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The historical roots of India's service-led development: A sectoral analysis of Anglo-Indian productivity differences, 1870–2000

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ABSTRACT

India fell further behind the UK in terms of GDP per capita and overall labour productivity between the 1870s and the 1970s, but has been catching-up since. This paper offers a sectoral analysis of these trends. Comparative India/UK labour productivity in agriculture has declined continuously, and agriculture still accounts for around two-thirds of employment in India. Agriculture thus played a key role in India's falling behind and has subsequently slowed down the process of catching up. Although there have been substantial fluctuations in comparative India/UK labour productivity in industry, this sector has exhibited no long run trend. The only sector to exhibit an upward trend in comparative India/UK labour productivity is services. India's recent emergence as a dynamic service-led economy thus appears to have long historical roots. Although India has been characterised by relatively low levels of physical and human capital formation overall, its education provision has historically been unusually skewed towards secondary and tertiary levels. This has provided a limited supply of high productivity workers who have been employed predominantly in services.

1. Introduction

This paper examines the comparative productivity performance of India and the United Kingdom since the late 19th century. Although there are a number of existing studies of comparative productivity and income over this period for members of today's rich-country convergence club, there are none comparing the experience of countries which have remained less developed with the experience of rich nations (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 developed nations. 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).

A second reason for making a long run comparative study of India is 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 and other fast-growing Asian economies, where manufacturing has played a leading role (Bosworth and Collins, 2008). In this paper, we ask to what extent this success in services has long historical roots, by breaking down aggregate economic performance on a sectoral basis.

A third reason for examining long run comparative productivity performance between these two nations is provided by the recent debate over the timing of the Great Divergence of productivity and living standards between Europe and Asia.

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Parthasarathi (1998) and Pomeranz (2000) have claimed that India and China, respectively, remained on the same development level as Britain in the late 18th century and fell behind only during the 19th century. However, this would be very difficult to reconcile with the evidence on comparative GDP per capita accumulated by Maddison (1995, 2003), which suggests that in 1870, Indian and Chinese living standards were little more than 15 per cent of the UK level. This has led Frank (1998) to reject the Maddison data in favour of alternative estimates by Bairoch (1981), which show "future developed countries" and "future third world countries" on a par at the end of the 18th century. Both Maddison (2003) and Bairoch (1981) obtain their estimates of comparative GDP per capita by projecting backwards from a recent benchmark year, using national time series of GDP and population for many countries. Recent debates have suggested the need for additional benchmarks in earlier years, to provide cross-sectional checks on the time series projections (Ward and Devereux, 2003, 2004; Broadberry, 2003). This paper provides some earlier benchmark evidence for the India/UK case that is consistent with the Maddison (2003) projections, and therefore supportive of Broadberry and Gupta's (2006) case for an early modern Great Divergence.

The comparative labour productivity performance can be summarised as follows. Between 1870 and 1970, output per worker in India fell from around 15 per cent of the UK level in the economy as a whole to less than 10 per cent, as India fell further behind. Since the 1970s, India has begun to catch up on the United Kingdom, but by the end of the 20th 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 more than 10 per cent of the UK level, by 1999/2000 this had fallen to around 1 per cent. In industry, comparative India/UK labour productivity has been stationary, with India returning to around 15 per cent of the UK level, although there have also been substantial periods of deviation from this long run level. In services, there has been a trend improvement of India's comparative labour productivity position from around 15 per cent of the UK level in the late 19th century to around 30 per cent by the late 20th 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 20th 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, 2008).

The paper proceeds as follows. Section 2 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 3, while Section 4 considers ways of cross-checking the results. Section 5 investigates the long historical roots of India's better comparative performance in services. Although the overall level of investment in physical and human capital has been low, India has historically devoted a large share of its spending on education to secondary and higher levels. Thus India has produced a small cadre of highly educated workers, who have been employed largely in services. Section 4 concludes.

2. Data and methods for Anglo-Indian productivity comparisons

2.1. 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 20th century and Heston (1983) for the late 19th 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 A1 in the Appendix presents the output and employment data for the whole economy and for the three main sectors, agriculture, industry and services, together with a detailed listing of sources. 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 comprise railways and communications, government services, other commerce and transport, professions and liberal arts, domestic service and house property.

The output and employment data from the Appendix can be used to calculate indices of labour productivity by major sector. From these indices it is possible to calculate the average annual growth rates of labour productivity by sector, which are presented here in Table 1. During the late 19th century, labour productivity growth was fastest in industry, as modern industry developed in India, and slowest in services, despite the modernisation of the transport network. During the first half of the 20th 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 20th century, respectable labour productivity growth in industry and services has again been offset by slow productivity growth in agriculture.

