

Appendix B

INTERTEMPORAL MEASURES OF REAL GROSS DOMESTIC PRODUCT

Estimates of national income started 300 years ago. The first big step was taken by practitioners of the "political arithmetic" which William Petty started in the seventeenth century. In 1696, Gregory King made estimates of English national income, using a variety of evidence on income, expenditure and production. He made rougher estimates for France and Holland as well, to compare capacity to tax, save, and mobilise for war. Davenant and Temple had a similar interest in such exercises in England as did Vauban and Boisguilbert in France. But King was the most distinguished of these pioneers.

In 1896, Michael Mulhall published estimates of income levels for 19 countries, and like King, he converted their incomes to a large extent by exchange rates. He followed a more or less standardised technique, calculating national income by industry of origin for 9 sectors. His estimates were better documented than those of King.

In 1940 Colin Clark took a major step forward. He published estimates of real income levels for 30 countries in "international units", i.e. he made the first crude corrections for differences in the purchasing power parity of currencies. He also presented estimates of the growth of real income over time for 14 countries. In many cases his time series were weak because he was willing to make crude links between different and not always comparable "spot" estimates, and to make use of some dubious deflators, but he made an exhaustive survey of the work of virtually all the economists and statisticians who had published in his field in the nineteenth and twentieth centuries and had extensive correspondence with the statisticians of his day who were engaged in such work. Clark never hesitated to adjust these estimates to conform to his own ideas about the appropriate coverage of the accounts or methods of treatment of particular items. He also used the estimates analytically. Systematic comparative confrontation is a particularly good way of testing the plausibility and consistency of estimates and may well induce careful scrutiny of "outlier countries". In 1940, however, there was no agreement on the coverage and methodology of national accounts, and the comparability of the different estimates was therefore restricted.

The move towards modern standardised concepts of national accounts arose from developments in the USA in the 1930s and in the UK in the 1940s. Simon Kuznets was involved in the first presentation of official estimates to the US Senate in 1934 and with longer run estimates in the National Bureau of Economic Research. From 1941 to 1948, Milton Gilbert was responsible for the official US estimates, and developed conventions wider in coverage than Kuznets preferred, because they included items of government and private product in final expenditure which Kuznets treated as intermediate product.

In the UK, the official commitment to national accounts started in wartime under pressure from Keynes. The first official accounts were prepared by James Meade and Richard Stone. In 1944 there were consultations between British, Canadian and US statisticians with a view to standardisation of concepts and procedures. In the postwar years, comparable accounts were felt to be a political necessity to facilitate assessment of needs for Marshall Aid and burden-sharing in NATO. Richard Stone was the main person involved in developing the standardised approach, and he and Milton Gilbert were very active in the 1950s in seeing that it was implemented in OEEC countries. Shortly after, the OEEC system was merged with the standardised UN system which was applied by official statisticians in most countries in the postwar years, except in communist countries. The latter kept accounts which excluded many service activities, and so involved some duplication.

Thanks to these efforts, these are now official estimates of GDP growth in nominal and real terms for the years since 1950 for about 150 countries. These are, in principle, reasonably comparable in scope, though many still have substantial shortcomings. The standardised system provides a coherent macroeconomic framework covering the whole economy, which can be crosschecked in three ways. From the production side, it is the sum of value added in different sectors, e.g. agriculture, industry and services, net of duplication. It is also the sum of final expenditures, e.g. by consumers, investors and government. From the income side, it is the total of wages, rents and profits. When fully elaborated, it can also provide an integrated view of development over time in volume, value, relative and absolute prices and changes in economic structure. In some cases, the framework has been expanded to provide a fuller set of growth accounts, including measures of labour input and capital stock.

For some countries, there have been retrospective official or quasi-official estimates for prewar years, back to 1830 for Austria, 1860 for Finland, 1865 for Norway, 1900 for the Netherlands, 1925 for Germany, 1926 for Canada and 1929 for the USA. However, the work on retrospective national accounts has largely been undertaken outside government by scholars who have generally followed UN/OECD guidelines, and made explicit links of their series with the official postwar estimates. Many of these were influenced or stimulated by Simon Kuznets who organised international cooperation in this domain in the International Association for Research in Income and Wealth, founded in 1947.

The most satisfactory of the scholarly exercises were those carried out in the UK by Charles Feinstein, and by Noel Butlin in Australia. Other countries where there has been a major effort are Japan where Kazushi Ohkawa inaugurated the 14 volume study of Hitotsubashi University; Sweden, where Olle Krantz is completing the fifth round of estimates (which go back to 1800); Finland, where Riita Hjerppe supervised the 13 volume study financed by the Bank of Finland; and the USA, where we have the studies of Gallman, Kendrick and Kuznets. Canada, Denmark, France, Italy and Germany have all had major scholarly studies which still leave room for improvement. For Austria and Norway we have official studies which are not fully documented in their published form. In Belgium and the Netherlands there are major research groups working to improve the long term picture which is still a bit shaky. The weakest estimates are for New Zealand and Switzerland.

For most other parts of the world, the quality of the estimates is poorer than for our first group, but for Argentina, Brazil, Czechoslovakia, Hungary, India, Indonesia, Korea, Mexico, Spain and Taiwan the estimates are at about the same level as we presently have for Belgium and the Netherlands.

Table B-1 summarises the type of indicator available for the advanced capitalist countries for prewar years. For 11 of them I used the estimates by industry of origin. For the UK I used Feinstein's compromise estimate which is an average for the movements he found for production, expenditure and real income. For Norway and the USA, the long run indicators refer to real expenditure and this is also the case for the Netherlands for the interwar period. For New Zealand the estimate relies on proxy indicators and for Switzerland on deflated income. For most of the other countries where estimates for prewar are available, the predominant method for measuring real product is by industry of origin.

Table B-1
Summary Confrontation of Methods Used in Constructing Historical National Accounts
for 16 Advanced Capitalist Countries

Main Authors	Value Added Approach	Expenditure Approach	Income
Approach			

AUSTRALIA

N.G. Butlin, 1986 1788-1827, VA
1828-1860, VAVOP

N.G. Butlin, 1962 1861-1939, 13 sectors, 1861-1939
VAVOP 4 categories of
investment, VAVOP

N.G. Butlin, 1977 1900-74, 9 categories,
VAVOP

AUSTRIA

A. Kausel, 1979 1830-1913, 5 sectors, VAVOP

A. Kausel, 1965 1913, 1920, 1937 and 1946- 1913, 1924, 1937 and 1948- 1913, 1924 and
1948- 1950, 11 branches, VAVOP 1950, 6 categories, VAVOP 1950, 8
categories,

VA

BELGIUM

J. Gadisseur, 1973 1846-1913, 2 sectors (ag. and
ind.), VO. I made crude
service proxy for 1846-1913,
even cruder proxies for 1830-
1846 using Gadisseur for
industry and Goossens for
agriculture

C. Carbonnelle, 1959 1920-1938, 6 branches, VO.
I made crude service
interpolation

CANADA

O.J. Firestone, 1957 1851-70, 8 sectors, VAVOP

O.J. Firestone, 1958 1867-1953, 8 sectors, 1867-1953, substantial detail
VAVOP. Detailed analysis by category, VAVOP
for benchmark years at decade
intervals. Rougher annual
estimates

M.C. Urquhart, 1870-1926, 18 sectors on an 1870-1926 partial: invest-
1986 and 1993 annual basis and benchmark ment for 7 sectors,
estimates for 2 distributive government expenditure and
sectors. Substantial branch exports, VA
details for agriculture and

manufacturing, VA. Deflation only for GNP aggregate

Main Authors Approach	Value Added Approach	Expenditure Approach	Income
Statistics Canada 11 VA	1926 onwards, 15 sectors, VA	1926 onwards, 14 categories VAVOP	1926 onwards, categories,

DENMARK

S.A. Hansen, 1974	1818-1950, 23 branches, VAVOP	1844-1950, 3 categories, VAVOP	
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FINLAND

R. Hjerppe, 1989 categories salaries. living and price index	1860-1985 13 branches, VAVOP	1860-1985 5 categories, VAVOP	1860-1985, 5 of wages and VA, cost of wholesale
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FRANCE

M. Levy-Leboyer & wages, VA F. Bourguignon, 1985	1820-1913, 5 sectors, dustry measure for 1820-70	1820-1913, 13 categories, VAVOP. I used only the in-	1820-1913 VA
J.C. Toutain, 1987	1815-1913, 1920-1938 and 1950. 12 branches, VAVOP. For 1820-70 I used his indicators for agriculture and services. For 1870-1960 I used his GDP estimates.		

GERMANY

R.H. Tilly, 1978	2 branches (ag. 1831-1849 and ind. 1831-1846/7) for Prussia for 3 benchmark years, VO. I made a crude service sector proxy, adjusted to cover all Germany using demographic ratios, and linked to Hoffmann in 1850		
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W.G. Hoffmann, 1965 1924-1938	1850-1913, 1925-1938 9 branches (with detail for 147 industries), VO. Weighting system not clear.	1850-1913, 1924-1938, 1950, 5 categories, VAVOP	1850-1913, 9 categories, VA
ITALY			
R. Ercolani & categories O. Vitali (Fua salaries, Group), 1975	1861-1952, 11 branches, VAVOP	1861-1952, 18 categories, VAVOP	1861-1971, 2 of wages and VA
Maddison, 1991	Reweighted version of the above supplemented with production estimates of Fenoaltea		

Main Authors Approach	Value Added Approach	Expenditure Approach	Income
JAPAN			
K. Ohkawa and 1953-70	1885-1940, 5 sectors,	1885-1940, 1930-44 and	1906-40,
M. Shinohara, 1979	VAVOP. I used this source	1946-70, 6 categories,	4 categories,
VA	for 1885-1940 and their expenditure estimate for 1940-50	VAVOP	
NETHERLANDS			
J.L. van Zanden, 1987	Four benchmarks (1820,		Four
benchmarks 1880 and	1850, 1880 and 1910).		(1820, 1850,
and three	8 sectors, VO		1910) wage
property			types of
			income, VA
C. van Bochove & category, T.A. Huitker, CBS, 1987	1921-39, 21 sectors VA (not yet published)	1921-1939, 1946-1986. 7 categories, VAVOP	1900-1921. 1
cost of 1921-39,		I used this for 1921-	deflated by
categories,		60, and deflated income	living index,
		for 1900-21	1946-86, 9
			VA
NORWAY			
Central Bureau of 1940-1950. Statistics, 1970	1930-1939, 1946-1950. 11 branches, VAVOP	1865-1939, 1936-1950. 7 categories, VAVOP. I used this series. I filled the 1939-1946 gap from another CBS source and adjusted from Norwegian to OECD concept of GDP	1930-1939, 149 items, VA
SWEDEN			
O. Krantz and C.A. Nilsson, 1975	1861-1970, 7 sector breakdown, VAVOP	1861-1970, 7 category breakdown	
O. Krantz and Associates, 1986-91	1800-1980, industry of origin, VAVOP		

7 background vols.
2 (on agriculture
and foreign trade)
pending

SWITZERLAND

C. Clark, 1957
1899,
1951.

1890, 1895,
1913, 1924-
VAVOP. 1

category

crudely

deflated

UK

P. Deane, 1968

1830-1914, 5 categories,
VAVOP. I used her 1830-
1855 figures

Main Authors Approach	Value Added Approach	Expenditure Approach	Income
C.H. Feinstein, 1972 VA	1855-1913, 1920-1960, 4 sectors, VAVOP. Plus VO for 15 branches	1870-1960 7 categories, VAVOP	1855-1960, 5 categories,
R.E. Gallman, 1966		USA 1839, 1844, 1849, 1854, 1859 benchmarks and over- lapping decade averages from 1859-43 to 1899-1908. Gallman replicates Kuznets technique and methods of presentation. Uses a large amount of information on commodity output and rougher estimates for services to build up volume estimates of final flows to consumers (4 way breakdown) and to capital formation (3-way breakdown). Full detail of estimates not published. I derived my 1840-69 estimates from Gallman.	
N.S. Balke and R.J. Gordon, 1989		1869-90. For this period Kuznets (1961) published only 5 year moving aver- ages as he considered the annual information to be too weak. Balke and Gordon revamped the existing commodity flow estimates to incorporate extra infor- mation on construction, transport and communica- tions. They provided annual estimates of nominal GDP, real GDP in 1982 prices and a GDP deflator. I used their estimates for 1869-90.	
J.W. Kendrick, 1961	Private Domestic Product: volume indices for 10 benchmark years from 1869 to 1953 with a 10	Decade averages of GDP for 1869-78 and 1879-88 and annual estimates for 1889- 1953. Kendrick used Kuznets'	

	sector breakdown. His service estimate is a residual and his total is derived from the expenditure GDP. For most of the individual sectors he provides annual figures.	(1961) commodity flow estimates with adjustments to put them on the basis used by the US Dept. of Commerce. VAVOP	
Main Authors Approach	Value Added Approach	Expenditure Approach	Income
Dept. of Commerce		1929-onwards annual estimates, 14 categories. They supply 3 weighting variants: 1987 weights, annual chain-weighting and quinquennially changing benchmarks. I used the latter.	VA

VA means that the source cited shows current values. VO means that the source provides volume indices or constant price estimates. P means that the appropriate deflators are given or are implicitly available in the source cited. I have not included New Zealand in the Table as Rankin (1992) used proxy indicators.

The reliability of the growth measure will depend on the quality of the source material and the sophistication and ingenuity of those preparing the estimates. The likelihood of avoiding obvious errors is much greater if there have been several rounds of estimation or if growth performance has been measured by more than one method. However, there are some significant problems which affect the comparability of the growth measures.

Sensitivity of Recorded Growth Rates to Weighting Procedures

One of these is the sensitivity of the estimates to bias introduced by the choice of benchmark weights. Obviously, if one were faced with massive disparities of approach to this question, comparative analysis would be gravely compromised because, over time, technological change leads to the emergence of new products, and with rising income the pattern of consumer expenditure and the structure of investment change. Relative and absolute prices change and so do the patterns of output and employment. For this reason it is necessary to build up the long term growth estimates in separate time segments which cover a span of years in which such changes are not overwhelming. Thus it would be absurd to compare growth for 1820-1992 in country A using 1820 weights throughout, and in country B using 1992 weights throughout. Ideally it would be desirable to have synchronous changes in weighting in all the countries under comparison but in practice this is not feasible.

