57.3)	4.8 (56.1)	4.3 (57.3)
Tinplate	6.2 (22.7)	7.3 (22.8)	8.1 (15.3)	9.9 (15.1)	11.6 (16.1)
Wool	1.9 (45.6)	0.7 (46.1)	3.0 (38.3)	1.4 (38.5)	2.5 (35.5)
Wool manufactures	21.4 (67.7)	20.9 (65.7)	20.7 (58.5)	23.4 (58.4)	24.4 (59.8)
Industry-composite tariff	46.8	45.2	38.1	37.9	38.9

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1875/6	1876/7	1877/8	1878/9	1879/80
Alkali	4.7 (21.9)	6.1 (23.2)	6.0 (24.7)	5.9 (29.7)	3.6 (25.2)
Books	1.5 (25.0)	1.3 (25.0)	1.4 (25.0)	1.7 (24.7)	1.0 (24.8)
Cement	--	--	--	--	--
Clocks and watches	0.1 (26.4)	0.1 (27.3)	0.1 (27.0)	0.1 (27.2)	0.1 (26.5)
Coal	0.5 (18.9)	0.7 (20.9)	0.7 (22.3)	0.6 (21.3)	0.2 (22.3)
Cotton manufactures	15.6 (40.2)	14.5 (39.8)	14.0 (39.5)	13.9 (38.8)	10.9 (38.8)
Earthenware and chinaware	3.4 (42.1)	3.8 (42.1)	4.2 (41.9)	4.1 (42.3)	2.7 (42.4)
Flax and manufactures thereof	15.9 (33.7)	18.4 (33.7)	18.5 (33.2)	19.3 (33.7)	13.7 (33.7)
Fur and manufactures thereof	1.7 (20.6)	1.5 (20.6)	1.3 (20.5)	1.9 (20.6)	1.2 (20.8)
Iron, steel, and manufactures thereof	11.1 (36.2)	9.8 (36.8)	9.1 (38.5)	9.3 (38.0)	26.8 (42.2)
Leather and manufactures thereof	2.1 (34.7)	2.1 (33.0)	2.0 (34.5)	2.2 (34.8)	2.7 (29.0)
Salt	1.5 (37.2)	1.6 (49.4)	1.6 (48.8)	1.8 (47.4)	0.8 (48.3)
Silk manufactures	4.1 (58.5)	4.4 (58.9)	3.8 (59.1)	4.9 (59.3)	4.3 (59.0)
Tinplate	11.3 (21.3)	13.1 (25.0)	13.0 (27.0)	14.2 (29.9)	11.1 (24.7)
Wool	3.9 (35.3)	3.8 (37.9)	5.1 (38.8)	3.0 (35.7)	8.2 (41.2)
Wool manufactures	22.6 (65.5)	18.8 (66.5)	19.1 (66.8)	17.1 (67.2)	12.7 (68.7)
Industry-composite tariff	41.2	40.7	41.2	41.2	41.2

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1880/1	1881/2	1882/3	1883/4	1884/5
Alkali	4.1 (27.9)	3.5 (32.8)	4.2 (31.1)	5.1 (28.5)	5.3 (29.7)
Books	1.3 (24.8)	1.3 (24.8)	1.4 (24.8)	1.4 (25.0)	1.4 (25.0)
Cement	--	--	--	0.5 (20.0)	0.5 (20.0)
Clocks and watches	0.1 (26.5)	0.1 (36.8)	0.1 (26.5)	0.1 (25.8)	0.1 (26.3)
Coal	0.6 (24.6)	0.7 (27.9)	0.5 (24.0)	0.8 (22.5)	0.9 (22.6)
Cotton manufactures	13.6 (38.5)	13.9 (39.1)	14.5 (37.8)	12.4 (40.1)	12.7 (40.1)
Earthenware and chinaware	3.8 (42.7)	3.4 (43.2)	4.4 (43.1)	2.8 (55.7)	3.4 (56.4)
Flax and manufactures thereof	12.0 (33.2)	11.9 (33.3)	12.6 (32.8)	13.7 (34.1)	15.1 (34.1)
Fur and manufactures thereof	1.8 (21.3)	2.0 (21.8)	1.6 (22.0)	2.4 (20.8)	1.8 (20.5)
Iron, steel, and manufactures thereof	26.1 (41.7)	26.5 (44.8)	20.7 (40.6)	12.4 (39.7)	9.7 (40.0)
Leather and manufactures thereof	2.0 (31.7)	2.0 (31.0)	2.2 (29.8)	1.4 (27.8)	1.5 (28.0)
Salt	1.2 (48.2)	0.9 (45.8)	0.9 (47.8)	1.2 (49.9)	1.3 (53.0)
Silk manufactures	4.8 (58.8)	5.1 (59.1)	4.4 (59.0)	5.2 (49.9)	4.9 (49.8)
Tinplate	11.3 (28.5)	11.8 (29.6)	13.5 (30.2)	17.0 (27.9)	18.6 (30.4)
Wool	3.6 (40.3)	3.0 (37.3)	3.6 (37.4)	5.5 (33.3)	4.1 (33.4)
Wool manufactures	13.6 (67.7)	14.0 (68.1)	15.3 (68.5)	18.1 (66.2)	18.5 (67.2)
Industry-composite tariff	41.7	43.0	41.7	40.9	41.8

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1885/6	1886/7	1887/8	1888/9	1889/90
Alkali	4.8 (31.2)	4.0 (33.7)	3.7 (36.8)	3.5 (36.9)	3.9 (32.9)
Books	1.3 (25.0)	1.2 (25.0)	1.4 (25.0)	1.3 (25.0)	1.2 (25.0)
Cement	0.4 (20.0)	0.6 (20.0)	1.0 (20.0)	0.7 (20.0)	0.9 (20.0)
Clocks and watches	0.1 (26.2)	0.1 (26.0)	0.1 (25.9)	0.1 (26.0)	0.1 (26.0)
Coal	0.7 (23.3)	0.6 (24.3)	0.4 (22.3)	0.3 (21.7)	0.1 (22.2)
Cotton manufactures	11.0 (40.2)	9.8 (40.2)	9.1 (40.0)	8.5 (40.0)	9.5 (39.9)
Earthenware and chinaware	3.1 (56.7)	3.1 (57.0)	3.3 (57.0)	3.2 (57.1)	3.2 (57.1)
Flax and manufactures thereof	13.5 (34.3)	13.3 (34.2)	13.1 (34.2)	14.2 (34.0)	14.7 (33.9)
Fur and manufactures thereof	1.7 (20.4)	1.5 (20.4)	1.9 (20.2)	2.1 (20.2)	2.0 (20.2)
Iron, steel, and manufactures thereof	10.3 (42.5)	17.3 (43.8)	15.5 (46.7)	8.7 (42.8)	9.9 (38.0)
Leather and manufactures thereof	2.0 (28.5)	1.7 (30.1)	2.2 (29.8)	2.1 (30.5)	1.9 (31.7)
Salt	1.1 (47.3)	0.9 (46.5)	0.7 (49.0)	0.6 (49.2)	0.6 (41.3)
Silk manufactures	4.4 (49.7)	4.6 (49.7)	5.2 (49.6)	5.5 (49.6)	5.4 (49.5)
Tinplate	17.0 (32.4)	14.6 (33.8)	15.9 (33.2)	17.8 (34.7)	16.7 (32.5)
Wool	7.7 (37.2)	7.4 (36.1)	6.5 (33.6)	7.4 (34.3)	6.7 (33.8)
Wool manufactures	21.0 (67.3)	19.3 (67.2)	20.1 (68.3)	23.8 (67.1)	23.2 (69.1)
Industry-composite tariff	43.4	43.9	44.4	44.5	43.8