2.2. 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, the series are presented in the Appendix, together with full details of data sources. The territory covered refers to the United Kingdom of Great Britain

Table 1
Average annual growth rates of output per employee (% per year).

	Agriculture	Industry	Services	GDP
A. India				
1872/73–1900/01	0.4	1.1	0.0	0.4
1900/01–1946/47	0.0	1.4	1.0	0.5
1950/51–1970/71	0.9	3.4	2.8	1.9
1970/71–1999/00	0.9	2.7	2.3	2.5
B. United Kingdom				
1871–1911	0.6	0.8	0.6	0.8
1920–1950	1.7	2.3	0.1	1.1
1950–1970	5.2	2.6	1.5	2.1
1970–1999	3.6	3.0	1.0	1.7

Source: Derived from Appendix Tables A1 and A2.

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. As in the Indian case, the output and employment series can be combined to derive indices of labour productivity, from which the labour productivity growth rates shown in Table 1 are calculated.

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 for India and the United Kingdom in Table 1, due to the different dates of major boundary changes, there are indications of some of the major factors behind the differential labour productivity growth performance of India and the United Kingdom. First, note that overall labour productivity grew faster in Britain than in India before 1970, and faster in India since 1970. We should thus expect to see India falling further behind Britain until around 1970 and beginning to catch up thereafter. Second, the largest growth rate differentials were in agriculture, so that we can expect to see this sector making a large contribution to Indian falling behind. Third, during the period of Indian 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 (2008) on the key role of services in Indian growth.

2.3. A benchmark for 1950

The labour productivity data for India and the United Kingdom from the Appendix 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 ca. 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 and the availability of low wage labour.

Table 2 provides an India/UK PPP for agriculture ca. 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, so that no farm gate price exists for this product. Since rice was imported into Britain, however, a wholesale price can be obtained. 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 3 provides a PPP for industry ca. 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

Table 2
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 3
An India/UK PPP for industry, 1950/51.

	PPP (Rs per £)	Indian weights (%)	UK weights (%)
Chemicals and allied	20.98	8.8	7.2
Metals and engineering	11.66	20.6	46.9
Textiles and clothing	6.99	54.3	17.9
Food, drink and 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).

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.

The validity of the PPP results clearly depends on the accurate matching of products and industries between the two countries. In this particular case, it is perhaps worth noting that the classification scheme used in the Indian production census was modelled very closely on the British census, making the process of matching relatively straightforward. Furthermore, in the case of differentiated products, it is important to allow only for vertical product differentiation, not horizontal product differentiation as a result of differences in tastes. This is generally recognised in the classification system, which provides separate information on, for example, different types of steel, soap, yarn etc. Given the small scale of the deviation of the PPP from the exchange rate compared with the scale of the productivity differences, we can be confident that quality differences do not play a large role in the results. A more detailed discussion of this issue is contained in Broadberry (1997c: 24–25).

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 12.26 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 et al. (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 4 to provide a benchmark level of comparative labour productivity by sector ca. 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 ca. 1950, Indian output per worker was less than 10 per cent of the UK level.

3. Sectoral aspects of productivity performance

3.1. Comparative labour productivity levels by sector

Table 5 provides a breakdown of comparative labour productivity levels by the three main sectors of agriculture, industry and services. It is clear that agriculture played a key role in India's falling further behind during the period 1871/73–1970/71

Table 4
Comparative India/UK GDP per employee by sector, 1950/51.

	Agriculture	Industry	Services	GDP
A. Compared at exchange rate				
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				
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 2 and 3.

Table 5
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 Appendix Tables A1 and A2.
* Indicates benchmark year for time series projections.

and has subsequently slowed down the process of catching-up. 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 1970s, this had fallen to around 2 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.

3.2. 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 6 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 already by the late 19th century devoted a very small share of the labour force to agriculture. Thus, for example, while both Germany and the United States still had around 50 per cent of their labour forces tied up in agriculture ca. 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 20th 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 6 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 services to expand their shares of

Table 6
Labour force by sector (%).

	Agriculture	Industry	Services
A. India			
1875	73.4	14.5	12.1
1910/11	75.5	10.3	14.2
1929/30	76.1	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			
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).

employment, particularly after 1970. Again the importance of services in Indian productivity performance highlighted by Bosworth and Collins (2008) for the current period appears to have its roots in earlier experience.