In fact, most studies are linked segments with weights that are periodically changed even where the constant price (volume estimates) may be expressed for convenience in numeraire prices of a single year. Thus for France, Toutain gives constant price estimates

using a 1905-13 numeraire, and, for Finland, Hjerppe gives the figures in 1926 or 1985 Finnish marks, but their underlying procedure involves 20 year linked segments using prices and value added weights characteristic for each subperiod. For Sweden, Krantz used 20 to 25 year subperiods with Laspeyres volume indices and Paasche deflators. For the other countries, changes in weights are at less regular intervals. In the country notes I have specified what these are. In the case of Italy I broke up the original estimates of Fua and Associates which were originally in 1938 weights for a ninety year period.

In some cases, the weights appear to be fixed for excessively long periods, or it is not easy to see what procedures were used. The Hoffmann indices for Germany are presented in 1913 prices and the Hansen figures for Denmark in 1929 prices. In practice, there was probably some degree of variance in the structure of their component deflators or volume indices, if only because of the accidental character of data availability. Where a full set of estimates is presented for values (VA), volumes (VO) and prices (P) or unit values, one can reweight the published series to enhance international comparability. Usually the published detail is limited, so reweighting is possible only in less aggregated form than in the original.

For the postwar years, for most of the advanced capitalist group, the weights have been changed several times, and there is now a EUROSTAT recommendation that weights be changed every five years. The recommendation has been adopted in Belgium, Germany, Ireland, Sweden and the UK. Thus when Germany or the UK issue official estimates for a period of several decades in "1985" prices, this is simply a *numeraire*, and the underlying estimates are segments weighted by the price structure of successive base years. In most other OECD countries the weighting base is changed at longer intervals of ten years or so. Two exceptions are the Netherlands, which since 1981 has changed its weights every year, and the USA where the official estimates have hitherto been revised every five years, but with a single set of price weights for the whole period back to 1929. For the Netherlands, den Bakker has published a number of alternative weighting systems. For the USA, the Dept. of Commerce has now produced three alternative weighting systems, i.e. the official estimates where the weights are the same for over 60 years; a chain-weighted system like that used in the Netherlands, and an index with shifting 5 year weights. For 1959-92, US GDP grew 2.88 per cent a year with the official measure, 3.16 with 5 year changes in weights, and 3.12 per cent with the Dutch technique. I used the US version with 5 year changing weights as it is closer methodologically to the procedures used in the other countries.

Revisions to Correct for Inadequate Coverage

Another type of problem arises from revisions in the level of income to cover previously inadequate coverage of the accounts. The most extreme case is Italy where there have been several official benchmark revisions, each involving a substantial upward adjustment in the level of output. To a large extent these were necessary to improve coverage of the "underground" economy. The last revision in 1985 involved an upward adjustment of 18.7 per cent. The Italian authorities have not themselves made an explicit link with their earlier accounts. The easy solution is to raise all the previous estimates uniformly by 18.7 per cent, but this is unsatisfactory if the gap in coverage in fact occurred gradually. For this reason I used the available evidence to provide a more gradual phasing in this last large jump. Leandro Prados has made the same type of tapered adjustment for Spain. In the Netherlands there was an upward adjustment of 6.2 per cent for the year 1969, and the Dutch authorities have revised their estimates to account for this. It has recently been officially acknowledged in Greece and Portugal that the official GDP estimates for 1990

needed an upward adjustment of 25.2 per cent and 14.2 per cent respectively. I have made the necessary corrections, but for lack of better information, I simply raised the estimates for all earlier years in the same proportion. In the case of Argentina the latest revision involved an upward adjustment of 36 per cent. The authorities have revised their estimates back to 1980, and for earlier years I had no alternative but to raise all earlier years in the same proportion. In the case of Peru, de Soto has argued that the official accounts made inadequate allowance for informal activity but I did not have enough evidence to warrant an adjustment.

Intercountry Variations in Measurement Procedures and Source Material

Although great progress has been made in standardising the conceptual basis for national accounts, there are still significant differences in the way various items are measured. Thus the UK and the USA place major reliance on information on income flows which is derived from tax sources, whereas Germany relies more on output information from industrial surveys. There is no reason to expect a particular bias in the overall measurement of growth because of such differences, because statistical offices have elaborate techniques for cross-checking the consistency of information, e.g. by using input-output tables. However, when the primary returns are from *enterprises*, the boundaries of sectors will not be identical with those in countries which rely on reports from *establishments*.

A more significant source of discrepancy arises in service sectors (including government activities) where output is difficult to measure. In some countries, employment indicators are used as a proxy. In others, there may be detailed weighting to allow for changes in the relative importance of personnel with differences in skill and qualification, or imputation for productivity growth.

Measurement of output in high-tech industries can also be tackled in different ways. When the USA introduced a hedonic price index for computers, which took much better account of characteristics such as memory capacity and speed of operation, the new price index fell much more sharply than its predecessor, and added 0.3 per cent a year to GDP growth for 1982-8 (see M.F. Foss, M.E. Manser and A.H. Young, eds., *Price Measurements and Their Uses*, University of Chicago, 1993, p. 2).

Special Problems of Former Communist Economies

The problems of measuring real GDP growth for communist countries are *sui generis* and are discussed below on pp. 96-7 (for East Germany), on pp. 55-60 (for East European countries), and on pp. 62 and 82-5 (for China). It seems likely to me that the figures for GDP growth shown below for Bulgaria, Romania and Yugoslavia for 1950-73 exaggerate the economic performance of these countries, even though they were prepared by western analysts who were attempting to make measures of GDP by the same criteria as those used for western countries.

The Need for Caution and Cross-Checks

In spite of the fact that national accounts estimation is one of the oldest branches of economics - it has as long a history as the scholarly study of demography - it is clear from the above comments that there is still scope for much further work to improve the estimates we have.

From past experience the most promising procedure for filling gaps in our knowledge is to proceed on the same lines as in the past: i.e. to follow the tradition of building up indexes of the volume of value added in sectors like agriculture, industry, transport, communications and housing services where indicators are likely to be most readily available, refining the already existing deflators and crosschecking the necessarily rougher estimates for services with techniques used in other countries. It is essential that the techniques and results of research should be described as transparently as possible, so that further work can build upon it. It is equally necessary, when producing new estimates to replace those which already exist, that any substantial differences from the old estimates be explained.

It is useful to make plausibility checks, e.g. to see whether the apparent growth rates or levels of performance of the country in question make it an "outlier". If it appears to be growing much faster or more slowly than countries with a similar level of income, one needs to inquire into the reasons why this should be so. It is also useful to look at the year to year movements. If these are large and erratic the reasons need to be scrutinised. One is also likely to discover errors or problems in the estimates if they are used in an analytic framework of comparative growth accounts which will tend to highlight outlier characteristics.

Where short cuts or proxies are derived by regression, it is desirable to test their validity against the historical estimates of GDP we already have and to do this for as many countries as possible.

When work is presented transparently it is much simpler to modify the estimates with supplementary information, or to modify procedures which can be improved. Thus I was able to adjust or augment (apart from adjustments for geographic coverage) the estimates for Belgium, Brazil, France, Germany, Ireland, Italy, Korea, Mexico, Portugal, the UK and USSR.

Source Notes for Indices of Real GDP

Advanced Capitalist Countries

The figures are adjusted to exclude the impact of territorial change. For Belgium and Japan the GDP correction coefficient for territorial change was identical with that for population. For the eight other countries, the GDP adjustment coefficient was different, because independent evidence was available for GDP within the old and new frontiers. In all cases, however, the territorial scope of the GDP estimates is compatible with those for population in Table 1.

In order to enhance comparability in coverage and weighting procedures, the estimates for 1960 onwards are generally from OECD, *National Accounts*, various editions. There are, however, some exceptions as noted below. 1993 is from OECD *Economic Outlook*, December 1993.

The sources for individual countries are as follows:

Australia: 1828-60 GDP by industry of origin at 1848-50 prices from N.G. Butlin, "Contours of the Australian Economy 1788-1860", *Australian Economic History Review*, Sept. 1986, pp. 112-13; 1820-8 real GDP derived from the GNE/GDP ratio in Butlin, 1986, and real GNE per capita figures in N.G. Butlin, "Our 200 Years", *Queensland*

Calendar, 1988. 1860-1 link derived by using the 1860-1 GDP deflator in W. Vamplew (ed.), *Australians: Historical Statistics*, Fairfax, Broadway, 1987, p. 219. 1861-1938/9, GDP by industry of origin in 1910/11 prices from N.G. Butlin, *Australian Domestic Product, Investment and Foreign Borrowing 1861-1938/39*, Cambridge, 1962, pp. 460-1; amended as indicated in N.G. Butlin, *Investment in Australian Economic Development 1861-1900*, Cambridge, 1964, p.453, and with revised deflator shown in M.W. Butlin, *A Preliminary Annual Database 1900/01 to 1973/74*, Discussion Paper 7701, Reserve Bank of Australia, May 1977, p.41. 1938/9-1950 from expenditure aggregates in 1966/7 prices in M.W. Butlin, *op.cit.*, p.85. 1950 onwards from OECD sources. I adjusted all figures to a calendar year basis.

Austria: 1830-1913, GDP by industry of origin in 1913 prices from A. Kausel, "Österreichs Volkseinkommen 1830 bis 1913" in *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829-1979, Beiträge zur österreichischen Statistik*, Heft 550, Vienna, 1979, pp. 692-3. 1820-30 per capita movement assumed to be the same as that for 1830-40 (see Kausel, p. 701). 1913-50 gross national product in 1937 prices by expenditure and industry of origin, from A. Kausel, N. Nemeth, and H. Seidel, "Österreichs Volkseinkommen, 1913-63", *Monatsberichte des Österreichischen Institutes für Wirtschaftsforschung*, 14th Sonderheft, Vienna, August 1965, p. 38 and 42; 1937-45 from F. Butschek, *Die Österreichische Wirtschaft 1938 bis 1945*, Fischer, Stuttgart, 1979, p. 65. The figures are corrected for territorial change, which was large. (In 1911-13, present-day Austria represented only 37.4 per cent of the total output of the Austrian part of the Austro-Hungarian Empire.) The figures refer to the product generated within the present boundaries of Austria.

Belgium: 1820-46 movement in agricultural output from estimates supplied by Martine Goossens, 1831-46 industrial output estimates supplied by Jean Gadisseur (1820-31 assumed to increase at same pace as in 1831-42), service output 1820-46 assumed to move with population. 1846-1913 GDP derived from movements in agricultural and industrial output from J. Gadisseur, "Contribution à l'étude de la production agricole en Belgique de 1846 à 1913", *Revue belge d'histoire contemporaine*, vol. IV, 1-2, 1973, and service output which was assumed to move with employment in services (derived for census years from P. Bairoch, *La Population active et sa structure*, Brussels, 1968, pp. 87-8). 1913 weights and 1913-50 GDP estimates derived from C. Carbonnelle, "Recherches sur l'évolution de la production en Belgique de 1900 à 1957", *Cahiers Économiques de Bruxelles*, no. 3, April 1959, p. 358. Carbonnelle gives GDP figures for only a few benchmark years but gives a commodity production series for many more years. Interpolations were made for the service sector to arrive at a figure for GDP for all the years for which Carbonnelle shows total commodity production. Figures corrected to exclude the effect of the cession by Germany of Eupen and Malmédy in 1925, which added 0.81 per cent to population and was assumed to have added the same proportion to output. The GDP figures for 1914-19 and 1939-47 are interpolations between the 1913 and 1920 estimates and 1938-48 respectively, assuming the same pattern of movement as in France.

Canada: 1851-70 GNP by industry of origin in 1935-39 prices from O.J. Firestone, "Canada's Changing Economy in the Second Half of the 19th Century", NBER, New York, 1957, processed. 1870-1926 GDP (value added in 20 sectors) in current prices, with the aggregate deflator at 1900 prices from M.C. Urquhart and Associates, ed., *Gross National Product, Canada 1870-1926: The Derivation of the Estimates*, McGill Queen's University Press, Montreal, 1993, pp. 11-12 and 24-5, linked to the 1926-60 official

constant price estimates. In the official series, 1926-60 was in three segments: 1926-47 (in 1935-9 prices), 1947-56 (in 1949 prices) and 1956-60 (in 1957 prices), see Statistics Canada, *National Income and Expenditure Accounts*, vol. 1, *The Annual Estimates 1926-1974*, Ottawa, 1975, p. 323. 1960 onwards from OECD, *National Accounts*. I adjusted the figures for 1949 onwards by .987 to offset the incorporation of Newfoundland in that year. It should be noted that the growth of GDP shown by Urquhart for 1870-1926 is faster (3.5 per cent per annum) than the 3.3 per cent shown by O.J. Firestone, *Canada's Economic Development 1867-1953*, Income and Wealth Series VII, Bowes and Bowes, London, 1958. Urquhart and Associates have a significantly lower estimate of the value of total product in 1870 and a higher estimate in the 1920s than Firestone. Their deflator rises only slightly faster than Firestone's. Firestone estimated GDP by industry of origin, and by type of expenditure in current and constant (1935-9) prices. His basic effort was concentrated on benchmark years at decade intervals. The Urquhart study which is otherwise very fully documented and transparent, makes inadequate reference to Firestone, and it is not clear why the estimates differ, or why the Urquhart team could not estimate sectoral deflators as Firestone did. This is obviously worth further study as it is clear from our Table 2-5 that Canada (together with Argentina) was an outlier in terms of per capita GDP growth from 1870 to 1913. For 1820-50, I simply assumed that per capita product in Canada grew at the same rate as in the USA.

