

CHAPTER 1

INTRODUCTION AND SUMMARY TABLES

1.0 AIMS, SOURCES AND METHODS

This volume is the last in the series *Studies in the National Income and Expenditure of the United Kingdom*. It was originally conceived of as a short article which would simply bring together the separate estimates for 1920–38 prepared by the several contributors to the series, but over the years it has swelled inexorably to reach its present dimensions. It now has three basic objectives. First, to provide a complete set of national accounts for the inter-war years and to present these in a form which is, as nearly as possible, consistent in concept and definition with the post-war estimates published by the Central Statistical Office (C.S.O.). Second, to extend the estimates to cover the years before 1914 and the two war-time periods and thus to provide long-run series of comparable estimates for all the main items, though with less detail than for the inter-war years. Third, to provide for all series a concise statement of the concepts and definitions adopted; and – for all series not elsewhere described – a detailed account of the sources and methods of estimation used.

The presentation of consistently defined and estimated long-run series is thus the primary purpose. For some series the starting point is 1855, for others 1870 or 1900, and for a few it is 1920. The terminal date for all the main series is 1965, but a few lesser items are given only to 1938. The initial date is governed by the character of the data available, and, in general, the criterion was to limit the estimates to the period for which something approaching a direct estimate could be made for at least the major components of any item. Some of the major statistical landmarks which identify this period as the second half of the nineteenth century are the re-introduction of income-tax in 1842/3, the comprehensive collection of official annual statistics of metal and mineral production from 1854, and of agricultural output from 1866, the first census of wages and earnings in 1886, the annual compilation of aggregate returns of local authority revenue and expenditure from 1884/5, and the first census of production, taken in 1907. National accounting estimates can be made for earlier periods,¹ and these are valuable

but are essentially artefacts, produced by assuming, for example, a relationship to some other series for which figures exist, or by extrapolating on the basis of an indicator which in fact covers only a very limited portion of the item for which it does duty.

1965 was chosen as the terminal date, partly as a matter of convenience, but mainly on grounds of reliability. Experience has shown that all estimates in the annual C.S.O. Blue Books on *National Income and Expenditure* are liable to be altered, but figures for the most recent years are particularly subject to revision as more comprehensive and accurate information becomes available. The post-1946 estimates are readily available in the Blue Books and are reproduced here only in order to provide a single source for long-run national income series; since this can never be fully up to date even in the year of publication, it seemed sensible to break off at a point which would provide a reliable run of estimates, leaving more recent figures to be obtained, as required, from the latest Blue Book. In most cases it should be possible to link on to the present volume without the need for adjustment to the pre-1965 estimates; but this may cease to be possible if the C.S.O. make extensive changes in their concepts or sources.²

The estimates presented cover all the main national accounting aggregates and their principal components. The three customary sets of estimates are provided, based on the summation of factor incomes, of final expenditure, and of net output (value added). The first is given at current prices, the second at both current and constant prices, and the third in the form of constant price index numbers. The economy is also divided into five sectors, outlined in Chapter 1.2, for

¹ See, for example, Phyllis Deane and W. A. Cole, *British Economic Growth, 1688–1959*, 1962 [156], and Phyllis Deane, 'New Estimates of Gross National Product for the United Kingdom, 1830–1914', *The Review of Income and Wealth*, 14, 1968 [155].

² In the case of constant price series there is the discontinuity arising from the adoption of the new base year (1963) in the 1969 Blue Book, replacing the 1958 prices used until 1968.

each of which a revenue and expenditure account is given. The principal series are shown annually, others are given only for selected years.

A detailed account of the scope of each of the five sectors, and of the definition and coverage of each series is given in the relevant chapter. The concepts and definitions are basically those employed by the C.S.O. for the 1967 Blue Book,¹ and a comprehensive discussion of these ideas is now available in *National Accounts Statistics: Sources and Methods*.²

The estimates for 1946 onwards are, with a few very minor exceptions, simply reproduced from the Blue Books without adjustment of any sort. For most items the Blue Book used was that for 1968 – which does not appear to contain any changes in concept or definition as compared with the 1967 edition – but for some items this does not contain the required run of figures and it was necessary to use earlier Blue Books.

For earlier periods existing estimates were adopted wherever possible, with only such adjustment as was necessary to obtain consistency both with the post-war estimates and with other items within the system of national accounts. For the most part this was a question of consistency in matters of concepts and definitions, but occasional alterations arising from differences in estimation procedures were also called for. Where no previous estimate was available or where it was thought possible to produce substantially improved results, new estimates were prepared. This applies, for example, to the estimates of trading profits and to much of the corporate appropriation account for the inter-war period, to several items in the personal income and expenditure account and to the balance of payments on current account for the same period, and it applies to most of the estimates for the years before 1920. The volume also includes new estimates of central and local government revenue and expenditure in the inter-war years. These were prepared some time ago by Professor J. E. G. Utting, but have not previously been published.

In all cases where the estimates are based on already published work the text gives only a very brief indication of sources and methods of estimation, together with a note of any adjustments made to the previous estimates. The interested reader can then refer to the original source for a more comprehensive account of the derivation of the estimates. Where new estimates are presented a complete explanation is given of the sources and methods used. This will generally be far more detailed than is required by the average user of the statistics, but is provided so that future investigators can subject the present estimates to close scrutiny, and amend and improve them as necessary to take account

of changes in accepted definitions and in the information available.

The fact that only new estimates are described in full means that the number of pages devoted to an item may not be a good measure of its importance. It should also be acknowledged that no set of national accounts is ever 'finished' and the statistician is always aware of further corrections and improvements which might be made. There does, however, come a point at which the benefits obtained by additional changes are unlikely to compensate for the cost of further delay in publication,³ and the interlocking nature of the accounts always makes it difficult to limit any change to a single item in the system.

The material is organised in 11 chapters. Following this introductory chapter in which the major estimates are briefly presented, there is a chapter for the income and expenditure of each of the five sectors. Chapters 7 to 9 cover three items which affect more than one sector and so are best treated separately; and the last two chapters cover respectively indices of real output and data on population and labour force. Within each chapter the normal sequence is to indicate the scope of the sector and/or the definition of the series covered, to outline or describe in full the sources and methods used, to make a comparison with other estimates if this seems fruitful, to call attention to any major breaks in the consistency of the series which it was not possible to eliminate, and finally to give some judgement regarding the reliability of the estimates. Each of these sections is, in turn, sub-divided where necessary on a chronological basis. All the main tables in which the estimates are presented are brought together at the end of the book, but a variety of 'working tables' are given in context in each chapter.

The present volume is essentially a source book and like all but the first of its forerunners in this series, contains no attempt to process or analyse the material assembled. However while this material was being prepared I have at the same time been working together with Professor R. C. O. Matthews and Mr J. C. Odling-Smee on a project in which the post-war growth of the British economy is studied in historical perspective. The project is sponsored by the Social Science Research Council of New York as part of a wider

¹ C.S.O., *National Income and Expenditure 1967* [75].

² C.S.O., 1968 [73]. An earlier version was published by the C.S.O. in 1956 as *National Income Statistics: Sources and Methods* [74].

³ For the purposes of this calculation the relevant 'cost' is that borne by the prospective users of the statistics. If the cost to the author is included the break-even point would have been reached much earlier.

international survey, and contains, first, a systematic examination of the growth, composition and inter-relationship of the principal long-run series presented in this volume and also of many others derived from them, such as output per unit of input; and second, an

attempt to describe and explain the observed trends and relationships. The results should be published shortly after this book appears, and the two may to some extent be regarded as companion volumes.

1.1 SUMMARY TABLES OF DOMESTIC AND NATIONAL PRODUCT AT CURRENT AND CONSTANT PRICES, 1855-1965

The results likely to be of most general use are the long-run estimates of national product given in Tables 1 to 9. The first four tables relate to estimates of domestic and national product at current prices. Tables 5 to 8 give corresponding estimates or index numbers at constant prices. Table 9 is again at current prices and shows the composition of the gross domestic product (G.D.P.) by industry and type of income.

Table 1 runs from 1855 to 1965 and represents the aggregation of factor incomes to show G.D.P., G.N.P. and net national product (national income), all at current factor cost. Net domestic product can be derived directly from the table. The aggregates for 1948-65 differ from those in the Blue Book because the residual error (i.e. the difference between the income and expenditure estimates) is not here treated as a component of the income estimate but is shown separately in Table 4.

In Table 1, as in most other tables, two estimates are given for 1920. The first is consistent with earlier years both in definition and in the inclusion of Southern Ireland. The second is consistent in definition with later years and covers the United Kingdom of Great Britain and Northern Ireland. The formal date of the formation of the Irish Free State (later the Republic of Eire) was December 1922, but it operated as an independent fiscal unit retrospectively from 1 April 1922, while the change in the recording of the overseas trade statistics was not made until 1 April 1923. Although it does some violence to the historical record it seemed more convenient to make the break at a point which would not interrupt the series for the inter-war period, and what was formerly Southern Ireland is accordingly excluded in all cases from 1920 (second estimate) onwards. The difference between the two estimates thus reflects both any change in definition which may arise at this point in the series and also the implicit estimate for Southern Ireland. The changes in definition are always noted and generally quantified in the relevant chapters. The implicit figures for Southern Ireland must not be regarded as a direct estimate for that region; the margins of error involved in the adjustment made to each series are probably small and acceptable

in relation to the estimates for the United Kingdom but could easily be intolerably large relative to the estimates for Southern Ireland.

Table 2 provides an alternative estimate of G.N.P. at factor cost for the period 1870-1965. It is built up from data on final expenditure at current market prices and adjusted to exclude taxes on expenditure net of subsidies. Table 3 offers another variation on this theme. Starting from total domestic expenditure (column (5) of Table 2) it adds exports of goods and services to get total final expenditure, and then deducts imports of goods and services to get G.D.P. at market prices. Adding net property income from abroad yields G.N.P. at market prices. Taxes on expenditure are then deducted and subsidies added to obtain the two aggregates (total final expenditure and G.D.P.) at current factor cost.

A variant of the main aggregates sometimes required is a measure relating only to the private sector of the economy, i.e. excluding income originating in the government sector. For example, gross private domestic product can be estimated by deducting from G.D.P. at factor cost estimates of the wages and salaries paid to civilian and military employees of central and local government, other than those in government trading enterprises. For 1920-38 an estimate on this basis can be derived by deducting the estimates for central and local government employees given in Tables 33 and 35. Corresponding data for the post-war period are given in the Blue Book [75, e.g. 1968, Table 48].

The two estimates of G.D.P. at factor cost derived respectively from the income data and the expenditure data are compared in Table 4. The table shows the absolute and relative magnitude of the difference between the two estimates (the 'residual error') and also provides a 'compromise estimate' calculated as an arithmetic mean of the income and expenditure series. The residual error and the compromise estimate are discussed in Chapter 1.4.

Table 5 again covers the period 1870-1965 from the *expenditure* side, but the estimates are given *at constant prices*. For this, as for other long-run series at constant prices, four main price bases are used: 1900 prices for 1870-1913, 1938 prices for 1913-48, 1948 prices for

1938 and 1948, and 1958 prices for 1948–65.¹ This particular selection of base years was determined largely by the existing estimates.

While it might have been possible, with the usual reservations regarding new products, quality changes, and so on, to recalculate all the individual items on a common price basis for the whole period 1870–1965, it was thought preferable not to do so. This is admittedly, in one sense, less convenient for the reader, since it is not possible to make a direct comparison – in pounds of any one year – of, say, G.D.P. in 1870 and 1965. However, the revaluation of series covering a period of almost a century at the prices of any single year would not be very meaningful, whereas the three main sets of prices used are broadly representative of prices ruling in their respective periods. They thus constitute a more appropriate basis for the aggregation of components in each period than would, say the revaluation of post-war expenditures at the very different relative prices of the inter-war or pre-1914 periods.

Given these sets of constant price estimates it is possible to obtain a very rough indication of the changes in the volume of expenditure over the whole period by calculating a single quantity index linking the various segments. For some readers this will be a procedure of little or no value, for others the convenience of a long-run index may outweigh the conceptual defects. The purists will presumably ignore Tables 6 to 8; the pragmatists may find them useful.² For the expenditure data the procedure is as follows: for 1870–1913 and 1913–38 two fixed weight quantity indices can be readily calculated (e.g. for G.D.P. from column (12) of Table 5) and linked by splicing at the single overlapping year, 1913. For the period 1938–48 it seemed desirable to take account of the fact that the effect of changes in relative prices between these two dates is sufficiently large to produce substantially different measures of the change in the volume of expenditure according to whether 1938 or 1948 prices are used. This applies most notably to the estimates for consumers' expenditure, where estimates at 1938 prices show an increase of 7.4% between 1938 and 1948, as against a rise of only 0.5% when 1948 prices are used. For G.D.P. at constant factor cost, the increases are 16.5% and 12.2% respectively. Each of these results is valid and interesting, but for the purposes of the present volume there is an obvious advantage in having a single long-run series. If 1938 prices only had been used for the whole run of 1913–48 estimates the weighting system would have been consistent with that adopted for other periods, i.e. a single year towards, but not at, the end (cf. 1900 weights for 1870–1913 and 1958 weights for 1948–65). However, in this

instance it was thought inappropriate to overlook the alternative results obtained with 1938 weights, since the 'conflict' reflects the special circumstances of the trans-war structural changes at the end of the period. Accordingly, a compromise result was obtained for 1938–48 by using a Fisher 'ideal' index. The trans-war movement is thus calculated by taking the geometric mean of estimates for the growth between 1938 and 1948 calculated at 1938 prices and at 1948 prices, and then interpolating by means of the annual estimates at 1938 prices. Finally the overlapping year 1948 is used to splice on the quantity index for 1948–64 at 1958 prices. The index number obtained in this manner for G.D.P. at factor cost is shown, with 1913 = 100, in Table 6, column (2). The corresponding indices for consumers' expenditure, public authorities' current expenditure on goods and services, domestic fixed capital formation, exports and imports, and G.N.P. (expenditure data) at factor cost are given in Table 7.

