

PROBLEMS RAISED BY THE CALCULATION OF REAL NATIONAL INCOME IN SOUTH AFRICA

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I. INTRODUCTION

REAL Domestic or National Income estimates prepared on the lines suggested by the United Nations Economic and Social Council,¹ or detailed calculations made by countries like the United States, United Kingdom, etc., are not, as yet, available for South Africa. Research on this subject is still in its infancy and reliable and detailed statistics will not be forthcoming for some years. During recent years, however, valuable basic information has come to hand, partly as a by-product of official statistical enquiries and partly as a result of various departmental studies.

The purpose of this article is to record what has already been done on this subject in South Africa, give an account of the statistical material available for calculation of the relevant components in a system of Real National Accounts, state the problems so far encountered and the problems that will have to be faced in the actual calculations in future.

As the theoretical and conceptual problems attached to the calculation of Real National Accounts have been discussed at length in United Nations publications as well as by a number of eminent economists, no contribution is offered in this direction. The general principles set out by the Statistical Commission of the United Nations² are accepted and only the problems encountered in conforming to the proposed methods will be dealt with.

The main practical problem in calculating Real National Income is the construction of appropriate price and quantity indices for the deflation of current values or the extrapolation of base year values by quantity indices. The best type of index formula to use for the construction of price and volume index numbers, will in most cases depend on the basic material available, but it is suggested that the example of most countries already calculating real figures, in using the Laspeyre formula

¹ *A System of Price and Quantity Indexes for National Accounts*, United Nations, Economic and Social Council, New York, 1957 (E/CN.3/L.46).

² *Ibid.*

for volume indices¹ and the Paasche formula for price indices, be followed as far as possible, in order to utilize the advantages of the identity; Laspeyre volume index \times Paasche price index = value index. Existing indices, irrespective of the formula employed for their construction, will, however, have to be used, as the paucity of appropriate price and volume indices in less advanced countries is well-known.

Real Domestic and National Income figures for South Africa have frequently been quoted in official publications and by well-known economists. The procedure adopted for their calculations has mainly been confined to the deflation of the Domestic or National Income figures by the official wholesale and/or consumer price index. Without reiterating the many disadvantages attached to the above-mentioned method of deriving Real National Income, it could be mentioned that the weights and composition of the official wholesale price index is still based on information pertaining to the years 1922-4 and includes only commodities consumed locally,² while the weights and composition of the consumer price index have recently been revised, for the first time since 1938, on the basis of a Survey of Family Expenditure conducted in November 1955. If it is further kept in mind that the ratio of foreign trade to national income in South Africa is relatively high³ and that the bulk of her exports consists of agricultural produce and minerals which are very prone to price fluctuations on world markets with the result that the terms of trade adjustment in the case of South Africa should be considerable, it follows that little value can be attached to the existing Real National Income figures for South Africa. Research in this field is long overdue, but fortunately, an urgent attempt to fill this important gap in the statistical data will be made in the near future.

II. THE COMPILATION OF THE REAL NATIONAL INCOME OF SOUTH AFRICA

In the comprehensive study undertaken by the Statistical Commission previously quoted, it is recommended that countries engaged in the calculation of Real National Accounts,

¹ This method is employed by the Bureau of Census and Statistics for the calculation of volume indices of industrial production and volume indices of external trade.

² It therefore excludes commodities, such as wool, which are mainly exported. A new wholesale price index using 1956-7 weights was introduced in 1961.

³ During 1959 imports amounted to about 21 per cent and exports (excluding gold) to about 18 per cent of the national income.

or anticipating research in that direction, should concentrate on the following three series, as the other components of the system can be deduced from them.

1. Gross Domestic Product.
2. Gross Domestic Expenditure.
3. External Account.

The available basic data and problems connected with the construction of real figures for the above-mentioned series for South Africa will now be discussed.

1. GROSS DOMESTIC PRODUCT

It is recommended by the Statistical Commission that gross figures, i.e. before provision is made for the depreciation of capital goods, should be used in the calculation of Real Domestic Product. In South Africa, however, the official Domestic Product figures are given net of depreciation allowances, mainly because a large part of the basic information used for the calculations is currently only available in this form, e.g. the net profit figures in the case of manufacturing and trade and commerce. The official Domestic Product figures must, therefore, first of all be adjusted to a gross basis. The available depreciation figures for South Africa are calculated independently on the straight line method and need not be exactly equal to the amount actually provided in practice, as it is known that the Inland Revenue Department employs the declining-balance method for tax purposes. These figures can, therefore, not merely be added to the net figures in order to obtain the Gross Domestic Product.

The industrial classification of South Africa's Domestic Product does not conform in detail to the International Standard Industrial Classification of all Economic Activities (I.S.I.C.). Real figures based on the present classification will, therefore, tend to lose some of their value as a basis for comparing the importance and the rate of growth of the industrial classes in South Africa with that of other countries. Before undertaking the calculation of the Real Domestic Product according to industrial origin, a detailed reclassification of all economic activities as recommended in I.S.I.C. will, therefore, have to be made.

