Globalization and the Great Divergence: Was Indian Deindustrialization after 1750 Different?

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Abstract

India was a major player in the world export market for textiles in the early 18th century, but by the middle of the 19th century it had lost all of its export market and much of its domestic market, primarily to Britain. The ensuing deindustrialization was greatest between c1750 and c1860. How much of India's deindustrialization was due to local supply-side forces -- such as political fragmentation and a rising incidence of drought, and how much to world price shocks generated by industrial revolutions in Britain and the rest of Europe? The question is especially interesting since the rest of the poor periphery also had to face a flood of European manufactures manifested by a fall in the relative price of manufactures and a rise in their terms of trade. An open, three-sector neo-Ricardian model organizes thinking and a new relative commodity and factor price database implements the empirical analysis. The size of Indian deindustrialization is then assessed by comparison with other parts of the periphery: negative local supply-side forces mattered much more in India than elsewhere.

1. A Deindustrialization Paradox?

The idea that India suffered deindustrialization during the 19th century has a long pedigree. The image of skilled weavers thrown back on the soil was a powerful metaphor for the economic stagnation Indian nationalists believed was brought about by British rule. Furthermore, the literature attributes most of India's deindustrialization to Britain's productivity gains in textile and metal manufacture and to the world transport revolution. Improved British productivity, first in cottage production and then in factory goods, led to declining world textile and metal product prices, making their production in India increasingly uneconomic (Roy 2002). These forces were reinforced by declining sea freight rates, which served to foster trade and specialization for both Britain and India. As a result, Britain first won over India's export market and eventually took over much of its domestic market as well. This conventional thesis is reinforced by an additional globalization force adding to India's deindustrialization: relative to textiles and other manufactures, India's commodity export sector saw its terms of trade improve significantly in the 18th century and it drew workers away from manufacturing.

If globalization was the root cause of deindustrialization in India, we should see a secular boom in India's net barter terms of trade (P_X/P_M) before 1860. That is, productivity events in British industry, and the subsequent invasion of British manufactures in both India and third markets everywhere, should have driven down India's prices of its imports (P_M) and of its manufactures. The rising demand for primary goods in British markets – to satisfy the demand for intermediate inputs generated by a booming manufacturing there as well as for food generated by rising incomes there – should have also served to raise the price of India's commodity export prices (P_X).

Why, then, do we *not* see a big terms of trade boom for India, while we *do* see it everywhere else in the poor periphery? Figure 1 compares the terms of trade for India 1800-1913 with population-weighted series for other regions of the poor periphery, consisting of Latin

America, the Middle East, and Southeast Asia.[1] India underwent a significant improvement in its terms of trade from 1800 to the mid-1820s, followed by a collapse through the early 1830s. India's terms of trade rose and collapsed again between 1850 and 1865. After that, India's terms of trade maintained an average level of about 115 (1800=100). Between 1800 and 1870, then, India's terms of trade rose only 15 percent, or about 0.2 percent per annum. The experience of other regions around the poor periphery was much more dramatic. The Middle Eastern terms of trade rose by 270 percent between 1800 and 1870, or 3.9 percent per annum; the Southeast Asian terms of trade increased by 231 percent, or 3.3 percent per annum; and the Latin American terms of trade increased by 247 percent, or 3.5 percent per annum.[2]

In addition, India underwent at least as great, and perhaps even greater, deindustrialization than did the rest of the poor periphery. Section 3 will offer additional evidence on India's 19th century deindustrialization experience, but Table 1 reports some comparative evidence. The table estimates the share of the domestic textile market claimed by net foreign imports (negative figures imply a net export position, as for India 1800) for three regions around the poor periphery and at various points in time after the early 1800s. We use textiles to illustrate import penetration and deindustrialization since it is better documented and since it was such a big share of manufacturing activity. In 1800, India's net exports were 6-7 percent of the domestic textile market. By 1833, India had become a net importer, amounting to 5 percent of the domestic market. By 1877, the foreign import share of the domestic textile market had risen to between 58 and 65 percent. Over three-quarters of a century, the foreign import share of the domestic market rose, and the domestic producers' share fell by the huge factor of 64 to 72 percentage points (an average of 68 percentage points). The figure for the Ottoman Empire was similar, 59 to 86

[1] These series come from Williamson (2008) where their construction is described at length.
[2] Terms of trade increases up to the 1860s were also much bigger for the European periphery. In addition, after the 1840s their increase was much bigger for Japan and the Mideast (Williamson 2006a, 2006b, 2008). Like India, the terms of trade boom was modest for Mexico 1750-1870. Since Dutch disease forces were weaker, Mexico was better able to minimize deindustrialization effects (Dobado, Gómez Galvarriato, and Williamson 2008).

percentage points (an average of 73 percentage points). In contrast, Mexico did far better fending off foreign competition, since the figure was only 15 percentage points. So much for 19th century comparative deindustrialization rates. What about the 18th century? Here, India's deindustrialization was clearly more dramatic than that of the rest of the periphery. Based on Paul Bairoch's (1982) estimates, Table 4 reports that between 1750 and 1800 India's world manufacturing output share dropped by 4.8 percentage points, from a 1750 base of 24.5 percent, *much* bigger than the fall elsewhere around the periphery since China gained 0.5 percentage points, and the rest of the periphery only lost 1 percentage point. Bairoch's data suggest that during the half century before 1800, well before European factories flooded world markets with manufactures, India suffered much more pronounced deindustrialization than did the rest of the periphery.

How do we resolve this Indian paradox of relatively dramatic deindustrialization with relatively modest terms of trade improvements? This paper argues that the paradox can only be resolved by focusing on the domestic supply side, conditions that were unique to India and which played a far more important role in accounting for deindustrialization there than elsewhere. While the Indian historical literature does occasionally note a possible role for supply side forces, the connection has never been pursued extensively. This paper argues that the economic woes India suffered following the dissolution of Mughal hegemony in the 18th century ultimately led to aggregate supply-side problems for Indian manufacturing, even if some producers in some regions benefited from the new order. In addition, India suffered a profound secular deterioration in climate conditions in the century or so following the early 1700s, events which appear to have added greatly to the slump in agricultural productivity, to the rise in grain prices, to an increase in nominal wages, and thus (as we shall see) to deindustrialization. The paper argues that these explanations are complementary, not competitive.

Before proceeding to the evidence, let us first agree on a precise definition of deindustrialization and elaborate on its likely causes. Suppose an economy produces two

commodities: agricultural goods, which are exported, and manufactured goods, which are imported. Suppose it uses three factors of production: labor, which is mobile between the two sectors; land, which is used only in agriculture; and capital, which is used only in manufacturing. Suppose further that this economy is what trade economists call a "small country" that takes its terms of trade as given, dictated by world markets. With these assumptions, deindustrialization can be defined as the movement of labor out of manufacturing and into agriculture, either measured in absolute numbers (hereafter called *absolute labor force deindustrialization*), or as a share of total employment (hereafter called *labor force share deindustrialization*).

While deindustrialization is easy enough to define, an assessment of its short and long run impact on living standards and GDP growth is more contentious and hinges on the root causes of deindustrialization. One possibility is that a country deindustrializes because its comparative advantage in the agricultural export sector has been strengthened by productivity advance on the land or by increasing openness in the world economy, or both. Under those conditions, GDP increases in the short-run. If productivity advance on the land is the cause, nothing happens to the terms of trade unless the small country assumption is violated. If increased openness is the cause, the country enjoys an unambiguous terms of trade improvement as declining world trade barriers raise export prices and lower import prices in the home market. Whether real wages also increase depends on the direction of the terms of trade change and whether the agricultural good dominates workers' budgets. Whether GDP increases in the long run depends on whether industry generates accumulation and productivity externalities that agriculture does not. If industrialization is a carrier of growth—as most growth theories imply—then deindustrialization could lead to a growth slowdown and a low-income equilibrium. The possibility that deindustrialization induced by increased openness in the world economy could engender slower growth over the long run provides one potential explanation of the Great Divergence in income between countries that characterized the 19th and first half of the 20th centuries (Maddison 2001; Blattman et al. 2007;

Williamson 2008), and accounts for the much of the power that deindustrialization has had in both the politics and the historiography of the countries affected by it.

A second possibility is that a country deindustrializes due to deterioration in home manufacturing productivity and/or competitiveness. In this case, and still retaining the small country assumption, nothing happens to the terms of trade, but real wages and living standards deteriorate, and so does GDP. The economic impact of deindustrialization from this source is unambiguous, and also a potential explanation for India's role in the Great Divergence.

In order to make this simple framework flexible enough to handle the causes of deindustrialization that were likely to have been most important for India, a non-tradable grain sector needs to be added. The three sectors considered in the rest of the paper are: agricultural commodity exports, which are tradable on world markets and include industrial intermediates (such as raw cotton and jute) and high-value consumer goods (such as opium and tea); manufacturing, which is dominated by textiles and metal products and is also tradable; and grains, which are non-tradable and include rice, wheat and other food staples.[3]

Section 2 explores the three (non-competing) hypotheses about the causes of India's deindustrialization experience. Section 3 reviews existing attempts to measure India's deindustrialization. Section 4 develops a simple, neo-Ricardian, general equilibrium model of deindustrialization in order to formalize predictions about relative prices and their relationship to employment measures of deindustrialization. Section 5 presents three new price series – commodity agricultural exports, manufactured textiles and non-tradable grains, three wage series – the grain wage, the own-wage in the import competing sector, and the own-wage in the export sector, the intersectoral terms of trade between export agricultural commodities and textiles, and the external terms of trade. This new evidence is then assessed in relation to the three hypotheses.

[3] Grains became tradable commodities throughout Asia in the late 19th century, but for the 18th and early 19th century, it is more accurate to treat them as non-tradables.

India's relative price experience is also compared with its primary competitor, England. Section 6 concludes.

