GROWTH OF SECTOR REAL PRODUCT*

MEASURES AND METHODS IN SELECTED O.E.C.D. COUNTRIES

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This paper is concerned with the influence of different estimation procedures on the data for real output by industry group of a number of O.E.C.D. countries. The authors have examined the methods and indicators used in preparing sector real output data and have tried to assess the effect of the different methods on the recorded changes of sector real output. The data for real output, employment and productivity are compared for the different sectors and countries. The comparison between sectors lays particular emphasis on the dichotomy between the services and non-service sectors of the economy. In this comparison as well as in inter-country comparison it is seen that the data are influenced to a considerable extent by different methods. The survey of estimation methods also shows the incidence of use of double deflation techniques and other methods in the different countries, and the extent to which quality change, output specification and valuation problems are reflected in the different methods.

Introduction

The national accounts now provide the framework within which economic performance and development are largely assessed. That this should be so, most of us will agree. Nevertheless there does seem to be a tendency, in a good deal of economic analysis and discussion, for the numbers in the accounting system to assume an independent existence and to lose sight of the limitations imposed by the conventions adopted and the methods used in practice for their estimation. This paper is concerned with only one facet of the national accounts—real product by industry sector—and more specifically with the impact and influence of accounting conventions and estimation procedures on the recorded movements of real product and their interpretation. Since the main emphasis is on the association between measures and methods, the paper does not attempt to provide an exhaustive economic analysis of sector real product movements, nor a comprehensive survey of methods of estimation used. The degree of sector detail used is that

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generally available for a number of O.E.C.D. Member countries and published in O.E.C.D. national accounts publications.[1] In analysing the sector data and surveying the methods of estimation used, particular emphasis has been placed on the dichotomy between the services sectors and the other industry sectors of the economy.

The first section of the paper reviews the main issues of concept and definition in the accounting system which have an impact on real product measurement. Section 2 presents the analysis of real product growth over the period 1954–1963 as reflected in the data for a number of O.E.C.D. countries. The final section is concerned with the actual methods and types of indicator used by countries in the construction of real product data.

1. Concepts and Definitions

The data with which we are concerned in this paper derive from the concept of aggregate economic production underlying the present international standard accounting system[2] of the United Nations and the O.E.C.D. (O.E.E.C.). The merits, or otherwise, of the particular way in which the production boundary of this system is fixed do not concern us here. A number of the products (activities) which are encompassed do, however, give rise to particular difficulties of measurement (for either value or quantity).

The inclusion of the various activities of general government within the production concept provides an example of an activity which does not result in any clearly definable or measurable product. While the same difficulty of specification applies over a wide range of service activity the situation in the government sector is complicated by the fact that government services are not normally sold and therefore no market valuation exists. The convention of valuing government service output as equivalent to wages and salaries paid plus imputed rent on certain government assets means that for this sizeable and expanding sector of the economy a predominantly labour input measure is used for both the level and growth of product.

The production boundary is set so as to cover also the stream of services which is considered to flow over time from the occupation or ownership of a dwelling house. The value of product in the sector "ownership of dwellings" is equated with actual and imputed (in the case of owner occupation) rents paid, and the sector's real product growth, neglecting for the time being the question of the changing quality of houses, is measured by changes in the stock of occupied dwelling houses. This output per se does not, of course, result from any input of

1. For the full detail of the sector classification and the reconciliation with I.S.I.C. categories see "A Standardised System of National Accounts," pp. 19 and 56 of the English text. O.E.E.C., Paris, 1958.
2. Although the concept of aggregate production used in the accounting systems of certain countries does differ from this, the data used in this paper are adjusted, as far as possible, to conform to the standard concept. The most significant deviations from the standard concept occur in the French system of accounts—where the activities of general government, financial intermediaries, households and private non-profit institutions are not considered to contribute to the domestic product—and in the system of the Scandinavian countries, where a large part of repair and maintenance outlay is considered to be a final expenditure. [For a survey of adjustments made to country data see "Statistics of National Accounts 1950–1961," pp. 215–82. O.E.C.D., Paris, 1964.]

labour and the sector clearly ought to be excluded from any use of the aggregate output data for "productivity" purposes. For the countries covered in this paper the product of the dwellings sector accounts on average for about 4 per cent of total product (the combined contributions of dwellings and general government is on average about 10 per cent).

A further output convention which gives rise to special difficulties for real output measurement is that for the imputation of bank output and bank charges. The imputed output (difference between interest and dividends received and interest paid by banks) of course only affects the total output of the economy to the extent that the corresponding bank charges are debited to households rather than entered as an element of the intermediate costs of other producing sectors. While the real product of banks is, in itself, difficult to define and measure the mechanism of the imputation process means that the difficulty carries over to the calculation of the volume of inputs for the other industry sectors using bank services. Recognising the need for some form of imputation to avoid the paradox of a negative product occurring it would seem preferable for the imputation to be carried through without affecting the recording of inter-industry transactions.[3]

The above are the most important instances of a decision to include a particular activity within the boundary of output necessitating special conventions for its measurement. For the remaining activities within the boundary the "market" provides some basis of valuation. The economy's *total* output of goods and services may be valued either by adding final expenditures (less imports), by adding incomes received by the factors of production, or by adding the values of product in the various industry groups. In valuing the product of a particular sector only the income and output methods are possible while for measuring changes in the volume of sector product over time, only the output method is practicable. Whether the output method is followed by applying appropriate price indices to the values of inputs and outputs or by applying quantity indicator series to the value of net output in a base year it is necessary at the outset to decide what is the unit of output to be measured. While this may be possible in a relatively unambiguous way for tractors, furniture and other commodities, it is less obvious for the activity of a doctor, a trade union or a self-service store. This problem is dealt with more specifically in the third section of the paper in the context of the choice of indicators. However, before presenting the analysis of country data in the following section of the paper it is necessary to underline that the industry group data are not an aggregation of subgroups of uniquely defined outputs. The industry sectoring is based on a classification by activities, not commodities. The criterion of classification for activities is in itself variable—sometimes the use of a particular raw material may be the basis for grouping various activities together, e.g. leather and leather products, or some notion of a common process, e.g. chemicals. To regard this as necessarily a deficiency would be to confuse classification with enumeration. It does, however, indicate that "productivity" at the level of sector detail used in this paper has no technological connotation.