As the two above-mentioned problems are of prime importance for the calculation of Real Domestic Product, South

Africa is fortunate in that the calculation of the Gross Domestic Product from 1910 onwards, properly classified according to I.S.I.C., forms the subject of a doctoral thesis at one of our universities and is already far advanced.

Although the present industrial classification, which is given below, does not comply with that prescribed by I.S.I.C., the statistical material available and specific problems will be treated within the existing classification.

Class: (a) Agriculture, Forestry and Fishing.

(b) Mining.

(c) Manufacturing, Private.

(d) Trade and Commerce.

(e) Transportation.

(f) Catering.

(g) Professions.

(h) Finance (Banking, Insurance, etc.).

(i) Miscellaneous Business.

(j) Home Ownership.

(k) Public Authorities.

(l) Private Households.

(m) Aggregates of Persons.

(a) Agriculture, Forestry and Fishing

Under this heading are included all agricultural activities, including imputations for non-marketed produce and income from Bantu agriculture. Plottolders and the agricultural part of 'mixed' enterprises are also covered. It also includes the Agricultural Control Boards, Wool Levy Fund, S.A. Wool Board and all private forestry and fishing.

The calculation of the real value added in agriculture and forestry presents no big problem. The calculation of the gross value of agricultural production is based on output quantities and prices obtained from annual agricultural censuses. The derivation of gross output at constant prices is in these circumstances a relatively straightforward operation, requiring simply the revaluation of the available quantity data in the prices of a given base year. In the case of South Africa, a volume index of gross agricultural production is calculated by the Division of Economics and Markets of the Department of Agriculture and published regularly in their *Crops and Markets*.

This index can be used to extrapolate the value added in the

base year to arrive at the value added in agriculture in real terms. Although this method will give a good indication of the real value added, a constant ratio of inputs to outputs is assumed. In agriculture, however, technical and climatic factors tend to cause significant short-term changes in the above-mentioned ratio and the only solution seems to be the valuation of inputs at the prices of the base year or the construction of a quantity index of inputs. In South Africa the value only of inputs is available. This calls for the construction of a price index to deflate the value of inputs at current prices in order to arrive at the value of inputs at constant prices which can then be subtracted from the gross value of agricultural production at constant prices to yield real value added. For most of the inputs, such as fertilizers, seed, etc., prices are available and it should be possible to construct a fairly representative index.

A further problem that will have to be faced is the calculation of the real value added which originates, not from normal agricultural operations, but in the self-construction of capital assets, e.g., dams, furrows, outbuildings, etc. The only appropriate method would seem to be the deflation of this component by the price index deduced from the calculation of the value added, in real terms, in the construction industry.

The value added at constant prices by Agricultural Control Boards could be calculated by the construction of an index of the physical volume of produce handled during each period. Figures of the physical volume of fresh fish and crayfish caught during each season is published regularly in *Commerce and Industry*, and this data could be used for the calculation of real value added by the fishing industry.

(b) *Mining*

Under this heading are included all mining establishments and allied enterprises, e.g. The Rand Refinery Ltd., The Transvaal and Orange Free State Chamber of Mines and the labour-recruiting corporations.

Although mining is one of the most important industries in South Africa, and its contribution to the net Domestic Product amounts to approximately 13 per cent, an official volume of production index does not exist for this sector. Fortunately, an unofficial index of the volume of gross mineral production has been constructed in the S.A. Reserve Bank, which can be used in

calculating the value of mineral production at constant prices. This index should also give a fair indication of the value added in real terms, but again, a constant ratio of inputs to outputs is assumed. As this assumption can obviously not be justified in the case of the gold-mining industry, where costs are continually rising while the price of gold is relatively fixed for long periods, an attempt will have to be made in estimating the inputs at constant prices and to derive the value added in real terms by deducting inputs at constant prices from the output at constant prices. Again, South Africa is fortunate in having a complete list of quantities and values of materials used in the mining industry which is published in the *Annual Report of the Government Mining Engineer*. This list, however, does not distinguish between materials used for current production and those used for capital formation purposes. All items of a capital nature will therefore have to be eliminated from the list, and the remaining items revalued at base year prices. This task should not be too formidable.

A problem similar to that encountered in agriculture, presents itself in the case of the mining industry, namely, the value added in respect of the self-construction of capital assets, including the construction of shafts. The general practice in South Africa is that the construction of shafts is partly undertaken by the mining companies themselves and partly by outside contractors. The value added attributable to the construction of capital assets by the mines themselves forms part of value added by the mining industry, and this should also be revalued at base year prices. Little or no information is, however, available about this component of Domestic Product and the relevant information will have to be collected. Shaft development, expressed in terms of footage, might prove an adequate indicator, but research on this aspect is not yet completed. What has been said about shafts applies equally to other capital assets, e.g. buildings, dams, etc.

(c) *Private Manufacturing*

All private manufacturing and construction industries are included under this heading, as well as employers' organizations in these fields. Several public corporations are also included here.