2. India's Deindustrialization: Three Hypotheses and One Offset

Any account of India's deindustrialization must embrace three contending hypotheses. First, there is the impact of globalization and industrial productivity advance in Europe. Second, there are the political changes which might have impacted costs and productivity in Indian industry. The dissolution of the Mughal empire into a constellation of small successor states was followed, after a time, by the initial phase of reintegration of these states under the East India Company. Historians have long thought that India underwent an overall economic decline during the transition between hegemonies. This proposition has recently become controversial, but this paper stakes out a position in favor of it. It argues that the political fragmentation of the 18th century engendered a rise in grain prices that was reinforced by a second negative supply-side force, a devastating climatic shift which generated a steep upward trend in drought frequency.[4] This section starts with the Mughal collapse hypothesis, and then turns to the deteriorating climate hypothesis.

The Mughal Collapse Hypothesis

The dissolution of Mughal hegemony could have affected manufacturing through several channels. It could have reduced agricultural productivity through an increased rent burden, shifting of settlement owing to insecurity, and warfare. Reduced agricultural productivity would be reflected in an increase of the price of grain, the key non-tradable, and therefore in the relative

[4] Some have argued that deteriorating weather conditions helped precipitate the collapse of the Mughal Empire (Grove and Chappell 2000: 15), but the alleged connection is not central to the issues raised here.

price of non-tradeables to tradables (such as textiles).[5] To the extent that grain was the dominant consumption good for workers and that the grain wage was close to subsistence, this negative productivity shock should have put upward pressure on the nominal wage. Indeed, East India Company officials in Surat were already complaining in the 1720s that rising foodgrain and raw cotton prices were putting upward pressure on the prime cost of textiles they were sending to England (Chaudhuri 1978: 299-300). Wages started from a low nominal but high real base in the mid-18th century (Parthasarathi 1998; Allen 2005; Prakash 2004: 268, 383). Competitiveness in textile manufacturing was, of course, negatively related to the own real wage, the nominal wage divided by the price of textiles. Declining textile prices and rising nominal wages put downward pressure on 'profits' from both below and above. An increase in the own wage in textiles would have hurt the competitive edge India had in export markets, such as the booming Atlantic economy.[6] A decline in 18th century agricultural productivity in India would suggest that even before factory-driven technologies appeared after 1780, Britain was already beginning to break India's powerful grip on the world export market for textiles.[7]

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[5] India is assumed to have been a price taker for textiles and other manufactures. Given this assumption, domestic demand did not matter in determining the performance of Indian industry. Only price and competitiveness on the supply side mattered. Thus, this paper ignores as irrelevant any argument which appeals to a rise in the demand for cloth as per capita income rose (Harnetty 1991: 455, 506; Morris 1983: 669).

[6] English merchants and English ships were the main suppliers to the Atlantic trade, a lot of it the so-called re-export trade. While the share of Indian textiles in the West African trade was about 38 percent in the 1730s, it had fallen to 22 percent in the 1780s and 3 percent in the 1840s (Inikori 2002: 512-3 and 516). By the end of the 17th century, Indian calicos were a major force in European markets (Landes 1998: 154). For example, the share of Indian textiles in total English trade with southern Europe was more than 20 percent in the 1720s, but this share fell to about 6 percent in the 1780s and less than 4 percent in the 1840s (Inikori 2002: 517). India was losing its world market share in textiles during the 18th century, long before the industrial revolution.

[7] To make matters worse, India, which had captured a good share of the English market in the 17th century, had -- as an English defensive response -- already been legislated out of that market by Parliamentary decree between 1701 and 1722 (Inikori 2002: 431-2), thus protecting local textile producers. But Parliament kept the Atlantic economy as a competitive free trade zone. Of course, the large Indian Ocean market was also a free trade zone, and India had dominated this for centuries (Chaudhuri 1978; Landes 1998: 154). It should be stressed that India also had a technological edge over England in the early 18th century (Prakash 2004: 268-9). Before the machines of Hargraves, Arkwright and Crompton, Indian spinners were the only ones capable of producing yarn strong enough for the warp, and thus could produce pure cotton cloth. European spinners could not do this, and thus could only produce a mixed cotton-linen cloth.

This is not the first work to exploit the connection between labor productivity in pre-industrial agriculture, nominal wages in industry, and the resulting competitiveness in world markets for manufactures. Alexander Gerschenkron (1962), W. Arthur Lewis (1978: chp. 2) and even Adam Smith all used the argument to good effect in explaining why low productivity in agriculture helps explain the absence or delay of industrial revolutions. More recently, Prasannan Parthasarathi (1998) has argued that while low nominal wages in pre-colonial and early colonial India gave it the edge in world textile markets, living standards for labor in the south of India were just as high as that in the south of England. Indian productivity in food grain production was higher, and thus food grain prices were lower.

The evidence for an overall 18th century economic decline begins with unskilled wages in grain units, which are a good measure of the overall level of economic activity in a largely agricultural economy. Figure 2 presents three grain-wage series, two for North India and one for South India (Mukerjee 1939; Broadberry and Gupta 2005). The figure documents a long-run decline in grain wages beginning in the last decades of the 17th century and continuing until early in the century. The wage data in 17th and 18th century India are particularly thin and must be treated with caution. Nevertheless, they provide one of the few indicators of the condition of ordinary people across time.

Historians traditionally viewed India's 18th century as a dark era of warfare, political chaos, and economic decline sandwiched between the stable and prosperous Mughal and British hegemonies. This view has been vigorously challenged by the most recent generation of Indian historians, who have emphasized the continuities between the earlier Mughal and later British states and the constellation of small successor states that emerged with the ebbing of Mughal power (e.g. Alam 1986; Bayly 1983; Marshall 1987). The largest of these successor states were the former Mughal provinces of Bengal, Awadh, Benaras, and Hyderabad. There were many smaller ones as well. Their rulers were former provincial governors, Mughal officials, and other men powerful enough to assert *de facto* sovereignty. They collected the land revenue, sometimes

using a modification of the old Mughal system, but submitted less and less of it to Delhi in favor of building up their own armies and courts.

While it has been widely accepted that the successor states provided a greater degree of political continuity and stability than was previously thought, no consensus has been reached about the implications of this fact for the Indian economy. Peter Marshall (2003) brings together contributions from the contending scholars and provides a useful overview. Where the 18th century economy is concerned, some see the literature on the successor states as a useful corrective but believe the overall picture is one of decline. Others believe the traditional view to be fully overturned and view the 18th century as a period of continued growth, despite the ebbing of Mughal hegemony. Two key differences between these views concern, first, the implications of the new political order for the principal towns and middle classes of the successor states, and second, the degree of centralization and stability provided by the Mughal regime before its collapse, and thus the relative effect of the subsequent decentralization of power.

This paper favors the position that aggregate economic output declined following the dissolution of a strong empire into contending states. The more optimistic narrative tends to place too much emphasis on the prosperity of a few areas and groups, such as the towns of the successor states and their middle classes, and too little emphasis on the evidence for decline in the rural areas and peripheries of these states. Even in an era of aggregate economic decline, local booms could result from the diversion of land revenues from Delhi to the big towns of the successor states, where the new rulers and their revenue farmers lived. Moreover, agriculture overwhelmingly dominated the 18th century Indian economy,[8] so it is the economic performance of that sector which largely dictated the course of the overall economy, not what happened in the towns.[9] The optimistic narrative also seems to discount the strength of the Mughal empire and the

[8] Agriculture employed 68 percent of the Indian labor force even as late as 1901 (Roy 2002: 113).
[9] Since grain is taken to have been non-tradable internationally, any secular tendency for domestic demand to outpace domestic supply would have raised grain prices. An exogenous acceleration of population growth would have lowered labor productivity on the land, reduced food supply relative to demand, and

economically favorable stability it brought. The Mughal state shows evidence of having achieved a high level of centralization and control of revenue sources. Revenue realization per cultivated acre was as high in remote provinces as in the center. Examination of the careers of Mughal revenue officials shows that provincial postings were of virtually the same duration (about two and a half years) all over the empire, suggesting that remote provinces were well integrated into the imperial machinery (Habib 2003). A regime powerful enough to extract 40 percent of the economic surplus from distant provinces must have also insured peace and security, which were in turn favorable for agricultural investment and productivity.

A number of features of the transition of political authority from the Mughal empire to the successor states provide further evidence supporting an overall economic decline, one that resulted from reduced agricultural productivity. As central Mughal authority waned, the state resorted increasingly to revenue farming, and the practice became even more widespread in the successor states. This served to raise the effective rent share to 50 percent or more, far greater than the maximum said to have been extracted by the Mughal state (Raychaudhuri 1983: 17; Bayly 1983: 10). "With revenue assessment geared to 50 per cent or more, in contrast to China's 5 to 6 per cent, the Indian peasant had little incentive to invest labour or capital" (Raychaudhuri 1983: 17). The economics is familiar to development economists, economic historians, and observers of modern agrarian backwardness: The lower the share of output received by the peasant, the less incentive he has to carefully monitor the crop, to invest in the land, and to remain in place rather than fleeing. Scattered evidence suggests that the rent burden may have been quite extreme in some locations (Bayly 1983: 42). North of Delhi in Rohilla, cultivators were stripped of their land rights entirely and reduced to direct dependence. Under the *savak* system in north Awadh, cultivators received as little as one sixth of the produce and their wives and children were required for *corvée* for a large part of the year. The Sayyids of Moradabad

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thus raised the price of food. However, population grew at only 0.26 percent per annum between 1700 and 1820, and this was only a trivial increase over what preceded it (Moosvi 2000: 322). Thus, other forces are needed have to explain any observed rise in the relative price of grains.

employed the *batai* system in which they "appropriated all 'save a bare subsistence' from the cultivators and invaded the villages for several months a year with bullock teams, armed retainers, and weighmen to secure the best portion of the crop." Productivity must have suffered as a result of the increased rent burden, and Tapan Raychauduri claims that grain prices "increased by 30 percent or more in the 1740s and 1750s" as a result (Raychaudhuri 1983: 6). There is no reason to believe that the revenue burden declined when the British became rulers of the successor states. Indeed, when British revenue officials saw slack in the existing system, they often increased the revenue burden.