Denmark: 1820-1947 GDP at 1929 factor cost by industry of origin from S.A. Hansen, *Økonomisk vækst i Danmark*, vol. II, Institute of Economic History, Copenhagen, 1974, pp. 229-32 (figures from 1921 onwards adjusted to offset the acquisition of North Schleswig, which added 5.3 per cent to the population, and 4.5 per cent to GDP). The Hansen study was much more elaborate than that of K. Bjerke and N. Ussing, *Studier over Danmarks Nationalprodukt 1870-1950*, GADS, Copenhagen, 1958. Hansen published a 23-way breakdown of value added, compared with the 2-way breakdown of Bjerke and Ussing, and he covered a much longer period. 1947-60 GDP at 1955 factor cost from Søren Larsen, "Reviderede tidsserier for produktionsvaerdi og bruttofaktoringkomst for perioden 1947- 65", CBS, Copenhagen, 1992, mimeographed. 1960 onwards from OECD, *National Accounts 1960-91*, vol. 1, Paris, 1993.

Finland: 1820-60 per capita GDP assumed to increase by 22.5 per cent, as indicated in S. Keikkinen, R. Hjerpe, Y. Kaukiainen, E. Markkanen and I. Nummela, "Förändringar i levnadsstandarden i Finland, 1750-1913", in G. Karlsson, ed., *Levestandarden i Norden 1750-1914*, Reykjavik, 1987, p. 74. 1860-1960 GDP by industry of origin at market prices from R. Hjerpe, *The Finnish Economy 1860-1985: Growth and Structural Change*, Bank of Finland, Helsinki, 1989, pp. 198-200. She uses a Laspeyres-type volume index for about 20 years at a time, with the segments being chained.

France: There are two major studies of French economic growth which appeared in 1985 and 1987.

J.C. Toutain, *Le Produit intérieur de la France de 1789 à 1982*, Presses Universitaires de Grenoble, 1987 is the latest and most comprehensive of these. It is the fifteenth volume in a series on the quantitative history of the French economy. The project was conceived by François Perroux in his Institute of Applied Economics (ISEA, now ISMEA) in the early 1950s (see F. Perroux and others, "La croissance économique française", in M. Gilbert, ed., *Income and Wealth*, Series III, Bowes and Bowes, Cambridge, 1953, pp. 45-101 for a review of the long history of French national income estimation).

The detailed work of ISMEA was supervised by Jean Marczewski who laid down the methodological basis which the group subsequently followed. The group's work was started at the initiative of Simon Kuznets and received initial financial support from the American Social Science Research Council. Marczewski was influenced by Kuznets' early emphasis on decade averages (which he used mainly as a cautious presentational device, but which Marczewski turned into a method of index construction with a more complex system of weights for the constant price estimates). The methodology is laid out in J. Marczewski, "Histoire quantitative - Buts et méthodes", *Cahiers de l'ISEA*, July 1961 and in "Some Aspects of the Economic Growth of France 1660-1958", *Economic Development and Cultural Change*, April 1961.

Marczewski attached primary importance to getting decennial averages to establish broad trends in the growth of physical product. Each pair of successive decades was crossweighted, and the changes in volume between the averages for successive pairs of decades were then chained to produce estimates for benchmark years.

Toutain published studies on agriculture in 1961, population in 1963 and transport in 1967. T.J. Markovitch produced four volumes on industry in 1965-6. There were subsequent volumes on wages and salaries (1967), consumption (1971), and state expenditure (1976) which provided material for an income and expenditure approach to supplement the industry of origin approach.

It was not until 1987, 26 years after the start of the project that Toutain provided annual estimates and extended the research to cover the whole economy. Toutain (1987, pp. 191-2) explains how he derived annual indicators which he adjusted to fit the decennial benchmarks. The latter were based on much more complete information than the annual indicators. Toutain presents volume and value indices for the three main sectors (agriculture, industry and services) and for GDP. He provides indicators for 6 service branches (housing, liberal professions, domestic service, transport, commerce and public services) and 7 industrial branches (mining, metallurgy, metal processing, food products, bread, textiles and construction). Toutain covers the years 1815-1913 and 1920-38 and links these to the official series for 1949-82. For his constant price estimates he uses a 1905-1913 numeraire, but his underlying benchmark procedure is based on chains of 20 year segments where successive decades are crossweighted with price structures characteristic of each of the two decades.

The alternative estimates for 1820-1913 are those of Levy-Leboyer, "Les Series de base", in M. Levy-Leboyer and F. Bourguignon, *L'Economie française au XIX siècle*, Economica, Paris, 1985. Levy-Leboyer provides estimates of GDP broken down by expenditure category in current prices. He gives volume and value estimates for agriculture, industry and a composite "non-agriculture". There is no explicit volume estimate for GDP but one can derive this (and his estimate for the volume of services) from the information he gives.

There are significant differences between the estimates of Toutain and Levy-Leboyer but the 1870-1913 GDP movement is not very different (see Tables B-2 and B-3).

Levy-Leboyer (1985) discusses the results which the Marczewski team produced in the 1960s and complains that they depart from those of earlier authors such as Mulhall and Bairoch. He gives the impression that his own procedures were adapted to accommodate what he considers to be the accepted wisdom of earlier years, but it is not clear in what respects this may be so. His critical comments on the Marczewski team are mainly directed to discussion of the current value series, and he was not, of course, able to comment on the much more comprehensive estimates which Toutain published in 1987.

Table B-2
Confrontation of Toutain and Levy-Leboyer Estimates of Value and Volume of French GDP, 1820-1913

Value Added in million francs at current prices				Volume Indices by Sector (1913 = 100.0)			
Agriculture	Industry	Services	GDP	Agriculture	Industry	Services	GDP
Toutain				Toutain			
18203,637	3,252	2,076	8,965	46.9	9.7	29.6	22.0
18709,442	8,411	6,016	23,959	81.1	35.0	50.5	52.1
191313,024	19,212	17,335	49,571	100.0	100.0	100.0	100.0
Levy-Leboyer				Levy-Leboyer			
18204,117	3,391	1,503	9,011	41.4	18.0	(17.5)	(25.1)
18707,958	6,374	4,980	19,312	71.5	42.4	(42.7)	(51.4)
191311,907	16,143	10,792	38,842	100.0	100.0	(100.0)	(100.0)

Sources: Toutain (1987) and Levy-Leboyer (1985). The figures in brackets are not explicit in Levy-Leboyer but are easily derived from the information he gives. I arrived at the Levy-Leboyer GDP volume index by using 1913 weights.

Table B-3
Confrontation of Toutain and Levy-Leboyer Sectoral and Aggregate Deflators (1913 = 100)

Agriculture	Industry	Services	GDP	Agriculture	Industry	Services	GDP	
Toutain				Levy-Leboyer				
1820	59.6	174.5	40.5	82.2	83.5	116.7	79.6	92.4
1870	89.4	125.1	68.7	92.7	93.5	93.1	108.1	96.6
1913	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: As for Table B-2.

Levy-Leboyer published his first annual estimates for agriculture and industry in his "La croissance économique en France au XIV siècle: Resultats préliminaires", *Annales: Economies, Sociétés, Civilisations*, July-August 1968 where his sources and weighting procedures are indicated in greater detail. In 1978 he revised his estimates for the commodity sector and made estimates of investment for 1820-1913, in "Capital Investment and Economic Growth in France 1870-1930", in P. Mathias and M.M. Postan, eds., *The Cambridge Economic History of Europe*, vol. VII, Part I, Cambridge University Press, 1978. The latter source gives little detail on his procedures in measuring commodity output.

The studies of Toutain and Levy-Leboyer are more transparent in important respects than those for some other countries (e.g. Hoffmann's estimates for Germany). Toutain's work is based on a much bigger and better documented research input, and represents a

more serious effort to cover the services sector. However, it would have been useful to have Toutain's critique of the Levy-Leboyer estimates and some analysis of the sensitivity of his own results (for growth and cyclical movements) to alternative weighting procedures. It would also be useful to have a better idea of why Toutain's industrial movement is different from that of Markovitch.

Table B-4
Alternative Indices of French Industrial Output
(1913 = 100)

	Markovitch (1965)	Levy-Leboyer (1968)	Crouzet (1970)	Levy-Leboyer (1978 and 1985)	Toutain (1987)
1820	15.7	9.6	20.7	18.0	9.7
1870	47.8	30.3	40.0	42.4	35.0
1913	100.0	100.0	100.0	100.0	100.0
Annual Average Compound Growth Rates					
1820-70	2.3	2.3	1.3	1.7	2.6
1870-1913	1.7	2.8	2.2	2.0	2.5
1820-1913	2.0	2.6	1.7	1.9	2.5

Source: Col. 1 from J.J. Markovitch "L'industrie française de 1789 à 1964 - Sources et méthodes", *Cahiers de l'ISEA*, AF4, July 1965, Table 1, pp. 216-7. Markovitch gives figures for decades or quinquennia, and I had to interpolate to get figures for the years shown here. Second, fourth and fifth columns from works already cited, third column from F. Crouzet, "Essai de construction d'un indice annuel de la production industrielle française au XIX siècle", *Annales ESC*, January-February 1970.

There have been several estimates of French industrial production since Markovitch's work in 1965-6 (see Table B-4). Later investigators have all made some use of his benchmark weights. Levy-Leboyer (1968) showed faster growth than Markovitch, Crouzet showed slower growth, and Levy-Leboyer (1978 and 1985) made new estimates with slower growth. Toutain's (1987) estimate shows faster growth than Markovitch and is closer to Levy-Leboyer (1968) than to any of the others.

I have adopted the Toutain GDP movement for 1870-1913, but as he shows an 1820-70 per capita movement which is substantially faster than the European norm and his measure of industrial growth is an outlier, I used a compromise estimate for 1820-70 growth. I used the agriculture and services indicators of Toutain (1987) and the industrial index of Levy-Leboyer, with Toutain's 1870 sector values as weights. For 1920-38 and 1949-60 GDP I used Toutain (1987). My interpolation between 1913 and 1920 was based on figures for industrial and agricultural output shown by J. Dessirier, "Indices comparés de la production industrielle et production agricole en divers pays de 1870 à 1928", *Bulletin de la statistique générale de la France, Études spéciales*, October-December 1928; service output was assumed stable in this period. Interpolation between 1938 and 1949 was based on A. Sauvy's report on national income in 1938 francs to the Conseil Économique, *Journal officiel*, 7 April 1954. The figures are adjusted to exclude the impact of frontier changes. Between 1871 and 1918 France lost Alsace and Lorraine. For this period, GDP and population were 95.92 per cent of what they would otherwise have been.

In 1861 France acquired Savoie, Haute Savoie and part of the Alpes Maritimes. This raised population and GDP by 1.797 per cent.

Table B-5 summarises the implications of the various possible estimates of French GDP (in per capita terms). It can be seen that the Toutain and the Levy-Leboyer estimates show faster growth than my compromise estimate for 1820-70. All estimates are adjusted to exclude the impact of frontier changes.

Table B-5
Alternative Estimates of French GDP per Capita 1820-1913

	1820	1870	1913
My compromise estimate	1,218	1,858	3,452
Toutain (1987)	983	1,858	3,452
Levy-Leboyer (1985)	1,123	1,836	3,452

Germany: 1820-50, GDP estimated from Prussian output data in R.H. Tilly, "Capital Formation in Germany in the Nineteenth Century", in P. Mathias and M.M. Postan (eds.), *Cambridge Economic History of Europe*, vol. VII, I, 1978, pp. 395, 420, and 441. Using 1850 weights for agriculture, industry, and services from W.G. Hoffmann, F. Grumbach and H. Hesse, *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*, Springer, Berlin, 1965, p. 454, Prussian per capita output in agriculture and industry were multiplied by population in Germany as a whole. Output in services was assumed to move with population.

1850-1938 and link to 1950 derived from Hoffmann's net domestic product (value added by industry) at 1913 factor cost (adjusted to exclude the impact of the reincorporation of the Saar, which Hoffmann includes from 1934): see Hoffmann, Grumbach and Hesse, *op. cit.*, pp. 454-5. This source gives no figures for 1914-24, but starts again in 1925. The pattern of movement in individual years 1914-24 was derived from annual indices of industrial and agricultural output in Dessirier, *op. cit.*, using Hoffmann's weights for these sectors and adjusting them to fit his sectoral output benchmarks for 1913 and 1925. Service output was interpolated between Hoffmann's 1913 and 1925 figures for this sector.

Hoffmann provides two estimates of real expenditure as well as the real product estimates I used. The real expenditure measure for which he has a continuous series (col. 5 of pp. 827-8) shows a growth rate of 2.35 per cent for 1850-1938 compared with a real product growth rate of 2.27, but he also provides an alternative real expenditure measure (col. 7 on pp. 827-8) which is incomplete for some years.

Alternative estimates of GDP 1925-38 (derived largely from income statistics) at 1936 market prices are available in K.-H. Raabe, "Die langfristige Entwicklung des Sozialprodukts im Bundesgebiet", *Wirtschaft und Statistik*, June 1954 (later reproduced in *Bevölkerung und Wirtschaft 1872-1972*, Statistical Office, Wiesbaden, 1972, p. 260), but the cyclical movements presented by Hoffmann seem more plausible. 1938-44 GNP in 1939 prices (from the expenditure side) for the 1938 territory (including Austria and Sudetenland) from W.C. Haraldson and E.F. Denison, "The Gross National Product of Germany 1936-1944", *Special Paper 1* (mimeographed) in J.K. Galbraith (ed.), *The Effects of Strategic Bombing on the German War Economy*, US Strategic Bombing Survey, 1945. 1946 (linked to 1936) from *Wirtschaftsproblemen der Besatzungszonen*, D.I.W. Duncker and Humblot, Berlin, 1948, p. 135; 1945 was assumed to lie midway

between 1944 and 1946. 1947-50 (linked to adjusted Hoffmann's estimates for the change between 1936 and 1950) from *Statistics of National Product and Expenditure No. 2, 1938 and 1947 to 1955*, OEEC, Paris, 1957, p. 63.

1950-80 GDP at 1985 market prices from Statistisches Bundesamt, *Volkswirtschaftliche Gesamtrechnungen, Revidierte Ergebnisse 1950 bis 1990*, Wiesbaden. Thereafter from OECD National Accounts publications.

