NBER WORKING PAPER SERIES

AFTER COLUMBUS: EXPLAINING THE GLOBAL TRADE BOOM 1500-1800

Kevin H. O'Rourke
Jeffrey G. Williamson

Working Paper 8186
http://www.nber.org/papers/w8186

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
March 2001

The authors acknowledge with pleasure the excellent research assistance of Ximena Clark, David Foster and Raven Saks, plus help with the rent data from Greg Clark, Phil Hoffman and Jan Luiten van Zanden. An earlier version of this paper was improved by comments from Arne Bigsten, Kirti Chaudhuri, Don Davis, Ron Findlay, Andre Gunder Frank, Elhanan Helpman, Doug Irwin, Ron Jones, Lars Jonung, Paul Krugman, Bob Mundell, Cormac Ó Gráda, Gunnar Persson, Dick Sylla, participants at the Ohlin Conference (Stockholm, October 14-16, 1999) and seminar participants at Copenhagen, Gotenborg, Harvard, LSE and the Stockholm School of Economics. Williamson also acknowledges generous research support from the National Science Foundation SBR-9505656 and SES-0001362. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

After Columbus: Explaining the Global Trade Boom 1500-1800
Kevin H. O'Rourke and Jeffrey G. Williamson
NBER Working Paper No. 8186
March 2001
JEL No. F14, N7

ABSTRACT

This paper documents the size and timing of the world inter-continental trade boom following the great voyages in the 1490s of Columbus, da Gama and their followers. Indeed, a trade boom followed over the subsequent three centuries. But what was its cause? The conventional wisdom in the world history literature offers globalization as the answer: it alleges that declining trade barriers, falling transport costs and overseas "discovery" explains the boom. In contrast, this paper reports the evidence that confirms unambiguously that there was no commodity price convergence between continents, something that would have emerged had globalization been a force that mattered. Thus, the trade boom must have been caused by some combination of European import demand and foreign export supply from Asia and the Americas. Furthermore, the behavior of the relative price of foreign importables in European cities should tell us which mattered most and when. We offer detailed evidence on the relative prices of such importables in European markets over the five centuries1350-1850. We then offer a model which is used to decompose the sources of the trade boom 1500-1800.

Kevin H. O'Rourke
Department of Economics
Trinity College
Dublin 2, Ireland
and CEPR and NBER
kevin.orourke@tcd.ie

Jeffrey G. Williamson
Department of Economics
Harvard University
Cambridge, MA 02138 USA
and NBER
jwilliam@kuznets.fas.harvard.edu

I. Introduction

Why has world trade grown? This fundamental question has been posed recently by such notable international economists as Paul Krugman (1995) and Robert Feenstra (1998). In Krugman's words: "Most journalistic discussion of the growth of world trade seems to view growing integration as driven by a technological imperative – to believe that improvements in transportation and communication technology constitute an irresistible force dissolving national boundaries" (Krugman 1995, p. 328). An alternative explanation might stress instead declining political barriers to trade, which (like technological improvements) help link distant markets together and erase commodity price gaps between them. A third potential explanation seems to have been even more powerful in practice, since it appears that fully two-thirds of the late 20th century trade boom can be explained by unusually fast income growth (Baier and Bergstrand 2001).

This modern debate has a powerful historical resonance. Consider another canonical example of world trade growth. The conventional wisdom is that there was a secular world trade boom following the Voyages of Discovery by Christopher Columbus, Vasco da Gama and their European followers. This paper measures, we believe for the first time, the size and timing of that secular trade boom. Furthermore, and just as in the late 20th century case discussed by Krugman, there is a conventional historical wisdom which argues that the trade boom after Columbus can be explained by declining trade barriers and/or transport costs between Europe and the overseas continents with whom it traded for "exotic" products, consumed by the elite. This paper rejects this view, and offers instead the model and the evidence necessary to decompose the sources of the trade boom into the demand and supply fundamentals that really mattered.

The next section measures the world trade boom as it was manifested by European imports from, and exports to, both Asia and the Americas. The evidence there shows that the share of trade in GDP has certainly increased over the 500 years since 1492. However, it also documents that some centuries underwent far bigger world trade booms than others. Section III asks whether the trade boom can be explained by declining trade barriers. If there was such a decline, then it should have left a trail marked by falling commodity price gaps between exporting and importing trading partners. There is no such evidence, suggesting that "discovery" and transport productivity improvements were offset by trading monopoly markups, tariffs, non-tariff restrictions, wars, and pirates, all of which served in combination to choke off trade. The trade boom would have been a lot bigger, it seems, without those man-made interventions.

If it wasn't declining trade barriers that explains the trade boom after Columbus, what was it? Section IV offers the leading demand and supply contenders. It also offers some important new evidence: it measures the relative price of "exotic" imports from Asia and the Americas in European urban markets over the five centuries between 1350 and 1850. These relative prices are the smoking guns which suggest when European demand and overseas supply dominated and whether supply from Asia and the Americas behaved differently.[1] The section also offers estimates of European "surplus" income growth, presumably the central force driving import demand. Section V develops the explicit partial-equilibrium model and the actual decomposition of the trade boom sources, century-by-century, from Columbus to the Crystal Palace. Finally, Section VI speculates further on the sources of the trade boom, including the role played by China's (and Korea's and Japan's) retreat from world markets from the mid-15th century to the mid-19th century. We finish with some qualifications, and suggestions for future research.

[1] In one of his first forays into history, Ronald Findlay (1982) used just such relative price evidence in an attempt to decompose the sources of trade growth during the Industrial Revolution.

II. The Trade Boom After Columbus

Table 1 documents the world trade boom between 1500 and 1992. The evidence summarized there takes many forms, and it is never quite what we'd like: sometimes reporting trade in value, sometimes in quantity; sometimes for one product, sometimes for another; sometimes carried by one country, sometimes another; and never, at least until 1800 and Angus Maddison (1995), a constant price world trade index. Still, the regional, product, and country coverage is enormous. And, in any case, it's all that the archives have yielded thus far.[2]

[Table 1 about here]

The panel at the bottom of Table 1 reports two notable facts. ***First***, the growth of world trade was pretty much the same in the 19th and 20th centuries, roughly 3.5 percent per annum. This is a surprising fact, given that world GDP growth doubled from 1.5 to 3 percent per annum between 1820-1913 and 1913-1992 (Maddison 1995: p. 227). Since the growth of world trade was almost identical in the two centuries, it follows that trade shares rose much faster in the 19th than the 20th century. So far, it looks like the 19th century is the canonical globalization epoch, not the 20th century. ***Second***, trade growth prior to 1800 was much slower, about 1.1 percent per annum. Of course, everything else grew more slowly in this pre-industrial period too, so a 1.1 percent per annum growth rate may still be fast enough to ensure that trade shares were on the increase in the wake of da Gama and Columbus.[3]

---

[2] Table 1 computes an unweighted average of the growth rates underlying all series in each half century after 1500, and then cumulates these half-century growth rates to yield 1.06 percent per annum between 1500 and 1800. Alternatively, one can include in the calculation only those series describing European imports from Asia and the Americas, since in the presence of bullion flows European export growth need not have equalled European import growth, and since we will later be appealing to European import demand in our attempt to account for these trade flows. However, the two calculations yield much the same result: 1.06 versus 0.97 percent per annum. See also footnote 3.

[3] We also calculated trade growth rates excluding all nominal series on the premise that it's the volume of trade to be explained, not the value. If prices were falling, the 1.1 percent growth rate would understate trade volume growth, while the reverse would be true if prices were rising. Excluding all the nominal series in Table 1 lowers trade growth from 0.66 to 0.11 percent per annum

They were certainly on the increase in 18th century Britain where the export to GNP ratio rose from 8.4 percent in 1700, to 14.6 percent in 1760, and to 15.7 percent in 1801.[4]

The world history literature is written as if that 1.1 percent per annum growth rate in world trade can be explained by globalization forces, unleashed by the voyages of Christopher Columbus and Vasco da Gama. Can it? This is the central question that motivates this essay.

III. Was the Trade Boom Driven by Declining Trade Barriers, and Was There Commodity Price Convergence?

The most obvious explanation for the global trade boom is that it was caused by declining transport costs and/or some fall in man-made barriers to trade. Such a view seems to us implicit in a recent statement by Andre Gunder Frank that "there was a single global world economy with a worldwide division of labour and multilateral trade from 1500 onward" (Frank 1998, p. 52). This position is shared by several prominent world historians. Jerry Bentley views the period after 1500 as "a genuinely global epoch of world history" (Bentley 1996, pp. 768-9). Immanuel Wallerstein believes that by the sixteenth century a European "world-economy based upon the capitalist mode of production" had appeared (Wallerstein 1974, p. 67). These historians are on the side of Adam Smith who believed that "the discovery of America and that of a passage to the East Indies by the Cape of Good Hope, are the two greatest and most important events recorded in the history of mankind" (Smith 1776: 6th ed., 1791, Vol. II, Chp. VII, Pt. III, p. 139).

---

in the 17th century, a big decline. In the 18th century, excluding the nominal series lowers growth from 1.26 to 0.9 percent per annum. Overall, excluding the nominal series lowers growth over the three centuries from 1.06 to 0.76 percent per annum. These differences are big enough to suggest that we use both – thus establishing upper and lower bounds – when, in Section V, we decompose the sources of the trade boom.

[4] The share falls in 1780 before recovering to that all-time high in 1801 (Crafts 1985, Table 6.6, p. 131).

If this world history pro-globalization hypothesis is correct, then we should be able to document commodity price convergence between Europe, Asia and the Americas over the three centuries. If we cannot document commodity price convergence, then the pro-globalization hypothesis must be rejected and we will have to search for other explanations of the trade boom.

Definitions matter, of course. Although it is commodity price convergence that matters for the integration of international commodity markets, and which to us signals globalization as it affects international trade, historians rarely look for evidence of such convergence or its absence.[5] They tend instead to look at quantity data, such as trade volumes, or qualitative information, such as the rise and fall of trade routes.[6] For globalization as we define it to have an independent influence on an economy, trade-creating forces must change domestic commodity prices: it is these changes in domestic commodity prices which trigger changes in such variables as the distribution of income (e.g., land rents relative to wages), absolute living standards or the quality of life.

Where, then, should we look for evidence of globalization as we define it? Initially, only goods with very high value to bulk ratios were shipped, like silk, exotic spices and precious metals. Indeed, long distance trade in the pre-18th century period was strictly limited to what might be called non-competing goods: Europe imported spices, silk, sugar and gold, which were not found there at all, or were in very scarce supply; Asia imported silver, linens and woolens, which were not found there at all (with the important exception of Japanese silver before 1668). Dutch exports of precious metals to Asia accounted for between a half and two-thirds of the value of Asian products imported into Europe by the Dutch East India Company (hereafter, VOC: Vereenigde Oostindische Compagnie, established

---

[5] One revealing indicator is to look for entries under "prices" in the subject index of well-known world history texts. Here are some partial results: Abu-Lughod (1989), none; Prakesh (1998), none; McNeill (1999), one to "price revolution"; Curtin (1984), two, one on "administered prices" and another to "price fixing"; and Chaudhuri (1982), none. The examples could be multiplied.

[6] In fairness to the world historians, however, their reliance on quantity data has distinguished allies. For example, Robert Feenstra (1998), the economist, leans heavily on such data in his discussion of the growing integration of 20th century international commodity markets.

