



The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

Papers downloaded from AgEcon Search may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

THE HISTORICAL ROOTS OF INDIA'S SERVICE-LED
DEVELOPMENT: A SECTORAL ANALYSIS OF ANGLO-INDIAN
PRODUCTIVITY DIFFERENCES, 1870-2000

Stephen Broadberry and Bishnupriya Gupta

No 817

WARWICK ECONOMIC RESEARCH PAPERS

DEPARTMENT OF ECONOMICS

THE UNIVERSITY OF
WARWICK

THE HISTORICAL ROOTS OF INDIA'S SERVICE-LED DEVELOPMENT: A SECTORAL ANALYSIS OF ANGLO-INDIAN PRODUCTIVITY DIFFERENCES, 1870-2000

Stephen Broadberry and Bishnupriya Gupta

Department of Economics, University of Warwick, Coventry CV4 7AL, United Kingdom

S.N.Broadberry@warwick.ac.uk
B.Gupta@warwick.ac.uk

2 October 2007

File: IndiaUK1

Abstract: Overall labour productivity in India was already only around 15 per cent of the UK level between the early 1870s and the late 1920s. Between 1929 and 1950 India fell further behind and remained at around 10 per cent of the UK level until the 1970s. India has been catching-up since the 1970s, but by the end of the twentieth century was still further behind than in the late nineteenth century. Agriculture has played an important role in India's relative decline to 1950 and subsequent delay in catching up, since comparative India/UK labour productivity in this sector has declined continuously and agriculture still accounts for around two-thirds of employment in India. Comparative India/UK labour productivity in industry has fluctuated around a level of around 15 per cent. The only sector to exhibit trend improvement in comparative India/UK labour productivity over the long run is services, rising from around 15 per cent to around 30%. India's recent emergence as a dynamic service-led economy appears to have long historical roots.

JEL classification: N10, N30, O47, O57

Key words: Labour productivity, sectoral disaggregation, international comparison

We would like to thank participants in the Workshop on Historical Comparison of International Income and Productivities at Hitotsubashi University for helpful comments.

I. INTRODUCTION

There are a number of existing studies of comparative productivity and income over the period since the late nineteenth century for members of today's rich-country convergence club (Pilat, 1993; Broadberry, 1998; Broadberry and Irwin, 2007). However, to identify the forces making for economic success, it is also important to examine the experience of countries which have remained less developed and compare them with the experience of the rich world. This paper considers the experience of India since 1870 in comparison with the United Kingdom. An Anglo-Indian comparison is feasible because much statistical information was collected in India during the period of British rule before 1947, in a form which is relatively easy to compare with Britain. The comparison is also made possible by the impressive reconstruction of the Indian historical national accounts by Sivasubramonian (2000). The Anglo-Indian comparison is also of particular interest because of the recent emergence of India as a fast-growing tiger economy based on services rather than industry, in striking contrast to the case of China (Bosworth and Collins, 2007).

The comparative labour productivity performance can be summarised as follows. Around 1870, output per worker in India was about 15 per cent of the UK level in the economy as a whole, and fluctuated around this level until the end of the 1920s. Between 1929 and 1950, Indian labour productivity fell below 10 per cent of the UK level, where it remained until the 1970s. Since the 1970s, India has begun to catch up on the United Kingdom, but by the end of the twentieth century was still further behind than in the early 1870s. Looking at the sectoral aspects of this relative decline, it is clear that agriculture lies at the heart of India's productivity problem. Whereas in 1870 Indian labour productivity in agriculture was at more than 10 per

cent of the UK level, by 1999/2000 this had fallen to around 1 per cent. In industry, Indian labour productivity has been stationary, returning to around 15 per cent of the British level, although there have also been substantial periods of deviation from this long run level. In services, there has been a trend improvement from around 15 per cent of the UK level in the late nineteenth century to around 30 per cent by the late twentieth century. Since agriculture accounted for around three-quarters of the Indian labour force between the 1870s and the 1970s, and still 65 per cent at the end of the twentieth century, it is clear that India needs to drastically increase agricultural labour productivity if it is to improve its overall productivity performance. The sectoral results also suggest that India's recent experience of service-led growth has long historical roots (Bosworth and Collins, 2007).

The paper proceeds as follows. Section II sets out the basic data sources and methods, analysing the time series evidence on growth rates in the two countries and showing how to combine this with the cross-sectional evidence on comparative levels of income and productivity calculated at purchasing power parity. The results of the sectoral productivity comparison and the differences in the sectoral distribution of the labour force are then presented in section III. This is then followed in section IV by an analysis of differences in the share of the population in the labour force and the implications for comparative levels of per capita income. Section V then considers ways of cross-checking the results, while section VI concludes.