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1890/1	1891/2	1892/3	1893/4	1894/5
Alkali	4.7 (26.7)	6.0 (24.5)	5.5 (25.0)	5.3 (30.5)	4.1 (30.9)
Books	1.3 (25.0)	1.6 (25.0)	1.3 (25.0)	1.8 (25.0)	1.3 (25.0)
Cement	1.5 (20.8)	1.7 (21.9)	1.3 (24.0)	2.0 (24.9)	1.1 (24.8)
Clocks and watches	0.1 (26.5)	0.1 (27.0)	0.1 (27.3)	0.0 (26.6)	0.1 (25.0)
Coal	0.3 (21.7)	0.7 (22.6)	0.4 (22.7)	0.5 (23.1)	0.4 (24.4)
Cotton manufactures	9.4 (51.0)	12.1 (57.3)	12.8 (57.1)	13.5 (56.3)	15.2 (46.8)
Earthenware and chinaware	3.5 (57.2)	4.5 (57.6)	4.1 (57.6)	5.0 (57.7)	5.3 (34.9)
Flax and manufactures thereof	13.9 (37.9)	19.5 (39.1)	18.1 (39.1)	21.2 (39.1)	17.5 (36.2)
Fur and manufactures thereof	2.1 (20.8)	2.4 (21.5)	1.8 (21.4)	2.7 (21.4)	3.0 (20.6)
Iron, steel, and manufactures thereof	7.8 (39.3)	9.3 (42.8)	9.2 (48.6)	6.6 (50.0)	7.5 (38.7)
Leather and manufactures thereof	1.8 (33.2)	2.2 (33.7)	2.1 (34.2)	2.8 (33.3)	3.1 (26.3)
Salt	0.5 (44.1)	0.5 (46.0)	0.4 (42.8)	0.7 (39.9)	0.1 (47.4)
Silk manufactures	4.2 (51.9)	3.3 (54.0)	3.3 (53.6)	3.5 (53.1)	3.2 (47.5)
Tinplate	27.1 (29.1)	12.2 (74.6)	15.2 (78.4)	18.5 (82.4)	13.9 (56.7)
Wool	7.0 (38.4)	7.7 (44.1)	8.4 (44.3)	2.6 (41.1)	0.5 (39.0)
Wool manufactures	14.8 (80.6)	16.3 (95.8)	15.9 (98.6)	13.1 (97.3)	23.8 (56.8)
Industry-composite tariff	43.1	55.0	57.8	57.6	44.7

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1895/6	1896/7	1897/8	1898/9	1899/00
Alkali	3.3 (31.0)	3.1 (30.8)	2.0 (49.6)	1.0 (52.3)	1.1 (45.8)
Books	1.1 (25.0)	1.2 (25.0)	1.7 (25.0)	1.7 (25.0)	1.4 (25.0)
Cement	1.1 (24.7)	0.8 (25.1)	0.7 (24.6)	0.7 (24.0)	0.5 (23.1)
Clocks and watches	0.1 (25.0)	0.1 (25.0)	0.2 (38.2)	0.2 (35.8)	0.2 (36.1)
Coal	0.2 (13.8)	0.2 (14.2)	0.6 (23.8)	0.5 (22.0)	0.4 (21.3)
Cotton manufactures	14.4 (45.9)	18.4 (46.0)	19.5 (54.8)	22.1 (56.0)	21.6 (55.3)
Earthenware and chinaware	5.2 (33.8)	5.2 (34.0)	4.9 (55.4)	5.1 (58.8)	4.1 (58.8)
Flax and manufactures thereof	15.5 (35.6)	21.0 (34.8)	23.8 (41.1)	28.3 (42.0)	24.8 (41.3)
Fur and manufactures thereof	2.3 (20.7)	1.4 (20.9)	2.4 (21.1)	2.4 (20.9)	2.1 (21.3)
Iron, steel, and manufactures thereof	10.4 (32.0)	6.7 (34.1)	7.8 (36.7)	8.1 (38.1)	10.9 (34.9)
Leather and manufactures thereof	2.5 (25.5)	3.2 (24.6)	4.3 (32.3)	4.3 (35.7)	3.4 (35.3)
Salt	0.0 (15.5)	0.0 (34.6)	0.7 (47.3)	0.7 (46.7)	0.6 (46.7)
Silk manufactures	2.7 (47.0)	2.4 (46.8)	3.5 (54.3)	4.0 (54.0)	3.5 (52.0)
Tinplate	9.6 (51.7)	6.8 (51.6)	6.9 (66.4)	4.5 (62.4)	6.0 (46.5)
Wool	0.0 (0.0)	0.0 (0.0)	8.3 (47.0)	5.6 (47.3)	9.7 (48.9)
Wool manufactures	31.6 (47.8)	29.5 (46.4)	12.8 (80.4)	10.9 (94.9)	9.6 (91.4)
Industry-composite tariff	41.3	40.8	50.7	52.0	49.6

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1900/1	1901/2	1902/3	1903/4	1904/5
Alkali	0.7 (40.8)	0.5 (37.4)	0.3 (37.5)	0.3 (36.6)	0.3 (37.6)
Books	1.6 (24.9)	1.6 (25.0)	1.3 (25.0)	1.6 (25.0)	1.5 (24.9)
Cement	0.4 (23.1)	0.1 (22.9)	0.2 (24.7)	0.2 (24.2)	0.1 (23.8)
Clocks and watches	0.3 (35.9)	0.3 (34.1)	0.2 (35.8)	0.2 (36.3)	0.2 (37.7)
Coal	0.3 (20.1)	0.5 (19.9)	5.0 (8.2)	0.5 (6.6)	0.2 (21.6)
Cotton manufactures	21.5 (54.9)	21.1 (54.9)	18.8 (53.7)	21.1 (53.8)	17.8 (54.3)
Earthenware and chinaware	4.8 (58.8)	3.8 (59.1)	3.0 (58.9)	4.0 (58.9)	3.3 (59.0)
Flax and manufactures thereof	28.0 (39.3)	27.1 (39.0)	21.6 (40.2)	27.2 (40.1)	24.8 (39.6)
Fur and manufactures thereof	2.0 (21.3)	2.4 (21.2)	1.7 (21.2)	1.9 (21.1)	1.6 (20.8)
Iron, steel, and manufactures thereof	10.7 (35.9)	10.9 (33.7)	21.9 (30.9)	10.7 (34.0)	9.3 (34.4)
Leather and manufactures thereof	3.7 (35.1)	3.2 (36.1)	2.9 (35.4)	3.3 (36.5)	3.8 (34.0)
Salt	0.7 (45.0)	0.6 (38.9)	0.4 (41.1)	0.4 (41.2)	0.3 (40.1)
Silk manufactures	2.9 (53.1)	2.7 (53.6)	2.0 (53.5)	2.2 (52.8)	1.8 (53.5)
Tinplate	5.6 (46.6)	7.7 (49.2)	3.2 (50.9)	4.3 (54.6)	5.3 (53.0)
Wool	8.0 (50.8)	8.0 (59.0)	8.7 (54.7)	11.7 (48.9)	19.6 (46.6)
Wool manufactures	8.8 (91.3)	9.6 (91.6)	8.7 (91.0)	10.3 (92.6)	10.3 (91.8)
Industry-composite tariff	48.7	49.5	45.3	49.5	49.3