I have corrected the estimates for territorial change, which was extremely complicated:

- a) In 1870 Germany took Alsace-Lorraine from France. This increased its population and GDP by 4 per cent;
- b) between 1918 and 1922 Germany lost Alsace-Lorraine, Memel, Danzig, Eupen and Malmedy, Saarland, North Schleswig and Eastern Upper Silesia. These territories had a population of 7,330 thousand in 1918 out of a total of 66,811 thousand within the 1918 Reich frontiers, i.e. the old Reich was 12.3 per cent bigger in terms of population. However, as 1913 per capita income in the truncated area was 2.4 per cent higher than in the former Reich, the total income loss due to these changes was 9.7 per cent (for the population changes see A. Maddison, *Dynamic Forces in Capitalist Development*, 1991, pp. 232-5; for the per capita income difference see F. Grünig, "Die Anfänge der volkswirtschaftlichen Gesamtrechnung in Deutschland", *Beiträge zur empirischen Konjunkturforschung*, Berlin, 1950, p. 76);
- c) in 1935, Germany regained the Saarland which added 1.79 per cent to population and income;
- d) in 1938 Germany incorporated Austria and the Sudetenland which added over 8 per cent to GDP and later took over Alsace-Lorraine and parts of Poland and Yugoslavia. In 1941 these areas added 22.4 per cent to the GDP generated with the 1937 frontiers (see Haraldson and Denison, *op.cit.*, p. 12).

On the basis of the geographic distribution of German product in 1936 (see *Statistisches Handbuch für Deutschland 1928-1944*, Länderrat des Amerikanischen Besatzungsgebiet, Ehrenwirth, Munich, 1949, pp. 600-1) one can see that GDP generated within the boundaries initially fixed for the Federal Republic (excluding Saarland and West Berlin) was only 56.9 per cent of that within the 1936 boundaries, or 64.3 per cent if we add the Saar and West Berlin (which were incorporated in the Federal Republic statistics in 1960). 10.7 per cent of 1936 GDP was generated in territories east of the Oder Neisse which went to Poland and the USSR, and the rest went to the Soviet zone and East Berlin which later became the DDR.

Table B-6
Area Breakdown of German GDP, Population and Per Capita GDP 1936, and 1990

	1936		
	National Income million RM	Population (000)	Per Capita Income in RM
Federal Republic Territory ^a	41,757	42,208	989
DDR Territory	16,159	15,614	1,035
East of Oder-Neisse	6,968	9,514	732
Total (1936 territory)	64,884	67,336	964
Saar	629	821	766
West Berlin	4,175	2,685	1,555
	1990 (second half year)		
	GDP billion DM	Population (000)	Per Capita GDP in DM
Federal Republic ^a	1,216.9	63,527	19,864
Former DDR	97.7	16,111	6,064
Total	1,359.6	79,638	17,007

a) including Saar and West Berlin.

Source: 1936 from *Handbuch* (1949); second half of 1990 from Statistisches Bundesamt, *Erste Ergebnisse der Sozialproduktsberechnung 1992*, Fachserie 18, Reihe 1, Wiesbaden, January 1993, pp. 39 and 41.

In the course of 1990, the territory of the DDR reverted to the Federal Republic. Table B-6 compares the situation in the second half of 1990 (immediately after reunification) with that in 1936.

The 1936 and 1990 per capita ratios derivable from Table B-6 can be used in conjunction with my estimates of the movement in GDP per capita in the territory of the Bundesrepublik (Table 4a of Appendix D). Thus we have an estimate for the Bundesrepublik area of \$4,571 (in 1990 international dollars) for 1936 rising to \$18,685 in 1990 and we can infer that, in the area of the DDR, per capita GDP rose from \$4,783 to \$5,704, i.e. at .33 per cent a year compared with 2.64 in the area of the Federal Republic.

Table B-7
Previous Estimates of the Performance of the East German Economy

	Population Index of (000s)	GNP at Constant Prices (1950=100)	Inferential Level of GDP per capita in 1990 Geary Khamis \$		Population (000s)	Index of GDP at Constant Prices	Inferential Level of GDP per capita in 1990 Geary Khamis \$
1936	15,614	129.9	4,783	1970	17,058	231.9	7,816
				1971	17,061	237.1	7,990
1946	18,488	n.a.	n.a.	1972	17,043	245.1	8,268
1947	19,102	n.a.	n.a.	1973	16,980	252.8	8,559
1948	19,044	n.a.	n.a.	1974	16,925	264.9	8,998
1949	18,793	n.a.	n.a.	1975	16,850	274.7	9,373
1950	18,388	100.0	3,127	1976	16,786	280.2	9,597
1951	18,335	n.a.	n.a.	1977	16,765	288.8	9,904
1952	18,334	n.a.	n.a.	1978	16,756	293.7	10,077
1953	18,271	n.a.	n.a.	1979	16,745	301.9	10,365
1954	18,057	n.a.	n.a.	1980	16,737	308.3	10,590
1955	17,928	136.4	4,374	1981	16,736	314.6	10,806
1956	17,735	n.a.	n.a.	1982	16,732	313.5	10,772
1957	17,478	n.a.	n.a.	1983	16,700	319.5	10,999
1958	17,262	n.a.	n.a.	1984	16,671	328.6	11,332
1959	17,148	n.a.	n.a.	1985	16,644	338.8	11,703
1960	17,114	173.9	5,842	1986	16,625	343.7	11,886
1961	17,002	175.2	5,924	1987	16,642	349.5	12,074
1962	16,874	180.0	6,133	1988	16,667	353.3	12,187
1963	16,930	185.8	6,309	1989	16,399	357.4	12,530
1964	16,972	190.9	6,467				
1965	17,020	198.6	6,708	1990 ^a	16,111		5,704
1966	17,058	204.7	6,899	1991	15,910		5,346
1967	17,082	211.3	7,111	1992	15,730		6,666
1968	17,084	220.9	7,434	1993	15,648		7,003
1969	17,076	226.1	7,612				

a) second half of 1990.

Source: GDP index derived as follows: 1936-50 movement from E.M. Snell and M. Harper, "Postwar Economic Growth in East Germany: A Comparison with West Germany", in *Economic Developments in Countries of Eastern Europe*, Joint Economic Committee, US Congress, Washington DC, 1970, p. 561; 1950-65 from T.P. Alton, "Economic Structure and Growth in Eastern Europe", in the same (1970) volume, p. 46; 1965-75 from Alton, *op.cit.* (1985), pp. 109-10; 1975-89 from T.P. Alton, ed., "Economic Growth in Eastern Europe 1975-1989", *Occasional Paper* 110, Research Project on National Income in East Central Europe, New York, 1990, p. 26. Population estimates derived from the same Joint Economic Committee volumes, and from publications of the Federal Statistical Office, Wiesbaden. GDP per capita is benchmarked on the 1936 estimate in Table B-2 and its movement is derived from the first two columns of this table.

The situation in the East German economy which became apparent after reunification was very different from what had previously been estimated. Western estimates of East German per capita GDP levels put them at about threequarters of those in the Federal Republic and about two thirds of those in the United States (see T.P. Alton, "East European GNPs, Origins of Product, Final Uses, Rates of Growth, and International Comparisons", in *East European Economies: Slow Growth in the 1980s*, vol. 1, p. 127, Joint Economic Committee, US Congress, 1985). Per capita GDP growth in East Germany was thought to have been faster between 1950 and 1989 than in any other of the East European economies (3.6 per cent per annum, compared with 3.5 per cent in Bulgaria and Yugoslavia, 3.1 per cent in Romania, 2.6 per cent in Hungary, 2.4 per cent in Czechoslovakia and the USSR and 2.1 per cent per annum in Poland).

Table B-7 presents previous Western estimates of the performance of the East German economy. There are two reasons for the apparently successful growth performance of Eastern Germany and the huge drop in per capita GDP between 1989 and the second half of 1990 which one can see in Table B-7. In the first place, the statistical basis for Western estimates of the DDR's growth performance was rather flimsy, and much more so than that for Czechoslovakia and Hungary. Furthermore, the East German authorities are known to have deliberately understated the degree of inflation in ways which would have affected some components of the Alton group's estimates, e.g. trade. It is not plausible to believe that East German per capita growth performance could have been much different from that of Czechoslovakia, which was closest to it in the proportion engaged in agriculture, the nature of its industrial output, the skills of its labour force, levels of prewar economic development, 1950 levels of income, and size of the population. If East German per capita growth performance in 1950-89 had in fact been like that of Czechoslovakia, its 1989 level would have been less than two thirds of what it was imagined to be. This would still imply a drop in per capita product levels by more than a quarter from 1989 to the second half of 1990, but this would not be surprising in an economy whose governmental, administrative, police and military structures had been jettisoned, and whose competitiveness had been ruined by monetary union at a grossly overvalued exchange rate.

Italy: For 1861-1951, estimates of GDP at factor cost within present frontiers are available in G. Fua (ed.), *Lo sviluppo economico in Italia*, vol. iii, Angeli, Milan, 1969, pp. 410-12, but I felt that use of 1938 weights for a ninety year period was likely to understate growth and reduce comparability with other countries, so I reweighted 1861-1913 with 1870 weights, and 1913-38 with 1913 weights. This produced a slight increase in growth rates which rose from 1.39 per cent a year to 1.47 per cent for the 1861-1913 segment, and raised growth in 1913-38 by 0.06 per cent a year. However, there was a bigger change (a further rise of GDP growth) for 1861-1913 by 0.32 per cent a year which resulted from a change I made for the industrial sector where I substituted the estimates of Stefano Fenoaltea for the years 1861-1913. The Fenoaltea estimates for mining, utilities, and construction are from "The Extractive Industries in Italy, 1861-1913", *Journal of European Economic History*, Spring 1988, "The Growth of the Utilities Industries in Italy 1861-1913", *Journal of Economic History*, Sept. 1982, "Construction in Italy, 1861-1913", *Rivista di Storia Economica*, International Issue, 1987. For manufacturing I used Fenoaltea, "Public Policy and Italian Industrial Development 1861-1913", Harvard Ph.D. Thesis, 1967 (Tables 24, 25, and 27) excluding utilities, and adding silk from Fenoaltea, "The Growth of Italy's Silk Industry, 1861-1913", *Rivista di Storia Economica*, October 1988. For 1951-70 I used estimates of R. Golinelli and M.M. Monterastelli, *Un metodo per la ricostruzione di serie storiche compatibili con la nuova contabilità nazionale*, Prometeia, Bologna, 1990. The official ISTAT estimates I used for 1970 onwards have a more complete coverage of the underground economy than is the case in other countries (20.2 per cent of total GDP). In other countries, underground activities which escape the net of official national accounts statisticians are typically about 3 per cent of GDP (see D. Blades, "The Hidden Economy and the National Accounts", OECD, *Occasional Studies*, June 1982, p. 39). I therefore made a 3 per cent downward adjustment to the benchmark level of Italian GDP to enhance international comparability. This has no effect on our index of Italian GDP growth: it only affects the level comparisons. See A. Maddison, "A Revised Estimate of Italian Economic Growth 1861-1989", *Banca Nazionale del Lavoro Quarterly Review*, June 1991 for further details.

There have been a number of territorial changes since 1861 when Italy became a nation. In 1866, after the war with Austria, the Venetian territories became part of Italy, and after 1870 the Papal states were added. In 1919 South Tirol, the old Austrian Kustenland provinces and the port of Zara were acquired. Fiume was added in 1922. In 1945, Zara, Fiume and part of Venezia-Giulia were ceded to Yugoslavia. Until the settlement of 1954 Trieste was in dispute and under international occupation; thereafter the city and a strip of coast went to Italy and the hinterland to Yugoslavia. In 1947, Tenda and Briga were added to France. The impact of these changes can be seen in Table G-2.

Japan: 1885-1940 GDP at 1934-6 market prices by industry of origin from K. Ohkawa and M. Shinohara, eds., *Patterns of Japanese Development: A Quantitative Appraisal*, Yale 1979, pp. 278-80. 1940-50 expenditure on GNP at 1934-36 prices adjusted to a GDP basis using coefficients from *op. cit.* pp.268-9. 1945 GDP taken to be two-thirds of the 1944 level (see Y. Kosai, *The Era of High Speed Growth*, University of Tokyo, 1986, p.34 for partial indicators for 1945). 1946 GDP assumed to lie halfway between 1945 and 1947. 1950-2 from *National Income White Paper*, (in Japanese) 1963 ed., p.178, adjusted to a calendar year basis. 1952 onwards from OECD *National Accounts*. An upward adjustment of 0.66 per cent was made for 1946 to offset the impact of territorial change (loss of Okinawa). It was assumed that the official figures published by OECD are adjusted to exclude the effect of the reacquisition of Okinawa in 1973 (which added 0.92 per cent to population and to GDP). The figures for 1820 and 1870 are rough conjectures. For 1870-90, I assumed that per capita product rose at the same rate as in 1890-1913 and for 1820-70 that GDP per capita rose by 0.1 per cent a year in line with the position of those who think that there was modest growth in the Tokugawa period - see T.C.

Smith, "Pre- Modern Economic Growth: Japan and the West", *Past and Present*, August 1973, pp. 127-60, and S.B. Hanley and K. Yamamura, *Economic and Demographic Change in Preindustrial Japan, 1600-1868*, Princeton, 1977.

Netherlands: J.L. van Zanden, "Economische groei in Nederland in de negentiende eeuw. Enkele nieuwe resultaten", *Economisch en Sociaal-Historisch Jaarboek*, 1987, pp. 58-60 provides a GDP index by industry of origin (8 sectors) for 1820, 1850, 1880 and 1910. His weights are derived from the sectoral breakdown of employment weighted by productivity. He and his associates are reworking these estimates and kindly supplied me with their provisional (Smits/Van Zanden) real GDP index, which I used for 1850-1900. 1900-60 from C.A. van Bochove and T.A. Huitker, "Main National Accounting Series, 1900-1986", *CBS Occasional Paper*, No. 17, The Hague, 1987. This official retrospective series links several segments. 1900-20 current price estimates of net national income are deflated by a fixed base cost of living index, 1921-39 is an elaborate reestimate by type of expenditure with annual chain weighting procedures to produce volume and price indexes, 1939-48 was bridged by direct comparison of the two years with rough estimates of the same type as for 1900-20. 1948-69 was measured by the commodity flow method with fixed weights. 1969 onwards is the outcome of a major revision which raised the level of GDP by 6.2 per cent in the link year 1969. The revised index is in 1980 prices for 1969-81 and is an annual chain index from 1981. For 1960 onwards I took the estimates from OECD, *National Accounts* (this incorporates the official estimates). G.P. den Bakker, "The Choice of Index Number Formulae and Weights in National Accounts", CBS, Occasional Papers NA-044, The Hague, 1991 presents several alternative weights for 1921-39. The official chain-weighted index rises by 2.6 per cent per annum for this period whereas an index with 1921 weights would rise by 3.0 per cent a year.

