NEW ESTIMATES OF GROSS NATIONAL PRODUCT FOR THE UNITED KINGDOM 1830–1914

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This paper presents a new annual series for United Kingdom gross national product, at current and constant prices, calculated from the expenditure side. These results differ significantly from previous estimates in that they go back to the beginning of the railway age on an annual basis and also in that the constant price estimates involve a detailed deflation of the main components of expenditure on consumption and capital formation. The implications of the new results are summarised, with particular reference to rates of growth and relative price changes, and an appendix describes the sources of the estimates.

1. *Character of the new estimates*

Most estimates of British gross national product for the nineteenth century have been compiled from the income side, a method which depends on income tax assessment data for the upper income groups and on occupational censuses, combined with miscellaneous wage rate data, for the lower income groups. The occupational censuses are available only at decade intervals and the income tax assessments are subject to major discontinuities. But apart altogether from the special problems of using each of these two sources, neither is even notionally complete before the 1850s, so that estimates for the first half of the century are somewhat impressionistic and heavily dependent on contemporary assessments. Between them the two sources do not by any means cover the whole range of incomes earned and hence—except to the extent that earnings estimates based on wage rate data tend to underestimate unemployment or underemployment in years of depression—estimates made from the income side are likely to understate the national aggregates. Moreover it is difficult to devise ways of deflating the income estimates except by applying catch-all price indices with arbitrary and indefensible weighting systems.

With these problems in mind it was decided to construct (as part of an inquiry into capital formation and economic growth in the United Kingdom since the beginning of the railway age), a new set of annual estimates of gross national product at factor cost on the basis of expenditure estimates.[1] Detailed estimates of gross domestic fixed capital formation were basic to the capital formation inquiry. A reasonable basis of estimates for public authority expenditures could be derived from parliamentary reports and finance accounts. Imlah's estimate of annual export of capital based on his balance of payments calculations were accepted for foreign investment. A good deal of work has already been put into making consumers' expenditure estimates for the period 1870–1914 by the Jefferys-Walters and Prest-Adams research teams. It remained to carry the main categories of these consumers' expenditure estimates back to 1830 and to deflate them and the capital formation estimates in as much detail as possible.

1. This is part of an inquiry in progress at the Department of Applied Economics of the University of Cambridge with the aid of a grant provided by the Rockefeller Foundation.

No attempt was made to estimate net additions to stocks and work in progress which is unlikely to be a significant omission from the gross national product totals, though it would need of course to be borne in mind in considering the gross investment aggregates.

These estimates of gross national product from the expenditure side have a wider coverage and constitute a broader basis from which to measure annual variations in the national aggregates. They also lend themselves to more direct and therefore more convincing methods of deflation. This makes them a more satisfactory starting point than the income estimates from which to calculate either overall national rates of economic growth or year by year changes in the level of economic activity. Since the expenditure approach leads more often to errors of double counting than to errors of omission these new estimates are, on the whole, more likely to overstate than to understate the absolute national totals.

The main results are given annually in the table at the end of this article which is followed by an appendix summarising the methods of estimate.

2. *The new findings*

a. Rates of growth

Table 1 shows the long-term growth implications of these estimates, measured over periods of about a generation (30 years) and between averages for whole decades. In these terms the peak rates of expansion were reached in the middle decades of the century. For aggregate gross national product the fastest long term rate of growth seems to have developed between the 1840s and the 1870s and to have been under 2½% per annum: for average gross national product per head of the population the peak, measured in these terms, seems

TABLE 1

LONG-TERM RATES OF GROWTH IN UNITED KINGDOM GROSS NATIONAL PRODUCT

Annual percentage rates of compound growth calculated as between averages for decades

	Total G.N.P.	Average G.N.P.
1830/39–1860/69	1.97	1.61
1835/44–1865/74	2.36	1.85
1840/49–1870/79	2.42	1.85
1845/54–1875/84	2.31	1.59
1850/59–1880/89	2.15	1.46
1855/64–1885/94	2.13	1.33
1860/69–1890/99	2.05	1.17
1865/74–1895/1904	1.98	1.07
1870/79–1900/09	1.94	1.05
1875/84–1905/14	1.88	1.00

Source: See Appendix Table B for annual estimates of gross national product measured at factor cost and at 1900 prices.

to have been reached slightly earlier and sustained a little longer, but it is consistently below 2%.

Of course higher rates of growth can be deduced from these estimates by looking at shorter periods and by measuring the rates of change between two single years—between a trough and a peak, say—rather than as between averages for whole decades. Even so there does not seem to have been any period as long as a decade when the rate of expansion of gross national product reached 3% per annum. In these terms, i.e. measuring between one year and another, the longest period of sustained expansion seems to have been the 17-year period 1858–75 when gross national product is estimated to have grown at about 2.8% per annum compound and gross national product per head of population at about 2%.

These are appreciably lower estimates of the British rate of growth than those calculated by Dr. Cole and myself in the course of an earlier inquiry—the difference being largely a consequence of the difference in deflation procedure.[2] In effect, the retail price index which we used to deflate earlier estimates implied a much steeper price fall from the early 1870s to the 1890s than the price index implicit in the deflation methods used to produce the estimates presented in this paper. Similarly for the various wholesale price indices (e.g. the Rousseaux price index) which have been used to deflate earlier national product estimates—they overstate the price fall in the later years of the century and hence overestimate the rate of growth in real gross national product.[3]

One of the main difficulties in interpreting U.K. growth estimates over the period 1830–1914 is the fact that Ireland, which accounted for about a third of U.K. population at the beginning of the period, experienced a substantially different pattern of economic development. Until such time as independent estimates of Irish gross national product become available there is little we can do about this except to try to form some idea of the changing order of magnitude of the Irish component and of the nature of the bias that its inclusion gives to the British estimates. With this in mind an attempt was made to exclude Ireland by applying to Irish population totals estimates of average Irish G.N.P. based on arbitrary but apparently plausible assumptions which it was hoped were sufficiently realistic to make it possible to derive order of magnitude estimates for Great Britain as a residual.