For the estimates of *output at constant prices* the calculation is made, in the first instance, in the form of quantity indices; and the procedure is broadly consistent with that used for the expenditure series. Different weights are again used for the separate sub-periods, and these are then linked to form a single index with 1913 = 100. The base years used in the output index are not always the same as those for expenditure: in particular, in the case of industrial production the trans-World War II link is based on the mean of movements calculated with 1935 and 1948 prices, the inter-war years use a combination of 1924, 1930 and 1935 prices, and for years before 1914 the base year prices are those of 1907. However, the relative prices should be roughly comparable (e.g. in 1900 and 1907 or 1935 and 1938). The final index for the main components and for G.D.P. at factor cost are set out in Table 8 and the G.D.P. series is reproduced in column (1) of Table 6 for comparison with the expenditure estimate.

Two further index numbers of G.D.P. at constant factor cost are given in columns (3) and (4) of Table 6. Column (3) is obtained by dividing the current price estimate of factor incomes (column (9) of Table 1) by the implied price deflator for G.D.P. derived from the current and constant price estimates of expenditure

¹ This describes the basic form of the weighting system used for the expenditure components and aggregates of Table 5. It is not, however, a completely accurate description since there are some items for which slightly different base year weights were used. Full details of these are given in the relevant chapters; the main series involved are those for foreign trade, where the base dates were changed frequently within each sub-period (see Chapter 6.1).

² These index number problems apply equally to the long-run price indices given in Tables 61–5.

TABLE 1.1 COMPARISON OF INDEX NUMBERS OF CONSUMERS' EXPENDITURE AND GROSS DOMESTIC PRODUCT, 1900-13, AT 1900 AND AT 1938 PRICES (1900 = 100)

	Consumers' expenditure at market prices		Gross domestic product at constant factor cost	
	1938 prices (1)	1900 prices (2)	1938 prices (3)	1900 prices (4)
1900	100.0	100.0	100.0	100.0
1901	101.6	102.0	104.4	104.0
1902	101.3	102.5	103.4	104.5
1903	100.6	102.9	101.7	104.5
1904	101.4	104.4	102.3	105.3
1905	101.2	105.0	103.6	106.9
1906	102.1	106.8	105.1	109.4
1907	103.0	108.2	105.2	109.8
1908	102.8	107.9	101.1	105.5
1909	102.2	108.4	104.5	109.4
1910	102.9	110.1	107.8	113.4
1911	106.0	113.4	110.2	116.0
1912	106.3	114.2	110.2	115.5
1913	109.1	118.3	115.1	121.7

SOURCE: (1) Stone and Rowe [249, II.], p. 144.
(2) and (4) Table 5.

(3) Column (1) plus other expenditure series in Table 5 adjusted to 1938 prices by means of the average value indices in Table 61.

(see column (7) of Table 61). The final index is a 'compromise estimate' derived by taking the arithmetic mean of the indices obtained from the output, expenditure and income data. There is much less difference between the figures shown for any year in this table than there is in Table 4; this reflects the fact that, as the data are in index number form, the *persistent* excess of the expenditure estimate over the income estimate is eliminated. For a more detailed analysis and comparison of these four measures of G.D.P. see Chapter 1.4 below.

It is now widely recognised that the choice of base year can significantly influence the recorded rates of growth, and that if, as is normally the case, there is a negative correlation between the relative changes in output and the relative changes in prices (so that, for example, output rises most for those products for which prices rise least), then the choice of an early year as a price base will result in a higher rate of growth than would be shown with a later year. It should, therefore, be noted that the base year prices used in the present estimates for each sub-period generally relate to the *end* of the period, and so tend to give a downward bias to the estimated growth rates.

Consequently, one of the ways in which it would have been desirable to improve the present results is by providing alternative estimates with early-year price bases. This has not been done in any systematic way, but it is possible to give a few illustrations of the

orders of magnitude involved. There is, first, the disparity noted above (p. 4) in the 1938 weight and 1948 weight calculations of the trans-World War II estimates of consumers' expenditure and G.D.P. Secondly the expenditure estimates for 1900-13 can be recalculated using 1938 rather than 1900 prices as weights.¹ The item principally affected is consumers' expenditure, and this grows rather more slowly at 1938 prices, partly because a higher (relative) weight is given to two of the slow growing items, beer and tobacco; partly because of the effect of the negative correlation between the proportionate movements of price and expenditure within certain categories, e.g. food. However, the change in price structure between categories of expenditure is partly a matter of indirect taxes and once this is allowed for by the adjustment to factor cost the change in weights has less effect on growth of G.D.P. at constant factor cost, but is still sufficient to lower the growth rate from 1.5 to 1.1% p.a. The two sets of estimates are shown as index numbers with 1900 = 100 in Table 1.1.

¹ 1938 is not necessarily the most appropriate year to choose for such a comparison, but it is one for which the required data were most readily available, notably for consumers' expenditure for which a very detailed recalculation is desirable. See R. Stone and D. A. Rowe, *The Measurement of Consumers' Expenditure and Behaviour in the United Kingdom, 1920-1938*, vol. I, 1953, vol. II, 1966 [249].

TABLE 1.2 COMPARISON OF INDEX NUMBERS OF MANUFACTURING OUTPUT WITH DIFFERENT BASE YEARS

	Period	Base year	Percentage increase
(i)	1948-54	1948	32.0
		1954	18.7
(ii)	1935-48	1935	40.7
		1948	31.3
(iii)	1907-24	1907	32.6
		1924	21.3

SOURCE: (i) R. J. Nicholson and S. Gupta, *Output and Productivity Changes in British Manufacturing Industry, 1948-1954*, *J. R. Statist. Soc.*, Series A, 123, 1960 [221], p. 438.
(ii) B. C. Brown, 'Industrial Production in 1935 and 1948', *London and Cambridge Economic Bulletin*, N.S.12, 1954 [138], p. vi.

(iii) A. Maddison, 'Output, Employment and Productivity in British Manufacturing in the Last Half Century', *Bulletin of the Oxford University Institute of Statistics*, 17, 1955 [205], p. 371.

The third illustration comes from index numbers of manufacturing production, where the calculations in Table 1.2 are available for sets of indices, identical in every respect except the choice of which year's prices are to be used for combining the series. This is the sector where the effect of the change in weights is, in principle, likely to be greatest, and as Table 1.2 shows it is in fact quite substantial, though the periods covered by the table are perhaps atypical: (ii) and (iii) reflect the extensive structural changes associated with World Wars I and II, and (i) includes the prices of 1948, a year affected by price controls and other special factors.

These few examples are perhaps sufficient to show the importance of the choice of base year weights, and any interpretation of the growth rates shown by the present estimates must take this aspect into account, treating small differences found in international or inter-temporal comparisons with due caution.

There is one final point to be made regarding the estimates at constant prices. It arises in connection with the balance of payments components of the expenditure estimates in Table 5. The procedure followed was the separate deflation, by means of appropriate indices, of the series for exports of goods and services, imports of goods and services and net property income from abroad. This provides the required measure of real *product*. There is, however, an alternative procedure which would take into account any gains (or losses) to the United Kingdom from changes in the terms of

trade, and so provide a true measure of real *income*. For this it would be necessary to deflate the balance on current account (i.e. net investment abroad) by a single price index; and for most purposes the import price index would be the most appropriate one to use.

The implications of the previous paragraph can be set out as follows:

Let Q_x and Q_m = the volume of exports and imports,
 P_x and P_m = the prices of exports and imports.

The estimate of real product thus corresponds to:

$$\frac{Q_x P_x}{P_x} - \frac{Q_m P_m}{P_m} = Q_x - Q_m \quad (1)$$

To estimate real income we would instead take:

$$\frac{Q_x P_x}{P_m} - \frac{Q_m P_m}{P_m} = Q_x \cdot \frac{P_x}{P_m} - Q_m \quad (2)$$

The difference between the two estimates is thus:

$$Q_x \cdot \frac{P_x}{P_m} - Q_x \quad (3)$$

The gain (or loss) from the change in the terms of trade can thus be calculated from the ratio P_x/P_m applied to the volume of exports.¹ As can be seen from the series in Tables 61 and 64 the extent of the change in the terms of trade is not negligible.

¹ For further discussion of these issues see R. G. D. Allen, 'Price Index Numbers', *Review of the International Statistical Institute*, 31, No. 3, 1963 [110], pp. 294-6. The above paragraphs are based on Allen's treatment of the problem.

1.2 SECTOR ACCOUNTS, 1920-65

The estimation of total national income has a long history in England, reaching back at least as far as Gregory King's calculations for 1688. It was not, however, until the establishment of the Central Statistical Office that attempts were made to provide a *sectoral* analysis of the flow of incomes and expenditure. Such sectors aggregate the transactions of groups within the economy which are broadly homogeneous with respect to their economic function. Detailed sector accounts are now available in the Blue Book for each year from 1946 onwards, and the present section summarises the estimates made for this study which permit the extension of the sector accounts to cover the period 1920-38, and in some cases also earlier years.

As in the Blue Book, the economy is divided into five sectors. The first covers all *persons* or households and also certain non-profit-making bodies serving individuals, the life funds of life assurance companies, and the funds of occupational pension schemes. The second covers *corporate productive enterprises*, both companies and public corporations. There is a third sector for the transactions of the *Central Government* and a fourth for that of *local authorities*; and a final sector representing the *rest of the world*, which is designed to record all transactions between residents and non-residents.

A separate chapter is devoted to each of these sectors

and each contains a precise statement of the scope and definition of the sector. A revenue and expenditure (current) account for each of the five sectors is given in Tables 10 to 13 and 15, and Table 14 aggregates the accounts for the Central Government and local authorities to provide a summary of the transactions of the public authorities (but not public corporations) with the other sectors. In each of the sector tables the attempt is made to eliminate all intra-sector transactions.

For the personal and corporate sectors the estimates can be made only for 1920-38 and 1946-65 but for the public authorities continuous sector accounts have been compiled from 1900, and the account for the overseas sector is given from 1870, and could be carried back even further.

The current accounts for the four domestic sectors each yield an estimate of the excess of income over expenditure and these, together with any addition to tax and dividend reserves, may be regarded as the savings of the sector before providing for depreciation and stock appreciation. These estimates of savings for 1920-38 and 1946-65 are brought together in a combined capital account in Table 16, and after adjustment for stock appreciation and the residual error are related to the estimates of investment, i.e. gross domestic fixed capital formation, stockbuilding and net investment abroad.

1.3 SELECTED RATIOS, 1855-1965

As already noted, it is not intended to analyse or process the statistical series gathered together in this study, but it may save readers a certain amount of computing if some of the more obvious ratios are provided. This is done in Tables 17 to 20.¹ The first of these tables shows personal disposable income and net national income, both in pounds at current prices, per head of the population; and consumers' expenditure and gross domestic product, both in pounds at constant (1913) prices, per head of the population. In Table 18 the percentage distribution of G.D.P. at current prices between wages, profits and other factor incomes is calculated; and Table 19 gives the ratio of the various categories of expenditure (including exports and imports) to G.N.P. at constant prices. Finally, Table 20 presents in the form of chained indices three of the main series for output (the compromise index of gross domestic product at constant factor cost), labour (total numbers in employment) and capital (the gross stock

of reproducible fixed capital at constant replacement cost); and combines these to give three much-used series: output per worker, the capital-output ratio and the capital-labour ratio. Some of the main series included in this table are graphed in Figure 1.2, p. 13.

Even these rather basic percentages and ratios ought to be qualified in certain respects: for example, by allowing for changes in age composition when considering *per capita* consumption, for the property and labour components of income from self-employment when considering factor shares, or for changes in hours worked when considering output per worker. However, such refinements belong to the companion study being undertaken with Professor Matthews (see p. 2).

¹ Most of the series used for these tables are included in the summary tables already described. Additional series for population, labour and capital come from Tables 55, 57 and 43 respectively.

TABLE 1.3 COMPARISON WITH THE BLUE BOOK ESTIMATES OF GROSS NATIONAL PRODUCT IN 1938 (£ M.)

	Blue Book (1)	Present estimate (2)
<i>A. Factor incomes</i>		
Income from employment	3,022	2,989
Income from self-employment	647	615
Gross trading profits of companies	690	687
Gross trading surplus of public corporations	10	10
Gross trading surplus of other public enterprises	64	62
Rent	470	460
<i>Less</i> Stock appreciation	80	109
	<hr/>	<hr/>
G.D.P. at factor cost	4,983	4,932
Net property income from abroad	192	192
	<hr/>	<hr/>
G.N.P. at factor cost	5,175	5,124
<i>B. Expenditure estimate</i>		
Consumers' expenditure	4,394	4,392
Public authorities' current expenditure	772	749
Gross domestic fixed capital formation	656	592
Value of the physical increase in stocks and work in progress	—	83
	<hr/>	<hr/>
Total domestic expenditure	5,822	5,816
Exports and property income from abroad	976	1,010
<i>Less</i> Imports and property income paid abroad	1,038	1,062
<i>Less</i> Taxes on expenditure net of subsidies	585	587
	<hr/>	<hr/>
G.N.P. at factor cost	5,175	5,177

SOURCE: (1) 1967 Blue Book [75], Table 1.