II. DATA AND METHODS FOR ANGLO-INDIAN PRODUCTIVITY COMPARISONS

1. Indian time series

The starting point for our comparative study is the time series data for India and the United Kingdom. For India, we rely largely on the historical national accounts reconstructed by Sivasubramonian (2000) for the twentieth century and Heston (1983) for the late nineteenth century. The data are generally presented on a fiscal year basis, running from 1 April to 31 March, and refer to the boundaries of British India until 1946/47 and modern India thereafter. Table 1 presents the output and employment data for the whole economy and for the three main sectors, agriculture, industry and services. It should be noted that agriculture includes livestock farming, forestry and fishing as well as arable farming, while industry includes mining, construction and the utilities as well as manufacturing. Services comprises railways and communications, government services, other commerce and transport, professions and liberal arts, domestic service and house property. Full details of data sources are given in Appendix 1.

The output and employment data from Table 1 can be used to calculate indices of labour productivity by major sector in Table 2. From these indices it is possible to calculate the average annual growth rates of labour productivity by sector. During the late nineteenth century, labour productivity growth was fastest in industry and slowest in services. During the first half of the twentieth century, although there was respectable labour productivity growth in industry and services, labour productivity growth in the economy as a whole was held back by stagnation in agriculture. During the second half of the twentieth century, respectable labour productivity growth in industry and services has again been offset by slow productivity growth in agriculture.

2. UK time series

The UK time series are taken largely from the historical national accounts of Feinstein (1972), updated with output estimates from the *UK National Accounts* and employment data from O'Mahony (2002). Again, full details of data sources are given in Appendix 1. The territory covered refers to the United Kingdom of Great Britain and the whole of Ireland before 1920, but Great Britain and Northern Ireland after 1920. In contrast to Broadberry (1998), where the output and employment data were both spliced at 1920, following the procedures of Maddison (1995) to provide continuous series within the current boundaries of the United Kingdom, in this study both the output and employment series change with the secession of southern Ireland, as in Maddison (2003). This does not make a lot of difference to the UK data, but is more in line with the procedures of Sivasubramonian (2000) for dealing with the major boundary change at the time of Indian independence. The output and employment series are presented on a sectoral basis in Table 3, from which it is possible to derive the indices of labour productivity and the labour productivity growth rates shown in Table 4.

UK labour productivity growth before World War I was fairly evenly spread across the major sectors, but slightly faster in industry than in services or agriculture. The period 1920-1950 saw an increase in the labour productivity growth rate in industry and agriculture, but stagnation in services. The period after World War II saw a further acceleration in the labour productivity growth rate, particularly in agriculture and industry.

Although the periodisation is slightly different in Tables 2 and 4, due to the different dates of major boundary changes, there are already a number of indications

of some of the major factors behind the differential productivity growth performance of India and the United Kingdom. First, note that overall labour productivity grew faster in Britain than in India before 1950, at about the same rate in the two countries between 1950 and 1970, and faster in India since 1970. We should thus expect to see India falling further behind Britain until around 1950 and beginning to catch up after 1970. Second, the largest growth rate differentials were in agriculture, so that we can expect to see this sector making a large contribution to India falling behind. Third, during the period of India catching up since 1970, although labour productivity growth has been faster in industry than in services in both India and Britain, it is only in services that labour productivity growth has been higher in India than in Britain. This is in line with the focus of Bosworth and Collins (2007) on the key role of services in Indian growth.

3. A benchmark for 1950

The labour productivity data for India and the United Kingdom from Tables 2 and 4 can be combined to provide trends in comparative labour productivity for each sector in index number form. To pin down the comparative labour productivity level, we provide a benchmark estimate for circa 1950, using data on nominal value added per employee in each country, compared at sector-specific price ratios, adjusted for purchasing power parity (PPP). This is necessary because the exchange rate cannot be assumed to be a perfect guide to differences in prices between two countries, especially at the level of individual goods and services, or particular sectors. For example, a country with a comparative advantage in agriculture may expect to have relatively cheap food, while a country with a comparative advantage in manufacturing may expect to have relatively cheap industrial goods, although we may expect the

effects of trade to moderate such tendencies. In the case of comparisons between developed and less developed countries, moreover, Balassa (1964) and Samuelson (1964) have highlighted the tendency of less developed economies to have a lower overall price level, due to the presence of non-traded goods and services.