4. 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 Table 5. 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,b, 1998, 2006) 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 19th 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 7. 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 employee from the 1950/51 benchmark in Table 5 against Maddison's (2003) benchmark estimate for 1990. Our time series projection in Table 5 puts Indian GDP per employee in 1990 at 11.0 per cent of the UK level. However, to compare with Maddison's benchmark of 8.5 percent, we need to work in terms of GDP per capita rather than GDP per employee. Sivasubramonian (2000: 617–620), drawing on the work of Visaria (2002), suggests a lower ratio of employment to population in India than in Britain, resulting in a time series projection of Indian GDP per capita of 8.8 per cent of the UK level in 1990, very close to the Maddison benchmark.

Table 7
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 5; PPP benchmarks: 1935/36: using same method as Table 2, 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 4; 1970/71, 1980/81 and 1990/91: Prasada Rao (1993:Table 5.9).
* Indicates benchmark year for time series projections.

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).

Our findings have some implications for the recent debate over the timing of the Great Divergence of productivity and living standards between Europe and Asia. Although the debate has centred around the claims of Pomeranz (2000) that China was as developed as Europe in the late 18th century and fell behind only during the 19th century, similar claims have been made for India by Parthasarathi (1998), who argues for slightly higher wages in south India than in England as late as the second half of the 18th century. This would be very difficult to reconcile with Maddison's (1995, 2003) evidence on comparative GDP per capita, which suggests that in 1870, Indian living standards were little more than 15 per cent of the UK level. Because the rate of growth of British per capita income before 1870 has been established firmly and was not particularly fast, this would imply an implausibly large collapse of Indian living standards during the 19th century (Crafts and Harley, 1992; Deane and Cole, 1967).

One possible way out of this conundrum, suggested by Frank (1988), would be to reject the Maddison data in favour of alternative estimates by Bairoch (1981), the sources for which were never adequately documented. Bairoch's (1981) estimates show "future developed countries" and "future third world countries" on a par at the end of the 18th century, and a smaller gap in the second half of the 19th century than suggested by Maddison. Since both Maddison (2003) and Bairoch (1981) obtain their estimates of 19th century comparative GDP per capita by projecting backwards from a recent benchmark year, using national time series of GDP and population for many countries, one way of deciding between the two sets of estimates is through consistency with earlier benchmarks and sectoral evidence, following the methodology of Broadberry (2003). The benchmark evidence for the India/UK case discussed in this section is consistent with the Maddison (2003) projections, and thus confirms Broadberry and Gupta's (2006) case for an early modern Great Divergence.

5. The historical roots of service-led growth

5.1. The contributions of physical and human capital to aggregate performance

The sectoral analysis suggests that the recent dynamic performance of services is not something which suddenly emerged during India's recent phase of overall catching-up, but rather has long historical roots. Indeed, India has been catching-up in services since the late 19th century, and we now investigate the factors behind this early dynamism of India's service sector and its persistence into the present. We shall emphasise a long-standing high share of secondary and higher education in Indian educational investment, even at very low levels of development.

However, to avoid misunderstanding, it is important to place this finding in the context of generally low levels of accumulation of both human and physical capital in India. In this section, we therefore set out the record of investment in physical and human capital in India and the United Kingdom over the period since 1890 in a growth accounting framework. Appendix Table A3 provides time series of the non-residential capital stock in India and the United Kingdom and uses the data to calculate total factor input (TFI) and total factor productivity (TFP) in the two economies. The Indian data are not available on a sectoral basis, so the estimates are provided only for the aggregate economy. The UK capital stock data are taken from Feinstein (1972, 1988) for the period before 1950 and from the official national accounts for later years. For India, the post-1950 data are from Sivasubramonian (2004), while the pre-1950 data are from van Leeuwen (2007), based on the investment data of Roy (1996).

To calculate TFP, we derive weights for capital and labour from their respective factor shares. For the United Kingdom, the share of capital declined from 44 per cent before World War I to 35 percent between the wars and 30 per cent after World War II (Matthews et al., 1982: 164). For India, the share of capital is only available for the post-World War II period from Sivasubramonian (2004: 27–28). Since the share of capital in postwar India was relatively high, at 40 percent, we have used the same weights for the pre-World War II period. The data in Table 8 suggest low social returns to the growth of the capital stock in colonial India, with no TFP growth before 1950. The 1930s were a particularly unproductive period, with relatively stagnant output despite substantial growth in the non-residential capital stock. India was falling further behind in terms of TFP until 1950, as TFP growth was strongly positive in the United Kingdom during this period. The postwar period saw positive TFP growth in India, but at a slightly lower rate than in the United Kingdom until 1970. Since 1970, TFP growth has accelerated in India and decelerated in the United Kingdom, so that India has been catching up in terms of TFP as well as labour productivity during this period. The results are consistent with the findings of Sivasubramonian (2004) and Bosworth et al. (2007) for postwar India and Matthews et al. (1982) for 20th century Britain.

