

Comparative Productivity Levels in the Developed Countries ⁽¹⁾

In the past decade the concern with economic growth has been so great that the empirical study of productivity *levels* has been relatively neglected. Estimates of the present standing of different countries must therefore rely mainly on extrapolations of work done a decade ago.

One reason why this field has been neglected is that the O.E.E.C. explored the subject of real G.N.P. levels pretty thoroughly in studies published from 1954 to 1959 and these still provide a reasonably firm basis for extrapolation. But the statistical raw material for this kind of research is much better now than it was ten years ago (2), advances in computing technology enable the results to be analysed in more sophisticated form than was previously possible, important countries were left out of the earlier investigations and further extrapolation of these studies is becoming more hazardous. It is to be hoped therefore that the international agencies can be induced to take up such studies again.

Level of Output

The technical details of our calculations are contained in Annex A and we will merely summarise them here. The basic source is a study by O.E.E.C. published in 1958 and relating to the year 1955 (3).

(1) This paper was presented to the British Royal Commission on Trade Unions and Employers' Associations. It includes revisions of earlier estimates which I presented to a meeting of the Business Economists' Group in London in October 1966, which were quoted in *The Economist*, October 22, 1966, p. 410.

(2) In particular, the six Common Market countries all took an industrial census in 1963, the results of which will be available soon. In the case of France, the previous census was in 1867!

(3) M. GILBERT and Associates, *Comparative National Products and Price Levels*, O.E.E.C., Paris, 1958. In part this study was simply an extrapolation of an earlier study (for 5 countries), see M. GILBERT and I. B. KRAVIS, *An International Comparison of National*

It covered 8 West European countries and the U.S.A. We have supplemented these comparisons by using studies which have appeared subsequently, comparing Canada, Japan and the U.S.S.R. with the United States. The results of these studies have been updated largely by using series published by O.E.C.D. whose estimates of real G.N.P. growth rates are generally held to be very reliable, though there are some doubts about this, as described in Annex B.

The results one achieves in making comparisons of real expenditure in different countries will vary according to the weighting system used. If the basket of goods produced by two economies is valued at British prices, the result will not be the same as it would be using American prices. In fact, the only common weighting system available for the twelve countries considered here is the American one, and as we argue in the statistical annex, there are good reasons to think that this is the best kind of weighting system to use.

The first interesting conclusion we can draw from the comparison concerns the level of output of the different economies (see Table 1).

TABLE 1

1965 REAL G.N.P. AT FACTOR COST AT 1965 U.S. RELATIVE PRICES
(\$ billion)

U.S.A.	630.5	Canada	45.1
U.S.S.R.	382.1	Netherlands	24.2
Japan	145.0	Belgium	20.3
Germany (F.R.)	137.5	Denmark	10.8
U.K.	120.0	Norway	8.4
France	107.0	12 Country Total	1,707.8
Italy	76.9		

Source: Annex Table A-1.

Products and the Purchasing Power of Currencies, O.E.E.C. Paris, 1954, for which the data referred to 1950. These two studies dealt with levels of expenditure in real terms. There was another study concerned with levels of real output but this referred only to two countries, the U.K. and the U.S.A., see D. PAIGE and G. BOMBACH, *A Comparison of National Output and Productivity of the U.K. and U.S.*, O.E.E.C., Paris, 1959. The Bombach/Paige measure of real output is more suitable as the numerator for a productivity index than the real expenditure estimates of Gilbert and Associates, but the results of the two approaches did not differ by very much for the U.K.-U.S.A. comparison. At U.S. relative prices, Bombach and Paige arrived at an estimate of U.K. output which was 5.7 per cent higher than that using the Gilbert and Associates technique, See BOMBACH and PAIGE, *Op. cit.*, p 15.

It can be seen that the U.K. is the fifth largest of these economies, and the only other country which is likely to have a bigger output than the U.K. is China.

The Purchasing Power of Currencies

The second significant point to be derived from such studies is the relative purchasing power of currencies and their relation to official exchange rates.

If the exchange rates reflected the purchasing power of currencies accurately, there would be no need to undertake elaborate studies of real income. We could merely convert the national accounts statistics of different countries into dollars at official exchange rates and get the results immediately. Table 2 shows that there is, in fact, a considerable difference between the purchasing power of currencies and the exchange rate.

As the U.S. price structure is used as the basing point, the comparisons are related to the purchasing power of the U.S. dollar at the official exchange rate. In all the other countries, except Canada, the internal purchasing power of the currency is higher than the exchange rate. In normal circumstances this agio of the purchasing power over the exchange rate tends to vary inversely with the level of real income per head. As a country becomes richer, the relative price of services rises, because people who are servants, barbers, schoolteachers, civil servants or soldiers manage to increase their incomes more or less parallel with those of the rest of the community but their productivity does not rise. As these services do not enter international trade, the difference in their price does not affect the international competitiveness of the economy, which is determined largely by the price level for tradeable goods. Differences between the exchange rate and purchasing power cannot be taken to reflect the need for exchange rate adjustment, but if the differential between a country's exchange rate and the purchasing power of its currency is very much out of line with that in countries at the same level of development, we may take it as some evidence of the need for exchange rate adjustment. There was clear evidence of this kind for France and the Netherlands in 1955 (see Table 2). However, the equilibrium exchange rate will also be affected by capital flows or government payments overseas, or by the degree of state control over foreign transactions. Thus in Canada, large capital

inflows affect the equilibrium exchange rate, and in the U.S.S.R., complete government control over foreign trade means that the exchange rate does not have the same function as in a market economy.