New Zealand: 1870-1939 GNP in 1910/11 prices from K. Rankin, "New Zealand's Gross National Product: 1859-1939, *Review of Income and Wealth*, March 1992, pp. 60-1. These are proxy estimates based on regressions involving assumptions about velocity of circulation, nominal money supply, a variety of price indices (wholesale, export, import, farm and non-farm) and population. Rankin tests his method by applying the same procedure to Australia to see whether it approximated to Butlin's independent estimates of GNP. He discusses the plausibility of his results in the light of previous spot estimates of aggregate output in New Zealand, but he does not check his procedure for years after 1939 for which there are official estimates of total output. He does not explain clearly why he excludes the Maori population from his estimating procedure for per capita estimates, though he does explain that they were excluded from some of the spot estimates he discusses. For 1939-50 I used C. Clark, *The Conditions of Economic Progress*, third edition, Macmillan, London, 1957, pp. 171-2 (which Clark derived by deflating official estimates in current prices). For 1950 onwards I used OECD Development Centre, and OECD National Accounts estimates. The index is for calendar years to 1939 and fiscal years starting April 1st thereafter.

Norway: 1865-1930 GDP by category of expenditure at 1910 market prices 1930-9 at 1938 prices and 1946-50 at 1955 prices from *National Accounts 1865-1960*, Central Bureau of Statistics, Oslo, 1965, pp. 348-59 (I adjusted gross fixed investment downwards by a third to eliminate repairs and maintenance). 1939-44 movement in national income (excluding shipping and whaling operations carried out from Allied bases 1940-4) from O. Aukrust and P.J. Bjerve, *Hva krigen kostet Norge*, Dreyers, Oslo, 1945, p. 45. 1945 assumed to be midway between 1944 and 1946. For 1820-65 I assumed that the per capita GDP movement was the same as in Sweden.

Sweden: There have been five major studies of Swedish growth experience. E. Lindahl, E. Dahlgren and K. Kock, *Wages, Cost of Living and National Income in Sweden 1860-1930*, 2 vols., King, London, 1937, was the pioneering study, followed by O. Lindahl, *Sveriges Nationalprodukt 1861-1951*, Konjunkturinstitutet, Stockholm, 1956, Ö. Johansson, *The Gross Domestic Product of Sweden and Its Composition 1861-1955*, Almqvist and Wiksell, Stockholm, 1967, and O. Krantz and C.-A. Nilsson, *Swedish National Product 1861-1970*, CWK Gleerup, 1975. The fifth study has been in preparation for several years and is the most ambitious. Seven volumes have appeared since 1986. They cover the period since 1800. The new estimates involve a downward revision in the growth rate in the nineteenth century. Preliminary 1820-1960 GDP estimates by industry of origin were kindly supplied by Olle Krantz, his procedures are explained in Olle Krantz, "New Estimates of Swedish Historical GDP Since the Beginning of the Nineteenth Century", *Review of Income and Wealth*, June 1988. Krantz divided the period into eight segments with an average length of 22 years. For each segment he used Paasche deflators and Laspeyres volume indices, and then linked the segments. Krantz has also produced a supplementary estimate of the volume of domestic work (not included in GDP). See O. Krantz, *Husligt arbete 1800-1980*, Lund, 1987.

Switzerland: The historical estimates are poor and weaker than for all other West European countries. I took 1899-1950 real product in international units from C. Clark, *Conditions of Economic Progress* (3rd ed.), Macmillan, London, 1957, pp. 188-9. For 1870-99 it was assumed that per capita product moved as in Germany. There is a graphical indication of the growth of Swiss real product in F. Kneschaurek, "Problemen der langfristigen Marktprognose", *Aussenwirtschaft*, December 1959, p. 336. This shows faster growth than C. Clark to 1938. On the other hand, U. Zwingli and E. Ducret, "Das Sozialprodukt als Wertmesser des langfristigen Wirtschaftswachstums", *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*, March-June 1964, show slower growth for 1910-38 than Clark. For a survey of past attempts to estimate Swiss GDP growth before 1950, see *Annuaire statistique de la Suisse 1993*, Office fédéral de la Statistique, Berne, pp. 131-4. The figures for 1900-12 and 1914-23 are interpolations.

U.K.: 1820-31 derived from N.F.R. Crafts, "British Economic Growth 1700-1831: A Review of the Evidence", *Economic History Review*, May 1983. For 1801-31 Crafts shows growth rates for 6 sectors by industry of origin and for total "real national product". He uses the 1821 national income weights of P. Deane and W.A. Cole, *British Economic Growth 1688-1959*, Cambridge, 1964, p. 166. 1801-31 growth shown by Crafts (p. 187) refers to Great Britain (i.e. England, Wales and Scotland). I adjusted it to a U.K. basis assuming Irish output per head of population in 1831 to have been half of that in Great Britain (hypothesis of P. Deane, "New Estimates of Gross National Product for the United Kingdom 1830-1914", *Review of Income and Wealth*, June 1968) and to have been stagnant from 1801 to 1831. Crafts has recently made a very minor adjustment to his earlier estimates which I have ignored - see N.F.R. Crafts and C.K. Harley, "Output Growth and the British Industrial Revolution: a Restatement of the Crafts-Harley View", *Economic History Review*, 1992, pp. 703-30. 1830-1855 gross national product by type of expenditure at factor cost from P. Deane (1968), p. 106. Deane expresses her results in a 1900 numeraire but the underlying procedure involves linkage of segments with different weights. Her estimates of volume movement were linked to 1855-1960 GDP at factor cost (compromise) estimate of C.H. Feinstein, *National Income Expenditure and Output of the United Kingdom 1855-1965*, Cambridge, 1972, pp. T18-20. Feinstein's "compromise" figures average the results of his real expenditure, output and income estimates which he calculated separately (though he used the expenditure deflator to arrive at real income). For 1870-1960, the compromise measure shows a compound growth rate of 1.73 per cent a year, the output estimate 1.68 per cent, income 1.72 per

cent, and expenditure 1.80 per cent a year. He used 1900 prices for 1870-1913, 1938 prices for 1913-38, a Fisher geometric average of 1938 and 1948 prices for 1938-48 and 1958 prices for 1948-60. Figures from 1920 onwards are increased by 3.8 per cent (Feinstein's coefficient) to offset the exclusion of output in the area which became the Irish Republic.

U.S.A.: The hard core of modern estimation was carried out by Simon Kuznets. He took over the NBER research in this field around 1930, and also prepared the first official estimates, *National Income 1929-32*, which were transmitted to the Finance Committee of the US Senate by the Dept. of Commerce in January 1934. This showed the flows of different categories of income broken down by industry together with corresponding employment estimates prepared by Robert Nathan. A cost of living index was provided as a tentative deflator, together with very fully documented appendices with sources. This approach was further elaborated in S. Kuznets, *National Income and Its Composition 1919-38*, NBER, New York, 1941, which contained estimates (at current and 1929 prices) of the industrial distribution of different categories of income (wage, property, and entrepreneurial).

Kuznets also derived estimates by category of expenditure for 1919 onwards by the "commodity flow" method, i.e. he used census and other information on production, and determined what part represented the final flow to consumers and capital formation. These flows from producers were given distributive mark-ups to reflect final sales values. Rougher estimates were made for services. This work was sponsored by the Committee on Credit and Banking which was interested in commodity flows as a counterpart to its interest in flows of financial resources. The details of this approach are described in S. Kuznets, *Commodity Flow and Capital Formation*, NBER, New York, 1938. The expenditure estimates were extended back to 1869 in S. Kuznets, L. Epstein and E. Jenks, *National Product Since 1869*, NBER, New York, 1946 (but these referred to overlapping decades and were not annual). This extension back to 1869 relied very heavily on W.H. Shaw, *Value of Commodity Output Since 1869*, NBER, New York, 1947, who used the same procedure for making commodity flow estimates of values as Kuznets (1938) did. Shaw also supplied price deflators. Estimates in the same form can also be found (in an analytical context) in S. Kuznets, *Income and Wealth of the United States: Trends and Structure*, Income and Wealth Series II, Bowes and Bowes, Cambridge, 1952; this study contains an annex on the estimates for 1800 to 1870 by Martin and King. Kuznets had a poor opinion of these, and although he did not produce alternative estimates, he gave a clear indication of the direction in which they were biased, and some clues for constructing estimates with limited information.

The final version of Kuznets' massive work appeared in his *Capital in the American Economy*, NBER, Princeton, 1961. Here he published annual estimates of GNP by type of expenditure in current and in 1929 dollars (pp. 555-8) back to 1889. As the underlying census information was inadequate before 1889, he showed only 5-year moving averages back to 1871 (pp. 559-64). He had three variants of GNP with different assumptions about which products were intermediate.

The US Dept. of Commerce did not adopt the Kuznets' definitions of the scope of GNP. He explained his disagreement with their procedures in S. Kuznets, "Discussion of the New Department of Commerce Income Series", *Review of Economics and Statistics*, August 1948. The official side was not convinced by his arguments, see M. Gilbert, G. Jaszi, E.F. Denison, and C.F. Schwartz, "Objectives of National Income Measurement: A Reply to Professor Kuznets" in the same publication.

The Kuznets estimates were published in transparent form with the full scholarly apparatus characteristic of the NBER. It was therefore possible for John Kendrick (who in any case had access to the worksheets) to convert the Kuznets annual estimates of GNP (variant III) back to 1889 (with some minor adjustment) by type of expenditure to a Dept. of Commerce basis, see

J.W. Kendrick, *Productivity Trends in the United States*, NBER, Princeton, 1961, pp. 298-9. Like Kuznets, Kendrick used fixed 1929 weights for his volume estimates, but he also gave a chain weighted alternative, which for 1889-1929 shows a growth rate of 3.82 per cent a year compared with 3.68 for his fixed weight index for the private domestic economy (p. 327). For 1869-1889 Kendrick presented only decade averages, as it seemed probable that they exaggerated growth. Kendrick (1961) augmented the NBER sectoral production studies (by Barger, Fabricant and others) to show annual movements in output or value added on an annual basis back to 1869 in many cases. However, he did not construct an estimate of GDP by industry of origin. His aggregate (pp. 302-3) covers 9 production sectors in combination with total private GDP by type of expenditure. The bulk of private service activity was derived as a residual. Even then his estimates were presented only for 10 benchmark years. Thus we have the paradox that the USA is one of the few countries where the construction of historical accounts by industry of origin has been neglected, though the statistical basis for such estimates is better than elsewhere.

Robert Gallman revised and extended the Kuznets estimates backwards (variant I) using the same commodity flow approach and techniques of presentation. He first estimated value added (in 1879 prices) for agriculture, mining, manufacturing and construction for benchmark years, see R.E. Gallman, "Commodity Output, 1839-1899", in W.N. Parker, *Trends in the American Economy in the Nineteenth Century*, NBER, Princeton, 1960, p. 43. He used these results, census, and other information to construct his estimates of GNP by type of expenditure (four-way breakdown of consumption and three-way breakdown of capital formation) in 1860 prices, see R.E. Gallman, "Gross National Product in the United States 1834-1909", in D.S. Brady, ed., *Output, Employment and Productivity in the United States after 1800*, NBER, New York, 1966, p. 26. Unfortunately he provided figures only for five benchmark years, 1839, 1844, 1849, 1854, and 1859 and for overlapping decades from 1834-43 to 1899-1908, and he has not yet published the full detail of his procedures.

I derived my estimates for 1840-69 from Gallman, but for 1869-90 I used the estimates of N.S. Balke and R.J. Gordon, "The Estimation of Prewar Gross National Product: Methodology and New Evidence", *Journal of Political Economy*, February 1989, p. 84. They revamped the Gallman-Kendrick-Kuznets commodity flow estimates, using additional information on construction, transport and communications, to provide annual estimates of nominal GNP, real GNP and a GNP deflator. For 1869-90, their average annual estimate for real GNP growth was 4.16 per cent a year, which is lower than the unpublished Kendrick figure of 5.44 per cent, or the 5.55 per cent of Kuznets. As both Kuznets and Kendrick thought their 1869 estimate was too low, the Balke-Gordon estimate seems acceptable.

For 1820-40, the evidence is rather weak, and one must still rely on the kind of reasoning which Kuznets (1952) first applied, and which can be found in P.A. David, "The Growth of Real Product in the United States before 1840: New Evidence, Controlled Conjectures", *Journal of Economic History*, June 1967, and more recently in T. Weiss, US Labor Force Estimates and Economic Growth, 1800-1860", in R.E. Gallman and J.J. Wallis, eds., *American Economic Growth and Standards of Living Before the Civil War*, University of Chicago Press, 1992, p. 27. I used a variant of the Kuznets-David inferential approach. I calculated agricultural productivity 1820-40, taking agricultural value added (output of crops and livestock products plus change in livestock inventories, minus intermediate products consumed) from M.W. Towne and W.D. Rasmussen, "Farm Gross Product and Gross Investment in the Nineteenth Century", in Parker, ed. (1960, p. 25), and agricultural employment from Weiss (1992, p. 51). Agricultural productivity (thus measured) grew by .62 per cent a year from 1820-40. Like Kuznets and David, I assumed that productivity growth in the rest of the economy was faster (1 per cent a year). Although service productivity growth is likely to have been modest, the assumption of faster growth in non-agriculture seems warranted as K.L. Sokoloff found manufacturing productivity to have grown by 2.2 per cent a year, see his "Productivity Growth in

Manufacturing During Early Industrialisation: Evidence from the American Northeast, 1820-1860", in S.L. Engerman and R.E. Gallmann, *Long Terms Factors in American Economic Growth*, Chicago, 1986, p. 695

For 1929 onwards I used the official US Dept. of Commerce estimates of GDP by category of expenditure: 1929-58 at 1987 prices from *National Income and Product Accounts of the United States*, vol. 1, BEA, US Dept. of Commerce, Washington DC, February 1993. 1959-92 from A.H. Young, "Alternative Measures of Changes in Real Output and Prices, Quarterly Estimates for 1959-92", *Survey of Current Business*, March 1993. Young presents three alternative indices of real GDP volume. I used his index where benchmarks change every five years, because this is closer to the procedure used in other OECD countries for this period. The option I used produces faster growth than the officially preferred series where 1987 weights are used throughout. Unfortunately, for 1929-58, the correspondingly weighted series are not yet available. Figures for years before 1960 exclude Alaska and Hawaii, which added .294 per cent to 1960 GDP (see *Survey of Current Business*, December 1980, p. 17). I adjusted the figures to exclude the impact of this geographic change.