1602),[7] while VOC imports into Europe were dominated by spices, tea, coffee, drugs, perfumes, dye-stuffs, sugar and saltpetre. Indeed these were 84 percent of the VOC import total in 1619/1621, 73 percent in 1698/1700, and still a hefty 64 percent as late as 1778-1780 (Prakesh 1998, Table 4.1, p. 115). Imports into Lisbon from Asia were almost all spices in 1518 (Prakesh 1998, Table 2.2, p. 35). Textiles came to take a larger share of that total, but spices were still 88 percent of Asian imports into Lisbon by 1610 (Prakesh 1998, Table 2.3, p. 36). Even the English East India Company, famous for their gamble to focus on the Indian textile trade, had imports heavily weighted by spices and other luxuries: the figure is 43.4 percent in 1668-1670 and 46.5 percent in 1758-1760 (Prakesh 1998, Table 4.2, p. 120). By definition, these non-competing goods were very expensive luxuries in importing markets, and thus could bear the very high cost of transportation from their (cheap) sources. Also by definition, their presence or absence in Europe had no impact on domestic production since they were non-competing.

So what is the evidence of price convergence for those commodities which were traded during the Age of Commerce? Elsewhere we have reviewed the evidence (O'Rourke and Williamson 2000a,b), so the rest of this section only offers a brief survey of freight rates and commodity price convergence since 1492.

At the beginning of the 17th century, freight costs on the East India round-trip voyage from Europe were £30-32 per ton, whether carried in a Dutch or an English vessel (Steensgaard 1965, p. 148). A half century later, the freight costs on English chartered ships had fallen to £16-23, or by 23-50 percent (Steensgaard 1965, Table 1, p. 152), an impressive decline on the face of it. However, it turns out that the source of the decline was a fall in the turnaround time in Southeast Asia (Steensgaard 1965, p. 154). Prior to 1640, ships were required to spend time putting down local revolts in Asian waters, building forts, negotiating agreements, showing the flag, and fending off European

[7] Findlay (1996, pp. 53-4).

competitors. After 1640, chartered ships did not perform these functions, but rather a permanent Asian fleet of smaller VOC ships did. The cost per ton per trip does not include the cost of the permanent fleet, borne by the East India Company as before, but not directly included as part of the charter cost per ton. When these costs are added back in, our guess is that most of the decline in transport costs over the half century would evaporate.[8] Ralph Davis (1962, pp. 262-4) and Bal Krishna (1924, pp. 321-3) extend the freight cost evidence from the 1650s to the 1730s. They find that freight costs "were higher in the 1720s and 1730s than they had been in the 1660s and 1670s and they took another step upward in the 1760s, when they return to the levels prevailing in the early seventeenth century" (Menard 1991, p. 250). Freight rates for 'fine' textiles shipped to England from the Malabar Coast and Bay of Bengal or from Bombay and Surat show no sign of decline in the 18th century when deflated by the average prices paid for Bengali and Bombay textiles respectively (Davis 1962, p. 263; Chaudhuri 1978, Tables C.20, C.22). As far as we can tell, there is no evidence of any transport revolution along Euro-Asian trade routes during the Age of Commerce.

What about commodity price convergence? We have the required price data for spices and coffee, items which combined were 68 percent of Dutch homeward cargoes in the mid-17th century (Reid 1993, pp. 288-9). Figure 1 plots markups for cloves, pepper and coffee (Bulbeck, Reid, Tan and Wu 1998), where markups are defined as the ratio of European to Asian price. There is plenty of evidence of price convergence for cloves from the 1590s to the 1640s, but it was short-lived, since the spread soared to a 350-year high in the 1660s, maintaining that high level during the VOC monopoly and up to the 1770s. The clove price spread fell steeply at the end of the French Wars, and by the 1820s was one-fourteenth of the 1730s level. This low spread was maintained across the 19th century. Between the 1620s and the 1730s, the pepper price spread showed no trend, after which, however, it

[8] We say "most" but do not assert "all." Presumably, the VOC saved on costs by switching to a permanent Asian fleet. In Steengaard's words, "The extra expense involved in setting up this permanent Asian trading fleet must have been slight compared with the saving achieved by employing the big return ships solely for the purpose for which they were intended" (Steengaard 1965, p. 156).

soared to a 250-year high in the 1790s. By the 1820s, the pepper price spread of the early 17th century was recovered, and price convergence continued up to the 1880s, when the series ends. While there is some modest evidence of price convergence for coffee during the half century between the 1730s and the 1780s, everything gained was lost and more during the French Wars. At the war's end, price convergence resumed, so that the coffee price spread in the 1850s was one-sixth of what it had been in the 1750s, and in the 1930s it was one-thirteenth of what it had been in the 1730s. Thus, there is absolutely no evidence of commodity price convergence for these "exotic" goods so central to Dutch trade. Was English trade in Asia any different than Dutch trade? Apparently not (O'Rourke and Williamson 2000a: Figures 8A-F).

[Figure 1 about here]

Of course, the price spread on pepper, cloves, coffee, tea and other non-competing goods was not driven solely, or even mainly, by the costs of shipping, but rather, and most importantly, by monopoly,[9] international conflict, and government tariff and non-tariff restrictions. But we are indifferent about the sources of commodity price convergence: anything that impedes price convergence suppresses trade, and there is no evidence of secular commodity price convergence before the 1820s.

Is there any reason to expect the price spread on *competing* goods between Europe and Asia to have behaved differently, as opposed to the *non-competing* "exotics" we have just examined? We think it unlikely, especially if we cannot find it for the important East Indian cloth trade. Figure 2 plots the average prices received by the East India Company on its Asian textile sales in Europe, divided by the average prices it paid for those textiles in Asia. Again, there is no sign of a secular decline in mark-ups (where mark-ups include all trade costs, as well as any East India Company monopoly

[9] A reading of Douglas Irwin (1991, esp. p. 1297) suggests that pretty much all of the intercontinental trade at this time was by state-chartered monopolies. Like most monopolies, they raised prices paid by consumers (in Europe), lowered prices paid by suppliers (in Asia), restricted output and limited trade. This is hardly the stuff that globalization is made of!

profits) over the century between 1664 and 1759.[10] This textile trade was extremely large and it was on the rise. Yet, the evidence on freight rates and mark-ups suggest that growing trade volumes in the late 17th century were almost certainly driven by the outward expansion of European import demand or Asian export supply rather than by world commodity market integration *per se*. If it was globalization at work, we would see evidence of commodity price convergence and there is none.

[Figure 2 about here]

The evolution of transport costs in the North Atlantic prior to the early 19th century is summarized by Russell Menard (1991), and his freight cost indices offer no unambiguous support for pre-18th century globalization either (although his interest is in transport revolutions, and his evidence is thus limited to freight rates rather than commodity price gaps). The best case for a North Atlantic pre-19th century transport revolution lies with the tobacco trade. Between 1618 and 1775, freight charges on tobacco shipments from the Chesapeake to London fell substantially: adjusted by the Brown-Hopkins consumer price index, real freight rates fell by 1.6 percent per annum over the entire colonial period (Menard 1991, p. 255). The worst case for a North American pre-19th century transport revolution lies with the sugar trade of Barbados and Jamaica, as well as with the rice trade of Charleston, both with England. Menard (1991, Table 6.6, p. 264) documents stability in the peacetime real freight charges on sugar between the 1650s and the 1760s, and thus no support for globalization in the North Atlantic prior to the 19th century. The rice trade also shows no fall in real freight rates between the 1690s and the 1760s. However, freight rates did undergo an impressive decline after the 1760s (Menard 1991, Table 6.8, pp. 268-9), but there is reason to believe that this late 18th century

[10] All import price data come from Chaudhuri's (1978) Table C.24, which also provides data on sales prices and mark-ups from 1664 to 1704. From 1710 to 1759, the sales prices used are those given in Chaudhuri's Table A.13 (p. 302); like the earlier data in Table C.24, these are average prices, but since they are listed in a separate table, we cannot be sure that they are strictly comparable with those earlier figures.

decline in freight rates is overstated,[11] and, in any case, it would have been greatly offset by rising insurance charges in the more hostile world of the French Wars.

There is plenty of evidence of an inter-continental trade boom during the Age of Commerce, but there is very little evidence of commodity price convergence between the continents.

IV. Demand and Supply: Decomposing the Sources of the Trade Boom

Background

Before we bring some more empirical evidence to bear on what in the traditional literature has been largely a qualitative discussion about the economic impact of the Voyages of Discovery, we need, once again, to define terms. Obviously, we take globalization to mean the integration of commodity markets between continents. The Voyages of Discovery also involved a transfer of technology, plants, animals and diseases on an enormous scale, never seen before or since; but this is not the focus of the present paper. Furthermore, the economic potential of the Voyages of Discovery could never have been fully realized without the peopling of these frontiers and the investment of European capital in them; thus, it also involved factor markets. More to the point of this paper, the inter-continental trade boom that followed the voyages of Columbus and da Gama must have had its source in some combination of three factors: a boom in European demand for tradables (the continent that was pulling away economically from the Rest), a boom in tradable supply from the Rest, and a

[11] The argument for overstatement is given in O'Rourke and Williamson (2000b), but it goes something like this: Menard (1991, Table 6.6, p. 264) documents stability in the peacetime real freight charges on sugar between the 1650s and the 1760s, deflating the nominal charges by the Brown-Hopkins (1981) consumer price index (CPI) in England. But if sugar prices in Barbados and Jamaica fell by more than did the CPI in England, the rise in Menard's real freight rate index would be understated and its fall overstated. Apparently sugar prices did fall by more (Mechner 1999, Figure 2.2, p. 58a; McCusker and Menard 1991, Figure 7.1, p. 158). The North Atlantic rice trade also shows a fall in real freight rates after the 1760s, but, once again, if rice prices in Charleston fell by more than did the CPI in England, then this late 18th century decline in freight rates is overstated.

decline in the barriers to trade. If a decline in trade barriers had accounted for the trade boom over the three centuries following 1492, then globalization would have been the driving force, as implied by the world history rhetoric. Without any significant decline in trade barriers, world history rhetoric is incorrect. Instead, global trade boomed after 1492 *in spite of* barriers to trade and anti-global Mercantilist sentiment, and it would have been a bigger boom without these anti-global forces.[12]

Figure 3 presents a stylized view of trade between some European home country like England and the rest of the overseas world, like Asia (the latter denoted by an asterisk). MM is the home import demand function (that is, domestic demand minus domestic supply), with import demand declining as the home market price (p) increases. SS is the foreign export supply function (foreign supply minus foreign demand), with export supply rising as the price abroad (p^*) increases. In the absence of transport costs, monopolies, wars, pirates, and other trade barriers, international commodity markets would be perfectly integrated: prices would be the same at home and abroad, determined by the intersection of the two schedules. Transport costs, protection, war, pirates, and monopoly drive a wedge (t) between export and import prices: higher tariffs, transport costs, war embargoes and monopoly rents increase the wedge while their disappearance reduce it. Commodity market integration, or globalization as we define it here, is represented by a decline in the wedge: falling transport costs or trade barriers lead to falling import prices in both places, rising export prices in both places, commodity price convergence, and an increase in trade volumes.

[Figure 3 about here]

The fact that trade should rise as trade barriers fall is, of course, the rationale behind using trade volumes or the share of trade (exports, or exports plus imports) in GDP as a proxy for globalization and international commodity market integration. Indeed, several authors (e.g. Chase-

[12] With the *caveat* that overseas supply could in principle have boomed due to international factor migration, another (albeit quite distinct) dimension of what is commonly referred to as 'globalization'. These migrations would include African slaves to the Americas, as well as "free" immigration into Southeast Asia from India and China.

Dunn, Kawano and Brewer 1999; Hirst and Thompson 1996) have used Angus Maddison's data (e.g. Maddison 1991, 1995) to trace out long-run trends in commodity market integration since the early 19th century, and historians of pre-industrial experience also use such evidence. However, Figure 3 makes it clear that globalization is not the only reason why the volume of trade, or trade's share in GDP, might increase over time. Outward shifts in either import demand (to MM') or export supply (to SS') could also lead to trade expansion, and such shifts could occur as a result of population growth, the colonization of empty lands, capital accumulation, technological change, and a variety of other factors. Alternatively, globalization could coincide with falling trade volumes if MM or SS were shifting inwards over time. Thus, the *only* irrefutable evidence that globalization is taking place, on our definition, is a decline in the international dispersion of commodity prices or what we will call commodity price convergence. However, we were not able to find it in Section III.