3. For example by treating banks and other financial institutions as a final expenditure category which consumed its own product. Alternatively, the whole of the imputation could be debited to households, as is done in the Norwegian national accounts.

2. Growth of Output, Employment and Output per Person Employed 1954–1963

This section of the paper is mainly concerned with the calculated rates of growth of real output in different sectors of the economy for a number of O.E.C.D. countries over the period 1954–1963. Data are presented at two levels of aggregation using four and twelve sectors respectively. Data are also given for growth of employment and for growth of output per employed person in individual sectors. Apart from the intrinsic interest of such figures, detailed comparisons of output and employment statistics for individual sectors may help to uncover weaknesses in one or another set of data which are not apparent at an aggregative level. The choice of 1954 as a base year was partly determined by the availability of data, especially on employment.

(a) Growth of Real Output

Sector growth rates for real output are shown in Table I. It can be seen that growth tends to be faster in those sectors concerned with the production and distribution of industrial goods; conversely, growth is usually slowest in agriculture and in "general" services—defined as all services other than transport, communications and distribution. The main exception to these generalisations is the United States where the growth of general services actually exceeded that of industry. At a less aggregative level some further marked tendencies can be discerned; in particular, the rapid growth of public utilities and financial services in all countries.

To some extent, differences in sector growth rates can be attributed to changes in the pattern of final demand associated with a rising level of real per capita income. Perhaps more important, however, are the effects of technological progress and other discoveries affecting supply conditions. Developments of this kind have their negative as well as their positive aspects: for example, the exploitation of oil and natural gas as sources of fuel and power has not only led to the rapid expansion of these industries but also to the relative, or even absolute, decline of coal mining in every country—despite the steadily increasing total demand for fuel and power. Similarly, the development of road and air transportation has resulted in a relative decline in maritime and, especially, rail passenger transportation, again notwithstanding a greatly increased demand for transportation services as such. Obviously, many more examples could be given.

The relative decline of agriculture in all countries is a familiar characteristic of the growth process; indeed, the size of the agricultural sector is in itself not a bad indicator of the stage of economic development reached by a country. This relatively slow rate of growth of agriculture is clearly attributable to the low income elasticity of demand for most agricultural products. On the other hand, the relatively slow growth of general services cannot be explained in this way. Nor, indeed, can their slow growth be satisfactorily explained by their gradual replacement by other sources of supply as a result of technological progress, even though it may be possible to find one or two instances of this. In practice, the main reason for the comparatively slow growth of general services in all countries seems to be that a substantial proportion of the real output indicators used in this sector consists

TABLE I. GROWTH OF GROSS DOMESTIC PRODUCT AT FACTOR COST 1954–1963

PER CENT PER ANNUM

	Germany (F.R.)[a]	Italy	France[a]	Denmark[b]	Canada	Netherlands	Norway	U.S.A.[a,c]	Belgium[a]	U.K.
1. Agriculture, Forestry and Fishing	2.2	2.2	1.6	1.7	3.4	1.1	−1.9	1.2	2.0	2.4
2. Mining and Quarrying	2.3	8.1	2.9	−0.7	7.0		3.4	2.0	−2.5	−1.2
3. Manufacturing	7.6	8.9	5.7	5.4	3.9	5.2	4.3	3.3	4.2	2.8
4. Construction	5.9	8.0	6.2	4.6	3.3		0.6	1.0	2.8	2.7
5. Electricity, Gas and Water	7.0	7.1	9.3	6.7	9.1		7.3	8.2	5.7	5.2
6. Transport and Communications	5.4	6.5	5.8	4.3	5.6	4.4	7.1	4.2	4.0	2.0
7. Distribution	6.9	6.6	6.2	5.2	4.1	5.2[d]	4.0	3.2	3.8	2.8
8. Banking, Insurance and Real Estate	5.8	6.6	6.3	5.5	3.5		4.9	4.7	6.6	4.1
9. Public Administration and Defence	4.8	3.6	2.1	6.2	2.4	2.5	2.8	2.4	1.7	−1.2
10. Other Services	4.6	2.2	4.7	1.6	3.9		3.9	4.5	2.6	2.8
11. Ownership of Dwellings	8.7	2.6	4.7	3.6	5.4	—	2.0	—[e]	0.9	2.0
12. Total G.D.P.	6.2	5.9	5.0	4.7	4.2	4.2	3.7	3.4	3.3	2.4
I. Agriculture, Forestry and Fishing	2.2	2.2	1.6	1.7	3.4	1.1	−1.9	1.2	2.0	2.4
II. Industry (2, 3, 4, 5)	7.0	8.7	5.8	5.3	4.5	5.2	3.7	3.2	3.6	2.6
III. Transport and Distribution (6, 7)	6.4	6.6	6.1	4.8	4.7	3.9	5.8	3.4	3.9	2.5
IV. General Services (8, 9, 10, 11)	5.4	3.6	3.7	4.6	3.8		3.5	3.8	2.4	1.9

a. G.D.P. at market prices.
b. 1955–1963.
c. In 1963, including Alaska and Hawaii.

d. Includes Ownership of Dwellings.
e. Ownership of Dwellings is included in Agriculture, Banking, Insurance, and Real Estate, and Other Services.

simply of employment changes. Whereas substantial increases in labour productivity may be recorded in other sectors, including agriculture, the output indicators in use over a wide range of general services permit little or no increase in output per person.

If the two consistently slow growing sectors—agriculture and general services—are compared, some important points of difference emerge. The share of agriculture in total G.D.P. (measured at current prices) has been declining steadily over time in every country, but the share of general services in G.D.P., on the other hand, has actually been expanding everywhere, both these generalisations without a single exception (see Table II). Moreover, apart from some less industrialised countries (Ireland, Portugal, Spain and Turkey) the increase in the share of general services in G.D.P. was actually greater than that of industry. Even in countries such as Germany and Italy where industrial output was growing extremely rapidly, the increase in the proportion of G.D.P. originating from industry was not so great as that for general services. The relatively slow measured growth of the real output of general services in conjunction with their steadily increasing share in G.D.P. reflects, of course, the fact that implicit price increases in this sector have been much greater than the average for the economy as a whole. Not only have price increases been distinctly faster in this sector than in other broad sectors, but the difference has been sufficiently great to ensure that, at current prices, growth in this sector has generally been faster than elsewhere in the economy. The contrast with agriculture is especially marked in this respect because agricultural prices have, on balance, tended to rise more slowly than other prices so that the gap between growth in agriculture and in other sectors has been even wider at current prices than at constant prices.