Table 2 compares annual compound rates of growth calculated between

2. See Phyllis Deane and W. A. Cole, *British Economic Growth*, Table 74, p. 284, where it was estimated, for example, that the annual rates of growth in G.N.P. per head were as follows for the U.K.

1855/64–1885/94	2.0
1860/69–1890/99	2.1
1865/74–1895/1904	1.9
1870/79–1900/09	1.6
1875/84–1905/14	1.5

3. An additional reason why some of the price indexes should suggest a higher rate of growth than the estimates presented in this paper is that they are attached to earlier base years. This applies for example to the Rousseaux index which is based on an average of the years 1865 and 1885. In an industrialising country the effect of adopting an early base year for constant price estimates is to give an upward bias to resulting growth estimates by comparison with those based on later price years.

bench mark years for the United Kingdom with corresponding estimates for Great Britain, the latter calculated after excluding Ireland on the assumption that (i) in 1830 average G.N.P. in Ireland was half the average for the U.K., and that (ii) except as between 1840 and 1850, when it was assumed the average did not change, Irish G.N.P. per head expanded at the rate of 10% per decade throughout the period 1830–1910. The results of the comparison suggest that the average U.K. growth rate was appreciably depressed by the inclusion of the Irish component up to about 1880 and only very slightly affected in the early 20th century when the Irish population had more than halved and the British economy had lost its earlier momentum. In so far as growth rates in Ireland were actually slower than we have presumed here, then growth rates for Great Britain taken by itself would have been higher than has been suggested in Table 2. It is worth noting for example that the effect of assuming a zero rate of growth in Irish product per head over the decade of the 1840s was to raise the growth rate for Britain to nearly a third above the U.K. rate.

TABLE 2

COMPARATIVE GROWTH RATES FOR THE UNITED KINGDOM AND GREAT BRITAIN AFTER EXCLUDING ORDER-OF-MAGNITUDE ESTIMATES FOR IRELAND

Annual rate of growth in gross national product

	(1) United Kingdom	(2) Great Britain (residually)
1830–40	2.31	2.77
1840–50	1.74	2.30
1850–60	2.54	2.76
1860–70	2.62	2.83
1870–80	2.00	2.77
1880–90	1.91	2.03
1890–1900	2.39	2.47
1900–1910	1.19	1.20

Source: (1) Calculated from Appendix Table B.
(2) G.B. totals estimated as a residual after excluding Ireland on arbitrary assumptions described in text.

Nevertheless the British growth rate still remains at consistently low levels by the standards of most other countries at a comparable stage of industrialisation. Only if we make the assumption that the average gross national product in Ireland was appreciably more than half the U.K. level circa 1850 (which seems unlikely) *and* that the growth rate for Irish productivity stayed at zero levels after the 1840s (which seems even more improbable) do we derive growth estimates touching 3% for British G.N.P. in the 1850s and 1860s.

The "order of magnitude" figures for Great Britain which underlie the second column of Table 2 do not have sufficient intrinsic validity to permit a useful direct comparison with our earlier estimates for Great Britain made from

the income side.[4] For what it is worth, however, the juxtaposition of the two sets of figures suggests that our earlier estimates probably overstated the rate of expansion of the British economy in the 1830s and 1840s.

b. The changing disposition of national expenditures

The new estimates also provide a better indication than has hitherto been available of the changing pattern of resource use as between consumption (private or public) and capital formation. Table 3 illustrates the broad outline by showing the main categories of expenditure as percentages of gross national product at market prices.

Possibly the most striking feature of these results is the rather low proportion of national expenditure they show as devoted to domestic fixed capital formation. It should be borne in mind that we have attempted no estimate of investment in stocks and work in progress which would probably involve an addition of between 1 and 2% to the percentages for domestic investment averaged by decades and also that the percentages in Table 3 are calculated in terms of gross expenditures at market prices. Since indirect taxes fell mainly on consumption goods the corresponding capital formation estimates expressed as percentages of gross national product at factor cost are above those in Table 3.

TABLE 3

DISPOSITION OF EXPENDITURE GENERATING GROSS NATIONAL PRODUCT AT MARKET PRICES

Decade averages as percentages of G.N.P. at current market prices

	Consumers' expenditure	Current public expenditure on goods and services	Gross fixed domestic capital formation	Net foreign investment
	%	%	%	%
1830/39	88.4	6.6	4.1	0.9
1835/44	87.7	6.7	4.7	0.8
1840/49	86.2	7.1	6.0	0.7
1845/54	85.5	7.1	6.5	0.9
1850/59	85.1	7.4	5.4	2.2
1855/64	85.2	7.0	5.3	2.6
1860/69	85.2	6.0	5.8	2.9
1865/74	83.7	5.3	6.3	4.7
1870/79	84.2	5.4	6.5	3.9
1875/84	84.8	5.7	6.3	3.1
1880/89	83.7	5.8	5.6	4.9
1885/94	84.0	5.9	5.3	4.9
1890/99	84.5	6.3	6.0	3.2
1895/1904	83.1	7.8	7.0	2.2
1900/09	81.5	8.1	6.4	4.0
1905/14	80.0	8.0	5.2	6.8

Source: For annual estimates on which the decade averages were based see Appendix Table A.