TABLE 2
RATIO OF THE PURCHASING POWER OF THE CURRENCY
TO THE EXCHANGE RATE IN 1955 AND 1965
(U.S.A. = 100)

	1955	1965		1955	1965
Japan	—	1.86	Belgium	1.32	1.36
Italy	1.84	1.52	France	1.19	1.35
Germany (F.R.)	1.66	1.41	Denmark	1.51	1.25
Netherlands	1.71	1.40	U.S.S.R.	—	1.16
Norway	1.49	1.38	U.S.A.	1.00	1.00
U.K.	1.52	1.38	Canada	—	0.93

Source: Annex Table A-1 for 1965, and M. GILBERT and Associates, *Op. cit.*, p. 28 for 1955.

Output per Head of Population

The third interesting fact which emerges from the figures is output per head of population. In Table 3 we can see that U.S. output per head of population is about half as high again as in the U.K., and that in Germany it is about 10 per cent above British levels. For Canada, Denmark, Norway, the U.K., France and Belgium, output per head of population is so closely grouped that we cannot legitimately distinguish between these countries, given the

TABLE 3
REAL OUTPUT PER HEAD OF POPULATION IN 1965
(U.K. = 100)

U.S.A.	147.5	France	99.4
Germany (F.R.)	110.0	Belgium	97.5
Canada	104.6	Netherlands	91.9
Denmark	103.2	U.S.S.R.	75.4
Norway	101.9	Italy	67.8
U.K.	100.0	Japan	67.4

Source: Annex Tables A-1 and A-2.

probable range of error in the figures. Similarly, Japan and Italy are at virtually identical levels, and the U.S.S.R. is nearer to their level than to that of the more industrialised West European countries.

Consumption per Head

However, only part of G.N.P. is available for consumption, and a good deal is claimed by government and investment. Table 4 shows the proportion of G.N.P. going for these non-consumption purposes in 1965.

TABLE 4
SHARE OF G.N.P. GOING TO INVESTMENT & GOVERNMENT IN 1965

U.S.S.R.	(50.0)	Italy	37.7
Japan	44.5	Denmark	37.5
Norway	44.0	U.S.A.	37.4
Germany (F.R.)	43.2	France	36.2
Netherlands	42.0	U.K.	36.0
Canada	38.2	Belgium	34.5

Source: *National Accounts Statistics 1956-65*, O.E.C.D., Paris, for Western countries. *New Directions in the Soviet Economy*, Joint Economic Committee, U.S. Congress, 1966, p. 129 gives a figure of 53.5 per cent for the U.S.S.R. for 1964 but we have adjusted this downwards as the figure for investment seemed too high. Norwegian figures adjusted downwards to exclude repair and maintenance expenditures excluded by other countries.

It should be noted that Table 4 shows ratios in national currencies at market prices and not in U.S. relative prices at factor cost. Hence if we apply these ratios to Table 3 to obtain real consumption per head, we will get very crude estimates. However, we present the results for what they are worth in Table 5.

TABLE 5
COMPARATIVE LEVELS OF REAL CONSUMPTION PER HEAD IN 1965

U.S.A.	144.3	Germany (F.R.)	97.7
Canada	101.0	Norway	89.2
Denmark	100.9	Netherlands	83.3
U.K.	100.0	Italy	66.1
Belgium	99.9	U.S.S.R.	58.9
France	99.1	Japan	58.6

Source: Tables 3 and 4.

We can see the U.K. occupies fourth rank in this table as compared with sixth place in Table 3, because she spends relatively less than most countries on investment and government. However, the real consumption level in Canada, Denmark, the U.K., Belgium, France and Germany is virtually identical.

Productivity

We now turn from national consumption levels to productivity. Some countries obtain their consumption by dint of harder work than others, and the productivity measure gives a better indicator of the efficiency of the economy. Table 6 shows the proportion of the population employed in the 12 countries. It can be seen that there is quite a wide range, with Japan, Denmark and the U.K. at the top end of the scale employing almost half the population, whereas Canada employs just over a third. In 1965 these differences were not due in any significant degree to involuntary unemployment, but mainly reflected differences in demographic structure, different social attitudes to female employment or varying degrees of participation in higher education. To some extent they also reflect purely statistical differences in the treatment of unpaid family workers, most of whom are women in agriculture, and whose activity is difficult to measure accurately. This can be seen clearly in Table 7 which shows the proportion of women employed in agriculture and non-agriculture in the different countries in 1965. The apparent intercountry variation of female employment in agriculture varies much more than that in the rest of the economy. The range for agriculture is from 8.3 per cent to 54.0 per cent. For non-agriculture the range is from 24.8 to 40.9 per cent. In fact the range shown for agriculture looks most improbable. Social outlook and the organisation of rural family life are not so different in Holland and Germany that one can accept the difference between 8.3 and 54.0 as anything more than a statistical artifact, particularly when the activity rate for women in non-agriculture is so similar. These differences are, in fact, largely due to different methods of imputation of activity for a section of the labour force which is not paid (4).