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1905/6	1906/7	1907/8	1908/9	1909/10
Alkali	0.2 (35.2)	--	--	--	--
Books	1.5 (25.0)	1.5 (25.0)	1.9 (25.0)	1.8 (25.0)	2.7 (29.0)
Cement	0.1 (24.8)	0.8 (25.1)	0.8 (24.1)	0.1 (20.6)	0.1 (22.1)
Clocks and watches	0.1 (39.6)	0.1 (39.0)	0.1 (35.8)	0.1 (37.5)	0.1 (35.6)
Coal	0.3 (21.6)	0.2 (20.8)	0.1 (22.5)	0.1 (20.6)	0.0 (16.1)
Cotton manufactures	20.2 (54.0)	20.3 (53.4)	24.9 (52.3)	22.1 (53.4)	18.0 (56.0)
Earthenware and chinaware	2.9 (58.9)	2.8 (58.6)	3.5 (58.8)	2.6 (58.7)	2.5 (58.5)
Flax and manufactures thereof	27.4 (38.0)	27.3 (35.0)	27.4 (35.1)	24.8 (38.3)	24.4 (38.7)
Fur and manufactures thereof	1.6 (21.2)	1.1 (21.4)	0.6 (22.2)	1.5 (21.7)	1.3 (25.3)
Iron, steel, and manufactures thereof	13.0 (29.4)	18.7 (26.8)	13.7 (30.1)	10.0 (32.4)	14.9 (27.1)
Leather and manufactures thereof	3.9 (34.1)	3.5 (30.9)	3.1 (32.0)	3.1 (36.3)	3.7 (32.0)
Salt	0.3 (41.9)	0.3 (43.7)	0.3 (45.1)	0.3 (41.3)	0.2 (39.6)
Silk manufactures	1.7 (53.2)	1.9 (52.7)	2.0 (51.9)	2.0 (53.1)	2.7 (53.4)
Tinplate	3.5 (52.9)	4.1 (45.6)	4.8 (49.0)	3.5 (54.6)	3.8 (43.2)
Wool	13.0 (43.5)	10.6 (40.9)	8.5 (42.7)	20.8 (49.1)	17.2 (44.3)
Wool manufactures	10.1 (90.3)	6.9 (89.4)	8.3 (91.2)	7.2 (90.2)	8.5 (90.1)
Industry-composite tariff	46.8	42.5	45.4	47.9	45.8

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.1. *Industry weights, industry tariffs, and industry-composite tariff, 1870/1-1912/3* (continued)

Industry	1910/1	1911/2	1912/3
Alkali	--	--	--
Books	3.2 (29.1)	3.5 (29.9)	3.0 (29.7)
Cement	0.1 (23.2)	0.1 (22.0)	0.0 (21.9)
Clocks and watches	0.2 (37.1)	0.1 (36.0)	0.1 (35.8)
Coal	0.0 (14.8)	0.0 (13.7)	0.0 (14.8)
Cotton manufactures	21.0 (55.7)	21.8 (55.6)	20.5 (55.0)
Earthenware and chinaware	2.8 (58.3)	2.4 (58.4)	2.5 (58.2)
Flax and manufactures thereof	26.9 (38.9)	28.4 (36.7)	29.7 (33.2)
Fur and manufactures thereof	1.2 (26.2)	1.0 (25.9)	1.0 (26.2)
Iron, steel, and manufactures thereof	15.5 (26.0)	11.2 (28.6)	12.9 (26.1)
Leather and manufactures thereof	3.9 (32.3)	4.8 (29.8)	5.4 (27.9)
Salt	0.3 (36.2)	0.3 (41.1)	0.3 (40.7)
Silk manufactures	4.1 (52.5)	3.4 (52.0)	3.0 (51.4)
Tinplate	3.2 (36.2)	0.3 (25.2)	1.0 (29.9)
Wool	8.9 (42.2)	15.1 (43.6)	13.9 (44.7)
Wool manufactures	8.8 (87.7)	7.6 (83.0)	6.8 (81.8)
Industry-composite tariff	45.3	44.8	42.4

Source: Calculated from *Foreign commerce and navigation of the United States*. See text.
Notes: Weights are expressed in %. Per-industry *ad valorem* equivalent tariffs are expressed in % and indicated in parentheses. Several industries contain discontinuities, as discussed in the text.

Appendix 2.2. *Specie, dutiable, and free American imports from Britain, 1870/1-1912/3*

	(1)	(2)	(3)
Year	Specie imports from Britain ($ million)	Dutiable imports from Britain ($ million)	Free imports from Britain, excluding specie ($ million)
1870/1	0.1	212.1	8.6
1871/2	0.6	236.5	12.2
1872/3	0.5	219.7	17.6
1873/4	13.6	159.5	20.5
1874/5	1.7	137.0	18.3
1875/6	1.5	108.7	14.6
1876/7	21.4	95.7	18.0
1877/8	12.6	90.9	16.4
1878/9	3.4	89.9	18.6
1879/80	--	179.8	30.8
1880/1	--	150.4	24.1
1881/2	--	169.9	25.7
1882/3	--	161.3	27.3
1883/4	--	135.0	27.6
1884/5	--	112.2	24.5
1885/6	--	126.9	27.3
1886/7	--	138.3	26.7
1887/8	--	147.2	30.7
1888/9	--	150.1	28.2
1889/90	--	155.8	30.6
1890/1	--	158.3	36.4
1891/2	--	120.9	35.4
1892/3	--	139.7	43.2
1893/4	--	82.9	24.5
1894/5	--	108.7	50.4
1895/6	--	114.0	56.0
1896/7	--	96.5	71.5
1897/8	--	76.2	32.7
1898/9	--	82.2	36.3
1899/00	--	106.8	52.8
1900/1	--	92.5	50.9
1901/2	--	110.0	55.8
1902/3	--	131.3	58.7
1903/4	--	108.7	57.1
1904/5	--	114.1	61.7
1905/6	--	133.0	77.1
1906/7	--	155.3	90.8
1907/8	--	124.7	65.6
1908/9	--	134.5	74.1
1909/10	--	154.5	116.5
1910/1	--	138.6	122.7
1911/2	--	135.8	137.1
1912/3	--	143.0	152.5

Source: Foreign commerce and navigation of the United States.

Notes: It should not be assumed from col. 1 that there were no specie imports from Britain after 1878/9. Rather, it should simply be noted that, after 1878/9, the *Foreign Commerce* records specie and merchandise imports separately.