4. Phyllis Deane and W. A. Cole, *op. cit.*, p. 166.

Nevertheless, even when these qualifications have been made the proportion of the nation's resources which were put into domestic investment in the 19th century was surprisingly low. It rose at the expense of consumers' expenditure in the 1840s when the railway construction boom was at its height, fell back in favour of a slight increase in public expenditure and a larger increase in foreign investment in the 1850s, and then rose again in the 1860s and 1870s—but not spectacularly: indeed in the late 1860s and 1870s it was foreign investment that was showing the strongest attractions to new savings. After falling back again in the 1880s and early 1890s in favour of a rising foreign investment, domestic investment recovered over the turn of the century at the expense of foreign investment and receded again in the decade leading up to the first world war. At its relative peak in the decade straddling the turn of the century 1895/1904 it accounted for 7% of gross national product at market prices and about 8% of gross national product at factor cost. Even making allowance for additions to stocks and work in progress it seems unlikely that U.K. gross domestic investment exceeded 10% of G.N.P. for any decade preceding the first world war.

The relative importance of foreign investment in the U.K. economy of the 19th century is well known and needs no further emphasis here, though perhaps it is worth noting that in the decade 1905/14, when net foreign investment is estimated to have well exceeded gross domestic fixed capital formation, Imlah's estimates suggest that the inflow of interest and dividends from foreign assets was more than enough to finance an export of capital, even on this scale—amounting to between 7 and 8% of gross national product at factor cost.

The other interesting feature of Table 3 is the way public current expenditure, after creeping upwards in the 1830s and 1840s, reaching a peak in the 1850s due largely to the impact of the Crimean War, dropped back to what were probably their lowest levels for the nineteenth century in the late 1860s and the 1870s. These expenditures begin to creep up again in the 1880s and are inflated by the Boer war in the decade straddling the turn of the century, but it is worth noting that the British economy seems to have reached its peak rate of expansion at a period when the weight of public expenditure was lightening markedly.

The capital formation estimates that underlie the percentages in Table 3 were made by building up annual series for each of the different kinds of capital expenditure that could be separately identified and it is therefore possible to see how the form of the nation's additions to its capital changed through time. Table 4 illustrates this by showing the percentage composition of gross domestic fixed capital formation decade by decade in terms of four main categories—(1) industrial capital, including gas, electricity, water and farm machinery, (2) transport and communications, (3) social capital including dwellings, poor houses, hospitals, schools, sewerage, etc., and (4) administration and defence—mainly public buildings and ships of the royal navy.

It is of course possible that we have failed to cover all classes of capital expenditure simply because we have not succeeded in identifying all relevant categories. It is likely too that the errors of omission will be concentrated largely within the wide and miscellaneous variety of expenditures that we have called

industrial capital. However, although there is almost certainly some degree of underestimate in the first column of Table 4 it seems unlikely that a fuller basis of information would make much difference to the overall pattern of relative shares. Capital in transport and communications constituted by far the most important form of new capital created in each decade except that of the 1830s. On the average of the 1840s, 1850s and 1860s this category accounted for well over half the gross capital formation. Social capital (largely dwellings, but also including new hospitals, poor houses, schools and sanitation systems) was next in importance; in the 1830s (and probably also in the 1820s) new dwellings ranked above transport and communications in relative importance. Capital for administrative and defence purposes did not become at all significant until the turn of the century and more particularly in the decade leading up to the first world war.

In effect then, well over three quarters of gross domestic fixed capital formation expenditures during this period went into constructing the basic infrastructure

TABLE 4

DISTRIBUTION OF GROSS DOMESTIC FIXED CAPITAL FORMATION

As percentages of total G.D.F.C.F. at current prices averaged by decades

	(1)	(2)	(3)	(4)
	Industrial capital including gas, electricity, and water	Transport and communications	Dwellings and other social capital	Administration and defence
	%	%	%	%
1830/39	19.8	36.8	40.5	2.8
1835/44	20.5	42.3	34.0	3.2
1840/49	16.1	59.0	21.2	3.7
1845/54	18.5	57.1	20.5	3.8
1850/59	22.8	46.9	24.1	6.3
1855/64	19.3	51.9	22.1	6.6
1860/69	22.5	50.7	22.1	4.7
1865/74	25.3	46.1	25.0	3.6
1870/79	20.6	44.5	31.3	3.5
1875/84	17.6	47.5	31.0	3.9
1880/89	18.5	48.9	27.4	5.2
1885/94	20.4	45.7	27.2	6.7
1890/99	20.7	41.7	29.4	8.2
1895/1904	20.6	39.7	29.7	10.0
1900/09	21.5	39.9	27.6	11.0
1905/14	23.1	38.6	23.8	14.5

(1) Including plant, machinery, factory buildings, warehouses.

(2) Including roads, railways, canals, ships, vehicles, horse transport, docks, harbours, telegraphs and telephones.

(3) Including dwellings, poorhouses, hospitals, schools and sewage.

(4) Including expenditure on buildings by public and service departments, barracks, naval ships and dockyards.

of a highly industrialised and urbanised economy—the equipment of a transport and communications system and the social capital in dwellings and public buildings and defence equipment. Less than a quarter and sometimes less than a fifth went into more directly productive forms of industrial plant and equipment.

c. The implicit price indices

The effect of converting the various consumers' expenditure and capital formation series to 1900 prices separately and independently is to imply overall price movements differing substantially from those suggested by the existing price indices which have generally been used to deflate national income estimates. Reference has already been made to the impact of this on the resultant growth estimates. The main trouble with the existing indices is that they are heavily—sometimes exclusively—based on commodities entering into overseas trade. The trade statistics are of course the most fruitful source of annual price data reaching over long periods of time and it is not surprising that the unit price data for exports and imports have been used so frequently as proxies for the identical or similar commodities on the home market. Table 5 illustrates the direction and extent of the bias that this dependence on price data derived from the trade returns can give to constant price estimates by comparing the price indices