Table 8
Growth rates of TFP (% per year).

	India		UK
1890/91–1900/01	−0.8	1891–1911	0.3
1900/01–1946/47	−0.1	1920–1950	1.0
1950/51–1970/71	1.0	1950–1970	1.3
1970/71–1999/00	1.3	1970–1999	0.9

Source: Derived from Appendix Table A3.

Table 9 presents the TFP data on a comparative India/UK basis, with UK = 100 in all years. To do this it is necessary to estimate the comparative level of TFP in 1950, our benchmark year. The nominal level of capital per employee is compared at the PPP for industry. The first column of Table 9 reproduces the comparative labour productivity data from Table 5. The second column indicates that India's capital stock per employee has increased from around 5 per cent of the UK level to around 7 per cent of the UK level, with most of the increase occurring in the 1930s and 1940s. The upshot for comparative TFP levels is shown in the third column. India's TFP level fell substantially relative to the UK level during the period of rapid capital accumulation of the 1930s and 1940s, but has grown throughout the postwar period. By the end of the 20th century, however, India was still further behind than during the late 19th century. At the aggregate level, then, we can conclude that in the late 19th and early 20th centuries, low stocks of physical capital explained much of India's low level of labour productivity. However, from the end of the 1920s, inefficient utilisation of the factors of production explained an increasingly large part of India's poor labour productivity performance.

Table 10 shows average years of education in the population aged 25 and older for India and the United Kingdom. For the period from 1950, the data are taken from Barro and Lee (2001). The 1950 levels have been projected to earlier years using data on the average years of education of the UK male population aged 15 years and older from Matthews et al. (1982) and the average years of education of the Indian population aged 15 and over from van Leeuwen (2007). The scale of the human capital difference between India and Britain was of the same order of magnitude in the late 19th century as the physical capital difference. However, during the 20th century, India has closed the human capital gap much more successfully than the physical capital gap.

Finally, the results of this section can be used to place the findings of Bosworth and Collins (2008) on India's recent growth performance in historical perspective. They note that at the aggregate level, physical and human capital accumulation have contributed relatively little to Indian growth in the period since 1978. Once again, this finding can be seen to have long historical roots.

5.2. Human capital and sectoral performance

We now turn to the contribution of human capital to India's service sector performance. Per capita expenditure on education and the share of education in total expenditure was low in British India compared not only to the United Kingdom and other British colonies, but also in comparison to the princely states in India and other underdeveloped countries (Chaudhary, 2009: 279). However, this mainly affected primary education, and the picture was rather different in secondary education. In the early 20th century, Chaudhary (2009: 281) shows that the percentage of the population in secondary education was higher in India than in France and Japan, and only marginally below England and Wales. Table 11 shows the share of secondary and higher education in total government expenditure on education in India, together with data for Indonesia and

Table 9
India/UK comparative TFP (UK = 100).

	Comparative Y/L	Comparative K/L	Comparative TFP
1890/91	13.8	4.3	41.9
1900/01	13.2	5.2	37.4
1910/11	14.4	4.3	44.0
1920/21	13.4	4.1	42.6
1929/30	14.2	4.5	43.2
1935/36	12.8	5.2	36.9
1946/48	11.7	7.0	29.9
1950/51	9.3*	7.1*	23.5*
1960/61	9.7	6.7	24.7
1970/71	8.9	6.1	22.7
1980/81	10.2	6.7	24.2
1990/91	11.0	6.9	25.3
1999/00	11.4	6.9	25.4

Source: Derived from Appendix Table A3.
* Indicates benchmark year for time series projections.

Table 10
Average years of education in the population aged 25 and older.

	India	United Kingdom
1890/91	0.20	4.23
1910/11	0.37	5.36
1929/30	0.64	6.47
1950/51	1.20	7.32
1970/71	1.90	7.66
1990/91	3.68	8.74
1999/00	4.77	9.35

Sources: Barro and Lee (2001: http://www.cid.harvard.edu/ciddata/ciddata.html); van Leeuwen (2007: Table A.7.1), Matthews et al. (1982: 573).

Table 11
Share of secondary and higher education in total government expenditure on education (%).

	India	Indonesia	Japan
1890	61.2	18.8	14.8
1910	62.3	18.5	24.2
1930	59.5	21.4	30.8
1950	57.3	28.2	59.6
1970	75.5	36.2	62.9
1990	56.9	58.8	66.9

Source: van Leeuwen (2007: 276–284).

