# Quality of macroeconomic data on Africa:  Nigeria as a case study

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# I.  Introduction

To enhance the quality of policy decisions, most academicians in the less-developed countries engage in empirical research using the macroeconomic data of the country concerned.  However, given the formal-informal sector dichotomy of these economies, attention has focused on enhancing the reliability of data from the informal sector, which usually accounts for a large proportion of the economy's total output.  Some of the notable endeavours on this issue have been in the area of national income accounts.

An implicit assumption underlying this research focus is that the data from the formal sector, especially published macroeconomic indexes, are reliable.  This assumption may have been based on the fact that official data collection and processing agencies are normally established and could collect data from reliable sources within the system.  However, some observations and concerns have been expressed recently at various conferences.  Of particular concern is the potential non-reliability of published data given the wide divergence of data values from different sources on similar items.

The existence of these defects on data from published sources raises some policy-related problems.  For example, the same author using data from different sources may reach different conclusions on identical research tasks.  The same problem arises when different researchers use data from different sources. Consequently, the policy makers may be exposed to divergent research findings and would be unable to identify those that are authentic.  It is therefore desirable to conduct research to enhance an understanding of the nature and severity of the defects of published macroeconomic data in developing countries.

This research study aims to provide a lead in this regard. Specifically, the study attempts to evaluate the nature and extent of consistency of key macroeconomic data frequently used by researchers and policy analysts across various data sources, both internal and external.  Initially, Nigeria will be used as a case study.  Thereafter attempts will be made to replicate the study for other African countries with a view to evolving an appropriate methodological framework for the collection and dissemination of data on African countries.  The latter constitutes the second phase of the study proposal.

The remainder of this report is organized as follows.  The next section provides a brief background discussion to justify the need for the study, followed by the discussion in Section III of the methodology employed for the study.  Section IV presents data analysis and discussion of results, while concluding remarks are contained in the last section.

# II. Background

For the setting of goals and evaluation of performance, governments often rely on data from published sources. In fact, governments often establish at least one agency to be solely responsible for collecting and processing macroeconomic data as guides to policy decisions and evaluation. However, concern has been expressed regarding the reliability of these data. For example, Gurr (1972) notes that it is well recognized and frequently lamented that the quality of cross-national social, economic and political data is highly varying and, for many countries, of dubious reliability.

Efforts have been made to overcome this problem in the developed economies. A fruitful outcome of this endeavour was the publication of a National Accounting Framework by the League of Nations in 1947. Efforts have also been made to improve on data for specific subject-matters. For example, for more than 30 years, economists have been aware of, and have attempted to correct, discrepancies in developed countries' trade data observed in matched export and import statistics (Allen and Ely, 1953; Morgenstern, 1963; Yeats, 1978; OECD, 1985). Many private organizations also exist to collect and analyse macroeconomic data for public consumption. To a large extent, the reliability of these data appears high given the similarity of data sets from different sources.

However, this "success" story cannot be claimed for the less-developed countries, for several reasons. First, with respect to National Accounts, the system developed by the League of Nations has been considered inappropriate for developing countries. This is mainly attributable to the differences in economic structures, especially in view of these countries' large subsistence sectors (Arya, 1976; Aboyade, 1978).

Second, there are hardly any private organizations that engage in this type of assignment. Hence, there is usually a government monopoly in the collection and dissemination of public data. Even where such attempts have been made by private organizations, there is usually a wide divergence of the data from the various sources. A typical example in Nigeria relates to the controversy over data on capacity utilization. There was a wide gap between the figures released by the Central Bank of Nigeria and those released by the Manufacturers' Association of Nigeria.

In rectifying this problem, attention has focused on the development of adequate sampling survey methods for the subsistence sector. Some data collection methods such as the Delphi have been advocated or attempted (Ariyo, 1990; Hill and von der Mehden, 1978). It has thereby been implicitly assumed that data from the formal sector should be reliable, and many scholars rely rather uncritically on these published sources. In effect,

the limited attempts to evaluate the quality of data bases have focused on sample surveys on specific subject matters such as income distribution (Rajaraman, 1976).