We represent the post-1492 trade boom documented in Section II as a rise from T_0 to T_1, T_2 or T_3. If $\underline{t}$ remained constant (no move toward more global integration), then outward shifts in either MM or SS, but not both, would generate a trade boom to T_1 (where the price gap, $\underline{t}$, remains the same, although prices change in both markets). An outward shift in *both* MM and SS would generate a bigger trade boom to T_2 (still holding $\underline{t}$ constant). If at the same time $\underline{t}$ evaporated (global integration), we would observe an even bigger trade boom to T_3. Figure 3 is translated into an explicit "sources-of-trade" equation and estimated in Section V, where the observed trade boom is actually decomposed into the component parts associated with shifts in European demand and Asian supply.

Relative Price Trends

Figure 3 makes it clear that the behavior of the relative prices of spices, silk, tea, sugar and the many other 'exotic' commodities imported by Europe from overseas should tell us whether it was mainly supply or mainly demand which accounted for the global trade boom from 1500 to 1800. Appendix 1 reports in detail how we calculated trends in the prices of these "exotic" European imports relative to a commodity that didn't travel very far in those times, grain (wheat, oats or barley, depending on the source used). The evidence is very rich, and the sources well known, which is surprising given that, as far as we know, they have never been used for this purpose. Three famous scholars from a previous generation have left behind an amazing data base describing prices for the three main European participants in the overseas trade: Earl Hamilton on Spain (Hamilton 1934, 1936, 1947); Nicolaas Posthumus on the Netherlands (Posthumus 1946); and William Beveridge on England (Beveridge 1939). These scholars documented (in most cases, annually) the prices of spices, sugar, incense, indigo, tobacco, opium, coffee, tea, and other non-competing importables from Asia and the New World, as they prevailed in major European cities like Amsterdam, London and Seville.[13] We have used these data to calculate trends in the relative price of non-competing importables in every half-century between 1350 and 1850. The findings are summarized in Table 2, where they are reported separately for imports from Asia and imports from the Americas, as well as the total.

[Table 2 about here]

The following seven relative price facts emerge from Table 2. ***First***, it was not some spectacular boom in the relative price of imported "exotic" products – bloating trading profits to even higher levels -- that sent Columbus and da Gama off to seek them. Granted, the evidence is thin,[14] but what we do have says that relative prices *fell* across the 15th century. ***Second***, these relative prices fell even faster in the 16th century, just as one would expect if supply booms in Asia and the Americas were doing the work. Indeed, the 16th century collapse in those relative prices was bigger by far than

[13] These scholars also took great care with weights, measures and quality. These commodities are as close to being homogenous over these centuries as the most demanding economist would wish.

[14] Indeed, Appendix Table 1 shows that all we've got for 1450-1500 is Posthumus on pepper and ginger, and, even though ginger dominates, prices of the two move in opposite directions! If pepper is what was really motivating da Gama, then an account which emphasises rising relative prices prompting greater investment in exploration becomes more plausible. Ginger tells the opposite story, and Posthumus cannot offer any other exotic non-competing import prices to resolve the conflict. Thankfully, the data get much thicker after 1550.

in any other period save 1800-1850. However, we believe that the forces underlying these 16th and 19th century experiences were *completely* different. It was *not* declining trade barriers, commodity price convergence and globalization that accounted for the dramatic fall in relative prices during the 16th century, but rather booming supply abroad. In contrast, declining transport costs mattered a great deal in the early 19th century, especially so since income growth in Europe was far faster than at any time between 1500 and 1850 and it would have served by itself to raise the price of importables. ***Third***, the secular relative price fall stopped in the 17th century -- actually, prices rose across that century -- evidence suggesting that a boom in European demand or a collapse in Asian supply was dominant in the 1600s. ***Fourth***, the relative price of non-competing imports was more stable across the 18th century, suggesting that European demand and foreign supply changes were more closely offsetting. However, note that price histories were quite different between the first and second half of the century. While relative prices were very stable up to 1750, they underwent a fall from mid-century to 1800, suggesting that booming Asian supply or (more likely for a continent at total war) slumping European demand dominated during the French Wars. ***Fifth***, the relative price fell across the first half of the 19th century, and at the most dramatic per annum rate seen across the whole half millennium before 1850. To repeat our comment above, we view this evidence as consistent with powerful globalization forces at work after the French Wars (O'Rourke and Williamson 2000a, b), especially so since those globalization forces (lowering relative prices of importables) had to fight against accelerating income growth in Europe carried by industrial revolutions (raising relative prices of importables). ***Sixth***, the relative prices of imports from Asia and the Americas behaved very differently. For example, during the great 16th century collapse in the relative price of non-competing imports, those coming from the Americas actually rose in relative price. It was Asian import prices that were doing all the work during that century, and thus it was Asian supply, not supply from the Americas, that mattered. The same inverse correlation was present in the 17th century, but in this case while the relative price of imports from Asia rose, it fell for those from the Americas.[15] These apparent differences between Asian and American supply are striking, and we will make use of them in Section VI. ***Seventh and finally***, over the three centuries as a whole, the relative price of these import goods declined, suggesting that on average overseas supply-side forces were dominant. However, it was Asian goods whose relative price fell in European markets over the three centuries, not the relative price of goods from the Americas.

Measuring European Import Demand

Section V will put some meat on the bare bones just exposed by the movements in the relative price of non-competing imports. But since those price trends suggest that European import demand mattered at various points over the five centuries between 1350 and 1850, we next offer a measure of the growth in that part of European income that generated the demand. Appendix 2 supplies the details, so here we just offer a summary.

We begin with the premise that the vast majority of the "exotic" imports from Asia and the Americas were out of the reach of any but the rich: changing living standards of the workers in cities and villages would have had only a trivial impact on European import demand; changing incomes of those at or near the top of the income pyramid would have had a big impact. The rich consisted mainly of landowners, urban merchants, and those in the "residual" class serving the rich and controlling the poor. Given this premise, we estimate the growth of the European "surplus" by half-century between 1500 and 1850, relying on estimates of the growth in English land rents (documented by Gregory Clark). Although French land rents (documented by Philip Hoffman) and Dutch and Flemish land rents (documented by Jan Luiten van Zanden) appear to have behaved pretty much like English land

[15] The American figures for the 16th century depend entirely on just one sugar price series, so we must be cautious about this finding for that century. However, the 17th century is much more richly documented for the Americas, and the price observations are certainly not limited to sugar. See Appendix Table 1.

rents over the full three centuries, the latter are better documented within centuries so we rely on them in what follows. The results are summarized in Table 3, and they suggest the following: European surplus income fell in the 16th century, so it could not have contributed anything to the trade boom; surplus income grew fairly vigorously in the 17th and 18th centuries, when its contribution to the trade boom must have been much more important; and surplus income boomed in the 19th century, when it must have contributed very importantly to the trade boom. We will use this evidence in the next section to implement the trade boom decomposition.

[Table 3 about here]

V. Accounting for the Trade Boom After Columbus

Europe's external trade boomed in the three centuries following 1500, but the evidence reviewed in Section III suggests that the combined effect of changing trade barriers, trade monopolies, and transport costs cannot account for the boom since there is no evidence of global commodity price convergence before the 19th century. We have already proposed other explanations for the trade boom. Now we will go one step further and actually decompose the boom into that portion explained by shifting European demand and that portion explained by shifting Asian (and American) supply.[16]

The decomposition is implemented by the following simple partial equilibrium relationship:

$$D(p+t,Y) = S^{*}(p,X) - D^{*}(p,Y^{*}) \qquad \textbf{(1)}$$

where D and D^* are demand in Europe and Asia respectively, and S^* represents Asian supply. Equation **(1)** reflects the plausible assumption that these Asian goods are non-competing; that is,

[16] For the sake of brevity, we will refer in what follows to these combined supply effects coming from Asia and the Americas as simply 'Asia'.

goods such as spices and pepper were produced in Asia but not in Europe. The Asian price is given by p, and the European price is p+t, where t is the price gap between the two continents (reflecting the combined effects of freight costs, trade monopoly mark-ups, and government policy). X is a shift factor, reflecting the combined effects on Asian supply of population growth, technological change and so forth. Y and Y^* are European and Asian income respectively, where, as we documented in Section IV, "income" refers to the surplus above subsistence received by the rich.

Totally differentiating **(1)**, and assuming that the large t does not change,[17] yields:

$$D_p dp + D_Y dY = S_p dp + S_X dX - D_p^* dp - D_Y^* dY^* \qquad \textbf{(2)}$$

while further manipulation yields:

$$E_p \hat{p} + E_Y \hat{Y} = \frac{Q}{M}\left(E_p^S \hat{p} + E_X^S \hat{X} - E_p^* \hat{p} - E_Y^* \hat{Y}^* \right) \qquad \textbf{(3)}$$

where E_p and E_Y represent price and income elasticities of European demand respectively, the same demand elasticities in Asia are denoted with a star, a '^' over a variable denotes the proportional rate of change, and E^S_p and E^S_X are the Asian supply elasticities with respect to price and the shift factor respectively. Q is the total output of these Asian trade goods (i.e. total Asian supply), while M is the total trade in the goods (i.e. total European demand).

From equation **(3)** we can derive the following expression for the rate of change in prices:

$$\hat{p} = \frac{1}{\left[\frac{Q}{M}\left(E_p^S - E_p^* \right) - E_p \right]} \left[E_Y \hat{Y} + \frac{Q}{M}\left(E_Y^* \hat{Y}^* - E_X^S \hat{X} \right) \right] \qquad \textbf{(4)}$$

[17] The assumption is consistent with the evidence in Section III.

Thus, the change in prices is a positive function of incomes on both continents, and a negative function of supply shifts in Asia, as expected.

Finally, we want to account for the European trade boom, here written as the growth in imports,

$$\hat{M} = E_p \hat{p} + E_Y \hat{Y} \qquad \textbf{(5)}$$

We can substitute **(4)** into the right-hand side of equation **(5),** expressing the rate of change of imports as

$$\hat{M} = E_Y \hat{Y} + \frac{E_p}{\left[\frac{Q}{M}\left(E_p^S - E_p^*\right) - E_p\right]}\left[E_Y \hat{Y} + \frac{Q}{M}\left(E_Y^* \hat{Y}^* - E_X^S \hat{X}\right)\right] \qquad \textbf{(6)}$$

This is the equation which we use to decompose the inter-continental trade boom. Trade growth depends on three exogenous variables: European income, Asian income, and Asian supply.[18] Asian income growth lowers trade (E_p is negative), Asian supply growth boosts trade, and European income growth also boosts trade. European income growth appears twice in equation **(6)**; the first term is the direct positive effect of income growth on European demand. The second, more complicated term is negative; it reflects the fact that higher European demand and trade will force up the Asian supply price, and hence the European price as well. This will offer a partial offset to the direct, trade-expanding effect of income growth (i.e. the demand curve shifts out, but the economy then moves up the new demand curve). The size of this offset will depend on Q/M, which appears in the denominator of the second term in the equation: the higher is the ratio of Asian output to inter-continental trade (i.e. the less significant is European trade in the context of of total Asian supply), the more elastic will be

[18] Prices are endogenous, of course. As we have argued, "income" refers to the surplus above subsistence and thus belonged only to the fortunate few who received those incomes.

Asian supply (the closer Europe is to being a price-taker), the smaller will be the price increase associated with the European demand expansion, and the smaller will be the price offset associated with that expansion.

Section II supplies the data needed to document the growth of trade. Section IV supplies the data needed to document the growth of the relative price of Asian imports and of European “surplus” incomes of the rich. In order to estimate the effect of income growth on trade, we also need estimates of the elasticities embedded in the model, particularly European income and price elasticities of demand. We derive these elasticities from equation **(5)**, which expresses trade growth as a function of European price changes and European income growth. Table 4 summarizes the results.