Table 5 provides an India/UK PPP for agriculture circa 1950, using wholesale price data. Whilst it may be argued from a theoretical point of view that it would be better to have farm gate prices, this approach runs into the serious problem that the major Indian food crop is not grown in Britain. Given the importance of rice to the Indian economy, it seems more satisfactory to use wholesale prices to capture the availability of cheap food in the Indian economy. This is indeed reflected in the fact that at Indian production weights the PPP for agriculture is £1 = Rs 10.80, well below the exchange rate of £1 = Rs 13.36. Using UK production weights, however, gives a much higher weight to livestock products such as meat, which were relatively expensive in India, yielding a PPP for agriculture using UK weights of £1 = Rs 16.43. The geometric mean of the PPPs for agriculture at Indian and UK weights is £1 = Rs 13.32, which is close to the exchange rate.

Table 6 provides a PPP for industry circa 1950 using factory gate prices from production censuses for India and the United Kingdom. Weights reflect shares in value added for major industrial categories such as chemicals, metals, etc. while within these categories individual products are weighted in line with shares of gross output. The industrial PPP of £1 = Rs 11.43 is the geometric mean of Rs 10.52 at Indian weights and Rs 12.43 at UK weights, indicating a lower industrial price level in India. However, this result depends heavily on the large textiles and clothing sector

where Indian prices were low, with Indian prices of many other industrial products, particularly chemicals, being higher than in Britain.

For services, we have followed Broadberry and Irwin (2007) in using a weighted average of the PPPs for agriculture and industry, taking the geometric mean of Indian and UK weights. This yields a PPP of £1 = Rs 12.25 for services and also for the economy as a whole. Although this indicates a lower price level in India than in Britain, the scale of the deviation from purchasing power parity is relatively small compared with the differences in more recent times. This apparent absence of a large Balassa-Samuelson effect in 1950 is consistent with the empirical findings of Bergin, Glick and Taylor (2006), who show the emergence of a significant Balassa-Samuelson effect amongst a large sample of countries only after the 1950s.

These PPPs can be used in Table 7 to provide a benchmark level of comparative labour productivity by sector circa 1950, which can be contrasted with the levels obtained using the market exchange rate. Using the sector-specific PPPs raises the Indian labour productivity level significantly in industry, services and the economy as a whole. For the economy as a whole circa 1950, Indian output per worker was less than 10 per cent of the UK level.

III. SECTORAL ASPECTS OF PRODUCTIVITY PERFORMANCE

1. Comparative labour productivity levels by sector

Table 8 provides a breakdown of comparative labour productivity levels by the three main sectors of agriculture, industry and services. It is clear that India's falling further behind during the period 1871-73 to 1950-51 and the slowness of India's subsequent

catching-up has a lot to do with the performance of agriculture. In the early 1870s, an average Indian agricultural worker produced a bit more than 10 per cent of the output produced by an average British agricultural worker. By the 1950s, this had fallen to around 5 per cent, and by the 1990s to as little as 1 per cent. In industry, comparative labour productivity fluctuated but remained stationary, with Indian labour productivity returning to around 15 per cent of the British level. In services, the India/UK comparative labour productivity level trended upwards from around 15 per cent to around 30 per cent, although the disruption surrounding independence interrupted this upward trajectory, providing a setback to services as well as to agriculture and industry.

2. The structure of economic activity

To fully understand the contributions of the three main sectors to comparative productivity performance, it is necessary to track their shares in economic activity as well as their comparative productivity levels. Table 9 shows the percentage distribution of employment by major sectors for selected years. The sectoral composition of economic activity was clearly very different in the two countries. Compared even with other developed economies, Britain devoted a very small share of the labour force to agriculture, already by the late nineteenth century. Thus, for example, while both Germany and the United States still had around 50 per cent of their labour forces tied up in agriculture circa 1870, the United Kingdom had just 22.2 per cent (Broadberry, 1998: 385). For India, the agricultural share of the labour force was around 75 per cent for the century after 1870, and even by the end of the twentieth century agriculture still accounted for nearly 65 per cent of Indian employment. Given this commitment of resources to an inherently low value added

sector, and the poor productivity performance within that sector, it is not difficult to understand India's disappointing overall productivity performance during this period.

The other striking development in Table 9 is the growing share of employment accounted for by services in India, as well as in Britain. During the period of British rule in India, this was accompanied by a declining share of industry, but as agriculture began to shrink in importance, it became possible for both industry and agriculture to expand their shares of employment, particularly after 1970. Again the importance of services in Indian productivity performance highlighted by Bosworth and Collins (2007) for the current period appears to have its roots in earlier experience.

IV. PER CAPITA INCOMES AND LABOUR PRODUCTIVITY

Table 10 shows trends in comparative India/UK per capita incomes and labour productivity for the economy as a whole for the period 1871-73 to 1999-2000. The trends in the two series are quite similar, but the long term decline in India's relative position is greater for per capita income than for labour productivity. This can be explained by different trends in the share of the population in the labour force in the two countries, shown in Table 11. Whereas in the early 1870s India had a slightly larger share of the population working than the United Kingdom, by the 1990s India's share was substantially lower than the UK's. This can be explained by the growing share of young people in the Indian population and by the growing proportion of women not entering the labour force in India.