Recent developments suggest that this high level of confidence in published data may be inappropriate.  For example, at the World Bank Conference on African Economic Issues held in Nairobi in 1990, there was serious concern regarding the reliability of published data upon which applied research works on Africa were based.  Similarly, at the workshop of the African Economic Research Consortium in May 1991, the issue of wide disparities among data on Africa from different sources re-echoed.  While noting the severity of the problem, the workshop merely advised that in the interim, each researcher should clearly identify the data sources.  It also suggested that attempts be made to evolve a longer-term solution to the problem.

The issue of the degree of convergence of macroeconomic data from different sources should be of interest in empirical or policy-related research.  For example, if the divergences are significant, then there is the problem of identifying the authentic data source.  Second, researchers patronizing different data sources may reach different conclusions on identical research problems.  Similarly, there will be lack of consensus among policy makers armed with the different research results. Consequently, the degree of judgmental accuracy of the policy makers will be less than optimal.  This is in view of research findings, especially in the accounting context, that indicate that consensus places an upper limit on the degree of judgmental accuracy (Ashton, 1985).

The findings of some recent research seem to justify this concern.  For example, Yeats (1990) conducted a research on consistency of trade data on LDCs.  Unlike the findings the author reported in respect of developed economies (Yeats, 1978), he found severe inconsistencies in data for developing countries. Wells (1992) compared four measures of agricultural output for Nigeria between 1962 and 1990.  He reported that the various aggregates show significantly different readings of agricultural growth.  Also, according to the author, a decomposition of the aggregates of gross agricultural output tends to show, in some cases, considerable discrepancies in basic measures of crop production.  He therefore suggested the need to explore the sources of differences between various measures as well as a strategy for reconciling some of these differences.

The aim of this study is to provide an input into the design of a longer-term solution to the problem.  The overall goal is to enhance the degree of consistency of data from different sources. To achieve this general objective, the study will feature the following. First, Nigeria will be used as a case study for providing evidence bearing on the study's subject matter.  A methodological framework will be developed for assessing the degree of consistency among selected macroeconomic data often used by researchers.

The second feature of the study is the identification of the major causes of observed inconsistencies, if any, in the data sets.  In this regard, some of the differences in the data sets, such as definition of terms, measurement procedures, etc., will be identified. Eventually, the methodological framework will be replicated in other African countries with a view to developing a continental perspective on the study's subject matter.

# III. Effect of data on quality of research

As indicated earlier, some research has already been carried out on data consistency for some LDCs. However, the need for concern about this subject matter is not usually appreciated. The need derives from the fact that data is the most critical input that determines the quality of research works and the accuracy of research-based judgmental tasks, especially those that are of policy relevance.

The literature suggests that the whole essence of research design centres on ensuring the reliability of underlying data, to be complemented with valid measuring techniques. For example, Bernard (1971) notes that research design constitutes the blueprint for the collection, measurement and analysis of data. Similar substantive definitions were offered by Seltz, Wrightsman and Cook (1976) as well as Emory (1980). Hence, the quality of research design hinges on the extent to which it can enhance the reliability of data as well as the validity of measurement techniques employed.

There are typically two types of research data available to the researcher. These are the primary and the secondary data sources. The focus of this study is on secondary data, about which much anxiety has been expressed regarding the ever-recurring threats to its reliability. In fact, Kerlinger (1973), has asserted that, given its inherent unreliability, secondary data could be used only when there is no access to primary data. He further noted that extreme caution should be exercised in interpreting the results of research based on secondary data.

However, there are some issues to consider in enhancing the reliability of data from secondary sources, some of which will be discussed in the next section. We will nevertheless discuss briefly in this section how the characteristics of underlying data influence the type of research methodology and statistical methods that could be used to ensure the validity of the research findings. Essentially, this has to do with the measurement scale of data and its effect on statistical methods or procedures that could be used for a given research exercise.