[Table 4 about here]

Abstracting from changes in taste, all of these data and elasticities should be jointly consistent with equation **(5)**. Focussing on the first two centuries and on the trade data in column (1), it should be the case, for example, that

$$1.26 = -0.9 * E_p - 0.03 * E_Y$$

and

$$0.66 = 0.28 * E_p + 0.53 * E_Y$$

which allows us to solve for the two unknown elasticities, E_p and E_Y. The four rows in Table 4 yield six pairs of simultaneous equations, and hence six solutions, for these two variables. The six solutions for E_p are: -1.47, -1.82, -1.48, -1.47, -1.55, and -1.03, with a mean value of -1.47. The six solutions for E_Y are: 2.02, 2.21, 2.35, 2.14, 2.07, and 2.52, with a mean value of 2.22. Alternatively, we could use the 'volume only' trade estimates in column (2),[19] in which case our estimates for the price elasticity would be: -1.43, -2.04, -1.45, -1.44, -1.60, and -0.75, with a mean of -1.45. The income elasticity estimates would be: 0.96, 1.29, 1.52, 1.20, 1.05, and 1.79, with a mean of 1.3.

These estimates seem to fall within a remarkably tight range, and the implied price elasticities do not seem to be very sensitive to which trade data are used. Income elasticities, however, are more sensitive to the trade data used: the "volume only" trade data imply a much lower elasticity (1.3) than the "total" trade data (2.22), and thus income growth will imply less trade growth using the former calculations. On the other hand, the trade growth to be explained is lower in column (2) than in column (1).

The last four columns of Table 4 use equation **(6)**, under various assumptions, to calculate the share of total trade growth explained by the growth in Europe's surplus income. Columns (5) and (6) use the trade data in column (1), and the associated elasticities, while columns (7) and (8) use the trade data in column (2) and the elasticities implied by those. We assume that Asian and European demand elasticities were identical, that Asian supply elasticities were one, and that the ratio of Asian output to European demand, Q/M, was either 100 or 10 (i.e. that Europe took somewhere between 1 and 10 percent of the output of these traded goods, a wide range that reflects the absence of even a guess about these magnitudes in the traditional literature).

The four estimates produce remarkably similar results. European income growth explained none of the 16th century trade boom: income actually fell during this period, as did the domestic relative price of these imported goods. The 16th century trade boom can therefore be explained either by rising Asian supply, falling Asian demand, or by some combination of the two. We will have more to say about this in Section VI. In contrast, the more modest 17th century trade boom can be explained entirely by European income growth, as evidenced by the rising relative prices of non-competing

[19] See footnote 3 above.

imports during the period. The 18th century trade boom must be explained by a mixture of demand and supply: between 59 and 75 percent of the trade boom can be explained by European income growth; it follows that between 25 and 41 percent of the trade boom can be explained by changing Asian supply. Over the three centuries as a whole, European income growth explained between 50 and 65 percent of the inter-continental trade boom.[20]

VI. Speculations and an Agenda

Did Chinese Autarkic Policy Crowd in Europe?

The 'world' we have been talking about so far excludes China. This is a very big part of the pre-industrial world to exclude, perhaps representing as much as a quarter of global GDP at that time.[21] The exclusion, however, is consistent with the way this literature is written, since it is well known that 15th century China went increasingly autarkic, which was a profound switch from a previously very open trade policy. Between 1405 and 1430, seven great junk armadas sailed as far as Zanzibar, and Chinese trade with East Africa was sizeable. Chinese envoys went to Mecca, and kings from Ceylon and Sumatra were brought back to China. To quote from Eric Jones (1981, p. 204):

> The emperor Yung-lo ... had found the imported goods ... horses, copper, timber, hides, drugs, spices, gold, silver, even rice ... to be well worth acquiring. He had sent in return, besides a certain quantity of silk, ceramics and tea. ... In addition, private trade was growing.

But the last great Chinese fleet was sent abroad in 1433, and soon afterwards private maritime trade was declared illegal. While the resumption of the imperial voyages was proposed in 1480, the idea was crushed and by 1553 the art of building large ships had been forgotten (Jones 1981, pp. 203-5). Although the reasons for the spectacular policy switch are still being debated by specialists, we do

[20] Interestingly, the recent paper by Baier and Bergstrand (2001) estimates that income growth explains about 67 percent of the OECD trade boom from the late 1950s to the late 1980s.

[21] This rough guess is based on Maddison (1998, pp. 19-38).

know that the ‘inexplicable withdrawal’ continued and intensified. While smuggling and piracy filled the vacuum for a while, the Mings (1368-1644) eventually banned all trade and much later the Manchus (1644-1911) pushed the autarkic policy still further. Thus, by the time of the European Voyages of Discovery, the official imperial policy of shutting China’s doors to external trade was already in place. And China kept its doors tightly closed through the Mings and the Manchus until, at the end of the latter dynasty, China lost the Opium Wars and in 1852 British military might pried them back open again.[22]

Three hundred and fifty or four hundred years is a long time to leave world trade in the hands of others. Is it possible that China’s de-globalization move “crowded in” European trade with the rest of Asia?[23] Might the world trade boom documented in Section II, of which western historians have made so much, be a figment of Euro-centric trade histories, and might it actually reflect international economic *disintegration*, rather than integration? While we only pose this as a proposition worth exploring, a withdrawal of China from Asian markets would only have had its impact during that period of transition from an open to a closed trade policy which we take to be from the late 15th century to about the middle of the 16th century. Once China had completely withdrawn, it could, of course, have had no impact on world markets. But *while* it withdrew, the prices of exportables in South and Southeast Asia would have fallen as demand in a previously major market dried up. At the same time, the price of importables in South and Southeast Asia would have risen as supply from a previously major producer dried up. Did relative prices in South and Southeast Asia exhibit these trends from the late 15th century through the mid 16th century? Better yet, did the price of exportables

[22] There was a China trade in precious metals, but apparently very little else (see, for example, von Glahn 1996).

[23] By the phrase “rest of Asia,” we mean South and Southeast Asia. After all, China’s de-globalization move into autarky was shared, with a lag, by Korea (the Hermit Kingdom) and Japan, the latter persuaded by American gunboats to open up to trade in 1858 after about two centuries of isolation.

in China fall relative to the price of its importables?

The speculation about a Chinese policy dog wagging a European tail is, of course, consistent with Table 4 where we show that European demand played no role in accounting for the trade boom in the 16th century, and that (non-Chinese) Asian supply accounted for all of it. Furthermore, recall the message from Table 2 which documents a fall in the relative price of non-competing importables in European markets in the 16th century, but *only* for Asian goods, not for those from the Americas. These relative price facts and the sources-of-trade-boom accounting for 1500-1800 are also consistent with the view that China crowded in European trade with the rest of Asia over the three centuries following da Gama. Of course, these relative price and trade boom accounting facts are not proof of the Chinese-retreat-crowded-in-Europe speculation, but they are certainly consistent with it.

A European Population and Trade Boom Connection?

European "surplus" income growth accounted for none of the trade boom in the 16th century, all of it in 17th century, and about two-thirds of it in the 18th century. What determined growth of this economic surplus? According to one characterization in Appendix 2 (assumption A), the surplus consisted solely of land rents. Since land acreage changed only very slowly, or not at all, in England, France, the Lowlands and the rest of western Europe, the real surplus must have grown at about the same rate as did real rents per acre. In the 16th and 17th centuries, total factor productivity growth was very slow in European agriculture (even in English agriculture: Allen 1992), so land rents must have been driven primarily by land/labor ratios – periods of rising population pressure on the land being periods of rapid increase in the ratio of land rents to the wages of landless laborers, as well as, more importantly, periods of rising land rents by themselves. This is the connection for which the classical model was developed, and, with the exception of one paradoxical episode, the evidence from England confirms it.

Elsewhere, we have shown just how tight the English correlation was between the wage-rental ratio and the land-labor ratio (1565-1828: O'Rourke and Williamson 2000b, Table 3). Appendix Table 2 also shows how pressure on the land between 1600 and 1850 not only lowered the wage-rental ratio but also raised deflated land rents. Thus, European population pressure on the land must have contributed mightily to the trade boom after 1600, and the mechanism was from decreasing land-labor ratio, to increasing land rents, to increasing economic surplus, and to demand for "exotic" imports from Asia and the Americas.

The 16th century is, however, a paradox. While English 16th century population pressure on the land was as large or even larger than it was in the subsequent two centuries, rents per acre *fell* (Appendix Table 2).[24] Thus, any Malthusian explanation of the trade boom after Columbus will have to be enriched to account for this paradoxical century.

An Asian Population and Trade Boom Connection?

Of course, if Malthusian forces in Europe were a major force contributing to the trade boom, couldn't the same be true of South and Southeast Asia? Presumably, population pressure on the land there would have had the same effect. Was there a population boom in Asia (outside of autarkic China)? If so, did this lead to a growth in surplus incomes, higher Asian demand for its "exotic" trade goods, and a decline in the Asian export supply of these goods? Or might Asian population growth have stimulated the production of certain labor-intensive goods, such as textiles, thus contributing to the trade boom? Unlike in the European case, Asian population growth might have reduced trade or stimulated it, and we cannot be sure which should have dominated.

In any case, there was no population boom in the most important South Asian region, India, where population grew at only 0.17 percent per annum between 1500 and 1700, and at only 0.26

[24] Rents rose relative to wages, but rents themselves fell, and it's the latter which is central to the argument here.

percent per annum between 1700 and 1820.[25] If South and Southeast Asia behaved like India, then the population-cum-trade-boom connection is unlikely to have characterized Asia to anywhere near the same extent as it characterized Europe. If we had the same kind of long run rent series for India that we have for western Europe, this issue might be resolved.

An Agenda

Much more research remains to be done on the evolution of world trade following Columbus and da Gama, and new price histories will help lead the way.

First, our inter-continental price gap evidence does not extend much before 1580, and such evidence is crucial to understanding the century 1450-1550. We also need to stand on the shoulders of giants like William Beveridge, Earl Hamilton, and Nicholaas Posthumus to search for more relative price information within Europe, certainly for the poorly-documented 15th century, but also for the 16th century where the evidence for American imports is so sparse. More price data would also help assess the plausibility of the hypothesis that a Chinese retreat into autarky drove the 16th century trade boom in the rest of the world. Did the relative price of Chinese exportables, like silk and porcelain, rise in the aftermath of Chinese withdrawal, both in the rest of Asia and in Europe? Did the relative price of such commodities fall in China? We searched for such evidence in English secondary sources, but without success so far. Perhaps China specialists can find them in the primary archives.

Second, by the second half of the 18th century the mix of inter-continental traded goods had undergone a change that would evolve still further in the 19th century. Imported goods like tea and sugar were being consumed increasingly by the working class, and imported intermediates like raw cotton were being processed by expanding manufacturing activities, both events suggesting a change in the sources of European import demand. Tailoring our model to fit late 18th and early 19th century

[25] Based on Maddison (1998): Table 1.2, p. 20; Lavely and Wong (1998): Table 2, p. 719; and Pomeranz (2000).

circumstances might enable us to provide a disaggregated decomposition of the trade boom for the three half centuries 1700-1750, 1750-1800 and 1800-1850. Such a decomposition might provide valuable insights, given the transport revolution of the 19th century, the changing structure of the European economy at the time, and the debates concerning the links between trade and growth during the Industrial Revolution.

Third, we would like to know much more about the forces underlying Asian and American export supply during the three centuries following Columbus. Did Asian population growth, such as it was, promote or suppress trade? To what extent were changes in the area under cultivation important factors in Asia (as they surely were in the Americas)? To what extent did European exports of labor, capital and enterprise play a role in expanding overseas supply?