A special factor contributing to the rapid price increases in general services has been the deliberate increase in controlled rents, or the relaxation of rent controls, in certain countries.[4] Even if housing is excluded from general services, however, the above generalisations are largely unaffected and it is clear that the substantial price increases in general services are mainly due to the somewhat arbitrary conventions applied in measuring price and quantity changes over a wide range of services—especially public administration, defence, health and education. The usual identification of change in real output with change in employment in the latter sectors implies that increases in wage and salary rates are fully reflected in corresponding price increases for output so that price increases for general services are invariably well above the average for the rest of the economy. In so far as the scope for technological progress and increases in productivity is genuinely comparatively small in certain kinds of services, the opportunity cost of such services will gradually increase in the course of time and hence it is proper that such services should become relatively more expensive. Moreover, in so far as the demand for such services is price inelastic they will also tend to absorb an increasing share of G.D.P. at current prices. Not too much weight can be placed on this type of argument, however, for several reasons. Firstly, the limited scope for productivity increase in many services is a restriction

    4. *Cf.*, W. Fellner and others: "The Problem of Rising Prices," O.E.E.C., Paris, 1961, chapters II and III.

TABLE II. INDUSTRY STRUCTURE OF G.D.P. AT FACTOR COST, 1954–1963

BASED ON CURRENT PRICE DATA

	Austria		Belgium[a]		Canada		Denmark[b]		France[a]		Germany (F.R.)[a]	
	1954	*1963*	*1954*	*1963*	*1954*	*1963*	*1954*	*1963*	*1954*	*1963*	*1954*	*1963[g]*
1. Agriculture, Forestry and Fishing	16.7	10.7	7.9	7.0	8.9	7.6	18.6	12.6	11.6	8.7	8.7	5.1
2. Mining and Quarrying	⎤40.0	38.7	4.5	2.5	4.0	4.1	0.2	0.1	2.2	1.6	6.2[i]	2.7
3. Manufacturing	⎦		31.1	29.8	28.3	25.6	27.3	29.5	37.6	36.5	40.2	40.4
4. Construction	7.1	9.4	7.5	6.9	6.0	5.2	7.6	7.7	6.3	7.7	5.8	7.6
5. Electricity, Gas and Water	2.8	2.8	2.2	2.1	2.7	3.3	1.7	1.8	1.6	1.8	—	2.0
6. Transportation and Communications	6.7	7.0	7.8	7.3	8.9	8.8	9.2	9.7	5.2	5.0	6.5	6.1
7. Distribution	8.3	8.9	7.4	11.2	13.8	13.4	14.7	14.2	13.2	13.5	12.6	13.4
8. Banking, Insurance and Real Estate	2.8	3.9	2.6	3.5	5.1	6.6	2.5	2.7	0.8	0.9	2.6	3.2
9. Public Administration and Defence	9.2	10.7	6.1	6.6	6.7	7.3	⎤13.6	16.6	8.8	9.0	7.5	8.2
10. Other Services	5.2	6.9	14.6	16.2	11.2	14.2	⎦		10.2	11.5	7.5	8.1
11. Ownership of Dwellings	1.2	1.0	8.8	6.9	4.4	3.9	4.6	5.1	2.5	3.8	2.4	3.2
12. Gross Domestic Product at Factor Cost	100.0	100.0	100.0[m]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
I. Agriculture, Forestry and Fishing	16.7	10.7	7.9	7.0	8.9	7.6	18.6	12.6	11.6	8.7	8.7	5.1
II. Industry (2, 3, 4, 5)	49.9	50.9	45.3	41.3	41.0	38.2	36.8	39.1	47.7	47.6	52.2	52.7
III. Transport and Distribution (6, 7)	15.0	15.9	15.2	18.5	22.7	22.2	23.9	23.9	18.4	18.5	19.1	19.5
IV. General Services including Ownership of Dwellings (8, 9, 10, 11)	18.4	22.5	32.1	33.2	27.4	32.0	20.7	24.4	22.3	25.2	20.0	22.7

For footnotes see page 43.

TABLE II. (continued)

INDUSTRY STRUCTURE OF G.D.P. AT FACTOR COST, 1954–1963

BASED ON CURRENT PRICE DATA

	Greece		Ireland[e]		Italy[d]		Netherlands		Norway	
	1954	1963	1954	1963	1954	1963	1954	1963	1954	1963
1. Agriculture, Forestry and Fishing	34.3	28.9	28.6	22.0	24.0	15.5	12.2	8.8	13.9	8.7
2. Mining and Quarrying	1.0	1.1			1.2	0.9	2.3		1.4	0.9
3. Manufacturing	18.1	18.1	29.2	33.0	31.6	33.1	30.9	41.4	27.7	26.0
4. Construction	3.8	5.7			2.9	8.0	6.2		8.2	8.1
5. Electricity, Gas and Water	1.2	1.9			5.7	2.8	2.3		2.2	3.0
6. Transportation and Communications	8.0	7.7	16.5	17.2	6.4	7.0	9.1	8.5	15.8	18.1
7. Distribution	11.9	10.9			9.1	9.3	12.3	20.4	12.4	12.5
8. Banking, Insurance and Real Estate	1.8	2.7	—[j]	—[j]	3.1	3.8	2.7		2.3	2.9
9. Public Administration and Defence	6.9	7.8	6.2	6.1	10.1	12.0	7.4	7.9	4.1	4.8
10. Other Services	7.8	7.8	15.8	18.4	4.2	3.9	11.5	13.0	9.6	11.9
11. Ownership of Dwellings	5.2	7.4	3.6	3.8	3.0	5.6	3.1	—[k]	2.4	3.1
12. Gross Domestic Product at Factor Cost	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
I. Agriculture, Forestry and Fishing	34.3	28.9	28.6	22.0	24.0	15.5	12.2	8.8	13.9	8.7
II. Industry (2, 3, 4, 5)	24.1	26.8	29.2	33.0	41.4	44.8	41.7	41.4	39.5	38.0
III. Transport and Distribution (6, 7)	19.9	18.6	16.5	17.2	15.5	16.3	21.4	—	28.2	30.6
IV. General Services including Ownership of Dwellings (8, 9, 10, 11)	21.7	25.7	25.6	28.3	20.4	25.3	24.7	—	18.4	22.7

