QUARTERLY INTERPOLATION OF CONSTANT PRICE GROSS DOMESTIC PRODUCT OF NIGERIA–1963/64–1972/73

I. INTRODUCTION[1]

To some extent, an ever-increasing interest in the study of macro-economic relationships has created a need for not only improving the quality but also increasing the variety of statistics that should be generated for the economy. More often, the economist, in an attempt to explain certain economic behaviour in a macro setting examines the relationship between two or more variables such as income and investment or government spending, money supply and price level, etc. A serious problem in the explanation of such relationships or within-year changes in some of these variables is posed by the absence or inadequacy of relevant quantitative information for periods less than a year. In order to fill this gap with respect to national income statistics which sometimes forms the core of macro-economic analysis, this paper explores the possibility of estimating quarterly constant price Gross Domestic Product (GDP) of Nigeria from published annual figures.

Such statistics, apart from supplementing the published annual series, will aid further understanding of intra-year operation of the economy. Taken along with some other variables, they may unfold the net quantitative effects of economic policy measures. Since it may emphasize the direction (if not the magnitude) of the changes in the economy over time, the series should be valuable for monitoring developments in the monetary sector. Moreover it will facilitate economic analysis by minimizing the dualism between fiscal and calendar year data comparison.

This paper does not attempt to question the basic concepts of measurement of the National Product; rather it has employed statistical techniques to break-up annual into quarterly series. An effort is made to explore an alternative approach to the use of a single economic indicator (as is the practice in most empirical studies) to estimate GDP on a quarterly basis. A sectoral disaggregation of the Gross Domestic Product of Nigeria calls for a set of economic indicators (e.g., Index of Manufacturing Output, Government Expenditure, etc.) which are closely related to and/or may be used to explain periodic changes in sectoral activities. Such related quarterly data are used as interpolators to generate the desired GDP quarterly series. Although errors associated with the estimates are also calculated, they may not by themselves adequately indicate the degree of under or over-estimation. Their testing power in this respect appears to be crippled by various sources of error associated with the computation of the related series and those implicit errors in the GDP annual estimates. Thus an assessment of the series may be subjective and depend on the user's sensitivity to the intra-year movements demonstrated by the results.

[1]The author is highly indebted to colleagues in the Research Department for their useful suggestions on the earlier draft of the paper.

II. METHODOLOGY

The Quantity Theory postulates a linear relationship between money supply and National Product via the equation

$$MV = PY \quad \ldots\ldots (1)$$

where M and V stand for money supply (narrowly defined) and income velocity while P and Y represent price level and National Product respectively. This equation can further be resolved into

$$Y = kM = k(DD + COB) \quad \ldots\ldots (2)$$

where DD, COB and k are termed demand deposit, currency outside banks and a constant respectively. In other words, the growth in the Product could be made a function of the growth in money supply or even the growth in the share of the currency stock in the total money supply.[1]

In some studies, the share of the export sector in aggregate output is often employed to predict the short-term behaviour of national product.[2] Such a method assumes that the GDP is highly sensitive to the external sector. Similarly some other studies utilise the Index of Industrial Production to determine short-term changes in national product depending on the extent of industrialisation and also the degree of association observed between the two variables.[3] These short-cut approaches are warranted by the constraints which poor data pose to economic analysis. Moreover, adequate as these estimation techniques may seem, they yield results whose accuracies depend on the sensitivity of the single indicator employed to the over-all size of the Gross Domestic Product.

The current exercise which covers a period of ten years 1963/64–1972/73 makes use of disaggregated GDP by ten major contributory sectors viz. Agriculture, Mining and Quarrying, Manufacturing, Public Utilities, Building and Construction, Distribution, Transport and Communications, General Government, Education and Health, and Other Services.[4]

(A) The Related Series

The selection of the economic indicators used in this paper poses some difficulty considering the fact that properly recorded information is basically lacking in most socio-economic activities in Nigeria. An economic activity takes place with or without transaction and the contribution of

[1]T. E. Nwade, 'Converting Nigeria's Annual GDP into quarterly series' C. B. N. unpublished paper.

[2]Ibi Ajayi, S and Teriba, O. 'The Inflationary Processes in Nigeria 1960-1972–Evidence from Quarterly Data' unpublished paper.

[3]Ginsburgh, V. A. "A further Note on the Derivation of Quarterly Figures consistent with Annual Data" *Applied Statistics* Vol. 22, No. 3, 368-373.

[4]See Tables I and II.

each activity is measured through the elements responsible for the creation of value. But in situations where productive activity takes place without market transaction, imputation of transactions becomes unavoidable. To the extent that the size of this imputation is large, the Nigerian experience in National Accounting has demonstrated the mutual dependence of the three traditional approaches–'Income,' 'Expenditure' and 'Output'. Consequently, care is exercised in choosing economic indicators/related series within the limits of national accounting practice such that they also satisfy the criteria of availability, relevance and association.[1] These indicators are thus selected whose between-year movements are closely associated with corresponding GDP components and whose within-year movements may equally be similar. Where the related series is available monthly, data re-arrangement is done in quarters to facilitate comparison on fiscal year basis. Also, value series are in certain cases expressed in relative terms in order to eliminate price effects. The economic series so selected are of two categories. Some indicators are available systematically over the reference period while others are partially relevant to the period in review.

Because of the nature of the crops cultivated and the pricing and marketing arrangements, the agricultural sector can be sub-sectorised into subsistence and commercial agriculture. Data on agricultural output is generally lacking but since subsistence agriculture is not as organised as the commercial counterpart, estimates of aggregate agricultural output are not available on monthly/quarterly basis. However, it is considered that estimated producer incomes from major controlled commodities like cocoa, palm produce, groundnut and benniseed could to some extent be indicative of the contribution of agriculture to the Gross Domestic Product.

