

Britain's Loss from Foreign Industrialization: A Provisional Estimate*

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It is pardonable to use an occasional metaphorical flourish to elevate the commonplaces and simplify the complexities of economic history. The danger, however, is that the flourish will become an obstruction rather than an aid to thought. A case in point is the set of assertions made explicitly by many scholars and reaffirmed by the very mass of the literature on Britain's international economic relations in the 19th century, that British income "depended" on foreign trade, that trade was "crucial," or that it was "of central importance" to the economy. William Ashworth, for example, asserts that "Britain's livelihood depended on international trade and the performance of international services,"¹ and Phyllis Deane and W. A. Cole state that "by the end of the nineteenth century the British economy was heavily dependent on world markets, and the rate and pattern of British economic growth was largely conditioned by the response of producers and consumers in the rest of the world."² The difficulty is that these metaphors of dependence have attached to them no clear literal meaning, or at best none that does justice to their connotations. The primary piece of evidence for the importance of trade, for example, is the high ratio of exports to national income—typically .20 from 1870 to 1913 for domestic commodity exports alone and .27 including net exports of invisibles—and the ratio is often used as an implicit definition of importance. This somewhat casual attempt at giving concrete meaning to the metaphor of "dependence," however, is not very successful. It cannot mean that income falls in

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¹*An Economic History of England, 1870-1939* (London: Methuen, 1960), p. 256.

²*British Economic Growth, 1688-1959* (Cambridge: Cambridge University Press, 1962), p. 28.

proportion as exports fall, for this is unlikely to be the case, except in the very short run. Nor can it mean that any sector of this size is considered to be just as important. Domestic service employed many more men and women than all textiles and mining combined in the late 19th century and its gross value of output was probably larger than the value of exports of textiles and coal, yet few would say that it was "crucial" or that with a decline in the demand for butlers and nannies "Britain could no longer hope to depend on the demand for domestic service as she had in the past."

The natural response to this criticism is that great changes were occurring in the export markets for textiles and coal in the late 19th century, but not in the markets for domestic service; it is the combination of these changes with the export sector's large size that make it important. Again, however, the discussion has been dominated by metaphor. The most significant of the changes, it is said, was the rise of new industrial powers, especially Germany and the United States, who broke the British monopoly of trade in manufactures. In response to the apparent failure of free trade to meet the new challenge to Britain, there arose a body of fair trade opinion, with a bellicose vocabulary of commercial "peril," "struggle," "invasion," and "conquest." The issue of what policy to take towards the new industrial competition was one of the most heated in British politics, and the violence of the metaphors is therefore not surprising. Edwin Cannan, a partisan in the debate, expressed his scorn for the violent fair trade vocabulary in the following violent words:

In regard to international relations, the first business of the teacher of economic theory is to tear to pieces and trample upon the misleading military metaphors which have been applied by sciolists to the peaceful exchange of commodities. We hear much, for example, in these days of "England's commercial supremacy," and of other nations "challenging" it, and how it is our duty to "repel the attack," and so on. The economist asks "what is commercial supremacy?" and there is no answer.³

Notwithstanding Cannan's just rage, however, the military metaphors of the fair traders have been adopted by many historians, among them R. J. S. Hoffman in his pioneering study *Great Britain and the German Trade Rivalry, 1875-1914*. He describes the 1870's, for example, in the following terms:

Competition of a threatening character from the European Continent and America had not yet begun to make itself felt, for the new in-

³"The Practical Utility of Economic Science," *Economic Journal* 12 (1902), p. 470.

dustrialism beyond England was still in comparative infancy [and tariffs were low] . . . Great Britain stood out in the early seventies, perhaps more conspicuously than ever before, as the supreme commercial power of the world. Never again was this position to be so removed from challenge, for [by the end of the seventies] . . . there were clearly in operation all of the great factors which ultimately pulled Britain down from her high estate of trade supremacy and forced her to fight for her life in a new economic world.⁴

Hoffman's belief in the foreign threat to Britain's welfare is not peculiar to him: in less emphatic form, it has become part of the accepted view of Britain's prospects in the late 19th century.

If the metaphors of Britain being "defeated" in a trade on which she was "dependent" are taken seriously, the deduction is that Britain should have collapsed, which she did not. To resolve this contradiction, which is inherent in the prevailing interpretation of Britain's mid-century monopoly of manufacturing trade and its subsequent dissolution, it appears that one or both of the metaphors must be abandoned.