(2) Tables 1 and 2.

1.4 CONSISTENCY AND RELIABILITY

CONSISTENCY

Most of the component series are the outcome of separate and generally independent sets of estimates for three main sub-periods: pre-1914 (or 1920), 1920-38 and 1946-64, with heavy reliance on interpolation to fill in the two war-time periods. There are, quite commonly, corresponding breaks in the underlying source material, and the problems of continuity thus arise primarily at the two switch points, 1920 and 1938.

To take the later year first: there is for most series a Blue Book estimate for 1938 which is intended to be consistent with the post-war estimates. Since the present estimates for 1938 are always, as nearly as possible, consistent in source and definition with the inter-war series, a comparison of the two sets of estimates for 1938 will provide some useful guidance on two points: first, the degree of long-run comparability between the present inter-war estimates and the C.S.O. series for

1946 onwards; and second, the extent of any actual discontinuities occurring between 1938 and 1939 (or 1945 and 1946). The 1938 income and category of expenditure estimates, at current prices, from the two sources are set out in Table 1.3 and we consider first the question of long-run comparability.

On the income side the numerical agreement on the estimates for all the main components is extremely good. The largest discrepancy (about 5%) is in the estimate for income from self-employment; as explained in Chapter 7.1 this is largely a difference in estimation of a very uncertain item. It is likely that the C.S.O. estimates for the post-war years will have continued to be on a slightly higher basis, which would affect the consistency of the income estimates over the period as a whole, though not, in later post-war years, to a serious extent, since income from self-employment is steadily declining in importance as a component of factor incomes. For two other items, company trading profits

and rent, the apparent agreement in 1938 is partly the result of a difference in the treatment of royalties, etc. (as a result of which the present estimate of profits is some £24 m. lower than it would be on the C.S.O. definition and the estimate of rents some £24 m. higher) offset by differences in estimation. Without this difference in definition the present estimate of profits would exceed the Blue Book estimate by some £21 m., and the estimate of rent would be lower by some £34 m. (see Chapters 7.1 and 8.0). This would still be a difference of less than 4% in the case of company profits but is nearer 8% for rent, and so is large enough to call for a certain caution in comparisons of income from rent across the two periods. This difference in definition of profits and rent automatically cancels out so that G.N.P. is unaffected, and the overall difference in the level of the estimates for 1938 is only 1%.

On the expenditure side the two aggregates agree almost exactly, but there are moderate – and only by chance compensating – discrepancies in some of the component items. For imports and exports this is largely a matter of definition, and as suggested in Chapter 6.0 the present estimates for 1938 and earlier years are more consistent in definition with the post-1946 series than the Blue Book's own estimates for 1938. This is also true for items accounting for part of the discrepancy in public authorities' current expenditure on goods and services. The differences of estimation in fixed capital formation and stockbuilding are quite large, but since the sources and methods of estimation used by the C.S.O. for the estimation of these items in the post-war period are quite different from those used for their 1938 estimate, the disagreement on the levels in that year cannot cast much light on the comparability of the inter-war and post-war estimates.¹

Turning next to the problem of actual breaks in continuity where the two series meet, income from self-employment is the only item where there is a marked discontinuity between 1938 and 1939. The present estimate is used in Table 1 for 1938, but the Blue Book estimate for that year was accepted as being more consistent with the 1946 estimate and was accordingly used when interpolating to get estimates for 1939–45. Part of the rise between 1938 and 1939 is, therefore, spurious. For other items, on both the income and the expenditure side, the difference is either not large enough to matter in a period of rapid change (e.g. for income from employment) or else the Blue Book estimate for 1938 was not considered as necessarily more consistent with the post-1946 series and was, therefore, disregarded in making the estimates for 1939–45.

We consider next the extent to which the continuity of the series is broken between 1919 and 1920. There

are three factors which are, or might be, the source of discontinuities: the exclusion of Southern Ireland from 1920 onwards, changes in definition affecting certain series, and differences in estimation. Unfortunately, there is generally no overlapping year covering both the pre-1920 and the inter-war estimates – the inter-war series all begin in 1920 and the earlier series end in either 1914 or 1919 – and it is, therefore, difficult to quantify the effects of any differences in estimation. Where the pre-war series ends in 1914 a rough measure of continuity usually results from the use of 1914 and 1920 as benchmarks when interpolating to cover the war years, and this is probably reasonably adequate given the large changes over this period. In those cases where the first series ends in 1919 there is no way in which a precise indication can be given of the extent of any differences in estimation. The most important instance is the series for consumers' expenditure, and since the preparation of the two series – for 1900–19 and 1920–38 – was quite closely coordinated it is likely that any error on this account in the estimated movement between 1919 and 1920 will be relatively small.

It is possible to be rather more precise regarding the effects of changes in definition and the exclusion of Southern Ireland. Table 1.4 reproduces the two income estimates for 1920 given in Table 1 together with the corresponding expenditure estimates from Tables 2 and 3. It will be seen that the differences in definition are small, both on the individual items and in total, but for some purposes it might be necessary to allow for the change in treatment of Southern Ireland.

Apart from these 'across the board' breaks in 1920 and 1938 there are certain individual series affected by a change in source at other dates. The most troublesome example is probably the series for consumers' expenditure where there is a difference between the series available before and after 1900. An attempt has been made to allow for this (see Chapter 2.4) but it still leaves an element of discontinuity in the estimates.

The preceding discussion has related to the current price estimates of factor incomes and of the various categories of expenditure, and there are no additional discontinuities affecting the corresponding estimates at constant prices. There may, however, be some differences in the comparability of measurement of the growth over different periods, arising either from the factors inherent in the index number problem including, in particular, questions of quality change and of the influence of the choice of base year weights; or from

¹ This applies also to the estimates of stock appreciation on which there is a large discrepancy for 1938.

TABLE 1.4 RECONCILIATION OF ESTIMATES OF GROSS DOMESTIC PRODUCT IN 1920

(£M.)

	'Pre-1920' basis (1)	Less Southern Ireland (2)	Difference in definition (3)	'Post-1920' basis (4)
<i>A. Factor incomes</i>				
Wages	2,475	106	47 ^a	2,416
Salaries	850	17	—	833
Other income from employment	200	—	—	200
Farmers' income	197	36	—	161
Other income from self-employment and corporate profits	1,233	25	4 ^b	1,212
Trading profits of public enterprises	20	—	—	20
Rent	259	11	-24 ^c	224
Stock appreciation	+200	—	—	+200
G.D.P.	5,434	195	27	5,266
<i>B. Expenditure estimate</i>				
Consumers' expenditure	5,246	226	—	5,020
Other domestic expenditure	920	50	—	870
Exports of goods and services	2,049	-79 ^d	—	2,128
Less Imports of goods and services	1,985	-51 ^d	—	2,036
Less Taxes on expenditure net of subsidies	386	16	—	370
G.D.P.	5,844	232	—	5,612

SOURCE: Tables 1, 2 and 3 plus text.

^a For 1920-38 an addition of 2% was made to wages to cover earnings from subsidiary jobs etc. (see Chapter 2.1, p. 33).

^b The net result of several differences, including those listed in note c; see Table 7.12 for details.

^c Difference in treatment of rent of owner-occupied property and royalties, etc. See Chapter 8.0, p. 181.

^d The negative sign reflects the fact that trade between Southern Ireland and Great Britain plus Northern Ireland exceeded trade between Southern Ireland and the rest of the world.

the changes in the character and accuracy of the price data and of the quantity indicators available in different periods. Since the base year weights are all located near the end of the sub-periods for which they are used the growth rates within each segment should be, in this respect at least, broadly comparable. As against this, the periods differ greatly in length so that, for example, 1900 is much further away from 1856 than 1958 is from 1948. With regard to the other possible factors affecting comparability, it is impossible to make any quantitative assessment. There has probably been a general tendency for the quality of the basic price and quantity data to improve over the period as a whole but one cannot say in which direction this is likely to alter any estimate, and it seems unlikely that this has any appreciable effect on the measured growth within successive periods.

On balance it seems reasonable to conclude that all these series i.e. the G.D.P. or G.N.P. aggregates and their major components at current and constant prices

can for most purposes be regarded as continuous series, consistently defined and measured, over the whole period from 1855 (or 1870) to 1965. It is only for very detailed analysis of, for example, short-term fluctuations that the identified breaks are likely to be a material factor in analysis of the data. The one series not covered by this conclusion is the estimate of the gross capital stock, where there is the quite sizable discrepancy in the two available estimates for 1938. This is discussed more fully in Chapter 9.1.

RELIABILITY

There are broadly three ways in which the reliability of the main aggregates might be assessed: by comparison with other estimates, by comparison of the separate measures of G.D.P. or G.N.P. given in the present study, and by reference to the subjective evaluations of the statisticians responsible for the compilation of the component series. We can consider each of these in turn.

(i) *Comparison with other estimates*

Scope for the first of these methods is unfortunately rather limited, since the present estimates have, in general, either adapted, amended or deliberately rejected existing series. Where comparisons with alternative estimates of component series are appropriate they are made in the relevant chapters (e.g. Chapter 7.1); and there is little to be learned from comparison with older national income estimates (for example, those of Bowley or Colin Clark) which employed different definitions and relied on less complete data.¹

The one alternative series with which comparison might be fruitful is the estimate of G.N.P. at constant factor cost recently published by Phyllis Deane [155], though even with this series the main reference must be to the respective rates of growth over the common period 1856-1913.² The series is based on expenditure data and the current price version has a number of components in common with Table 2, but the deflation to constant prices is a sufficiently independent calculation to provide some measure of genuine comparison with the present estimate from expenditure data. The results are set out in Table 1.5 for selected periods, taking years which are broadly comparably cyclical peaks.

TABLE 1.5 COMPARISON WITH PHYLLIS DEANE'S ESTIMATES OF RATE OF GROWTH OF G.N.P. AT CONSTANT FACTOR COST, 1856-1913 (% per annum compound; based on expenditure data^a)

	Deane (1)	Present estimate (2)
1856-1913	2.0	2.1 ^a
1856-1873	2.5	2.3 ^a
1873-1900	2.0	2.1
1900-1913	1.55	1.7

^a For 1856-73 the present estimate is based on income data.

SOURCE: (1) Deane [155], pp. 106-7.

(2) Table 7, column (7); and, for 1856-73, Table 6, column (3) adjusted to include net property income from abroad at 1900 prices.

It can be seen that the two estimates agree well on the rate of growth of G.N.P. at constant factor cost both over the full period 1856-1913 and in the three sub-periods. The main source of disagreement is in the estimates of gross domestic fixed capital formation, and this is examined more closely in Chapter 9.0, pp.191-5.

Apart from stockbuilding, which is not included in Miss Deane's estimates and which is very inadequately covered in ours (cf. pp. 17-8, below), the other important difference is in the treatment of the adjustment to constant factor cost. Miss Deane deflated her current price series for taxes on expenditure by means of the price index implicit in her aggregate estimates for consumers' expenditure and capital formation, whereas the procedure adopted for the present estimates is the direct application of the base year rates of taxation to the individual estimates at constant market prices for those components of expenditure subject to tax. This is, I believe, the more accurate procedure.

Finally, there are two slight differences relating to consumers' expenditure: we both use the same basic series but (a) the present estimates for 1894-99 include an upward adjustment (rising from 3 to 5 %) designed to improve the link with the series for 1900 onwards (see p. 49);³ and (b) in the present estimates the individual series for 1900-13 were separately revalued at 1900 prices whereas Miss Deane deflated aggregate expenditure at current prices by an index compiled by Prest in which the change in prices between successive years is calculated by means of Fisher cross-weight indices which are then chained together to

¹ However, a reconciliation with the last of the older national income estimates (by Jefferys and Walters) is given in the appendix to this chapter, pp. 23-9.

² The level of Miss Deane's series is of less value than the long swings or the long-run rate of growth for several reasons, including the omission of an estimate for stockbuilding, the incomplete coverage of domestic fixed capital formation, and the inclusion of movements of gold and specie in her series for exports less imports of goods and services.

Two earlier estimates of G.N.P. and N.N.P. at constant factor cost were published by Deane and Cole [156, pp. 282-4] but Miss Deane has now noted [155, p. 97] that the price indices underlying these estimates overstate the fall in prices from 1873 to the mid-nineties and correspondingly overstate the rate of growth of real product over that period. The deflation of G.N.P. by indices of wholesale or retail prices is, in any event, a very unsatisfactory procedure, particularly for measuring real *output* as opposed to real *income*, and for this and other reasons cannot be justified where alternative deflators are available. For an early recognition of this problem, as of so many others, see Colin Clark, *National Income and Outlay*, 1937 [149], pp. 230-31.

³ This adjustment is of some importance if 1899, rather than 1900, is taken as the appropriate year for calculating growth rates in Table 1.5, and would indicate a greater discrepancy between the two series; for 1873-99 the G.N.P. growth rates are Deane: 1.9 % p.a., present estimate: 2.2 % p.a., and for 1899-1913 the corresponding rates are 1.7 and 1.4 % p.a.