V. CROSS-CHECKING THE RESULTS

A number of recent studies have questioned the use of time series projections from a single benchmark over long periods of time, the methodology used here in Tables 8 and 10. Ward and Devereux (2003) suggest that the further one projects from the original benchmark, the bigger the discrepancy between time series projections using GDP per head in constant prices and cross-sectional benchmarks based on nominal GDP per head converted at PPPs, because of index number problems. The issue is the subject of debate in Broadberry (2003) and Ward and Devereux (2004). In fact, however, Broadberry (1993) had already suggested the use of additional benchmarks to provide cross-checks in a study of comparative productivity in manufacturing, while Broadberry (1997a; 1997b; 1998) applied the method to full sectoral productivity comparisons over the period 1870-1990 for the United Kingdom with the United States and Germany, and found broad agreement between the benchmarks and time series evidence for those countries. Broadberry and Irwin (2006; 2007) find similar agreement between time series projections and benchmarks for the United Kingdom compared with the United States in the nineteenth century and the United Kingdom compared with Australia over the period 1861-1948.

Dealing with a less developed economy such as India presents greater data problems than with relatively rich countries such as the United States and Germany. Nevertheless, for the agricultural sector at least, it is possible to collect together a number of additional benchmark estimates of comparative India/UK labour productivity levels in Table 12. For 1935/36, it is possible to use the same methods as for the 1950/51 agricultural benchmark, to arrive at a comparative India/UK labour productivity level of 7.5, which is quite consistent with the time series projection of 7.1. For the period 1970-1990, Prasada Rao (1993) provides benchmark estimates of

agricultural output per worker every 5 years for many countries, including India and the United Kingdom. These estimates suggest that the time series projections are broadly tracking the benchmarks.

For the economy as a whole, we can check the projection of GDP per capita from the 1950/51 benchmark in Table 10 against Maddison's (2003) benchmark estimate for 1990. Our time series projection suggests Indian GDP per capita in 1990 at 8.8 per cent of the UK level, which compares with Maddison's benchmark estimate of 8.5 per cent.

For industry, as yet we lack comparable benchmark studies for other years. Timmer (1999) has conducted an India/US benchmark comparison for manufacturing using Indian price data for 1983/84 and US price data for 1987 projected back to 1983. Making use of a US/UK benchmark for 1987, it is possible to derive an estimate of the India/UK comparative labour productivity level. Apart from the fact that this already involves a substantial element of time series projection to a year for which we do not have employment data, there are additional adjustments which make comparability with the Sivasubramonian (2000) data problematic. Timmer (1999) finally reports his results in the form of a benchmark for 1987, reporting Indian labour productivity in manufacturing at 16.4 per cent of the UK level for registered firms, but only 4.1 per cent for all firms. The former number is broadly consistent with our time series projections, while the latter seems difficult to square with the data on GDP per head. This suggests that Timmer is including more of the village economy in the industrial sector than Sivasubramonian (2000).

VI. CONCLUSION

This paper provides a sectoral analysis of comparative India/UK labour productivity performance over the period 1870-2000. In the late nineteenth century, overall labour productivity in India was around 15 per cent of the UK level, where it remained until the end of the 1920s. Between 1929 and 1950, India fell further behind and remained at around 10 per cent of the UK level until the 1970s, since when India has been catching-up. However, by the end of the twentieth century India remained further behind than in the late nineteenth century. This disappointing Indian productivity performance is largely due to the agricultural sector. This is the only sector where India has continued to fall further and further behind, with labour productivity at the end of the twentieth century around 1 per cent of the UK level. Although there have been fluctuations in comparative India/UK productivity in industry, there has been no trend, with India at around 15 per cent of the UK level in the late nineteenth and late twentieth centuries. Only in services has there been an upward trend in comparative India/UK labour productivity. The recent emergence of a dynamic service-led Indian economy thus has long historical roots.