Japan. The data have been put carefully onto a comparable basis by van Leeuwen (2007) for a comparative study of human capital and economic growth in these three economies. At the aggregate level, van Leeuwen (2007) finds that India and Indonesia had relatively low levels of investment in education compared with Japan, as would be expected if human capital has a role to play in economic development. However, the data in Table 11 also confirm Chaudhary's (2009) finding that the little investment in education occurring in India was dramatically skewed towards secondary and higher levels, rather than primary education. Indeed, as early as the late 19th century, India already exhibits the pattern of a developed country in the distribution of resources across the different levels of education. If these more highly educated workers were employed predominantly in services, then it would help to explain the better labour productivity performance of Indian services.

Fig. 1 shows the breakdown of the labour force by level of education in the main sectors of the Indian economy in 2001. Clearly, the proportion of workers with secondary or higher education is much greater in finance and public administration,

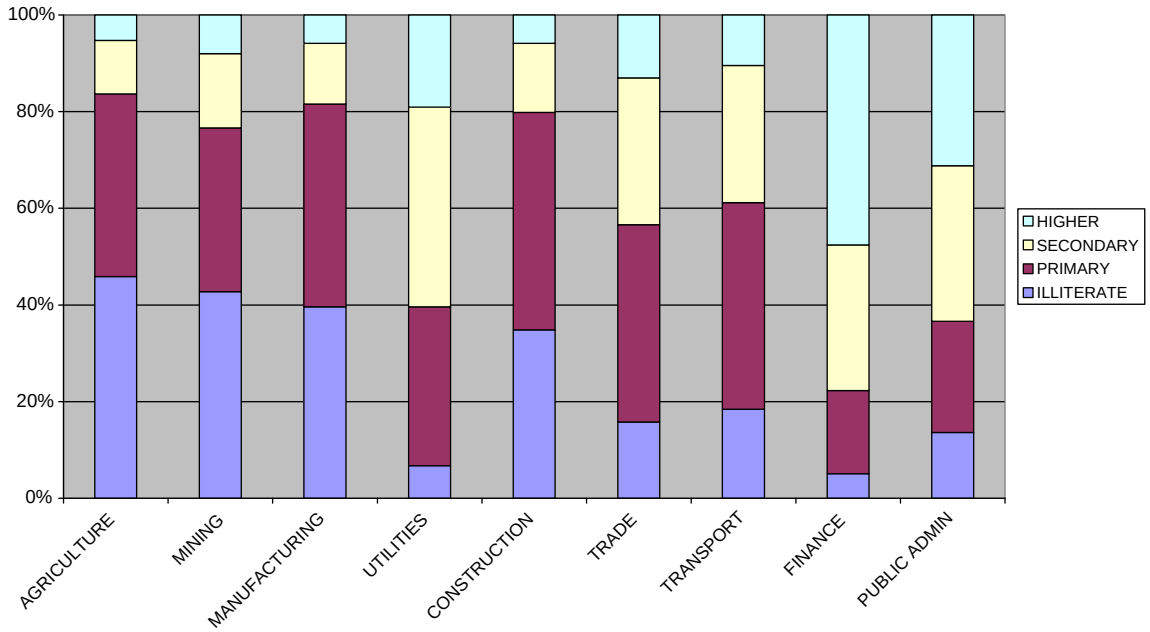

Fig. 1. Educations levels of employees in India by sector, 2001 (%). Source: Office of the Register General and Census Commissioner (2003).

but the ratio is also very favourable in trade and transport. The only non-service sector with a high share of its labour force educated above primary level is the very small utilities sector. The majority of workers in Indian agriculture and the rest of industry are illiterate or educated only to primary level. India's most highly educated workers today are thus disproportionately employed in services, the most dynamic sector. We now show that this was also the case in the early 20th century, and provide a historical explanation for this elitist system of education.

Although the 1901 census does not allow us to provide a complete breakdown of the education levels of workers by sector, it is still possible to demonstrate an association between education and services. First, the 1901 census shows that the inhabitants of urban areas were far better educated than those of rural areas. Whereas 259 males and 49 females per thousand could read and write in large towns, the corresponding literacy rates for the country as a whole were 98 for males and seven for females. Although the cities were not the only centres of commerce, they were where the centres of higher education, seats of government and the law courts were located. A second way of demonstrating a link between education and services is through the caste system. The statistics of education by religion show that the Parsis were by far the most educated group, with nearly three-quarters of males and more than half of females able to read and write, giving a figure of almost two-thirds for all Parsis. The Jains were the next most highly educated, with 47 per cent of males and 2 per cent of females literate, giving a figure of 25 per cent for all Jains. Both these communities had a large presence in trade, commerce and modern industry. Evidence from another well studied trading community in Bengal also supports this association between literacy and commercial services. Drawing on the Census of 1921, Timberg (1978: 67) shows that among the Marwaris in Calcutta, a trading community that migrated from Western India to Bengal, literacy among the males was as high as in the elite castes in Bengal, although very low amongst women.