	Portugal		Spain		Turkey[e]		U.K.[f]		U.S.A.[a,g,h]	
	1954	1963	1954	1963	1954	1963	1954	1963	1954	1963
1. Agriculture, Forestry and Fishing	31.0	22.8	25.6	23.9	40.0	40.7	5.0	3.7	5.9	4.0
2. Mining and Quarrying	1.1	0.5	2.3	1.5	1.3	17.0[i]	3.6	2.8	2.6	2.0
3. Manufacturing	]33.6	39.7	22.8	25.5	13.5		35.9	34.7	28.6	27.6
4. Construction			5.0	5.3	5.7	5.5	5.7	6.6	4.8	4.6
5. Electricity, Gas and Water	1.9	2.6	1.7	2.3	0.4	—	2.4	3.2	2.3	2.6
6. Transportation and Communications	5.2	5.4	6.5	5.9	7.0	6.7	8.0	8.3	6.7	6.3
7. Distribution	8.1	7.1	11.8	11.0	12.1	9.2	12.8	12.1	17.9	17.7
8. Banking, Insurance and Real Estate	2.0	2.7	3.2	5.0	2.7	—	2.9	3.3	11.4	12.4
9. Public Administration and Defence	5.1	7.0	4.8	5.5	14.1	17.4	6.3	6.0	11.3	12.6
10. Other Services	8.9	8.9	9.5	10.7			14.1	17.0	8.5	10.2
11. Ownership of Dwellings	3.1	3.3	6.8	3.4	3.2	3.5	2.9	3.8	—[1]	—[1]
12. Gross Domestic Product at Factor Cost	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
I. Agriculture, Forestry and Fishing	31.0	22.8	25.6	23.9	40.0	40.7	5.0	3.7	5.9	4.0
II. Industry (2, 3, 4, 5)	36.6	42.8	31.8	34.6	20.9	22.5	47.6	47.3	38.3	36.8
III. Transport and Distribution (6, 7)	13.3	12.5	18.3	16.9	19.1	15.9	20.8	20.4	24.6	24.0
IV. General Services including Ownership of Dwellings (8, 9, 10, 11)	19.1	21.9	24.3	24.6	20.0	20.9	26.2	30.1	31.2	35.2

a. G.D.P. at market prices.

b. The individual sector and total G.D.P. estimates on which the percentages are based include repair and maintenance, as well as taxes on land and buildings, etc.

c. The individual sector estimates include stock appreciation which has been deducted in total from G.D.P.

d. The individual sector estimates are net of subsidies but include a certain amount of duplication. The net total of these two items has been deducted from G.D.P.

e. Net domestic product at factor cost.

f. The individual sector estimates include stock appreciation. The total of stock appreciation together with the residual error has been eliminated from the G.D.P.

g. Apart from item 9, the data represent product originating in the private sector.

h. In 1963, including Alaska and Hawaii.

i. Including Electricity, Gas and Water.

j. Included in Other Services.

k. Included in items 7 and 8.

l. Included in items 1, 8 and 10.

m. Including statistical error.

imposed more by the way their output is conventionally measured than by the actual possibilities of finding new and more efficient methods of production. One may assume, or at least hope, that there have been substantial improvements over the years in efficiency and productivity in banking, for example, as a result of increasing mechanisation, but the measured change in real output in this industry is sometimes based solely on change in employment. Secondly, many of the services in question are not bought and sold on the market so that their price elasticity of demand is purely notional. Thirdly, the demand for several of the services under consideration—such as health, education and public services—is likely to be highly income elastic so that their relatively slow measured rate of growth in real terms must be viewed with some scepticism. Finally, it may be observed that it is slightly paradoxical that, whereas existing methods of measurement for certain services imply that at any given moment of time differences in remuneration between individuals are a perfect indication of the differences in their outputs, changes in rates of remuneration over time are assumed to have no connection whatsoever with changes in output.

A specific factor which has an irregular effect on the growth of general services in different countries consists of changes in the size of the armed forces. In the United Kingdom, for example, the reduction in the armed forces over the period in question considerably more than offset the increase in employment in public administration which led to an overall decline in the output of government services. In some other countries, the situation was quite different in this respect. For this reason, the growth of government services is liable to be quite irregular and may not bear any very stable relationship to growth of total G.D.P. as between one country and another, especially in the short run.

It is worth considering to what extent relatively rapid growth of real output is accompanied by accelerated structural change within the economy. Even though the basic pattern of sector growth rates may be fairly consistent from country to country, the dispersion of sector growth rates might be expected to be greater for the faster growing countries. In fact, the data in Tables I and II do not lend much support to this hypothesis. The standard deviations of the twelve sector growth rates in Table I all lie within the range 1.8 to 2.5 and, on average, they are no greater for Germany, Italy and France than for the United States, Belgium and the United Kingdom. If the sector growth rates are weighted by the share of the sector in total G.D.P., Italy and Norway stand out as having rather greater dispersion than other countries, mainly because of the wide gap in these two countries between growth in agriculture and that in other sectors. If the actual changes in sector shares (at current prices) between 1954 and 1963 are considered, Italy and Norway again stand out as having experienced the greatest structural change because of the relatively large decline in the agricultural sector (including forestry and fishing) in each country. In general, however, it is difficult to detect any systematic tendency for the shares of individual sectors in total output to be more flexible in fast growing countries such as Germany and France than in slower growing countries such as Belgium and the United Kingdom, at least over the period considered here and at this level of aggregation.

