A Plea for Trade Theory in Economic History*

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Abstract: This paper discusses the applicability of the small-scale general equilibrium models of trade theory to the problems of economic history. The examples are drawn from the experience of the Atlantic Economy from its emergence to the end of the nineteenth century.

I INTRODUCTION

M y title is intended as a modest tribute to the only economist that ever lived who was both a great trade theorist and a great economic historian, Eli Heckscher. Seventy years ago he delivered an address to the International Historical Congress at Oslo on "A Plea for Theory in Economic History". In this brief address, published in the *Economic Journal* in January 1929, Heckscher incisively made the point about economic theory that "no economic history worthy of the name is possible without it". He pointed out that ignorance of the most elementary economic theory by economic historians of the ancient world, for example, had led to the absurd proposition that the Roman empire declined because it had become so large that it had ceased to have any foreign trade! Heckscher's contention was novel in his day but with the rise of "cliometrics" pioneered in our time by Robert Fogel, Douglas North and others it is now hardly in dispute. The case I wish to present here, however, is a much narrower and more specific one, namely that the sort of small-scale, tractable general equi-

librium models that are the workhorses of trade theory are also powerful engines of historical analysis and inquiry.

Ever since my student days I have wondered about what motivated Heckscher to produce his amazing 1919 article on factor price equalisation, so different in style and content from his voluminous works on the economic history of Sweden and on Mercantilism. The answer is provided in the introduction to the recent volume edited by Harry Flam and June Flanders (1991) that contains new translations of Heckscher's article and of Bertil Ohlin's 1924 dissertation that it apparently inspired. Heckscher, a staunch cosmopolitan liberal all his life, published a critique of protectionist policies in Sweden in a volume that was reviewed by none other than the great Knut Wicksell himself. Wicksell raised the question of how one could defend free trade if it led to such a fall in real wages that the country might be depopulated through emigration. The "European Grain Invasion" by cheap wheat from the North American prairies had led to heavy emigration by the Swedish rural population at the end of the nineteenth century. Heckscher seems to have been led to this great theoretical feat by the desire to respond to Wicksell's critique. Heckscher's own comparative advantage was as a historian but it is clear that this is not inconsistent with an absolute advantage to also be a theorist of the first rank.

II SPECIFIC-FACTORS MODEL AND ANGLO-AMERICAN DIFFERENCES IN THE NINETEENTH CENTURY

Heckscher's original model was elaborated by Bertil Ohlin into a full general equilibrium formulation. It is interesting to note, however, that the sharpness and insight of Heckscher's original simple "two-by-two" model was lost by this approach. Factor price equalisation itself, which Heckscher fully established, was replaced by a weaker notion of tendency toward equality rather than complete equality. It was Abba Lerner's unpublished paper of 1932 and Paul Samuelson's two famous articles in the late forties that restored the elegance and power of the original conception. I will later discuss how this so-called Heckscher-Ohlin-Samuelson or HOS model can and has been used to cast light on economic history.

Before turning to that, I would first like to consider another beautifully simple and flexible model associated with the factor proportions approach. This is the model of sector-specific factors, or Ricardo-Viner model as Samuelson dubbed it. Interestingly, it was a problem of economic history that inspired the construction and development of this model also.

In the middle of the nineteenth century a number of British observers had noted the high capital-intensity of production and the associated high level of output per worker in several branches of manufacturing in the United States.

They attributed this to the stimulus of higher real wages due to the relative abundance of land. The pull of the open frontier exercised an upward pressure on the real wage for industrial pursuits in the settled eastern portions of the country. These early ideas were crystallized in a paper by Erwin Rothbarth (1946) on "The Causes of the Superior Efficiency of USA Industry as Compared with British Industry". This paper imaginatively linked land abundance, labour scarcity, and choice of techniques in a schematic way without however presenting a formal model. The eminent economic historian H. J. Habbakuk (1967) discussed these issues at length in a stimulating book that provoked a flurry of seminal articles by the "new" economic historians Peter Temin (1966, 1971) and Robert Fogel (1967). Temin explicitly formulated the bare bones of what we now know as the specific factors model in the mathematical appendix to his 1966 paper. Fogel contributed a searching critique of Temin's model and also made some valuable extensions. The Temin-Fogel debate was notable for the theoretical sophistication and acuteness of both these prominent historians, and the interplay of historical evidence and the specification of the appropriate analytical model.

The key problem that Temin and Fogel focused on was how to reconcile the fact that both the return to capital and the real wage were higher in the US than in Britain. In a one-product model with similar technology in the two countries the "factor price frontier" is negatively sloped and is identical for both countries. A higher real wage in the US must imply a lower return to capital in the US, not a higher one. A superior technology in the US would of course permit both factor prices to be higher but this would not be consistent with the belief that, except for relatively short lags, the same technological opportunities were open to both countries.