The caste system can be seen as playing an important role in these patterns of education and sectoral productivity performance. Few occupations required much education, and given the hereditary structure of occupation through the caste system, education remained confined to the elite castes. The majority of people involved in agriculture and cottage industry had little demand for education, as there were no incentives of upward mobility. The upper castes had their own schools and when state education became a reality in colonial India, they were in a position to exploit the system. In states where caste divisions were stronger, the schools catered specifically to the upper caste children. Chaudhary (2009: 291–296) finds that districts with greater caste diversity spent less on primary education and districts with a high share of Brahmans (the priestly caste) and other upper castes had a high proportion of secondary schools, again suggestive of the high demand for post-primary education among the elites.

Table 12
Literacy rates per 1000 by caste in Indian states, 1901.

	Males	Females		Males	Females
Assam	**67**	**4**	**United Provinces of Agra and Oudh**	**57**	**2**
Brahman	517	27	Kayastha	553	46
Kayastha	471	56	Barhai	17	1
			Lohar	17	1
Bengal	**104**	**5**	**Baroda state**	**163**	**8**
Baidya	648	259	Chatidraseni (Kayastha Prabhu)	744	88
Kayastha	560	66	Brahman (Maharashtra)	730	56
Brahman	467	26	Vania	631	18
			Brahman (Gujurat)	429	17
Berar	**85**	**3**	**Central India Agency**	**55**	**3**
Brahman	595	47	Maratha	231	10
Wani	530	8	Brahman	183	3
Pathan	104	7			
Bombay	**116**	**9**	**Cochin State**	**224**	**45**
Vani (Gujurat)	776	158	Brahman (Malayali)	695	227
Prabhu	474	177	Kshatriya (Malayali)	615	319
Brahman	580	54			
Burma	**378**	**45**	**Mysore State**	**93**	**8**
Burmese	490	55	Brahman	681	64
Talaing	357	62	Digambara	410	21
Karen	143	37	Panchala	177	4
Central Provinces	**54**	**2**	**Travancore State**	**215**	**31**
Bania	446	11	Brahman (Malayali)	663	191
Brahman	365	9	Ambalavasi	576	156
Sonar	215	4			
Madras	**119**	**9**			
Eurasian	729	710			
Brahman	578	44			
Native Christian	162	59			

Source: Risley and Gait (1903), *Report on the Census of India*, 1901.

Given the economic conditions of the majority of the people and the rigidities of the caste system, it is not surprising that education was confined to a small elite of occupational groups such as priests, traders and accountants, who worked largely in the service sector. Furthermore, the narrow boundaries of caste groups within which a demand for education existed ensured that there was a disproportionately high demand for secondary education.

It is clear, then, that the elites had a strong preference for secondary and higher education. However, it should also be noted that within the elites, the trading castes had similar preferences to the Brahmans, the group usually considered to have had the highest demand for education. Table 12 examines the caste-level literacy figures by province for 1901. The figures in bold give the literacy rates for all castes in the province, while the other figures give the rates for the elite priestly, warrior and trading castes. The caste hierarchy differed across regions, with different castes dominant in trade, commerce and other services in different provinces. In all provinces, the trading castes and others involved in services shared similar levels of literacy as the Brahmans. Indeed, in some provinces, such as Bengal, Bombay and Madras, the castes engaged in trade and commerce had significantly higher levels of literacy than the Brahmans. Table 12 thus suggests that the high levels of education found in the Indian service sector today date back at least to the beginning of the 20th century.

We have focused here on education by caste to explain high productivity in Indian services. However, there may be additional links between the caste system and service sector productivity. Kumar (1987: 393) ends an interesting article on services in Madras Presidency in the first half of the 19th century with the question: "is it indeed the case that in India services were performed outside the family by specialists, to a much larger extent than in other comparable societies and if so, does the caste system provide an explanation?" A game-theoretic interpretation of the caste system as a means of contract enforcement by Freitas (2007) appears to answer this question in the affirmative. First, a high degree of occupational specialisation is seen as resulting from an enforcement strategy which involves the denial of a service by a monopoly supplier. Second, a high degree of reliance on the provision of services outside the family even at low levels of development results from the purity system, which bolsters the monopoly position of suppliers.