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(b) *Growth of Employment*

Growth of employment (including the self-employed and unpaid family workers) exhibits a rather different sector pattern from that for real output, mainly because general services is a rapidly expanding sector measured in terms of employment. The general picture shown by the data in Table III may be summarised as follows. In every country employment in agriculture was declining steadily, usually by around 3 per cent per year. (It is interesting to note that, *ex post,* there is no apparent relationship between the rate of decline of agricultural employment in different countries and the rate of growth of employment elsewhere in the economy. For example, the rate of outflow from agriculture was about the same in Germany or Canada as in France even though the growth of employment in industry and services was much greater in the two former countries.) There were also sharp reductions in employment in mining in all countries with data available. The growth of employment in industry tended to be about the same as that for the economy as a whole, except in Italy where it was exceptionally fast. Employment in transport and distribution tended to grow rather more quickly than that in industry, although an important difference emerges which is not present in the output figures—namely, that measured in terms of employment distribution is a fast growing sector whereas transport is slow growing or even declining. Finally, the growth of employment in general services also tended to be faster than in industry, notably in Belgium, Canada, the United Kingdom and the United States. It follows from these generalisations that growth of employment in services as a whole tended to be distinctly faster than in the rest of the economy and, in several countries, the increase in the actual number of persons employed in services was greater than that for the total active labour force. On balance, the redistribution of employment was primarily from agriculture to services and only to a lesser extent from agriculture to industry (except in Italy).

In principle, the change in employment in a sector depends not only on the growth of output in that sector but also on any increase in labour productivity due to improved methods of production. In practice, however, it is not easy to apply this principle to agriculture and general services. The difficulty for agriculture is that reductions in employment are usually partly due to the gradual elimination of disguised unemployment in the sector and they may, therefore, greatly overstate the reduction in effective labour input. In most countries, the employment statistics for agriculture are of only limited usefulness and the measured growth of output per person may reflect increases in the effective rate of utilisation of the labour force nominally ascribed to agriculture just as much as improvements in methods of production. As already mentioned, the difficulty for many kinds of general services lies with the output statistics, in that no separation can be made between change in real output and change in labour input. Where changes in output are based solely, or largely, on changes in employment the implicit changes in output per person are obviously without any real significance.

Substantial changes in average output per person in general services as a whole may nevertheless occur for several reasons. Firstly, in such a broad sector

TABLE III. GROWTH OF EMPLOYMENT 1954–1963

PER CENT PER ANNUM

	Canada	Italy	Germany (F.R.)	Netherlands[a]	Denmark	U.S.A.	Belgium[b]	U.K.	Norway	France
1. Agriculture, Forestry and Fishing	−3.3	−2.7	−3.4	−2.1	−2.5	−2.7	−3.7	−1.9	−2.6	−3.6
2. Mining and Quarrying	−2.7	—	−1.8	−1.1	2.4	−2.5	−5.7	−2.7	−1.3	−2.8
3. Manufacturing	2.2	—	2.4	1.6		0.3	1.0	0.4	0.3	0.9
4. Construction	2.8	—	2.3	2.1	2.8	1.4	2.2	1.5	−0.4	2.8
5. Electricity, Gas and Water	3.5	—	2.2	0.3	—	0.6	0.7	0.7	0.9	2.3
6. Transport and Communications	1.4	—	1.6	1.8	—	−0.7	0.4	−0.3	1.8	1.2
7. Distribution	2.6	—	3.1	2.3	—	1.5	1.6	1.6	2.4	2.4
8. Banking, Insurance and Real Estate	5.1	—	6.2		—	3.1		3.2		
9. Public Administration and Defence	5.1	—	4.5	1.8	—	3.2	1.2	−2.1	1.6	1.3
10. Other Services		—	1.5		—	3.1		1.9		
11. Total	2.1	1.8	1.6	1.4	1.2	1.1	0.6	0.5	0.2	0.2
I. Agriculture, Forestry and Fishing	−3.3	−2.7	−3.4	−2.1	−2.5	−2.7	−3.7	−1.9	−2.6	−3.6
II. Industry (2, 3, 4, 5)	2.1	4.6	2.2	1.6	2.5[c]	0.5	0.6	0.4	0.1	1.2
III. Transport and Distribution (6, 7)	2.2	3.4	2.6	2.2	1.9	1.1	1.6	0.9	1.9	2.0[d]
IV. General Services (8, 9, 10)	5.1		3.4	1.8		3.1	1.2	0.8		1.3[d]

a. 1954–1962.
b. 1955–1963.
c. Excluding Electricity, Gas and Water which are included with Transport and Distribution and General Services.
d. Banking, etc., is included in Transport and Distribution.

as this, by no means all, or even a majority, of the real output indicators in use are based on employment series. Secondly, a redistribution of labour involving the employment of a larger proportion of more highly qualified and highly paid staff will raise output per person on average. Even though real output changes may be based on changes in employment, individuals are not all given equal weight; in practice, individuals are usually weighted by their remuneration so that a redistribution in favour of more (or less) highly paid staff materialises as an increase (or decrease) in output. An important example of this is provided by the increase in average output per person in government services in the United Kingdom which seems to have been mainly due to the decline in the numbers of relatively poorly paid armed forces following the abolition of conscription. Thirdly, changes in output per person in general services may be observed simply because the output and employment data used are not properly comparable (a problem which is not, of course, peculiar to this sector).

An example of such lack of comparability is provided by the Canadian data where output per person in general services (excluding housing) declined by nearly two per cent per year between 1954 and 1963. The Canadian statistical authorities themselves are emphatic that it is quite improper to divide their real output series for this sector by the corresponding employment series,[5] a sentiment which would doubtless be echoed by many other statistical authorities. It must be accepted, therefore, that in most countries statistics of growth of output per person over a wide range of services are totally devoid of economic, or any other, significance. Two comments are apposite at this juncture.

Firstly, it is precisely these same series of real output and employment aggregated over the economy as a whole which tend to be used without much hesitation or qualification as a basis for policy decisions or international comparisons. Only by confronting such data at a much lower level of aggregation is it possible to check their mutual consistency and comparability. Secondly, given that the recorded statistics of growth of output per person in agriculture are also extremely dubious, it seems that in most countries growth of average output per person as conventionally measured over as much as a quarter to a third of the entire economy has no particular economic relevance or significance.