Manufacturing and construction is by far the most important

industrial class in South Africa, with a contribution of approximately 25 per cent to the net Domestic Product. Although figures relating to the physical volume of industrial production are collected under the annual *Census of Industrial Establishments*, no complete and up-to-date index of the physical volume of industrial production is available. The responsibility for the construction of such an index rests with the Government department responsible for the collection of the basic data, viz. the Bureau of Census and Statistics, as the confidential nature of the data and certain requirements as to their secrecy exclude the possibility of research by private persons or organizations on this important subject.

Research by the Bureau is, however, far advanced and to date indices of the physical volume of gross and net output have been published in respect of fourteen major groups or classes of manufacturing industry, comprising not less than 122 individual industry indices. These indices were, however, only calculated for the period 1945-6 to 1953-4 as the, ' . . . return was fundamentally revised in 1954/55 and it was found impracticable to collect information regarding the materials used and quantities and cost of different articles manufactured. Plans are being devised for bringing the series up to date'.¹ The calculation of the real value added by private manufacturing and construction depends therefore largely on the completion of the indices for the other major industrial groups and the calculation of comparable indices for the period since 1953-4.

The best method of calculating the value added in real terms would be to calculate the gross value of production at constant prices and then to subtract from it total inputs at constant prices. As mentioned previously, volume indices of gross output are already available for fourteen major groups and indices for the other groups will be forthcoming within the near future. As it is unlikely that the calculation of inputs at constant prices will be considered at present, another method will have to be used.

The best alternative method would seem to be the utilization of the volume indices of net output. These indices ' . . . are obtained by "weighting" the gross volume indices of the different industry groups by means of figures which are proportional to

¹ Bureau of Census and Statistics: *Physical Volume of Production of the Food, Beverage and Tobacco Manufacturing Industries, 1945/46 to 1953/54*; Government Printer, Pretoria, 1959, p. 1.

the *net output* of the industries'.¹ In this respect, *net output* is defined as the difference between gross output and materials, including packing materials, and fuel used. This definition of net output differs somewhat from that used in national accounts mainly in respect of the following items:

- (i) Subsidies are omitted from the value of gross output.
- (ii) Amounts paid to other firms for work done are omitted from inputs.
- (iii) Overheads are not included in inputs.

It may be possible to allocate subsidies to the relevant industry classes to bring their value added in line with the value added by other classes, while the amounts paid to other firms for work done should in most cases not influence the weights used to any extent. As far as item (iii) is concerned, the official report states, '... it would be difficult to determine whether the *relative* net outputs of the different industries would be significantly affected. It is, indeed, questionable whether the tremendous amount of labour which these refinements would involve, would be justified.'²

In the construction of the volume indices of gross output, the Laspeyre's formula was used, but instead of revaluing the output of the different years at base year prices, the output of each year was revalued in the prices of the immediately preceding year. The index for any year on zero year as base is then obtained by chaining the consecutive links, e.g. $I_{03} = I_{01} \times I_{12} \times I_{23} \div (100)^2$. By using this method year-to-year changes in the ratio of value added to the volume of gross output is immediately reflected in the volume index of net output. This index should therefore give a very good indication of the real value added in private industry and construction.

(d) *Trade and Commerce*

This sector is made up of all establishments which handle goods physically as well as commercial agencies, auctioneers, etc., and chambers of commerce. As wholesale and retail trade accounts for approximately 95 per cent of the value added in this sector, attention will be given only to the problems attached to the calculation of their contribution in real terms.

¹ Ibid, p. 4.

² Ibid, p. 6.

Although this sector makes a large contribution to total Domestic Product, few value and volume figures relating to them are available. The most important source of information is the Censuses of Distribution, but only two of these censuses have been conducted in the post-war period, viz. for 1946-7 and for 1951-2. The results of sample surveys of retail trade are, however, available on an annual basis from 1951-2 to 1958-9 giving, in index form, data relating to sales, purchases, stocks, salaries, and wages, other expenses, total expenses and net trading profit. The only other data available are monthly indices of retail sales for eleven metropolitan areas and sales according to the twelve main kinds of retail business in these areas.

In calculating the real value added for this sector, wholesale and retail trade should be treated separately as more information relating to retail trade is available. The most appropriate method to calculate the real value added by retail trade with the available statistical material seems to be the deflation of the sales figures, collected under the annual survey, for the twelve main kinds of retail business, by appropriate price indices calculated from existing price data collected for the construction of the consumer price index. These series can then be used to extrapolate the value added in the base year for each kind of business to arrive at the value added, at constant prices, by the retail trade as a whole. Although this series should give a good indication of the value added at constant prices, two assumptions are made which may not necessarily be true, viz. that there is a constant ratio of value added to sales and that the services performed in distribution are of a constant quality. The first assumption may be justified in a period of equilibrium, but certainly not in a period of change-over from a sellers' to a buyers' market as has been experienced in South Africa since World War II. As far as the second assumption is concerned, the Statistical Commission states: 'The experience of many countries in the post-war period has indicated that in periods of disequilibrium, particularly when sellers' markets operate, substantial deterioration in distributive services is likely to occur'.¹

As very little information apart from that collected under the Censuses of Distribution is available for the wholesale trade, the only possible way of estimating the value added at

¹ *Op. cit.*, p. 95.

constant prices would at present seem to be the deflation of the value added at current prices by the official wholesale price index. This will give a very rough indication of the value added at constant prices, as it is doubtful whether at present this index gives a true reflection of the movement in wholesale prices in general. The two assumptions made in the case of the retail trade also apply *pari passu* to the wholesale trade.