(4) We are strengthened in this conclusion by the fact that these apparent differences in the female labour force in agriculture have persisted for many years. If they were of recent origin, they might more legitimately be taken to reflect real and temporary differences in labour force dynamics in countries experiencing differing growth rates.

PROPORTION OF POPULATION EMPLOYED IN 1965

TABLE 6

Japan	48.5	Norway	40.9
Denmark	47.8	Belgium	39.2
U.K.	47.3	U.S.A.	38.0
Germany (F.R.)	45.9	Italy	37.7
U.S.S.R.	44.8	Netherlands	36.6
France	40.9	Canada	35.6

Source: Annex Table A-2.

APPARENT IMPORTANCE OF FEMALE LABOUR FORCE IN 1965

TABLE 7

	Recorded Female Share in Total Labour Force	Recorded Female Share in Agricultural Labour Force	Recorded Female Share in Non-Agricultural Labour Force
Belgium	31.0	20.4	31.6
Canada	28.6	10.7	30.5
Denmark	35.0	28.7	36.1
France ^a	33.4	32.6	33.6
Germany ^b	36.2	54.0	27.4
Italy	27.3	31.6	25.9
Japan	39.8	52.4	35.5
Netherlands ^c	23.2	8.3	24.8
Norway	30.0	29.7	30.1
U.K.	34.6	12.6	35.4
U.S.A.	34.0	18.7	34.9
U.S.S.R.	44.1	51.6	40.9

^a 1962; ^b includes West Berlin; ^c 1964.

Source: O.E.C.D. Statistics Division for Western countries. U.S.S.R. from N. T. DODGE, *Women in the Soviet Economy*, Johns Hopkins, Baltimore, 1966, p. 44, and *Narodnoe Khoziasivo S.S.S.R. v 1965 g.*, Moscow.

ADJUSTED PROPORTION OF POPULATION EMPLOYED IN 1965

TABLE 8

Denmark	48.5	Germany (F.R.)	40.3
U.K.	47.8	Belgium	39.5
Japan	45.2	U.S.A.	38.3
U.S.S.R.	43.5	Netherlands	37.3
France	41.0	Italy	36.9
Norway	41.0	Canada	36.5

Source: Annex Tables A-1 and A-2 and Table 7.

Perhaps the best way to correct for this purely statistical variation is to adjust the sex-ratio of employment in agriculture to that for the rest of the economy. If we do this, we get the figures in Table 8 which are an alternative to Table 6.

Tables 9 and 10 show productivity, i.e. G.N.P. per person employed for the whole economy, using in Table 9 the unadjusted employment figures (Table 6) and in Table 10 the adjusted employment figures (Table 8).

TABLE 9

COMPARATIVE LEVEL OF REAL OUTPUT PER PERSON EMPLOYED IN 1965
(U.K. = 100)

U.S.A.	183.5	France	111.7
Canada	138.9	Denmark	102.2
Norway	117.8	U.K.	100.0
Belgium	117.6	Italy	85.0
Netherlands	115.6	U.S.S.R.	79.4
Germany (F.R.)	113.2	Japan	65.7

Source: Annex Tables A-1 and A-2.

TABLE 10

ADJUSTED COMPARATIVE LEVEL OF REAL OUTPUT
PER PERSON EMPLOYED IN 1965
(U.K. = 100)

U.S.A.	184.1	Netherlands	114.8
Canada	137.1	Denmark	101.8
Germany (F.R.)	130.6	U.K.	100.0
Norway	119.7	Italy	87.9
Belgium	118.1	U.S.S.R.	82.8
France	116.0	Japan	74.0

Source: Annex Tables A-1 and A-2 and Table 8.

We can see from Table 9 that the productivity performance of the U.S.A. and Canada are appreciably better than is suggested by their level of per capita output. In these two countries people continue their education longer, women work less and people retire earlier than in Europe. The U.K. position is ninth in the productivity league whether one adjusts the employment figure or not. However, the productivity rating of Germany and Japan is signi-

ficantly improved if the adjusted productivity figure is used. Table 10 is a better measure of relative productivity than Table 9.

Unfortunately, annual figures on working hours are available in reasonably comparable form only for manufacturing, and figures on annual holidays are rather poor and not regularly available. Thus the data on total hours worked are very weak. However, for 1960, Edward Denison has made rather detailed estimates of annual working hours for nine countries which we have extrapolated to 1965. We have also added estimates for Japan, the U.S.S.R. and Canada. As there was little difference between most countries in annual working hours the correction of the productivity figures for these differences does not change the productivity ranking of any of the countries, except the U.S.S.R. and Italy.

TABLE 11

AVERAGE ANNUAL HOURS PER PERSON EMPLOYED 1965
(U.K. = 100)

Netherlands	108.0	Norway	99.0
France	104.8	Belgium	98.9
Germany (F.R.)	100.8	Denmark	97.7
U.K.	100.0	Canada	97.4
Japan	99.7	U.S.A.	97.4
Italy	99.3	U.S.S.R.	92.5

Source: E. F. DENISON, *Why Growth Rates Differ*, Brookings, Washington D.C., pp. 58 and 363 (total civilian annual hours for 1960 without adjustment for sickness and bad weather) extrapolated to 1965 with movement for manufacturing hours shown in *Yearbook of Labour Statistics*, I.L.O., Geneva, 1966. Japan from *Economic Statistics of Japan 1966*, U.S.S.R. from *Dimensions of Soviet Economic Power*, U.S. Congress, 1962, p. 158. It was assumed that working hours in Canada were the same as in the U.S.A.