(c) Growth of Real Output per Person Employed

Despite the reservations made in the previous paragraphs, it is worth examining the pattern of sector growth rates for output per person even though this may initially involve accepting the latter at their face value. A fairly consistent pattern is clearly seen to emerge for most countries. Growth of real output per person employed in agriculture was generally much faster than in any of the other three main sectors considered, although faster rates can be observed at a lower level of aggregation for sectors such as public utilities and mining. In a few countries the rate of growth of output per person in agriculture was twice, or even three times, as fast as that for the economy as a whole. In general, there

5. See "Indexes of Real Domestic Product by Industry of Origin, 1935–61," p. 14. (Dominion Bureau of Statistics, Catalogue No. 61–505.)

seems to have been no correlation whatsoever between the growth of output per person in agriculture and that elsewhere in the economy, although there was a tendency for output per person in agriculture to grow most rapidly in those countries where the measured decline in the agricultural labour force was greatest. An inverse relationship between change in employment and change in output per person may simply be due to errors or other deficiencies in the estimates of employment change (which are likely to be particularly serious for agriculture) but the observed correlation may not be without economic significance. The faster the rate of decline of the agricultural labour force, the faster the least efficient units of production are likely to be eliminated and hence the faster output per person is likely to rise *on average* for the industry as a whole. This sort of effect may occur in mining in some countries.

Growth of output per person in industry and in transport and distribution was usually very similar to the rate for the economy as a whole. Moreover, industry, transport and distribution share the distinction of having fairly reliable and meaningful indicators for both real output and employment change and the economic links between these sectors are rather stronger than those with other sectors. If they are grouped together into a single sector on these grounds, a remarkably close agreement is found between their growth of output per person and that for the economy as a whole (Table V). As a composite sector, industry, transport and distribution accounted for between a half and two-thirds of total employment in the various countries in 1963.

Growth of output per person in general services (with or without ownership of dwellings) was much slower, on average, than in the other broad sectors. Moreover, excluding Canada, there was rather less variation from country to country in the growth rates for this sector, as one would expect. There was, nevertheless, some suggestion of a positive correlation with the growth of output per person for the economy as a whole.

Because of the limited significance which can be attached to the measured growth of output per person in general services, it might be thought desirable to exclude at least some of the items under this heading when considering, for example, policy decisions involving the growth of average output per person for the economy as a whole. There would, however, be little justification for excluding a whole range of services in this way without at the same time excluding agriculture where the measured growth of output per person is also suspect. Moreover, the exclusion of both agriculture and general services would, as it happens, leave the overall growth rate of output per person largely unchanged since this would simply mean reverting to industry, transport and distribution.

A curious feature of the data in Tables IV and V is that, whereas there is not much correlation between growth of output per person in agriculture or general services taken separately and growth elsewhere in the economy, when the two sectors are combined such a correlation does emerge. The explanation lies in the change in relative sizes of the two sectors together with the difference in their average *levels* of output per person. For example, in France and Germany average output per person in general services in 1954 was about two and a half times greater than in agriculture; furthermore, whereas employment was con-

TABLE IV. GROWTH OF GROSS DOMESTIC PRODUCT PER EMPLOYED PERSON 1954–1963

PER CENT PER ANNUM

	France	Germany (F.R.)	Italy	Norway	Denmark[a]	Netherlands[b]	Belgium	U.S.A.	Canada	U.K.
1. Agriculture, Forestry and Fishing	5.4	5.8	5.0	0.7	4.4	4.5	5.9	4.0	6.9	4.4
2. Mining and Quarrying	5.9	4.1	—	4.7	⎫ 2.8	—	3.4	4.6	10.0	1.5
3. Manufacturing	4.7	5.0	—	4.0	⎭	—	3.1	2.9	1.6	2.3
4. Construction	3.3	3.5	—	1.0	1.8	—	0.6	−0.3	0.5	1.2
5. Electricity, Gas and Water	6.8	4.7	—	6.4	—	---	4.9	7.6	5.4	4.5
6. Transport and Communications	4.5	3.7	—	5.3	—	2.7	3.7	5.0	4.1	2.3
7. Distribution	⎤ 3.8	3.6	—	⎤ 1.7	—	⎤ 2.7[f]	⎤ 2.6	1.6	1.5	1.2
8. Banking, Insurance and Real Estate	⎦	−0.3	—	⎦	—	⎦	⎦	1.5	−1.5	0.9
9. Public Administration and Defence	⎤ 2.1	0.3	—	⎤ 1.9	—	⎤ 0.5	⎤ 1.1	−0.7	⎤ −1.7	1.0
10. Other Services	⎦	3.1	—	⎦	—	⎦	⎦	1.3	⎦	0.9
11. Total G.D.P.	4.7	4.5	4.0	3.5	3.5	2.9	2.7	2.3		1.9
I. Agriculture, Forestry and Fishing	5.4	5.8	5.0	0.7	4.4	4.5	5.9	4.0	6.9	4.4
II. Industry (2, 3, 4, 5)	4.6	4.7	3.9	3.6	2.7[e]	3.7	2.9	2.8	2.3	2.2
III. Transport and Distribution (6, 7)	4.0[d]	3.7	⎤ 1.4	3.5[d]	⎤ 2.8	2.7[d,f]	3.0[d]	2.4	2.4	1.6
IV. General Services (including Ownership of Dwellings)	2.3[d]	1.9	⎦	1.6[d]	⎦	—	0.7[d]	0.7	−1.2	1.1
(excluding Ownership of Dwellings)	2.1[d]	1.4	1.7[e]	1.6[d]	2.9[e]	0.5[d]	1.1[d]	—	−1.7	1.1

a. 1955–1963.
b. 1954–1962.
c. Excluding Electricity, Gas and Water which are included with Transport and Distribution and General Services.

d. Banking, etc., is included in Distribution.
e. Including Transport and Distribution.
f. Including Ownership of Dwellings.

tracting in agriculture that in services was expanding so that the change in the relative sizes of the two sectors was very pronounced, especially in Germany. The effect of this redistribution in conjunction with the marked disparity in the levels of output per person was such as to make the growth of output per person in the combined sector much greater than any conventional weighted average of the growth rates in the two individual sectors.[6] On the other hand, in some other countries, such as Belgium and the United Kingdom, these effects were much less important, not merely because the redistribution itself was very much smaller but also because of the much smaller difference between average output per person in agriculture and in the rest of the economy. For these reasons, it is not possible to find any consistent relationship between the growth of output per person in agriculture and general services taken separately and growth in the two sectors combined.