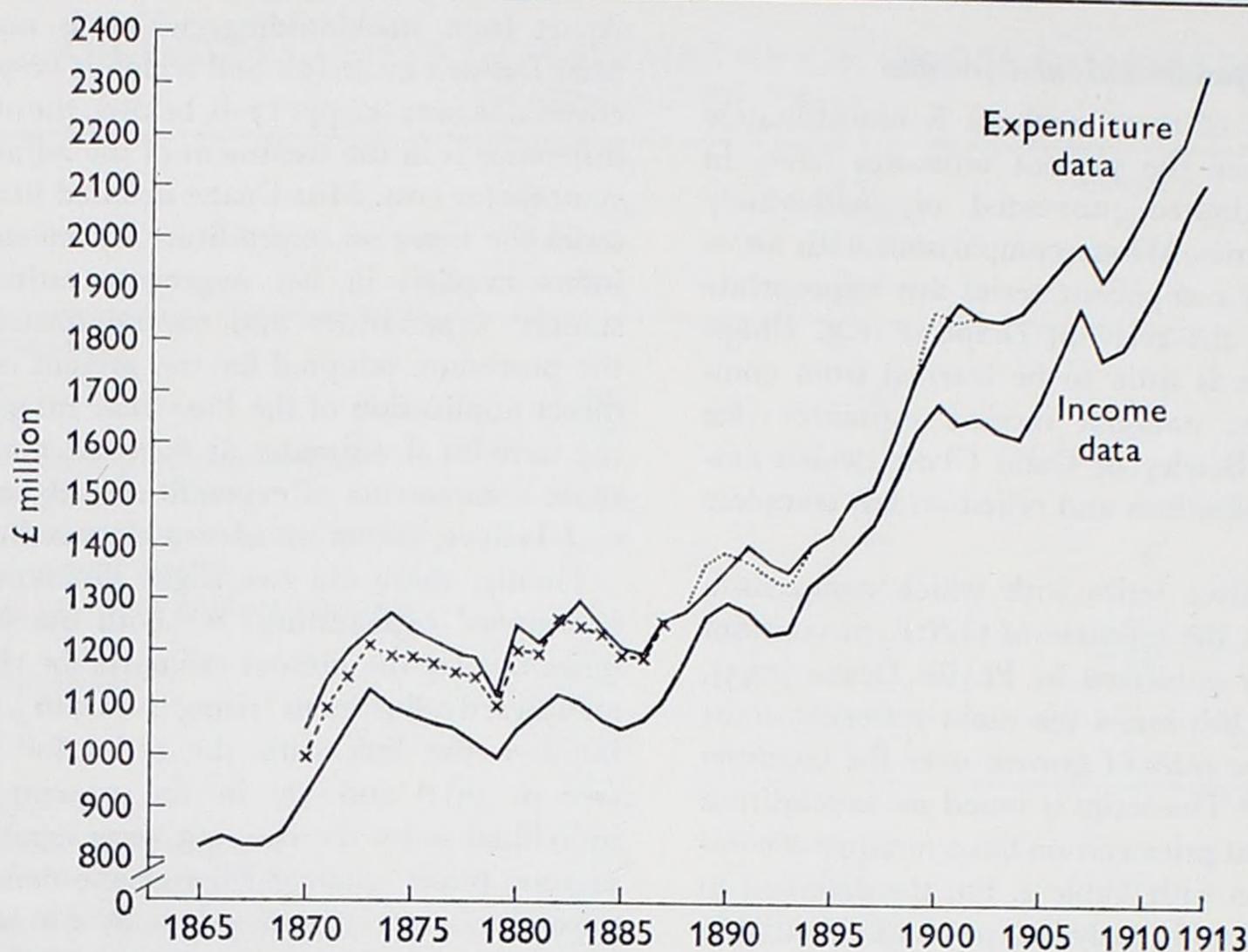


FIGURE I.1 COMPARISON OF INCOME AND EXPENDITURE ESTIMATES OF GROSS DOMESTIC PRODUCT AT CURRENT FACTOR COST, 1865-1913

× ---- × Expenditure data adjusted for stockbuilding and trend
 Expenditure data adjusted for stockbuilding

form a single index.¹ The effect of this procedure is thus to introduce the quantity weights of all earlier years into the price index obtained for any given year, and as compared with the present procedure this results in a more rapid increase in the price index and hence a slower increase in real expenditure.²

(ii) *Comparison of present estimates*

The second method is the comparison of the separate estimates made in the present study. For G.D.P. at current prices there are two estimates, based respectively on income data (Table 1) and expenditure data (Table 3), and at constant prices there are three estimates set out in Table 6, derived respectively from output data, from expenditure data, and from income data deflated by the implicit price index from the expenditure estimates. The separate estimates are not completely independent, since some components draw on a common source: for example, estimates of expenditure on domestic service depend on estimates of wages earned in domestic service, and estimates of the real output of passenger transport use the same series for passenger-miles as the series for expenditure at constant prices. In general, however, the differences both in the raw data and in the methods by which they are processed to yield the required national

accounts series are sufficiently great to make comparison of the results a worthwhile guide to the existence and possible magnitude of errors in the estimates of G.D.P. or related aggregates.³

We deal first with the estimates at *current prices*. The residual error, i.e. the difference between the estimates at current prices of G.D.P. at factor cost from the expenditure side and from the income side, is shown in

¹ A. R. Prest, assisted by A. A. Adams, *Consumers' Expenditure in the United Kingdom, 1900-1919*, 1954 [232], p. 4. The change in prices between years 1 and 2 would thus be calculated as:

$$\left(\frac{\sum q_1 p_2}{\sum q_1 p_1} \cdot \frac{\sum q_2 p_2}{\sum q_2 p_1} \right)$$

² With the crossed-weight linked indices real consumers' expenditure rises at 1.2% p.a. between 1900 and 1913; with the 1900 price series the rate of growth is 1.3% p.a.

³ The analysis which follows is very general. For a more rigorous statistical analysis see the article by M. C. Fuller, 'Some Tests on the Compatibility of Historical Series of National Accounts Estimates', *Bulletin of the Oxford University Institute of Economics and Statistics*, 32, 1970 [165]. Fuller carried out a number of statistical tests on the data of Tables 4 and 6, but in order to do so was required to make certain assumptions about the types of error in the different series, and his results thus depend directly on the nature of the assumed model. Broadly speaking, his conclusions correspond to those reached below.

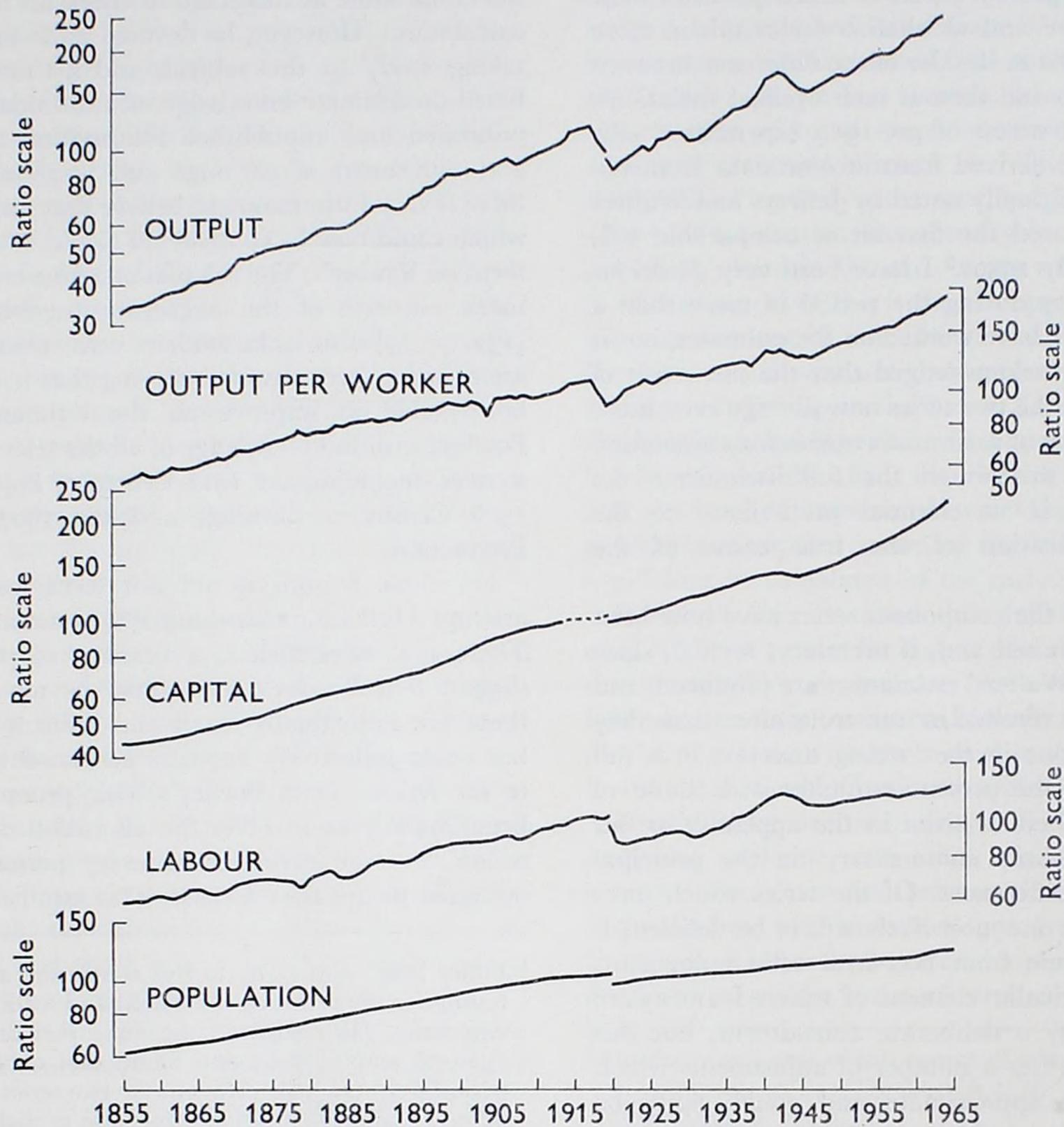


FIGURE 1.2 OUTPUT, INPUTS AND PRODUCTIVITY (INDEX NUMBERS, 1913 = 100)
 Output: Gross domestic product at constant factor cost
 Output per worker: Gross domestic product at constant factor cost per man-year
 Capital: Gross stock of reproducible fixed assets at constant replacement cost
 Labour: Total in employment – man-years

Table 4 both in absolute terms and as a percentage of the income estimate; the two series for 1870–1913 are graphed in Figure 1.1. Two points emerge from this confrontation of the two approaches. First, the discrepancy is positive throughout the first six decades, i.e. expenditure persistently exceeds income in every year from 1870 to 1932. In the later inter-war and post-World War II period the sign varies but with a positive discrepancy still predominating.

Second, there is a marked downward trend in the relative size of the discrepancy. The gap between the two estimates starts at a rather high level but becomes

progressively smaller relative to G.D.P., and a number of separate levels can be identified. From 1870 to 1887 the average (unweighted) discrepancy as a percentage of the income estimate is just over 14%, and for 1888 to 1913 the average falls to 9% (with 5 years when the discrepancy exceeds 12% and 6 when it falls below 6%). In 1920–6 the average is reduced to just over 6%; and for the remaining inter-war period the discrepancy is consistently low, with the average well below 2% (ignoring sign). From 1948 onwards the gap narrows still further and the average discrepancy (ignoring sign) is less than 1%.

It is thus the pre-1914 period which provides most cause for concern¹ and we shall consider this in more detail, looking first at the size of the difference between the two estimates and then at their cyclical variations.

The persistent excess of pre-1914 expenditure estimates over those derived from income data is an old puzzle: it was originally noted by Jefferys and Walters when they prepared the first set of comparable estimates in the early 1950s.² I have been very conscious of the discrepancy during the period of more than a decade in which I have worked on the estimates, but it must be ruefully acknowledged that the net result of my efforts is that the two series now diverge even more widely. In the face of such misfortune some consolation may be found in the thought that full disclosure of the 'residual error' is an essential preliminary to the ultimate identification of the true cause of the discrepancy.

All but two of the component series have now been thoroughly scrutinised and, if necessary, revised, since the Jefferys and Walters' estimates were produced, and although this has resulted in numerous alterations they have typically gone in the 'wrong direction'.³ A full reconciliation of the present estimates with those of Jefferys and Walters is given in the appendix to this chapter, with a brief commentary on the principal reasons for the differences. Of the series which have been revised, the one most likely still to be deficient is profits and income from non-farm self-employment. There is no particular element of which I am aware that would justify a deliberate amendment, but this estimate incorporates a number of adjustments which are unavoidably approximate and could easily be understated. This would apply in particular to the allowances for income evading taxation and for small (non-wage) incomes not subject to income tax, and to a lesser extent to the amounts added back for depreciation.⁴ The other main series: rent, public authorities' current expenditure, domestic capital formation and net investment abroad all seem much less likely to be significantly wrong.⁵ The fact that reconsideration of all these component series has only served to widen the discrepancy suggests, however, that suspicion must now fall on the two remaining items.

The two series which have not been re-examined for this volume are Bowley's estimates of wages, and Jefferys and Walters' estimates of consumers' expenditure for the years 1870-99. Bowley, unfortunately, never published a detailed account of the sources and methods used in the construction of his final index of average money wages; he considered that the material was 'too extensive to print in full' and the compilation 'too complicated for exhibition in a simple form',⁶ and it is

thus impossible at this stage to check his methods and calculations. However, he devoted a life-time of painstaking study to this subject, and his estimates were based on intimate knowledge of a formidable array of published and unpublished information on the level and movement of earnings and wage-rates, so that there is very little reason to believe that any new index which could now be constructed would be an improvement on Bowley's. The calculation of the crucial benchmark estimate of the aggregate wage-bill in 1911 [132, p. 74] also lacks modern verification, but there are again no grounds for believing that it would today be possible to improve on the estimate made by Bowley, with full knowledge of all the relevant primary sources, including the 1911 Census of Population, the 1906 Census of Earnings and the 1907 Census of Production.