Following the implicit framework of Rothbarth, Temin adopted a two-sector model in which agriculture used land, manufacturing used capital, while both sectors drew on a common pool of labour i.e., the structure of the now familiar specific-factors model. Suppose that the land-labour ratio in the US is higher than in Britain while the capital-labour ratio is the same, with relative product prices equalised through free trade. It is then easy to see that the higher land endowment in the US would pull more labour into agricultural employment relative to manufacturing, leaving less labour to be employed with capital in the manufacturing sector. This would result in a lower return to capital and a higher real wage in the US, just as in the case of the one-product model. Land abundance in the US cannot therefore account for the stylised facts with the same technology in both sectors and the same relative product prices.

Suppose, however, that the relative price of manufactures is higher in the US, say because of a tariff on imports. This will draw more labour into manufacturing, thereby raising the return on capital. The rise in the return to capital

due to the higher relative price of manufactures could thus more than off-set the reduction in the return to capital due to the more abundant supply of land, while raising real wages even higher than in the absence of the tariff. The stylised facts of a higher return to capital and higher real wages in the US can thus be consistent with identical technology in both sectors and greater land abundance in the US.

This resolution of the Temin-Fogel debate was clearly expressed in the classic article of Ronald Jones (1971) that developed the specific-factors model with full rigour and generality. It is interesting to note that Jones and Fogel were colleagues at the University of Rochester and that Jones thanks Fogel for bringing the Temin-Fogel literature to his attention. Once again we have a fruitful blend of a problem inspired by economic history and the small-scale general equilibrium tools of trade theory.

III MODELLING THE EMERGENCE OF THE ATLANTIC ECONOMY

Having seen how the problem of the "Atlantic economy" in the nineteenth century inspired the construction of both the HOS and the specific-factors models of trade theory let us now turn the relationship around and see how these models themselves can throw further light on our understanding of the emergence of the Atlantic Economy itself. As is well known Adam Smith devoted considerable space in *The Wealth of the Nations* to "the Advantages which Europe has derived from the discovery of America". The theme has provoked a vast outpouring of historical literature but relatively little in the way of economic modelling in an attempt to capture the essence of the stylised facts. In what follows I will try to adapt the specific factors model for this purpose.

The simplest way to do this is to consider Europe with initially fixed endowments of land, capital, and labour; the technology to produce the two goods, food and manufactures, and the preferences of the consumers for expenditure on these goods. The relative price of the two goods, and the real returns to all three factors will then of course all be determined precisely as in the standard model we have been discussing.

Suppose now that "America" is "discovered". The easiest meaning to attach to this statement is that it represents an exogenous increase in the supply of land available to Europe, assuming either that there were no original inhabitants or that they were exterminated upon contact by disease or violence. Assume that European labour is perfectly mobile across the Atlantic. The new equilibrium will clearly involve a rise in real wages, both for the emigrants and the population that remains in Europe, a fall in European food production and in the common relative price of food, and a decline in the rent per acre of land in Europe. At constant relative product prices employment, output, and the return to capital

in manufacturing would all fall. The higher real income of the combined original population, however, will lead to increases in all of these variables, thus offsetting the initial declines. Let us assume, as is reasonable, that manufacturing employment, and hence output and the return to capital, both increase. America thus has a new immigrant population, enjoying the same real wages as their relatives in Europe. It is completely specialised on food production, which it exports in exchange for manufactures from Europe. If "land" in America is homogeneous with that in Europe, and the technology of food production is also the same, then the rent per acre of land will also be the same as in Europe, because the real wage is the same.

While it has become customary to consider all factor supplies as given in both versions of the factor proportions hypothesis, there is no reason why we cannot augment these models to include endogenously determined quantities of some or all of the factors. Let us consider labour first. Following the work of economist and demographer Ronald Lee (1973) in formalising the Malthusian hypothesis we can make fertility an increasing function, and mortality a decreasing function, of the real wage. These functions then determine a Malthusian equilibrium wage, at which fertility and mortality will exactly balance to leave the population unchanged. With fixed supplies of land and capital we can determine the demand for labour in food and manufacturing at this real wage, for any given relative price of food and manufactures. The total population, or labour force (assuming the two to be proportional) will then be equal in the long-run Malthusian equilibrium to the sum of these demands at a relative product price that cleared the goods markets.

Returning now to our model of the Atlantic Economy we have seen that real wages rise for the initial level of the European population, whichever side of the Atlantic they choose to live. Assuming that the Malthusian model that we have just outlined applies to the "pre-industrial" Europe of the era of the discoveries and their aftermath the higher real wage implies an increase in fertility and a decline in mortality. Population therefore expands, driving down real wages and raising rents per acre and the return to capital, until the real wage sinks once again to the Malthusian equilibrium level. The model could also be modified to allow for the fact that people might lower their fertility after they experience significantly higher real wages, for any one of the complex reasons considered under the rubric of the "demographic revolution". A leftward shift in the positively sloped relation between fertility and the real wage implies that the new Malthusian equilibrium wage will be higher than the original one before the "discovery of America", though lower than that prevailing in the immediate aftermath of the discovery.

Let us now consider how to make the supply of capital endogenous. As we know from capital theory and optimal growth theory, there is an incentive to

accumulate capital so long as the rate of return obtainable exceeds the given rate of time preference. Thus a long-run equilibrium condition that we can impose on a specific factors model is that the return on capital, which we can identify with the marginal product of capital in the manufacturing sector (i.e. "capital" is a stock of the manufactured good itself), must be equal to the constant rate of time preference. With the supplies of land and labour fixed we can vary the supply of capital until we have the rate of return on capital equal to the given rate of time preference, taking care that the relative product price clears the markets for food and manufacturing.