Rulers of the successor states also engaged in territorial disputes, and it is possible that the increased rent burden reflected added military expenses. These wars drew key resources out of agriculture and led to the destruction of capital (Bayly 1983: 70). Areas at the edges of successor states were particularly prone to agricultural decline, perhaps because these were most affected by territorial disputes, both between states and between local strongmen, who in remote areas were relatively free to plunder their neighbors. This led to population shifts as cultivators retreated to more secure areas. Bayly describes large areas of agricultural decline, particularly in the northwest (1983: 76) where

> "warfare withdrew both men and animals from agriculture ... Recruitment into armies, the consolidation of population into defensive centers, and general migration ... contributed to a patchy and local decline in cultivated area. Draught animals determined the extent of cultivation even more than human labor, and there is scattered evidence of a great dearth of animal power in north central India" (Bayly 1983: 70-1).

A dearth of animal power would certainly have led to less efficient cultivation techniques and increased grain prices. Cultivators who relied on the bullocks owned by others would have been particularly vulnerable to fluctuations in their availability due to warfare. To cite one example, when Ahmed Shah Durrani invaded India from the northwest in 1759, bullock hire rates between Benares and Patna, a route nearly 600 km from the furthest extent of the fighting, increased by

500 percent (Bayly 1983: 68). Since most long distance transport was by bullock, the scarcity of bullock power resulting from warfare would have increased transport costs. Political fragmentation and warfare also disrupted India's major internal trade routes, increased transport and insurance costs (Habib 2003), and reduced the gains from regional trade.

Thus, a contemporary observer's claim that the dissolution of the Mughal empire led to "a scarcity of grains in all parts, [and] the wages of labour [were] greatly enhanced" seems credible (Holwell 1766-1767, cited in Raychaudhuri 1983: 6). This presumed rise in nominal wages would have slowly eroded the long-standing source of Indian competitiveness in foreign textile markets, long before Britain flooded those markets with factory-made products, and declining agricultural productivity in India must have been at the heart of it.

The Mughal collapse probably had direct disruptive effects on the Indian textile sector in addition to increasing wages, although evidence for these effects is even more fragmentary. For example, Maratha raids into Bengal in the 1740s targeted looms for destruction. In addition, many spinners and weavers depended on cash advances from merchants to purchase raw materials. This was particularly true in the export sector, where the quality of raw materials was higher. East India Company officials noted that the cash advance system was disrupted when conflict engulfed a region. This happened in Surat in the 1730s and in Bengal and the northwest in the 1740s and 1750s (Chaudhuri 1978).

The Climate, El Niño and Agricultural Crisis Hypothesis

There was another force at work that may also have served to lower agricultural productivity and raise grain prices in 18th and early 19th century India – El Niño, the periodic rise in Pacific sea surface temperature that can cause India's monsoon rains to fail. Charles Darwin stressed the influence of climate in *The Origin of the Species*, in particular when he wrote that "drought seems to be the most effective of all checks" (1972: 72). Indeed, for some time now, climate historians have developed evidence documenting frequent and deep droughts in South

Asia over the late 18th and 19th century (e.g. Grove 1997; Grove, Damodaran and Sangwan 1998; Grove and Chappell 2000) and modern Indian data clearly document the powerful role of rainfall on grain yields (Kapuscinski 2000).

Figure 3 plots the occurrence of drought in India between 1525 and 1900. It includes archive-based drought data reported in Richard Grove and John Chappell (2000: Table 1) and culled from various sources (Habib 1977; Dyson 1989; and 19th century publications). The pattern is striking. The average likelihood of a drought occurring was 34 percent for the period 1525-1649, or about one drought year every three (Figure 3, panel B). The average then fell to 18 percent for the long century from 1650 to 1774, or about one drought year every six. Indeed, between 1720 and 1765 there were two fifteen year spans without a single drought (Figure 3, panel A). However, drought incidence increased substantially from 1775, reaching a devastating likelihood of 40 percent for the years 1785 to 1825. Moreover, the five-year drought of 1788-1793 surpassed in severity any drought of the previous century (Grove and Chappel 2000: 18). The monsoon failed to arrive for three years straight in southeast India, and annual rainfall was less than 40 percent of the pre-drought level.

Thus, India experienced a historically low rate of drought during the long century 1650-1774, years which saw the Mughal Empire's golden age under Shah Jahan, its overextension and collapse under Aurangzeb, and the rise of competing successor states. Shah Jahan's reign was at the height of Mughal opulence, during which he built the Taj Mahal and the Lal Quila. Aurangzeb by contrast was austere, and preferred to use the agricultural surplus for conquest rather than luxury (Wolpert 1989). The Mughals increased the territory under their control by about half during the reigns of Shah Jahan and Aurangzeb, moving deep into southern and western India. The Empire reached its territorial maximum at around the end of the 17th century, when only the very southern tip of the subcontinent was excluded (O'Brien 1999). The last decades of Aurangzeb's life were spent trying to subdue the tenacious Marathas in western India, at great cost in both blood and treasure. During the fractious succession following Aurangzeb's

death in 1707, the Marathas surged out of their Deccan strongholds, extending their control across almost a third of India by 1757. The low drought occurrence during these years must have augmented agricultural productivity and thus the resources available for territorial conquest. But these unusually good climatic conditions soured at the end of the 1760s, when India was politically fragmented and conflict widespread, thus making a bad agricultural situation worse.

The combined influence of drought and the disintegration of the Mughal Empire on diminishing grain yields in the second half of the 18th and early 19th century can be inferred from various fragmentary sources. For example, the evidence documenting deserted villages in rural Tamil Nadu in southern India (Lardinois 1989: 34-43) reveal very high rates between 1795 and 1847, but they were more than twice as high in 1795-1814 (21.4 percent) than 1816-1847 (10.1 percent). This evidence certainly suggests low and falling agricultural productivity in the second half of the 18th and the early 19th century, but the best evidence of poor agricultural conditions in India was the soaring relative price of grains, evidence which will be discussed at much greater length below.

A Deindustrialization Offset: The Financial Drain

Even if we had good data on Indian employment and output in the late 18th and early 19th centuries, long term deindustrialization forces might still be difficult to identify since, between 1772 and 1815, there was a huge net financial transfer, or 'drain', from India to Britain. The "drain resulting from contact with the West was the excess of exports from India for which there was no equivalent import" (Furber 1948: 304), including "a bewildering variety of cotton goods for re-export or domestic [consumption], and the superior grade of saltpeter that gave British cannon an edge" (Esteban 2001: 65). Indian textiles were at this time an important vehicle by which Britons repatriated wealth accumulated in India to England, increasing demand for them. Javier Cuenca Esteban estimates these net financial transfers from India to Britain reached a peak of £1,014,000 annually in 1784-1792 before declining to £477,000 in 1808-1815 and -£77,000 in

1816-1820 (Esteban 2001: Table 1, line 20). However, even at their peak, these net Indian transfers still amounted to less than 2 percent of British industrial output (Deane and Cole 1967: Table 37, 166, using 1801 "manufacture, mining, building"). As a share of Indian industrial output, these net transfers were probably about the same.[8] Thus, while a secular fall in the 'drain' after the 1784-1792 peak must have served to speed up the pace of deindustrialization in early 19th century India by reducing demand for Indian textiles, the effect could not have been very big. In any case, the fall in the 'drain' after 1784-1792 was equivalent to the rise before, thus implying little effect on deindustrialization over the full half century 1750-1810. There must have been other fundamentals at work that mattered far more.

The Globalization Hypothesis: Britain Did It

Around the beginning of the 19th century, the fundamental economic dynamics underlying deindustrialization in India started to change from agricultural productivity decline at home to globalization shocks induced by factory-based industrialization abroad. The change did not necessarily eliminate the role of agricultural productivity decline at home, but it must have reduced it. Globalization has, of course, long been the most popular explanation for India's deindustrialization, and it is an important component of the historiography of colonial India constructed by the Indian nationalists. For example, Jawaharlal Nehru's classic *Discovery of India* (1947) argued that India became progressively ruralized in the 19th century owing to the destruction of artisanal employment by British factory-made goods. Nehru laid the blame squarely on colonial economic policy, which almost entirely eschewed tariff protection and did nothing to help nurture Indian industry (Nehru 1947: 247-53). Similar arguments can be found in the work of the 19th century nationalist Dadabhai Naoroji, pioneering Indian economic historian R. C. Dutt, and the Marxist historian D. D. Kosambi.

[8] Maddison (2001: 184 and 214) estimates that in 1820 the GDP of the India (including present-day Bangladesh and Pakistan) was about three times that of the United Kingdom, but the industrial share must have been a lot smaller in India. The text assumes that these offsetting forces were roughly comparable.