The meaning of Britain's "defeat" in international trade seems plain enough: Britain's share in world manufacturing exports fell dramatically from 1870 to 1913, as first Germany and then the United States expanded into markets beyond their borders. According to Folke Hilgerdt's *Industrialization and Foreign Trade*, the first comprehensive work on the statistics of world trade and manufacturing, Britain's share of trade in manufactures fell from about 38 percent in the late 1870's to about 27 percent in 1913.⁵ A. Maizels and H. Tyszynski tell the same story and make the further point that this loss of trade was primarily a fall in Britain's share of each market rather than an unfavorable shift of the composition of markets by location or product. Maizels, for example, estimates that from 1899 to 1914 Britain lost £360 million in annual manufacturing exports on account of competition in each market, a loss of about 18 percent of the actual value of her manufacturing exports in 1913, while Germany gained £330 million.⁶ The economic meaning of this arithmetic is that the supply curve of manufactures in the rest of the

⁴*Great Britain and the German Trade Rivalry* (Philadelphia: University of Pennsylvania Press, 1933), p. 5f.

⁵*Industrialization and Foreign Trade* (Geneva: League of Nations Secretariat, Economic, Financial and Transit Department, 1945), p. 157f.

⁶A. Maizels, *Industrial Growth and World Trade* (Cambridge: Cambridge University Press, 1963), p. 200. Cf. H. Tyszynski, "World Trade in Manufactured Commodities, 1899-1950," *Manchester School* 19 (September 1951), pp. 272-304.

world was moving out faster than in Great Britain during the late nineteenth century. That is, the fall in Britain's share of exports was indeed a result of the industrialization of other countries: larger output of manufactures elsewhere—a loss of manufacturing “supremacy”—reduced British exports below what they would otherwise have been.

Giving a precise meaning to Britain's defeat in exports, then, requires an estimate of “what they would otherwise have been.” Industrialization of Britain's competitors amounted to an increase in their supply of manufactures, so that removing the effect of industrialization on Britain's export trade in 1913 would require a hypothetical reduction in the supply of the rest of the world. If the demand for manufactures by the rest of the world, to take one extreme, was in no way related to its supply, the excess demand for manufactures by the rest of the world—that is, the rest of the world's imports of manufactures from Britain—would increase by the full amount of the hypothetical decrease in the rest of the world's supply. A diagram putting the demand and supply systems of Britain and the rest of the world in 1913 back to back illustrates this case:

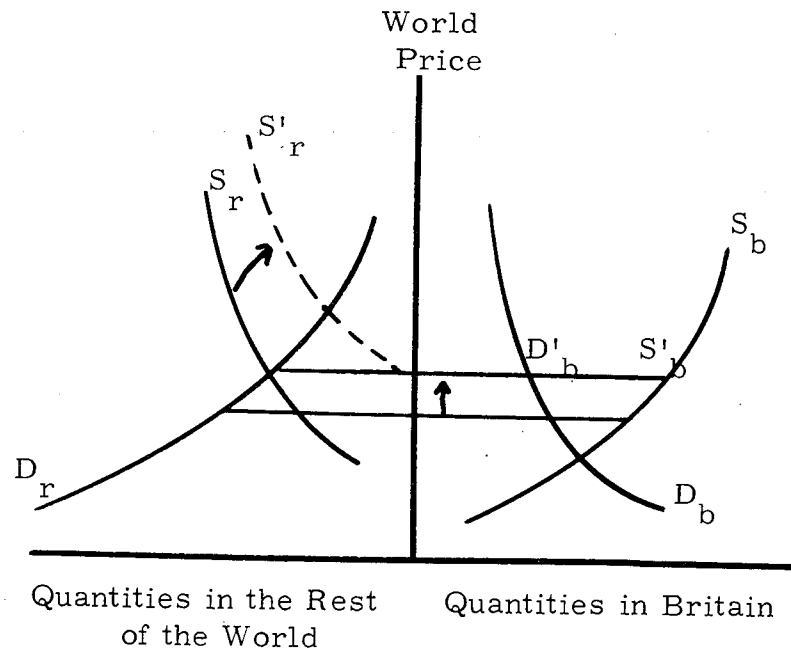


Fig. 1. Deindustrialization without an induced change in demand

The supply curve of the rest of the world is reduced without industrialization, but the demand curve is taken to be unchanged. Given constant and known elasticities for the curves, the new equilibrium exports from Britain, $D'_b S'_b$, can be estimated by reducing the rest of the world's supply curve until it yields the share of total output of 1870. The essential feature of the solution at this extreme is that Britain's share of manufacturing output, not exports, is increased to its level of 1870 to find the hypothetical exports in 1913.