(e) *Transport*

(1) *South African Railways and Harbours.* The value added by the South African Railways and Harbours Administration may be divided into four departments, viz. railways,¹ harbours, airways and steamships; the railways being by far the most important contributor, while the contribution of steamships may for all practical purposes be ignored.

The most feasible method for estimating the value added, at constant prices, by the different departments seems to be the extrapolation of the value added in the base year, by a physical volume index of services rendered. This calls for the construction of at least four volume indices pertaining to the activities of the four departments. The available statistical material may best be discussed separately for the different departments.

(i) *Railways. Passenger Transport.* Detailed annual statistics of passenger journeys are published in the annual Report of the General Manager of Railways and Harbours. Journeys are classified under first, second and third class, season tickets and special fares for the Bantu. Under each of these headings, the number of single, return and excursion journeys are given, properly classified in suburban and long-distance journeys with the revenue collected stated separately. With the aid of these statistics, a reliable physical volume index of passenger journeys can be constructed.

Goods Transport. Particulars of ton-miles of coal, livestock and other goods as well as free-hauled traffic are also published in the Reports of the General Manager. By using the revenue collected under each of these headings as weights, and making the necessary adjustments for free-hauled traffic, a physical volume index of all goods transported can be constructed.

The revenue derived from the above-mentioned types of transport accounts for approximately 90 per cent of the total

¹ Including road motor services.

revenue of the railways. If the physical volume figures in respect of parcel and mail transport are taken into consideration this percentage will increase to approximately 94 per cent. A physical volume index calculated from the above information should be sufficient for the extrapolation of the value added by the railways in the base year to arrive at the value added in the different years at base year prices.

(ii) *Harbours*. As regards harbours, a physical volume index of goods handled can be constructed from statistics relating to the weight of goods landed, shipped and transhipped, and this can in turn be employed in extrapolating the value added by harbours at constant prices.

(iii) *Airways*. Statistics relating to airways can again be subdivided into passenger, mail and freight traffic. For passenger traffic, passenger-miles further classified according to internal, regional and trunk journeys are available. Ton-miles, also classified into internal, regional and trunk flights, are available for mail and freight traffic. By using the gross revenue for each kind of traffic as weights, a physical volume index for extrapolation purposes can be constructed.

(iv) *Steamships*. Although the contribution by steamships to the total value added by the S.A.R. & H., is negligible, statistics relating to the total weight of goods transported, as well as the nautical miles covered, are available, and can be utilized in extrapolating its contribution to the total Domestic Product at constant prices.

The values arrived at by applying the above methods, should, on the whole, be a good approximation of the value added by the S.A.R. & H. in real terms.

(2) *Other Transport (Private)*. This item includes cartage contracting and private passenger transport services. Very little information is available about this item, while information relating to physical volume is non-existent. Two alternative methods are possible for evaluating its contribution to real Domestic Product, viz. the deflation of its value added by the official consumer price index or the assumption that its value added is subject to the same price movements as the value added by the Railways. The last-mentioned method seems to be more acceptable as changes in the consumer price index are influenced by factors which bear no relation to transport costs. On the other hand, it is quite reasonable to assume that prices and costs

in two competitive industries, in this case the Railways and private transport, will be closely related and their margin of profit will tend to show the same trend. By calculating the physical volume index for the activities of the Railways, and dividing it into the value added at current prices, the implicit price index is obtained. This index may then be used for the deflation of the value added at current prices by private transport, to arrive at the value added at constant prices.

(f) *Catering*

This item includes all licensed and unlicensed hotels, boarding-houses, restaurants, cafés, Bantu eating-houses, etc. The basic data was collected under the two Censuses of Distribution for the years 1946-7 and 1951-2, and no value or volume figures are available for the intervening years, nor for the period subsequent to the 1951-2 census.

As this item is relatively small, and no price or volume figures are available, deflation by that part of the consumer price index relating to food seems to be the only solution. The assumption made is that the ratio between the price of food and the value added at current prices remained the same, an assumption which may not hold over a period of years, but which should give a reasonable approximation to the true position.

(g) *Professions*

Included under this item are all private medical practitioners, dentists, actuaries, accountants and auditors, architects and quantity surveyors, advocates, attorneys, engineers, etc.