According to Emory (1980), data-scale classifications employ the characteristics of the real numbers system. The generally accepted scale conceptualization is based on three characteristics:

   (a)   that numbers are ordered, whereby one number is greater than, less than or equal to another number;
   (b)   that differences between numbers are ordered, so that the difference between any pair of numbers is greater than, less than or equal to the difference between any other pair of numbers; and

**Table 1**: Data scales and applications

| Type of scale | Characteristics of scale | Basic empirical operation |
|---|---|---|
| Nominal | No order, distance or origin. | Determination of equality. |
| Ordinal | Order but no distance or unique origin. | Determination of greater or lesser values. |
| Interval | Both order and distance but no unique origin. | Determination of equality of intervals or differences. |
| Ratio | Order, distance, and unique origin. | Determination of ratios. |

Source:  Emory (1980).

(c)     that the number series has a unique origin indicated by the number zero. On the basis of these characteristics, all numbers have been categorized into four scales, viz: the nominal, the ordinal, the interval and the ratio scales.  The nominal is the weakest scale, while the ratio is the most stringent.  In summary form, the link between the type of data scale, the characteristic of each scale and the basic empirical operation applicable is shown in Table 1. The interested reader is referred to standard texts on research methodology for further elaboration.

Of concern to the researcher is an awareness of the sources, and implications of measurement errors, with a view to taking appropriate remedial measures.  Although several major sources of measurement errors have been identified (Sellitz, Wrightsman and Cook, 1976), generally there are four basic sources of measurement errors.  These are those through the respondent, situational errors, the measurer as an error and errors due to the measurement instrument employed.  Respondent-induced errors arise due to the way the data collector or analyst mentally processes or interprets the signals of the information.  They reflect the heuristics and biases the respondent brought to bear on the task.  Some of these biases have been elaborated upon in the human information processing literature (e.g., Tversky and Kahneman, 1974; Nisbelt and Ross, 1980; Libby, 1981; Solomon, Ariyo and Tomassini, 1985; and Ariyo, 1993).

Situation errors are due to factors that distract attention. Seemingly minor issues such as telephone calls, greetings, unexpected entry or exit of colleagues might disrupt the concentration of a researcher and thereby generate some errors. Some errors may also be introduced consciously or unconsciously by the measurer or researcher.  This arises when the researcher is non-neutral and had prior expectations or hunches that influenced the recording or interpretation of raw data.  The most common problem under this scenario manifests itself in form of errors of commission and omission.  Finally, one of the most serious issues relates to measurement errors, given their implications for the reliability

and validity of research efforts.

Given its importance, the literature has identified some characteristics of sound measurement. These are validity, reliability and practicability. In a nutshell, validity refers to the extent to which a test measures what we actually wish to measure. Reliability on the other hand has to do with the accuracy and precision of a measurement procedure. It is mainly concerned with estimates of the degree to which a measurement is free of random or unstable error. Practicability also is concerned with a wide range of factors of economy, convenience and interpretability. The interested reader is referred to Robert, Hagen and Hagen (1969) for further details.

It is important to note that reliability is a necessary but not a sufficient condition for ensuring validity of measurement. For example, let's say a weighing scale had been miscalibrated to underweigh any object by, say, 5 kilograms. If one million people weighed the same item at different times, they will all report identical results. To that extent, the weighing-scale is reliable. However, the results are not valid, given the induced underweigh of 5 kilograms already entrenched in the process. To that extent, reliability is an inevitable desirable attribute of any measurement process. Furthermore, if the weighing-scale measures erratically from time to time, then it is not reliable and the measures therefrom can therefore never be valid.

# IV. Methods of assessing quality of data

The discussion in the previous section has elucidated the importance of quality of data as the primary determinant of research reliability and validity. According to Emory (1980), the question of data quality essentially has to do with the issue of data accuracy. He noted that any concern that any investigator has in studying the quality of secondary data is to determine the degree to which they accurately reflect reality. This section discusses some approaches available for assessing the quality of secondary data.