The demand for manufactures, of course, would not be as high without as it was with industrialization in the rest of the world, both because a substantial portion of the demand for manufactures is for manufactured investment and intermediate goods and because the lower level of income without industrialization would reduce the demand for manufactured consumers' goods. Assuming that *all* the increase in the demand for manufactures in industrializing countries was a result of industrialization, Britain's hypothetical exports in 1913 could be estimated by extrapolating her 1870 share of *exports* (rather than output, as above) to 1913. If demand as well as supply is presumed to grow more slowly without industrialization, in other words, the excess supply (exports) rather than the total supply (output) of Britain will remain in its 1870 relation to the rest of the world. In terms of the diagram, in this case the demand curve as well as the supply curve is reduced:

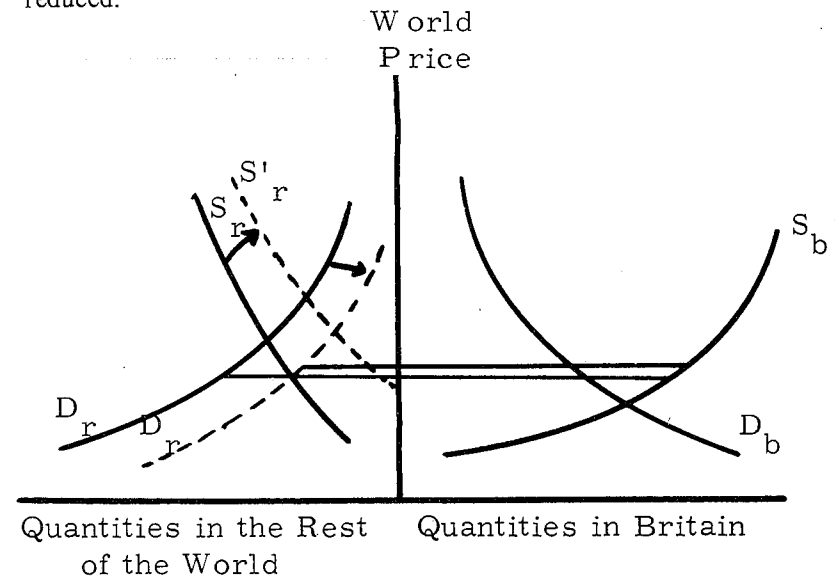


Fig. 2. Deindustrialization with an induced change in demand

The measure of export losses from industrialization based on the British share of world *exports* assumes that all the growth in demand was induced, and the measure based on the share in world *output* assumes that none of it was induced. In short, the fall in Britain's share of world exports and world output of manufactures—the statistical counterparts of her “defeat” in exports and her “loss of supremacy” in output—yields bounds on the loss of manufacturing exports due to competing industrialization.

It is less easy to give a concrete interpretation of the metaphor of Britain's “dependence” on these manufacturing exports. The extensive literature on industrialization and manufacturing trade has astonishingly little to say about the significance to the countries involved of the quantities of exports lost or gained. The sheer size of Britain's lost exports, which range from 35 to 350 percent of actual exports in 1913 depending on which method of estimation is used, might seem to be sufficient evidence that competing industrialization was an important influence on British welfare. Only if the resources used in making exports have no alternative employment, however, would the full value of the lost exports have been equal to the lost national income. That is, the lost exports would have been the lost income only if the British economy from 1870 to 1913 was always far below full employment, which is very difficult to believe.⁷

Given full employment, a fall in the demand for exports would have reduced national income by the fall in British producers' surplus, that is, by the loss in total export revenue minus the sum of the value in alternative uses of the freed resources and the value of consumers' surplus gained from the lower price of exportables (which is merely a transfer from British producers to British consumers). In other words, the rent that Britain could extract from the rest of the world would have fallen. In the diagram below, the sum of the British demand for her own exportables (D_b) and the rest of the world's excess demand (ED_r) is reduced by industrialization from its hypothetical position ($D_b + ED'_r$) to its actual position ($D_b + ED_r$), reducing British national income by the area $dd'ee'$:

⁷I have examined this question more closely in another paper, “Did Victorian Britain Fail?,” *Economic History Review*, forthcoming, December 1970.