TABLE 12

ADJUSTED COMPARATIVE LEVEL OF OUTPUT PER MAN HOUR IN 1965
(U.K. = 100)

U.S.A.	188.0	Netherlands	106.3
Canada	140.8	Denmark	104.2
Germany (F.R.)	129.6	U.K.	100.0
Norway	120.9	U.S.S.R.	89.5
Belgium	119.4	Italy	88.5
France	110.7	Japan	74.2

Source: Tables 10 and 11.

Productivity by Sector

It may now be asked whether we can say anything about inter-country variations in productivity for individual sectors of the economy. Unfortunately, the statistical groundwork for such estimates is weak. The study of O.E.E.C. which we have used as the basis for the aggregate estimates did not show real output for individual sectors of the economy, but it is possible to measure output in agriculture and non-agriculture for each country in terms of its own national prices. This we have done in the first column of Table 13 which shows the share of agriculture in G.N.P. at factor cost (net of depreciation for Japan and the U.S.A.). The figures in national prices are affected by distortions in the price system which are important for agriculture because of the effect of price and rent controls and import restrictions. However, by using figures at factor cost, we have at least eliminated distortions due to indirect taxes and subsidies. In measuring productivity by sector we are also faced by the problem of measuring female employment, and for this reason prefer to use the adjusted employment figure of Table 13.

TABLE 13
SHARE OF AGRICULTURE IN TOTAL OUTPUT AND EMPLOYMENT

	Output at Factor Cost	Recorded Employment	Adjusted Employment
Belgium	6.2	5.6	6.4
Canada	6.5	10.0	12.4
Denmark	12.7	17.0	18.6
France	9.6 ^a	17.7	17.9
Germany (F.R.)	5.6 ^a	11.4	8.2
Italy	13.4	25.5	24.0
Japan	11.9	25.5	20.2
Netherlands	8.3	9.3	11.0
Norway	8.8	19.2	19.3
U.K.	3.5	3.4	4.6
U.S.A.	3.6	5.9	7.3
U.S.S.R.	15.3	30.1	28.0

^a at market prices the ratio for France is 7.8, and for Germany (F.R.) 4.5.

Source: Column 1 from *National Accounts Statistics 1956-65*, O.E.C.D., Paris, no date; the figures for agriculture for France and Germany in this publication are at market prices. We have made a rough estimate of the ratio at factor cost with the help of data on agricultural subsidies in *Agricultural Policies in 1966*, O.E.C.D., Paris. Columns 2 and 3 are from the O.E.C.D. Statistics Division, and from A. MADDISON, *Economic Growth in Japan and the U.S.S.R.*, forthcoming.

Table 14 is derived from the output and employment figures in Table 13 and shows productivity in agriculture and non-agriculture in each country relative to the level for the economy as a whole. In Table 15, we have gone a step further and shown a figure for output per head in non-agriculture, relative to that in the U.K.

TABLE 14
ADJUSTED PRODUCTIVITY LEVELS IN AGRICULTURE AND NON-AGRICULTURE
RELATIVE TO PRODUCTIVITY IN THE ECONOMY AS A WHOLE IN 1965

	Agriculture	Non-Agriculture	Economy as a Whole
Belgium	97.3	100.2	100.0
Canada	52.3	106.7	100.0
Denmark	68.2	107.3	100.0
France	53.6	110.0	100.0
Germany (F.R.)	68.3	102.8	100.0
Italy	56.0	113.9	100.0
Japan	59.1	110.4	100.0
Netherlands	75.6	103.0	100.0
Norway	45.6	113.0	100.0
U.K.	75.4	101.2	100.0
U.S.A.	49.3	104.0	100.0
U.S.S.R.	54.6	107.6	100.0

Source: As for Table 13.

TABLE 15
COMPARATIVE LEVELS OF ADJUSTED OUTPUT PER PERSON EMPLOYED
IN THE NON-AGRICULTURAL SECTOR IN 1965
(U.K. = 100)

U.S.A.	188.1	Netherlands	116.8
Canada	144.6	Denmark	107.9
Norway	133.7	U.K.	100.0
Germany (F.R.)	132.7	Italy	98.9
France	126.1	U.S.S.R.	96.2
Belgium	116.9	Japan	80.7

Source: Tables 10 and 14.

The sectoral measures of productivity should be treated with great reserve and it is clear that further fundamental research is needed to improve the data (5). The main difference between this

(5) In particular, it is desirable that more attention should be paid to the relation between manpower statistics and national accounting aggregates. This would be useful not only in productivity studies but for many other aspects of economic policy, including incomes policy.

table and Table 10 is that the level of British productivity in non-agriculture does not appear to be significantly different from that in Italy or the U.S.S.R., whereas the U.K. is significantly ahead of these countries in aggregate productivity.

Conclusions on 1965 Level of Productivity

We have now presented several tables showing relative levels of productivity in 1965:

- (a) Table 9 is the simplest measure of output per person employed;
- (b) Table 10 corrects this for possible distortions in the measurement of female employment;
- (c) Table 12 shows output per man hour;
- (d) Table 15 shows output per person employed in the non-agricultural sector.