Three conclusions are inescapable: a quantitative study of the international economy after the Voyages of Discovery does not support the use of world history globalization rhetoric for the three centuries before Waterloo; it does support the view that European import demand was an important part of the trade boom following Columbus and da Gama; and it also suggests that the history of Europe's Age of Commerce cannot be written without China.

References

J. Abu-Lughod (1989), Before European Hegemony: The World System A. D. 1250-1350 (New York: Oxford University Press).

R. C. Allen (1992), Enclosure and the Yeoman: The Agricultural Development of the South Midlands 1450-1850 (Oxford: Clarendon Press).

S. L. Baier and J. H. Bergstrand (2001), "The Growth of World Trade: Tariffs, Transport Costs, and Income Similarity," Journal of International Economics 53: 1-27.

P. Bairoch (1988), Cities and Economic Development (Chicago: University of Chicago Press).

J. H. Bentley (1996), "AHR forum - Cross-cultural interaction and periodization in world history," American Historical Review 101: 749-770.

W. Beveridge (1939), Prices and Wages in England from the Twelfth to the Nineteenth Century, Volume 1, Price Tables: Mercantile Era (London: Longmans, Green and Co.).

H. Phelps Brown and S. V. Hopkins (1981), A Perspective of Wages and Prices (London: Methuen).

D. Bulbeck, A. Reid, L. C. Tan and Y. Wu (1998), Southeast Asian Exports Since the 14th Century: Cloves, Pepper, Coffee, and Sugar (Leiden, The Netherlands: KITLV Press).

C. Chase-Dunn, Y. Kawano and B. Brewer (1999), "Economic Globalization Since 1795: Structures and Cycles in the Modern World System," mimeo, available at http://csf.colorado.edu/wsystems/archive/papers/c-d&hall/isa99b/isa99b.htm

K.N. Chaudhuri (1978), The Trading World of Asia and the English East India Company 1660-1760 (Cambridge: Cambridge University Press).

K. N. Chaudhuri (1982), "European Trade with India," in T. Raychaudhuri and I. Habib (eds.), The Cambridge Economic History of India: Volume I: c1200-c1750 (Cambridge: Cambridge University Press): 382-407.

G. Clark (1999), "Farmland Rental Values and Agrarian History: England and Wales, 1500-1912," Department of Economics, University of California, Davis (August 1999).

G. Clark (n.d.), "Nominal and Real Male Agricultural Wages, 1250-1850, and English Economic Growth," Agricultural History Center, Working Paper Series No. 96, University of California, Davis (n.d.).

N. F. R. Crafts (1985), British Economic Growth During the Industrial Revolution (Oxford: Clarendon Press).

P. D. Curtin (1984), Cross-Cultural Trade in World History (Cambridge: Cambridge University Press).

R. Davis (1962), The Rise of the English Shipping Industry in the Seventeenth and Eighteenth Centuries (London: Macmillan).

P. Deane and W. A. Cole (1967), British Economic Growth 1688-1959: Trends and Structure (Cambridge: Cambridge University Press, 2nd ed.).

R. Feenstra (1998), "Integration of Trade and Disintegration of Production in the Global Economy," Journal of Economic Perspectives 12, 4: 31-50.

R. Findlay (1982), "Trade and Growth in the Industrial Revolution," in C.P. Kindleberger and G. Di Tella (eds.), Economics in the Long View: Essays in Honor of W.W. Rostow (Macmillan).

R. Findlay (1996), "The Emergence of the World Economy," Columbia University Department of Economics Discussion Paper No. 9596-08 (April).

F. J. Fisher (1939/40), "Commercial Trends and Policy in Sixteenth-Century England," Economic History Review 10 (November): 95-117.

A. G. Frank (1998), ReOrient: Global Economy in the Asian Age (Berkeley, Cal.: University of California Press).

K. Glamann (1974), "The Dutch East India Company's Trade in Japanese Copper, 1645-1736," Scandinavian Economic History Review 15, 3: 351-6.

E. J. Hamilton (1934), American Treasure and the Price Revolution in Spain, 1501-1650 (Cambridge, Mass.: Harvard University Press).

— (1936), Money, Prices and Wages in Valencia, Aragon and Navarre 1351-1500 (Cambridge, Mass.: Harvard University Press).

— (1947), War and Prices in Spain, 1651-1800 (Cambridge, Mass.: Harvard University Press).

P. Q. Hirst and G. Thompson (1996), Globalization in Question : The International Economy and the Possibilities of Governance (Cambridge: Polity Press).

P. T. Hoffman (1996), Growth in a Traditional Society: The French Countryside, 1450-1815 (Princeton, NJ: Princeton University Press).

P. Hohenberg and L. H. Lees (1985), The Making of Urban Europe 1000-1950 (Cambridge, Mass.: Harvard University Press).

D. A. Irwin (1991), "Mercantilism as Strategic Trade Policy: The Anglo-Dutch Rivalry for the East India Trade," Journal of Political Economy 99: 1296-314.

E. L. Jones (1981), The European Miracle (Cambridge: Cambridge University Press).

B. Krishna (1924), Commercial Relations Between England and India, 1603-1757 (London).

P. Krugman (1995), "Growing World Trade: Causes and Consequences," Brookings Papers on Economic Activity (1): 327-377.

W. Lavely and R. B. Wong, "Revising the Malthusian Narrative: The Comparative Study of Population Dynamics in Late Imperial China," Journal of Asian Studies 57 (August): 714-48.

P. H. Lindert and J. G. Williamson (1982), "Revising England's Social Tables 1688-1812," Explorations in Economic History 19 (October): 385-408.

A. Maddison (1991), Dynamic Forces in Capitalist Development: A Long-Run Comparative View (Oxford: Oxford University Press).

— (1995), Monitoring the World Economy 1820-1992 (Paris: OECD).

— (1998), Chinese Economic Performance in the Long Run (Paris: OECD).

J. J. McCusker and R. Menard (1991), The Economy of British America, 1607-1789 (Chapel Hill, N.C.: University of North Carolina Press).

W. H. McNeill (1999), A World History. Fourth ed. (Oxford: Oxford University Press).

E. Mechner (1999), Pirates and Planters: Trade and Development in the Caribbean, 1492-1680, PhD thesis, Department of Economics, Harvard University (May).

R. Menard (1991), "Transport Costs and Long-Range Trade, 1300-1800: Was There a European 'Transport Revolution' in the Early Modern Era?" in J. D. Tracy (ed.), Political Economy of Merchant Empires, (Cambridge: Cambridge University Press): 228-75.

K. H. O'Rourke and J. G. Williamson (2000a), "The Heckscher-Ohlin Model Between 1400 and 2000: When It Explained Factor Price Convergence, When It Did Not, and Why," in R. Findlay, L. Jonung and M. Lundahl (eds.), Bertil Ohlin: A Centennial Celebration (Cambridge, Mass.: MIT Press forthcoming).

— (2000b), "When Did Globalization Begin?" NBER Working Paper 7632, National Bureau of Economic Research, Cambridge, Mass. (April).

C. R. Phillips (1990), "The Growth and Composition of Trade in the Iberian Empires, 1450-1750," in J. D. Tracy (ed.), The Rise of Merchant Empires: Long-Distance Trade in the Early Modern World 1350-1750 (Cambridge: Cambridge University Press), 34-101.

K. Pomeranz (2000), The Great Divergence: Europe, China, and the Making of the Modern World Economy (Princeton, N.J.: Princeton University Press).

N. W. Posthumus (1946 and 1964), Inquiry into the History of Prices in Holland, Volumes I and II (Leiden: E. J. Brill).

O. Prakesh (1998), The New Cambridge History of India: Volume II (5): European Commercial Enterprise in Pre-Colonial India (Cambridge: Cambridge University Press).

A. Reid (1993), Southeast Asia in the Age of Commerce 1450-1680: Volume Two: Expansion and Crisis (New Haven, Conn.: Yale University Press).

A. Smith (1776), The Wealth of Nations, 6th ed., 1791 (London: Strahan and Cadell).

N. Steensgaard (1965), "Freight Costs in the English East India Trade 1601-1657," Scandinavian

Economic History Review 13: 143-62.

--- (1990), "The Growth and Composition of the Long-Distance Trade of England and the Dutch Republic before 1750," in J. D. Tracy (ed.), The Rise of Merchant Empires: Long-Distance Trade in the Early Modern World 1350-1750 (Cambridge: Cambridge University Press), 102-52

T. M. Truxes (1988), Irish-American Trade 1660-1783 (Cambridge: Cambridge University Press).

U. S. Department of Commerce (1975), Historical Statistics of the United States: Colonial Times to 1970, Part 2 (Washington, D.C.: USGPO).

J. L van Zanden (1998), "The Development of Agricultural Productivity in Europe 1500-1800," NEHA-jaarboek 61: 66-85. Background data to graphs in this source supplied by personal correspondence with the author.

R. von Glahn (1996), Fountain of Fortune: Money and Monetary Policy in China, 1000-1700 (Berkeley, Calif.: University of California Press).

I. Wallerstein (1974), The Modern World-System I: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century (San Diego, Calif.: Academic Press).

Table 1

Five Centuries of Inter-Continental Trade Growth 1500-1992

Trade route/type	Per Annum Growth (%)	Denomination	Abbreviated Source
	1500-1549		
Portugal to/from Asia	1.37	tonnage	Prakash: 32
Southeast Asia spice exports	2.53	exports (1940US$)	Bulbeck: 12-13
Cloth exports from London	1.84	export volume	Fisher: 96
Shipping volume to/fro Span Indies	3.94	toneladas	Phillips: 43-4
Average	**2.42**		
	1550-1599		
Portugal to/from Asia	0.94	tonnage	Prakesh: 32
Southeast Asia spice exports	2.31	exports (1940US$)	Bulbeck: 12-13
Cloth exports from London	0.10	export volume	Fisher: 96
Shipping volume to/fro Span Indies	1.22	toneladas	Phillips: 43-4
Sugar exports from Span colonies	-6.11	weight	Phillips: 58-9
Sugar exports from Port colonies	0.68	weight	Phillips: 60-2
Hide exports from Span colonies	1.73	number	Philipps: 70-2
Average	**0.12**		
	1600-1649		
Portugal to/from Asia	-3.36	tonnage	Prakesh: 32
Southeast Asia spice exports	0.71	exports (1940US$)	Bulbeck: 12-13
Dutch East India to Asia	1.62	tonnage	Prakesh: 104
Dutch East India from Asia	2.17	tonnage	Prakesh: 104
Dutch East India imports from Asia	2.71	imports (florins)	Prakesh: 115
Dutch East India from Coromandel	2.76	exports (florins)	Prakesh: 180
Dutch East India from Gujarat	1.65	export (florins)	Prakesh: 185
English tobacco imports from Amer	0.12	imports (kilos)	Steensgaard: 141
English East India to Asia	2.99	exports (£)	Prakesh: 106
Shipping volume to/fro Span Indies	-1.70	toneladas	Phillips: 43-4
Sugar exports from Span colonies	0.15	weight	Phillips: 58-9
Sugar exports from Port colonies	0.92	weight	Phillips: 60-2
Hide exports from Span colonies	-0.96	number	Phillips: 70-2
Average	**0.75**		
	1650-1699		
Portugal to/from Asia	0.25	tonnage	Prakesh: 32
Southeast Asia spice exports	-0.33	exports (1940US$)	Bulbeck: 12-13
Dutch East India to Asia	0.48	tonnage	Prakesh: 104
Dutch East India from Asia	0.63	tonnage	Prakesh: 104
Dutch East India imports from Asia	0.12	imports (florins)	Prakesh: 115
Dutch East India from Coromandel	1.65	exports (florins)	Prakesh: 180
Dutch East India from Gujarat	0.17	exports (florins)	Prakesh: 185
Dutch East India from Bengal	3.07	exports (florins)	Prakesh: 196