For these reasons it did not seem worthwhile to attempt a full-scale reworking of the estimate for wages. There are, nevertheless, a number of points which suggest that Bowley's series may be too low. All of them are individually small and difficult to quantify but could collectively impart a certain downward bias to the results. First, Bowley's basic procedure for the benchmark year involves the allocation of an appropriate 'average earnings' to every person shown as occupied in the 1911 Census. This assumes that every

¹ Fuller [165] also came to this conclusion as a result of testing for the presence of location and scale errors in the two series. He compared the three periods 1870-1913, 1920-38 and 1948-64 and found that only in the first period were the scale errors in the two series significantly different, and the location errors also probably different.

² James B. Jefferys and Dorothy Walters, 'National Income and Expenditure of the United Kingdom, 1870-1952', *Income and Wealth, Series V*, 1955 [184], pp. 7-13. (The estimates were first presented at a conference held in 1953.)

³ It may be as well in this connection to state explicitly that while always aware of the discrepancy I have tried to prevent it from exercising any unwarranted influence on the results. Changes have been made wherever these were called for by the conceptual framework or the data sources without regard to any adverse effect this might have on the residual error. By contrast, Jefferys and Walters deliberately aimed to bring the two measures of N.N.P. closer together. For example, where alternative series were available - as for overseas lending - they selected the one which would have this effect (cf. [184], p. 7, n. 2).

⁴ See Chapter 7.2 for detailed discussion of each of these adjustments.

⁵ The stockbuilding series is defective (see pp. 17-8, below) but this will have only a slight effect on the average size of the residual error.

⁶ A. L. Bowley, *Wages and Income in the United Kingdom since 1860*, 1937 [132], p. 5.

occupied person has only one job, and while it is true that with a six-day, fifty-four-hour week the opportunity for double jobs would be limited, there will be some omission of supplementary earnings. This applies also to the omission of the occasional contributions to family income that might have been earned by housewives, children not yet occupied or retired persons. Secondly, there is the possibility of some slight understatement in the figure for average earnings derived from the 1906 enquiry. This will occur in trades where casual labour was common so that a single worker could appear in the returns from more than one employer and thus be counted twice in the divisor, the number of persons employed.¹ Thirdly, the estimates allow for income in kind in industries where it was an important item (agriculture and domestic service) but not for the lesser amounts which would have been provided in other trades.

The above points would all affect the 1911 benchmark and suggest accordingly a relatively constant (proportionate) understatement in all years. A further factor tending in the same direction is that Bowley may possibly have overstated the level of unemployment in the period before 1880, but this would be a rather minor aspect.² Finally, there is the possibility of a random error in the early years of the series: the extrapolation from 1911 could be checked by Bowley by reference to the results of the first wage census of 1886; before that there is no control on the estimates and the margin of error could be higher.

On the expenditure side the pre-1900 estimates of consumers' expenditure are rather more vulnerable and it might be rewarding to attempt to construct new estimates.³ There are a number of possible defects in the present series, some of them noted by Jefferys and Walters [184, pp. 11-13], and it is significant that these possible errors all point in the same direction: to the likelihood that the estimate becomes *progressively* too high as it moves back to 1870. The first such defect may be in the estimate for distributive margins. Large mark-ups (40% for home-grown food, 35% for home-produced manufactures, and 26.5% and 43.5% for the corresponding imports) are incorporated in the basic estimates to cover the costs of distribution, and are assumed to have been constant from 1870 to the end of the century. It seems more likely that margins were lower in the early years, and increased over time. This is what one would logically expect to find given that the scope for increasing productivity is less in distribution than in production; and it is what has been shown in studies of the trend in margins in the United States.⁴

The second possible source of error is in the estimates

for finished manufactured consumer goods. For this series a benchmark derived from the 1907 Census of Production was extrapolated back to 1870. The indicators used for this purpose were mainly input series, e.g. consumption of cotton yarn for woven cotton goods, or of flour for bread, biscuits, etc.⁵ They assume a constant ratio of input to net output, but if, as is likely, the degree of fabrication has actually increased over the period, the level in the early years will be overstated. A further aspect of this is that the procedure followed takes no account of any changes in the proportion of the input which was not commercially processed and sold but worked up in the home. The extent of home dress-making, baking, etc. will almost certainly have been greater in the 1870s than in the benchmark year and the level of consumers' expenditure – as opposed to total consumption including the 'subsistence sector' – will thus be overstated in the early years.

It should also be noted that Jefferys and Walters used Hoffman's series for output of woven goods (wool, cotton and silk) as the indicators for clothing. W. Arthur Lewis has recently constructed a series for clothing output,⁶ and this shows a lower level in the 1870s relative to 1907 than the Hoffman series for woven goods.

Finally, there are the estimates for various services, including medicine, education, entertainment, catering, gas and water and private transport. For these items the base year estimates (1901) are extrapolated by means of series for numbers employed and what is described as a price index of services but is, in effect,

¹ Bowley was aware of this source of error but dismissed it as unimportant. See *The Division of the Product of Industry*, 1919 [127], p. 27, n. 1.

² See the discussion in Chapter 11.1, p. 225, of the uncertainty regarding the unemployment data available for this period.

³ One possible starting point would be to check the level of the Jefferys and Walters' estimates against the scattered data on household budgets, etc. See, for example, J. A. Banks, *Prosperity and Parenthood*, 1954 [113], especially Chapters IV-VI, and J. Burnett, *A History of the Cost of Living*, 1969 [139], Chapter 4.

⁴ See H. Barger, *Distribution's Place in the American Economy since 1869*, 1955 [114]. It is perhaps also worth noting that a report 'On the present Appropriation of Wages and other Sources of Income' drawn up by Professor Leone Levi and others in 1881 assumed a margin of 20% in estimating the retail cost of food, clothing and other products. See *Report of the British Association for the Advancement of Science*, 1881, p. 275.

⁵ The indicators were taken from W. G. Hoffmann, *British Industry, 1700-1950*, 1955 (English edition) [179].

⁶ See W. Arthur Lewis, *The Deceleration of British Growth, 1873-1913*, 1970 [202], p. 91. Like the other series referred to above this is strictly an estimate of the total consumption of clothing, including clothes made at home.

TABLE 1.6 DATES OF TURNING POINTS IN THE ESTIMATES OF G.D.P.
AT CURRENT PRICES AND IN THE N.B.E.R. REFERENCE CYCLE

Peaks				Troughs			
Expenditure estimate	Income estimate	Reference cycle	Compromise estimate	Expenditure estimate	Income estimate	Reference cycle	Compromise estimate
1874	1873	1873	1873				
1880	—	—	—	1879	1879	1879	1879
1883	1882	1883	1882	1881	—	—	—
1891	1890	1890	1890	1886	1885	1886	1885
1901	1900	1900	1900	1893	1892/93	1894	1892/93
—	1902	1903	1902	—	1901	1901	1901
1907	1907	1907	1907	1902/03	1904	1904	1903/04
1913	1913	1913	1913	1908	1908	1908	1908

simply a general index of wage rates.¹ These estimates must also be subject to a large margin of error.

The upshot of this discussion is thus to cast doubt on three major components: wages and profits (including non-farm income from self-employment) may be too low; consumers' expenditure may be too high, particularly in the earlier decades. Unfortunately it is not yet possible to apportion the errors more precisely. However, since it appears likely that the 'true' estimate of G.D.P. at current factor cost will lie somewhere between the income and expenditure estimates it would seem to be appropriate to average the two available series so as to form a single best 'compromise estimate'. A case might be made for the view that this should be a weighted average of the income and expenditure estimates for each year, rather than a simple average. This would allow for the possibility, suggested by the preceding analysis, that the proportionate error in the income estimate will be broadly constant over the period 1870–1913 (e.g. because of understatement of the 1911 wages benchmark), whereas the proportionate error in the consumers' expenditure series will tend to rise as we move backwards to 1870. This hypothesis is supported by the trend in the relative size of the residual error in column (4) of Table 4; but before finally deciding on the best procedure for deriving a compromise estimate, it is necessary to consider also the relative merits of the two estimates for 1870–1914 with respect to cyclical movements.

When attention is focused on the cyclical aspect there is some reason to prefer the income estimate.

Earnings fluctuate with well-supported movements in unemployment and wage-rates, and profits reflect the changes recorded for tax purposes, though admittedly this last item is subject to some reservation with respect to the problem of the 'three-year moving average' (see Appendix 7.2, pp. 167–70) and the absence of any adjustment for stock appreciation. The greater doubt felt regarding the expenditure estimate arises from the entirely arbitrary allowance for stock changes; the inability of the indicators based on consumption of raw materials (not all of which are adjusted for changes in stores in ports, warehouses, etc.)² to reflect accurately the output of finished consumer goods and still less the timing of consumer purchases; the similar defect in the series for investment in machinery; and the reliance on inter-censal linear interpolation for the estimates of consumers' expenditure on services.

This subjective assessment of the reliability of the two estimates as a guide to cyclical variations is confirmed by the comparison in Table 1.6 of the dating of troughs and peaks shown by the two series in Table 4 with each other, and with the 'reference dates' determined by the National Bureau of Economic Research.³

The income estimate agrees with the reference cycle on the timing of 9 of the 13 turning points, and thus

¹ See Colin Clark [149], p. 230.

² This applies, for example, to the series for furniture, bread, etc., leather goods and paper. See Hoffmann [179], pp. 251, 270, 279 and 283.

³ See A. F. Burns and Wesley C. Mitchell, *Measuring Business Cycles*, N.B.E.R., 1947 [140], p. 79.

Year	Description of year in annals	Change in G.D.P. (£ m.) (expenditure data)	Year	Description of year in annals	Change in G.D.P. (£ m.) (expenditure data)
1872	Prosperity		1888	Moderate prosperity	
1873	Prosperity; recession	+ 33	1889	Prosperity	+ 42
1874	Depression	+ 35	1890	Prosperity; panic, recession	+ 42
1878	Deepening depression		1891	Industrial recession; financial prostration	+ 43
1879	Depression; revival	- 78	1892	Depression	- 29
1880	Slow revival	+ 143	1893	Deep depression	- 16
1881	Mild prosperity		1899	Prosperity	
1882	Mild prosperity	+ 37	1900	Prosperity; recession	+ 83
1883	Slow recession	+ 44	1901	Mild depression	+ 61

scores significantly better than the expenditure estimate which coincides at only six turning points.¹ The expenditure series also has only one peak at the turn of the century (1901) followed by a trough in 1904 whereas the reference cycle (and also the income estimate) includes a minor cycle with a trough in 1901 and a peak in 1903.²

Scrutiny of the expenditure estimates reveals a number of occasions on which the year to year changes appear to be inconsistent with general trade conditions at the time,³ and with the movement of the income estimate. This applies, in particular on five occasions, involving a total of 13 years: 1873-4, 1879-80, 1882-3, 1889-93 and 1900-1. These are the years which account for the major part of the variance in the proportionate residual error (see column (4) of Table 4) and on each occasion it appears to be the expenditure estimate which is primarily to blame. In 1874, 1883, 1891 and 1901 it rises sharply although the evidence points to a downturn; and conversely in 1873, 1882, 1889-90 and 1900 the expenditure estimate seems to show insufficient increase. In addition, the decline in 1879 and the recovery in 1880 appear to be greatly exaggerated. The change in the level of the expenditures estimates in these years contrasts as shown above with the changing summary description of the years given by Thorp [254], pp. 167-74. For example, the change from 'prosperity; recession' in 1873 to 'depression' in 1874 appears to be inconsistent with the rise of £35m. shown by the expenditure estimate. Business cycle turning points are not simple events which can be unambiguously dated, and both the N.B.E.R. dating and Thorp's annals are very imperfect standards of reference, but some adjustment to the expenditure estimates seems to be called for on each of these five occasions.

The case for adjustment is greatly strengthened by the consideration that timing discrepancies of the type

observed on these five occasions are precisely what would result from errors in stock changes. If, for example, we have a series of (actual or implicit) stock estimates for three years, 0, 1, and 2 of which the estimate for year 1 is understated, then the estimate of stockbuilding in year 1 will be too low and the estimate for year 2 will be too high. The errors will always be equal in amount and opposite in sign but, of course, need not be confined to two adjoining years. Errors of this nature could easily occur in the present estimates of expenditure; either in the highly suspect series for stockbuilding, or in the estimates of consumers' expenditure since, as noted earlier, these do not make proper allowance for stock changes.

The expenditure estimates for the 13 years have accordingly been manipulated so as to adjust the cyclical pattern while leaving the average level of the series unchanged. The adjustments made are (£m.):

1873	+ 30	1889	+ 50
1874	- 30	1890	+ 30
		1891	- 30
1879	+ 20	1892	- 30
1880	- 20	1893	- 20
1882	+ 30	1900	+ 40
1883	- 30	1901	- 40

The actual amounts are entirely arbitrary but seem to be roughly what is required to obtain the appropriate cyclical turning points. The average size of the revisions

¹ On the four occasions where it diverges from the reference cycle the income estimate always turns earlier; the expenditure estimate lags by one year at the peaks and leads by one year at the troughs.

² In the case of the income estimate the subsidiary peak occurs in 1902.

³ As shown, for example, by the reference cycle and by the *Business Annals* compiled by W. L. Thorp, N.B.E.R., 1926 [254], pp. 166-76.

is relatively small: 2.2 % (ignoring sign); and the corrections 'for stockbuilding' do not remove all apparent discrepancies in the expenditure estimates, but they do eliminate what appear to be the major defects. The amended estimates of total expenditure are given in italics in column (1) of Table 4, and are shown by the broken line on Figure 1.1. As already indicated the correction probably applies predominantly to the estimate of stockbuilding and to components of consumers' expenditure and fixed capital formation not properly adjusted for stock changes, but I have not tried to apportion it between these series, and the adjustment is not carried through to the component estimates in Tables 2 and 3.