TABLE 5

THE IMPLICIT PRICE INDICES COMPARED WITH INDICES OF EXPORT AND IMPORT PRICES

Indices averaged by decades on the base 1900 = 100

	(1)	(2)	(3)	(4)	(5)
	Consumers' expenditure	Gross fixed capital formation	Total expenditure generating gross national product	Exports	Imports
1830/39	104.8	87.0	102.6	160.8	152.5
1835/44	102.2	87.3	99.2	145.1	150.4
1840/49	99.2	87.1	96.0	125.8	133.7
1845/54	97.9	86.7	94.5	117.1	127.7
1850/59	101.5	85.6	96.2	115.8	142.2
1855/64	108.0	87.6	101.0	126.0	155.2
1860/69	111.7	89.1	105.4	137.1	158.2
1865/74	113.3	98.9	109.0	139.4	154.5
1870/79	111.1	92.6	107.2	127.1	141.7
1875/84	107.4	95.9	102.4	110.6	130.7
1880/89	102.1	89.1	97.0	98.2	116.6
1885/94	99.0	84.1	94.3	92.0	104.0
1890/99	98.0	84.9	93.7	88.0	96.3
1895/1904	98.5	90.0	95.5	88.9	94.1
1900/09	101.5	94.1	98.7	95.1	99.8
1905/14	104.9	94.3	101.3	98.5	114.0

Sources: Cols. (1)–(3) are derived from the price indices implicit in the calculations shown in Tables A and B below. Cols. (4) and (5) are derived from the price indices estimated by A. H. Imlah, *Economic Elements in the Pax Britannica*, pp. 94–98. We have converted Imlah's index from an 1880 base to a 1900 base for the purposes of this comparison.

implicit in our estimates with the price relatives for exports and imports—each series averaged by decades and based on 1900 = 100.

The striking feature of this comparison is the surprisingly modest range within which the implicit price indices move over this period. Capital prices seem to creep gradually upward but consumers' prices show no consistent secular trend. Of course the effect of averaging the indices by decades is to narrow the range of variation but, even when the annual series are considered, the prices of consumers' expenditures, taken overall, do not rise above 17% in excess of the 1900 level or fall below 92% of it. Capital expenditures show a wider range—falling to about 25% below the 1900 level in the early 1850s and rising to about 20% above in 1873. But this is a narrow fluctuation compared with that suggested by either the export or the import price indices which moreover suggest a very steep secular decline in nineteenth century prices. Deflation by any price index which depends heavily on the overseas trade statistics is thus likely to introduce a strong upward bias into the long term growth estimates.

APPENDIX ON SOURCES AND METHODS

1. *Consumers' Expenditure*

The current price series were based on D. A. Rowe's adjustment of the Prest and Adams estimates for the years 1900–1914, Jefferys' and Walters' estimates for the period 1870–1900 and a new series of estimates for each of the categories distinguished by Jefferys and Walters for the period 1830–70.[5] The constant price estimates for the period 1900–14 were calculated by applying the Prest-Adams index of prices for total consumers' expenditure to the Rowe series of current expenditures. For the period 1870–1900 constant price series were calculated by constructing price indices for each of the categories of expenditure distinguished by Jefferys and Walters and then deflating the Jefferys and Walters expenditure estimates at current prices. For the period 1830–70, estimates at constant prices were made separately for all categories of expenditure where quantity data were available by applying a 1900 price derived from the Prest-Adams study: where quantity data were not available the current expenditure estimates were deflated by the most appropriate available price index.

The new estimates were thus concerned (a) with the expenditures for the period 1830–70 and (b) with the new price indices used to deflate the Jefferys' and Walters' estimates for the period 1870–1900. In both cases we started with the five categories of expenditure distinguished by Jefferys and Walters. The methods are therefore described below under these broad heads:

a. Consumption of home-manufactured consumer goods at current prices

For the 1830–70 estimates we constructed an index of total manufacturing activity on the basis of Hoffman's index (excluding building) and deducted for

5. B. R. Mitchell, *Abstract of Historical Statistics*, pp. 370–1 for D. A. Rowe's estimates. A. R. Prest and A. A. Adams, *Consumers' Expenditure in the United Kingdom, 1900–1919*. Simon Kuznets (ed.), *Income and Wealth Series V*, James B. Jefferys and Dorothy Walters, "National Income and Expenditure of the United Kingdom, 1870–1952".