Appendix 3.1. *Data sources for panel regression*

British exports

For all countries, these figures are obtained from *Annual statements of the trade of the United Kingdom* and deflated by the British export price index from Imlah, *Pax Britannica*, pp. 96-8. For consistency, figures for Canada include Newfoundland and Labrador.

British lending

For all countries, these figures are obtained from Stone, *Global export*, and deflated by the British export price index from Imlah, *Pax Britannica*, pp. 96-8.

Real GDP

Australia: Butlin, *Australian domestic product*, pp. 33-4.
Canada: Urquhart, *Derivation of the estimates*, pp. 24-5.
New Zealand: Calculated as the real GDP per capita reported in Greasley and Oxley, 'Cointegration based approach', pp. 365-6, multiplied by the non-Maori population of New Zealand reported in Rankin, 'Gross national product', pp. 58-9.
Uruguay: Maddison, *World economy*, p. 132.
United States: Sutch and Carter, *Historical statistics*, table Ca9.

Terms of trade

Australia: Wilson, *Capital imports*, p. 89.
Canada: Calculated from Urquhart and Buckley, *Historical statistics of Canada*, p. 184. This series pertains to fiscal years ending 31 March (until 1908) and ending 30 June (thereafter). Therefore, the terms of trade lag British exports by either one-quarter or one-half year.
New Zealand: Calculated from Easton and Wilson, 'N. Z.'s terms', pp. 36-7. I thank Brian Easton for supplying this data.
Uruguay: Baptista and Bértola, 1999, unpublished data. I thank Belén Baptista for supplying this data.
United States: Lipsey, *Price and quantity*, p. 442. This series pertains to fiscal years ending 30 June. Therefore, the terms of trade lead British exports by one-half year.

Appendix 3.2. *Augmented Dickey-Fuller test statistics*

	Interval	I(0)	I(1)
Australia			
Exports	1871-1913	-2.50	-5.85***
Lending	1871-1913	-2.75*	-7.30***
GDP	1871-1913	-1.78	-8.80***
Terms of trade	1871-1913	-2.55	-9.56***
Canada			
Exports	1871-1913	0.04	-7.49***
Lending	1871-1913	-2.56	-10.10***
GDP	1871-1913	1.60	-6.46***
Terms of trade	1871-1913	-2.53	-6.85***
New Zealand			
Exports	1871-1913	-2.65*	-5.75***
Lending	1871-1913	-4.04***	-9.11***
GDP	1871-1913	-2.27	-6.10***
Terms of trade	1871-1913	-3.65***	-7.51***
Railway capital formation	1872-1900	-3.19**	-3.82***
Iron	1872-1900	-3.41**	-5.11***
Cotton textiles	1872-1900	-1.29	-5.77***
Uruguay			
Exports	1877-1913	-2.18	-8.01***
Lending	1877-1913	-3.65**	-6.57***
GDP	1877-1913	-0.59	-8.12***
Terms of trade	1877-1913	-1.91	-6.13***
United States			
Exports	1880-1913	-3.47**	-8.99***
Lending	1880-1913	-3.09**	-7.57***
GDP	1880-1913	-0.35	-8.67***
Terms of trade	1880-1913	-2.55	-5.61***

Notes: All variables are expressed in natural logarithms. * indicates statistical significance at 10%, ** at 5%, and *** at 1%.

Appendix 4.1. *RCA indicators for Belgium, 1880-1900*

Industry	1880	1890	1900
Beer	0.1 (15)	0.1 (16)	0.0 (16)
Cement	2.6 (5)	1.3 (8)	5.8 (2)
Chemicals, including dyestuffs, medicine, and paint	0.9 (7)	2.0 (4)	2.3 (5)
Clocks and watches	0.0 (17)	0.0 (17)	0.0 (17)
Copper manufactures	0.3 (13)	0.4 (11)	0.3 (13)
Cotton manufactures, including yarn	0.3 (12)	0.3 (12)	0.3 (11)
Earthenware and chinaware	0.8 (8)	1.8 (5)	1.5 (8)
Flax, hemp, and jute manufactures, including yarn and cordage	4.4 (2)	4.9 (2)	5.1 (3)
Glass	8.7 (1)	7.0 (1)	8.3 (1)
Iron, steel, and manufactures thereof, excluding machinery	0.7 (9)	1.7 (6)	1.5 (7)
Leather and manufactures thereof	0.5 (11)	0.6 (10)	1.2 (9)
Machinery, including steam engines and locomotives	2.6 (4)	3.3 (3)	2.3 (4)
Paper and manufactures thereof	3.1 (3)	1.6 (7)	1.7 (6)
Rubber manufactures	0.1 (14)	0.1 (15)	0.2 (14)
Silk manufactures	0.0 (16)	0.1 (14)	0.1 (15)
Spirits	0.5 (10)	0.1 (13)	0.3 (12)
Woollen and worsted manufactures, including yarn	1.8 (6)	1.3 (9)	0.8 (10)

Sources: See text.
Note: Rankings of indicators are noted in parentheses.

Appendix 4.2. *RCA indicators for France, 1880-1900*

Industry	1880	1890	1900
Beer	0.1 (17)	0.3 (17)	0.5 (16)
Cement	0.4 (14)	2.0 (8)	1.9 (7)
Chemicals, including dyestuffs, medicine, and paint	1.2 (9)	1.2 (10)	1.4 (10)
Clocks and watches	3.6 (3)	3.6 (3)	4.8 (2)
Copper manufactures	0.3 (15)	0.6 (14)	0.7 (13)
Cotton manufactures, including yarn	0.3 (16)	0.4 (16)	0.7 (14)
Earthenware and chinaware	1.4 (8)	1.9 (9)	1.8 (9)
Flax, hemp, and jute manufactures, including yarn and cordage	0.8 (11)	0.5 (15)	1.0 (12)
Glass	1.6 (7)	2.1 (7)	2.1 (6)
Iron, steel, and manufactures thereof, excluding machinery	0.5 (13)	0.8 (11)	0.6 (15)
Leather and manufactures thereof	4.1 (2)	3.6 (4)	3.0 (4)
Machinery, including steam engines and locomotives	0.5 (12)	0.7 (13)	0.5 (17)
Paper and manufactures thereof	2.7 (5)	2.3 (6)	1.9 (8)
Rubber manufactures	1.2 (10)	0.8 (12)	1.0 (11)
Silk manufactures	3.6 (4)	4.3 (2)	5.6 (1)
Spirits	4.5 (1)	4.8 (1)	3.7 (3)
Woollen and worsted manufactures, including yarn	2.5 (6)	2.4 (5)	2.2 (5)

Sources: See text.
Note: Rankings of indicators are noted in parentheses.