In order to ensure that the seasonal pattern of income accruing to farmers from cash crops is not altogether different from overall income from agriculture, a further exercise has been conducted to cover the production of some food crops like yam, maize, beans, rice, cassava and soghum. With due regard to varying planting and harvesting periods of these crops, expected farmers' income reveals heavy returns between the third and fourth quarters of the fiscal year. Incidentally, this coincides with the harvesting periods for most crops. Thus producer incomes from both food and cash crops tend to possess similar seasonal characteristics although reliable data is available only in respect of controlled commodities. Alternatively, because of the relatively large contribution of agriculture to total Gross Domestic Product and consequently its tendency to dominate the observed seasonal pattern in the overall quarterly estimates, a second calculation is made for the agricultural sub-sector whereby it is treated as a residual of all the sector.[2] Similarly, export earnings from forest products such as timber sawn, timber logs, plywood and veneers are pooled on a quarterly basis to estimate the forestry component. The residual in this sector, made up of 'livestock' and 'fishing' activities, is interpolated by published livestock data.

The three components of the Index of Industrial Production have been employed in estimating the quarterly shares of Mining and Quarrying, Manufacturing and Public Utilities, although the series were non-existent prior to 1966. In order to bridge this gap some other available statistics such as direct labour input in the mining sector, commercial/industrial energy consumed by the manufacturing sector and total electricity generated by the power authorities have been substituted as suitable proxies in the respective sectors.

The study also made use of statistics of government finance to estimate the quarterly contributions of three other sectors–General Administration, Health and Education. Since the government component in the latter sectors is sizable, it is assumed that the recurrent expenditure of the Federal and State governments, as the estimator, could account for the three sectors. This is preferred to total expenditure (recurrent and capital) not only because of higher correlation co-efficient with the corresponding GDP component but also because of the lag that exists between the approval and disbursement of capital expenditure, the execution of projects and hence achievement of actual development goals. In that sense, government recurrent expenditure is considered to have a more systematic impact on short-term GDP estimates than the level of aggregate expenditure.

However, the task of constructing a proxy variable arises where a suitable interpolator is unavailable. This is the case with both distribution and construction industries where there is no published index of distributive trade or reliable information on construction activity. In place of a construction index, total cement consumption as an input of building and civil engineering works has been regarded as a related series with which to interpolate the sector's contribution to the Domestic Product. Thus cement consumption is approximated as the sum of imports and domestic production. Similarly, data inadequacy in Distribution is treated by pooling the published supply indices of some selected items of distributive trade like cement, paints, footwear, aerated waters, beer, soft drinks, etc. on a quarterly basis with import indices of food, drinks and tobacco to obtain a series which describes the trend in the sector's activity. By summing the derived quarterly estimates of the service sectors excluding 'Other Services', a related series so formed becomes the interpolator of 'Other Services' regarded as the overall error term.

(B) Estimation Procedure

Ordinarily, when available quarterly figures of one variable are used to estimate the unknown quarterly levels of another variable, a regression equation is formed between the annual values of the two variables. The coefficient so derived is used as a multiplier of the known quarterly quantities to obtain the unknown estimates. This technique called 'regression estimator' and another variant 'difference estimator' rely on an observed/assumed relationship between the two variables averaged for all the units over the entire period. Alternatively, the multiple regression estimator could be employed to establish the relationship between total GDP and

[1] See Table III.

[2] Table V shows the results of alternative estimate in parenthesis. These are equally reflected in the totals.

its disaggregated components. Such a regression model is most valuable in determining the influence of each sectoral activity on the aggregate GDP and in forecasting its probable future values. But the general defect of this approach is the poor fit (i.e., low value of determination coefficient, R^2) of the multiple regression, particularly when as many as eleven variables are being considered simultaneously.[1] On the other hand, the 'ratio estimator' in a problem of this nature tends to yield more accurate estimates which reflect to a greater degree intra-year as well as inter-year fluctuations.[2]

Broadly, the method of estimation for each subsector involves:[3]

(i) a preliminary GDP quarterly approximation;
(ii) derivation of deviations from the trend values of the GDP quarterly approximations via the deviation from the trend of the related series (i.e., by making the former a function of the later);
(iii) using the result in (ii) to improve the quarterly approximations, which amounts to superimposition of the trend values of the related series on GDP quarterly estimates; and
(iv) adjustment of the estimates consistent with known annual figures.

For linear interpolation of a series over a relatively unstable period such as 1963/74-1972/73, the data may be transformed in order to achieve overall the two objectives of unbiasedness and minimum variance. Such a transformation, logarithmic in this case, also ensures that emphasis is placed on not absolute but relative movements.

A first approximation is obtained via ratio estimation technique. Quarterly values of the interpolator are multiplied by a constant, the ratio of quarterly average of GDP to that of the related series, obtained year by year, i.e.

$$X'_{ij} = \frac{L\bar{x}_j}{L\bar{y}_j} \cdot Ly_{ij} \quad \ldots\ldots\ldots\ldots (3)$$

Where X'_{ij} = first GDP approximation for the ith quarter of the jth year.

$L\bar{x}_j$ = the logarithim of GDP quarterly average for the jth year.

$L\bar{y}_j$ = the logarithm of quarterly average of the related series for the jth year.

Ly_{ij} = the logarithm of the related series for the ith quarter of the jth year.

These preliminary estimates are preserved in logarithmic form to ensure log-linearity of the series and make deviation from the trend values of the two series homogenous.[4]

[1]This was the experience of Arnold C. Herberger in his essay 'The Dynamics of Inflation in Chile' published in the collection; *Measurement in Economics* edited by Christ, C. F. et al.

[2]For an exposition of this estimator, reference could be made to detailed accounts given by Raj. D. *Sampling Theory* Chapter 5, and Cochran, W. G. *Sampling Techniques* Chapter 6 & 7.

[3]This method is extensively discussed in Friedman, M: The Interpolation of Time Series by Related Series, *Journal of American Statistical Association*, 57, 729-757.

[4]The calculation is demonstrated in Table IV.

The second step is to obtain the trend values of both the GDP quarterly approximations and the related indicator. Each statistical series is regressed over time to yield linear trend values:

$$X'_t = a + bt \quad \ldots\ldots\ldots\ldots (4)$$

$$L_{Y_t} = a + bt \quad \ldots\ldots\ldots\ldots (5)$$

where X'_t = GDP quarterly approximations at time t

L_{Y_t} = Quarterly series of the related indicator at time t.