Dutch from Asia	0.33	exports (florins)	Prakesh: 203
Dutch copper imports from Japan	0.23	imports (Dutch lbs)	Glamann: 52-3
English East India to Asia	2.79	exports (£)	Prakesh: 106
English East India from Asia	-1.23	imports (£)	Chaudhuri: 508-10
English East India textiles from Asia	0	imports (£)	Chaudhuri: 547-8
English tobacco imports from Amer	2.83	imports (kilos)	Steensgaard: 141
Sugar exports from Span colonies	-3.83	weight	Phillips: 58-9
Sugar exports from Port colonies	4.36	weight	Phillips: 60-2
Hide exports from Span colonies	-2.09	number	Phillips: 70-2
Average	**0.55**		

1700-1749

Southeast Asia spice exports	1.68	exports (1940US$)	Bulbeck: 12-13
Dutch East India to Asia	1.07	tonnage	Prakesh: 104
Dutch East India from Asia	1.20	tonnage	Prakesh: 104
Dutch East India from Asia	0.12	imports (florins)	Prakesh: 115
Dutch East India from Gujarat	-0.40	exports (florins)	Prakesh: 185
Dutch East India from Bengal	0.56	exports (florins)	Prakesh: 196
Dutch from Asia	1.24	exports (florins)	Prakesh: 203
Dutch textiles from Coromandel	-0.53	exports (florins)	Prakesh: 222
Dutch from Malabar	1.07	exports (florins)	Prakesh: 229
Dutch copper imports from Japan	1.02	imports (Dutch lbs)	Glamann: 52-3
English East India to Asia	1.88	exports (£)	Prakesh: 106
English East India from Asia	2.28	imports (£)	Chaudhuri: 508-10
English East India textiles from Asia	2.26	imports (£)	Chaudhuri: 547-8
English foreign trade	1.15	imports + exports (£)	Deane & Cole: 48
English tobacco imports from Amer	1.80	imports (kilos)	Steensgaard: 141
French East India to Asia	2.12	exports (LT)	Prakesh: 109
French East India from Asia	0.11	imports (LT)	Prakesh: 254
Amer Colonies trade with England	2.60	imports + exports (£) 7	US Hist Stat: 1176-
Brit Amer Colonies furs to England	1.43	exports (£)	US Hist Stat: 1188
Irish exports to Amer Colonies	2.15	exports (£)	Truxes: 260-1
Sugar exports from Span colonies	4.63	weight	Phillips: 58-9
Sugar exports from Port colonies	-2.00	weight	Phillips: 60-2
Hide exports from Span colonies	3.08	number	Phillips: 70-2
Average	**1.33**		

1750-1799

Southeast Asia spice exports	0.83	exports (1940US$)	Bulbeck: 12-13
Dutch East India to Asia	-1.10	tonnage	Prakesh: 104
Dutch East India from Asia	-1.43	tonnage	Prakesh: 104
Dutch East India from Asia	0.11	imports (florins)	Prakesh: 115
Dutch East India from Gujarat	1.51	exports (florins)	Prakesh: 185
Dutch East India from Bengal	-0.57	exports (florins)	Prakesh: 196
Dutch from Malabar	0.69	exports (florins)	Prakesh: 229
Danish Asiatic from Asia	3.47	imports (ryx $)	Prakesh: 310
English/British foreign trade	1.15	imports + exports (£)	Deane & Cole: 48
Amer Colonies trade with England	0.36	imports + exports (£)	US Hist Stat:1176-7
Brit Amer Colonies furs to England	3.62	exports (£)	US Hist Stat:1188
Irish exports to Amer Colonies	2.69	exports (£)	Truxes: 260-1
Sugar exports from Span colonies	-0.46	weight	Phillips: 58-9
Hide exports from Span colonies	3.86	number	Phillips: 70-2

Average	**1.17**		
	1800-1849		
World constant price exports	**4.18**	exports (1990US$)	Maddison: 239
	1850-1899		
World constant price exports	**2.83**	exports (1990US$)	Maddison: 239
	1900-1949		
World constant price exports	**1.71**	exports (1990US$)	Maddison: 239
	1950-1992		
World constant price exports	**5.45**	exports (1990US$)	Maddison: 239
1500-1599	**1.26**	**(volume only: 1.26)**	
1600-1699	**0.66**	**(volume only: 0.11)**	
1700-1799	**1.26**	**(volume only: 0.90)**	
1500-1799	**1.06**	**(volume only: 0.76)**	
1800-1899	**3.53**		
1900-1992	**3.44**		
1800-1992	**3.50**		

Sources: Bulbeck, Reid, Tan and Wu (1998); Chaudhuri (1978); Deane and Cole (1967): Fisher (1939/40); Glamann (1974); Maddison (1995); Phillips (1990); Steensgaard (1990); Truxes (1988); U.S. Department of Commerce (1975).

Methods: Some of the within half-century series were shorter than 50 years, but we used them anyway as long as the route/type time series in question covered more than 25 years. We often had to interpolate between benchmark dates, but the vast majority of the half century average per annum rates reported above are calculated from an estimated equation where route/type figures have been regressed on time and time squared for the half century in question. The half century averages are unweighted.

Table 2

Average Relative Price of European Non-Competing Importables 1350-1850 (changes per annum in percent)

	Asia	America	Total
1350-1400	1.16	na	1.16
1400-1450	-0.58	na	-0.58
1450-1500	-0.11	na	-0.11
1400-1500	-0.35	na	-0.35
1500-1550	-0.72	0.44	-0.58
1550-1600	-1.38	0.53	-1.22
1500-1600	-1.05	0.48	-0.90
1600-1650	0.39	-0.41	0.14
1650-1700	0.78	-0.19	0.41
1600-1700	0.58	-0.30	0.28
1700-1750	-0.05	0.09	0.01
1750-1800	-0.49	-0.14	-0.34
1700-1800	-0.27	-0.02	-0.17
1500-1800	-0.25	0.05	-0.27
1800-1850	-1.38	-0.98	-1.15

Source: Appendix Table 1.

Table 3

European "Surplus" Income Growth 1500-1850
(percent per annum)

1500-1600	-0.03
1600-1700	0.53
1700-1800	0.43
1500-1800	0.31
1800-1850	1.90

Sources and Notes: Derived from Appendix Table 2, using assumption C.

Table 4

The Sources of Europe's Trade Boom 1500-1800:
The Share Explained by European Surplus Income Growth
(in percent)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Period	M	M	p	Y	Share 1	Share 2	Share 3	Share 4
1500-1600	1.26	1.26	-0.9	-0.03	none	none	none	none
1600-1700	0.66	0.11	0.28	0.53	all	all	all	all
1700-1800	1.26	0.9	-0.17	0.43	75.3	71.5	61.7	58.6
1500-1800	1.06	0.76	-0.27	0.31	64.5	61.3	52.7	50.1

(1): per annum rate of growth of trade, using all entries in Table 1
(2): per annum rate of growth of trade, using the volume entries in Table 1
(3): per annum rate of change of relative prices, from Table 2
(4): per annum rate of growth of European surplus income, from Table 3 (or Appendix Table 2)
(5): share of trade growth explained by income growth, assuming trade growth in (1), and Q/M = 100
(6): share of trade growth explained by income growth, assuming trade growth in (1), and Q/M = 10
(7): share of trade growth explained by income growth, assuming trade growth in (2), and Q/M = 100
(8): share of trade growth explained by income growth, assuming trade growth in (2), and Q/M = 10

Appendix 1
Estimating Relative Price Trends, 1350-1850

In order to calculate trends in the relative prices of spices and other goods imported by Europe from overseas, we collected data on the prices of such goods, and of domestically produced (approximately non-tradable) grains, in Spain (Hamilton 1934, 1936, 1947), the Netherlands (Posthumus 1946) and England (Beveridge 1939). In the case of Spain, traded goods prices were expressed relative to wheat (or an agricultural price index, in the case of Navarre 1351-1500); in the case of the Netherlands, Amsterdam prices (Vol. I) were expressed relative to the price of Frisian winter barley, while prices from other institutions (Vol. II) were expressed relative to the price of wheat; in the case of England, traded goods prices were expressed relative to oats prices.

We ran regressions of all computed relative prices on time and time-squared, over the entire period for which the series was available.[26] We then took the first and last fitted values from these regressions, within each 50-year period (1350-1400, 1400-1450, 1450-1500 and so on), and computed the annual percentage rate of change between those first and last fitted values. The series was included in the table below if there was at least 25 years between the first and last observations, within a given half-century. Thus, a series would be included for the half-century 1400-1450 if, say, the first observation (and hence fitted value) fell in 1420, and the last fell in 1448. The series would not be included if the first observation fell in 1420 and the last fell in 1440.[27]

For each half-century we then calculated the mean percentage rate of change in prices. These half-century growth rates were then cumulated to give 100-year and 300-year growth rates in relative prices, and it is these which are used in the calculations described in Section V of the text.

Full details of the individual price series used are given in Appendix Table 1.

---

[26] In a handful of cases, involving New Castile series spanning two and a half centuries, the quadratic trend was clearly not appropriate and regressions were run for the two subperiods 1500-1650 and 1650-1800. On occasion, as indicated in Appendix Table 1, the end-point for the series within a half-century would be taken as 1701 (say) rather than 1700.

[27] In the case of the English data from Beveridge and the Dutch data from Posthumus Vol. II, fitted values were generated for missing observations. This generated more British and Dutch entries in Appendix Table 1, ensuring that the overall results were not as dominated by the Spanish and Amsterdam prices as would have otherwise been the case.

Appendix Table 1
Trends in the Relative Price of Non-Competing Imports, 1350-1850

Commodity	Start year	End year	Growth rate (% p.a.)
1350-1400			
Cardamom (Navarre)	1358	1400	0.8
Cinnamon (Navarre)	1358	1400	2.41
Cloves (Navarre)	1358	1400	0.02
Ginger (Navarre)	1357	1400	2.11
Pepper (Navarre)	1358	1400	0.45
Average			1.16
1400-1450			
Cardamom (Navarre)	1400	1451	0.73
Cinnamon (Navarre)	1400	1451	-0.41
Cloves (Navarre)	1400	1451	-1.48
Cuminseed (Navarre)	1401	1439	-0.14
Ginger (Navarre)	1400	1451	-1.79
Pepper (Navarre)	1400	1451	-0.42
Average			-0.58
1450-1500			
Pepper (Posthumus vol. 2)	1462	1500	0.46
Ginger (Posthumus vol. 2)	1462	1500	-0.69
Average			-0.11
1500-1550			
Asia			
Cinnamon (Old Castile)	1510	1550	-1.81
Cloves (Old Castile)	1508	1550	-1.87
Ginger1 (Posthumus vol. 2)	1500	1529	1.36
Incense (Old Castile)	1510	1550	-1.35
Pepper (Old Castile)	1518	1550	-1.00
Pepper (Posthumus vol. 2)	1500	1525	0.18
Pepper (Valencia)	1504	1550	-0.59
Asia average			-0.72
Americas			
Sugar (Posthumus vol. 2)	1500	1550	0.44
Americas average			0.44
Total average			-0.58
1550-1600			
Asia			
Cinnamon (Andalusia)	1554	1600	-2.89
Cinnamon (New Castile)	1556	1600	-3.53
Cinnamon (Old Castile)	1550	1600	-1.48
Cloves (Old Castile)	1550	1600	-0.58
Ginger (Posthumus vol. 2)	1550	1600	-1.80
Incense (New Castile)	1560	1600	-1.75
Incense (Old Castile)	1550	1600	-0.40
Pepper (Andalusia)	1555	1600	0.50
Pepper (New Castile)	1556	1600	-1.37
Pepper (Old Castile)	1550	1600	-0.56
Pepper (Posthumus vol. 2)	1550	1600	-1.33
Asia average			-1.38
Americas			
Sugar (Posthumus vol. 2)	1550	1600	0.53
Americas average			0.53
Total average			-1.22