The economic logic underlying the deindustrialization-through-globalization hypothesis is that rapid productivity advance in European manufacturing—led by Britain—lowered the relative price of textiles, metal products and other manufactures in world markets. To put it another way, European industrial leaders had to share their productivity gains with consumers around the globe as augmented world supplies of manufactures lowered world prices. Having first defeated India in its export markets, ever cheaper British factory-made yarn and cloth took away more and more of India's local market from her own producers (Moosvi 2002: 341). While poor agricultural productivity performance, rising grain prices and increasing nominal wages may still have been eroding competitiveness of Indian manufacturing, the globalization hypothesis has it that Indian deindustrialization over the half century following 1810 was driven increasingly by globalization manifested by a rising terms of trade. The impact has often been illustrated by trends in Britain's external terms of trade which fell by 40 percent over the four decades between 1801-1810 and 1841-1850 (Mitchell and Deane 1962: 331). That is, the price of British exports (manufactures) fell dramatically compared with that of its imports (industrial intermediates, food and other primary products). India's textile producers would have faced a big negative price shock on that score alone. To make matters worse, newly independent Latin America, the United States, Australia, Canada and New Zealand raised their tariffs on imported manufactures to enormous heights (Williamson 2005). Failing to keep up with European factory-based productivity growth, facing new high tariffs its old export markets, and unable to defend their own markets with tariffs, the Indian textile industry became less profitable, and deindustrialization ensued. These foreign-productivity-induced price shocks were reinforced by another global event, the transport revolution (Shah Mohammed and Williamson 2004). Thus, the relative supply price of manufactures in India was driven down still further, and it was driven down even more compared with Indian commodity exports, since overseas transport improvements served to raise export prices in the home market. In short, the standard globalization hypothesis has it that world market events served to create Dutch disease effects in

India: the import-competing sectors slumped, the export sectors boomed, and deindustrialization took place. While this globalization-hypothesis certainly sounds plausible, recall that India's terms of trade rose only modestly between 1800 and 1870 (15 percent), suggesting that negative domestic supply side forces were still playing a very active part.

The decline in world textile prices caused by British productivity advance made production in India less attractive. It also contributed to a shift in the terms of trade between India's own textiles and commodity export sectors, a shift reinforced by booming world demand for Indian commodity exports. This shift alone would have caused a decline in the relative employment in textiles. The most important export commodities for India in the first half of the 19th century were opium, raw cotton, raw silk, and sugar, and they were a growing fraction of India's exports. By 1811, they accounted for 57 percent of India's exports by value, compared to 33 percent for cotton piece goods (Chaudhuri 1983). The role played by the terms of trade in reallocating resources to commodity export sectors is noted in the literature on the commercialization of Bengali agriculture in the late 18th century (Chowdhury 1964), but it has not yet become a part of the deindustrialization debate.

In sum, the long run sources of India's deindustrialization were both the globalization price shocks induced by European productivity advance in manufacturing (and the derived demand for industrial intermediates such as cotton and indigo) plus the negative productivity shocks to Indian agriculture induced by the earlier Mughal decline and deteriorating climate conditions.[10] These foreign and domestic effects were not competing. They were both at work, although each had its most important influence in different epochs.

[10] Peter Harnetty would appear to agree, although he was speaking of the Central Provinces in the 1860s, not the century starting roughly with 1750. Harnetty says (1991: 460): "The combination of high food prices and cheap cloth imports had a depressing effect on the local industry."

3. Measuring India's Deindustrialization

Inputs, Outputs, and Deindustrialization

Owing to the dearth of statistical evidence, there have been only four attempts to directly measure India's deindustrialization using estimated employment shares, and that only for the 19th century. This paper reports the first attempt to apply relative price evidence to the Indian deindustrialization question,[11] and by doing so offers previously missing evidence, tentative though it may be, about deindustrialization in the 18th century.

Tirthankar Roy (2000) offers a useful survey of the existing direct 19th century evidence, starting with this big fact: It seems likely that the share of the work force engaged in industry was quite a bit higher in 1800 (probably 15-18 percent[12]) than it was in 1900 (about 10 percent), implying that labor force share deindustrialization took place over the 19th century. However, the literature insists on some qualifications to this big deindustrialization fact. First, many workers who gave up industry over the century were working only part-time. Second, the import of machine-made goods only helps explain the demise of textiles. Finally, cheaper imported cloth would have benefited consumers.[13]

The first evidence supporting labor force share deindustrialization was offered more than a half century ago by Colin Clark (1950). Clark published tabulations of the 1881 and 1911 Census of India showing that the share of the Indian workforce in manufacturing, mining, and construction declined from 28.4 to 12.4 percent from 1881 to 1911, implying dramatic late 19th century deindustrialization. Daniel Thorner (1962) re-examined the Census data and convincingly

[11] It has, however, been applied by the author, with collaborators, to Mexico (Dobado, Gómez and Williamson 2008) and is currently being applied to Egypt (Williamson and Yousef ongoing) and the Ottoman Empire (Pamuk, Williamson and Yousef ongoing).

[12] This Indian 1800 figure of 15-18 percent compares favorably with that of other periphery regions almost a century later: Mexico 1895 11.7 percent and the United States 1880 18.8 percent. Gómez and Williamson (2008: Table 5).

[13] The literature also argues that cheaper imported yarn would have reduced the production costs facing handloom weavers, thus making them more competitive. Since cheaper European factory-produced yarn would have lowered the production costs not just for Indian handloom weavers but for weavers the world around, it is not clear how this made Indian weavers more competitive with imported cloth.

argued that the tabulations used by Clark were misleading. His revised estimates show that the sectoral employment structure was stationary after 1901, with only a very small decline in male non-agricultural employment between 1881 and 1901. Thorner used these revisions to make an important point: if there was a major shift out of industry, it occurred before 1881, not after. Indeed, Om Prakash (2005: 28) reports that Indian textile employment fell by 3.6 million between 1850 and 1880.

The third attempt to measure deindustrialization looks to the early 19th century, closer to the years which the qualitative literature has always suggested were those of most dramatic deindustrialization.[14] Amiya Bagchi (1976a, 1976b) examined evidence on handloom spinning and other traditional industry in Gangetic Bihar, data collected between 1809 and 1813 by the East India Company surveyor Francis Buchanan Hamilton.[15] Bagchi compared Hamilton's data with the 1901 Census estimates for the same area. First, he removed commercial workers from the 1901 data to make them consistent with the 1809-13 data. Second, the population dependent on industrial employment requires an estimate of family size, and Bagchi offered two estimates using alternative assumptions. In either case, Bagchi's evidence suggests a substantial decline in the industrial employment share during the 19th century, from more than 21 percent to less than 9 percent (Table 2). The Bagchi and Thorner evidence suggests that most 19th century deindustrialization took place during its first half, and that it was big.

While the employment share in other industrial occupations also fell over the century, it is important to note that the largest component of deindustrialization was the decline of cotton spinning.[16] Table 3 rearranges Bagchi's original numbers, making the contribution of cotton

[14] Among the most well known examples is the powerful image quoted by Karl Marx in *Das Kapital*: "The misery hardly finds a parallel in the history of commerce. The bones of the cotton-weavers are bleaching the plains of India" (1977[1867], vol. 1: 558). Marx attributed this quote to the Governor-General of India in 1834-1835, who was Lord William Bentinck. However, Morris D. Morris has pointed out that the quoted words do not appear in Bentinck's report of that year or in his papers (Morris 1969: 165, n.152). The true source of this first report of deindustrialization remains a mystery.

[15] Hamilton spent nearly $20 million (2005 US$) on the survey, and his information appears to be of high quality (Martin 1838).

[16] The percent of industrial workers who were spinners fell from 82 to 15 between 1809-13 and 1901.

spinning to overall deindustrialization more transparent. Of the population that depended on cotton weaving and spinning in 1809-1813, more than 80 percent depended on spinning. Since cotton spinning was performed part-time by women at home using extremely simple technology, it may seem implausible to argue that the demise of cotton spinning in the early 19th century destroyed India's platform for modern industrialization. Yet European economic historians assign the same importance to home-based cotton spinning: 17th and 18th century proto-industrial cottage industries are said to have supplied the platform for the factory-based British industrial revolution that followed (Mokyr 1993: chps. 1-3). Furthermore, women and children were key players then too (de Vries 1994).

Finally, in an unpublished study reported by Irfan Habib (1985), Amalendu Guha calculated the amount of cotton yarn available for Indian handloom production by subtracting the quantity used in local machine production from total local yarn production and imports. The result documents a huge decline in yarn used for handloom production, from 419 million pounds in 1850, to 240 in 1870 and to 221 in 1900. This indirect evidence suggests that the decline in hand spinning documented for Gangetic Bihar in the early 19th century was widespread, that it was followed by a decline in hand weaving during the mid-century, and that the decline of both hand spinning and weaving was almost complete by 1870. These facts are consistent with Peter Harnetty's summary:

> "At the opening of the century, the handloom weavers had supplied all the textile requirements of the country and had maintained a flourishing export trade, notably to Britain [e.g. re-exports]. This reached its peak in value in 1800 and in volume in 1802, thereafter, imports of Indian piece goods to Britain declined sharply in face of competition from the growing British cotton industry." "From about 1840 … British imports entered the [local] market in strength." "At the turn of the [20th] century, India was absorbing more than 40 per cent of total British cloth exports to the world" (Harnetty 1991: 472).

As argued above, the trouble actually started during the half century *before* the 1800 peak with Britain's challenge to India's dominant presence in foreign markets.

Paul Bairoch (1982) used evidence similar to that reviewed above to assess deindustrialization not only in India, but across the rest of the periphery. While they should be treated with caution, his estimates are reported in Table 4. In 1750, China and India together accounted for 57 percent of world manufacturing output, while India itself accounted for about a quarter. By 1800, India's world share had already eroded to less than a fifth, by 1860 to less than a tenth, and by 1880 to less than 3 percent. According to Bairoch's estimates, India's share in world manufacturing output declined precipitously in the half century 1750-1800, *before* factory-led industrialization took hold in Britain and consistent with the hypothesis that significant deindustrialization took place in the second half of the 18th century.

World output shares can also change due to different rates of output growth across countries. The economic implications of faster growth abroad are much more benign than those of slow growth at home. Anticipating this criticism, Bairoch (1982: Tables 6 and 9) also documented that per capita levels of industrialization in India fell from an index of 7 in 1750 to 3 in 1860 and 2 in 1913.