Deviations from the trend values are further defined as

$$u_{ij} = X'_{ij} - T_X \quad \ldots\ldots\ldots\ldots (6)$$

$$v_{ij} = L_{Y_{ij}} - T_Y \quad \ldots\ldots\ldots\ldots (7)$$

where X'_{ij} and $L_{Y_{ij}}$ are variables defined in equation (3) and T_X and T_Y are the respective trend values as defined in equations (4) and (5) above.

Since the aim is to use the known deviations from the trend values of the related indicator to improve the GDP quarterly approximations, a linear relationship is thus developed between the two sets of deviations.

$$U'_{ij} = a + bv_{ij} + \varepsilon \quad \ldots\ldots\ldots\ldots (8)$$

where U'_{ij} and V_{ij} are both the estimated and estimator respectively, and the optimum value of b which minimizes the error of the estimate is $\tau_{uv} \frac{\sigma_u}{\sigma_v}$.

The next task is that of transferring the deviations from the trend of the related series on to the GDP quarterly approximations. If in place of u_{ij} in equation (6) above, U'_{ij} of (8) is substituted into that relationship, we obtain

$$U'_{ij} = X_{ij} - T_{X'} \quad \ldots\ldots\ldots\ldots (9)$$

from where it follows that an improved estimate X^*_{ij} is the sum of U'_{ij} and $T_{X'}$

for the purpose of consistency, the quarterly estimates need some adjustment to correspond with published annual totals. With the series expressed in logarithmic form, the quantity $\sum_{i=2}^{4N} \left(X_i^* - L_{Y_i}\right)^2$ has been minimised under N (= 10) constraints such that the annual total for the jth year is exactly the sum of the four corresponding quarters, i.e.

$$X_j^{**} = \sum_{k=4j-3}^{4j} X^*_k; (j = 1, 2, \ldots . N)^1 \quad \ldots\ldots\ldots (10)$$

The adjusted totals for sub-sectors are grossed up to sectoral and hence overall GDP totals.[2]

III. EVALUATION OF THE ESTIMATES

As shown above, the ratio estimator generated the quarterly figures vis the relationship $X_R = YR$. Therefore the variance of the estimate $X_R = Y^2$ Var (R) which may be expanded thus:

[1]This method is suggested by V. A. Ginsburgh *ibid* 371.

[2]See Table V.

$$\text{Var}(X_R) = Y^2 E(X - RY)^2 \quad \ldots\ldots\ldots\ldots\ldots\ldots (11)$$

$$= \frac{N}{N(N-1)} \left(\text{var}(X) + R^2 \text{var}(Y) - 2R \text{ Cov}(X,Y) \right)$$

This value, computed for sub-sectors and sectors, demonstrates the accuracy and hence the reliability of the estimates. But no matter the size of these individual errors, some consistency with known facts could be sought to explain the behaviour of the series. Therefore, the quantitative appraisal of the estimates may tend to satisfy theoretical expectations much more than it can defend qualitative interpretation of the results.

The limitations of the estimates are many and the user should address himself to the extent to which they may affect the result of his empirical study. Firstly, for some components of the GDP, suitable economic indicators cannot be found to interpolate and as such these are treated as residuals. These activities include Livestock and Fishing (in Agriculture), Communications, 'Others' (in Education and Health) and Other Services. The pattern of seasonality of their major components (within which they are treated as residuals) has been superimposed on these series. Secondly, there are smaller components such as Crafts (in Manufacturing), Water Supply (in public Utilities) and Marketing Boards (in Distribution) which form small proportions of GDP sectoral aggregates. Their contribution is so small that they are considered less likely to alter, to a large extent, the intra-year behaviour of the major activities with which they were combined.

Thirdly, although serious efforts is involved in constructing indicators on quarterly basis where none existed, the choice in each case cannot claim to have achieved optimum results. Examples of such exercises are Agriculture and Distribution in which incomes from and supply of certain commodities are respectively considered appropriate. Although relative changes in structure may not be seriously affected, the availability of a Distribution Index could yield a better estimate of quarterly output in distributive trade. On the other hand, an index of agricultural output covering food and cash crops is the ideal economic indicator to monitor the quarterly share of agricultural sector in total GDP. The operations of the Marketing Board (now called Commodity Boards) are export-oriented. Unfortunately, their commodity purchases in recent years no longer adequately represent total production because of the increasingly sizeable demand for agricultural raw material inputs by local processing industries as well as leakages through smuggling activities. Therefore, the alternative calculation for the agricultural sector and hence the resulting GDP aggregate tend to be more plausible.

Finally, the related series as well as the annual GDP estimates are fraught with errors calculable and otherwise either through conceptual or operational problems. In spite of these and other shortcomings, there is no reason to dismiss altogether the seasonality of some of the activities under consideration. For example, high returns from agriculture seem to coincide with harvesting of the major crops which fall within the period August-November, assuming an even distribution of returns from other round-the-year crops. So also can we observe the bustling activities of wholesale and retail distribution coinciding with festive seasons that characterise the third and fourth quarters of the fiscal year. Moreover, the recurrent expenditure of the government reaches its peak in the last quarter of the fiscal year probably out of the urge to settle all outstanding claims and payments for services rendered before the beginning of another financial year. These sectoral aggregates–Government, Agriculture and Distribution (to which Transport also plays a complementary role)–account for a range of 52% to 65% of the total Gross Domestic Product, and they are likely to influence (if not dictate) the observed seasonality in the derived quarterly estimates.