Although information of services provided by private professional persons are non-existent, certain indicators do, however, exist with the aid of which an estimate of their contribution in real terms may be made. The number of private medical and dental practitioners can be estimated from the total number registered minus the number employed by public authorities and private concerns, and this series can be used as an indication of the services actually rendered by the private medical and dental professions. The contribution of architects and quantity surveyors should be closely related to the value of building plans passed. The latter series (properly adjusted for price changes) may be utilized for this purpose. As an indication of the services rendered by advocates and attorneys, the number

of cases tried in the lower and high courts may be used in conjunction with some minor series, e.g. value index of property transferred and bonds registered. The number of accountants, auditors and actuaries is also available, while the contribution of private engineers, etc., should be negligible and may be assumed to show the same trends as the total of all the other professions combined.

(h) *Finance*

Finance is defined to include banking, insurance, building societies, trust companies, stockbrokers, investment companies, estate agents, etc. The South African Reserve Bank and the Land and Agricultural Bank of South Africa are also included here.

The following series may be used as indicators of the value added in real terms by the different types of financial institutions.

(i) *Banking*. The advances by the banking sector, deflated by a general price index, e.g. the wholesale or consumer price index, should give an indication of the services provided by the banks at constant prices. By allocating appropriate weights and deflating by a general price index, an index may, however, also be constructed from the advances by the banking sector on the one hand and bank debits on the other, which should perhaps give a better indication of the real value added.

(ii) *Building societies*. As in the case of the United Kingdom, the contribution of building societies may be estimated by deflating new advances on mortgage, the balances due on mortgage and total liabilities by a general price index, and allocating appropriate weights to the three components.

(iii) *Insurance*. For life insurance two indicators seem appropriate, viz. the total amount of cover provided and the life and annuity funds held, both deflated by an appropriate price index, e.g. the retail price index. Although arbitrary, the weights ascribed to the two components may be taken as equal. For all other types of insurance, premiums received less claims paid deflated by a general price index should give a fair indication of insurance services rendered at constant prices.

(iv) *Stockbrokers*. Stock exchange turnover, deflated by an appropriate price index, e.g. the index of share prices, should be a sufficiently reliable indication of services rendered at constant prices by stockbrokers.

(v) *Estate agents.* The value of property transferred, deflated by a general price index, should give a fair indication of their contribution to Domestic Product at constant prices.

(vi) *Trust companies and deposit receiving institutions.* The services rendered by this sector are closely related to the amount of savings administered. The total deposits held by these institutions deflated by a general price index should, therefore, be a good indicator of the services rendered at constant prices.

Although there is no measure of the physical volume of economic activity in this sector as a whole, the procedure set out above will yield a result accurate enough for all practical purposes.

(i) *Miscellaneous Business*

(i) *Central Government.* This item includes the departmentally administered organizations of Posts and Telegraphs, the S.A. Mint and the State Alluvial Diamond Diggings.

Posts and Telegraphs is by far the most important of the three departments and is responsible for about 90 per cent of the value added by this group. Physical volume figures, based on mail matter handled during one week of each year, are available under the following headings, viz. letters and postcards, newspapers, printed and commercial papers and parcels. Under each of these headings, the number of articles handled is further divided into inland mail and external mail received and external mail despatched. From these figures a physical volume index of mail matter handled by Posts and Telegraphs can easily be constructed. As far as telegrams and telephones are concerned, figures relating to the number of inland and international telegrams and the number of overseas telegrams are available, as well as the number of telephone calls, split up between local, trunk, and overseas. These figures can be utilized in the construction of a volume index of communication. After allocating appropriate weights, e.g. on the basis of revenue collected, a composite volume index of services rendered by Posts and Telegraphs at constant prices can be constructed.

Volume figures of diamonds produced by the State Alluvial Diamond Diggings are not published regularly, yet such figures, expressed in carats, are available at the Office of the Government Mining Engineer, and the value added in the base year can, therefore, be extrapolated with the use of this series.

The number of coins minted by the South African Mint can be deduced from particulars published annually in the *Report of the Controller and Auditor-General*, and this series can be utilized in extrapolating the Mint's contribution to Domestic Product at base year prices.

The value added at constant prices by the business undertakings of the Central Government should, therefore, be very reliable.

(ii) *Municipalities*. Hereunder are included the trading departments, viz. transportation, markets, abattoirs, the supply of electricity, gas and water, and the Kaffir beer section of the Bantu Administration Department.

Of the different trading departments, transportation, water and electricity are the most important. Volume figures relating to these three departments are published annually in the *South African Municipal Year Book*, viz. passengers carried and bus miles run for transportation, average daily consumption for water and number of units sold for electricity. A physical volume index based on these figures can therefore be constructed. The production of gas and Kaffir beer is only undertaken by a limited number of municipalities so that volume figures could be collected from them directly. As most slaughterings in South Africa take place in municipal abattoirs, the number of slaughterings as published in the *Annual Report of the Livestock and Meat Industries Control Board* can be regarded as an indicator of the services rendered, at constant prices, by municipal abattoirs. The slaughterings are classified according to the animals slaughtered, e.g. cattle, pigs, calves, etc. Volume and value figures of sales of vegetables and fruit on the eight principal markets are published regularly in *Crops and Markets*. As the sales on these eight principal markets account for approximately 80 per cent of sales in all municipal markets in South Africa, the volume figures can be used in estimating the value added at constant prices by municipal markets.