TABLE 1: Indian time series for output and employment (1929=100)**A. Output**

	Agriculture	Industry	Services	GDP
1872/73	65.8	36.7	47.3	56.0
1882/83	71.0	38.9	46.8	59.1
1890/91	81.3	46.3	51.2	67.4
1900/01	82.9	56.2	53.4	70.3
1910/11	99.2	78.0	67.8	86.8
1920/21	85.0	61.9	78.9	80.1
1929/30	100.0	100.0	100.0	100.0
1935/36	99.2	107.0	102.4	101.2
1946/47	101.3	119.4	110.4	106.5
1950/51	87.8	108.0	91.6	91.7
1960/61	119.7	196.4	135.6	134.9
1970/71	149.9	333.2	212.7	193.7
1980/81	175.4	493.4	322.1	262.9
1990/91	180.7	994.3	589.2	453.0
1999/00	313.4	1,717.0	1,126.9	751.1

B. Employment

	Agriculture	Industry	Services	Total
1872/73	83.4	99.4	82.3	84.6
1882/83	84.9	100.9	84.2	86.2
1890/91	91.3	108.8	90.5	92.7
1900/01	93.1	111.2	92.0	94.5
1910/11	99.7	114.1	96.2	100.5
1920/21	99.9	103.9	93.0	99.1
1929/30	100.0	100.0	100.0	100.0
1935/36	101.7	108.4	107.6	103.2
1946/47	111.9	125.4	117.4	113.9
1950/51	112.5	130.0	127.5	116.3
1960/61	130.1	168.4	145.6	135.7
1970/71	161.5	203.0	170.9	166.7
1980/81	165.3	264.2	194.1	178.5
1990/91	208.0	316.5	278.7	228.1
1999/00	262.9	474.7	463.4	311.7

Sources: see Appendix 1.

TABLE 2: Indian labour productivity**A. Time series for output per employee (1929=100)**

	Agriculture	Industry	Services	GDP
1872/73	78.9	36.9	57.5	66.2
1882/83	83.6	38.6	55.6	68.6
1890/91	89.0	42.6	56.6	72.7
1900/01	89.0	50.5	58.0	74.4
1910/11	99.5	68.4	70.5	86.4
1920/21	85.1	59.6	84.8	80.8
1929/30	100.0	100.0	100.0	100.0
1935/36	97.5	98.7	95.2	98.1
1946/47	90.5	95.2	94.0	93.5
1950/51	78.0	83.1	71.8	78.8
1960/61	92.0	116.6	93.1	99.4
1970/71	92.8	164.1	124.5	116.2
1980/81	106.1	186.8	165.9	147.3
1990/91	86.9	314.2	211.4	198.6
1999/00	119.2	361.7	243.2	241.0

B. Average annual growth rates (% per year)

	Agriculture	Industry	Services	GDP
1872/73 to 1900/01	0.4	1.1	0.0	0.4
1900-01 to 1946/47	0.0	1.4	1.0	0.5
1950/51 to 1970/71	0.9	3.4	2.8	1.9
1970-81 to 1999/00	0.9	2.7	2.3	2.5

Sources: Derived from Table 1.

**TABLE 3: UK time series for output, employment and labour productivity
(1929=100)**

A. Output

	Agriculture	Industry	Services	GDP
1871	121.8	34.7	41.3	44.0
1881	116.8	42.6	52.5	52.2
1891	124.3	51.1	64.4	62.5
1901	113.6	64.0	78.3	75.0
1911	118.5	72.9	93.5	87.1
1920	83.5	78.0	93.5	87.0
1929	100.0	100.0	100.0	100.0
1935	103.4	112.5	107.1	109.2
1948	114.4	148.2	122.3	131.0
1950	125.8	165.7	124.6	140.7
1960	158.6	224.4	152.6	180.8
1970	201.1	296.0	195.6	235.0
1980	263.0	316.5	237.8	270.7
1990	327.8	374.0	317.5	349.5
1999	333.4	412.5	401.3	414.9

B. Employment

	Agriculture	Industry	Services	Total
1871	207.7	67.7	51.6	70.4
1881	190.4	73.4	59.5	75.5
1891	175.1	82.4	70.3	83.5
1901	161.1	93.1	83.7	93.6
1911	159.8	102.0	93.4	102.2
1920	115.9	109.5	92.5	101.8
1929	100.0	100.0	100.0	100.0
1935	91.2	98.3	103.9	100.5
1948	106.5	111.6	121.4	115.8
1950	105.0	115.2	120.5	117.0
1960	89.9	124.9	130.4	124.9
1970	59.7	123.6	141.3	127.3
1980	48.8	108.2	167.0	132.1
1990	42.4	86.4	196.6	136.3
1999	35.0	71.4	215.1	138.0

Sources: See Appendix 1.