South European Countries

Greece: 1913-29 real product in international units from C. Clark, *Conditions of Economic Progress*, 3rd edition, Macmillan, London, 1957; 1929-38 GNP at factor cost from *Ekonomikos Tachydromos*, 22 May 1954; 1938-50 from OEEC, *Europe and the World Economy*, Paris 1960, p.116. 1950 onwards from OECD, *National Accounts*, various issues.

Ireland: For Ireland, there is no time series for years before 1926, and I have simply used the indications of the relative size of Irish income in 1831 and 1920 by British historians (Deane and Feinstein - see note above on the UK) to get a crude picture. Mokyr has recently produced a spot estimate for 1841 (see J. Mokyr, *Why Ireland Starved: A Quantitative and Analytical History of the Irish Economy 1800-1850*, Allen and Unwin, London, 1985) which shows a much lower ratio than I have used (though the first edition of Mokyr's book showed a higher ratio than I used). Cullen has produced a spot estimate for 1911 which is higher than what one can derive from Feinstein. The Mokyr-Cullen estimates have led some Irish historians to assume faster growth than I have done - see K.A. Kennedy, T. Giblin and D. McHugh, *The Economic Development of Ireland in the Twentieth Century*, Routledge, London, 1988, pp. 17-18, and C. Ó Gráda, *Ireland Before and After the Famine*, Manchester University Press, 1988, p. 128. My estimates refer throughout to GDP in the area of the Irish republic (i.e. Southern Ireland). I took the 1920 per capita GDP level to be 54 per cent of that in the UK (excluding Southern Ireland) as estimated by C.H. Feinstein, *National Income, Expenditure and Output of the United Kingdom 1855-1965*, Cambridge University Press, 1972, Table 6. I assumed that this proportion was valid for 1820, 1900 and 1913 as well. 1926-50 from K.A. Kennedy, *Productivity and Industrial Growth: The Irish Experience*, Oxford University Press, 1971, p. 3. 1950-60 from OECD *National Accounts, 1950-68*, Paris, 1970. 1960-92 from CSO, *National Income and Expenditure 1992*, Dublin, 1993, p. ix.

Portugal: 1850-1913 GDP volume estimate derived from indices of agricultural and industrial output in Pedro Lains, "How Far Can We Go? Measuring Portuguese Economic Growth (1850-1913)" and statistical annex, paper presented to the World Cliometric Congress, Santander, 1989; for the service sector I used population as a proxy indicator. The 1890 sector weights (agriculture 49.3, industry 24.7 and services 26.0) were taken from Lains. For 1913-53 I used an

adjusted version of the GDP estimates of A.B. Nunes, E. Mata and N. Valerio, "Portuguese Economic Growth 1833-1985", *Journal of European Economic History*, vol. 18, 2, Fall 1989. The Nunes, Mata, Valerio estimates have been criticized by P. Lains and J. Reis, "Portuguese Economic Growth, 1833-1985: Some Doubts", *Journal of European Economic History*, vol. 20, 2, Fall 1991. The Nunes, Mata, Valerio estimates for GDP are based on 3 proxy indicators (exports, fiscal receipts, and government expenditures) at current prices, which they deflate by the cost of living index. These indicators are adjusted in the light of the relationship between their estimating technique and the official GDP series for 1947-85. I took their GDP estimate as representative for the material production sectors, and used population as a proxy for service sector growth. 1938-58 from *O Rendimento Nacional Português, Estudos*, No. 34, Instituto Nacional de Estatística, Lisbon, 1960; 1958-60 from R. Janes Cartado and N.E. Sequeira da Rosa, *Séries Longas as Contas Nacionais Portuguesas 1958-1985*, Banco de Portugal, Lisbon, 1986. 1960 onwards from OECD, *National Accounts*, various issues. The Portuguese authorities are in process of revising the GDP level upwards to incorporate the islands of the Azores and Madeira which were previously excluded, and to provide better estimates for construction and tourism-sectors which had previously been inadequately covered. This involved an upward revision in the 1990 GDP level of 14.1545 per cent. This figure is provisional (see H. Garrido, "Portugueses mais ricos", *Diario de Noticias*, Lisbon, 11 April 1994).

Spain: A rough estimate of the real income movement for 1820-50 was derived from L. Prados, *Comercio Exterior y Crecimiento Economico en Espana, 1826-1913: Tendencias a Largo Plazo, Estudios de Historia*, No. 7, Banco de España, 1982, p. 110. This shows the movement in national product in current prices for 1832-60, which I deflated by Sarda's wholesale price index in *Estadísticas Historicas de España*, Fundacion Banco Exterior, Madrid, 1989, p. 518. 1850-1993 GDP by category of expenditure was supplied by Leandro Prados de la Escosura. For 1850-1950 these estimates move in a similar way to those in his "Spain's Real Gross Domestic Product, 1850-1990: A New Series", *Ministério de Economia y Hacienda*, Madrid, March 1993, Table D.1, but for 1950-93, Prados has now made a tapered adjustment for jumps in the GDP level between successive segments of the official national accounts. The Spanish authorities have hitherto ignored these jumps and simply linked the successive indexes at the overlap year. Prados' procedure is analogous to that which I used to adjust the official Italian estimates. Prados shows his results for all years at 1980 "prices", but this is simply his numeraire, as the underlying procedure was to chain successive segments at characteristic constant prices for the relevant period.

Turkey: 1923-48 GDP by industry of origin at factor cost and by type of expenditure at 1938 market prices from T. Bulutay, Y.S. Tezel and N. Yelderim, *Türkiye Milli Geliri 1923-1948*, Ankara, 1974. 1913 per capita GDP assumed to be the same as in 1929. 1948 onwards from OECD, *National Accounts*, various issues.

East European Countries

In Eastern Europe and the USSR, the conventions for measuring macroeconomic performance in the communist period were different from those in other countries in our comparisons. The scope of the official output measure was narrower. It referred to "material product" and excluded a good many service activities. For the activities which were included, output was generally measured on a gross value rather than a value added basis, which led to some double counting and quality improvements for introduction of new products were exaggerated. A much larger proportion of statistical reporting came from administrative sources than in Western national

accounting practice. The price system and tax structure were also different from those in capitalist countries, and problems of comparability were further handicapped by the secretive habits of statistical agencies, and their susceptibility to official "guidance" concerning magnitudes which might throw adverse light on the achievements of the regime.

For the communist period, I have therefore relied almost entirely on estimates from Western sources. Abram Bergson is the most distinguished Western student of the subject, and he concentrated his efforts on the former USSR. In his *Soviet National Income and Product in 1937*, Columbia University Press, 1953, he developed an "adjusted factor cost" framework for valuation of Soviet output, where Soviet commodity prices were adjusted to equal average cost, and imputations were made for capital costs. Later he adjusted for turnover taxes and subsidies. He adjusted the scope of the accounts so that they approximated to the Western concept of GDP, and his indicators of production volume were intended to reflect value added rather than gross output. Bergson's methods were adopted by the US Central Intelligence Agency which made the annual estimates of Soviet GDP which were presented regularly and publicly to the Joint Economic Committee of the US Congress. The CIA also made similar estimates for China.

Thad Alton and his colleagues in the Research Project on National Income on East Central Europe in New York have prepared regular estimates for Bulgaria, Czechoslovakia, East Germany, Poland, Romania and Yugoslavia since the early 1960s, using the methodology developed originally by Bergson. This is a very ambitious project which has given greatest priority to measuring changes in real output by sector of the economy in order to measure movements in aggregate and sectoral output and productivity, but has also yielded estimates of real expenditure growth and aggregate levels in dollars corrected for differences in purchasing power parity.

The estimates rely mainly on East European sources for quantitative indicators of commodity and service output in different sectors. The weights approximate to gross value added at factor cost, and although they are ultimately derived from East European sources, they involved elaborate estimates of returns to labour, the net return on fixed and working capital and agricultural land, and the depreciation of fixed capital. The weights were first established for the mid 1950s in a series of detailed country monographs and studies for the 1950-65 segment of the estimates. The base was shifted to the late 1960s for the 1965-75 segment, in Thad Alton and Associates, "Statistics on East European Economic Structure and Growth", *Occasional Paper* 48, New York, 1975. The third shift (to mid 1970s weights) was made in *Occasional Paper* 64, New York, 1981 and these weights were applied to the 1975-85 time segment. The fourth weight shift to the 1980s was made in *Occasional Paper* 120, New York, 1992 and applied to the 1985-91 segment.

The sample of quantity indicators used in the Alton project seems quite respectable, but is smaller than would be available in an official statistical office with full access to the basic reporting system. In order to make a sensitivity test of the robustness of the sample procedure, G.J. Staller, "Comparison of Official and Recalculated Industrial Growth: Austria and Czechoslovakia", *Occasional Paper* 84, New York, 1984 recalculated Austrian output using a restricted sample analogous to the (387 item) sample used for Czechoslovak industrial output. He concluded that the sample procedure was reasonably reliable. However, this cannot be assumed to be the case for all the countries, because the openness of the statistical offices varied, and so did the size of the Alton group's research input. Judging by the number of research papers, the reliability of their results seems likely to be most sound for Czechoslovakia, Hungary and Poland, somewhat weaker for Bulgaria and weakest for East Germany (only 2 *Occasional Papers*), Romania (2 *Occasional Papers*) and Yugoslavia (5 *Occasional Papers*). These three countries all showed faster growth than the three which are best documented, and in the case of East Germany, in particular, there is now very strong evidence that the Alton group overstated growth.

The Alton group gave preference to its measures by industry of origin and regarded them as more reliable than its estimates by type of expenditure which generally showed slower growth. For the first segment (ending in 1965) the Alton (1970) expenditure side estimates for Czechoslovakia and Hungary showed slower growth (as noted below). For 1965-82, the expenditure side estimates (see Alton, 1985, p. 112) showed slower growth for Bulgaria (2.9 per cent a year for 1965-82 instead of 3.5); for Czechoslovakia 2.2 per cent a year instead of 2.6; for East Germany 2.5 per cent a year instead of 2.8 and for Poland 2.0 per cent a year instead of 2.6. The only case where the expenditure side estimates showed faster growth was in Poland for 1950-65.

The Alton group's estimates of output levels in dollars corrected for differences in purchasing power parity were generally derived from studies by other researchers, e.g. those of M. Ernst in their 1970 study, adjusted ICP estimates for 1985 and 1990.

Since 1990, the East European countries have undergone major political change and are moving away from planning and public ownership towards market prices and privatisation. They have given up the "material product" concept of total output and have widened the scope of their accounts to cover the whole of GDP. There is now much greater openness about statistical procedures and sources. The experience of East Germany in particular demonstrates the need to reexamine past estimates of comparative levels of performance and growth rates, but the situation will remain statistically obscure for some time until these countries have learned to monitor their new economies success-fully.

Useful surveys of the methodological problems can be found in CIA, *Measuring Soviet GNP: Problems and Solutions*, Directorate of Intelligence, September 1990, and in P. Marer and Associates, *Historically Planned Economies: A Guide to the Data*, World Bank, Washington DC, 1992.

Bulgaria: The estimates for Bulgaria are not as well documented as those for Czechoslovakia and Hungary. The 1913-26 movement of real income (including imputations) in international units was derived by Colin Clark from two separate spot estimates by different authors (see his *Conditions of Economic Progress*, 3rd edition, Macmillan, London, 1957, p. 105) which I linked at 1926 to the 1924-45 movement in real national income shown by A. Chakalov, *The National Income and Outlay of Bulgaria: 1924-1945* (in Bulgarian), Knipegraph, Sofia, 1946. This was then linked at 1939 to the 1939-65 movement in GNP by industry of origin (with mid 1950s weights) shown by T.P. Alton, "Economic Structure and Growth in Eastern Europe", in *Economic Developments in Countries of Eastern Europe*, Joint Economic Committee, US Congress, 1970, p. 46. 1965-75 movement of real GNP by industry of origin (with weights of the late 1960s) from T.P. Alton, "East European GNPs: Origins of Product, Final Uses, Rates of Growth and International Comparisons", in *East European Economies: Slow Growth in the 1980s*, vol. I, *Economic Performance and Policy*, Joint Economic Committee, US Congress, October 1985, pp. 109-10. The 1975-92 movement of real GNP by industry of origin (with mid 1970s weights for 1975-85 and mid 1980s weights for 1985 onwards) is from T.P. Alton and Associates, "Economic Growth in Eastern Europe", *Occasional Papers* 120 and 124, L.W. Research Project on National Income in East Central Europe, New York, 1992 and 1993. The Alton team have produced 7 *Occasional Papers* on individual sector performance in Bulgaria.