Real Wages and Deindustrialization

Models of deindustrialization suggest that it should be accompanied by a long run decline in real wages (e.g. Krugman and Venables 1995). The evidence for 18th and 19th century India is not yet of high quality, but it does document a secular deterioration (Figure 2).

Parthasarathi (1998) argues that real wages in mid-late 18th century South India were comparable to those in the south of England, and thus that the rising living standard gap between the two was a late 18th and early 19th century phenomenon. Robert Allen (2005) uses Mughal manuscript sources to compute the real wage in 1595 Agra, then the capital of the Mughal Empire. He compares it to the real wage in 1961, based on a common market basket of consumer

goods. Allen's evidence documents a fall in the real wage by about 23 percent over those 366 years, and if Parthasarathi is correct, most of that fall must have taken place after the mid-late 18th century. While based on sparse data, the most telling evidence on the timing of real wage performance comes from Radhakamal Mukerjee (1939) and Stephen Broadberry and Bishnupriya Gupta (2005), reproduced in Figure 2. Mukerjee reports 1600-1938 real wages of unskilled and skilled labor in northern India (nominal wage rates deflated by grain prices), while Broadberry and Gupta offer grain wage trends up to the late 19th century in both north and south India. According to these estimates, real wages had fallen 30-44 percent from their 1600 level by 1789, and 50-75 percent by 1875.

This evidence suggests that the vast majority of the real wage and living standards fall took place before 1850, or even before 1825, not after. Was deindustrialization responsible for the fall? Were the deindustrialization forces more powerful before 1850, or even before 1800, than after? To get answers, the sparse 19th century data on employment needs to be pushed back into the 18th century by use of the much richer relative price data. But before doing so, we need to model the relationship between relative prices and deindustrialization.

4. A Neo-Ricardian Model of Deindustrialization

In order to formalize intuitions about the relationship between relative prices and deindustrialization, a simple neo-Ricardian model is developed here that relies on the formal contribution of Ronald Jones (1971), and the economic insights of Adam Smith, Alexander Gerschenkron (1962) and W. Arthur Lewis (1954, 1978). Consider a perfectly competitive economy in which there are three sectors: textiles (T), grain (G), and agricultural commodity exports (C). Grain is not traded.[17] Agricultural commodity exports include non-grain items such as opium, tea, indigo, jute, and raw cotton. Textiles and agricultural commodities are traded in the

[17] This is a reasonable assumption until the latter half of the 19th century.

world market and sell for the world prices p_T and p_C, respectively. Labor (L) is mobile between all three sectors, is the only factor of production, and costs nominal wage w per unit. For simplicity, capital and land are ignored,[18] but they are not needed to make the point.

To create a link between agricultural productivity and wages in the textile sector -- which was likely to have been a key driver in India's loss of competitiveness in the 18th century world textile market, the model follows Lewis (1954, 1978) in assuming that the real wage in grain units is constant. This reflects the Malthusian assumption that in a poor country the supply of labor will be unlimited as long as the wage assures subsistence. The elastic labor supply assumption requires that there be explicit or disguised unemployment, so L represents employment rather than the population, which is denoted by P.

Suppose output in each sector is produced according to a Cobb-Douglas production function:

$$Y_G = GL_G^{\alpha} \quad (1)$$

$$Y_C = CL_C^{\beta} \quad (2)$$

$$Y_T = TL_T^{\gamma} \quad (3)$$

G, C, and T are technology parameters and the elasticities α, β, and γ are all less than 1.[19] The labor market is such that each individual will supply one unit of labor as long as the grain wage w/p_G is at or above the reservation price of 1. Assume that there is no rationing of labor, so that $L = L_G + L_C + L_T < P$. Perfect competition in each sector ensures through zero-profit conditions that labor demand will be given by:

$$L_G = (p_G G/w)^{(1/1-\alpha)} = G^{(1/1-\alpha)} \quad (4)$$

$$L_C = (p_C C/w)^{(1/1-\beta)} \quad (5)$$

$$L_T = (p_T T/w)^{(1/1-\gamma)} \quad (6)$$

[18] For our period, reliable information on these factors and their returns are difficult to obtain for India.

[19] Constraining the elasticities to be less than one ensures that labor demand is finite. It also implies decreasing returns to scale. Adding specific factors to each sector would allow for constant returns, but would not change the intuitions coming from the model.

If there is no technical change, the growth rates of labor demand are

$L_G^* = 0$ (7)

$L_C^* = -(1/1-\beta)(w^* - p_C^*)$ (8)

$L_T^* = -(1/1-\gamma)(w^* - p_T^*)$ (9)

Since the nominal wage is equal to the price of grain, employment in the grain-producing sector is fixed. Growth in the own wage in either commodity agriculture or textiles leads to a decline in the absolute number of workers employed there. Thus, *absolute labor force deindustrialization results from an increase in the own wage in textiles.* The own wage in either sector could increase due to a decline in the world price for its output. It could also increase if the price of grain rose, for example from a negative productivity shock in agricultural production.

The growth rate of the share of textile workers in total employment, the measure of *labor force share deindustrialization*, is:

$$L^*_T - L^* = \frac{-1}{(1-\beta)(1-\gamma)}\left(\left[(1-\beta)(1-\theta_{TL})(w^* - p_T^*)\right] - \left[(1-\gamma)\theta_{CL}(w^* - p_C^*)\right]\right) \quad (10)$$

The shares of textiles and commodity agriculture in total employment are given by θ_{TL} and θ_{CL}, respectively. Thus, *labor force share deindustrialization will result whenever the own wage in textiles is growing sufficiently fast compared to the own wage in agricultural commodity exports, and deindustrialization will be most severe when the difference in own wage growth rates is largest*. More formally, the condition that must be satisfied for labor force share deindustrialization is

$$w^* - p_T^* > \frac{(1-\gamma)\theta_{CL}}{(1-\beta)(1-\theta_{TL})}(w^* - p_C^*) \quad (11)$$

Given that both commodity agriculture and textile sectors are small shares of total employment in late 18th and early 19th century India, the ratio on the right-hand side is likely to be less than

one.[20] This implies that own wage growth in agricultural commodity exports would have to be even higher to counteract the deindustrialization effect of own wage growth in textiles. In short, labor force share deindustrialization is expected whenever own wage growth in textiles is positive, unless own wage growth in agricultural commodity exports is much greater. Own wage growth in agricultural commodity exports dampens the labor force share deindustrialization effect because it reduces L_C, which is in the denominator of the deindustrialization measure. As the share of the labor force employed in agricultural commodities increases, the greater growth in the own wage in textiles needs to be to overcome growth of the own wage in agricultural commodities and for deindustrialization to ensue. Condition (11) can also be rewritten to relate nominal wage growth to the terms of trade between textiles and commodity agriculture.

$$\frac{(1-\gamma)\theta_{CL}+(1-\beta)(1-\theta_{TL})}{(1-\beta)(1-\theta_{TL})}w^* > p_T{}^* - p_C{}^* \qquad (11')$$

Labor force share deindustrialization results when nominal wage growth, which deters production in both non-grain sectors, is sufficiently greater than the growth of the terms-of-trade favoring textiles, which encourages production in textiles over agricultural commodities. Thus, *labor force share deindustrialization should have been most severe when nominal wage growth was strongest and when the terms of trade were shifting most strongly in favor of agricultural commodities*.

In summary, *absolute labor force deindustrialization* will result if the own wage in textiles increases; and *labor force share deindustrialization* will result if own wage growth in textiles increases sufficiently faster than that of agricultural export commodities.

5. Relative Prices and the Own-Wage in Manufactures 1750-1913

[20] For example, let $\beta = \gamma$ and following Table 3 set $\theta_{TL} = 0.15$. If we assume $\theta_{CL} = 0.1$, then the ratio is 0.12. For absolute labor force deindustrialization to occur, own wage growth in textiles must be about 0.12 times greater than own wage growth in agricultural commodities.

Indian deindustrialization experience over the two centuries between 1700 and 1913 can be divided into four distinct epochs. Explanations for the sources of deindustrialization within these epochs implies predictions regarding Indian relative price trends.

The first epoch ran from about 1700 to 1760 and it was India's high water mark as a global manufacturing powerhouse. Indian textiles clothed tens of millions of Indians, southeast Asians, the fashionable men and women of Europe, American slaves and peons, Africans and others throughout the Middle East. This success rested in part on the high productivity of Indian agriculture, which was supported during this epoch by unusually reliable monsoons and a flourishing empire. However, political fragmentation and warfare following the collapse of the Mughal empire must have absorbed much of the agricultural surplus, resulting in no fall in grain prices in spite of the unusually favorable climate.

The second epoch, about 1760 to 1810, was one during which India lost its significant share of world textile markets to Britain. What was an important export sector at the beginning of the epoch became an important import-competing sector at the end. While that result can be partly explained by increasing cost competitiveness favoring Britain, superior factory technology was not yet the main force at work. Instead, reduced agricultural productivity was likely to have mattered most in this epoch. Grain prices rose and, in a subsistence economy where grain was the key consumption good, pushed up nominal wages economy-wide. The own wage rose in textiles, damaging cost competitiveness there.[21] Textiles therefore experienced a contraction. To the extent that the price of textiles relative to agricultural export commodities fell, the effect of reduced agricultural productivity would have fallen more heavily on textiles than export commodities, a labor force share deindustrialization effect.

During the third epoch, about 1810 to 1860, India lost much of its domestic textile market to Britain. This result can be explained in large part by the combined influence of relatively rapid

[21] If this formal "cost competitiveness" and "own-wage" language seems awkward when applied to household spinners and weavers, think instead of the grain that could be bought with nominal earnings in those households.

factory-based productivity advance in Britain and by increased world market integration, the latter driven by declining transport costs between the two trading partners, and to the free trade policy imposed on India by her colonial ruler. However, manufacturing's contraction was also explained by continued domestic supply side problems. While the effects of the Mughal decline were pretty much over, the effect of unfavorable climate was not (Figure 3) and thus low Indian grain productivity persisted, implying continued high nominal wages in manufacturing.