As we saw earlier, the "discovery of America" induces a rise in the return to capital as a result of both the exogenous increase in the supply of land and in the induced increase in the supply of labour. Thus, assuming initial equilibrium in the long run supply of capital prior to the discoveries, there is also an incentive for capital to be accumulated until the rate of return is again driven down to the given rate of time preference.

We thus see that the advantages which Europe has derived from the "discovery of America" are considerable. The increase in the supply of "land", or natural resources generally, was an enormous windfall for the European population, leading to increases in their real wages that stimulated the growth of population, and in the return to capital that boosted capital accumulation leading to further increases in the real wages and population. This "virtuous circle" of expansion could further lead to increases in the division of labour and specialisation that enhance productivity even further. This latter aspect of the process has been analysed brilliantly by Morgan Kelly (1997).

IV THE IMPACT OF THE INDUSTRIAL REVOLUTION
AND THE EUROPEAN GRAIN INVASION

I have yet to consider, however, what is perhaps the most significant single event that influenced economic relations across the Atlantic, the Industrial Revolution. Discussion of its origins and impact has of course been a staple of the discipline of economic history since its inception. An excellent overview by a distinguished group of cliometric practitioners is provided in the volume edited by Joel Mokyr (1993). The role of foreign trade in the Industrial Revolution has aroused considerable controversy. In Findlay (1982) I made an attempt to apply the tools of trade theory to the problem. Interpreting the Industrial Revolution as a discrete shift in the technology of the manufacturing sector in a two-good model, with a given demand curve for manufactures from the rest of the world, results in the emergence of an excess supply of manufactures at constant relative prices, thus leading to a deterioration in Britain's terms of trade. The scanty data available at that time were consistent with this outcome and other

predictions generated by this comparative statics exercise.

I returned to this problem in the wider context of the Atlantic Economy as a whole in Findlay (1993) which appropriately appeared in the *Festschrift* for Ronald Jones. In this much more general model, "Europe" is endowed with a fixed supply of labour and a given endowment of "land". Europe can produce food, with land and labour, or manufactures. The production function for manufactures requires "capital" and labour but also a proportional input of a "raw material", which is not produced within Europe itself. This reflects the dependence of textile production in Britain on imports of raw cotton from the New World, a key feature of the Industrial Revolution. The supply of "capital" is determined endogenously by assuming that in long-run equilibrium the stock of capital must be such that the return to capital in manufacturing must be equal to a given rate of time preference.

"America" is conceived as an empty wilderness from which "land" can be created but only at increasing marginal cost in terms of "capital". An acre of land in "America" or the "New World" is an asset with a rate of return equal to the ratio of its marginal product to its asset price, which is the marginal cost of its creation. Land and labour in America are used as in the HOS model to produce two goods, either food or raw material, with food being land-intensive and raw material labour-intensive. The only source of labour is by immigration from Europe with the requirement of an equal real wage across the Atlantic to equilibrate the labour market. The general equilibrium solution of the model determines the relative prices of the three goods: the real wage and the rent per acre; the asset price of land in America equal to its marginal cost in terms of capital; the supply of land in America i.e., the extent of the frontier; the stock of capital in manufactures; and the allocation of the original European population between the two regions, and the two sectors in each region. Trade is balanced, with raw materials exported from America and manufactures from Europe, while food could be exported by either region.

The Industrial Revolution can be depicted as a Hicks-neutral shift in the technology of manufactures in Europe. This is shown to lead to a rise in the relative price of raw materials and food in term of manufactures; an increase in the stock of capital in Europe; an increase in emigration to America; and an extension of the frontier in America. All of these implications are consistent with the historical record.

The final example of applying trade theory to the history of the Atlantic Economy that I wish to consider is the impact of the transportation revolution that occurred as a result of such innovations as the continental railroad, the steamship, and the refrigerator ship that led, for the first time, to the massive export of grain and beef across the Atlantic towards the end of the nineteenth century. This is what Kevin O'Rourke (1997) has called the "European Grain

Invasion 1870-1913", the title of his remarkably fine and comprehensive article on this subject. In Chapter 5 on "Trade , Migration and the Moving Frontier" of my Ohlin Lectures volume, Findlay (1995), I showed how an adaptation of the earlier "Christopher Columbus" model that I have outlined here can be applied to this problem. Together with O'Rourke's article it shows how the forces that sent so many Italians to Argentina and so many Swedes to Minnesota can be analysed in terms of the two models that sprang from the brow of Eli Heckscher in 1919. In a sense my work and O'Rourke's closes the circle. The European Grain Invasion led Heckscher to create a model that ultimately was used to "explain" that phenomenon itself.

I hope that the case has been made for the use of the simple models of trade theory to account for the big questions of economic history. While the examples have been drawn from the Atlantic Economy of the last few centuries the possibilities are not limited in either time or space.

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