Czechoslovakia: For 1820-1913 growth rates of per capita product by industry of origin were assumed to fall midway between the rates Kausel shows for Austria proper and for the rest of Cisleithania. See A. Kausel, "Österreichs Volkseinkommen 1830 bis 1913", in "Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829-1979", *Beiträge zum Österreichischen Statistik*, 550, Vienna, 1979. 1913-37, GDP by industry of origin with 1929 weights from F.L. Pryor, Z.P. Pryor, M. Stadnik, and G.J. Staller "Czechoslovakia Aggregate

Production in the Inter-war Period", *Review of Income and Wealth*, March 1971, p.36. 1937-65 GNP by industry of origin at 1956 adjusted factor cost from G. Lazarcik, "Czechoslovak Gross National Product by Sector of Origin and Final Use, 1937, and 1948-65", *Occasional Paper 26*, Research Project on National Income in East Central Europe, New York, 1969. Lazarcik also provides estimates of GNP growth by type of expenditure which show slower growth (1.9 per cent a year instead of 2.3 per cent) than by industry of origin. The Lazarcik estimates are based on 9 of the 12 other *Occasional Papers* on Czechoslovakia by sector, and the earlier benchmark study, T.P. Alton and Associates, *Czechoslovak National Income and Product, 1947-8 and 1955-6*, Columbia University Press, New York, 1962. 1965 onwards as for Bulgaria.

On 1 January 1993, the Czech and the Slovak republics became separate countries. The Czech republic had a population of 10,315 thousand in 1992, the Slovak republic had 5,300 thousand. Per capita product was about 15 per cent higher in the Czech republic than in Slovakia in the late 1980s.

Hungary: For 1870-1913, I used estimates of gross material product at 1913 prices in agriculture, transport and trade from L. Katus, "Economic Growth in Hungary during the Age of Dualism (1867-1913)" in E. Pemplenyi, ed., *Social Economic Research in the History of East Central Europe*, Akademiai Kiado, Budapest, 1970, p.108 and J. Komlos, *The Habsburg Monarchy as a Customs Union*, Princeton, 1983, pp. 291-3 for industrial production at 1913 prices. Housing and other services were assumed to grow parallel with population. 1900-42 net national product by industry of origin at 1938/9 factor cost from A. Eckstein, "National Income and Capital Formation in Hungary, 1900-50", in S. Kuznets, ed., *Income and Wealth*, series V GNP index, Bowes and Bowes, London, 1955, p. 175 (1924-38 data refer to fiscal years). The Eckstein series was linked at 1938 to estimates of GNP by industry of origin for 1938-65 at 1955 "adjusted" factor cost from L. Czirjak, "Hungarian GNP by Sectors of Origin of Product and End Uses, 1938 and 1946-67", *Occasional Paper 43*, Research Project on East Central Europe, New York, 1973. Czirjak also provides an estimate of GNP growth by type of expenditure, which shows slower growth (2.1 per cent a year instead of 2.3 per cent) than by industry of origin. The Czirjak estimates are built on 10 earlier *Occasional Papers* on Hungary by sector as well as the benchmark study showing the derivation of the 1955 adjusted factor cost weights, T.P. Alton and Associates, *Hungarian National Income and Product in 1955*, Columbia University Press, New York, 1963. 1965 onwards as for Bulgaria.

Poland: 1929-38 from K. Laski, *Akumulacja i spozycie w procesie uprzemyslowienia Polski Ludowej*, Ksiazka i Wiedza, Warsaw, 1956, pp. 86-90 as cited by N. Spulber, *The State and Economic Development in Eastern Europe*, Random House, New York, 1966, p. 59; 1937-65 from T.P. Alton (1970), p. 46, 1965 onwards as for Bulgaria. There are 9 *Occasional Papers* of Alton's team on Polish performance in individual sectors from prewar to 1965 as well as the benchmark volume, T.P. Alton and Associates, *Polish National Income and Product in 1954*, Columbia University Press, New York, 1965. Alton (1970), p. 52 shows real expenditure for 1950-65 rising by 5.2 per cent a year which is faster than the increase using his industry of origin estimates.

Romania: 1926-38 from "Venitul National", in *Enciclopedia Romaniei*, Bucharest, 1940, vol. 4, pp. 941-966 as cited by N. Spulber, p. 54, *op. cit.*; 1938-50 from D. Grindea, *Vencital National in Republica Socialista Romania*, Stiintifica, Bucharest, 1967, p. 113; 1950-65 from Alton (1970) *op. cit.*, p. 46; 1965-75 from T.P. Alton (1985) *op. cit.*, pp. 109-10; 1975-92 as for Bulgaria. The estimates for Romania are probably the weakest for our East European group. There are only 2 *Occasional Papers* from the Alton group on Romania and no benchmark volume.

USSR: For the Tsarist period to 1928 there are two different types of estimate of GDP growth: (a) by industry of origin, where the measures of output are volume estimates based on physical indicators, mainly for agriculture and industry: (b) expenditure studies in current prices with the components (private consumption, government current spending, and investment) deflated by price indices. In the following I have used sources based on the first method. Alternative studies of net domestic product may be found from the expenditure side in P.R. Gregory, *Russian National Income 1885-1913*, Cambridge University Press, 1982, pp. 56-7. For the period before 1913, the two methods concord very well. Using an adjusted version of Goldsmith's industry of origin material, I get a GDP index of 43.2 for 1890, 66.3 for 1900 and 100.0 for 1913. The average of Gregory's two alternatives is 43.2 for 1890, 66.3 for 1900, 100.0 for 1913. For the change between 1913 and 1928, Gregory (p. 113) provides two estimates of net national product at 1913 market prices, one of these showed 1928 as 94.4 percent of 1913 (which he preferred) and another showed 1928 as 106.2 percent of 1913. In my industry of origin estimate (described below) I estimate 1928 to be 99.8 percent of 1913. My 1870-1913 growth indicators were derived from R.W. Goldsmith, "The Economic Growth of Tsarist Russia 1860-1913", *Economic Development and Cultural Change*, April 1961, pp. 450, and 462-3, i.e. crop output at 1896-1900 weights, his industrial index (based on linked segments with 1887, 1900, and 1908 weights) and his indications for livestock and handicrafts. 1913 weights from M.E. Falkus, "Russia's National Income 1913: A Revaluation", *Economica*, February 1968, pp. 62 and 67 (forestry and fishing I assumed to move parallel to agriculture; construction, transport and communication parallel to industry).

Table B-8
Characteristics of the 15 Constituent Republics of the USSR in 1991

	Population (000s)	GDP (million 1990 inter- national dollars)	GDP per capita in 1990 inter- national dollars
Armenia	3,400	16,363	4,813
Azerbaijan	7,250	30,026	4,142
Belarus	10,300	65,619	6,371
Estonia	1,600	13,832	8,645
Georgia	5,500	29,520	5,367
Kazakhstan	16,850	98,513	5,846
Kyrgyzstan	4,500	13,158	2,924
Latvia	2,700	21,423	7,934
Lithuania	3,750	27,327	7,287
Moldova	4,400	20,242	4,600
Russia	148,800	990,360	6,656
Tajikistan	5,400	13,158	2,437
Turkmenistan	3,750	11,471	3,059
Ukraine	52,000	257,079	4,944
Uzbekistan	21,000	78,777	3,751
USSR	291,200	1,686,868	5,793

Source: Derived from B.M. Bolotin, "The Former Soviet Union as Reflected in National Accounts Statistics", *In Search of Answers in the Post Soviet Era*, IMEMO, Moscow, 1992. Col. 1 above is from Bolotin, pp. 182-3, col. 2 is adapted from Bolotin who presents his estimates in 1990 dollars, without giving the source for his PPPs. His total for the 15 republics is \$ 1,541,700 million. My estimate is 9.4 per cent higher and is derived as explained in Appendix D. However, I have used Bolotin's proportionate allocation of total GDP (pp. 184-5). Col. 3 is derived from cols. 1 and 2.

For 1913-28, I used the same technique of estimation as for 1870-1913, taking the estimate of net agricultural product from S.G. Wheatcroft in R.W. Davies, ed., *From Tsarism to the New Economic Policy*, Macmillan, London, 1990, p. 279, and industrial output from G.W. Nutter, *Growth of Industrial Production in the Soviet Union*, Princeton, 1962, p. 150, using the Falkus 1913 weights. 1928-40 and 1945-50 gross national product at 1937 prices by industry of origin from R. Moorsteen and R.P. Powell, *The Soviet Capital Stock 1928-1962*, Irwin, Illinois, 1966, p. 361 with the 1939-40 increase reduced to offset the population increase due to territorial acquisitions at that time.

1950-90 estimates of GNP at 1982 factor cost by industry of origin supplied by the CIA. Their weighting system is an adjusted factor cost method first developed by Abram Bergson in *Soviet National Income and Product in 1937*, Columbia, New York, 1953 which is intended to correct for distortions in the Soviet pricing system. 1990-1 movement from B.M. Bolotin, "The Former Soviet Union as Reflected in National Accounts Statistics", *In Search of Answers in the Post Soviet Era*, IMEMO, Moscow, 1992. 1991-2 movement derived from information for the 15 post Soviet republics in World Bank, *World Tables 1994*, Washington DC, 1994.

There have recently been suggestions within Russia that Western Kremlinologists overstated growth in the communist period. The most prominent of these new Russian revisionists is Khanin, whose work is conveniently summarised in M. Harrison, "Soviet Economic Growth Since 1928: The Alternative Statistics of G.I. Khanin", *Europe-Asia Studies*, vol. 45, No. 1, 1993, pp. 141-67. Khanin finds a different time path for growth than the CIA but no net difference for the postwar period as a whole. The big difference between his estimates and those which I use is that he gets a much lower rate of growth for 1928-40. However, Khanin has not used a GDP framework for his analysis and has not produced annual estimates, so his revision needs further substantiation.

At the end of 1991, the constituent republics of the USSR became independent. Their relative size is shown in Table B-8. The biggest was Russia with 51.1 per cent of the population and 58.7 per cent of GDP.

Yugoslavia: 1909-12 average, 1920-39, and 1947-54 annual GDP by industry of origin at 1953 market prices from I. Vinski, "National Product and Fixed Assets in the Territory of Yugoslavia 1900-59", in P. Deane, ed., *Income and Wealth*, Series IX, Bowes and Bowes, London, 1961, p. 221 linked at 1950 to GNP index for 1950-68 in T.P. Alton, "Economic Structure and Growth in Eastern Europe", in *Economic Developments in Countries of Eastern Europe*, Joint Economic Committee, US Congress, 1970, p. 46, 1968-75 from World Bank, *World Tables*, various issues. 1975-91 from "Economic Growth in Eastern Europe 1975-91" in T.P. Alton and Associates, *Occasional Paper*, 120, L.W. Research Project on National Income in East Central Europe, New York, 1992. I assumed a 20 per cent drop in GDP in 1992.

In the early 1990s, Yugoslavia split into five separate republics. The population in 1992 (in thousands) was Slovenia 1,990, Croatia 4,789, Bosnia-Herzegovina 4,383, the rump Yugoslav republic (Serbia and Montenegro) 10,597, and Macedonia 2,172.

Latin America

For Latin American countries, the 1990-3 GDP movements were taken from CEPAL, *Balance Preliminar de la Economía de América Latina y el Caribe 1993*, Santiago, December 1993.

Argentina: 1870-1900 per capita growth assumed to be the same as in 1900-13. 1900-1913 unpublished annual estimates supplied by ECLA/CONADE. Buenos Aires; these served as background for the quinquennial averages published in *El Desarrollo Económico de la Argentina*, ECLA, Mexico, 1959, p. 15; 1913-80 GDP by industry of origin at 1960 prices from IEERAL, "Estadísticas de la evolución económica de Argentina, 1913-84", *Estudios*, Buenos Aires, July-September, 1986. 1980-92 revised estimates of GDP at 1986 market prices (including 35.69 per cent upward revision in the 1980 level) from *Estimaciones anuales de la Oferta y Demanda Globales: Periodo 1980-1990*, Banco Central de la República Argentina, April 1993.

Brazil: 1820-50 per capita GDP growth assumed to be at the same rate as 1850-1913. 1850-1900 GDP by industry of origin from R.W. Goldsmith, *Desenvolvimento Financeiro sob um Século de Inflação*, Harper and Row, S. Paulo, 1986, pp. 22-3 and 82-83. 1900-85 GDP by industry of origin from A. Maddison and Associates, *The Political Economy of Poverty, Equity and Growth: Brazil and Mexico*, Oxford University Press, New York 1992; the 1900-50 estimates are based on sector weights for 1947, the 1950-85 estimates are in 1970 prices. 1985-90 GDP at 1987 market prices from World Bank, *World Tables 1993*.

Chile: 1900-80 from A.A. Hofman, "International Estimates of Capital. A 1950-1989 Comparison of Latin America and the USA", *Research Memorandum No. 509*, University of Groningen 1992. 1980-90 GDP at 1987 market prices from World Bank, *World Tables 1993*.

Colombia: 1900-13 per capita movement taken to be equal to the average for Brazil and Chile. 1913-29 from L.J. Zimmerman, *Arme en rijke landen*, The Hague, 1964. 1929-50 from CEPAL, *Series Historicas del Crecimiento de América Latina*, Santiago, 1978. 1950-80 from A. Urdinola and M. Carrizosa, *Poverty, Equity and Growth in Colombia*, processed, Bogota, 1985. 1980-90 GDP at 1987 market prices from World Bank, *World Tables 1993*.

Mexico: 1820-1900 per capita GDP movement from INEGI, *Estadísticas Historicas de Mexico*, Mexico, 1985, vol. 1, Table 9.1. 1900-80 as for Brazil. 1980-90 GDP at 1987 market prices from World Bank, *World Tables 1993*.

Peru: 1900-13 per capita GDP movement assumed equal to the average per capita movement in Brazil and Chile. 1913-41 GDP movement from C.A. Bolona Behr, "Tariff Policies in Peru, 1880-1980", Ph.D. thesis, Oxford University, 1981; 1942-5 GDP in 1950 dollars from "Cuadros del producto interno bruto en dolares de 1950", CEPAL, Santiago, October 1962, mimeographed; 1945-50 GDP at 1970 factor cost from *Series Historicas del Crecimiento de América Latina*, CEPAL, Santiago, 1978. 1950-80 GDP in 1979 prices by industry of origin and expenditure from Richard Webb, *Poverty, Equity and Growth in Peru*, processed, Lima, 1987. 1980-90 GDP at 1987 market prices from World Bank, *World Tables 1993*.