Appendix 4.3. *RCA indicators for Germany, 1880-1900*

Industry	1880	1890	1900
Beer	2.7 (6)	2.2 (8)	2.2 (7)
Cement	3.1 (4)	2.8 (5)	2.8 (4)
Chemicals, including dyestuffs, medicine, and paint	4.4 (1)	4.5 (2)	3.8 (2)
Clocks and watches	2.2 (8)	2.7 (6)	2.1 (9)
Copper manufactures	1.3 (14)	1.4 (13)	1.2 (14)
Cotton manufactures, including yarn	0.7 (16)	0.9 (16)	1.0 (15)
Earthenware and chinaware	2.5 (7)	1.9 (11)	2.8 (5)
Flax, hemp, and jute manufactures, including yarn and cordage	0.5 (17)	0.5 (17)	0.5 (17)
Glass	1.9 (11)	2.2 (9)	1.6 (12)
Iron, steel, and manufactures thereof, excluding machinery	2.0 (10)	1.9 (12)	2.0 (10)
Leather and manufactures thereof	2.0 (9)	2.6 (7)	1.9 (11)
Machinery, including steam engines and locomotives	1.2 (15)	0.9 (15)	1.5 (13)
Paper and manufactures thereof	3.2 (3)	4.7 (1)	4.0 (1)
Rubber manufactures	2.9 (5)	3.2 (4)	2.9 (3)
Silk manufactures	3.7 (2)	3.6 (3)	2.5 (6)
Spirits	1.9 (12)	1.2 (14)	0.9 (16)
Woollen and worsted manufactures, including yarn	1.8 (13)	2.1 (10)	2.1 (8)

Sources: See text.
Note: Rankings of indicators are noted in parentheses.

Appendix 4.4. *RCA indicators for the United States, 1880-1900*

Industry	1880	1890	1900
Beer	0.1 (12)	0.4 (9)	0.9 (7)
Cement	0.1 (14)	0.1 (15)	0.1 (15)
Chemicals, including dyestuffs, medicine, and paint	0.2 (7)	0.4 (8)	0.6 (10)
Clocks and watches	1.2 (1)	1.6 (1)	1.4 (5)
Copper manufactures	0.2 (9)	0.5 (6)	3.6 (1)
Cotton manufactures, including yarn	0.2 (11)	0.2 (13)	0.4 (12)
Earthenware and chinaware	0.0 (15)	0.1 (14)	0.2 (14)
Flax, hemp, and jute manufactures, including yarn and cordage	0.1 (13)	0.2 (12)	0.4 (11)
Glass	0.2 (10)	0.2 (11)	0.4 (13)
Iron, steel, and manufactures thereof, excluding machinery	0.3 (5)	0.4 (7)	1.4 (4)
Leather and manufactures thereof	0.5 (4)	0.8 (2)	1.6 (3)
Machinery, including steam engines and locomotives	0.5 (3)	0.8 (3)	1.6 (2)
Paper and manufactures thereof	0.2 (6)	0.2 (10)	0.7 (8)
Rubber manufactures	0.2 (8)	0.6 (4)	1.1 (6)
Silk manufactures	0.0 (17)	0.0 (17)	0.0 (17)
Spirits	0.7 (2)	0.5 (5)	0.6 (9)
Woollen and worsted manufactures, including yarn	0.0 (16)	0.0 (16)	0.0 (16)

Sources: See text.
Note: Rankings of indicators are noted in parentheses.

Appendix 4.5. *Industry components of factor proxies*

Census of Production (1907)
Beer: Brewing and malting trades
Cement: Cement trade
Chemicals, including dyestuffs, medicine, and paint: Chemicals, coal tar products, drugs, and perfumery trade; Paint, colour, and varnish trades
Clocks and watches: Watch and clock trades
Copper manufactures: Copper and brass trades (smelting, rolling, and casting)
Cotton manufactures, including yarn: Cotton trade; 61% of Bleaching, dyeing, printing, and finishing trades
Earthenware and chinaware: Bricks and fireclay trades; China and earthenware trades
Flax, hemp, and jute manufactures, including yarn and cordage: Jute, hemp, and linen trades; 11% of Bleaching, dyeing, printing, and finishing trades; Rope, twine, and net trades
Glass: Glass, stone, roofing, felts, and miscellaneous trades
Iron, steel, and manufactures thereof, excluding machinery: Iron and steel, engineering, and shipbuilding trades (all sub-industries thereof); excluding Engineering trades (including electrical engineering); excluding Shipbuilding and marine engineering trades; excluding Small arms trades
Leather and manufactures thereof: Boot and shoe trades; Glove trade; Leather trade (tanning and dressing); Saddlery and harness trade; Traveling bag and fancy leather goods trade
Machinery, including steam engines and locomotives: Engineering trades (including electrical engineering)
Paper and manufactures thereof: Paper trade; Cardboard box trade
Rubber and manufactures thereof: Indiarubber trades
Silk manufactures: Silk trades; 2% of Bleaching, dyeing, printing, and finishing trades
Spirits: Spirit distilling trade; Spirit compounding, rectifying, and methylating trades
Woollen and worsted manufactures, including yarn: Woollen and worsted trades; 26% of Bleaching, dyeing, printing, and finishing trades

Factory Inspectorate Returns (1870)*
Beer: Breweries
Chemicals, including dyestuffs, medicine, and paint: Miscellaneous chemical works
Clocks and watches: Clocks and watches
Copper manufactures: Copper-mills
Cotton manufactures, including yarn: Cotton factories
Earthenware and chinaware: Potteries; Other earthenware; Bricks and tiles
Flax, hemp, and jute manufactures, including yarn and cordage: Flax factories; Hemp factories; Jute factories; Ropemaking
Glass: Glass-making
Iron, steel, and manufactures thereof, excluding machinery: Blast furnaces and iron-mills; Foundries; Nails and rivets; Cutlery; Files, saws, and tools; Locks
Leather and manufactures thereof: Leather manufactures (all sub-industries thereof); Boot- and shoe-making; Manufacture of gloves
Machinery, including steam engines and locomotives: Manufacture of machinery
Paper and manufactures thereof: Paper manufactures (all sub-industries thereof)
Rubber and manufactures thereof: India-rubber and gutta percha
Silk manufactures: Silk factories
Spirits: Distilleries
Woollen and worsted manufactures, including yarn: Woollen factories; Worsted factories

* Compiled in Musson, 'Motive power', pp. 437-9.

Appendix 4.6. *Human capital proxies, 1883*

Industry	First quartile	Second quartile	Third quartile
Beer	1.69	1.74	1.92
Chemicals, including dyestuffs, medicine, and paint	1.46	1.97	2.38
Cotton manufactures, including yarn	1.62	1.92	2.77
Earthenware and chinaware	1.63	1.85	2.17
Flax, hemp, and jute manufactures, including yarn and cordage	1.46	1.82	2.11
Glass	1.92	2.28	2.54
Iron, steel, and manufactures thereof, excluding machinery	1.77	2.31	2.62
Leather and manufactures thereof	1.83	2.15	2.35
Machinery, including steam engines and locomotives	1.72	2.34	2.60
Paper and manufactures thereof	1.60	1.83	2.32
Silk manufactures	1.58	1.69	1.82
Spirits	1.66	1.82	2.06
Woollen and worsted manufactures, including yarn	1.49	1.78	2.31

Source: Calculated from *Returns of wages published between 1830 and 1886*.
Notes: The human capital proxies above are calculated by dividing the first, second, and third quartile wage observations for each industry by the lowest of the 737 observations in the sample. The lowest wage observation is 13s. per week, or the wage of a general labourer in the Belfast linen textile industry. Hence, the figures in the table can be interpreted as multiples of the unskilled wage.