With the expenditure estimate thus corrected there is no strong case for preferring one series rather than the other with respect to cyclical fluctuations and we can now revert to the question of a compromise estimate of G.D.P. at current factor cost. For the reasons set out above (p. 15) there are grounds for thinking that the expenditure estimate may be progressively too high as the series moves back to 1870. However, scrutiny of the amended residual error (column (4) of Table 4 including the figures in italics) shows that although the residual error does decline over the period it does not show a steady downward trend. On the contrary, it sub-divides into three sharply defined phases: from 1870 to 1887 it averages just over 14 % (of the income estimate); from 1888 to 1899 it narrows to under 7 %; and from 1900 to 1913 the discrepancy widens again to over 10 %. Within each of these sub-periods there is relatively little deviation around the average. Since it seems unlikely that the factors urged above as reasons for expecting an overstatement in the early years of the expenditure series would alter abruptly, any correction for these factors should have a fairly steady downward trend. Accordingly, the compromise estimate shown in column (5) of Table 4 has been calculated as follows: the expenditure estimate (after correction in the 13 specified years) was further adjusted for trend by subtraction of an amount declining linearly from 5 % of G.D.P. in 1870 to zero in 1887 and a simple arithmetic average was then taken of the income estimate and the expenditure estimate adjusted for stockbuilding and trend. This means that the balance of the discrepancy remaining after this correction of the expenditure series is then apportioned equally (agnostically) between the income and the expenditure estimates.

The turning points in this compromise estimate are also set out in Table 1.6 and the timing of the fluctuations conforms well with that given by the reference cycle. There is disagreement – by one year – at one major and one minor reference peak (1883 and 1903)

and at one of the troughs (1894), but these are among the least sharply defined turning points, and the cyclical pattern of the compromise estimate seems quite acceptable.

To conclude this comparison of the G.D.P. estimates at current prices we glance briefly at the series for the inter-war period. Both series agree in showing a peak in 1921, a decline until 1923 and a recovery – interrupted in 1926 – to a peak in 1929. Both show the descent into the depression at its most rapid in 1931, but the income estimate reaches bottom in 1932 and is moving up in 1933 while expenditure is still stagnant. Thereafter they move very closely together and both show a good rise in 1938, rather than the downswing from a peak in late 1937 suggested by the N.B.E.R. [140, p. 79]. It is difficult to say which of the two estimates is more likely to be right about the *level* of G.D.P. at current factor cost in the early 1920s. There are possible defects in a number of series on both the income and the expenditure side and for this period, as for the years after 1938, a straight average seems the best basis for a compromise estimate.

We turn now to Table 6 and the index numbers of G.D.P. at constant factor cost. We have three largely independent estimates, based respectively on output, expenditure and income data. The income estimate is deflated by the implicit price index derived from the expenditure data at current and constant prices, so that any discrepancies in annual movements between the income and expenditure estimates simply reflect the corresponding discrepancies in the current price estimates discussed in the preceding section. However, the *level* of the two series is brought much closer since both are given with 1913 = 100. In the discussion of the current price series revisions were suggested to the expenditure estimates for 13 years and the same considerations warrant corresponding (proportionate) adjustments to the estimates at constant prices. The amended figures are shown in italics in column (2) of Table 6 and in column (2A) the expenditure series is further revised to incorporate the downward adjustment to the trend of the series from 1870 to 1887. It is the revised estimates which are used in the analysis which follows.

In Table 1.7 the three alternative estimates are summarised in the form of growth rates between selected dates.¹ The calculations are confined to the period up to 1948, at which point the present estimates link

¹ The years selected are the reference cycle peaks identified in Table 1.6, but these dates do not always coincide with those shown by the series in Table 6 and the periods covered are, therefore, not fully comparable.

TABLE 1.7 COMPARISON OF RATES OF GROWTH OF OUTPUT, EXPENDITURE AND INCOME ESTIMATES OF G.D.P. AT CONSTANT FACTOR COST, 1857-1948 (% per annum compound)

	Expenditure data ^a				Income data (3)	Compromise estimate ^b (4)
	Output data (1)	Unadjusted for trend 1870-87 (2)	Adjusted for trend 1870-87 (2A)			
1857-1948 ^c	1.6	..			1.7	1.6
1873-1948 ^c	1.5	1.4	1.5		1.6	1.5
1873-1913	1.8	1.8	1.9		1.8	1.8
1913-1948 ^c	1.1	1.1			1.3	1.2
1857-1873	2.0	..			2.3	2.1
1873-1890	1.8	1.7	2.0		2.0	1.9
1890-1913	1.8	1.8			1.7	1.8
1913-1924 ^c	0.0	-0.35			-0.1	-0.15
1924-1938	2.0	2.0			2.4	2.15
1938-1948	1.05	1.35			1.4	1.3
1857-1866	2.1	..			1.55	1.85
1866-1873	1.9	..			3.0	2.4
1873-1882	1.8	1.9	2.4		1.65	1.9
1882-1890	1.8	1.5	1.7		2.45	2.0
1890-1900	1.8	2.4			2.0	2.1
1900-1907	1.8	1.0			1.6	1.5
1907-1913	1.7	1.8			1.2	1.6
1924-1929	2.3	2.3			3.15	2.6
1929-1938	1.9	1.9			1.9	1.9

^a Using the estimates adjusted for stockbuilding shown in italics in Table 6, column (2). See p. 17.

^b Arithmetic average of output, expenditure (adjusted for stockbuilding and trend) and income estimates.

^c Allowing for exclusion of Southern Ireland from 1920 onwards.

SOURCE: Table 6.

on to the C.S.O. series.¹ The table also contains the rates of growth for the compromise estimate of real G.D.P. obtained by taking an arithmetic average of the output, adjusted expenditure and income series.

The main conclusion to be drawn from the comparison of the three sets of growth rates is that the longer the time-span is, the closer the agreement. In the top panel of Table 1.7 the series are practically unanimous in showing a long-run rate of growth of 1½% p.a. over the whole period from 1857 to 1948; of 1.8% p.a. from 1873 to 1913 and of 1.1% p.a. from 1913 to 1948. In the second panel, the full period is further sub-divided to show four peace-time of 14 to 23 years in length, and two trans-war periods. For these periods there is still a moderate measure of agreement. The spread between the highest and lowest growth rate for each period ranges between 0.1 and 0.4 percentage points and is not negligible relative to the recorded rates of growth. However, if it can be assumed that the highest and lowest estimates shown in Table 1.7 can reasonably

be taken as the likely bounds of the true growth rates then it means that if we strike an average of the three growth rates – as in column (4) of Table 1.7 – the margin of error around that average will generally be ± 0.2 percentage points or less. For the peace-time periods in which the estimated growth rate is just under 2.0% per annum, this implies a margin of error in the estimated rates of growth of up to ± 10%.

The lower panel of Table 1.7 presents a further subdivision, showing growth rates over periods of five to nine years; and for most of these short periods the differences are quite large. If we again accept the highest and lowest growth rates as the upper and lower limits

¹ For an analysis of the discrepancies in the post-war period see W. A. H. Godley and C. Gillion, 'Measuring National Product', *National Institute Economic Review*, 27, February 1964 [169], p. 61; and C. R. Ross 'What has really Happened to Output?', *Bulletin of the Oxford University Institute of Economics and Statistics*, 26, 1964 [236], p. 1, with a 'Comment' by Godley and Gillion, *ibid.*, p. 271.

within which the true estimate must lie and compare these with the average of the growth rates we have the position shown in Table 1.8. The proportionate margins of error on this assumption are thus $\pm 25\%$ or more for five of the nine cycles. It is evident that over these individual cycles both the discrepancies in the timing of the peaks and troughs and the divergence in movements over short periods of years are responsible for quite marked variations in growth; and the particular years selected for comparison of growth rates can have an appreciable influence on the results. The cyclical pattern of the income and expenditure estimates has already been discussed (pp. 16-7). The annual movements of the output series are particularly suspect, partly because it suffers from some of the same problems of lack of correction for stock changes already noted in connection with the corresponding indicators used for consumers' expenditure; partly because considerable use is made of simple linear interpolation [see Lewis, 202, pp. 94 and 125]; and partly because of the rather speculative nature of the methods used to impart a cyclical pattern to certain series [see 202, pp. 88-93].

The final question is whether there is any reason for favouring or rejecting one or other of the three series in making a 'best estimate' of real G.D.P. Reference to Table 1.7 does not disclose any tendency for one estimate to be significantly and consistently out of line with the other two; and general consideration of the respective sources and methods of estimation does not create a basis for a clear-cut selection of a best or worst estimate. The obvious solution is thus to combine all the available evidence by taking an average of the three estimates (with the expenditure estimate adjusted for trend and stockbuilding) and this is done in column (4) of Table 6. It is the resulting compromise estimate of real G.D.P. which is then used in other tables e.g. Table 17.

(iii) *Reliability grades*

The final method of assessment is the evaluation of the series, undertaken by the investigator responsible for the estimates and expressed in terms of reliability grades. These are no more than the investigator's 'best guess' as to the likely margins of error in his series, but since he is better placed than any user can possibly be to make such a judgement, he has a clear duty to do so.

It can only be a subjective and approximate assessment because it is rarely the case that the estimates are drawn directly from probability samples; and even where it is possible to provide an objective calculation of the sampling error this will only be one of several sources of error. In the typical case encountered in the

TABLE 1.8 INTER-CYCLICAL GROWTH RATES AND POSSIBLE MARGINS OF ERROR, 1857-1938

	Average growth rate (% p.a.) (1)	Suggested margin of error (\pm) (% points) (2)	Margin of error as percentage of growth rate (\pm) (%) (3)
1857-1866	1.85	0.3	16
1866-1873	2.4	0.6	25
1873-1882	1.9	0.5	26
1882-1890	2.0	0.45	23
1890-1900	2.1	0.3	30
1900-1907	1.5	0.5	33
1907-1913	1.6	0.4	25
1924-1929	2.6	0.55	21
1929-1938	1.9	0.0	—

preparation of national accounts, errors can arise at each of the successive stages in the process by which raw data are converted into the final series. First, errors may be present in the basic data (e.g. in the statistics of profits assessed to tax) because of 'mistakes' or omissions made either by the business units submitting the returns or by the government department compiling them. This type of error is particularly difficult to evaluate. Second, the data available may not be comprehensive or continuous, so that adjustments are necessary: e.g. grossing-up to cover sectors omitted from the original data or interpolating between benchmarks for which more complete data are available. Alternatively, a known total may have to be allocated to one or more items (e.g. splitting corporate assessments between companies and local authorities); or separate components from different sources may have to be combined to reach a total. In the former case any errors in allocation will cancel out in total, if all of the items appear in the overall system of accounts; in the latter case the overall error could be the sum of the errors in the component series or, more probably - if the components are independent - there may be compensating errors. Third, errors may occur when the data originally designed and collected for one purpose (e.g. taxation) are adapted in order to comply with the different purposes and concepts of the national income estimates. Fourth, it may be necessary, in order to complete the estimates, to make allowances for which there is little or no basis in recorded facts, so that any adjustment can only be conjectural. This applies, for example, to the addition to profits for incomes evading taxation. Finally, there may be errors which are not

TABLE 1.9 SUMMARY OF RELIABILITY GRADES FOR MAIN SERIES, 1855-1965

	1948-65	1924-38	1890-1913	1870-89	pre-1870
Income from employment	A	A	B	C	C
Income from self-employment	B	B	C	} C	D
Gross trading profits of companies	B	B	B		—
Gross trading surplus of public corporations	A	A	—	—	—
Gross trading surplus of other public enterprises	B	B	—	—	—
Rent	B	B	B	B	B
Net property income from abroad	C	B	B	C	C
Consumers' expenditure	A	A	B	C	—
Public authorities' current expenditure	A	A	B	B	—
Gross domestic fixed capital formation	B	B	B/C	C	C
Stocks and work in progress					
physical increase	C	D	D	D	D
stock appreciation	C	D	—	—	—
Exports of goods and services	A	B	B	B	C
Imports of goods and services	A	B	B	B	C
Taxes on expenditure	A	A	A	B	—
Subsidies	A	B	—	—	—

inherent in the data available but are introduced by the investigator, including, for example, failure to work to a consistent conceptual framework, omission or duplication of certain items, or undetected computing errors.¹

The investigator is aware of all the stages at which he has had to adjust, blow up, apportion or otherwise manipulate his basic data, and of the reliability of the materials at his disposal for making all the requisite alterations; and he can generally form some impression of the reliability of the primary data itself. He may also be able to make comparisons with estimates made by others, or with independent estimates which he himself has prepared. In the light of this knowledge he can attempt to form a judgement on the likely margins of error in the final product. He can then make a statement of the form: 'In my judgement there is only one chance in (say) ten that the "true value" of this item differs from my estimate by more than $\pm x\%$.'

Assessments of this type have been provided for the post-war period by the Central Statistical Office [73, pp. 39-42]. They were also given for earlier years by the authors of previous volumes in this series. The particular system of gradings used by these writers was not entirely appropriate for the present volume, and the estimates have accordingly been reclassified.² The following system of gradings is used throughout this book both for the pre-1948 estimates taken from other sources and for the new estimates described and graded in this study:

Reliability grade	Margin of error
A Firm figures	\pm less than 5%
B Good estimates	\pm 5% to 15%
C Rough estimates	\pm 15% to 25%
D Conjectures	\pm more than 25%

¹ For a more detailed analysis of sources of inaccuracy see Oskar Morgenstern, *On the Accuracy of Economic Observations*, second edition, 1963 [215], and also R. W. Goldsmith, *A Study of Saving in the United States*, 1955 [170], vol. II, pp. 129-49.