In each of these twelve-country tables (6) the U.K. occupies ninth position, and the gap between her performance and that of France and Germany is often bigger than that between the U.K. and Italy. In Annex B, we have attempted to analyse possible distortions in the estimates which arise from our extrapolation of the Gilbert and Associates results from 1955 to 1965, and from this it would appear that the 1965 position of the other European countries may be overstated relative to the U.K. and the U.S.A., but the possible error is not large. It would move the U.K. up to eight place and Denmark down to ninth in two of the tables, and put the U.K. a little nearer to the level of France and Germany rather than to Italy.

In spite of its relatively low productivity level in 1965, the U.K. still managed to keep up with consumption levels in Canada, Germany

(6) Figures are not available in comparable form for Australia, New Zealand, Sweden and Switzerland, but it seems likely that U.K. productivity is below that in these countries. For Sweden and Switzerland, see estimates for 1960 in A. MADDISON, *Economic Growth in the West*, Allen and Unwin, London, 1964, p. 40. It would also seem likely that U.K. non-agricultural productivity is lower than that in East Germany and Czechoslovakia judging by the evidence in a careful Soviet study on similar lines to that of Bombach and Paige, see *Sopostavlenie Urovnei Ekonomicheskogo Razvitiia Sotsialisticheskikh Stran*, Moscow, 1965, p. 229 which shows industrial output per head of population in East Germany 53 per cent higher than in the U.S.S.R. and 35 per cent higher in Czechoslovakia.

and France because she buys a good deal of her food from the cheapest sources, investment is low, and the proportion of the population which works is high.

Levels of Performance Before 1965

The low position of the U.K. in the productivity league seems to be a phenomenon of the post-war years. In 1938, she was in second position behind the United States (7), in 1913 third behind Canada and the United States. In 1870, U.K. productivity was above that in the U.S.A.

These at least are the conclusions which emerge from Table 16 in which we have extrapolated the 1965 comparisons back to 1870, with the help of estimates of growth rates. In Table 17 we have pushed the estimates of output per head of population even further backwards.

TABLE 16
LEVELS OF REAL OUTPUT AT FACTOR COST PER PERSON EMPLOYED 1870-1965
(\$ at U.S. 1965 relative prices)

	1965	1938	1913	1870
Belgium	5431	2895	2331	1171
Canada	6303	2763	2671	1315
Denmark	4679	2615	2198	887
France	5335	2395	1905	1054
Germany	6003	2826	2310	1192
Italy	4041	1989	1370	972
Netherlands	5278	2831	2260	1715
Norway	5505	2659	1677	953 ^a
U.K.	4598	2985	2482	1725
U.S.A.	8417	4432	3260	1453 ^a

^a 1871.

Source: Adjusted figures for 1965 (figures corresponding to Table 10). 1870-1965 from A. MADDISON, *Economic Growth in the West*, Allen and Unwin, London, 1964, and A. MADDISON, *Economic Growth in Japan and the U.S.S.R.*, forthcoming.

(7) Laszlo Rostas made some estimates for pre-war years which suggest that Germany may already have had a lead over the U.K. in non-agricultural productivity at that time, see L. ROSTAS, *Comparative Productivity in British and American Industry*, Cambridge, 1948, p. 28.

LEVELS OF REAL GROSS NATIONAL PRODUCT
AT FACTOR COST PER HEAD OF POPULATION 1700-1965
(\$ at 1965 U.S. relative prices)

TABLE 17

	1965	1938	1913	1870	1840	1800	1700
Belgium	2145	1186	1062	508			
Canada	2301	1026	1031	439			
Denmark	2270	1243	974	397			
France	2187	1061	977	538	399	268	196
Germany	2419	1229	930	463			
Italy	1491	749	578	420			
Japan	1480	730	380	188			
Netherlands	1969	1071	889	685		342	
Norway	2256	1205	713	402			
U.K.	2198	1367	1148	729	517	313	213
U.S.A.	3240	1542	1263	513	359	231	
U.S.S.R.	1657	606	376	250			

Source: 1965 from Annex Table A-1 and A-2. 1870-1965 from A. MADDISON, *Economic Growth in Japan and the U.S.S.R.*, forthcoming. France 1807/8 - 1869/70 gross physical products at 1903-13 prices from J. MARCZEWski, *Histoire Quantitative de l'Economie Française*, vol. 4, I.S.E.A., Paris, July 1965, p. XCII, and 1705/6 - 1807/8 (same concept) from J. MARCZEWski, "Some Aspects of the Economic Growth of France 1660-1958", *Economic Development and Cultural Change*, April 1961, p. 376. Population figures from J.-C. TOU-RAIN, *Histoire Quantitative de l'Economie Française*, vol. 3, I.S.E.A., Paris, January 1963, pp. 16 and 22. Netherlands 1800 derived from W. A. COLE and P. DEANE, "The Growth of National Incomes", *The Cambridge Economic History of Europe*, vol. VI, p. 13. U.K. 1700-1840 from P. DEANE and W. A. COLE, *British Economic Growth 1688-1959*, Cambridge, 1964, pp. 78 (excluding government), and 282. 1840-1913 from figures supplied by Phyllis Deane. U.S.A. 1800-1840 from P. A. DAVID, "New Light on a Statistical Dark Age: U.S. Real Product Growth before 1840", *American Economic Review*, May 1967, p. 300. 1839-1869/78 G.N.P. from R. E. GALLMAN, "Gross National Product in the United States, 1834-1909", *Output, Employment and Productivity in the United States after 1800*, N.B.E.R., New York, 1966, p. 26, population from *Historical Statistics of the United States*, U.S. Dept. of Commerce, Washington D.C., 1966.