The rate of deindustrialization slowed down early in the fourth epoch, about 1860 to 1913, and then reversed as India slowly reindustrialized. This slow down and reversal can be explained by the subsidence in productivity advance in European manufacturing and in the world transport revolution. As a result, the terms of trade trend was flat and did not penalize import competing manufacturing. In addition, climate conditions improved for Indian agriculture. In any case, the emergence of an integrated world grain market (Latham and Neal 1983) probably served to put downward pressure on grain prices and nominal wages in India, thus increasing the competitiveness of local manufacturing.

These predictions are largely confirmed by the new relative price and terms-of-trade evidence reported in Figures 4-8 covering the 150 years 1700-1850. The price evidence includes three new series for grains, textiles, and agricultural commodities (Figure 4).[22] These price series are used to measure the intersectoral terms of trade between textiles and agricultural export commodities and the own wages in the two sectors.[23] The analysis which follows will focus on the century between the 1750s and the 1850s, when deindustrialization appears to have been most dramatic.

[22] The grain price series includes prices for rice, wheat, bajra, and jower from locations spanning the subcontinent. Restricting the included series to rice and wheat for Bengal and North India, which comprise the longest and most regionally consistent prices, shows the same patterns as the overall series. The main difference is that the rise in grain prices 1780-1850 is smoother in the restricted series. A full description of how the wage and price data were constructed can be found elsewhere (Clingingsmith and Williamson 2008: Data Appendix).

[23] A full description of the wage data can also be found in Clingingsmith and Williamson 2008: Data Appendix).

The first epoch corresponds to the dissolution of the Mughal empire. Despite favorable climate, the price of grain nearly doubled between 1700 and 1760, putting upward pressure on nominal wages and hurting India's competitiveness in both textile and commodity exports (Figure 4). Textile and commodity prices were roughly constant from 1700-1740 before climbing steadily between 1740 and 1760. There is no evidence here of falling textile prices due to improvements in production technology or transport. The intersectoral terms of trade between textiles and agricultural commodities moved slightly in favor of commodities during this period, putting some pressure on the allocation of resources between export sectors (Figure 5). Grain prices rose while nominal wages fell from 1700 to 1740 (Figures 4 and 6). The fall in textile's own wage from 1700 to 1730 favored local industry, after which it stayed flat (Figure 7), suggesting India actually became more competitive in its textile export market 1700-1760. Figure 7 offers no support for the view that deindustrialization was induced by an own wage rise in textiles 1700-1760, but Figure 5 does offer some support for the view that deindustrialization was induced by a small twist in the intersectoral terms of trade in favor of agricultural commodities.

Now consider the case for absolute labor force deindustrialization over the century after 1760, recalling that absolute labor force deindustrialization is defined as a decline in the industrial workforce, driven in the model by the own wage. Figure 7 shows that the own wage in textiles rose spectacularly between 1765 and 1810, more than tripling, with faster growth in the latter part of the period. Why the spectacular rise in w/p_T in the late 18th century? The answer is that grain prices, while volatile in the short run, soared upwards in the long run (Figure 4). This did not serve to reduce real wages (w/p_G): Figures 2 and 6 show that grain wages appear to have been largely stable following the early-mid 18th century,[24] consistent with a Lewis-like assumption about long run real wage stability. But the grain price boom did serve to inflate nominal wgaes. Since textile prices also began to fall after 1785 to about half that level in 1810, w/p_T soared.

[24] Note that Broadberry and Gupta's north India grain wage series contains no data points between 1690 and 1874, so it is impossible to discern trends within the 18th century from it.

There is no qualitative evidence suggesting significant productivity advance in Indian textiles and other manufacturing production before 1810,[25] so the evidence on the own wage is taken to offer powerful support for the thesis that reduced agricultural productivity attendant on the dissolution of Mughal hegemony and more frequent droughts can indeed explain much of India's pre-1810 loss of world markets and resulting deindustrialization. India lost much of its cost competitiveness as the own-wage in home manufacturing underwent that spectacular rise, and it was the rise in the price of non-tradable grains that pushed up the nominal wage to such high levels. Most of the secular rise in grain prices stopped after around 1810, but they stayed at high levels. Thus, while the upward pressure on nominal wages eased, wage competitiveness was not recovered. Still, the fall in p_T dominated deindustrialization conditions in Indian manufacturing. The own wage continued to rise after 1810 and deindustrialization persisted, but it was now driven mainly by exogenous world market forces (e.g. p_T). Between 1810 and 1850, the own wage roughly tripled.

Consider now labor force share deindustrialization across the middle two epochs, recalling that it should have been more intense when the own-wage in textiles was growing faster *and* when the intersectoral terms of trade was shifting most strongly in favor of agricultural commodities. Figure 7 shows the own wage almost tripling between 1765 and 1810, and more than tripling between 1810 and 1850.[26] Thus, own-wage growth was slightly stronger in the third epoch. However, the intersectoral terms of trade shift appears to have been strongest in the second epoch, that is before 1810 not after (Figure 5). Figure 1 documents India's external terms of trade from 1800. It shows two big spikes, the first over the decade of the 1810s and the second over the decade of the 1850s. When the series is smoothed, the measured trend in the terms of trade favoring India (thus penalizing the import competing sector) is very modest, as we saw in

[25] In any case, since agriculture was so huge, it must have dominated nation-wide labor scarcity conditions, not just those in manufacturing.

[26] Our data on wages is more sparse and of lower quality than our data on grain prices. Under the assumption of constant real grain wages, the own wages w/p_T and w/p_C can be proxied by p_G/p_T and p_G/p_C. These proxies reveal the same pattern as the own wages in Figure 7.

the introduction. In contrast, between 1750 and 1810 the intersectoral terms of trade between textiles and agricultural commodities (Figure 5: p_T/p_C) underwent a very sharp decline: by 1810 it was only 20 percent of its 1780 level. Thus, while the own wage in export commodities was stable during this period (Figure 7), it rose in textiles. This pattern suggests that deindustrialization was likely to have been greater during the half century before 1810 than in the half century thereafter. Before 1810, workers left textiles due to their demand for higher nominal wages to buy increasingly expensive grain and to a strong shift in the terms of trade favoring commodity exports and disfavoring textiles, while after 1810 workers left mainly due to falling world textile prices and a sagging demand for their output.

Since England was India's main competitor in world markets, a comparison of trends in the own-wage in textiles between the two should be a useful indicator of relative productivity change. Caution should be exercised here, since a measured increase in the ratio of Indian to English w/p_T will understate the role of own-wage inflation to the extent that English productivity growth performance was superior to India even before the great factory boom. The source for England is Gregory Clark (2004: Table 6 for nominal wages; Table 4 for grain and clothing prices), whose data allow the construction of both the proxy own wage (p_G/p_T) and the own wage in textiles (w/p_T) for 1705-1845. Figure 8 plots indices for w/p_T in India and England, and their ratio. The India/England own wage ratio was relatively stable between 1705 and 1760. The own wage in England grew by about 80% between 1765 and 1845, but the own wage in India grew much faster. The ratio of w/p_T in India relative to England shot up from 79 in 1760 to 181 in 1810 and 492 in 1845. Nearly half of that 85-year increase was completed by 1810, before the great flood of factory-produced textiles hit Indian markets in the third deindustrialization epoch. But even after 1810, it appears that some part of Indian deindustrialization was explained by poor productivity performance in grains: after all, p_T was pretty much equalized between India and Britain, so the faster rise in India's p_G/p_T implies a poorer productivity performance in grains there, and perhaps even compared with the rest of the periphery. And rise it did! Grain prices rose

almost four times faster in India than England, an event which must have put greater upward pressure on wage costs in India than England, thus raising the Indian own wage in textiles relative to England.

Relative price evidence is complicated by the fact that India's textile export volume grew strongly in the last decades of the eighteenth century (Datta 1999). Does this evidence counter our stress on 18th century deindustrialization? No, and for two reasons. First, it has already been noted that the period from 1772 to 1812 saw an artificial increase in demand for Indian textile exports from East India Company servants, who used them as a vehicle to transmit their fortunes back to England. This artificial demand shock served to mask the longer run fundamentals driving the Indian textile industry. Second, Table 5 shows that exports were by 1800 a relatively small component of the Indian textile market. Roy (2000) and Bagchi (1972) suggest that per capita consumption of cotton textiles in 1920 was about 11.65 yards. Between 1800 and 1920, India's per capita GDP grew by about 30 percent while the price of cotton textiles fell by half. Both of these events would have made per capita consumption of textiles considerably greater in 1920 than 1800. Using the level of per capita textile consumption in 1920 as a base, textile demand elasticities with respect to income and price applied to the observed changes in price and income per capita over the century imply per capita textile consumption in 1800 (Table 5, panel A). Total Indian population in 1800 -- about 194 million – can then be used to compute the total domestic consumption of textiles under each of the estimated elasticities (Table 5, panel B).[27] Textile export volumes are a bit harder to judge; while much of the export trade was carried out by the East India Company, there were also private local traders and other European companies at work. K. N. Chaudhuri (1983) presents evidence that London was the destination of 38 percent of the total exports of Bengal in the five years leading up to 1800. Michael Twomey (1983) suggests that Indian textile exports to London in 1800 were 30 million yards. If the English share of the

[27] Maddison (2003) estimates 1820 population at 207 million and population growth at about 0.38 percent per year.

total exports of Bengal is assumed equal to the English share of the textile exports of India, then it follows that total textile exports of India in 1800 was about 80 million yards. Thus, the export share of the Indian textile market in 1800 probably ranged between 4 and 12 percent (Table 5, panel C), where 6-7 percent seems most plausible. In short, India had lost much of its world market by 1800, and stronger growth in export volume thereafter would have had only a modest effect on India's textile industry as a whole.