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TABLE I

GROSS DOMESTIC PRODUCT AT 1962–1963 FACTOR COST (1963/64–1972/73) (₦ million)

Industry	1963/64	1964/65	1965/66	1966/67	1967/68*	1968/69*	1969/70*	1970/71	1971/72	1972/73
1. AGRICULTURE, FORESTRY, FISHING	1,737.8	1,731.4	1,742.2	1,581.8	1,358.0	1,338.0	1,530.5	1,887.7	1,985.2	1,861.1
1.1 Agriculture	1,402.2	1,367.2	1,366.2	1,196.6	1,054.2	1,034.4	1,212.0	1,437.0	1,518.8	1,374.7
1.2 Livestock	148.6	161.2	158.0	154.2	129.0	129.0	133.4	143.8	142.4	149.8
1.3 Forestry	142.6	136.2	143.4	135.8	68.0	68.0	75.5	129.2	130.3	125.5
1.4 Fishing	44.4	66.8	74.6	95.2	106.8	106.6	109.6	177.7	193.7	211.1
2. MINING AND QUARRYING	58.8	79.6	149.8	210.4	163.8	85.0	261.3	501.5	704.3	834.2
2.1 Oil	32.8	51.8	116.8	179.2	137.0	61.0	232.0	465.6	657.2	777.6
2.2 Metalliferous ores	10.0	10.4	10.8	10.6	10.4	10.4	9.6	8.6	7.9	7.3
2.3 Coal	1.8	2.4	2.8	1.6	0.2	0.0	0.0	0.2	0.7	1.0
2.4 Quarrying	14.2	15.0	19.4	19.0	16.2	13.6	19.7	27.1	38.5	48.3
3. MANUFACTURING AND CRAFTS	170.0	181.0	221.0	221.6	190.0	200.4	263.4	317.6	307.7	381.1
3.1 Manufacturing	129.6	140.2	179.8	180.0	159.4	169.4	232.0	274.4	264.1	337.1
3.2 Crafts	40.4	40.8	41.2	41.6	30.6	31.0	31.4	43.2	43.6	44.0
4. ELECTRICITY AND WATER SUPPLY	13.6	15.6	18.2	20.0	15.0	17.4	20.8	24.0	28.9	34.3
4.1 Electricity	12.2	14.0	16.0	17.4	13.6	15.2	17.8	20.0	25.3	30.7
4.2 Water Supply	1.4	1.6	2.2	2.6	1.4	2.2	3.0	4.0	3.6	3.6
5. BUILDING AND CONSTRUCTION	118.4	128.0	162.2	160.2	135.8	117.0	167.6	221.0	312.0	384.5
6. DISTRIBUTION	361.8	398.2	418.4	389.8	333.0	332.2	411.6	512.9	544.5	529.7
6.1 Marketing boards	13.0	9.0	11.0	9.4	26.4	35.2	25.8	3.2	4.6	4.6
6.2 Other distribution	348.8	389.2	407.4	380.4	306.6	297.0	385.8	509.7	539.9	525.1
7. TRANSPORT AND COMMUNICATION	131.0	149.2	146.2	142.0	113.4	125.6	127.6	137.9	168.0	206.6
7.1 Transport	117.4	133.2	127.6	123.0	100.8	112.0	114.0	123.5	150.0	186.8
7.1.1 Road transport	70.0	89.6	82.6	85.6	67.8	72.0	72.0	73.0	100.5	133.6
7.1.2 Railway	26.6	21.0	21.2	17.2	16.6	18.6	17.2	17.4	13.8	15.3
7.1.3 Harbours	13.6	15.2	15.8	14.4	12.8	14.4	17.2	24.2	27.6	28.4
7.1.4 Water transport	3.8	3.4	3.4	1.4	1.4	3.0	2.4	2.7	3.1	3.1
(a) Inland	2.0	1.4	1.6	0.4	0.2	0.4	0.4	0.4	0.4	0.4
(b) Overseas	1.8	2.0	1.8	1.0	1.2	2.6	2.0	2.3	2.7	2.7
7.1.5 Air transport	3.4	4.0	4.6	4.4	2.2	4.0	5.2	6.2	5.0	6.4
7.2 Communication	13.6	16.0	18.6	19.0	12.6	13.6	13.6	14.4	18.0	19.8
7.2.1 Post and telegraphs	11.4	13.4	15.4	15.6	9.0	9.4	9.6	10.8	13.8	13.0
7.2.2 Broadcasting	2.2	2.6	3.2	3.4	3.6	4.2	4.0	3.6	4.2	4.8
8. GENERAL ADMINISTRATION	77.8	89.6	96.8	99.2	84.6	139.0	258.1	327.6	338.8	303.8
9. EDUCATION	82.8	93.4	97.0	110.8	89.8	91.8	72.1	133.1	153.1	156.2
9.1 Government	13.0	14.2	16.8	21.8	19.2	15.2	18.3	59.6	66.9	81.8
9.2 Missions and private	63.4	69.2	67.4	74.0	58.2	60.6	35.2	48.0	50.8	35.6
9.3 Universities	5.2	8.2	10.2	11.4	9.2	12.0	13.8	18.8	26.5	28.9
9.4 Others	1.2	1.8	2.6	3.6	3.2	4.0	4.8	6.7	8.9	9.9
10. HEALTH	17.8	20.2	22.6	26.2	20.0	19.0	23.1	39.5	40.8	50.8
10.1 Government	12.8	14.4	16.2	18.8	14.2	13.6	16.5	28.2	29.1	36.3
10.2 Mission and private	5.0	5.8	6.4	7.4	5.8	5.4	6.6	11.3	11.7	14.5
11. OTHER SERVICES	55.8	61.4	72.4	82.8	68.8	78.4	89.4	116.2	132.2	150.5
TOTAL	2,825.6	2,947.6	3,146.8	3,044.8	2,572.2	2,543.8	3,225.5	4,219.0	4,715.5	4,892.8

NOTE: *The three Eastern States are not included in the estimate. *Source*: Federal Office of Statistics.