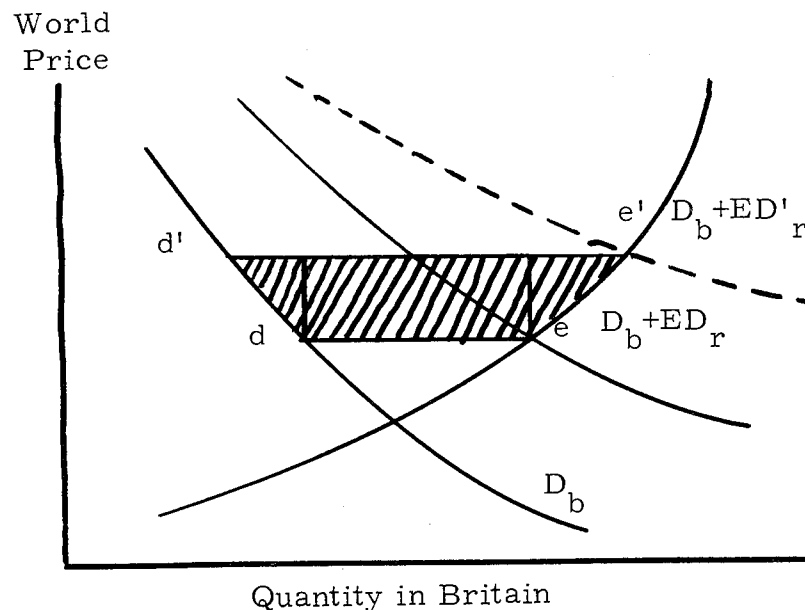


Fig. 3. Britain's loss from the fall in export demand from industrialization elsewhere

That area measures the loss to Britain from the industrialization of the rest of the world.

The question, then, is how large this loss was to Britain. The striking feature of the answer—striking in view of the widespread belief that Britain's welfare depended critically on foreign trade—is that the loss appears to have been small. To show that Britain's national income was on all accounts little affected by the industrialization of the rest of the world would be a formidable task, and it would be unwise to make sweeping statements about the results of such a rearrangement of the world as the non-industrialization of the United States and Germany. For the limited range of connections between industrialization and Britain's income considered here, however, the results do appear to have been surprisingly small.

To show this it is convenient to recast the geometry of the above model in algebra. There are two equations, one summarizing the normative argument of how the rent lost is related to the income lost and the second the behavioral argument of how the new equilibrium is related to the old. The first gives the approximately trape-

zoidal area of loss $dd'ee'$ in Figure 3 above as a function of the elasticities of demand and supply in Britain, the quantities of exportables demanded and supplied in 1913, and the percentage change in the world price resulting from a hypothetical deindustrialization of the rest of the world in 1913 (a bar over a variable, as over P here, will signify the percentage change in the variable between its actual and hypothetical value):

$$(1.) \quad dd'ee = \frac{1}{2}\bar{P}(D_d\epsilon\bar{P}) + \bar{P}(S_b - D_b) + \frac{1}{2}\bar{P}(S_b\eta\bar{P}).$$

It is assumed here that the demand for manufactured exportables can be represented by the constant-elasticity form $Q_d = D_bP^{-\epsilon}$, where ϵ is the elasticity of demand, and the supply by $Q_s = S_bP^\eta$, where η is the elasticity of supply. One million pounds worth of exportables in 1913 is taken as the unit, so that its price in 1913 is 1 and the parameters D_b and S_b are simply the values of exportables consumed and produced in 1913. The equation breaks the trapezoid into a middle rectangle $\bar{P}(S_b - D_b)$, representing the increased value of the old excess supply (that is, old exports) and two side triangles representing the increased value of the new exports. Its substance is merely that the increase in rents accruing to Britain will be larger the larger is the increase in price from the hypothetical de-industrialization elsewhere.