² This has the advantage of giving a uniform system of gradings, though at the cost of some slight inconsistency between the symbols used for grading aggregates (e.g. consumers' expenditure) in this volume and those assigned to detailed components in the original studies which the reader may wish to consult.

It may be convenient to note here that the grading systems which have been used previously are as follows:

Reliability grade	Studies in National Income and Expenditure
A	\pm less than 5%
B	\pm 5% to 10%
C	\pm 10% to 25%
D	\pm more than 25%.

It will be seen that the effect of the change introduced by the present volume is to widen the range of grade B and narrow that of grade C.

For grades A and B this is slightly less exacting than the grading used for the post-1948 estimates by the C.S.O. This is:

Reliability grade	Margin of error
A	± less than 3 %
B	± 3 % to 10 %
C	± more than 10 %

The probability that the true value for the item would lie within the limits given by these grades may be taken as 90 %.

Reliability grades are given for all the major estimates in the relevant chapters. They are summarised for the main peace-time periods in Table 1.9. For other periods, and for gradings of the components of these estimates, reference should be made to the section on reliability in each of the subsequent chapters, or to the original sources quoted there.

Finally, we may bring together all of the preceding discussion in the following evaluation of the reliability of the major aggregates, G.D.P. and G.N.P. The following gradings seem appropriate for both the current and constant price series and for estimates at both factor cost and market prices.

1855-1889	C	1924-1938	A
1890-1913	B	1939-1947	C
1914-1923	C	1948-1965	A

Reference is to the independent estimates for the aggregates. Gradings would be the same for the compromise estimates but the margin of error would lie at the lower end of the range for the respective grades.

There is a reasonably well defined basis for the dating of the changes in reliability indicated by the above grades except for the upgradings in 1890. There is good evidence that the reliability of the various component series improved towards the end of the nineteenth century, but it does not come at precisely the same time for each component and the revaluation from C to B can only be approximately located in 1890.

All the above comments refer only to the absolute levels of the annual series. It is probable that the margin of error in the *changes* in the series will be significantly less, particularly if attention is directed to the average change over a period of at least five years, and not to year-to-year movements.¹ In most cases the error in the average change shown by any series (other than stock-building) over a period of several years is unlikely to exceed ± 10 %.

¹ Fuller [165] has shown that the errors in the year-to-year percentage changes in all the series may be high in relation to the average size of the changes. This is particularly true for current price income and expenditure series before 1914 and for constant price income, expenditure and output series in both the 1870-1913 and 1920-38 periods. Therefore, he also concludes that the series are best used for comparisons over periods longer than one year.

APPENDIX 1.1

RECONCILIATION WITH PREVIOUS ESTIMATES OF NET NATIONAL PRODUCT AT CURRENT PRICES, 1870-1913

This appendix is designed to provide a reconciliation of the present estimates of pre-1913 national income with those published in two earlier investigations: A. R. Prest¹ and Jefferys and Walters [184]; and at the same time to account for the widening of the discrepancy between the income and the expenditure estimates. It is convenient to include the reconciliation at this point, following the discussion of the aggregates in Chapter 1, but the appendix assumes knowledge of the terminology and the details of methods and sources which are given in the description of the several components in the subsequent chapters.

As noted in Chapter 1.4 the discrepancy between the present estimates of income and expenditure is considerably larger than for the corresponding estimates compiled by Jefferys and Walters [184, p. 8].² The 'deterioration' can be summarised as shown in Table 1.10.

In each period the greater discrepancy is due principally to the fact that the present estimates of income are much lower. This is partly offset by a slightly lower estimate of expenditure in each period except 1900-9. Each of the several adjustments which have been made to the earlier estimates can be resolutely defended, even where they appear to have harmed the prospects of agreement between the income and expenditure series.³ We deal first with the more substantial changes on the income side, and for brevity the discussion is for the most part confined to annual averages over five or ten year periods. This brings out the major differences, but does mean that quite big variations in the year to year movements of the two series are largely ignored. An indication of the discrepancy in the annual movements is, however, given in Figure 1.3. The discussion relates solely to the initial estimates of national income and expenditure as presented in Tables 1, 2 and 3, i.e. no reference is made to the adjustments suggested in Chapter 1.4 and incorporated in Table 4.

TABLE 1.10 COMPARISON OF RESIDUAL ERROR IN ESTIMATES OF NET NATIONAL PRODUCT BY JEFFERYS AND WALTERS AND IN PRESENT ESTIMATES, 1870-1913
(£M.; annual averages)

	Increase in excess of expenditure over income (1)	Lower estimate of income than in J. and W. (2)	Lower estimate of expenditure than in J. and W. (3)
1870-79	56	73	17
1880-89	58	87	28
1890-99	78	89	11
1900-04	135	110	-25
1905-09	161	157	-4
1910-13	192	194	2

SOURCE: (1) Residual error in Table 4, column (3), less discrepancy in Jefferys and Walters [184], Table 1, column (8).
(2) Table 1, column (13), less Jefferys and Walters [184], Table 1, column (2). See also Table 1.11.
(3) Table 3, column (10) - Table 1, column (12) less Jefferys and Walters [184], Table 1, column (7). See also Table 1.12.

¹ A. R. Prest, 'National Income of the United Kingdom, 1870-1946', *Economic Journal*, LVIII, 1948 [231].

² In the present study the comparison was made in relation to gross domestic product at current factor cost (see Table 4), while in Jefferys and Walters the measure used was net national product. The absolute size of the discrepancy is independent of the particular concept, but for this appendix the aggregate to which it is related is net national product.

³ See also p. 14, n. 3.

TABLE 1.11 RECONCILIATION WITH JEFFERYS AND WALTERS' ESTIMATES OF NET NON-WAGE INCOME, 1870-1913
(£M.; annual averages)

	Jefferys and Walters (1)	Present estimate (2)	Total (1)-(2) (3)	Jefferys and Walters less present estimate				
				Farm profits (4)	Inter- mediate non-farm income (5)	Non-farm income subject to tax (6)	Evasion (7)	Deprecia- tion (8)
1870-79	654	581	73	21	10	15	-4	31
1880-89	721	634	87	37	12	4	3	30
1890-99	881	791	90	32	29	-7	2	34
1900-04	1063	953	110	31	30	2	4	43
1905-09	1241	1084	157	27	26	54	6	44
1910-13	1442	1248	194	32	24	86	2	50

SOURCE: Prest [231], p. 57, Jefferys and Walters [184], p. 25 and worksheets for present estimates - see text, pp. 24-7.

THE INCOME ESTIMATES

The estimates of net national income given by Jefferys and Walters are basically the work of A. R. Prest [231] with the addition of a few relatively minor adjustments. Bowley's estimates of the wages-bill [132, pp. 76-7] are accepted by both Prest and the present estimates so that all differences arise in the estimation of non-wage incomes (including salaries). These differences are summarised in Table 1.11 and graphed in Figure 1.3.

The difference between the two estimates of net non-wage income is thus fairly large, amounting to between 10 and 15 % of the present estimate. To see how it has arisen it is necessary to examine the components of the two series. The particular breakdown into the five components set out in columns (4) to (8) of Table 1.11 is determined by the form in which Prest's estimates were originally presented [231, p. 24]. We can consider each of the five in turn:

FARM PROFITS

The discrepancy between the two estimates of net farm profits is rather large, both as a source of the overall difference in Table 1.11, and relative to the level of the estimates for this item. The two series are graphed in Figure 1.3 and summarised below:

(£ million, annual averages)	Jefferys and Walters	Present estimate	Difference
1870-79	60	39	21
1880-89	58	21	37
1890-99	57	25	32
1900-04	61	30	31
1905-09	62	35	27
1910-13	71	39	32

The present estimate (which is taken from Table 23 with the omission of the amount allowed for depreciation) is based on detailed and direct estimates of net farm output less wages and rent. The Jefferys and Walters' estimate is the sum of four independent components: (a) Schedule B income tax assessments on farm income; (b) an adjustment to this made by Prest to allow more fully for annual variations in farm profits; (c) an allowance for farm profits not subject to tax; and (d) an addition made by Jefferys and Walters to allow for an assumed understatement in Prest's estimates.¹

Three of these four components (a), (b) and (d) can be shown to be defective and the aggregate is therefore highly unreliable. The first weakness in the estimate is the Schedule B assessment. The Inland Revenue assumed that farmers could not keep proper accounts and their 'statutory income' for tax purposes was accordingly deemed to be an arbitrary proportion of

¹ Of these four components only (d) is published separately [184], p. 25, and neither Prest nor Jefferys and Walters were aware of the actual amounts included in their series for farm profits. However, (a) is obtained as a byproduct of estimates required for Chapter 7 (see Appendix 7.2, p. 166, and Table 7.16), and (b) can be reconstructed by repeating the procedure described by Prest [231, pp. 45-6]. (c) is not shown separately but is implicitly incorporated in the overall allowance for intermediate income. A reasonably good estimate of the amount included can be made by taking estimates for 1880 and 1911 (see Appendix 7.3) and interpolating linearly, i.e. on the same basis that Prest used for the total intermediate income. Summing the four components gives the total shown above for Jefferys and Walters.

their gross rent as assessed for Schedule A (see also Appendix 7.2). It therefore bore no direct relation to the level of farm profits, and still less to their year-to-year variations. Second, the somewhat mechanical procedure adopted by Prest to introduce such variation above and below the level of the Schedule B assessment appears to have exaggerated the instability of profits (see Figure 1.3), and in any event overlooked an important aspect of the tax system. Under a concession introduced in the Customs and Inland Revenue Act 1851 and the Inland Revenue Act 1880, any farmer who could show at the end of the year of assessment that his actual profits and gains were *less* than the amount of his assessment was entitled to have the assessment reduced to the 'actual amount of such profits and gains'. If his actual profits were more than the assessment no addition was made.¹ Thus in so far as this concession was operative, the Schedule B assessment could be less than the actual profits but could never be more.

The final adjustment was made by Jefferys and Walters and was based on a calculation by Bowley relating to farm incomes in 1911. Bowley's estimates involved an addition of £26 m., and a corresponding addition was assumed to be required in other years although it was specifically noted that '...no direct evidence at present exists to confirm this assumption either in relation to the practice of understatement or to the relative importance of the understatement' [184, p. 24]. In fact, later evidence has made clear that Bowley was mistaken about the 1911 data, and no large adjustment is needed to reconcile the estimates based on income data with those derived from output statistics. The question is discussed in Chapter 2.2 below (p. 41).

INTERMEDIATE NON-FARM INCOME

Jefferys and Walters adopted Prest's series for total intermediate income, and this in turn was obtained by linear interpolation between benchmark estimates of £120 m. for 1880 and £314 m. for 1911, both due to Bowley. The amount in 1870-9 was taken to be constant at the 1880 level [231, p. 32]. As explained in connection with the previous item (p. 24, n. 1) part of this total must be allocated for the present purpose to farm incomes, and we deal now with the remainder.

In the present estimates the derivation of the series corresponding to intermediate non-farm income is described in detail in Appendix 7.3. The estimates lie below Prest's from 1870 to 1879 because they start from a new benchmark for 1861 and this implies a rising trend in the 1870s. Bowley's benchmark is used for 1880 so that the two series agree for that one year;

but from 1881 to 1913 they again diverge, with the present estimates falling below Prest's by the amount shown in column (5) of Table 1.10 and Figure 1.3. There are two reasons for this. First, £18 m. was deducted from Bowley's 1911 benchmark to avoid duplication with taxed wages and salaries covered elsewhere;² and a further £5 m. was deducted to exclude transfer incomes. For these deductions see Table 7.19 and pp. 172-4.

Secondly, the present estimates for years between 1880 and 1911 were made separately for four components of the total and for the two largest do not rely simply on linear interpolation (see p. 174). The result is both a different pattern of growth over the period: in particular, a slower rise from 1882 to 1893 and then a more rapid increase in the boom of the late 1890s and again from 1904 to 1907; and also a difference in the year-to-year movement (see Figure 1.3).

NON-FARM INCOME SUBJECT TO TAX

This covers a large number of separate items rising in total from £300 m. in 1870 to over £1,000 m. in 1913, and the discrepancy shown in column (6) of Table 1.11 (and in Figure 1.3) is the net outcome of a number of differences, mainly technical, in the derivation of income estimates from the tax data. Some of the differences are moderately important in relation to the individual components (e.g. profits, salaries or rent) but the net effect is negligible until 1904. Thereafter the present estimate rises rather less rapidly than Prest's; and as argued in an earlier paper this is because Prest went astray in the unscrambling of the Schedule D tax data for the period 1904-13 and obtained figures that were progressively in excess of the averages they were intended to constitute.³ For example, the Schedule D average relating to the three years 1911-13 was £518 m. but the unscrambled figures given by Prest for these years were, respectively (£ m.): 562, 616 and 657, i.e. an average of £612 m.⁴

¹ J. C. Stamp, *British Incomes and Property*, 1916 [247], pp. 83 and 93-6.

² Prest evidently overlooked the fact that in giving his total for intermediate income Bowley deducted some £18 m. from incomes subject to tax [127, pp. 14-15]. For the present estimates the same effect is achieved by making the deduction from intermediate income.

³ C. H. Feinstein, 'Income and Investment in the United Kingdom, 1856-1914', *Economic Journal*, LXXI, 1961 [160], pp. 377-9.