1600-1650			
Asia			
Cinnamon (Andalusia)	1600	1650	1.16
Cinnamon (New Castile)	1600	1649	1.71
Cinnamon (Old Castile)	1600	1649	1.17
Cloves (Amsterdam)	1609	1650	2.10
Cloves (Andalusia)	1600	1650	1.06
Cloves (Old Castile)	1600	1649	1.75
Coriander (Andalusia)	1601	1650	-0.69
Cuminseed (Andalusia)	1601	1650	-0.80
Incense (New Castile)	1600	1650	0.47
Incense (Old Castile)	1600	1650	1.13
Gatimalo indigo (Amsterdam)	1609	1650	0.21
Nutmeg (Amsterdam)	1609	1650	-0.00
Small pepper (Amsterdam)	1609	1650	-0.69
Pepper (Andalusia)	1600	1650	0.12
Pepper (New Castile)	1600	1649	0.71
Pepper (Old Castile)	1600	1650	0.43
Pepper (Posthumus vol. 2)	1600	1650	-1.24
Pepper (Valencia)	1604	1650	-1.55
Asia average			0.39
Americas			
Cochineal (Amsterdam)	1609	1650	-0.43
West Indian hides (Amsterdam)	1624	1650	-0.28
Sugar, Brazilian (Amsterdam)	1609	1650	-0.37
Loaf sugar (Amsterdam)	1609	1650	-1.03
Refined sugar (Amsterdam)	1609	1650	-0.32
Sugar (Posthumus vol. 2)	1625	1650	-0.68
Pernambuco wood (Amsterdam)	1609	1650	-0.15
Yellow wood (Amsterdam)	1626	1650	-0.04
Americas average			-0.41
Total average			0.14
1650-1700			
Asia			
Cinnamon, EIC (Amsterdam)	1650	1701	1.64
Cinnamon (Beveridge)	1661	1700	-0.20
Cinnamon (New Castile)	1651	1700	0.45
Cloves (Amsterdam)	1650	1701	0.51
Cloves (Beveridge)	1661	1700	0.12
Preserved ginger (Amsterdam)	1654	1701	1.43
Ginger (Beveridge)	1661	1700	0.30
Incense (New Castile)	1650	1700	0.63
Gatimalo indigo (Amsterdam)	1650	1701	0.22
Mace (Beveridge)	1661	1700	1.88
Nutmeg (Amsterdam)	1650	1701	0.68
Nutmeg (Beveridge)	1661	1700	2.45
Small pepper (Amsterdam)	1650	1682	-0.57
Pepper (Beveridge)	1661	1700	3.55
Pepper (New Castile)	1651	1700	0.32
Pepper (Posthumus vol. 2)	1650	1700	0.09
Rice (Beveridge)	1661	1700	0.21
Saltpetre (Amsterdam)	1665	1701	0.30
Asia average			0.78

Americas			
Cochineal (Amsterdam)	1650	1701	-0.48
Sugar, Brazilian (Amsterdam)	1650	1701	-0.4
Loaf sugar (Amsterdam)	1650	1701	-0.88
Refined sugar (Amsterdam)	1650	1701	-0.35
Sugar (Beveridge)	1661	1700	-0.12
Sugar (Posthumus vol. 2)	1650	1700	-0.4
Varinas tobacco (Amsterdam)	1674	1701	0.10
Virginia tobacco (Amsterdam)	1674	1701	0.14
Pernambuco wood (Amsterdam)	1650	1692	-0.10
Sappan wood (Amsterdam)	1650	1701	0.28
Yellow wood (Amsterdam)	1650	1692	0.09
Americas average			-0.19
Total average			0.41
1700-1750			
Asia			
Cinnamon, EIC (Amsterdam)	1701	1750	0.53
Cinnamon (Beveridge)	1700	1750	0.38
Cinnamon (New Castile)	1700	1750	-0.07
Cloves (Amsterdam)	1701	1750	-0.24
Cloves (Beveridge)	1700	1750	-0.26
Preserved ginger (Amsterdam)	1701	1750	0.33
Ginger (Beveridge)	1700	1750	-0.16
Incense (New Castile)	1700	1742	-0.53
Gatimalo indigo (Amsterdam)	1701	1750	0.23
Mace (Amsterdam)	1701	1750	-0.46
Mace (Beveridge)	1700	1750	-0.04
Tonkin musk (Amsterdam)	1701	1748	-0.50
Nutmeg (Amsterdam)	1701	1750	0.95
Nutmeg (Beveridge)	1700	1750	0.01
Opium (Amsterdam)	1703	1750	-0.21
Black pepper (Amsterdam)	1701	1750	0.19
White pepper (Amsterdam)	1701	1750	-0.23
Pepper (Beveridge)	1700	1750	0.27
Pepper (New Castile)	1700	1750	-0.19
Pepper (Posthumus vol. 2)	1703	1747	0.46
Rice (Beveridge)	1700	1750	-0.48
Saltpetre (Amsterdam)	1701	1750	-0.05
East Indian tin (Amsterdam)	1722	1750	-1.07
Asia average			-0.05
Americas			
Cochineal (Amsterdam)	1701	1750	-0.57
Cocoa, Caracas (Amsterdam)	1701	1750	-0.21
Hides, Brazilian (Amsterdam)	1701	1750	0.07
Sugar, Brazilian (Amsterdam)	1701	1750	-0.45
Loaf sugar (Amsterdam)	1701	1750	-0.14
Refined sugar (Amsterdam)	1701	1750	-0.38
Surinam sugar (Amsterdam)	1701	1750	0.30
Sugar (Beveridge)	1700	1750	-0.37
Sugar (Posthumus vol. 2)	1700	1750	0.16
Havana tobacco (Amsterdam)	1722	1750	1.89
Varinas tobacco (Amsterdam)	1701	1750	-0.22
Virginia tobacco (Amsterdam)	1701	1750	-0.06
Caliatour wood (Amsterdam)	1701	1750	0.09
Pernambuco wood (Amsterdam)	1703	1750	-0.03
Sappan wood of Siam (Amsterdam)	1705	1750	1.04
Yellow wood (Amsterdam)	1703	1750	0.28
Americas average			0.09
Total average			0.01

1750-1800			
Asia			
Cinnamon, EIC (Amsterdam)	1750	1800	0.08
Cinnamon (Beveridge)	1750	1781	0.73
Cinnamon (New Castile)	1750	1795	-0.62
Cloves (Amsterdam)	1750	1800	-1.41
Cloves (Beveridge)	1750	1781	-0.71
Java coffee (Amsterdam)	1750	1799	-0.58
Mocha coffee (Amsterdam)	1750	1799	-0.83
Preserved ginger (Amsterdam)	1750	1793	-0.26
White ginger (Amsterdam)	1750	1800	-0.51
Ginger (Beveridge)	1750	1781	-0.65
Gatimalo indigo (Amsterdam)	1750	1800	0.24
Java indigo (Amsterdam)	1750	1800	-0.13
Mace (Amsterdam)	1750	1794	1.37
Mace (Beveridge)	1750	1781	-1.65
Tonkin musk (Amsterdam)	1753	1800	0.59
Nutmeg (Amsterdam)	1750	1800	0.91
Nutmeg (Beveridge)	1750	1781	-1.83
Opium (Amsterdam)	1750	1800	0.02
Black pepper (Amsterdam)	1750	1800	-0.51
White pepper (Amsterdam)	1750	1800	-0.66
Pepper (Beveridge)	1750	1781	-1.23
Pepper (New Castile)	1750	1799	-0.90
Pepper (Posthumus vol. 2)	1772	1800	0.99
Rice (Beveridge)	1750	1781	-1.61
Saltpetre (Amsterdam)	1750	1793	-0.46
Buoy tea (Amsterdam)	1750	1800	-1.60
Pecco tea (Amsterdam)	1758	1800	-0.11
Souchon tea (Amsterdam)	1758	1800	-1.53
East Indian tin (Amsterdam)	1750	1795	-0.93
East Indian tin (Amsterdam)	1795	1835	-0.32
Java yarns 'A' (Amsterdam)	1750	1797	-0.91
Asia average			-0.49
Americas			
Cochineal (Amsterdam)	1750	1800	-0.69
Cocoa, Caracas (Amsterdam)	1750	1800	-0.47
Surinam cocoa (Amsterdam)	1750	1800	-0.28
Surinam coffee (Amsterdam)	1750	1800	-0.11
San Domingo coffee (Amsterdam)	1757	1800	1.39
Surinam cotton (Amsterdam)	1752	1801	-0.28
Hides, Buenos Aires (Amsterdam)	1766	1800	0.08
Sugar, Brazilian (Amsterdam)	1750	1800	-0.50
Loaf sugar (Amsterdam)	1750	1800	0.75
Refined sugar (Amsterdam)	1750	1800	-0.42
San Domingo sugar (Amsterdam)	1751	1799	0.86
Surinam sugar (Amsterdam)	1750	1800	-0.24
Sugar (Beveridge)	1750	1781	-0.70
Sugar (Posthumus vol. 2)	1750	1800	0.61
Havana tobacco (Amsterdam)	1750	1782	0.76
Varinas tobacco (Amsterdam)	1750	1800	-0.83
Virginia tobacco (Amsterdam)	1750	1800	-0.35
Caliatour wood (Amsterdam)	1750	1796	-2.09
Pernambuco wood (Amsterdam)	1750	1801	0.05
Sappan wood of Siam (Amsterdam)	1750	1797	-0.77
Yellow wood (Amsterdam)	1750	1800	0.39
Americas average			-0.14
Total average			-0.34

1800-1850			
Asia			
Cinnamon, EIC (Amsterdam)	1800	1841	-0.27
Preserved ginger (Amsterdam)	1805	1851	-1.56
White ginger (Amsterdam)	1800	1847	-3.01
Black pepper (Amsterdam)	1800	1850	-2.39
White pepper (Amsterdam)	1800	1850	-1.93
Saltpetre (Amsterdam)	1818	1847	-1.76
Buoy tea (Amsterdam)	1800	1850	-0.03
Pecco tea (Amsterdam)	1800	1843	-0.21
Souchon tea (Amsterdam)	1800	1850	-1.24
Asia average			-1.38
Americas			
Cocoa, Caracas (Amsterdam)	1800	1843	-0.92
Surinam cocoa (Amsterdam)	1800	1843	-1.22
San Domingo coffee (Amsterdam)	1800	1850	-2.00
Surinam cotton (Amsterdam)	1801	1850	-2.66
Hides, Buenos Aires (Amsterdam)	1800	1847	0.35
Sugar, Brazilian (Amsterdam)	1800	1848	-0.58
Refined sugar (Amsterdam)	1800	1851	-0.47
Surinam sugar (Amsterdam)	1800	1850	-1.06
Varinas tobacco (Amsterdam)	1800	1843	-2.94
Virginia tobacco (Amsterdam)	1800	1848	-0.83
Pernambuco wood (Amsterdam)	1801	1835	0.10
Yellow wood (Amsterdam)	1800	1835	0.44
Americas average			-0.98
Total average			-1.15

Appendix 2
Estimating the Growth of European "Surplus" Income 1500-1850

National Accounting Assumptions

GDP = whP + rA + E, where w = wage per worker (w per L), r = rent per acre (r per A), h = the labor participation rate (L over population, P) and E = residual income accruing to military, church, bureaucracy, merchants, traders and so on. Define the surplus as S = rA + E, the income accruing to landlords and residual claimants. Assume that land is fixed, so A* = 0. Assume also that the labor participation rate is constant, so h* = 0. Assume finally that the residual claimants' share of the surplus is E/S = 0.3 and that, therefore, the landed share of the surplus is rA/S = 0.7. This estimate is motivated by the work of Lindert and Williamson (1982: Table 2, p. 393) who document the revised Gregory King social tables figure for 1688 to be rA/S = 0.698, and the revised Joseph Massie social tables figure for 1759 to be rA /S = 0.695 (Table 3, pp. 396-7.)