The second equation, giving the increase in price sufficient to reestablish equilibrium after de-industrialization, is derived from the equilibrium condition in the world market for manufactures that the excess supply of the manufacturing nations other than Britain ($S_gP^{\eta'} - D_gP^{-\epsilon'}$) plus Britain's excess supply must equal the demand of the rest of the world ($D_rP^{-\epsilon''}$):

$$(S_gP^{\eta'} - D_gP^{-\epsilon'}) + (S_bP^\eta - D_bP^{-\epsilon}) = D_rP^{-\epsilon''}$$

The other manufacturing countries (primarily Germany and the United States) are separated from world demand for British exports in order to exhibit the effects of their de-industrialization on the export transactions of the world. For the purposes of the rough approximations desired here, the elasticities may be assumed to be the same in each part of the world. In that case, the equation can be rewritten:

$$P = \left(\frac{S_b + S_g}{D_b + D_g + D_r} \right)^{-[1/(\epsilon + \eta)]}$$

As was argued earlier, the hypothetical de-industrialization involves a reduction in the foreigners' supply curve of manufactures and, to some extent, an induced reduction in their demand curve. If the

percentage reduction of the demand curve, \bar{D}_g , is a certain proportion, δ , of the percentage reduction of the supply curve, \bar{S}_g , then the rate of change of price necessary to reestablish equilibrium will be, taking the proportional derivative of the last expression:

$$(2.) \quad \bar{P} = -\left(\frac{1}{\epsilon + \eta}\right) \left[\frac{S_g - \delta D_g}{S_b + S_g} \right] \bar{S}_g$$

The elasticities ϵ and η appear because the higher they are, the less need the world price change to reestablish equilibrium after a disturbance to supply. The term in square brackets merely shows the weight with which the reduction of supply in the industrializing countries (\bar{S}_g) affects supply as a whole. If none of the demand for manufactures would have been reduced along with the supply, then δ equals zero and the weight is the share of these countries in world manufacturing output; if the demand would have been reduced in proportion, δ equals one and the weight is the share of their exports alone in output.

Equations (1.) and (2.) depend on the following variables, arranged in increasing difficulty of empirical estimation:

- S_b Britain's output of manufactures in 1913 (£1520 million)
- D_b Britain's consumption of home-produced manufactures in 1913 (£1120 million)
- S_g Other manufacturing countries' output of manufactures in 1913 (£9300 million)
- D_g Other manufacturing countries' consumption of home produced manufactures in 1913 (£8200 million)
- \bar{S}_g Proportional change of S_g necessary to reduce its share in world output to its level in 1870 (100 percent)
- ϵ Elasticity of demand for manufactures with respect to price
- η Elasticity of supply of manufactures with respect to price
- δ Elasticity of D_g with respect to S_g

The estimation of the British supply of manufactures in 1913 (S_b) presents no serious problems, since the results of Britain's Census of Production in 1907 can be extrapolated with little danger of error to 1913. The appropriate definition of "output" is output with the same degree of duplication by stages of production as in the export statistics. For most industries the estimate made by the Census of gross output excluding sales within the industry itself is appropriate, yielding a total of £1140 million for the manufacturing

portion of industry as a whole.⁸ Making an ample allowance of £100 million for the output of semifinished items that were important exports, such as cotton yarn, and extrapolating the result to 1913 gives a value of S_b in 1913 of £1520 million.⁹ The corresponding value of consumption of home produced manufacturing output, D_b , is simply output minus exports of £397 million,¹⁰ or £1120 million.

For the rest of the world's output of manufactures (S_g) one must rely on Hilgerdt's index. Representing world output in 1925–29 (the base years for the index) by 100 units, his index implies that British output in 1913 was 10.4 units and the rest of the world's output 63.5.¹¹ Consequently, the value of the rest of the world's output in British prices (S_g), given that 10.4 units correspond to an S_b of £1520 million, was £9300 million. The exports of the rest of the world were £1100 million in 1913,¹² leaving consumption of home-produced manufactures in the industrializing countries (D_g) of £8200 million.

One need go only this far in the exercise to see that the impact of the industrialization of Germany alone was very small, a notable result in view of the contemporary alarm over Germany's rise. The reason is that Germany produced only 12.5 percent of world manufacturing output in 1913: reducing Germany's share to its level before she industrialized—a retrospective Morgenthau plan, as it were—would reduce world supply very little and therefore raise British export prices very little. Had German manufacturing output per capita remained at its level of 1870, the percentage reduction in the

⁸The *Final Report* of the Census gives an estimate of these non-duplicative outputs in the introduction to each industry's statistics. I have added them together, excluding the Mining, Utilities, Building, and Gas industries (U.K. Board of Trade, *Final Report on the First Census of Production of the U.K. [1907]* HMSO [London: 1912], *passim*). The classification of industries, by the way, was chosen by the designers of the Census to reflect the export list. W. Schlote, however, whose estimates of exports are used here, used the Brussels Register classification (*British Overseas Trade from 1700 to the 1930's*, trans. W. O. Henderson and W. H. Chaloner, [Oxford: Oxford University Press, 1952]).