(iii) *Other public*. Under this heading are included the Electricity Supply Commission (Escom), the Rand Water Board, the Transvaal Mineral Bath Board of Trustees and several public corporations financed by Government loans, viz. the South African Broadcasting Corporation (SABC), Phosphate Development Corporation (Phoscor), and South African Coal, Oil and Gas Corporation (Sasol).

Indicators of the volume of services rendered by the different undertakings are in most cases readily available, e.g. for Escom the number of electric units generated, for the Rand Water Board the quantity of water supplied, for the SABC the number of radio listeners' licences and the number of hours during which programmes were broadcast. Figures relating to the number of visits to the baths under the control of the Transvaal Mineral Bath Board of Trustees could be derived by dividing total receipts by the average rate per person.

The volume of production by some public corporations, e.g. Sasol and Phoscor, will have to be calculated by the Industrial Census division of the Bureau of Census and Statistics as returns are filed with them under the annual *Census of Industrial Establishments*. If this procedure should not be feasible, it may be easier to transfer their value added from this item to private industry, as their net volume of production will, in the first instance, already have been included in the net volume of production of that sector as explained under Private Manufacturing.

The above-mentioned indicators should provide a fairly accurate indication of the value added in real terms by this group of enterprises.

(iv) *Private business, miscellaneous.* Services relating to the care of the person, health, education, amusement, entertainment, sport, etc., and also fixed property ownership by business concerns such as blocks of flats and apartment houses, are included here.

As a volume index for the services rendered by amusement and entertainment, the total amusement tax collections are available from which total expenditure on amusement and entertainment can be calculated. By deflating this total expenditure by a general index, e.g. the consumer price index, a volume index is derived which, in the absence of additional information, may also be used in respect of services relating to the care of the person, health, education, sport, etc. Value added through the ownership of fixed property by business concerns may be deflated by the index of house rent calculated and published by the Bureau of Census and Statistics.

(j) *Home Ownership*

This item includes all private houses, but excludes farm-houses and houses owned by public authorities and business

enterprises which are classified under the appropriate sector of the economy.

The value added at constant prices for this sector may be estimated by any one of the following two methods. An index of house rent, based on a rent census conducted annually in the eight principal South African cities by the Bureau of Census and Statistics is available, and this index may be used for deflating the value added at current prices to derive value added at constant prices. Alternatively, the number of houses enumerated in the various Population Censuses and supplemented by annual figures of houses completed may be used to extrapolate the value added in the base year to arrive at value added at base year prices for the other years.

(k) *Public Authorities*

(i) *Central Government and provincial administrations.*

a. *Salaries and wages.* It is very difficult to determine an appropriate unit of quantity of Government services and their corresponding base year valuations. No functional classification of Government expenditure exists yet in South Africa, which makes the valuation from the output side even more difficult.

The only practical method would therefore seem to be the construction of an index of the quantity of labour inputs. In the *Annual Report of the Public Service Commission*, particulars of the authorized establishment, number of temporary and permanent personnel employed against posts on the authorized establishment, and temporary personnel employed against posts additional to the authorized establishment are published as at the 31st December of each year. These particulars are given for eight broad groups, e.g. administrative, clerical, professional, etc., and weights will have to be applied to each group in order to construct a weighted index of labour inputs. As senior personnel are supposed to be more productive than juniors, weights may be assigned to the different groups in the ratio of the maximum salary in each group. This index may then be used to extrapolate the value added in the base year. This procedure, although far from ideal, should give a fairly good indication of value added in real terms.

b. *Other income.* This item consists mainly of imputed rent on Government buildings and can again be deflated by the index of house rents.

(ii) *Local authorities.* Volume figures relating to the services rendered by local authorities are non-existent. From the input side, the only information available is the number of persons employed, classified according to race and sex. The only solution therefore seems to be the construction of an employment input index by allocating weights to the different races, further subdivided into male and female. Weights may be applied according to the calculated average salary earned by each group in the base year. This index may then be used for extrapolation purposes.

The other income of local authorities is mainly accounted for by imputed rent, and this component can again be deflated by the index of house rent.

(iii) *Other (higher education).* Included here are universities, technical colleges and special schools, as well as certain research and other institutions, e.g. the Council for Scientific and Industrial Research.

The number of teachers and pupils in universities, technical colleges, vocational and other educational institutions, as well as for private schools, are available. By allocating weights (the United Kingdom used equal weights) to the number of pupils and the number of teachers, an index is derived which may be regarded as an index of services rendered at constant prices by the educational institutions. This can be used for extrapolating the value added in the base year.

Statistics relating to the Council for Scientific and Industrial Research, which is the biggest of the other institutions, are not published although particulars of their staff and salary structure could be obtained from them direct.

The other income component, viz. imputed rent, can be deflated by using the index of house rent.