TABLE 4: UK labour productivity**A. Time series for output per employee (1929=100)**

	Agriculture	Industry	Services	GDP
1871	58.6	51.3	80.0	62.5
1881	61.3	58.0	88.2	69.1
1891	71.0	62.0	91.6	74.9
1901	70.5	68.7	93.5	80.1
1911	74.2	71.5	100.1	85.2
1920	72.0	71.2	101.1	85.5
1929	100.0	100.0	100.0	100.0
1935	113.4	114.4	103.1	108.7
1948	107.4	132.8	100.7	113.1
1950	119.8	143.8	103.4	120.3
1960	176.4	179.7	117.0	144.8
1970	336.9	239.5	138.4	184.6
1980	538.9	292.5	142.4	204.9
1990	773.1	432.9	161.5	256.4
1999	952.6	577.7	186.6	300.7

B. Average annual growth rates (% per year)

	Agriculture	Industry	Services	GDP
1871 to 1911	0.6	0.8	0.6	0.8
1920 to 1950	1.7	2.3	0.1	1.1
1950 to 1970	5.2	2.6	1.5	2.1
1970 to 1999	3.6	3.0	1.0	1.7

Sources: Derived from Table 3.

TABLE 5: An India/UK PPP for agriculture, 1950/51

	PPP (Rs per £)	Indian weights (%)	UK weights (%)
Wheat	16.12	15.1	14.2
Rice	6.97	52.9	
Barley	10.37	3.5	13.2
Tea	12.38	3.5	
Coffee	7.68	0.3	
Sugar	19.33	14.9	15.2
Mutton	17.78	1.6	50.5
Cotton	7.15	4.7	
Wool	12.59	0.2	6.6
Silk	20.41	0.3	
Jute	9.46	2.5	
Hides	8.07	0.5	0.3
Total agriculture	13.32	100.0	100.0

Sources: Indian prices: Central Statistical Organisation (1953: Table 121); UK prices: Editor of "The Statist" (1951); Indian weights: derived from Sivasubramonian (2000: Table 3.23, Appendix Table 3(c)); UK weights: Ministry of Agriculture, Fisheries and Food (1968); Ojala (1952: 208).

TABLE 6: An India/UK PPP for industry, 1950/51

	PPP (Rs per £)	Indian weights (%)	UK weights (%)
Chemicals & allied	20.98	8.8	7.2
Metals & engineering	11.66	20.6	46.9
Textiles & clothing	6.99	54.3	17.9
Food, drink & tobacco	15.43	11.0	10.7
Other industry	14.71	5.3	17.3
Total industry	11.43	100.0	100.0

Sources: Indian prices and weights: Ministry of Commerce and Industry (1954); UK prices and weights: Board of Trade (1956).

TABLE 7: Comparative India/UK GDP per employee by sector, 1950/51**A. Compared at exchange rate**

	Agriculture	Industry	Services	GDP
India (Rs)	421	833	997	556
UK (£)	587	498	466	487
Exchange rate (Rs per £)	13.36	13.36	13.36	13.36
India/UK (UK=100)	5.4	12.5	16.0	8.5

B. Compared at sectoral PPPs

	Agriculture	Industry	Services	GDP
India (Rs)	421	833	997	556
UK (£)	587	498	466	487
PPP (Rs per £)	13.32	11.43	12.26	12.26
India/UK (UK=100)	5.4	14.6	17.5	9.3

Sources: Nominal GDP: India: Sivasubramonian (2000: Table 6.9, Appendix Table 8(a)); UK: Mitchell (1988: 824); Employment: India: Sivasubramonian (2000: Tables 2.11, 9.32); UK: Feinstein (1972: Table 59); Market exchange rate: Central Statistical Organisation (1953: Table 101); PPPs: Tables 5 and 6.

TABLE 8: Comparative India/UK labour productivity by sector (UK=100)

	Agriculture	Industry	Services	GDP
1871-73	11.2	18.2	18.1	15.0
1881-83	11.3	16.8	15.9	14.1
1890-91	10.4	17.3	15.6	13.8
1900-01	10.5	18.6	15.6	13.2
1910-11	11.1	24.2	17.7	14.4
1920-21	9.8	21.1	21.1	13.4
1929-30	8.3	25.3	25.2	14.2
1935-36	7.1	21.8	23.2	12.8
1946-48	7.0	18.1	23.5	11.7
1950-51	*5.4	*14.6	*17.5	*9.3
1960-61	4.3	16.4	20.0	9.7
1970-71	2.3	17.3	22.6	8.9
1980-81	1.6	16.1	29.3	10.2
1990-91	0.9	18.3	33.0	11.0
1999-00	1.0	15.8	32.8	11.4

Source: Derived from Tables 2, 4 and 7.