Venezuela: 1900-1920 "economic activity" in four sectors in 1936 bolivars linked to 1920-70 GDP by industry of origin in 1968 bolivars from A. Baptista, *Bases cuantativas de la economía venezolana 1830-1989*, Comunicaciones Corporativas, Caracas, 1991, pp. 31-4. Baptista's indicator of economic activity in fact goes back to 1830, but as it is very volatile, I have not used

his 1830-99 figures. 1970-90 GDP at 1987 prices from World Bank, *World Tables 1993*, Washington DC.

Asia

Bangladesh: 1900-1950 per capita domestic product assumed to move as in pre-partition India. 1950-66 net domestic product by industry of origin at 1959 factor cost from A. Maddison, *Class Structure and Economic Growth*, Allen and Unwin, London, 1971, p. 171. 1966-70 from World Bank, *World Tables*, (1988). 1970 onwards GDP at 1987 market prices from World Bank, *World Tables*. The figures for 1967 onwards are for fiscal years.

Burma: 1901-38 net domestic product by industry of origin at 1901 prices for nine benchmark years from Aye Hlaing, "Trends of Economic Growth and Income Distribution in Burma 1870-1940", *Journal of the Burma Research Society*, 1964, p. 144 linked to 1938-59 estimates of GDP by industry of origin at 1947/8 prices in E.E. Hagen, *On the Theory of Social Change*, Dorsey, Homewood, Illinois, 1962, Table 18-1, linked at 1951 to OECD Development Centre estimates. 1972-92 from World Bank, *World Tables 1994*. All estimates are for fiscal years. 1913 is my interpolation.

China: There are a number of quantitative estimates which throw light on Chinese growth performance in the past century, but they do not always accord very well and conjectures about what rates of growth are plausible are made all the more difficult because of the wide variations in the estimates of present day (1990) Chinese income levels (see Appendix C). Over the really long-term, however, there is no other country whose past has been more magisterially investigated in quantitative terms than in Dwight Perkins, *Agricultural Development in China 1368-1968*, Aldine, Chicago, 1969.

For the period from the mid 1880s to 1933, we have various spot estimates which may be compared in order to infer the intervening growth performance. Chung-Li Chang, *The Income of the Chinese Gentry*, University of Washington, Seattle, 1962, pp. 296 and 324 provides an estimate for the mid 1880s which he converts into 1933 prices for comparison with Pao-san Ou's (1947) estimate for 1933. The latter study was in Chinese, but a similar version can be found in Pao-san Ou, "A New Estimate of China's National Income", *Journal of Political Economy*, 1946, pp. 547-54, with a slight upward revision in his Harvard Ph.D. thesis (1948).

Table B-9
Alternative Estimates (in billion 1933 yuan) of Chinese GDP
in the mid 1880s and in 1933

	mid 1880s		1933
Chang (1962)	12,254	Ou (1947)	20,044
Feuerwerker (1969)	14,710	Ou (1948)	21,770
		Liu (1946)	24,190 (excluding Manchuria, Jehol, Sinkiang, Mongolia and Tibet)
		Liu (1946)	26,660 (with Manchuria, Jehol, Sinkiang, Mongolia and Tibet)
		Liu and Yeh (1965)	29,880 (including Manchuria and Outer Mongolia)
		Yeh (1979)	29,460 (coverage not specified)

Source: Chang (1962), Feuerwerker (1969) and Ou (1947 and 1948) as above; Ta-chung Liu, *China's National Income 1931-36*, Brookings, Washington DC, 1946, p. 10; Ta-chung Liu and Kung-chia Yeh, *The Economy of the Chinese Mainland: National Income and Economic Development 1933-1959*, Princeton University Press, 1965, p. 66; Kung-chia Yeh, "China's National Income, 1931-36" in Chi-ming Hou and Tzong-shian Yu, eds., *Modern Chinese Economic History*, Academia Sinica, Taipei, 1979, p. 98. Feuerwerker (1977) in his *Economic Trends in the Republic of China*, Michigan Papers in Chinese Studies, No. 31, 1977.

Subsequently, Chang's estimate for the 1880s was adjusted upwards (somewhat cavalierly) in A. Feuerwerker, *The Chinese Economy, ca. 1870-1911*, Michigan Papers in Chinese Studies, No. 5, 1969, p. 2; Feuerwerker (1977, p. 12) appears to favour a comparison of his revision with the 1933 estimates of Liu and Yeh (1963). Thus Feuerwerker estimates output in the mid 1880s as 49.2 per cent of that in 1933. This compares with the 61.1 per cent ratio one can derive from Chang. As a rough compromise I averaged the two ratios at 55.15 per cent.

There are more options than this as there are 6 alternatives for 1933 which we can compare either with Chang or Feuerwerker, as shown in Table B-9.

For the period 1913-52 we have three options. The one I prefer is that of D.W. Perkins, ed., *China's Modern Economy in Historical Perspective*, Stanford University Press, 1975, p. 11. He provides an estimate for 1914/18, 1933 and 1952, from which I derived the following index: 1913 = 100, 1933 = 133.1, and 1952 = 142.1. Yeh (1979) p. 126 provides estimates for 1914/18, 1931/36 and 1952/7, which show slower interwar growth: one can derive an estimate of 1933 = 123.3 (1913 = 100) from Yeh. More recently T.G. Rawski, *Economic Growth in Prewar China*, University of California Press, Berkeley, 1989, p. 336 provided an index of aggregate output of 100 for 1914/18, 140 for 1931/36, 132 for 1946, 119 for 1949 and 166 for 1952. Unscrambling his multi-year averages, one can derive 1913 = 100, 1933 = 146.9, and 1952 = 175. Rawski has a strong bias towards establishing the case that Chinese growth was "substantial", and he reaches rather selectively towards evidence which will make the case. Perkins occupies a middle path between Rawski and Yeh. This is one reason for preferring the Perkins variant. The other is the massive scholarly effort involved in Perkins agricultural component which is the major part of output.

In constructing a time series for China, I used an average of the preferred ratios of Chang (1962) and Feuerwerker (1969, 1977) for 1885-1933 and linked this at 1933 to Perkins (1975). The annual 1931-6 movement I derived from Yeh (1979), p. 98 with inferential estimates for 1929-30, and 1936-8 as explained in A. Maddison, *Two Crises: Latin America and Asia 1929-33 and 1973-83*, OECD Development Centre, Paris, 1985, p. 85. Thus I have some documented basis for the following years:

1885	1913	1931	1932	1933	1934	1935	1936	1952
73.4	100.0	129.0	133.1	133.1	121.5	131.3	139.6	142.1

I derived 1890 and 1900 by interpolating between 1885 and 1913, and 1870 by extrapolating the 1885-1913 growth back to that year. I assumed no change in per capita real income from 1820 to 1870 because of the huge population loss and damage due to the Tai-ping rebellion.

GDP movement for 1952-90 was derived from H.X. Wu, "The Real Chinese Gross Domestic Product (GDP for the Pre-Reform Period 1952-77)", *Review of Income and Wealth*, March 1993. I used his estimates for agriculture and industry at 1980 prices. I assumed that half of services moved parallel to the joint product of agriculture and industry and half moved parallel to population; 1950-52 derived from A.G. Ashbrook's estimates (similarly adjusted) in Joint Economic Committee, *Chinese Economy Post-Mao*, US Congress, Washington DC, 1978, vol. 1, p. 231.

It should of course be stressed that the edifice is shaky and that I have adjusted estimates in a way which the authors may not have approved, e.g. pinpointing specific years which were originally embedded in multi-year averages.

India: 1870-1900 net domestic product by industry of origin in 1946-7 prices derived from A. Heston, "National Income", in D. Kumar and M. Desai, *Cambridge Economic History of India*, vol. 2, Cambridge, 1983, p. 397. For 1820-70 I assumed per capita product to rise by 0.1 per cent a year. 1900-46 net domestic product by industry of origin at 1938 factor cost from A. Maddison, "Alternative Estimates of the Real Product of India, 1900-46", *Indian Economic and Social History Review*, 22, 2, 1985. 1946-50 net domestic product by industry of origin at 1948 factor cost from A. Maddison, *Class Structure and Economic Growth: India and Pakistan Since the Moghuls*, Allen and Unwin, London, 1971, p. 169. All these figures refer to fiscal years. 1950-90, fiscal years, gross domestic product at 1980-1 market prices supplied by Central Statistical Organisation, Delhi, in May 1992. Thereafter from OECD Development Centre.

Indonesia: 1820-70 from rough estimates of real income for three ethnic groups (indigenous, foreign Asiatic, and "European") in A. Maddison, "Dutch Income In and From Indonesia", *Modern Asian Studies*, 23, 4 (1989), pp. 663-5. 1870-1992 estimates of GDP by industry of origin in 1983 prices supplied by Pierre van der Eng. They are a revision of estimates in his article, "The Real Domestic Product of Indonesia, 1880-1989", *Explorations in Economic History*, July 1992. I used his total GDP by industry of origin and not the variant where he uses a shadow price for energy. The figures are not adjusted to exclude the impact of the incorporation of Irian Jaya as a 26th province in 1968 and of East Timor as the 27th province in 1976. Both provinces are now included in the official GDP estimates, but it is not clear when they were included. Irian Jaya added about 0.8 per cent to Indonesian population and East Timor about 0.38 per cent in the respective years of accession.

Pakistan: As for Bangladesh. The 1966-90 figures are for fiscal years.

Philippines: 1900-50 derived by interpolation of estimates of GDP in 1939 prices by industry of origin for 1902, 1918, 1938, 1948 and 1961 in R.W. Hooley, "Long Term Growth of the Philippine Economy, 1902-1961", *The Philippine Economic Journal*, First Semester, 1968. 1950-80 supplied by National Statistical Coordination Board, Manila. 1980 onwards GDP at 1987 market prices from World Bank, *World Tables*, 1992.

South Korea: 1900-1913 per capita movement assumed equal to the average for the other 8 Asian countries. 1911-38 average of expenditure and product estimates of GDP at 1934-6 prices in T. Mizoguchi and M. Umemura, *Basic Economic Statistics of Former Japanese Colonies 1895-1938*. Toyo Keizai Shinposha, Tokyo, 1988, p.238. 1938-40 commodity output derived from Sang-Chul Suh, *Growth and Structural Changes in the Korean Economy, 1910-40*, Cambridge, Mass., 1978, p. 171, and 1940-1953 commodity output from Kwang Suk Kim and M. Roemer, *Growth and Structural Transformation*, Cambridge, Mass., 1979, p.35. For 1938-53 it was assumed that service output moved parallel to population. Sector weights for 1953 were taken from Kim and Roemer, p. 35. 1950-66 from A. Maddison, *Economic Progress and Policy in Developing Countries*, 1970, 1966-70 from World Bank, *World Tables*, 1988. 1970 onwards GDP at 1987 factor cost from World Bank, *World Tables*.

Taiwan: 1900 estimated by backward extrapolation of 1903-13 growth rate. 1903-38 average of expenditure and product estimates at 1934-6 prices in T. Mizoguchi and M. Umemura, *Basic Economic Statistics of Former Japanese Colonies 1895-1938*, Toyo Keizai Shinposha, Tokyo, 1988, p. 234. 1938-44 movement based on Hsing's estimate as cited by S.P.S. Ho, *Economic Development of Taiwan 1860-1970*, Yale 1978, p. 285. 1945-51 figures are interpolated assuming equal percentage growth each year. 1938-51 link from A. Maddison, *Economic Progress and Policy in Developing Countries*, Norton, New York, 1970, pp. 298-9. 1951 onwards GDP by type of expenditure at 1986 market prices from *National Income in Taiwan Area of the Republic of China*, Executive Yuan, Taipei.

Thailand: 1900-50 GDP by industry of origin estimates for a few benchmark years from Sompop Manarungsan, "Economic Development of Thailand, 1850-1950", University of Groningen, Ph. D. thesis, 1989 (his alternative procedure, using our population figures for 1950). 1950-85 GDP in 1972 prices from Oey Meesook and Associates, *The Political Economy of Poverty, Equity and Growth: Thailand, 1850-1985*, Washington DC, 1988, processed. 1985 onwards GDP at 1987 market prices from World Bank, *World Tables*.

Africa

Côte d'Ivoire: 1950 onwards from OECD Development Centre.

Egypt: 1913-50 GDP at 1954 prices derived from B. Hansen and G.A. Marzouk, *Development and Economic Policy in the UAR (Egypt)*, North Holland, Amsterdam, 1965, p. 3. 1950 onwards from OECD Development Centre.

Ethiopia: 1951-66 GDP from OECD Development Centre; 1966 onwards from World Bank, *World Tables*. I assumed 1950-1 volume movement to be the same as 1951-2.

Ghana: 1900-1913 GDP at 1911 prices and 1913-50 GDP at 1960 prices derived from R. Szereszewski, *Structural Changes in the Economy of Ghana*, Weidenfeld and Nicolson, London, 1965, pp. 74, 92, and 149. 1950-5 from A. Maddison, *Economic Progress and Policy in Developing Countries*, Allen and Unwin, London, 1970. 1955-91 GDP in purchasers' prices supplied by the Statistical Service, Republic of Ghana.

Kenya: 1950 onwards from OECD Development Centre.

Morocco: OECD Development Centre estimates based on information supplied by Ministry of Planning, Rabat.

Nigeria: 1950-84 GDP at constant prices by industry of origin for fiscal years beginning in the year indicated from D. Bevan, P. Collier and J. Gunning, *The Political Economy of Poverty, Equity and Growth: Indonesia and Nigeria*, Oxford University Press, forthcoming. 1984 onwards from OECD Development Centre.

South Africa: 1913-20 GDP divided by cost of living index from Bureau of Census and Statistics, *Union Statistics for Fifty Years, Jubilee Issue 1910-1960*, Pretoria, 1960; 1920-50 from L.J. Fourie, "Contribution of Factors of Production and Productivity to South African Economic Growth", IARIW, processed, 1971. 1946-70 GDP at 1975 prices from Development Bank of South Africa. 1970 onwards from World Bank, *World Tables*, Washington DC.

Tanzania: 1950 onwards from OECD Development Centre.

Zaire: 1950 onwards from OECD Development Centre.