For each of the above 13 industries, the occupations corresponding to the first, second, and third-quartile wage observations are reported, along with the respective industry (as defined in the *Returns of Wages*) and locality. Several occupations are reported below if the quartile wage observation corresponds to multiple identically-waged occupations, or if the quartile wage observation falls between occupations.

Beer
Observations: 6
1st quartile: £1.10; cellarmen, brewing trade, Edinburgh; carters, brewing trade, Edinburgh
2nd quartile: £1.13; carters, brewing trade, Edinburgh; maltmen, brewing trade, Edinburgh
3rd quartile: £1.25; maltmen, brewing trade, Edinburgh; brew house and tun room men, brewing trade, Edinburgh

Chemicals, including dyestuffs, medicine, and paint
Observations: 19
1st quartile: £0.95; labourers (manufacture of vitriol), chemical works, Glasgow; smiths hammermen, chemical works, Glasgow

2nd quartile: £1.28; furnacemen, chemical works, Glasgow; skilled hands, chemical works, Glasgow
3rd quartile: £1.55; coopers, chemical works, Glasgow; pattern makers, chemical works, Glasgow; masons, chemical works, Glasgow

Cotton manufactures, including yarn
Observations: 85
1st quartile: £1.05; strippers (carding), cotton manufactures, Manchester; grinders (carding), cotton manufactures, Manchester; stokers, cotton manufactures, Manchester; scutchers (carding), cotton manufactures, Oldham; stokers, cotton manufactures, Oldham; labourers and old hands; cotton manufactures, Oldham; colour mixers (calico printing), cotton printing and dyeing, Manchester; stokers, cotton printing and dyeing, Manchester; carters, cotton printing and dyeing, Glasgow
2nd quartile: £1.25; under carders (carding), cotton manufactures, Manchester; warehouse hands, cotton manufactures, Oldham; engine tenters, cotton printing and dyeing, Manchester
3rd quartile: £1.80; warpers (reeling), cotton manufactures, Oldham; dressers (reeling), cotton manufactures, Warrington

Earthenware and chinaware
Observations: 10
1st quartile: £1.06; enginemen (earthenware), earthenware and porcelain manufactures, Glasgow; kilnmen (earthenware), earthenware and porcelain manufactures, Glasgow
2nd quartile: £1.20; millmen (earthenware), earthenware and porcelain manufactures, Glasgow, panmen, earthenware and porcelain manufactures, Glasgow
3rd quartile: £1.41; throwers (earthenware), earthenware and porcelain manufactures, Glasgow; turners (earthenware), earthenware and porcelain manufactures, Glasgow; handlers (earthenware) earthenware and porcelain manufactures, Glasgow

Flax, hemp, and jute manufactures, including yarn and cordage
Observations: 46
1st quartile: £0.95; labourers, linen and flax manufactures, Dundee; cloth measurers, jute manufactures, Dundee
2nd quartile: £1.18; winding masters (weaving), linen and flax manufactures, Leeds; roughers or hacklers (spinning), linen and flax manufactures, Dundee; rope yarn spinners, rope, twine, and sail making, Greenock; winding masters (weaving), linen and flax manufactures, Belfast; cloth weighers, jute manufactures, Dundee; hemp dressers, rope, twine, and sail making, Dundee
3rd quartile: £1.37; foremen (spinning), jute manufactures, Dundee; tenters (weaving), linen and flax manufactures, Leeds; overlookers (spinning), linen and flax manufactures, Dundee

Glass
Observations: 29
1st quartile: £1.25; mixers, glass manufactures, South Shields; carters, glass manufactures, South Shields; potmakers, glass manufactures, Glasgow
2nd quartile: £1.48; grinders, glass manufactures, South Shields
3rd quartile: £1.65; warehouse hands, glass manufactures, Glasgow

Iron, steel, and manufactures thereof, excluding machinery
Observations: 164
1st quartile: £1.15; slotters, iron foundries and general engineering, Manchester; holders-up, iron foundries and general engineering, Cleveland; pattern maker's assistants (iron foundries), iron foundries and general engineering, Sunderland; drillers (iron

foundries), iron foundries and general engineering, Sunderland; chain strikers (iron forges), iron foundries and general engineering, Sunderland

2nd quartile: £1.50; roll turners (puddling), blast furnaces and rolling mills, Cleveland; under-hands (Martin-Siemen's Process), steel manufacture, Sheffield; vessel men (Bessemer Process), steel manufacture, Sheffield; smiths (Bessemer Process), steel manufacture, Sheffield; joiners (Bessemer Process), steel manufacture, Sheffield; bar rollers (18"), steel manufacture, Glasgow; boilermen, steel manufacture, Glasgow; joiners, steel manufacture, Glasgow; pattern makers, iron foundries and general engineering, Sheffield; pattern makers, iron foundries and general engineering, Cleveland; blacksmiths, iron foundries and general engineering, Cleveland; engine fitters, iron foundries and general engineering, Cleveland; turners, iron foundries and general engineering, Cleveland; joiners, iron foundries and general engineering, Cleveland; planers (iron foundries), iron foundries and general engineering, Sunderland

3rd quartile: £1.70; riveters (boiler maker), iron foundries and general engineering, Manchester; brass moulders (iron foundries), iron foundries and general engineering, Sunderland; joiners (iron foundries), iron foundries and general engineering, Sunderland

Leather and manufactures thereof

Observations: 56

1st quartile: £1.20; tanyard labourers, leather dressing, Bristol; pressmen (rough stuff department), boot and shoe manufacture, Leicester

2nd quartile: £1.40; strikers, leather tanning and dressing, Warrington; yard foremen, leather tanning and dressing, Warrington; clickers (clicking department), boot and shoe manufacture, Leicester; rounders (clicking department), boot and shoe manufacture, Leicester; rangers (rough stuff department), boot and shoe manufacture, Leicester; heelers (work out department), boot and shoe manufacture, Leicester; putters-up (work out department), boot and shoe manufacture, Leicester; foremen (packing department), boot and shoe manufacture, Bristol

3rd quartile: £1.53; shed foremen, leather tanning and dressing, Warrington; dyers, leather tanning and dressing, Nottingham; finishers, leather tanning and dressing, Nottingham; sorters (clicking department), boot and shoe manufacture, Leicester; foremen (machine closing department), boot and shoe manufacture, Leicester; sole sewers (work out department), boot and shoe manufacture, Leicester; finishers (work out department), boot and shoe manufacture, Leicester; engine drivers, boot and shoe manufacture, Leicester; heelers machine (work out department), boot and shoe manufacture, Bristol; foremen (rough stuff department), boot and shoe manufacture, Leicester; pattern cutters (clicking department), boot and shoe manufacture, Bristol

Machinery, including steam engines and locomotives

Observations: 112

1st quartile: £1.12; drillers, manufacture of machinery, Glasgow; strikers, manufacture of machinery, Birmingham

2nd quartile: £1.53; grinders and glazers, manufacture of machinery, Birmingham; pattern makers, manufacture of machinery, Dundee

3rd quartile: £1.69; iron moulders, manufacture of machinery, Greenock; planers and slotters, manufacture of machinery, Shields; machinemen, manufacture of machinery, Shields; turners, manufacture of machinery, Shields; boiler makers, manufacture of machinery, Glasgow