TABLE 9: Labour force by sector (%)**A. India**

	Agriculture	Industry	Services
1875	73.4	14.5	12.1
1910/11	75.5	10.3	14.2
1929/30	73.1	9.1	14.8
1950/51	73.6	10.2	16.2
1970/71	73.8	11.1	15.1
1999/00	64.2	13.9	21.9

B. United Kingdom

	Agriculture	Industry	Services
1871	22.2	42.4	35.4
1911	11.8	44.1	44.1
1929	7.5	44.2	48.3
1950	6.8	43.5	49.7
1970	3.5	42.9	53.6
2000	1.9	22.9	75.2

Sources: India: derived from Sivasubramonian (2000); UK: derived from Feinstein (1972) and O'Mahony (2002).

TABLE 10: Comparative India/UK per capita income and labour productivity (UK=100)

	GDP per capita	GDP per employee
1871-73	15.6	15.0
1881-83	15.1	14.1
1890-91	14.4	13.8
1900-01	13.6	13.2
1910-11	14.8	14.4
1920-21	13.1	13.4
1929-30	13.5	14.2
1935-36	11.9	12.8
1946-48	9.7	11.7
1950-51	*9.1	*9.3
1960-61	8.9	9.7
1970-71	8.4	8.9
1980-81	8.0	10.2
1990-91	8.8	11.0
1999-00	10.8	11.4

Sources: Population: India: Heston (1983: 394); Sivasubramonian (2000: Table 2.10, Appendix Table 8(c)); UK: Feinstein (1972: Table 55); Central Statistical Office (various years). GDP and PPPs from Tables 1, 3 and 7.

TABLE 11: Labour force share of population (%)

	India	United Kingdom
1871/73	46.1	44.5
1910/11	46.2	45.0
1929/30	41.3	42.6
1950/51	45.0	46.1
1970/71	42.8	45.7
1999/00	43.7	46.2

Sources: Labour force: India: Heston (1983: 394); Sivasubramonian (2000: Tables 2.10, 9.30-9.32); UK: Feinstein (1972: Tables 59, 60); O'Mahony (2002); Population: sources listed in Table 10.

TABLE 12: Benchmarks and time series projections in agriculture

	Time series projection	PPP benchmarks
1935/36	7.1	7.5
1950/51	*5.4	5.4
1970/71	2.3	2.3
1980/81	1.7	2.0
1990/91	0.9	1.8

Sources: Time series projection: Table 8; PPP benchmarks: 1935/36: using same method as Table 5, based on Indian data from Secretary of State for India (1939: Table 171) and UK data from Board of Trade (1939: Table 192); 1950/51: Table 5; 1970/71, 1980/81 and 1990/91: Prasada Rao (1993: Table 5.9).

APPENDIX 1: SOURCES FOR TIME SERIES PROJECTIONS OF COMPARATIVE LABOUR PRODUCTIVITY BY SECTOR

INDIA

Output by sector

1868/69 to 1900/01: Heston (1983: 397). Note that Heston provides data only for services plus small-scale industry. Small-scale industry is calculated for the pre-19000 period as the 1900-01 share (36%). The share remained at about this level until WWI, then dropped to around 30%, where it remained for the interwar period. The total of small-scale industry and services also grew only very slowly during this period, at 0.5% per annum.

1900/01 to 1946/47: Sivasubramonium (2000: Table 6.11).

1946/47 to 1999/2000: Sivasubramonium (2000: Table 8b).

Employment by sector

1868/69 to 1900/01: Heston (1983: 396). The 1900-01 employment data from Sivasubramonium (2000: Table 2.11) were used to determine the breakdown between agriculture, industry and services. The Heston (1983: 394, 396) data were used to establish the constancy of sectoral shares before 1900.

1900/01 to 1946/47: Sivasubramonium (2000: Table 2.11).

1946/47 to 1999/2000: Derived from Sivasubramonium (2000: Table 9.32).

Territory

Boundaries of British India before 1946/47, modern India thereafter.

UNITED KINGDOM

Output by sector

1871-1965: Feinstein (1972: Table 8). Weights for component parts of service sector from Feinstein (1972: 208).

1965-2000: UK National Statistics (various years), *UK National Accounts*.

Employment by sector

1871-1938: Feinstein (1972: Tables 59, 60).

1948-1999: O'Mahony (2002), projected back from 1950 to 1948 using Feinstein (1972: Table 59).

Territory

Boundaries of the United Kingdom of Great Britain and Ireland before 1920, Great Britain and Northern Ireland after 1920.

REFERENCES

A. Indian official sources

Central Statistical Organisation (1953), *Statistical Abstract, India 1951-52*, Delhi: Government of India.

Ministry of Commerce and Industry (1954), *Fifth Census of Indian Manufactures, 1950*, Calcutta: Government of India Press.

B. UK official sources

Board of Trade (1939), *Statistical Abstract for the United Kingdom, 1924-1938*, London: HMSO.

Board of Trade (1956), *Report on the Census of Production for 1951*, London: HMSO.