TABLE II

GROSS DOMESTIC PRODUCT AT 1962-1963 FACTOR COST—PERCENTAGE DISTRIBUTION

Industry	1963/64	1964/65	1965/66	1966/67	1967/68*	1968/69*	1969/70*	1970/71	1971/72	1972/73
1. AGRICULTURE, FORESTRY, FISHING	61.50	58.67	55.37	51.88	52.69	52.59	47.45	44.74	42.10	38.04
1.1 Agriculture	49.62	46.34	43.42	39.25	40.90	40.66	37.58	34.06	32.21	28.10
1.2 Livestock	5.26	5.46	5.02	5.06	5.01	5.07	4.13	3.41	3.02	3.06
1.3 Forestry	5.05	4.61	4.56	4.45	2.64	2.67	2.34	3.06	2.76	2.57
1.4 Fishing	1.57	2.26	2.37	3.12	4.14	4.19	3.40	4.21	4.11	4.31
2. MINING AND QUARRYING	2.08	2.70	4.76	6.90	6.36	3.34	8.10	11.89	14.94	17.05
2.1 Oil	1.16	1.76	3.71	5.88	5.32	2.40	7.19	11.04	13.94	15.89
2.2 Metalliferous ores	0.36	0.35	0.34	0.35	0.40	0.41	0.30	0.20	0.17	0.15
2.3 Coal	0.06	0.08	0.09	0.05	0.01	0.00	0.00	0.01	0.01	0.02
2.4 Quarrying	0.50	0.51	0.62	0.62	0.63	0.53	0.61	0.64	0.82	0.99
3. MANUFACTURING AND CRAFTS	6.02	6.13	7.02	7.36	7.35	7.88	8.17	7.53	6.52	7.79
3.1 Manufacturing	4.59	4.75	4.71	6.00	6.16	6.66	7.19	6.51	5.60	6.89
3.2 Crafts	1.43	1.38	1.31	1.36	1.19	1.22	0.98	1.02	0.92	0.90
4. ELECTRICITY AND WATER SUPPLY	0.48	0.52	0.58	0.66	0.58	0.69	0.64	0.57	0.61	0.70
4.1 Electricity	0.43	0.47	0.51	0.57	0.53	0.60	0.55	0.47	0.54	0.63
4.2 Water supply	0.05	0.05	0.07	0.09	0.05	0.09	0.09	0.10	0.07	0.07
5. BUILDING AND CONSTRUCTION	4.19	4.34	5.15	5.25	5.27	4.60	5.20	5.24	6.62	7.86
6. DISTRIBUTION	12.80	13.50	13.30	12.79	12.92	13.06	12.76	12.16	11.55	10.83
6.1 Marketing boards	0.46	0.31	0.35	0.31	1.02	1.38	0.80	0.08	0.10	0.10
6.2 Other distribution	12.34	13.19	12.95	12.48	11.90	11.68	11.96	12.08	11.45	10.73
7. TRANSPORT AND COMMUNICATION	4.64	5.07	4.64	4.65	4.40	4.94	3.95	3.27	3.56	4.22
7.1 Transport	4.16	4.54	4.05	4.03	3.91	4.41	3.53	2.93	3.18	3.82
7.1.1 Road transport	2.48	3.04	2.62	2.81	2.63	2.83	2.24	1.73	2.13	2.73
7.1.2 Railway	0.94	0.71	0.67	0.56	0.64	0.73	0.53	0.41	0.29	0.31
7.1.3 Harbours	0.49	0.52	0.50	0.47	0.50	0.57	0.53	0.58	0.58	0.58
7.1.4 Water transport	0.13	0.12	0.11	0.05	0.05	0.12	0.07	0.06	0.07	0.06
(a) Inland	0.07	0.05	0.05	0.01	0.01	0.02	0.01	0.01	0.01	0.01
(b) Overseas	0.06	0.07	0.06	0.04	0.04	0.10	0.06	0.05	0.06	0.05
7.1.5 Air transport	0.12	0.14	0.15	0.14	0.09	0.16	0.16	0.15	0.11	0.14
7.2 Communication	0.48	0.54	0.59	0.62	0.49	0.53	0.42	0.34	0.38	0.40
7.2.1 Posts and telegraphs	0.40	0.45	0.49	0.51	0.35	0.37	0.30	0.26	0.29	0.30
7.2.2 Broadcasting	0.08	0.09	0.10	0.11	0.14	0.16	0.12	0.08	0.09	0.10
8. GENERAL ADMINISTRATION	2.75	3.04	3.08	3.35	3.57	5.46	8.00	7.76	7.18	6.21
9. EDUCATION	2.93	3.17	3.08	3.62	3.47	3.61	2.24	3.15	3.25	3.19
9.1 Government	0.46	0.48	0.53	0.70	0.73	0.60	0.57	1.41	1.42	1.67
9.2 Missions and private	2.25	2.35	2.14	2.43	2.26	2.38	1.09	1.14	1.08	0.73
9.3 Universities	0.18	0.28	0.33	0.37	0.36	0.47	0.43	0.44	0.56	0.59
9.4 Others	0.04	0.06	0.08	0.12	0.12	0.16	0.15	0.16	0.19	0.20
10. HEALTH	0.63	0.69	0.72	0.82	0.72	0.75	0.72	0.94	0.87	1.04
10.1 Government	0.45	0.49	0.52	0.58	0.51	0.53	0.51	0.67	0.62	0.74
10.2 Missions and private	0.18	0.20	0.20	0.24	0.21	0.22	0.21	0.27	0.25	0.30
11. OTHER SERVICES	1.98	2.17	2.30	2.72	2.67	3.08	2.77	2.75	2.80	3.07
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

NOTE: *The three eastern states are not included in the estimates.
Source: Federal Office of Statistics, Lagos.

TABLE III

INTERPOLATOR AND THE ESTIMATE

GDP Component (X)	Related Series (Y) (Interpolator)	Correlation Coefficient Between GDP and Related Series	Observed Ratio Between Both R_{XY}	Standard Error of the GDP Estimate	Estimated Deviation About the Trend $u' = bv$
1. Agriculture	Producer incomes from major controlled commodities	0.53	1.2854	2:2347	1.5950v
2. Forestry	Forest earnings	0.60	0.4225	1.1060	0.6869v
3. Mining and quarrying	Index of mineral output	0.71	0.7971	1.9907	0.8376v
4. Manufacturing	Index of manufacturing production	0.85	0.8433	1.0730	0.9925v
5. Public utilities	Utility index (electricity)	0.81	0.3549	0.3172	0.2795v
6. Building and construction	Cement supply	0.59	0.6747	1.4061	0.6612v
7. Distribution	Index of domestic trade	0.76	0.9441	2.7391	0.8308v
8. Road transport	Vehicle registration (commercial)	0.92	0.3525	1.9302	0.1565v
9. Rail transport	Railway traffic receipts	0.92	1.3246	0.3711	1.1667v
10. Water transport	Total cargo handled	0.48	0.4902	0.5206	0.2805v
11. Air transport	Air freight	0.79	0.3434	0.0361	0.7813v
12. General administration	Government current expenditure	0.96	0.8885	2.5803	0.6843v
13. Education and health (government)	Government current expenditure	0.99	0.6480	0.4694	0.7192v