Estimating European Demand Growth

We assume that it was the size of the European surplus (S = rA + E) that determined its demand for "exotic" commodities. While we can observe rA, we cannot observe E or its growth, E*, prior to the 19th century, the critical period for any test of the demand-led post-1492 trade boom thesis. Thus, the A , B and C estimates in Appendix Table 2 correspond to three assumptions which, in turn, offer a range of plausibility to the S* estimate:

A: Assume E grows like rents (rA), implying S* = r*. This characterizes the residual class as parasitic on landlords (whom they protect, entertain, educate, fight for, sell to, buy from and so on);

B: Assume E grows like the economy-wide wage bill (wL), implying S* = 0.7r* + 0.3[w* + L*]. This characterizes the residual class as parasitic on the working class and peasants. Alternatively, this characterizes the residual class as having a fixed premium above the incomes of peasants and workers, and that their numbers are in constant proportion to the working class and peasant numbers (whom they police, bury, preach at, educate, oversee in the workhouses, lead to battle, sell to, buy from and so on).

C: Assume E grows like the urban wage bill (wLu*), implying S* = 0.7r* + 0.3[w* + Lu*].

This characterizes the residual class as having a fixed premium above the incomes of the urban working class, and that their numbers are in constant proportion to the urban working class. Note also that it assumes a constant wage gap between city and farm. We tend to favor this assumption which argues that urban growth is the engine driving imports and exports in the more advanced parts of Europe.

Appendix Table 2
Three Estimates of the Growth in England's Surplus 1500-1850
(in percent per annum)

Period	Three Estimates of S*: A	B	C	L*	r*	w*	Lu*
1500-1550	-0.12	- 0.11	0.02	0.60	-0.12	-0.68	1.02
1550-1600	-0.14	-0.24	-0.08	0.58	-0.14	-0.90	0.97
1600-1650	0.84	0.77	0.87	0.49	0.84	0.13	0.82
1650-1700	0.20	0.18	0.20	-0.06	0.20	0.20	0.01
1700-1750	0.16	0.18	0.31	0.26	0.16	-0.04	0.70
1750-1800	0.32	0.40	0.55	0.80	0.32	-0.20	1.30
1500-1800	0.21	0.19	0.31				
1800-1850	1.13	1.49	1.90	1.65	1.13	0.67	3.02

______

Notes and Sources: The figures for r*, w* and S* are deflated. The nominal wages and nominal farm land rents for 1565-1850 are from O'Rourke and Williamson (2000a). The nominal rents for 1495-1565 from Clark (1999: Table 6, p. 25). The deflator is the cost of living of farm labor (Clark n.d: Table 11, pp. 43-44). The labor force (L) estimates are also taken from O'Rourke and Williamson (2000a), and Lu is derived by applying the share of the population urban (u) to L. The u estimates are constructed from Bairoch (1988: pp. 177, 179, 215-16, 221) and Hohenberg and Lees (1985: p. 84).

Growth in Real Rents for Europe's Leaders 1500-1800

Did the surplus in the rest of Europe's center grow like that of England? Apparently, based on the per annum growth rates of rent estimates from France and Holland that follow:

Period	England	France	Holland	Center
1500-1800	+0.21	+0.36	+0.21	+0.28

The English data are from Appendix Table 2. The French data are from Hoffman (1996: Table 4.2, pp. 90-1) and the Dutch estimates are from background data to van Zanden (1998: Graph 2, p. 74). Both France and Holland to 1780 only. The "Center" is an end period weighted average of the three, using 1820 GDP weights (Maddison 1995: pp. 180-3).

Figure 1. Spice and coffee markups: Amsterdam vs. Southeast Asia 1580-1939

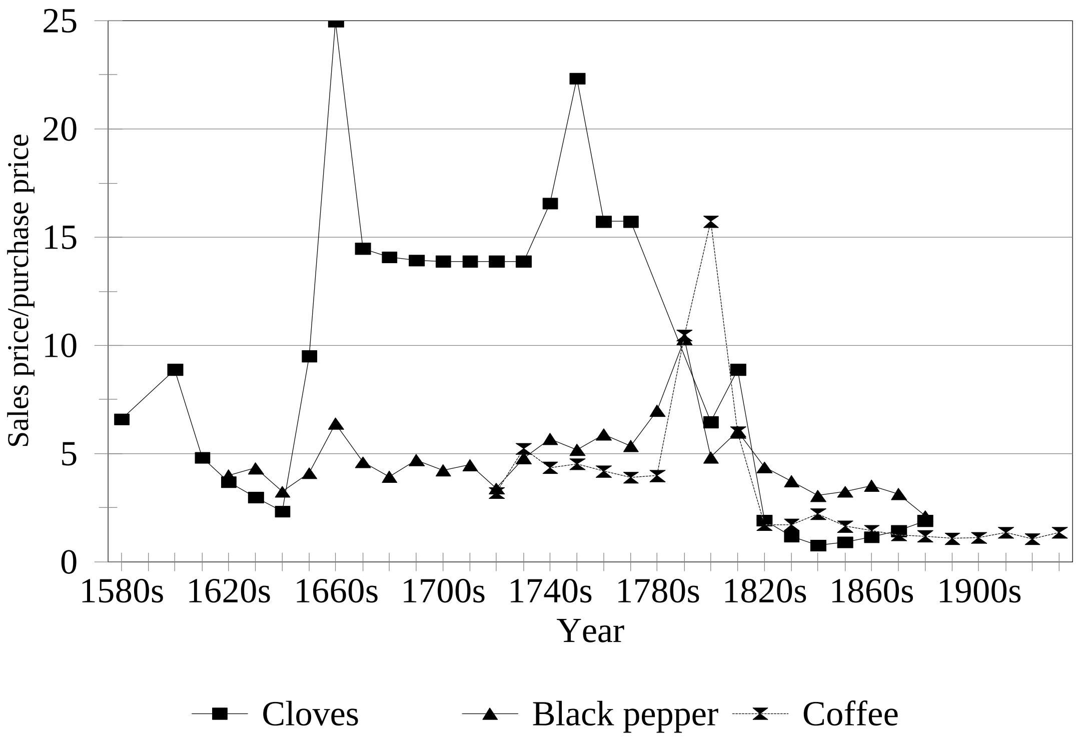
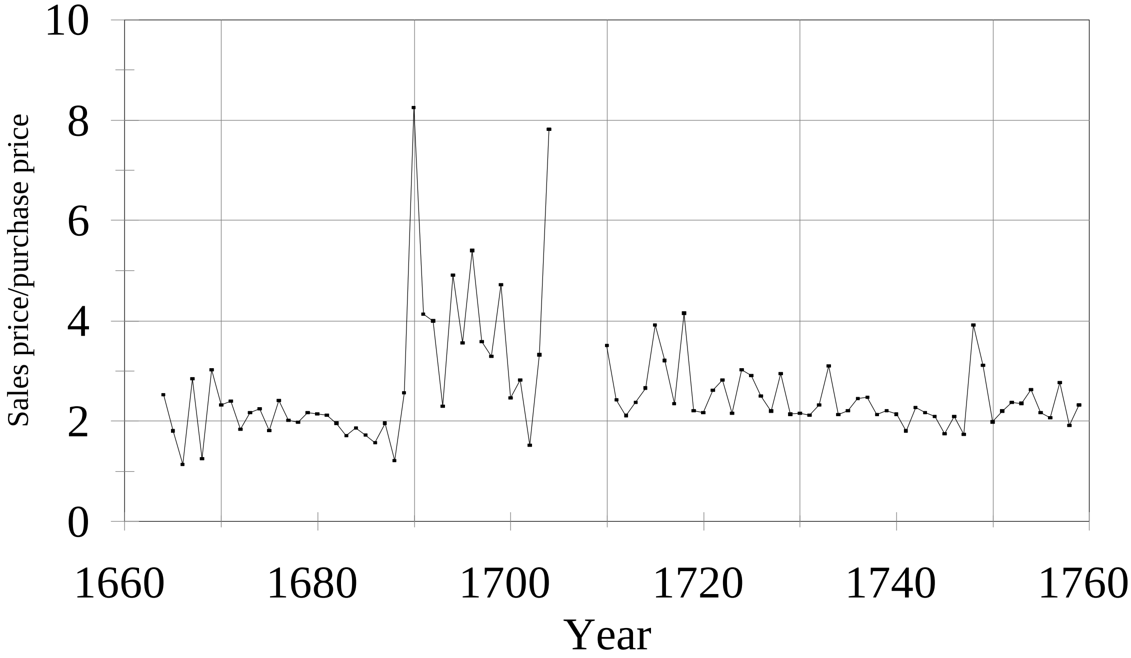


Figure 2. Asian textile trade markups

1664-1759



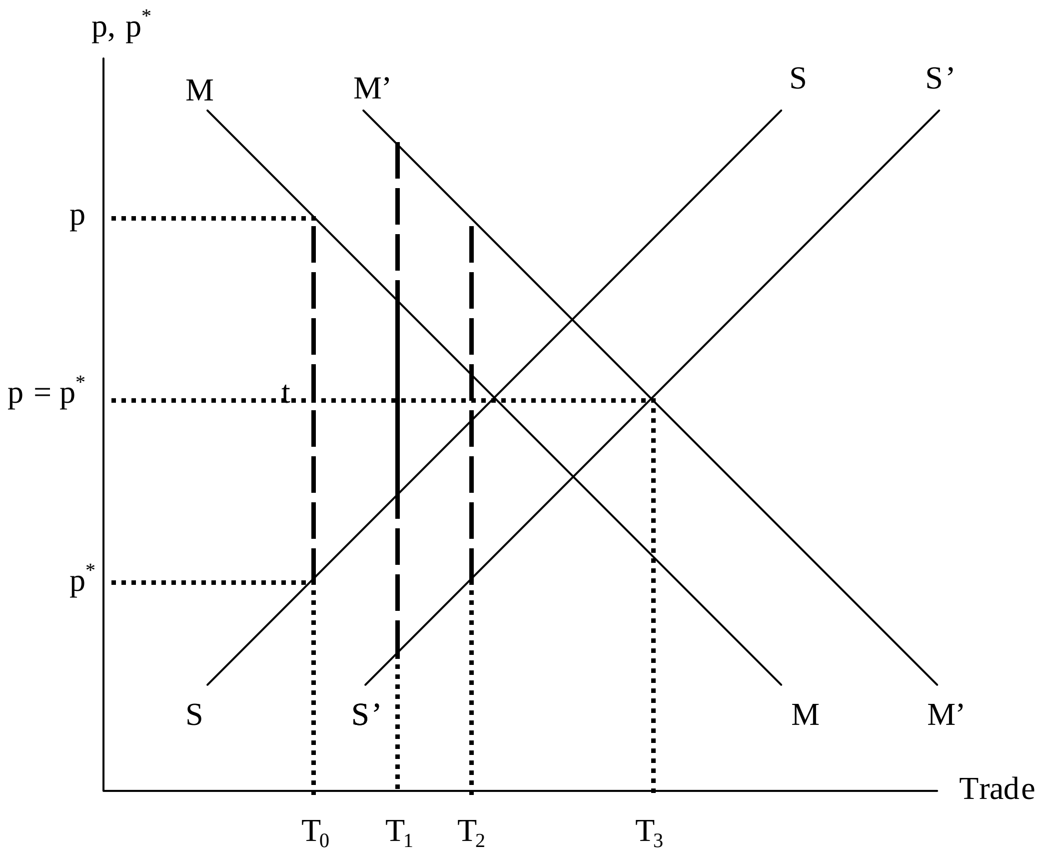


Figure 3. Explaining the world trade boom