⁹The extrapolation uses the Hoffman index of industrial production excluding building and Schlote's price index of exports of manufactured goods (Schlote, p. 177) to estimate the 1913 value of output from 1907.

¹⁰From Schlote, p. 126. Hilgerdt's estimate is £417 million, *Industrialization and Foreign Trade*, p. 158.

¹¹Hilgerdt, pp. 128, 140. His weights for 1925–29 are, unfortunately, value-added weights.

¹²Hilgerdt, p. 157f: world exports minus U.K. exports.

non-British output in 1913 (\bar{S}_g) would have been about 13 percent¹³ and, making strong assumptions to bias the estimate upward that ϵ and η were 1 and δ was 0, the rise in world prices would have been only 0.8 percent. National income would have been only £4 million above its actual level of £2,260 million in 1913. The threat of German industrialization was apparently political, not economic.

To make a similar argument about the industrialization of other countries in addition to Germany, especially the United States, requires stronger yet plausible assumptions about the parameters ϵ , η , and δ . The elasticity of demand, ϵ , was probably greater than 1 in absolute value in view of the high income elasticity and importance in total consumption of manufactured goods. The elasticity of supply is less certain, but some crude visual estimates, in lieu of a full econometric study of the matter, suggest that it was high. This is reasonable because throughout the period well over half of manufacturing exports were textiles, which used imported raw materials and ubiquitous skills: the very fact that Britain's competitors found her textile production easy to imitate suggests that there were few limitations of supply on its long-term expansion. In these circumstances, an elasticity of 3 is probably low. The last parameter, the elasticity of manufacturing demand with respect to a shift in supply (δ), surely lies between zero and one, but where exactly is difficult to say. It is probably much above zero, for both higher income and derived demand would raise demand as supply rose; indeed, the work of Hilgerdt and Maizels can be interpreted as an attempt to show that δ was high. A value of δ above .5 is perhaps reasonable.

Using these rough estimates of lower bounds on the elasticities in the price equation gives an estimate of \bar{P} of about 12 percent and an estimate of the increase in 1913 income of about £88 million, or 3.9 percent of national income. In view of the uncertainty surrounding the value of η and δ it is useful to consider a range of both, as in the following table (assuming ϵ equals 1.0):

¹³This is a percentage change which uses the midpoint of the new and old value as the base, as will all subsequent percentage changes. The 1870 and 1913 German outputs are derived from Hilgerdt, pp. 128, 138ff.

PERCENT OF BRITISH NATIONAL INCOME GAINED IN 1913

		δ , Elasticity of Non-British Demand for Manufactures with respect to Non-British Supply.				
		0	0.1	0.5	0.7	1.0
η ,	1	19	16	7.6	4.4	1.0
Elasticity	2	13	11	5.2	3.0	.7
of Supply	3	9.5	8.2	3.9	2.3	.5
of British	4	7.8	6.5	3.1	1.8	.4
Manufactures	5	6.4	5.6	2.7	1.5	.3

SOURCE: Equations (1.) and (2.), with values discussed in text.

For reasonable values of η and δ , the result is the same: the gain of income from de-industrializing the rest of the world in 1913 would have been remarkably small.

The limitations on the result are clear enough that there is no need to examine them in detail on this occasion. The model is a partial equilibrium one; Britain's gain in the alternative world from cheaper imports of agricultural goods, as well as her loss from more expensive manufactured imports and cheaper coal exports, is suppressed; the estimates of the elasticities could be much improved; and redistributive and transitional effects are ignored. Nonetheless, the exercise points to an important moral, namely, that the attention lavished on the trade sector and especially on foreign competition in that sector as a "determinant" of British income does not appear to be warranted by the facts. The late 19th century was the time of the greatest development of the international economy, with Britain—the world's banker, the world's shipper, and, less than before, the world's manufacturer—at its center. The inference that Britain was therefore dependent on even substantial changes in the character of the international economy, however, is doubtful. If the argument made here is even approximately true, another view is more tenable: if we must use metaphors, Britain's income "depended" not on the great changes in the international economy of the late 19th century, but on the pace of technological change and enterprise at home.