A number of other studies also provide a favourable interpretation of community networks based on the caste system solving informational problems which are particularly prevalent in commercial services (Timberg and Aiyar, 1980; Timberg, 1978; Rudner, 1994; Gupta, 2008). Here, however, it is important to emphasise that we are seeking to explain the relatively better performance of Indian services within an overall context of low productivity compared with other countries. Indeed, Wolcott (2008) points to negative effects of the caste system in industry, attributing the very high propensity to strike among Indian textile workers to social norms of mutual support established through caste networks. Again, this helps to understand the relative performance of Indian services and industry.

6. Conclusion

This paper provides a sectoral analysis of comparative India/UK labour productivity performance over the period 1870–2000. Between 1870 and 1970, output per worker in India fell from around 15 per cent of the UK level in the economy as a whole to less than 10 per cent, as India fell further behind. Since the 1970s, India has begun to catch-up on the United Kingdom, but by the end of the 20th century, was still further behind than in the early 1870s. 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 20th 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 19th and late 20th 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. Although overall levels of investment in human capital have been low in India, there has been a long-standing bias towards secondary and higher education, and these educated workers have been employed largely in services, where their productivity has been relatively high.

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Appendix A

Data and sources for time series projections.

Table A1
Time series for Indian output, employment and labour productivity by sector (1950 = 100).

	Agriculture	Industry	Services	GDP
A. Indian output				
1872/73	74.9	34.0	51.6	61.1
1882/83	80.9	36.0	51.1	64.4
1890/91	92.6	42.9	55.9	73.5
1900/01	94.4	52.0	58.3	76.7
1910/11	113.0	72.2	74.0	94.7
1920/21	96.8	57.3	86.1	87.4
1929/30	113.9	92.6	109.2	109.1
1935/36	113.0	99.1	111.8	110.4
1946/47	115.4	110.6	120.5	116.1
1950/51	100.0	100.0	100.0	100.0
1960/61	136.3	181.9	148.0	147.1
1970/71	170.7	308.5	232.2	211.2
1980/81	199.8	456.9	351.6	286.7
1990/91	205.8	920.6	643.2	494.0
1999/00	356.9	1,589.8	1,230.2	819.1
B. Indian employment				
1872/73	74.1	76.5	64.5	72.7
1882/83	75.5	77.6	66.0	74.1
1890/91	81.2	83.7	71.0	79.7
1900/01	82.8	85.5	72.2	81.3
1910/11	88.6	87.8	75.5	86.4
1920/21	88.8	79.9	72.9	85.2
1929/30	88.9	76.9	78.4	86.0
1935/36	90.4	83.4	84.4	88.7
1946/47	99.5	96.5	92.1	97.9
1950/51	100.0	100.0	100.0	100.0
1960/61	115.6	129.5	114.2	116.7
1970/71	143.6	156.2	134.0	143.3
1980/81	146.9	203.2	152.2	153.5
1990/91	184.9	243.5	218.6	196.1
1999/00	233.7	365.2	363.5	268.0
C. Indian output per employee				
1872/73	101.1	44.4	80.0	84.0
1882/83	107.2	46.4	77.4	87.0
1890/91	114.1	51.2	78.7	92.2
1900/01	114.1	60.8	80.8	94.3
1910/11	127.5	82.3	98.1	109.5
1920/21	109.0	71.7	118.1	102.5
1929/30	128.1	120.4	139.2	126.8
1935/36	125.0	118.8	132.5	124.4
1946/47	116.0	114.6	130.9	118.6
1950/51	100.0	100.0	100.0	100.0
1960/61	117.9	140.4	129.6	126.1
1970/71	118.9	197.6	173.2	147.4
1980/81	136.0	224.8	231.0	186.8
1990/91	111.3	378.1	294.3	251.9
1999/00	152.7	435.4	338.5	305.6

Sources:

Output by sector

1868/69–1900/01: 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.
1900/01–1946/47: Sivasubramonian (2000: Table 6.11).
1946/47–1999/2000: Sivasubramonian (2000: Table 8b).

Employment by sector

1868/69–1900/01: Heston (1983: 396). The 1900–01 employment data from Sivasubramonian (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.
1900/01–1946/47: Sivasubramonian (2000: Table 2.11).
1946/47–1999/2000: Derived from Sivasubramonian (2000): Table 9.32).

Territory

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

Table A2
UK time series for output, employment and labour productivity by sector (1950 = 100).