6. Conclusions

Deindustrialization appeared everywhere around the 19th century periphery, and globalization plays a major role in each region's historiography. Indian historiography gives even more space to deindustrialization than do other historiographies from the poor periphery. Yet, the deindustrializing global price shocks facing India were relatively modest. This apparent paradox is resolved once we pay attention to negative domestic supply side forces since they played a far more important role in India than elsewhere.

India's deindustrialization between 1760 and 1860 contained two main epochs, with somewhat different deindustrialization causes. The first epoch ran from about 1760 to 1810, when Indian manufacturing lost so much of its export market. This deindustrialization experience was a direct result of poor climate conditions and an indirect result of the dissolution of the Mughal Empire. The deterioration in climate conditions lowered agricultural productivity, raised grain prices, and thus increased nominal wages in home manufacturing, lowering India's competitiveness with England and other world producers. Furthermore, as central authority waned, these forces were strengthened: revenue farming expanded, the rent burden increased, warfare raised the price of agricultural inputs, and regional trade within the sub-continent declined, all serving to drive down the productivity of foodgrain agriculture still further. So grain prices had another reason to rise, and given that ordinary workers lived near subsistence, the

nominal wage rose even faster, hurting India's competitiveness in the export market all the more. India thus lost ground to Britain in the world textile market during a period when most British production was still carried out using the cottage system. Additionally, the intersectoral terms of trade moved against textiles, encouraging a shift to agricultural commodity production. India's share of world industrial production fell faster than in any other part of the non-European world. During the second epoch, running from about 1810 to 1860, Indian manufacturing lost much of its domestic market. The European productivity advance resulting from the adoption of the factory system drove down the relative price of textiles world-wide, a trend that was magnified as a world transport revolution lowered the price of European textile imports even further everywhere in the periphery. Thus, while the productivity of Indian agriculture stopped its decline during this period, under the relative security of Company rule and reinforced by a secular fall in drought frequency, and while the rise in grain prices slowed down and then stabilized, nominal grain prices remained high, and their *relative* price continued to rise.[28] By 1860, India had completed a century-long two-part transition from being a major net exporter to a major net importer of textiles. India's terms of trade were relatively flat over most of the 19th century, especially compared to the booms in the rest of the poor periphery, suggesting that domestic supply side conditions played a relatively important role in India. India's deindustrialization was over by the late 19th century, and a period of slow reindustrialization began, as it did in Shanghai, Japan, Brazil, Mexico and other parts of the poor periphery.[29]

[28] After 1860, global trade in grains changed conditions considerably. Thus, the assumption that grains were non-tradable is increasingly untenable as the late 19th century concludes. Cheaper imported grains (and railroad development within India) may have played a role in lowering the own wage in manufacturing after the 1860s or 1870s, and thus may have contributed to reindustrialization in India.
[29] Shanghai and Japan have been well studied, but Latin America has not. See Gómez and Williamson (2008) for some new evidence on Latin American industrialization 1870-1913.

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Table 1

De-Industrialization: Textile Import Penetration 1800s-1880s, India vs Mexico and the Ottoman Empire

	Percent of Home Textile Market Supplied by	
	Foreign Imports	Domestic Industry
India 1800	-6 to -7	106 to 107
India 1833	5	95
India 1877	58 to 65	35 to 42
Ottoman 1820s	3	97
Ottoman 1870s	62 to 89	11 to 38
Mexico 1800s	25	75
Mexico 1879	40	60

Source: Dobado, Gómez and Williamson (2008: Table 4) and Table 5 below.

Table 2

Population Dependent on Industry In Gangetic Bihar
(in percent)

	1809-1813	1901
Assumption A	28.5	8.5
Assumption B	21.6*	8.5

Source: Bagchi (1976b): Tables 1-5.
Note: Under Assumption A, each spinner supports only him or herself, and under Assumption B, each spinner also supports one other person. Under both assumptions, non-spinners are assumed to support the survey's modal family size (5).
* Bagchi reports 18.6, but this appears to be a mistake. See the breakdown in Table 3.

Table 3

Population of Gangetic Bihar Dependent on Different Occupations
(in percent)

	1809-1813	1901
Spinners	10.3	}1.3
Weavers	2.3	
Other Industrial	9.0	7.2
TOTAL	21.6*	8.5

Source: Bagchi (1976b): Tables 1-5.
* Bagchi reports 18.6%, but this appears to be a mistake.

Table 4

World Manufacturing Output 1750-1938
(in percent)

Year	India	China	Rest of the Periphery	Developed Core
1750	24.5	32.8	15.7	27.0
1800	19.7	33.3	14.7	32.3
1830	17.6	29.8	13.3	39.5
1880	2.8	12.5	5.6	79.1
1913	1.4	3.6	2.5	92.5
1938	2.4	3.1	1.7	92.8

Source: Simmons 1985, Table 1, p. 600, based on Bairoch 1982, Tables 10 and 13, pp. 296 and 304.
Note: India refers to the entire subcontinent.

Table 5 Estimating Export Share of Textile Production in 1800

Textile Consumption in 1920 (yards/capita):	11.65
Per-Capita Income Growth 1800-1920:	30%
Textile Price Change 1800-1920:	-50%

Panel A: Estimated Domestic Per-Capita Consumption, yards

Price Elasticity of Demand	Income Elasticity of 1.0	1.5
0.0	9	6
-0.5	6.0	4.0
-1.0	4.5	3.0

Panel B: Estimated Total Domestic Consumption, million

Price Elasticity of Demand	Income Elasticity of Demand 1.0	1.5
0.0	1,746	1164
-0.5	1,164	776
-1.0	873	582

Panel C: Estimated Export Share of Textile Production

Price Elasticity of Demand	Income Elasticity of 1.0	1.5
0.0	4%	6%
-0.5	6%	9%
-1.0	8%	12%

Notes: Estimated textile consumption in 1920 comes from Roy 2006 and Bagchi 1972. Per-capita income growth is based on estimates in Maddison 2003; we assume income in 1800 was the same as 1820. Textile price changes come from Haines 2006. Price and income

Figure 1
Terms of Trade in India and the Poor Periphery (1800=100)

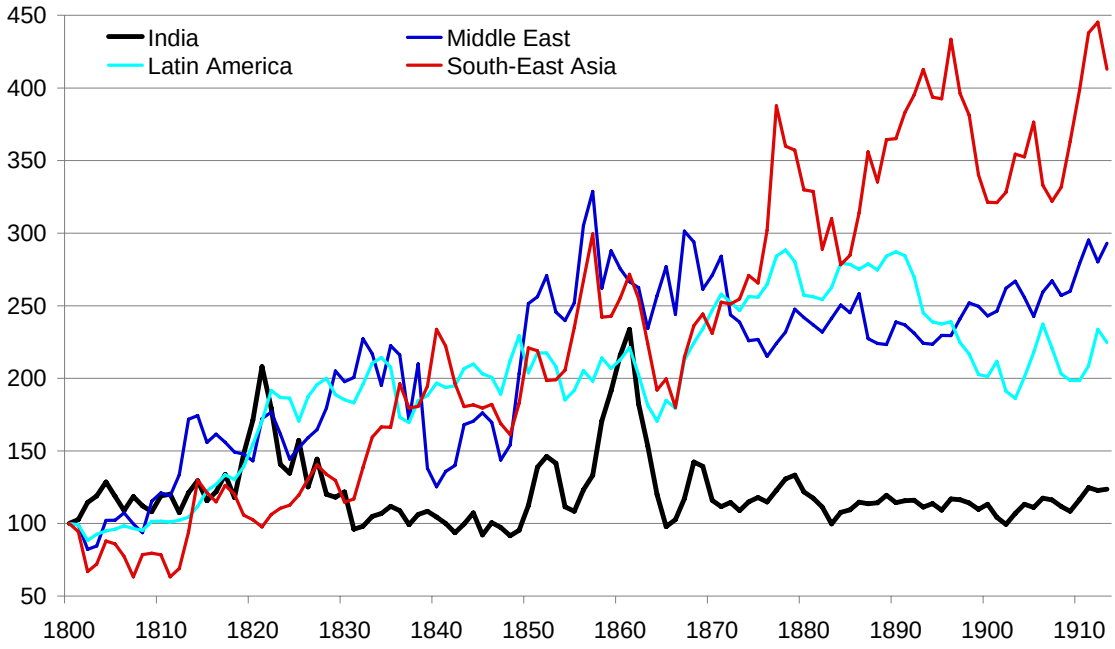
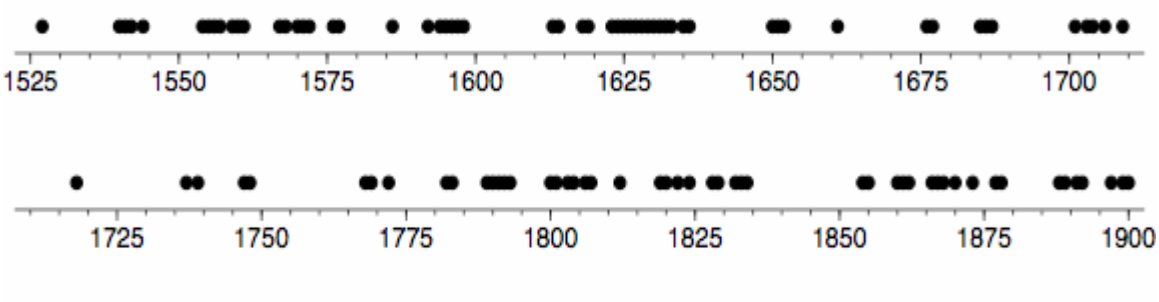
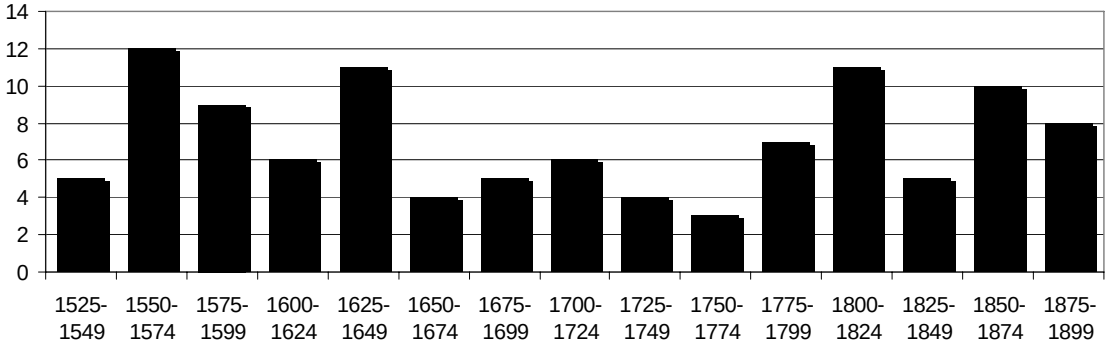