ANGUS MADDISON

Paris

ANNEX A

DETAILED SOURCES AND METHODS FOR THE MEASUREMENT
OF 1965 LEVELS OF OUTPUT AND EMPLOYMENT

Gross National Product.

Estimates comparing real G.N.P. in the U.S.A. with that in eight countries [Belgium, Denmark, France, Germany (F.R.), Italy, Netherlands, Norway, U.K.] are available for 1955 in the O.E.E.C. study by M. GILBERT and Associates, *Comparative National Products and Price Levels*, O.E.E.C., Paris, 1958, p. 86. These figures were extrapolated to 1965 with figures supplied by the O.E.C.D. Statistics Division. We have used the estimates at 1955 U.S. relative prices (1). The figures for Germany were adjusted upwards by 1.6 per cent as the original study by M. Gilbert and Associates excluded the Saar (see *Op. cit.*, p. 83). The 1955 figures for Norway were adjusted downwards by 3.5 per cent to adjust for repairs and maintenance (see A. MADDISON, *Economic Growth in the West*, Twentieth Century Fund, New York, 1964, pp. 236-7 for an explanation of this adjustment) (2). The 1965 figures for the U.S.A. include Hawaii and Alaska. The O.E.E.C. estimates excluded significant indirect taxes and included subsidies only in cases where they distorted the relative price structure, so that the totals referred to a concept close to G.N.P. at factor cost.

For the U.S.S.R. there are estimates for 1955 by M. BORNSTEIN, "A Comparison of Soviet and United States National Products", *Comparisons of the United States and Soviet Economies*, Part II, U.S. Congress, Joint Economic

(1) Gilbert and Associates also present estimates at European relative prices, but these are valid only as an alternative form of comparison between each country and the U.S.A. They cannot legitimately be used for comparisons between European countries as they involve the use of different weighting systems for each country, which is not the case when we stick to U.S. weights. The alternative of using an average of European prices is not very attractive as it is difficult to say what it means. There is also the problem that in 1955, the year for which the weights were available, there were many distortions in the European price structure due to various controls, e.g. on rents or foreign trade. The U.S. price structure reflected normal market forces more clearly at that time. In any case, European price structures have tended to move convergently closer to the U.S. price structure as the economies have drawn closer to U.S. real income levels. This has happened because of factors affecting both supply and demand. The price structure of the economies has been affected by the same pattern of technological change, and by a basic similarity in the structure of consumer demand in countries at a given level of income.

(2) There are probably a few other minor adjustments which should now be made to the estimates of Gilbert and Associates because of revisions in the basic national accounts estimates for 1955 which have since taken place. However, the most important of these revisions (in Germany) was already anticipated by Gilbert and Associates who did not always use the official national accounts as then published.

Committee, 1959, p. 385. When extrapolated to 1965 (see A. MADDISON, *Economic Growth in Japan and the U.S.S.R.*, forthcoming, for the G.N.P. series), these show the Soviet G.N.P. as 67.2 per cent of the U.S.A. measured in dollars. However, Bornstein's estimate is higher than that of Soviet statisticians, whose most recent estimates are in the 1965 edition of *Narodnoe Khoziastvo*, p. 87, (the Soviet Statistical Yearbook). These show Soviet 1965 national income (Soviet concept excluding most services) as 61.9 per cent of that of the U.S.A. (3), at U.S. relative prices (i.e. a Soviet national income per head 52.2 per cent of that of the U.S.A. in real terms). For 1965 the same source indicates that U.S. G.N.P. was 38.3 per cent bigger than its national income (Soviet concept). Estimates are not given of Soviet G.N.P. (Western concept), but we have estimated it by raising the national income figure by 35.4 per cent which is the ratio of total employment to employment in the sectors producing national income (Soviet concept). Thus Soviet real G.N.P. was 60.6 per cent of that of the U.S.A.

For Japan the only estimate covering the whole economy is by I. B. KRAVIS and M. W. S. DAVENPORT, "The Political Arithmetic of International Burden Sharing", *The Journal of Political Economy*, August 1963, p. 327. However, this is an extrapolation of an estimate for 1952 which only referred to consumption; the estimate for government and investment appears to have been very crude, and was based on a composite of Japanese and U.S. weights so that it is not comparable with the figures for the other countries. The Economic Research Institute of the Economic Planning Agency produced an *Analysis of Price Comparisons in Japan and the United States*, *Economic Bulletin No. 13*, September 1963 for consumption, and this has since been superseded by *A Study of International Comparison of Levels of Living* (in Japanese). Institute of People's Living, Tokyo, March 1965, p. 28. This gives a purchasing power ratio for consumption goods for 1960. We have used the ratio at U.S. weights (163 yen to the dollar), applied it to the G.N.P. figures in current prices for the two countries, and extrapolated to 1965 with figures supplied by O.E.C.D. As the purchasing power ratios for consumption and for G.N.P. were quite close in all the European countries in 1955 (see M. GILBERT and Associates, *Op cit.*, p. 40), it seems reasonably legitimate to use the consumption ratio for the economy as a whole in the Japanese case.