Paper and manufactures thereof

Observations: 32

1st quartile: £1.04; glazers, paper manufacture, Edinburgh; stokers, paper manufacture, Aberdeen; pad tenters, manufacture of paper hangings, Manchester; paper makers,

paper manufacture, Edinburgh; finishers, paper manufacture, Greenock; finishers, paper manufacture, Aberdeen

2nd quartile: £1.19; colour mixer labourers, manufacture of paper hangings, Manchester; stokers, paper manufacture, Edinburgh

3rd quartile: £1.51; mechanics, paper manufacture, Greenock; block and roller cutters, manufacture of paper hangings, Manchester; paper makers, paper manufacture, Aberdeen

Silk manufactures

Observations: 11

1st quartile: £1.03; silk dyers, silk manufactures, Macclesfield; overlookers (silk throwing), silk manufactures, Macclesfield; makers up (silk throwing), silk manufactures, Macclesfield; weavers (silk weaving), silk manufactures, Macclesfield; weavers (silk weaving), silk manufactures, Derby

2nd quartile: £1.10; overlookers (silk throwing), silk manufactures, Macclesfield; makers up (silk throwing), silk manufactures, Macclesfield; weavers (silk weaving), silk manufactures, Macclesfield; weavers (silk weaving), silk manufactures, Derby

3rd quartile: £1.18; overlookers (silk throwing), silk manufactures, Macclesfield; makers up (silk throwing), silk manufactures, Macclesfield; weavers (silk weaving), silk manufactures, Macclesfield; weavers (silk weaving), silk manufactures, Derby; finishers (silk weaving), silk manufactures, Macclesfield

Spirits

Observations: 4

1st quartile: £1.08; distilling men (distilleries), miscellaneous trades, Glasgow; carters (distilleries), miscellaneous trades, Glasgow

2nd quartile: £1.18; carters (distilleries), miscellaneous trades, Glasgow; millers (distilleries), miscellaneous trades, Glasgow

3rd quartile: £1.34; millers (distilleries), miscellaneous trades, Glasgow; coopers (distilleries), miscellaneous trades, Glasgow

Woollen and worsted manufactures, including yarn

Observations: 164

1st quartile: £0.97; spinners, woollen manufactures, Halifax; fettlers, woollen manufactures, Kendal

2nd quartile: £1.16; warpers and beamers, woollen manufactures, Halifax; press setters, brushers, and steamers, woollen manufactures, Dewsbury; engine tenters, woollen manufactures, Stroud; packers, worsted manufactures, Bradford

3rd quartile: £1.50; spinners, woollen manufactures, Huddersfield; engine tenters, woollen manufactures, Huddersfield; wool sorters, woollen manufactures, Stroud; spinners foremen, woollen manufactures, Stroud; spinning and doubling overlookers (spinning), worsted manufactures, Bradford

Appendix 4.7. *Grubel-Lloyd indices for British manufacturing industries, 1870-94*

Industry	1870	1871	1872	1873	1874
Alkali	0.19	0.15	0.12	0.10	0.12
Books	0.32	0.36	0.29	0.32	0.33
Caoutchouc manufactures*	0.11	0.11	0.15	0.19	0.19
Chemical products and preparations, n. e. s.	0.65	0.92	0.88	0.89	0.80
Copper manufactures*	0.85	0.86	[0.84]	0.98	[0.98]
Cordage and twine*	[0.93]	[1.00]	[0.76]	[0.80]	[0.79]
Cotton manufactures, excluding yarn+	0.04	0.05	0.05	0.05	0.05
Cotton yarn+	0.02	0.01	0.01	0.01	0.03
Drugs and medicinal preparations	0.67	0.72	0.78	0.66	0.79
Earthenware and chinaware	0.17	0.20	0.22	0.28	0.33
Glass	[0.94]	[0.94]	[0.96]	[0.96]	[0.85]
Hats	0.82	0.28	0.21	0.15	0.20
Iron, steel, and manufactures thereof*	0.11	0.11	0.11	0.11	0.15
Jute yarn	0.49	0.39	0.36	0.44	0.62
Lead manufactures*	[0.96]	[0.76]	[0.74]	[0.66]	[0.74]
Leather manufactures	0.88	0.77	0.82	0.79	0.93
Linen manufactures, excluding yarn+	0.04	0.04	0.05	0.06	0.06
Linen yarn+	0.05	0.21	0.22	0.05	0.13
Painters' colours and materials	0.65	0.62	0.64	0.70	0.67
Paper and manufactures thereof	[0.95]	0.94	0.97	0.99	[0.96]
Silk manufactures+	[0.17]	[0.39]	[0.38]	[0.31]	[0.30]
Spirits	[0.11]	[0.13]	[0.18]	[0.12]	[0.11]
Woollens and worsteds, excluding yarn+	0.27	0.29	0.22	0.26	0.30
Woollen and worsted yarn+	0.49	0.32	0.39	0.45	0.45

Source: Calculated from *Annual statements of the trade of the United Kingdom*. See text.
Notes: * indicates a capital goods industry. + indicates a textile industry. G-L indices for net-import industries are noted in brackets.

Appendix 4.7. *Grubel-Lloyd indices for British manufacturing industries, 1870-94* (continued)

Industry	1875	1876	1877	1878	1879
Alkali	0.11	0.10	0.09	0.06	0.07
Books	0.31	0.29	0.30	0.31	0.30
Caoutchouc manufactures*	0.21	0.22	0.20	0.27	0.21
Chemical products and preparations, n. e. s.	0.83	0.94	0.95	0.96	0.77
Copper manufactures*	[0.96]	[0.95]	[1.00]	0.94	0.98
Cordage and twine*	[0.82]	[0.65]	[0.73]	[0.81]	[0.87]
Cotton manufactures, excluding yarn+	0.04	0.06	0.06	0.08	0.08
Cotton yarn+	0.03	0.03	0.06	0.09	0.07
Drugs and medicinal preparations	0.77	0.90	0.82	0.77	0.94
Earthenware and chinaware	0.34	0.37	0.33	0.39	0.39
Glass	[0.77]	[0.66]	[0.62]	[0.54]	[0.66]
Hats	0.27	0.30	0.28	0.28	0.29
Iron, steel, and manufactures thereof*	0.20	0.23	0.23	0.26	0.24
Jute yarn	0.39	0.42	0.30	0.27	0.55
Lead manufactures*	[0.63]	[0.63]	[0.62]	[0.52]	[0.54]
Leather manufactures	[0.89]	[0.94]	[0.94]	[0.93]	0.99
Linen manufactures, excluding yarn+	0.06	0.08	0.09	0.08	0.07
Linen yarn+	0.19	0.23	0.36	0.49	0.51
Painters' colours and materials	0.74	0.81	0.78	0.78	0.84
Paper and manufactures thereof	0.99	[0.89]	[0.91]	[0.92]	[0.99]
Silk manufactures+	[0.25]	[0.26]	[0.23]	[0.26]	[0.23]
Spirits	[0.17]	[0.14]	[0.27]	[0.29]	[0.26]
Woollens and worsteds, excluding yarn+	0.33	0.42	0.46	0.52	0.52
Woollen and worsted yarn+	0.45	0.56	0.65	0.58	0.55

Source: Calculated from *Annual statements of the trade of the United Kingdom*. See text.
Notes: * indicates a capital goods industry. + indicates a textile industry. G-L indices for net-import industries are noted in brackets.