TABLE A

EXPENDITURE GENERATING GROSS NATIONAL PRODUCT AT CURRENT PRICES 1830–1914

	Consumers' expenditure	Public current expenditure on goods and services	Gross fixed domestic capital formation	Net foreign investment	Indirect taxes net of subsidies	Gross national product at factor cost
	£m	£m	£m	£m	£m	£m
1830	448.0	36.2	14.8	0.6	61.4	438.3
1831	440.0	34.7	16.5	2.4	56.1	437.5
1832	423.0	35.6	12.6	6.1	57.3	420.0
1833	419.0	35.0	12.5	3.6	58.0	412.1
1834	440.0	33.4	14.8	7.1	58.8	436.5
1835	449.0	33.4	23.2	12.7	56.0	462.3
1836	494.0	32.9	24.6	5.5	54.4	502.6
1837	471.0	33.5	27.4	2.3	55.8	478.4
1838	490.0	34.4	31.3	4.5	53.5	506.7
1839	518.0	35.6	33.3	3.1	54.6	535.4
1840	490.0	37.8	32.3	−2.3	56.1	501.7
1841	483.0	38.1	23.8	1.1	57.7	488.3
1842	460.0	39.3	21.1	−0.6	58.7	461.1
1843	441.0	40.7	18.6	9.3	57.3	452.3
1844	479.0	41.4	20.4	10.4	57.1	494.1
1845	502.0	39.8	31.3	9.3	59.1	523.3
1846	517.0	40.9	47.6	8.0	56.9	556.6
1847	555.0	42.1	60.3	−1.1	58.4	597.9
1848	522.0	47.0	48.4	2.1	57.3	562.2
1849	547.0	47.1	41.1	3.9	60.3	578.8
1850	508.0	44.0	32.5	10.6	58.7	536.4
1851	532.0	44.8	33.0	9.2	57.9	561.1
1852	532.0	45.4	37.7	7.7	57.0	565.8
1853	605.0	45.4	41.5	3.3	57.0	638.2
1854	635.0	54.6	43.7	5.8	58.7	680.4
1855	634.0	71.0	43.7	13.9	59.2	703.4
1856	672.0	60.5	41.9	21.8	62.9	733.3
1857	693.0	55.9	38.1	27.1	64.2	749.9
1858	659.0	53.8	38.2	22.4	63.8	709.6
1859	695.0	57.2	38.6	36.1	64.6	762.3
1860	715.0	58.5	40.8	23.7	66.9	771.1
1861	763.0	59.9	43.8	14.4	64.5	816.6
1862	775.0	59.2	45.5	11.5	65.4	825.8
1863	792.0	58.5	55.4	26.5	67.0	865.4
1864	849.0	58.5	62.7	22.8	66.4	926.6
1865	865.0	57.1	76.5	34.9	65.4	968.1
1866	925.0	58.5	68.0	33.0	65.9	1,018.6
1867	926.0	62.5	61.6	42.2	69.0	1,023.3
1868	932.0	66.0	63.1	36.5	70.4	1,027.2
1869	933.0	61.4	61.1	46.7	72.6	1,031.6
1870	954.0	62.0	71.3	44.1	71.0	1,060.4
1871	1,004.0	62.0	72.0	71.3	73.0	1,136.3

TABLE A (*Concluded*)

	Consumers' expenditure	Public current expenditure on goods and services	Gross fixed domestic capital formation	Net foreign investment	Indirect taxes net of subsidies	Gross national product at factor cost
	£m	£m	£m	£m	£m	£m
1872	1,065.0	62.0	79.7	98.0	76.0	1,228.7
1873	1,123.0	65.3	85.9	81.3	78.0	1,277.5
1874	1,123.0	66.6	97.0	70.9	78.0	1,279.5
1875	1,118.0	69.4	91.7	51.3	79.0	1,251.4
1876	1,126.0	72.6	90.6	23.2	81.0	1,231.4
1877	1,133.0	75.4	90.3	13.1	81.0	1,230.8
1878	1,120.0	78.6	83.2	16.9	82.0	1,216.7
1879	1,057.0	77.4	72.8	35.5	79.0	1,163.7
1880	1,146.0	78.0	75.3	35.6	79.0	1,255.9
1881	1,125.0	78.0	80.7	65.7	82.0	1,267.4
1882	1,157.0	78.6	88.5	58.7	84.0	1,298.8
1883	1,190.0	78.0	92.9	48.8	84.0	1,325.7
1884	1,162.0	80.6	82.1	72.3	85.0	1,312.0
1885	1,138.0	82.3	70.5	62.3	84.0	1,269.1
1886	1,126.0	81.5	64.2	78.9	85.0	1,265.6
1887	1,162.0	79.6	67.0	87.7	86.0	1,310.3
1888	1,186.0	79.4	73.7	91.9	87.0	1,244.0
1889	1,227.0	83.5	82.2	80.9	89.0	1,384.6
1890	1,253.0	86.7	85.6	98.5	92.0	1,431.8
1891	1,315.0	89.4	83.3	69.4	93.0	1,464.1
1892	1,314.0	92.3	84.7	59.1	94.0	1,456.1
1893	1,311.0	93.9	79.5	53.0	96.0	1,441.4
1894	1,318.0	95.8	84.4	38.7	99.0	1,438.0
1895	1,336.0	98.1	92.1	40.0	104.0	1,462.2
1896	1,381.0	102.0	95.3	56.8	108.0	1,527.1
1897	1,409.0	106.5	104.6	41.6	110.0	1,551.7
1898	1,465.0	112.2	125.4	22.9	112.0	1,613.5
1899	1,525.0	131.6	137.7	42.4	119.0	1,717.7
1900	1,626.0	194.2	147.4	37.9	125.0	1,880.5
1901	1,661.0	205.4	149.8	33.9	132.0	1,918.1
1902	1,670.0	196.6	149.7	33.3	139.0	1,910.6
1903	1,689.0	150.4	146.5	44.8	143.0	1,887.7
1904	1,710.0	146.9	146.3	51.7	147.0	1,907.9
1905	1,729.0	159.8	145.1	81.5	150.0	1,965.4
1906	1,759.0	161.7	139.7	117.5	151.0	2,026.9
1907	1,804.0	164.1	132.1	154.1	150.0	2,104.3
1908	1,803.0	166.8	102.4	154.7	146.0	2,080.9
1909	1,821.0	169.3	107.7	135.6	146.0	2,087.6
1910	1,866.0	171.8	110.2	167.3	166.0	2,149.3
1911	1,926.0	178.4	109.4	196.9	165.0	2,245.7
1912	1,995.0	198.5	116.2	197.1	165.0	2,341.8
1913	2,058.0	207.3	129.0	224.3	172.0	2,446.6
1914	2,006.0	308.9	122.1	164.6	180.0	2,421.6