(l) *Private Households*

This item covers only domestic servants in private households. Together with the annual survey of house rent, information has been collected of wages paid to domestic servants. To derive the value added at constant prices for this item, the value added at current prices could, therefore, be deflated by an index of the wages paid to domestic servants.

(m) *Non-Profit Societies, Clubs, etc. (Aggregates of Persons)*

Medical benefit societies, sports clubs, industrial councils,

trade unions, social welfare, religious and other non-profit institutions and societies as well as university and school hostels are included here.

The value added by all these different societies and clubs is so small that it would be impracticable to try to find an indicator for each one individually. Deflation by a general price index or even extrapolation by the increase in the population should suffice.

The total of all these figures of value added at constant prices would yield Real Gross Domestic Product at factor cost. Although this total in itself is very useful, a few adjusting entries are necessary to complete the income side of the accounts, viz.

- (i) Indirect taxes and subsidies.
- (ii) Net factor income payments from the rest of the world.
- (iii) The trading gain.

The first adjustment is necessary to make the transition from 'factor cost' to 'market prices', while the other two adjustments concern the transition from 'domestic' to 'national'.

(i) *Indirect taxes and subsidies.* Indirect taxes in South Africa consist mainly of three types, viz. customs, excise and property tax. The Statistical Commission recommends the following method of revaluing indirect taxes and subsidies. 'The revaluation of indirect taxes and subsidies presents few problems of method when the taxes or subsidies are applied to specific products of an industry. Thus a tax on cigarettes paid by the tobacco industry or a subsidy on wheat received by farmers may be converted to (base year) price series by regarding the tax or subsidy per unit of quantity as a "price".¹ This procedure is ideally suited for most of the excise duties, e.g. tax on petrol, tobacco, liquor, motor-cars, etc., and for subsidies, e.g. on wheat, which leaves us with rates, tax on fixed property and custom duties. It is further stated that '. . . Where the taxes and subsidies are not specific to particular products, for example, property taxes, it would be necessary to extrapolate the base year figures of tax or subsidy by a broader set of production indicators.'² The only feasible method of revaluing property tax at constant prices, would seem to be its extrapolation, at base year prices, by an

¹ Op. cit., p. 79.

² *ibid.*

index constructed from (i) the number of people falling under the jurisdiction of local authorities and (ii) the value added, at constant prices, by local authorities to Gross Domestic Product. It is evident that by using an indicator only indirectly associated with the actual tax, the real figures could be subject to a rather large margin of error.

In the case of customs duties, the only appropriate indicator would seem to be the volume index of imports, but even this would only give a very rough approximation to the actual custom duties at constant prices. Changes in the composition of imports, e.g. from items subject to a higher custom duty to items subject to a lower custom duty, will, however, not be reflected in the volume of imports. Weights might be allocated to the different items imported according to the tariff applicable to them and a volume index of custom duties thus calculated, yet it is doubtful whether the amount of work involved in such a calculation would be justified.

(ii) *Net factor income payments from the rest of the world.* This entry represents the net claim by foreign countries against the Domestic Production of a country resulting from the employment of foreign-owned factors of production. This flow of income payments cannot be broken down effectively into separate price and quantity components with the result that, according to the Statistical Commission, deflation of this item '... might be undertaken by computing the commodity equivalent of the income, rather than by attempting to qualify the flow in terms of factor inputs'.¹ Four basic situations are then distinguished, viz.

- a. An import surplus and a smaller positive net factor income payments flow from the rest of the world.
- b. An export surplus and a smaller negative net income flow.
- c. An import surplus and a negative net income flow.
- d. An export surplus and a positive net income flow.

In the post-war period the following actual situations presented themselves in the case of South Africa:

- (1) An import surplus with a negative net income flow.
- (2) An export surplus with a bigger negative net income flow.
- (3) An export surplus with a smaller negative net income flow.

¹ *Op. cit.*, p. 19.

On the recommendation of the Statistical Commission, it is proposed to treat the net income flows under the three different situations as follows:

- (1) An import surplus with a negative net income flow: In this case the negative net income flow should be regarded as an import substitute and accordingly deflated by the import price index.
- (2) An export surplus with a bigger negative net income flow: That part of the negative net income flow, that could be financed by the export surplus, should be deflated by the export price index, while the balance should be regarded as an import component and deflated by the import price index.
- (3) An export surplus with a smaller negative net income flow. As the whole negative net income flow can be financed with the export surplus, the export price index should be used for deflating this item.

The procedures described above are consistent with the principle of a system of accounts which balances in real terms. As import and export price indices are available,¹ the application of the above procedure is feasible in the case of South Africa.

(iii) *The trading gain*. This entry in the accounts measures the gain or loss resulting from changes, since the base year, in the volume of imports received in exchange for each unit of a country's exports. The gain or loss, which is relative to trading conditions in the base year, is measured in values of the base year to correspond with the general system of values adopted in the accounts.