	Agriculture	Industry	Services	GDP
A. UK output				
1871	96.8	20.9	33.1	31.3
1881	92.8	25.7	42.1	37.1
1891	98.8	30.8	51.7	44.4
1901	90.3	38.6	62.8	53.3
1911	94.2	44.0	75.0	61.9
1920	66.4	47.1	75.0	61.8
1929	79.5	60.4	80.3	71.1
1935	82.2	67.9	86.0	77.6
1948	90.9	89.4	98.2	93.1
1950	100.0	100.0	100.0	100.0
1960	126.1	135.4	122.5	128.5
1970	159.9	178.6	157.0	167.0
1980	209.1	191.0	190.9	192.4
1990	260.6	225.7	254.8	248.4
1999	265.0	248.9	322.1	294.9
B. UK employment				
1871	197.8	58.8	42.8	60.2
1881	181.3	63.7	49.4	64.5
1891	166.8	71.5	58.3	71.4
1901	153.4	80.8	69.5	80.0
1911	152.2	88.5	77.5	87.4
1920	110.4	95.1	76.8	87.0
1929	95.2	86.8	83.0	85.5
1935	86.9	85.3	86.2	85.9
1948	101.4	96.9	100.7	99.0
1950	100.0	100.0	100.0	100.0
1960	85.6	108.4	108.2	106.8
1970	56.9	107.3	117.3	108.8
1980	46.5	93.9	138.6	112.9
1990	40.4	75.0	163.2	116.5
1999	33.3	62.0	178.5	117.9
C. UK output per employee				
1871	48.9	35.6	77.4	52.0
1881	51.2	40.3	85.3	57.5
1891	59.3	43.1	88.6	62.2
1901	58.9	47.8	90.5	66.6
1911	61.9	49.7	96.8	70.9
1920	60.1	49.5	97.8	71.1
1929	83.5	69.5	96.7	83.2
1935	94.6	79.6	99.7	90.4
1948	89.7	92.3	97.4	94.1
1950	100.0	100.0	100.0	100.0
1960	147.2	124.9	113.2	120.4
1970	281.2	166.5	133.9	153.5
1980	449.8	203.4	137.7	170.4
1990	645.3	300.9	156.2	213.2
1999	795.1	401.7	180.4	250.0

Sources:
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 and 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.

Table A3
Aggregate time series for capital stock and total factor productivity (1950 = 100).

	GDP	Employment	Capital	TFI	TFP
A. India					
1890/91	73.5	79.7	29.1	53.3	138.0
1900/01	76.7	81.3	38.7	60.4	127.0
1910/11	94.7	86.4	39.1	62.9	150.5
1920/21	87.4	85.2	41.6	64.0	136.5
1929/30	109.1	86.0	51.7	70.1	155.5
1935/36	110.4	88.7	64.3	78.0	141.4
1946/47	116.1	97.9	93.2	96.0	121.0
1950/51	100.0	100.0	100.0	100.0	100.0
1960/61	147.1	116.7	130.6	122.1	120.5
1970/71	211.2	143.3	218.3	169.6	124.6
1980/81	286.7	153.5	344.6	212.1	135.2
1990/91	494.0	196.1	556.1	297.6	166.0
1999/00	819.1	268.0	971.2	448.6	182.6
B. UK					
1891	44.4	71.4	42.6	57.3	77.5
1901	53.3	80.0	52.2	66.8	79.8
1911	61.9	87.4	64.5	77.0	80.3
1920	61.8	87.0	73.1	82.1	75.3
1929	71.1	85.5	80.6	84.0	84.6
1935	77.6	85.9	85.6	86.0	90.2
1948	93.1	99.0	95.8	98.0	95.0
1950	100.0	100.0	100.0	100.0	100.0
1960	128.5	106.8	126.2	112.2	114.5
1970	167.0	108.8	194.2	129.4	129.0
1980	192.4	112.9	269.4	146.5	131.2
1990	248.4	116.5	342.2	160.9	154.3
1999	294.9	117.9	436.7	174.6	168.8

Sources for gross fixed non-residential capital stock:
India
1890/91–1950/51: van Leeuwen (2007: Table A2), derived from Roy (1996). The capital stock in 1950/51 was reduced to 82.7 per cent of van Leeuwen's level in line with population, to take account of lower population in modern India compared with colonial India.
1950/51–1999/00: Sivasubramonian (2004: Table 4.4).

United Kingdom
1871–1920: Feinstein (1988: Table XI).
1920–1965: Feinstein (1972: Table 44).
1965–1996: UK National Statistics (various years), *UK National Accounts*.
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