TABLE B

EXPENDITURE GENERATING GROSS NATIONAL PRODUCT AT CONSTANT 1900 PRICES, 1830–1914

	Consumers' expenditure	Public current expenditure on goods and services	Gross fixed domestic capital formation	Net foreign investment	Indirect taxes net of subsidies	Gross national product at factor cost
	£m	£m	£m	£m	£m	£m
1830	404.0	36.2	17.1	−5.6	55.0	396.7
1831	412.0	37.0	19.7	−0.5	52.7	415.4
1832	413.0	37.9	15.1	2.4	55.9	412.6
1833	419.0	38.2	15.0	0.9	58.0	415.1
1834	430.0	37.1	18.0	4.5	57.6	432.0
1835	440.0	36.7	26.4	7.6	54.7	456.0
1836	459.0	36.5	25.3	2.8	50.6	473.0
1837	453.0	37.8	29.9	−1.0	53.7	466.0
1838	467.0	39.4	34.5	3.1	51.3	492.6
1839	485.0	41.1	35.7	5.8	51.8	515.7
1840	474.0	44.3	35.4	1.6	55.1	500.2
1841	471.0	45.1	27.2	3.6	57.0	489.9
1842	465.0	46.9	25.2	3.2	60.3	480.0
1843	468.0	48.1	23.6	8.8	61.2	487.4
1844	493.0	48.8	25.0	8.9	59.0	516.7
1845	516.0	47.3	35.7	7.1	60.9	545.3
1846	532.0	50.7	49.7	7.5	58.6	581.4
1847	526.0	49.5	61.8	3.4	56.2	584.5
1848	540.0	55.1	55.3	1.3	59.7	592.1
1849	552.0	54.3	51.7	5.7	62.1	601.6
1850	550.0	54.3	42.8	13.4	64.6	595.9
1851	572.0	54.7	43.5	13.2	63.4	620.0
1852	577.0	55.8	47.1	13.6	62.9	630.5
1853	599.0	54.8	45.6	13.5	57.7	655.2
1854	604.0	60.6	45.8	19.5	57.4	672.5
1855	594.0	78.1	48.8	26.9	57.3	690.6
1856	622.0	76.8	46.5	36.3	60.3	721.4
1857	640.0	66.0	43.0	45.9	61.7	733.3
1858	637.0	68.3	44.6	30.0	63.1	716.8
1859	663.0	72.0	46.1	43.2	63.1	761.2
1860	669.0	75.8	47.8	39.8	64.9	767.5
1861	699.0	73.4	50.9	29.1	61.2	791.3
1862	710.0	71.8	52.4	18.6	61.4	791.4
1863	722.0	72.0	63.0	26.5	62.2	821.3
1864	741.0	70.1	66.7	24.0	59.1	842.8
1865	769.0	69.6	83.3	30.8	59.2	893.5
1866	796.0	68.6	73.5	25.2	57.5	905.9
1867	801.0	70.7	68.7	35.8	60.7	915.6
1868	825.0	72.6	70.9	43.1	64.1	947.5
1869	841.0	70.1	71.4	48.9	66.9	964.5
1870	867.0	71.2	77.6	48.2	65.9	998.1
1871	904.0	72.7	75.6	64.5	66.4	1,050.4

TABLE B (*Concluded*)

	Consumers' expenditure	Public current expenditure on goods and services	Gross fixed domestic capital formation	Net foreign investment	Indirect taxes net of subsidies	Gross national product at factor cost
	£m	£m	£m	£m	£m	£m
1872	924.0	71.7	70.7	75.2	65.4	1,076.2
1873	971.0	73.1	71.3	55.8	66.4	1,104.8
1874	992.0	74.9	83.0	54.6	68.3	1,136.2
1875	1,012.0	77.6	88.6	46.3	71.9	1,152.8
1876	1,016.0	80.0	91.5	35.0	74.6	1,147.8
1877	1,014.0	83.1	90.9	40.7	75.1	1,153.8
1878	1,034.0	87.1	86.9	36.5	77.8	1,166.8
1879	1,009.0	87.4	80.3	57.7	77.8	1,156.7
1880	1,071.0	87.3	77.4	61.3	76.0	1,221.0
1881	1,066.0	88.6	86.6	94.7	80.4	1,255.5
1882	1,090.0	89.7	92.0	82.3	81.4	1,272.6
1883	1,120.0	90.1	97.3	79.7	81.8	1,305.3
1884	1,131.0	93.7	93.0	99.9	85.5	1,332.1
1885	1,144.0	97.9	84.5	88.2	87.0	1,327.5
1886	1,146.0	99.8	76.5	105.1	88.9	1,338.4
1887	1,191.0	100.4	81.5	112.7	90.5	1,395.1
1888	1,212.0	101.4	88.1	124.4	91.7	1,434.2
1889	1,232.0	103.7	93.9	112.8	92.1	1,450.3
1890	1,257.0	105.8	95.2	116.9	94.0	1,480.8
1891	1,300.0	108.4	97.6	92.2	94.4	1,503.9
1892	1,308.0	112.5	102.9	84.7	96.4	1,511.6
1893	1,324.0	115.8	97.9	74.8	99.5	1,512.9
1894	1,353.0	119.5	103.8	60.5	104.2	1,532.6
1895	1,389.0	123.3	114.7	61.6	110.9	1,577.7
1896	1,447.0	127.7	115.8	84.4	116.0	1,658.9
1897	1,463.0	131.5	124.5	69.8	117.2	1,671.6
1898	1,504.0	135.5	143.1	50.9	117.9	1,715.7
1899	1,574.0	149.8	146.5	66.1	124.7	1,811.7
1900	1,626.0	194.2	147.4	37.9	125.0	1,880.5
1901	1,656.0	205.5	157.2	39.7	132.6	1,925.8
1902	1,664.0	200.7	162.1	50.4	140.8	1,936.5
1903	1,672.0	172.1	159.0	66.6	144.3	1,925.4
1904	1,696.0	173.1	159.5	70.3	148.4	1,950.5
1905	1,709.0	179.3	156.6	105.6	151.2	1,999.3
1906	1,735.0	181.0	147.6	133.2	151.0	2,045.8
1907	1,755.0	181.6	136.8	162.0	147.4	2,088.0
1908	1,747.0	184.8	109.8	168.3	143.5	2,066.5
1909	1,754.0	188.9	117.2	166.3	144.1	2,082.3
1910	1,776.0	190.9	115.5	196.3	161.8	2,118.8
1911	1,826.0	197.1	128.2	212.5	160.2	2,203.7
1912	1,835.0	206.2	122.4	210.4	155.0	2,219.1
1913	1,891.0	212.1	130.2	220.2	159.9	2,293.7
1914	1,846.0	300.7	121.2	167.9	167.6	2,268.2

exports of manufactures. This provided the basis for an estimate at constant prices and it was converted to current prices by using Imlah's price index for U.K. domestic exports for the period 1830–70. For the period 1870–1900 we deflated the Jefferys' and Walters' current expenditure estimates by means of their index of retail prices of manufactured consumer goods.