TABLE IV

QUARTERLY ESTIMATES OF FORESTRY COMPONENT OF GDP 1963/64–1972/73

PERIOD		GDP (Forestry) $L\bar{x}$	Forest Earnings L_Y	$L\bar{y}$	$L\bar{x}$ LY $L\bar{y}$ (X')	$T_{X'}$	T_Y	X'-$T_{X'}$ (u)	Y-T_Y (v)	U'	U'+$T_{X'}$ (X*)	Antilog X* GDP Estimate	Adjusted Estimate
1963/64	1	1.5520	3.6586	3.6312	1.5637	1.4862	3.6220	0.0775	0.0366	0.0251	1.5113	32.45	36.60
	2		3.5759		1.5284	1.4838	3.6108	0.0446	-0.0349	-0.0240	1.4598	28.82	32.50
	3		3.5273		1.5076	1.4813	3.5995	0.0263	-0.0722	-0.0496	1.4317	27.02	30.47
	4		3.7380		1.5976	1.4788	3.5883	0.1188	0.1497	0.1028	1.5816	38.16	43.03
1964/65	1	1.5321	3.6700	3.6195	1.5535	1.4764	3.5770	0.0771	0.0930	0.0639	1.5403	34.69	36.26
	2		3.5424		1.4995	1.4739	3.5658	0.0256	-0.0234	-0.0161	1.4578	28.69	29.99
	3		3.6094		1.5278	1.4714	3.5546	0.0564	0.0548	0.0376	1.5090	32.28	33.75
	4		3.6460		1.5433	1.4690	3.5433	0.0743	0.1027	0.0705	1.5395	34.63	36.20
1965/66	1	1.5545	3.5818	3.5589	1.5645	1.4665	3.5321	0.0980	0.0497	0.0341	1.5006	31.66	36.53
	2		3.5289		1.5414	1.4641	3.5208	0.0773	0.0081	0.0056	1.4697	29.49	34.02
	3		3.5245		1.5395	1.4616	3.5096	0.0779	0.0149	0.0102	1.4718	29.63	34.18
	4		3.5948		1.5702	1.4591	3.4984	0.1111	0.0964	0.0662	1.5253	33.52	38.67
1966/67	1	1.5308	3.5652	3.4995	1.5595	1.4567	3.4871	0.1028	0.0781	0.0536	1.5103	32.38	37.07
	2		3.4903		1.5268	1.4542	3.4759	0.0726	0.0144	0.0099	1.4641	29.12	33.33
	3		3.4527		1.5103	1.4517	3.4646	0.0586	-0.0119	-0.0082	1.4435	27.76	31.78
	4		3.4820		1.5231	1.4493	3.4534	0.0738	0.0286	0.0196	1.4679	29.37	33.62
1967/68	1	1.2304	3.5424	3.2720	1.3321	1.4468	3.4421	-0.1149	0.1003	0.0689	1.5157	32.78	26.62
	2		3.1875		1.1986	1.4443	3.4309	-0.2457	-0.2434	-0.1672	1.2771	18.92	15.37
	3		2.7634		1.0391	1.4419	3.4197	-0.4028	-0.6563	-0.4508	0.9911	9.80	7.96
	4		3.2737		1.2310	1.4394	3.4084	-0.2084	-0.1347	-0.0925	1.3469	22.23	18.05
1968/69	1	1.2304	3.3526	3.3795	1.2206	1.4369	3.3972	-0.2163	-0.0446	-0.0306	1.4063	25.49	16.01
	2		3.3722		1.2277	1.4345	3.3859	-0.2068	-0.0137	-0.0094	1.4251	26.62	16.72
	3		3.3181		1.2080	1.4320	3.3747	-0.2240	-0.0566	-0.0389	1.3931	24.73	15.54
	4		3.4615		1.2603	1.4296	3.3634	-0.1693	0.0981	0.0674	1.4970	31.41	19.73
1969/70	1	1.2761	3.4406	3.3530	1.3094	1.4271	3.3522	-0.1177	0.0884	0.0607	1.4878	30.75	21.41
	2		3.4048		1.2958	1.4246	3.3410	-0.1288	0.0638	0.0438	1.4684	29.41	20.48
	3		3.3079		1.2589	1.4222	3.3297	-0.1633	-0.0218	-0.0150	1.4072	25.54	17.79
	4		3.2264		1.2279	1.4197	3.3185	-0.1918	-0.0921	-0.0633	1.3564	22.72	15.82
1970/71	1	1.5092	3.3707	3.3083	1.5377	1.4172	3.3072	0.1205	0.0635	0.0436	1.4608	28.89	35.15
	2		3.3707		1.5377	1.4148	3.2960	0.2229	0.0747	0.0513	1.4661	29.25	35.58
	3		3.1886		1.4546	1.4123	3.2848	0.0423	-0.0962	-0.0661	1.3462	22.19	27.00
	4		3.2779		1.4953	1.4098	3.2735	0.0855	0.0044	0.0030	1.4128	25.87	31.47
1971/72	1	1.5130	3.2700	3.2519	1.5214	1.4074	3.2623	0.1140	0.0077	0.0053	1.4127	25.86	32.92
	2		3.2504		1.5123	1.4049	3.2510	0.1074	-0.0006	0.0004	1.4045	25.38	32.31
	3		3.2159		1.4962	1.4025	3.2398	0.0937	0.0239	-0.0164	1.3861	24.33	30.97
	4		3.2691		1.5210	1.4000	3.2285	0.1210	0.0406	0.0279	1.4279	26.79	34.10
1972/73	1	1.4966	3.2856	3.2657	1.5057	1.3975	3.2173	0.1082	0.0683	0.0469	1.4444	27.83	31.81
	2		3.2196		1.4755	1.3951	3.2061	0.0804	0.0135	0.0093	1.4044	25.37	29.00
	3		3.2756		1.5011	1.3926	3.1948	0.1085	0.0808	0.0555	1.4481	28.06	32.07
	4		3.2788		1.5026	1.3901	3.1836	0.1123	0.0952	0.0654	1.4555	28.54	32.62
TOTAL			136.1118		57.5272			0.0000	0.0000				