Although the joint sector agriculture and general services is a highly artificial one for most purposes (being defined here from the purely negative viewpoint of both sectors having suspect measures of growth of output per person) the discussion of the previous paragraph highlights the dangers of excluding individual sectors because their measures are suspect, a suggestion which is sometimes advanced with respect to certain types of services in particular. The drawback of any exclusion of this kind is that it automatically eliminates the effects of any redistribution of employment between that sector and the rest of the economy and, in general, redistribution of employment from sectors with low to those with high levels of output per person may be as important in raising the average for the economy as a whole as increases in output per person within sectors. However dubious the measures of growth of real output per person may be within agriculture or certain kinds of services, a net shift in employment from one to the other is bound to raise output per person for the economy as a whole given that their relative levels of output or value added per person measured at *current* prices have any validity. Moreover, to the extent that it is the least efficient or productive units which tend to lose labour in a sector with declining employment, whereas the additional labour engaged in an expanding sector tends to make use of highly efficient methods of production, the effects of redistribution of employment are likely to be grossly underestimated if they are based on differences in the *average* levels of output per person in the two sectors. Obviously, the difference in output per person between the marginal units primarily affected by the redistribution may be considerably greater than that between the averages for the two sectors. One effect of changes in employment in this situation is to accelerate the growth of average output per person *within* each of the sectors affected[7] but it is im-

6. This was a feature of rates of growth of output per person in the early post-war years as a result of the gradual transfer of manpower from the armed forces to civilian occupations (see, *e.g.,* W. B. Reddaway, "Movements in the Real Product of the United Kingdom, 1946–1949," *Journal of the Royal Statistical Society,* Series A, Vol. CXIII, Part IV, 1950, p. 452, para. IV.4). In extreme cases, it is possible for the growth rate in the combined sector to be greater than in either of the two individual sectors which comprise it.

7. Because the elimination of some of the least productive units in a declining industry (or, alternatively, an increase in the proportion of relatively productive units in an expanding industry) in itself increases the average level of efficiency or productivity of the industry as a whole. Formally, this is equivalent to the case where there is an increase in average output per person in a service sector resulting from an increase in the proportion of more highly qualified and highly paid personnel.

TABLE V. GROWTH OF GROSS DOMESTIC PRODUCT PER EMPLOYED PERSON

PER CENT PER ANNUM

	France	Germany (F.R.)	Italy	Norway	Denmark[a]	Netherlands[b]	Belgium	U.S.A.	Canada	U.K.
Industry, Transport and Distribution	4.4[c]	4.5	—	3.7[c]	—	3.0[c, d]	3.0	2.6	2.3	2.0
Agriculture and General Services	4.2	4.1	—	2.0	—	1.7	1.9	1.7	1.6	1.5
Total G.D.P.	4.7	4.5	4.0	3.5	3.5	2.9	2.7	2.3	2.1	1.9

a. 1955–1963.　　　　b. 1954–1962.　　　　c. Including Banking, etc.　　　　d. Including Ownership of Dwellings.

possible with the type of data and level of aggregation used here to distinguish how much of such growth is due to these factors from that part due simply to improvements in existing techniques of production. Failure to take account of these points may explain why most studies have tended to over-simplify this problem and to reach the doubtful conclusion that redistribution of employment is a relatively unimportant element in the process of economic growth.

3. *Methods of Estimation*

In principle the real product (net output) of an industry sector ought to be estimated by deducting the 'quantity' of inputs used from the 'quantity' of output produced. In practice this method is difficult to apply generally, firstly because for a wide range of production activity the 'quantity' of output or input is difficult to specify and secondly because the considerable amount of statistical data it requires may not be available. It is therefore frequently necessary to adopt some compromise procedure which applies a 'single' indicator of change over time to the net output "weights." The single indicators may relate to gross output, an intermediate or primary input element or a related expenditure series.

We may consider first the various ways in which the countries covered have arrived at the net output "weights" for the different sectors. In the cases of Canada, France and the Netherlands the base year net output data are taken from detailed input-output matrices. While the matrix presentation does not in itself imply that all the valuation problems have been solved it does require a considerable amount of information on production structures in the different sectors. It may also provide a check at the detailed sector level of estimates derived from the income side. For example in the Canadian "inter-industry flow" table for 1949 income originating values were obtained for forty industry groups which were subsequently used in deriving net output values for about 300 industries.[8] In the case of France and the Netherlands input-output matrices are prepared annually and the real product estimates are derived within the framework of these matrices. The net output weights for the United Kingdom and the United States are derived principally from income data; for the United Kingdom, however, the weights for the subdivision of industries covered by the index of industrial production are based on census of production net output values, the subdivision of transport and communication is based on gross receipts and within distribution the weights are based on gross margins.[9] In the case of the United States the income weights have been retained although in the recent work in preparing real product estimates by industry separate data on inputs and outputs were used. It was found that "it was not possible to calculate measures of total output and intermediate purchases that would yield exactly the industry gross product included in the GNP accounts"[10] (i.e. income derived estimate). For the other countries the "weights"

8. "Indexes of Real Domestic Product by Industry of Origin 1935–61," p. 51, para. 71. (Dominion Bureau of Statistics, Catalogue No. 61–505.)
9. "Economic Trends," No. 82, August 1960. (Central Statistical Office.) For a survey of methods used in preparing quarterly estimates of the gross domestic product for the U.K., see "Economic Trends," No. 148, February 1966.
10. "GNP by Major Industries, Concepts and Methods" (Dept. of Commerce, October 1962).

are derived from a range of sources reflecting the use of more varied procedures in calculating the current price sector data. In general the pattern is for the agriculture, mining, manufacturing and construction weights to be derived from census of production input and output data, while for other sectors enterprise accounting records, wage and salary bills, gross margins, etc., provide the weights.