Central Statistical Office (various years), *Annual Abstract of Statistics*, London: HMSO.

Ministry of Agriculture, Fisheries and Food (1968), *A Century of Agricultural Statistics: Great Britain 1866-1966*, London: HMSO.

National Statistics (various years), *UK National Accounts*, London: HMSO.

Secretary of State for India (1939), *Statistical Abstract for British India, with Statistics, where available, relating to certain Indian States from 1927-28 to 1936-37*, London: HMSO.

C. Books and Articles

Balassa, B. (1964), "The Purchasing-Power Parity Doctrine: A Reappraisal", *Journal of Political Economy*, 76, 584-96.

Bergin, P.R., Glick, A.M. and Taylor, A.M. (2006), "Productivity, Tradability, and the Long-Run Price Puzzle", *Journal of Monetary Economics*, 53, 2041-2066.

Bosworth, B. and Collins, S. (2007), "Accounting for Growth: Comparing China and India", (unpublished paper, Brookings Institution).

Broadberry, S.N. (1993), "Manufacturing and the Convergence Hypothesis: What the Long-Run Data Show", *Journal of Economic History*, 53, 772-795.

Broadberry, S.N. (1997a), "Forging Ahead, Falling Behind and Catching-Up: A Sectoral Analysis of Anglo-American Productivity Differences, 1870-1990", *Research in Economic History*, 17, 1-37.

Broadberry, S.N. (1997b), "Anglo-German Productivity Differences 1870-1990: A Sectoral Analysis", *European Review of Economic History*, 1, 247-267.

Broadberry, S.N. (1998), "How did the United States and Germany Overtake Britain? A Sectoral Analysis of Comparative Productivity Levels, 1870-1990", *Journal of Economic History*, 58, 375-407.

Broadberry, S.N. (2003), "Relative Per Capita Income Levels in the United Kingdom and the United States since 1870: Reconciling Time-Series Projections and Direct-Benchmark Estimates", *Journal of Economic History*, 63, 852-863.

Broadberry, S.N. and Irwin, D.A. (2006), "Labor Productivity in Britain and America during the Nineteenth Century", *Explorations in Economic History*, 43, 257-279.

Broadberry, S.N. and Irwin, D.A. (2007), "Lost Exceptionalism? Comparative Income and Productivity in Australia and the United Kingdom, 1861-1948", *Economic Record*, (forthcoming).

Editor of "The Statist" (1951), "Wholesale Prices in 1950", *Journal of the Royal Statistical Society, Series A (General)*, 114, 408-422.

Feinstein, C.H. (1972), *National Income, Expenditure and Output of the United Kingdom, 1855-1965*, Cambridge: Cambridge University Press.

Heston, A. (1983), “National Income”, in Kumar, D. and Desai, M. (eds.), *The Cambridge Economic History of India, Volume 2: c.1757-c.1970*, Cambridge: Cambridge University Press, 463-532.

Maddison, A. (1995), *Monitoring the World Economy, 1820-1992*, Paris: Organisation for Economic Co-operation and Development.

Maddison, A. (2003), *The World Economy: Historical Statistics*, Paris: Organisation for Economic Co-operation and Development.

Mitchell, B.R. (1988), *British Historical Statistics*, Cambridge: Cambridge University Press.

O’Mahony, M. (2002), *National Institute Sectorial Productivity Dataset*, NIESR, London, <http://www.niesr.ac.uk/research/research.htm#4>.

Ojala, E.M. (1952), *Agriculture and Economic Progress*, Oxford: Oxford University Press.

Pilat, D. (1993), “The Sectoral Productivity Performance of Japan and the United States, 1885-1990”, *Review of Income and Wealth*, 39, 357-375.

Prasada Rao, D.S. (1993), “Intercountry Comparisons of Agricultural Output and Productivity”, FAO Economic and Social Development Paper No. 112, Food and Agriculture Organisation, Rome.

Samuelson, P.A. (1964), “Theoretical Notes on Trade Problems”, *Review of Economics and Statistics*, 46, 145-54.

Sivasubramonian, S. (2000), *The National Income of India in the Twentieth Century*, New Delhi: Oxford University Press.

Timmer, M. (1999), “The Dynamics of Asian Manufacturing: A Comparative Perspective, 1963-1993”, Eindhoven: Eindhoven Centre for Innovation Studies.

Ward, M. and Devereux, J. (2003), “Measuring British Decline: Direct versus Long-Span Income Measures”, *Journal of Economic History*, 63, 826-851.

Ward, M. and Devereux, J. (2004), “Relative U.K./U.S. Output Reconsidered: A Reply to Professor Broadberry”, *Journal of Economic History*, 64, 879-891.