For Canada we have used the estimates of D. J. DALY and D. WALTERS, "Factors in Canada-United States Real Income Differences", Economic Council of Canada, Ottawa, 1967 (mimeographed). These are based on 1960 G.N.P. at factor cost at U.S. weights and were extrapolated to 1965.

(3) The estimates of U.S. national income (Soviet concept) seems to be similar to those of V. M. KUDROV, who explains them in detail in *Statistika Natsionalnogo Dokhoda S. Sh. A.*, Moscow, 1966, pp. 144-5. Kudrov also translated the O.E.E.C. study of Gilbert and Associates into Russian.

The conversion of the 1965 relatives (at 1955 or 1960 prices) into 1965 dollars and purchasing power was made with the help of data for 1965 U.S. G.N.P. at factor cost in *National Accounts Statistics 1956-65*, O.E.C.D., Paris, no date.

Population.

The figures were taken from the United Nations, *Monthly Bulletin of Statistics*, New York, August 1967.

Employment.

For all countries except the U.S.S.R., the figures were supplied by the O.E.C.D. Statistics Division. For the U.S.S.R., they are from *Narodnoe Khoziastvo 1965*, Moscow, 1966, pp. 435 and 558. The figures include 76,918 thousand wage and salary earners, 18,900 thousand collective farmers, 3,000 thousand military personnel and 4,500 thousand family workers on private plots. The

TABLE A-1
COMPARATIVE LEVELS OF G.N.P. IN REAL TERMS,
OF G.N.P. IN NATIONAL CURRENCIES,
AND OF THE PURCHASING POWER OF CURRENCIES, 1965

	Real G.N.P. at factor cost at 1965 U.S. Relative prices (\$ billions)	G.N.P. at factor cost in national current (billion national units)	Purchasing Power Equivalents for G.N.P. (specific country quantity weights) units of domestic currency per dollar	Agio of Purchasing Power over Exchange rate
Belgium	20.3	744.8	36.7	1.36
Canada	45.1	44.8	0.993	0.93
Denmark	10.8	59.8	5.53	1.25
France	107.0	390.3	3.65	1.35
Germany (F.R.)	137.5	388.9	2.83	1.41
Italy	76.9	31,530.0	410	1.52
Japan	145.0	28,069.0	194	1.86
Netherlands	24.2	62.3	2.58	1.40
Norway	8.4	43.3	5.18	1.38
U.K.	120.0	31.0	0.258	1.38
U.S.A.	630.5	630.5	1.00	1.00
U.S.S.R.	382.1	296.5 ^a	0.776	1.16

^a There are no Soviet estimates of G.N.P., but the Soviet Statistical Yearbook publishes figures of Soviet income per head (Soviet concept) in dollars adjusted for purchasing power and in dollars at official exchange rates. We assumed that the ratio between the two figures is also representative for G.N.P. which we have converted back into roubles (see *Narodnoe Khoziastvo 1965*, p. 87).

TABLE A-2

POPULATION, EMPLOYMENT AND EMPLOYMENT IN AGRICULTURE 1965

	Population (thousands)	Total Employment (thousands)	Employment in Agriculture (thousands)
Belgium	9,464	3,704	206
Canada	19,604	6,974	694
Denmark	4,758	2,270	385
France	48,922	19,987	3,538
Germany (F.R.)	56,839	26,100	2,964
Italy	51,576	19,410	4,956
Japan	97,960	47,480	12,120
Netherlands	12,292	4,494	416
Norway	3,723	1,524	293
U.K.	54,595	25,800	884
U.S.A.	194,572	73,810	4,345
U.S.S.R.	230,600	103,318	31,075

Soviet figures for the latter category have to be derived as a residual which moves rather erratically from year to year and can only be a vague estimate. In the U.S. Congressional reports on the Soviet economy (from which we derived the figures on the armed forces) there is a much higher figure for workers on private plots (10.9 million in 1964, see *New Directions in the Soviet Economy*, Joint Economic Committee, U.S. Congress, 1966, p. 788). However, this estimate is based on a calculation of labour input requirements in private plots assuming that output per man is similar to that in the public agricultural sector. This seems a questionable assumption and involves double counting of collective farmers and others who are already included in the labour force.