Appendix 4.7. *Grubel-Lloyd indices for British manufacturing industries, 1870-94* (continued)

Industry	1880	1881	1882	1883	1884
Alkali	0.06	0.07	0.08	0.07	0.06
Books	0.31	0.28	0.28	0.29	0.30
Caoutchouc manufactures*	0.26	0.24	0.27	0.33	0.41
Chemical products and preparations, n. e. s.	0.76	0.80	0.92	0.96	0.99
Copper manufactures*	0.89	0.79	0.88	0.82	0.80
Cordage and twine*	[0.88]	[0.91]	[0.90]	[0.89]	[0.89]
Cotton manufactures, excluding yarn+	0.08	0.07	0.07	0.07	0.07
Cotton yarn+	0.09	0.07	0.07	0.06	0.06
Drugs and medicinal preparations	0.90	0.95	0.94	[0.90]	0.94
Earthenware and chinaware	0.37	0.40	0.41	0.41	0.44
Glass	[0.68]	[0.73]	[0.79]	[0.81]	[0.79]
Hats	0.24	0.23	0.24	0.29	0.23
Iron, steel, and manufactures thereof*	0.23	0.24	0.22	0.25	0.28
Jute yarn	0.83	0.47	0.27	0.31	0.42
Lead manufactures*	[0.54]	[0.65]	[0.63]	[0.60]	[0.51]
Leather manufactures	[0.93]	0.94	0.98	[0.96]	0.99
Linen manufactures, excluding yarn+	0.08	0.08	0.09	0.12	0.12
Linen yarn+	0.43	0.32	0.35	0.42	0.32
Painters' colours and materials	0.83	0.82	0.79	0.79	0.76
Paper and manufactures thereof	0.99	0.92	0.91	0.94	0.97
Silk manufactures+	[0.26]	[0.36]	[0.39]	[0.37]	[0.33]
Spirits	[0.41]	[0.61]	[0.55]	[0.59]	[0.56]
Woollens and worsteds, excluding yarn+	0.61	0.50	0.48	0.51	0.51
Woollen and worsted yarn+	0.71	0.59	0.68	0.76	0.65

Source: Calculated from *Annual statements of the trade of the United Kingdom*. See text.
Notes: * indicates a capital goods industry. + indicates a textile industry. G-L indices for net-import industries are noted in brackets.

Appendix 4.7. *Grubel-Lloyd indices for British manufacturing industries, 1870-94* (continued)

Industry	1885	1886	1887	1888	1889
Alkali	0.05	0.06	0.05	0.06	0.04
Books	0.31	0.34	0.32	0.33	0.35
Caoutchouc manufactures*	0.61	0.53	0.46	0.41	0.44
Chemical products and preparations, n. e. s.	0.97	0.95	0.91	0.88	0.84
Copper manufactures*	0.80	0.85	0.68	[0.90]	0.80
Cordage and twine*	[0.92]	[0.87]	[0.92]	[0.99]	[0.87]
Cotton manufactures, excluding yarn+	0.07	0.06	0.07	0.07	0.08
Cotton yarn+	0.08	0.08	0.07	0.08	0.08
Drugs and medicinal preparations	0.97	0.90	0.85	0.98	0.91
Earthenware and chinaware	0.44	0.43	0.43	0.44	0.44
Glass	[0.74]	[0.77]	[0.76]	[0.74]	[0.78]
Hats	0.29	0.24	0.23	0.23	0.25
Iron, steel, and manufactures thereof*	0.29	0.26	0.22	0.23	0.22
Jute yarn	[0.96]	0.63	0.45	0.59	0.38
Lead manufactures*	[0.56]	[0.60]	[0.59]	[0.57]	[0.58]
Leather manufactures	0.95	0.95	0.95	0.92	0.93
Linen manufactures, excluding yarn+	0.10	0.11	0.13	0.14	0.14
Linen yarn+	0.38	0.70	0.74	0.89	0.95
Painters' colours and materials	0.79	0.76	0.78	0.77	0.80
Paper and manufactures thereof	0.94	[0.99]	[0.96]	1.00	[0.96]
Silk manufactures+	[0.32]	[0.35]	[0.37]	[0.41]	[0.35]
Spirits	[0.58]	[0.58]	[0.64]	[0.74]	[0.74]
Woollens and worsteds, excluding yarn+	0.56	0.58	0.54	0.61	0.63
Woollen and worsted yarn+	0.63	0.72	0.70	0.68	0.72

Source: Calculated from *Annual statements of the trade of the United Kingdom*. See text.
Notes: * indicates a capital goods industry. + indicates a textile industry. G-L indices for net-import industries are noted in brackets.

Appendix 4.7. *Grubel-Lloyd indices for British manufacturing industries, 1870-94* (continued)

Industry	1890	1891	1892	1893	1894
Alkali	0.03	0.04	0.04	0.08	0.12
Books	0.34	0.33	0.33	0.33	0.35
Caoutchouc manufactures*	0.46	0.45	0.50	0.48	0.56
Chemical products and preparations, n. e. s.	0.77	0.81	0.86	0.76	0.79
Copper manufactures*	0.79	0.79	0.64	0.81	0.85
Cordage and twine*	[0.95]	[0.87]	[0.90]	[0.89]	[0.82]
Cotton manufactures, excluding yarn+	0.07	0.09	0.10	0.09	0.09
Cotton yarn+	0.07	0.09	0.09	0.08	0.08
Drugs and medicinal preparations	0.90	0.87	0.90	0.92	0.90
Earthenware and chinaware	0.40	0.44	0.45	0.45	0.49
Glass	[0.68]	[0.61]	[0.53]	[0.48]	[0.46]
Hats	0.26	0.24	0.23	0.23	0.29
Iron, steel, and manufactures thereof*	0.21	0.24	0.26	0.27	0.29
Jute yarn	0.40	0.44	0.31	0.29	0.25
Lead manufactures*	[0.56]	[0.48]	[0.53]	[0.46]	[0.51]
Leather manufactures	0.92	0.96	[0.96]	[0.94]	[0.91]
Linen manufactures, excluding yarn+	0.14	0.16	0.14	0.14	0.17
Linen yarn+	0.88	0.92	0.94	0.85	0.81
Painters' colours and materials	0.79	0.75	0.80	0.82	0.80
Paper and manufactures thereof	[0.92]	[0.89]	[0.79]	[0.77]	[0.69]
Silk manufactures+	[0.33]	[0.27]	[0.25]	[0.23]	[0.17]
Spirits	[0.70]	[0.69]	[0.74]	[0.74]	[0.76]
Woollens and worsteds, excluding yarn+	0.63	0.69	0.71	0.77	0.82
Woollen and worsted yarn+	0.65	0.65	0.64	0.55	0.54

Source: Calculated from *Annual statements of the trade of the United Kingdom*. See text.
Notes: * indicates a capital goods industry. + indicates a textile industry. G-L indices for net-import industries are noted in brackets.