b. Consumption of home-produced finished agricultural consumer goods

Jefferys' and Walters' estimate for 1870 was extrapolated back to 1830 by means of an indicator composed of estimates of (i) expenditures on bread (based on Salaman's estimates of wheat flour consumed converted to a bread equivalent and evaluated at the London bread price),[6] (ii) expenditures on meat (based on estimated per head consumption for England and Wales, Scotland and Ireland separately evaluated at the Smithfield meat price) and (iii) expenditures on sugar (based on retained imports evaluated at the export price for refined sugar plus duty). In Jefferys' and Walters' estimates sugar was originally included here as a proxy for other processed agricultural goods. The price index used to deflate Jefferys' and Walters' 1870–1900 estimates for this category was composed of bread, animal products and potatoes, weighted on the basis of their importance in 1900 according to the Prest and Adams estimates.

c. Imports of finished consumer goods at current retail prices

Jefferys' and Walters' estimate for 1870 was extrapolated to 1830 on the basis of Imlah's estimates of the current value of all net imports excluding raw cotton and wool and this series was converted to 1900 prices by means of the Imlah index of import prices omitting cotton and wool. The price index used to deflate Jefferys' and Walters' current price estimates for 1870–1900 was based on a selected list of imports including rice, bacon, butter, margarine, cheese, cotton piece goods, woollen stuffs, gloves, boots and shoes, earthenware, glass, paper.

d. Consumption of services at current prices

Following Jefferys and Walters we distinguished 6 categories here—rents, rates, railways, post office, domestic and personal services, and other services—and made separate extrapolations back to 1830 for each of these. In making the estimates at constant prices we applied Wood's index of rents for housing and his index of the wages of a workman of unchanged grade in full employment.

2. *Public authorities' current expenditure on goods and services*

In making the estimates at current prices for the period after 1890 we took as our starting point the estimates made by Peacock and Wiseman for 1890, 1895, 1900, 1905, 1910, 1913 and 1915, interpolating between these years on the basis of published statistics of central and local government expenditure.[7] For earlier years we extrapolated from these estimates for central and local

6. R. N. Salaman, *The History and Social Influence of the Potato.*

7. A. T. Peacock and J. Wiseman, *The Growth of Public Expenditure in the United Kingdom.* The main series for central and local government are reproduced in B. R. Mitchell, *Abstract of British Historical Statistics.*

government expenditure respectively on the basis of the accounts published in parliamentary reports and returns. The statistics of local government expenditure become less and less complete as we go back in time. For most of the 19th century they are available only for England and Wales and before the 1870s the only continuous annual series were those relating to English poor relief and county expenditures. In effect the available statistics of Government expenditures were used as indicators rather than as direct estimates of the aggregate annual expenditures by public authorities on goods and services.

To deflate the current price indices we adopted a compromise between two methods. On the assumption that approximately half public authorities' current expenditure on goods and services consisted of the wages and salaries paid to government employees, and also on the assumption that there was no change in the productivity of government employees, we estimated the real value of these expenditures as a multiple of the number of persons in government employment. This involved estimating the numbers annually employed by government and applying 1900 expenditures to this series. For the largest categories of public servants (e.g. armed forces, police, post office employees, school teachers) it was possible to make reasonably satisfactory estimates from data published in departmental and parliamentary reports; and for the rest (e.g. civil servants and local government employees) it was possible to make acceptable order of magnitude estimates on the base of sporadic information in the census of occupations and other services. The other half of public expenditure was deflated with the aid of the price index implicit in our aggregate estimates for consumers' and capital formation expenditures.

3. *Gross domestic fixed capital formation*

a. Transport and communications

The series calculated separately under this head were railways, roads, tramways, docks, harbours and canals (for which Dr. B. R. Mitchell made detailed estimates based on data in company and government reports and other sources), ships (for which we used Dr. K. Maywald's estimates as a starting point), telegraphs and telephones, horse transport and motor cars.[8] Most of the material for estimates for these last three items was obtained from parliamentary returns or department reports (e.g. taxation statistics for vehicles and horses in road transport, post office and parliamentary reports for telegraphs and telephones) but it was necessary at times to search trade journals and other sources for price data (e.g. for costs of horses and carriages). Each transport series estimated was deflated separately or, at times when it was appropriate to begin with volume estimates (e.g. as with ships and horses and carriages), was raised to a current price basis by estimating the chronology of price changes.