$L\bar{x}_i$ = GDP (Forestry) quarterly average for ith year
$L\bar{y}_i$ = Forest Earnings quarterly average for ith year
X' = Preliminary quarterly estimates of GDP
$T_{X'}$ = X'_t = a' + b't (i.e. trend values of X')

T_Y = L_{Y_t} = a + bt (i.e. trend values of L_Y)
u & v are deviations from trend values; E(u) = E(v) = 0
U' = U_v = a + bv + E

TABLE V

QUARTERLY ESTIMATES OF THE GROSS DOMESTIC PRODUCT AT 1962-1963 FACTOR COST
(₦ million)

INDUSTRY	1963/64				1964/65			
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
1. Agriculture, forestry and fishing	211.88 (416.97)	174.06 (417.50)	784.46 (441.85)	567.40 (461.48)	152.41 (391.13)	186.70 (413.50)	962.87 (451.54)	429.42 (475.23)
Agriculture	107.45 (312.54)	97.43 (340.87)	728.43 (385.82)	468.89 (362.97)	76.54 (315.26)	75.27 (302.07)	890.67 (379.34)	324.72 (370.53)
Forestry	36.60	32.50	30.47	43.03	36.26	29.99	33.75	36.20
Fishing and livestock	67.83	44.13	25.56	55.48	39.61	81.44	38.45	68.50
2. Mining and quarrying	12.54	13.88	15.38	17.00	17.00	18.79	20.81	23.00
3. Manufacturing and crafts	42.09	40.74	42.86	44.31	41.72	43.06	47.11	49.11
4. Public utilities	3.24	3.34	3.46	3.56	3.70	3.83	3.97	4.10
5. Building and construction	30.55	32.70	30.25	24.90	24.41	26.85	42.20	34.54
6. Distribution	89.13	84.74	92.58	95.35	98.05	93.12	101.91	105.12
7. Transport and communication	32.16	31.58	33.56	33.70	35.71	37.00	39.12	37.37
Transport	28.82	28.30	30.08	30.20	31.88	33.03	34.93	33.36
Road	16.97	17.21	18.07	17.75	21.77	22.42	23.45	21.96
Rail	6.90	5.91	6.75	7.04	4.90	5.08	5.69	5.33
Air	0.76	0.89	0.87	0.88	0.93	1.05	1.00	1.02
Water (including harbours)	4.19	4.29	4.39	4.53	4.28	4.48	4.79	5.05
Communication	3.34	3.28	3.48	3.50	3.83	3.97	4.19	4.01
8. General administration	16.54	17.98	19.37	23.91	17.59	23.20	20.68	28.13
9. Education and health	21.52	23.27	24.95	30.86	22.35	29.64	26.02	35.59
Government	6.63	7.17	7.69	9.51	7.24	9.60	8.43	11.53
Others	14.89	16.10	17.26	21.35	15.11	20.04	17.59	24.06
10. Other services	13.24	13.11	14.17	15.28	14.21	14.97	15.36	16.86
TOTAL	472.89 (677.98)	435.4 (678.84)	1,061.04 (718.43)	856.27 (750.35)	427.15 (665.87)	477.16 (703.96)	1,280.05 (768.72)	763.24 (809.05)

INDUSTRY	1968/69*				1969/70*			
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
1. Agriculture, forestry and fishing	275.84 (284.79)	62.90 (280.12)	571.15 (353.93)	428.11 (419.16)	168.79 (338.98)	138.59 (377.15)	638.46 (400.63)	584.66 (413.74)
Agriculture	78.53 (87.48)	37.36 (254.58)	529.96 (312.74)	388.55 (379.60)	30.03 (200.22)	25.49 (264.05)	605.90 (368.07)	550.58 (379.66)
Forestry	16.01	16.72	15.54	19.73	21.41	20.48	17.79	15.82
Fishing and livestock	181.30	8.82	25.65	19.83	117.35	92.62	14.77	18.26
2. Mining and quarrying	9.68	11.64	25.38	38.30	58.24	53.95	66.88	82.23
3. Manufacturing and crafts	44.68	44.89	54.84	55.99	57.70	67.50	71.90	66.30
4. Public utilities	4.13	4.23	4.43	4.61	4.90	5.04	5.34	5.52
5. Building construction	32.42	25.93	27.78	30.87	36.57	38.88	45.39	46.76
6. Distribution	79.25	73.14	87.81	92.00	92.90	106.20	106.09	106.41
7. Transport and communication	30.94	29.83	31.71	33.12	30.27	31.55	31.92	33.86
Transport	27.59	26.60	28.28	29.50	27.04	28.19	28.52	30.25
Road	17.83	17.89	17.75	18.53	16.59	17.79	18.07	19.55
Rail	4.62	3.68	5.11	5.19	4.40	4.07	4.39	4.34
Air	0.77	0.87	1.08	1.25	1.32	1.41	1.19	1.28
Water (including harbours)	4.37	4.16	4.34	4.53	4.73	4.92	4.87	5.08
Communication	3.35	3.23	3.43	3.59	3.23	3.36	3.40	3.61
8. General administration	21.80	25.86	36.97	54.37	54.69	66.79	67.98	68.64
9. Education and health	17.22	20.39	29.44	43.75	20.29	24.80	25.05	25.06
Government	6.34	7.51	10.84	16.11	10.36	12.66	12.79	12.79
Others	10.88	12.88	18.60	27.64	9.93	12.14	12.26	12.27
10. Other services	16.53	16.53	20.60	24.74	19.85	22.98	23.14	23.43
TOTAL	532.49 (541.44)	315.34 (532.56)	890.11 (672.89)	805.86 (796.91)	544.20 (714.39)	556.28 (794.84)	1,082.15 (844.32)	1,042.87 (871.95)

*The three Eastern States are excluded.