ANNEX B

THE MEASUREMENT OF GROWTH RATES CONSISTENT
WITH MEASURES OF OUTPUT LEVEL

The standardisation of national accounts statistics in the developed Western countries has made great progress in the past two decades and the figures on growth rates are generally considered highly comparable. This is the judgment of two former Heads of the O.E.C.D. National Accounts Division who have explored the comparability of growth measures in the major Western countries more carefully than most other people, see the remarks of W. BECKERMAN in P. D. HENDERSON, *Economic Growth in Britain*, Weidenfeld and Nicolson, London, 1966, p. 63, and J. MCGIBBON, "The Statistical Comparability of Rates of Growth of Gross National Product", *Productivity Measurement Review*, O.E.C.D., Paris, February, 1964. E. F. DENISON has also concluded that methodological differences in the measurement of growth in national prices are likely to be small for the nine countries covered by Gilbert and Associates. See E. F. DENISON, *Why Growth Rates Differ*, Brookings, Washington D.C., 1967, p. 17. He does suggest downward adjustments to growth rates for Belgium and France of 0.23 and 0.28 per cent a year respectively for 1955-62 because of the use of methods for measuring government services, and construction which differ from those used by the other countries. We have not taken these adjustments for Belgium and France into account as they are rather small and there may well be errors of similar size for Japan and the U.S.S.R. For Canada, it has recently been suggested that growth may have been understated by 0.8 per cent a year from 1954 to 1963, because of inadequate measurement of growth in services, see A. T. P. HILL and J. MCGIBBON, "Sector Real Product, Measures and Methods for Selected O.E.C.D. Countries", International Association for Income and Wealth, Lom, Norway, September, 1965, mimeographed. As we extrapolated the Canadian figures from 1960 to 1965, we may therefore be understating Canadian real output by about 4 per cent. It would seem that the Canadian example is an extreme case of variation in measurement technique.

In spite of these fairly reassuring conclusions, doubt must remain about the validity of linking estimates of the level of real output for 1955 in U.S. prices with growth indices which are based on the national price weights of each country, whether the purpose is to extrapolate the O.E.C. estimates forward from 1955 to 1965 or to backcast them to 1870. Edward Denison has made a quantitative estimate of the hypothetical effect which convergent changes in relative prices may have on the measurement of economic performance (4).

(4) Denison does not treat this problem as one of measurement. He treats the difference between growth measured in national prices and in U.S. prices as a source of growth explicable in terms of economies of scale.

As countries raise their real income levels and narrow the economic distance between themselves and the United States, their price structures tend to converge towards those of the U.S.A. This happens because of basic similarities in technology and consumer tastes at given income levels. The countries which have been growing fastest will have the greatest degree of relative price change. Thus Denison suggests that the substitution of U.S. price weights for national price weights would reduce the measured growth of per capita consumption for the period 1955-62 in the manner shown in Table B-1.

TABLE B-1

DIFFERENCE BETWEEN REAL PER CAPITA CONSUMPTION GROWTH MEASURED IN NATIONAL AND IN U.S. RELATIVE PRICES 1955-62

	Annual recorded growth rate in national prices	Annual growth rate in U.S. relative prices	Difference in annual growth rate due to change in price structure
Belgium	2.1	1.8	0.31
Denmark	3.9	3.1	0.78
France	3.5	2.9	0.64
Germany	5.0	3.9	1.07
Italy	4.7	3.6	1.14
Netherlands	3.1	2.6	0.54
Norway	2.6	2.2	0.40
U.K.	2.0	1.8	0.24
U.S.A.	1.3	1.3	0.00

Source: E. F. DENISON, *Op. cit.*, p. 244.

Data are not available to make the calculation of columns 2 and 3 possible in a direct way. It results from a formula which Denison derives from the systematic pattern of difference in the 1950 levels of expenditure as measured in U.S. and national prices. Denison sees "no *a priori* reason" to suppose that these measurement difficulties apply to non-consumption items, and he scales down his correction by the ratio of consumption to net national product. The final impact of Denison's formula on the growth of net national product is shown in Table B-2. Until another benchmark study is taken on the same lines as that of Gilbert and Associates it will not be possible to test the Denison hypothesis. Denison makes some crude tests and finds that price structures have moved in the direction he suggests, but the magnitude of the movement is smaller than that suggested by his formula. This difference in magnitude may be due, as Denison suggests, to the fact that the data are not available in much detail, but it may also be due to the fact that most countries have updated their

weighting systems, and are not measuring their growth in terms of the relative prices of 1950, but of a later year in which the price structure was closer to that of the U.S. in 1950.

TABLE B-2

DIFFERENCE BETWEEN GROWTH OF NET NATIONAL PRODUCT MEASURED IN NATIONAL AND IN U.S. NATIONAL PRICES 1955-62

	Annual recorded growth rate in national prices	Annual growth rate in U.S. relative prices	Difference in annual growth rate due to change in price structure
Belgium	3.18	2.94	0.24
Denmark	4.92	4.38	0.54
France	5.03	4.57	0.46
Germany	5.39	4.69	0.70
Italy	5.71	4.91	0.80
Netherlands	3.83	3.48	0.35
Norway	3.27	3.00	0.27
U.K.	2.27	2.12	0.15
U.S.A.	2.67	2.67	0.00

Source: E. F. DENISON, *Op. cit.*, pp. 249, and 298-317.

If we take into account all the corrections which emerge explicitly from Denison's study (but not all of which are treated by him as measurement problems), and the correction for Canada suggested by Hill and McGibbon, and assume crudely that they are valid for the whole of the period 1955-65, and for 1960-65 for Canada, we arrive at the following correctives which may be applied to tables 9, 10, 12 and 15.

TABLE B-3

POSSIBLE CORRECTION RATIOS FOR TABLES 9, 10, 12 and 15
(U.K. = 100)

Belgium	96.85	Japan	n.a.
Canada	104.06	Netherlands	97.98
Denmark	96.21	Norway	98.83
France	94.34	U.K.	100.00
Germany (F.R.)	94.67	U.S.A.	101.50
Italy	93.73	U.S.S.R.	n.a.

If these correction coefficients were valid it would mean that the U.K. would move up to eighth place in Tables 9 and 10.

A. M.