Figure 2
Grain Wages in India 1600-1938 (1600=100)

Figure 3
Drought in India 1525-1900



(a) Drought years, 1525-1900



(b) 25-Year Average Number of Drought Years

Figure 4
Prices of Key Indian Goods 1700-1850 (1700=100)

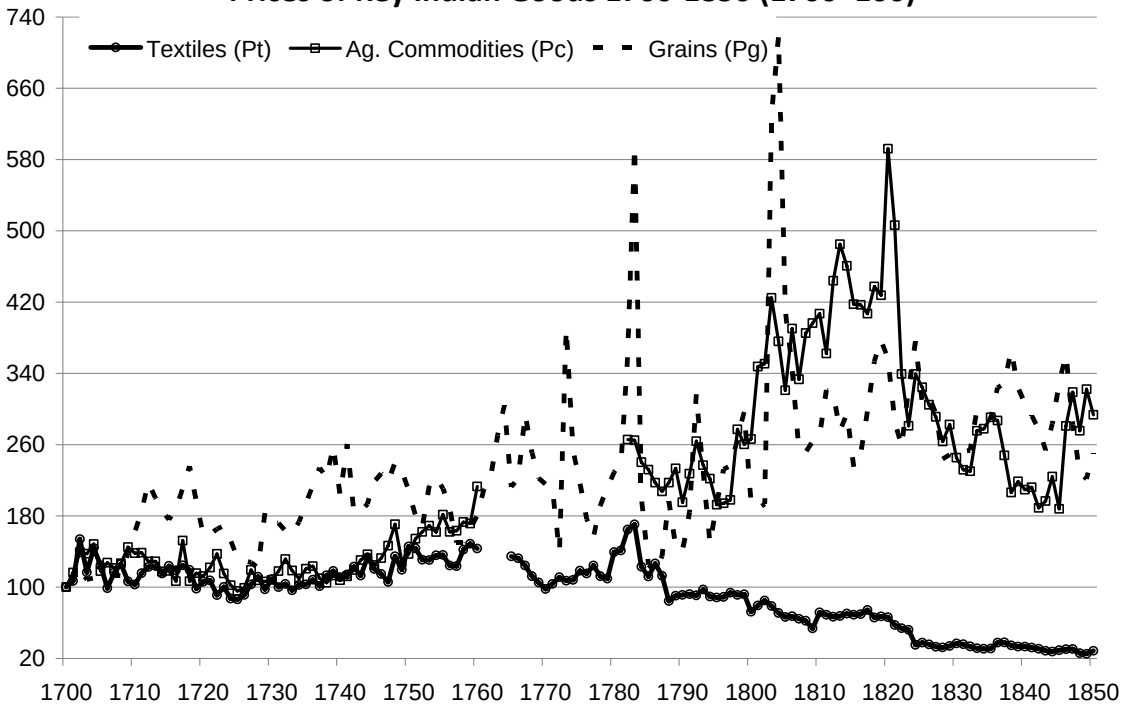


Figure 5
Intersectoral Terms of Trade (Pt/Pc)
1700-1850 (1700=100)

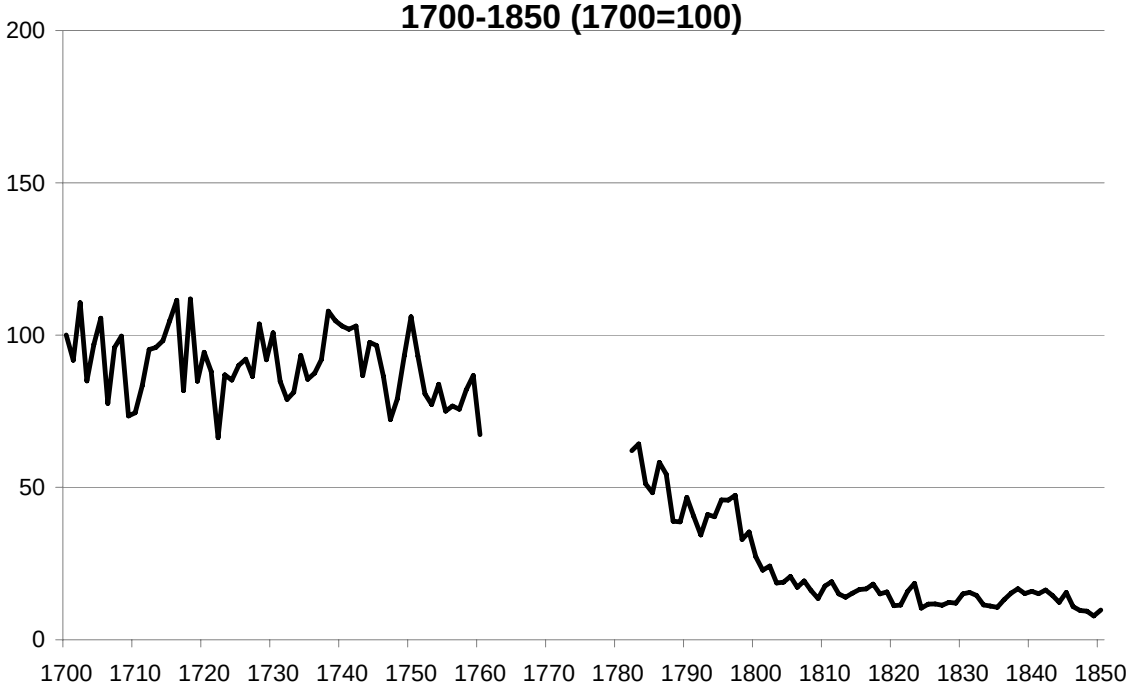


Figure 6
Grain Wage in India (w/Pg) 1700-1850 (1700=100)

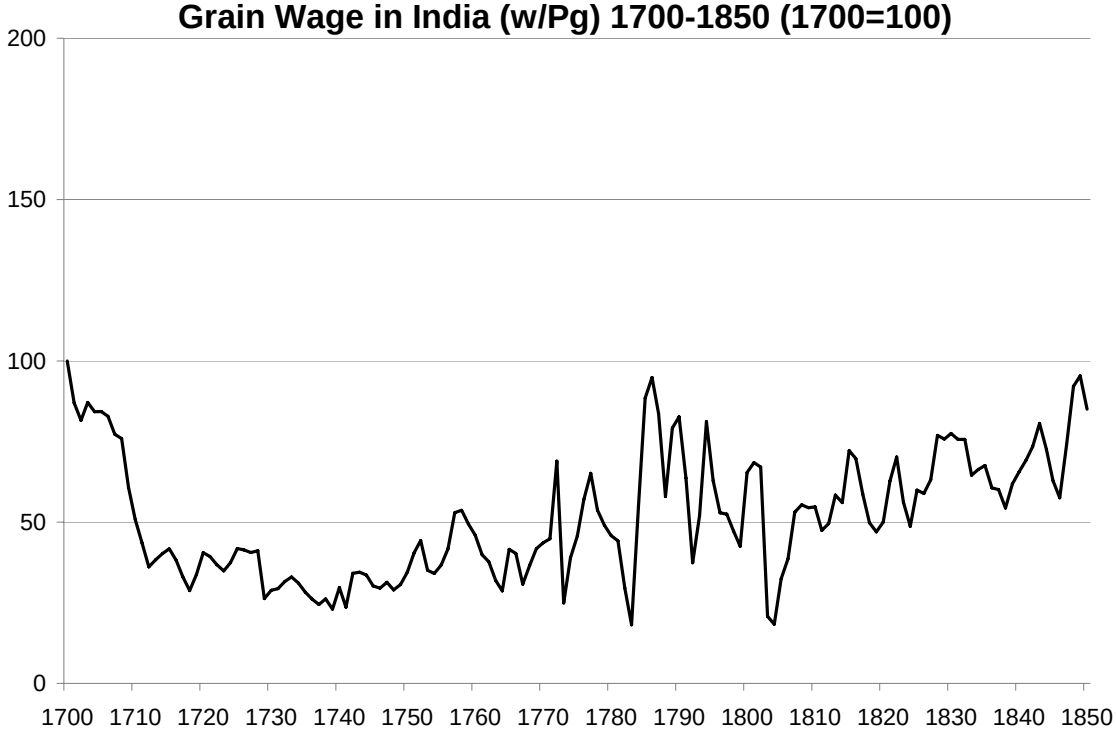


Figure 7
Own Wage in Textiles and Agricultural Commodities
1700-1850 (1700=100)