⁴ It must be remembered that the procedure followed by Prest did not provide him with separate estimates for each schedule (see Appendix 7.2) and so he could not

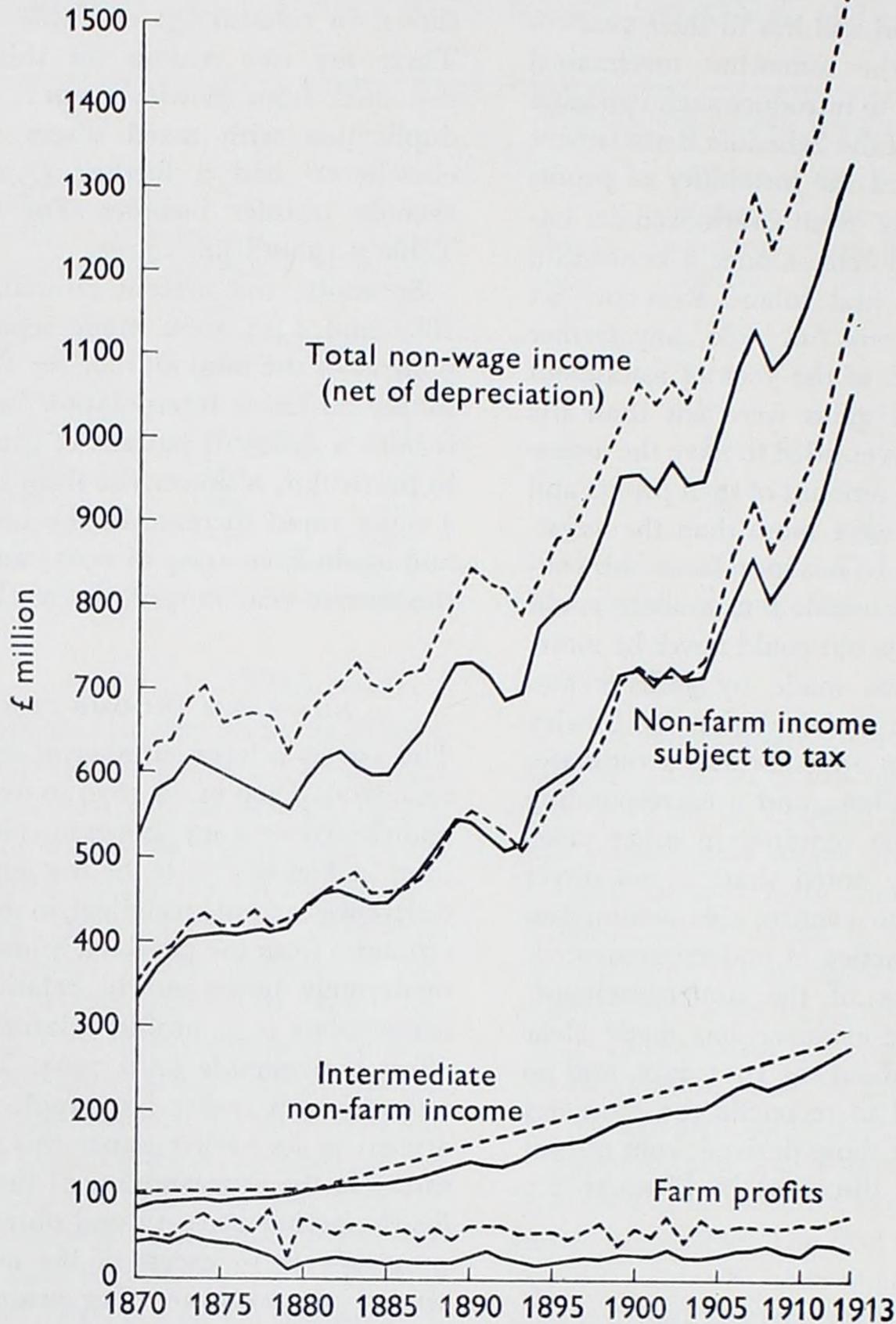


FIGURE 1.3 COMPARISON WITH JEFFERYS AND WALTERS' ESTIMATES OF NON-WAGE INCOME, 1870-1913
 ----- Jefferys and Walters ————— Present estimate

It may also be noted that there are discrepancies in the timing of the annual figures arising from the difference in the treatment of the unscrambled Schedule D series in the period 1870-1903. For details see Appendix 7.2 pp. 167-70.

EVASION

Both Prest and the present estimates take as their starting point estimates of evasion for 1913 by Stamp [247] and for 1880 by Bowley [128] and there are only minor differences in the interpolation between these benchmarks, and in the extrapolation to 1870.

DEPRECIATION

In absolute terms this is the item responsible for the largest part of the discrepancy shown in Table 1.10. The amount involved rises steadily from £28 m. in 1870 to £55 m. in 1913 and the story behind it is a somewhat complex one. Prest noted that 'estimation of profits from income tax returns implies that we are adopting Inland Revenue conventions on the allowances granted to maintain capital intact' [231, p. 49]

have been aware of this large discrepancy between his estimates and the corresponding Schedule D three-year average.

and accordingly presented the estimates derived from tax data as being net of depreciation. He was followed in this by Jefferys and Walters; and in my earlier paper the results were similarly described without discussion as net national income [160].

Subsequently, however, I realised that the Inland Revenue conventions did not make adequate allowance for depreciation of buildings and works and that a further sum would have to be deducted to obtain estimates of net income comparable with those for later periods. The estimate of net (non-wage) income in column (2) of Table 1.11 (or the aggregate N.N.P. in column (13) of Table 1) is thus obtained by the roundabout process of first adding back to the tax data the amount assumed to have been deducted for depreciation of plant, machinery, etc.¹ and of buildings² to get an estimate of gross income. An estimate of the total amount of estimated depreciation, calculated in Chapter 9.2 on the basis of estimates of the capital stock and length of life assumptions for broad categories of assets, is then deducted to get the required estimates of net income. The amounts involved in the respective adjustments can be illustrated by reference to the calculation for 1907.³

	Added back to cover depreciation allowed for tax purposes (1) (£ m.)	Deducted to get income net of depreciation (2) (£ m.)
1. Plant, machinery, vehicles, ships, etc.	53	53
2. Dwellings	5	14
3. Other buildings	—	14
4. Works	—	13
Total	58	94

For row 1 the amount in column (1) is based directly on column (2) (see p. 156). The amount actually disclosed in the tax records for depreciation of plant and machinery, etc. (wear and tear) in 1907 is £20 m. and the balance of £33 m. is assumed to have been allowed 'in the assessment' for enterprises using the renewals method. Any error in this assumption will thus affect the gross income estimate but not the comparison with Prest's estimate.

For rows 2 and 3 there was no specific allowance for tax purposes but in calculating the net annual value of 'houses, etc.' for Schedule A a deduction of one-sixth

was allowed which, according to Stamp [247, p. 195] was intended to cover maintenance and repairs and also 'eventual replacement of buildings'. The total amount so deducted for 1907 was £33 m. and since Cairncross estimated on the basis of Census of Production data that the actual value of repairs and alterations in 1907 was £38.5 m.⁴ it is clear that the Inland Revenue allowance could not have provided much in the way of depreciation. This is confirmed by Stamp's discussion of the question and his indication that the allowance for depreciation was assumed to be made on the 'annuity method' [247, pp. 194-6]. The figure of £5 m. shown in column (1) is from Chapter 8 and is highly conjectural, but seems more likely to be too high than too low as an estimate of the amount allowed for depreciation for tax purposes. The alternative estimate of £28 m. in column (2) covers depreciation of the stock of houses, factories, shops and other buildings - estimated in Chapter 9.1 to have a current replacement cost of over £3,000 m. in 1907 - and is consistent in concept and measurement with the inter-war and post-1948 estimates of depreciation (capital consumption).

Finally, row 4. This covers such assets as railway track, canals, mines, gasworks, waterworks, roads and sewers for which no depreciation was allowed by the Inland Revenue. While a case can be made for the view that assets of this type are non-depreciating, the only one for which no allowance is made in the current C.S.O. treatment is roads, and we have accordingly provided for depreciation of the other assets, assuming a life of 100 years.

Depreciation is so much a matter of convention that one cannot be dogmatic about any particular estimate, but it would seem quite evident that something substantially in excess of the allowances granted for tax purposes should be deducted in order to maintain consistency with present-day national accounting conventions.

¹ As explained in Chapter 7.2, p. 156, the amount actually deducted is not disclosed and cannot be precisely calculated.

² See Chapter 8, p. 180. There was no precise allowance for depreciation.

³ The calculation excludes farm equipment and buildings for which a further £4 m. was provided for depreciation, making a total (as in Table 1, column (12)) of £98 m.

⁴ A. K. Cairncross, *Home and Foreign Investment, 1870-1913*, 1953 [143], pp. 109-10.

TABLE 1.12 RECONCILIATION WITH JEFFERYS AND WALTERS' ESTIMATES OF NET NATIONAL EXPENDITURE, 1870-1913
(£M.; annual averages)

	Jefferys and Walters (1)	Present estimate (2)	Jefferys and Walters less present estimate			
			Total (1)-(2) (3)	Net investment abroad (4)	Other expenditure (5)	Less depreciation (6)
1870-79	1,181	1,164	17	-22	-2	-41
1880-89	1,282	1,254	28	-20	8	-40
1890-99	1,503	1,492	11	-17	-11	-39
1900-04	1,842	1,867	-25	-13	-61	-49
1905-09	1,991	1,995	-4	-26	-36	-58
1910-13	2,258	2,256	2	-24	-44	-70

SOURCE: Jefferys and Walters [184], Tables I and XV, and present estimates Table 2, column (10), Table 1, column (12) and Table 15, column (16).

THE EXPENDITURE ESTIMATES

The two sets of expenditure-based estimates of N.N.P. are compared in Table 1.12. The differences between them are on balance relatively small. They arise because the higher estimates given in this study for net investment abroad and for certain other components of expenditure, notably consumers' expenditure, and thus for G.N.P., are more than offset by a substantially larger deduction for depreciation which is made in arriving at N.N.P.

The present estimates for net investment abroad are based on the very detailed reworking of all the components by Professor A. H. Imlah.¹ Jefferys and Walters adopted the earlier estimates presented by Cairncross [143, pp. 170-81] which offered new estimates for some components and for the remainder followed the much earlier calculations of C. K. Hobson.² It now seems reasonably certain that Cairncross' estimates are too low³ and Imlah's series are generally accepted as the best available estimates of Britain's net lending abroad.

The differences on the 'other' components of expenditure are negligible from 1870 to 1899, for which period there are only minor differences in the two sets of estimates for public authorities' current expenditure on goods and services, domestic capital formation and indirect taxes. The same estimates of consumers' expenditure are used except for a small adjustment made in the present estimates for the late nineties (see Chapter 2.4). After 1900 the discrepancy increases, reflecting mainly the difference between Jefferys and Walters' own estimates of consumers' expenditure and the somewhat higher estimates by Prest [232] adopted in the present study. Prest's estimates are the result of a much

more detailed and thorough working of the material on expenditure and seem in every respect preferable.

Finally, we have again to consider a substantial difference with respect to depreciation.⁴ Both Jefferys and Walters and the present study begin with estimates of gross domestic capital formation, and depreciation has thus to be deducted to reach net capital formation and N.N.P. The very much higher level of the present estimates is indicated in the following table:

(£ million, annual averages)	Jefferys and Walters	Present estimates	Difference
1870-79	28	69	41
1880-89	30	70	40
1890-99	37	76	39
1900-04	48	97	49
1905-09	48	106	58
1910-13	49	119	70

¹ A. H. Imlah, *Economic Elements in the Pax Britannica*, 1958 [181], pp. 42-81.

² C. K. Hobson, *The Export of Capital*, 1914 [178], Chapter VII.

³ See Imlah [181], pp. 76-7 (especially n. 50) for substantiation of this conclusion. P. 14, n. 3, above, is also relevant.

⁴ The discrepancy arising in the case of the expenditure estimates (column (6) of Table 1.12) differs from the one discussed in connection with the income estimates (column (8) of Table 1.11). The present estimate is the same in both cases, but we are now comparing it with an explicit estimate given by Jefferys and Walters, whereas in the previous case (p. 27) we were comparing it with the amount *implicit* in their net income estimates, i.e. the amount allowed for tax purposes.

The conceptual basis of the present estimate has already been discussed in connection with the income estimates (pp. 26–7 above). The alternative estimate [184, p. 34] has as its basis an estimate of £50 m. for 1907 due to Cairncross [143, p. 122]. However, it is quite clear that this is not an allowance for depreciation – as the term is now understood – but an estimate of the renewal of fixed capital, i.e. of the replacement of that part of the capital stock which was scrapped during the year.¹ Given the currently accepted conventions for estimating depreciation (i.e. the straight line or reducing balance method) replacement will lie well below depreciation in an economy with an expanding stock of assets.² This applies equally to the method used

by Jefferys and Walters to extrapolate the 1907 benchmark.³

¹ For a further discussion of this distinction, in the context of a corresponding difference in the estimates for the inter-war period, see C. H. Feinstein, *Domestic Capital Formation in the United Kingdom, 1920–1938*, 1965 [162], pp. 251–2 and also pp. 50–1.

² For a theoretical demonstration of the reasons why ‘in a growing economy replacement falls far short of depreciation’, see E. V. Domar, ‘Depreciation, Replacement and Growth’, *Economic Journal*, LXIII, 1963 [157], pp. 1–32.

³ The procedure followed was one suggested by E. H. Phelps Brown; for comments on this procedure see Feinstein [162], p. 251.