The above has been concerned with the general methods of placing a value on the output of the different sectors in a given year. We may now turn to the indicators used to measure changes in the volume of sector output from one year to another. Reference has already been made to the double and single indicator methods and to the fact that the former is applicable only when the quantity (unit) of output and input can be specified. In general this means that the double or net output indicator method can be most readily applied for the non-service sector. That its use in practice is not solely determined by the size of the service sector is evident from the fact that while general services including housing accounts for around 30 per cent of output in Canada, the United Kingdom and the United States, net output indicators were used to cover about 46 per cent of total product in the United States (1954 weights), about 30 per cent for Canada (1949 weights) and only 4½ per cent for the United Kingdom (1954 weights). For the other countries it is more difficult from available information to quantify the incidence of the different indicators; for the Netherlands and France net output indicators are widely applied whereas for the other countries the use of net output indicators is largely determined by the availability annually of output and input data. The general impression is that their incidence would be similar (though somewhat smaller) to that for Canada. In the case of Denmark single indicator methods appear to be applied generally as in the United Kingdom.

Some impression of the general incidence of the various single indicator methods may be provided by the information for Canada and the United Kingdom. For Canada gross output indicators were used to cover about 50 per cent of total product, labour input indicators about 16 per cent and material input indicators about 5 per cent. For the United Kingdom gross output indicators covered about 65 per cent of total product, labour input indicators about 14 per cent, material input indicators about 7 per cent and constant price consumer expenditure indicators[11] about 10 per cent.

The following observations indicate the ways in which the different types of general indicators are used in the various sectors of the economy. It should be emphasised that in this paper we have presented data for fairly broad industry group categories for which estimates are in practice built up from much more detailed subdivisions. In characterising the types of indicator used the more detailed information available has whenever possible been used as the basis. It remains nevertheless a fairly arbitrary process. In most countries net output indicators are used for the agricultural sector although less generally for the forestry and fishing subdivision. Agriculture is in fact the only sector for which the United Kingdom procedures used net output as the indicator. For mining and quarrying a gross output indicator, usually tons of coal, is generally used. The

11. Constant price consumers' expenditure on rent, which is generally used for the volume of output in the ownership of dwellings sector, has been considered to be a gross output indicator.

United States explanatory note on methods states that the difference between the use of gross or net output indicator for the mining sector should not be too great since intermediate purchases are relatively minor. However, the rapid substitution of capital for labour which has taken place over the past decade in a number of European countries may well have been accompanied by considerable changes in the composition and amount of intermediate inputs. While manufacturing output would be expected to provide most scope for the use of net output indicators the extent of their use varies considerably amongst the countries. Most of manufacturing output in the United States is covered by net output indicators; in Canada about 45 per cent of this sector's output is covered by net output indicators, about 50 per cent by a gross output indicator and some 5 per cent by a material input indicator. For the United Kingdom about 15 per cent is covered by a material input indicator and the remainder of manufacturing output by gross output indicators. In the case of the United Kingdom the use of a material input indicator within manufacturing is most important in the food, drink and tobacco industries and in the miscellaneous metal goods industries producing tools, cutlery, cans, nuts, bolts, etc. It may be that the variety of specifications, sizes, etc., for these latter products make characterisation of output difficult. For construction activity the use of the different types of indicator is to some extent conditioned by different views on what constitutes the unit of output when the size and quality of houses and buildings varies so much. A gross output indicator such as surface or floor area is frequently used as an indicator which at least in part takes account of quality (size) difference. In some cases a material input indicator is adopted to reflect both changing quality and quantity. In the distribution sector (wholesale and retail trade) the indicators used by countries do not suggest any preoccupation with assessing changes in service content. The majority of countries use the volume of sales or changes in trade margins—the United Kingdom as a provisional procedure uses the deflated consumers' expenditure total as the output measure. In some cases the price indices used for deflation may, of course, incorporate an adjustment for changing service content, e.g. not treating lower prices in supermarkets and self-service stores as a general price reduction but as a decrease in service content.

Over the remaining range of service sectors (general services including housing in Table V) gross output or labour input indicators are generally used. In the case of the United States, however, a net output indicator method is applied for the major portions of finance and insurance. In Canada, where this general service group accounts for about a quarter of total output, labour input indicators measure movements over time for about 60 per cent of activities within the group and gross output indicators cover the others. In the case of the United Kingdom, where general services account for about 30 per cent of total output, labour input and gross output indicators are found in equal proportions. In Canada labour input indicators are used to cover all of finance and insurance activities and about 60 per cent of community recreational and business services. The labour input indicators are used in the United Kingdom principally for professional and scientific services and for the miscellaneous services category covering entertainment, hotels, restaurants, etc. Some of the gross output indicators, as with the labour input

measure, also preclude the possibility of any "productivity" increase; thus the use of number of doctors to indicate the development of output of health services clearly does not provide any measure of what doctors actually do. Similarly the use of number of teachers does not measure the services of education.

In the above summary a great number of the difficult issues in real product measurement have either been skipped over lightly or entirely omitted. For example the choice between valuation at factor cost or market prices has not been dealt with although as can be seen from the footnotes to the tables there is no evidence of one valuation principle being generally preferred. Similarly the problem of evaluating quality changes has been little more than mentioned. This is not to suggest that these are in any way less important issues. They do, however, give rise to more theoretical and esoteric debate and the aim in the present paper has been to underline the more obvious ways in which conventions and procedures impose considerable reservation on the use of sector product data for macro-economic analysis.

CROISSANCE DE LA PRODUCTION REELLE PAR SECTEUR

Cet article étudie l'influence des procédures de calcul sur les estimations de la production réelle par secteur dans un certain nombre de pays de l'O.C.D.E. Les auteurs ont examiné les méthodes utilisées dans ces calculs et se sont efforcés d'évaluer l'effet des méthodes sur les résultats enregistrés en ce qui concerne les variations de production réelle par secteur. Ils ont comparé les valeurs de la production réelle, de l'emploi et de la productivité dans différents secteurs et pays, en insistant sur la distinction entre les secteurs de services et les autres. Ces comparaisons montrent clairement que les estimations sont largement influencées par les différentes méthodes utilisées. L'étude des méthodes d'estimation montre également l'incidence de l'utilisation des techniques de double déflation et d'autres méthodes dans les différents pays ainsi que la mesure dans laquelle les problèmes du changement de qualité, de la spécification des produits et de la détermination de leur valeur sont traduits dans les différentes méthodes.