In practice, it must be decided beforehand on the basis of what figure the trading gain or loss is going to be calculated. Three alternatives are available, viz. figures of actual exchange (the lower of the export or import figures), the higher of these two aggregates, or consistently in respect of the export aggregate. According to the Statistical Commission the adoption of the lower of the export and import figures would give the more conservative estimate, and would conform to the principles of a balancing system of accounts at constant prices.

It is proposed to adopt the procedure recommended, i.e. the

¹ Bureau of Census and Statistics: *External Trade Statistics: Indices of Volume and Unit Values and Terms of Trade; 1946 to 1958*, Government Printer, Pretoria, 1960.

deflation of the total *actually* exchanged. The calculation of the trading gain or loss would then amount to the deflation of the lower of the import or export figures, firstly by the import price index, and then by the export price index. The difference between these two figures would then be the required trading gain or loss that must be taken into account when deriving the Gross National Product at constant prices from the Gross Domestic Product at constant prices. As gold is one of South Africa's principal export commodities, the gold production should be regarded as an ordinary merchandise export for the purpose of calculating the trade gain or loss.

If the Gross Domestic Product at constant prices is adjusted with these three items, it would yield Real Gross National Product at market prices, and would thus give a clear picture of the product or income side of the accounts at constant prices.

Although the construction of a balancing system of Real National Accounts is the ultimate goal, the main interest, at present, is the calculation of the Real Domestic and National Income series, and a detailed account of the proposed methods of estimating these series have been given in the previous section. To complete the picture, a brief discussion of the other two components required for balancing the accounts will now be undertaken.

2. GROSS DOMESTIC EXPENDITURE

In many countries detailed information about the composition of Domestic Expenditure at current prices is available, and these data, rather than production and/or income figures have been utilized in some countries in estimating Real Domestic Product or Income. This method of obtaining Real National Income can, however, for several reasons, not be employed successfully in the case of South Africa at present. The main deficiency has been the lack of detailed information regarding the composition of the various expenditure items. No information about the composition of Personal Consumption Expenditure or purchases of goods and services by public authorities is available.¹

¹ The paper on Personal Consumption Expenditure, classified according to the recommendations of the United Nations, which has been prepared for this conference, should yield sufficient information for the calculation of Real Personal Consumption Expenditure for South Africa. The economic and functional reclassification of Government transactions forms the subject of a doctoral thesis at one of our universities, and this information should also be available in the near future.

Furthermore, particulars of Domestic Capital Formation are only available under three broad headings, viz. buildings and construction, machinery and equipment, and inventories. For the calculation of expenditure on Real Capital Formation, more detail regarding the nature of the capital assets is required.

Preliminary estimates of Real Capital Formation in South Africa have been made, by deflating fixed capital expenditure by two components of the wholesale price index, viz. metals and building materials, and inventories by the wholesale price index.¹ This method is, however, fairly crude and more research will have to be undertaken in this field.

When the above basic information has become available, it is proposed to estimate Domestic Expenditure at constant prices by the construction as far as possible of volume indices for the different components and by deflating, with appropriate price indices, where the construction of reliable volume indices is not possible. Data collected for the calculation of the official wholesale and consumer price indices could be used in the construction of price indices for the deflation of specific components of domestic expenditure.

3. EXTERNAL ACCOUNT

Attention has already been given to the calculation of the trading gain and the evaluation of net factor payments from the rest of the world in real terms. The other two components, viz. imports and exports of goods and services must, therefore, still be revalued at base year prices.

Volume indices² of imports and exports are available and may be used for extrapolating imports and exports in the base year. Certain adjustments will, however, have to be made to these indices. Firstly, gold bullion and specie were not taken into consideration in the construction of the index. As previously mentioned, however, gold constitutes one of the principal export commodities of South Africa, and should, for this purpose, be regarded as an ordinary merchandise export. The volume index of exports will therefore have to be adjusted to include gold.

¹ cf. J. J. D. Willers: *Kapitaalvorming en kapitaalbesit in die Unie 1910-1953* (Capital Formation and Wealth in the Union 1910-1953), University of Pretoria, 1955 (unpublished thesis).

² Bureau of Census and Statistics: *External Trade Statistics: Indices of Volume and Unit Values and Terms of Trade*; 1946 to 1958. Government Printer, Pretoria, 1960.

The second adjustment concerns the statistical territory covered by the relevant volume indices. Since the 1st January 1955 the external trade statistics of South West Africa were incorporated with those of South Africa. The volume indices before 1955 relate, therefore, to the territory excluding South West Africa, while the data from 1955 to date covers South Africa including South West Africa. As the National Account Statistics of South Africa relate to this enlarged territory, an adjustment will have to be made to the volume figures before 1955 to take the imports and exports of South West Africa into consideration.

CONCLUSION

Until very recently little work has been done on the calculation of Real National Accounts figures, yet from the foregoing it should be clear that the stage is now set for the calculation of fairly reliable Real Domestic Product and Real National Product series for South Africa. Although many additional problems will certainly crop up when the actual detailed calculations are undertaken, it is hoped that this survey of the basic material available in South Africa and of some of the main problems that might be expected will be of some use to research workers in this field.