8. See B. R. Mitchell, "The Coming of the Railway Age and United Kingdom Economic Growth", *Journal of Economic History*, 1964, for a full description of the railway expenditure estimates, and K. Maywald, "The Construction Costs and Value of the British Merchant Fleet 1850–1938", *Scottish Journal of Political Economy*, 1956, for a description of the basis of our estimates for merchant shipping.

b. Dwellings and other social capital

The main component of this aggregate series was the estimate for dwellings. Here the procedure adopted was to estimate (i) the number of dwellings built annually, (ii) the cost of a typical new dwelling circa 1900, (iii) a correction factor to allow for the improvement in the quality of a typical new working class house and (iv) an index of building costs to convert the resulting estimates at 1900 constant values to current value terms. Estimates were made separately for Great Britain and for Ireland. The decennial population censuses gave figures of the stock of dwellings and J. Parry Lewis's index of house building activity in Great Britain was used to indicate the annual fluctuations.[9] To find the level of replacement and new building to which this index could be applied we used the estimates made by the Beckerman inquiry for the period 1901–11.[10] We estimated on the basis of data given in *The Housing Handbook* that the average cost of a new British house circa 1900 was £215.[11] This is below the figure adopted by Cairncross for 1907 but the Cairncross figure was based on a Glasgow average only and all the evidence seems to suggest that Scottish urban housing was more costly than English or Welsh urban housing. The improvement factor was calculated on the basis of estimates made in the course of the Beckerman inquiry at 1.25% per annum over the period 1880–1914. We adopted Maywald's indices of the costs of building wages and materials respectively and weighted them on the assumption that 40% of the cost of building a dwelling house was attributable to wages.[12] A similar procedure was followed for Ireland except that the improvement factor was put at 0.5% throughout and the index of building costs was calculated on the assumption that 80% of the cost of building in Ireland was attributable to wages.

The other capital expenditure series which have been estimated separately and included in this category of "social capital" are expenditures on school and college buildings, expenditures on new churches, expenditure on building poor law institutions, hospitals and asylums and capital expenditures on sewerage and sewage disposal units. A considerable amount of detailed annual information on these items of expenditure was available in reports and returns published in U.K. *Sessional Papers.* Wherever possible the estimates were made separately for Great Britain and Ireland and deflation of the current price series was carried out by applying what seemed in each case to be the most appropriate weights to Maywald's indices of building wages and materials.

c. Industrial Capital

Except in the case of gas, electricity and water for which Dr. Mitchell collected capital expenditure data from company and local authority accounts and for which a reasonably reliable basis of estimate was available over the

9. J. Parry Lewis, *Building Cycles and Britain's Growth*, pp. 316–7.

10. W. Beckerman and Associates, *The British Economy in 1975*, pp. 588–90.

11. W. Thompson, *The Housing Handbook*, 2nd edition, 1903, give costs and descriptions for 17,249 new dwellings built by local authorities, cooperative societies, model villages and garden cities at the turn of the century.

12. K. Maywald, "An Index of Building Costs in the United Kingdom", *Economic History Review*, 1954.

whole period, the estimates of gross fixed capital formation in industry were somewhat impressionistic. We made separate estimates for coalmining, iron and steel trades, textiles, agriculture (farm implements and machinery only) and other manufacturing industry. For cotton textiles we took as our starting point Blaug's estimates of fixed capital in cotton at bench mark dates in the 19th century,[13] and made estimates of annual additions to capital per head of the working force on the basis of data contained in a variety of sources—e.g. factory returns and reports, contemporary trade journals, 1907 census of production and other sources. A similar attempt to calculate capital per worker was attempted for other manufacturing trades. For the iron and steel trades we made order of magnitude estimates by calculating the capital stock annually for the basic iron and steel trades (including tinplate) and applying estimated values per works or furnace to blast furnaces, puddling iron works, tinplate works, bessemer converters and open hearth steel furnaces respectively. The numbers in each case were interpolated or extrapolated from published data in *Mineral Statistics* and trade journals and reports or histories of the iron and steel industry or its branches. For the other iron and steel and metal manufacturing industries we scaled up these estimates on the basis of horsepower data in the 1907 census of production and the returns made for 1870 under the Factories and Workshops Acts. For agriculture we started from Boreham's estimates of the value of occupiers' capital in machinery and implements 1867–1938[14] and interpolated and extrapolated from these on the basis of information in the *Agricultural Returns*. No attempt was made to calculate additions to agricultural capital in standing crops or livestock or expenditures on land clearing and drainage. In addition we made estimates of annual additions to the capital stock in shops, beerhouses, farmhouses, factories and warehouses based largely on the inhabited house duty and other property tax returns.

The estimates made under this heading are more likely to be affected by errors of omission than of double counting and give only a very rough overall indication of the levels and trends in industrial capital expenditures.

d. Administration and defence

The expenditures included here cover expenditures on new works and buildings by navy, army, and ordnance departments and by the various civil government departments including the post office. It also includes new naval construction expenditures on ships and dockyards. The material for these estimates was obtained from parliamentary reports and returns and departmental reports.

4. *Foreign Investment*

For the annual estimates of foreign investment at current prices we used the Imlah estimates of the annual net balance on current account.[15] But in converting

13. M. Blaug, "The Productivity of Capital in the Lancashire Cotton Industry during the Nineteenth Century", *Economic History Review*, 1961.

14. A. J. Boreham, "A Series of Estimates of Occupiers' Capital, 1867–1938", *The Farm Economist*, 1953.

15. A. H. Imlah, *Economic Elements in the Pax Britannica*, pp. 70–75.

to a constant price basis we deflated separately all the items in Imlah's balance of payments calculation by the most relevant index we could find so that an estimate of net foreign investment at 1900 prices is in effect a residual on a fully deflated balance of payments account.

Dans cet article, l'auteur présente une nouvelle série annuelle du produit national brut du Royaume Uni, à prix courants et constants, calculés du côté des dépenses. Les résultats, qu'elle obtient ainsi, différent nettement des estimations antérieures. Les raisons en sont que d'abord il remonte jusqu'au début du chemin de fer sur une base annuelle et qu'ensuite, les estimations à prix constants entraînent une déflation detaillée des principales composantes des dépenses de consommation et de formation du capital. Les implications de ces résultats originaux sont resumées, avec une insistance particulière sur les taux de croissance et les changements relatifs de prix. Pour terminer, en appendice, on trouvera les sources des estimations.