TABLE V (Continued)

QUARTERLY ESTIMATES OF THE GROSS DOMESTIC PRODUCT AT 1962–1963 FACTOR COST
(₦ million)

1965/66				1966/67				1967/68*			
1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
212.42	176.70	541.80	811.28	303.35	153.89	475.90	648.66	387.73	81.91	367.06	521.30
(406.14)	(410.58)	(438.95)	(486.53)	(353.29)	(374.25)	(415.32)	(438.94)	(444.07)	(290.97)	(291.57)	(331.39)
117.73	78.32	477.69	692.46	140.43	47.91	413.02	595.24	180.23	22.40	353.55	498.02
(311.45)	(312.20)	(374.84)	(367.71)	(190.37)	(268.27)	(352.44)	(385.52)	(236.57)	(231.46)	(278.06)	(308.11)
36.53	34.02	34.18	38.67	37.07	33.33	31.78	33.62	26.62	15.37	7.96	18.05
58.16	64.36	29.93	80.15	124.85	72.65	31.10	19.80	180.88	44.14	5.55	5.23
32.75	36.30	36.57	44.18	40.94	50.97	57.43	61.06	99.13	25.67	20.04	18.96
53.06	53.78	55.91	58.25	49.22	51.04	57.37	63.97	58.49	39.12	44.88	47.51
4.33	4.47	4.62	4.78	4.76	4.92	5.07	5.25	3.69	3.61	3.75	3.95
40.59	37.31	42.28	42.04	40.56	38.44	40.00	41.20	45.16	28.99	27.63	34.02
103.03	97.80	107.13	110.44	90.59	91.54	101.43	106.24	102.68	72.22	74.16	83.94
35.84	35.83	37.11	37.42	35.66	36.49	34.31	35.54	28.64	28.09	28.45	28.22
31.28	31.27	32.39	32.66	30.89	31.61	29.72	30.78	25.46	24.97	25.29	25.08
20.38	20.93	21.03	20.26	21.05	21.30	21.63	21.62	17.02	17.02	17.06	16.70
5.18	4.39	5.34	6.29	4.99	5.19	2.83	4.19	4.30	3.97	4.20	4.13
1.12	1.18	1.19	1.11	1.17	1.10	1.02	1.11	0.58	0.52	0.55	0.55
4.60	4.77	4.83	5.00	3.68	4.02	4.24	3.86	3.56	3.46	3.48	3.70
4.56	4.56	4.72	4.76	4.77	4.88	4.59	4.76	3.18	3.12	3.16	3.14
18.45	21.58	23.42	33.35	19.47	22.34	27.97	29.42	17.69	20.28	20.02	26.61
22.70	27.05	28.65	41.20	26.95	30.85	38.73	40.47	23.09	26.39	25.83	34.49
8.20	9.77	10.35	14.88	10.23	11.71	14.70	15.36	8.96	10.24	10.02	13.38
14.50	17.28	18.30	26.32	16.72	19.14	24.05	25.11	14.13	16.15	15.81	21.11
16.69	16.90	18.20	20.61	18.61	19.55	21.82	22.82	18.48	15.79	15.93	18.60
539.86	507.72	895.69	1,203.53	630.11	500.03	860.03	1,054.63	784.78	342.07	627.75	817.60
(733.58)	(741.60)	(792.84)	(878.78)	(680.05)	(720.39)	(799.45)	(844.91)	(841.12)	(551.13)	(552.26)	(627.69)

*The three Eastern States are excluded.

1970/71				1971/72				1972/73			
1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
255.54	220.97	855.18	556.01	293.01	91.05	899.72	701.42	283.12	179.21	812.62	586.15
(389.96)	(472.50)	(472.61)	(552.63)	(434.61)	(444.58)	(532.37)	(573.64)	(407.92)	(469.76)	(495.15)	(488.27)
82.34	36.64	813.75	504.27	61.07	37.78	785.61	634.34	69.20	45.08	735.55	524.87
(216.76)	(288.17)	(431.18)	(500.89)	(202.67)	(391.31)	(418.26)	(506.56)	(194.00)	(335.63)	(418.08)	(426.99)
35.15	35.58	27.00	31.47	32.92	32.31	30.97	34.10	31.81	29.00	32.07	32.62
138.05	148.75	14.43	20.27	199.02	20.96	83.14	32.98	182.11	105.13	45.00	28.66
98.29	119.17	133.54	150.50	168.06	161.28	185.10	189.86	197.81	207.38	214.08	214.93
72.35	80.45	83.27	81.53	75.90	77.27	77.70	76.83	86.55	92.25	98.42	103.88
5.64	5.84	6.10	6.42	6.76	7.12	7.40	7.62	8.04	8.22	8.73	9.31
56.16	59.13	48.49	57.22	71.75	74.97	80.15	85.13	90.96	83.17	99.03	111.34
124.17	123.06	124.62	141.05	128.14	130.15	144.01	142.20	132.13	122.00	135.07	140.50
32.47	32.93	33.54	38.96	40.38	41.56	41.76	44.30	48.91	48.71	50.96	58.02
29.08	29.49	30.04	34.89	36.05	37.11	37.29	39.55	44.22	44.04	46.08	52.46
17.68	17.64	18.55	19.13	23.81	24.67	25.61	26.41	31.79	32.73	34.23	34.85
4.27	4.69	4.02	4.42	3.59	3.34	3.01	3.86	4.03	3.70	3.33	4.24
1.52	1.50	1.53	1.65	1.26	1.20	1.30	1.24	1.61	1.57	1.64	1.58
5.61	5.66	5.94	9.69	7.39	7.90	7.37	8.04	6.79	6.04	6.88	11.79
3.39	3.44	3.50	4.07	4.33	4.45	4.47	4.75	4.69	4.67	4.88	5.56
45.87	87.32	82.28	112.13	51.31	58.29	101.23	127.97	43.32	99.98	97.61	62.89
23.79	46.37	43.18	59.26	29.00	32.88	58.20	73.82	26.49	63.22	61.09	56.20
14.69	28.64	26.67	36.60	18.32	20.77	36.77	46.64	18.81	44.90	43.38	39.91
9.10	17.73	16.51	22.66	10.68	12.11	21.43	27.18	7.68	18.32	17.71	16.29
22.86	29.26	28.65	35.43	26.43	27.92	36.64	41.21	30.28	40.30	41.60	38.32
737.14	804.50	1,438.85	1,238.51	890.74	702.49	1,631.91	1,490.36	947.61	944.44	1,619.21	1,381.54
(871.56)	(1,056.03)	(1,056.28)	(1,235.13)	(1,032.34)	(1,056.02)	(1,264.56)	(1,362.58)	(1,072.41)	(1,234.99)	(1,301.74)	(1,283.66)