Regardless of the collection methods employed, some techniques have been identified for checking the quality of data. These are usually referred to as post-hoc techniques (Zarkovich, 1975). Their uses depend upon the aims of checking and the characteristics being checked, as well as the facilities available to the evaluator, among others. Two of these deemed relevant to our study are discussed briefly as follows.

## Comparison of data from independent sources

This is one of the simple methods of checking the quality of data collected from different and independent sources. The term "independent" refers either to independent data sources or independent data collectors who are unaware of similar actions by the other party or parties. Of interest is an appraisal of the extent of agreement (convergence) of data from these different sources.

Convergence between the figures does not imply accuracy. The main problem here is how to establish the degree to which data from various sources are really comparable. That is, the data from different sources must refer to the same thing so that the comparison between them is strictly valid. This concerns the issue of construct validity. For example, comparison among time-series data can only be valid if and only if they cover the same reference period, are generated by similar measuring instruments and have identical meanings to the different investigators. Typical candidates here refer to definitions of concepts being investigated.

## Consistency checks

The aim of a consistency check or study is to evaluate how data from a given source compare with some generally known or accepted characteristics involved or their

relationships. Also, the same information may be available from several sources and the consistency can be studied between the resulting data. Any detected lack of consistency suggests that data from any of the sources should be treated with extreme caution. This is with respect to inter-source consistency checks. This is the issue of measurement reliability discussed earlier.

The internal consistency of data may also be of interest. This involves an investigation of the extent to which the estimates of different characteristics describe the same phenomenon in the same way or can be taken as logically related to each other. For example, in an agricultural survey, the sum of area under various crops cannot exceed the total arable land. Also, in an expenditure survey, the total expenditure cannot be greater than the estimated income plus used-up savings and borrowings of the population concerned within a specific time period.

These two methods are obviously applicable to this study. For example, several independent organizations collect and publish macroeconomic data on Nigeria. Hence, a comparison of similar data from the different sources is obviously germane to this study's objectives. In fact, this study was prompted by the perceived lack of convergence among data from different sources on similar macroeconomic aggregates, especially debt figures on Nigeria. This study is expected to provide an insight into the severity and causes of this problem.

We are also aware that some agencies administer more than one data source on similar macroeconomic indexes. Examples include the World Bank, the International Monetary Fund and, in the case of Nigeria, the Central Bank of Nigeria and the Federal Office of Statistics. An internal consistency check will require that the data series on similar items should be similar for each of the sources under the control of each agency. Any observed lack of internal consistency raises serious doubts regarding the reliability of the data series and hence possible invalidity of research findings based thereon.

# V.  Methodology

## Selection of data publications

As indicated earlier, many organizations publish macroeconomic data series on Nigeria. However, given the large number of publications, a basis for choice needs to be established. For our purpose, the selection was guided by either the intensity of patronage of data publications or source of availability of macroeconomic indexes of interest.

To facilitate the former, about 100 survey instruments were administered on selected respondents. The selection was guided by several considerations. For example, only those academicians deemed to be interested in applied research using published macroeconomic data were contacted. Similarly, there are some individuals in government who use macroeconomic data for planning and research purposes. These individuals work in places such as the Federal Office of Statistics, the Central Bank of Nigeria, as well as the National Planning Office in Nigeria.

The survey instrument was a questionnaire, as shown in the Appendix. It provides a list of some important data sources publishing macroeconomic indexes on Nigeria. It also requires the respondents to identify and indicate the sources they know and use. All these sources were to be ranked in descending order of perceived importance to each respondent. This ranking enables us to determine the intensity of patronage of each data source. Overall, 69 respondents sent in completed questionnaires; three of these were discarded because they were not usable. This represents an effective response rate of 69%, which was considered appreciable.

The results of the analysis of the responses are shown on Table 2. They indicate the number of times each of the data publications was cited by the respondents. For example, the Annual Abstract of Statistics published by the Federal Office of Statistics was cited 23 times. Similarly, the Principal Economic and Financial Indicators published by the Central Bank of Nigeria was cited only once.

To enhance an appreciation of the relative importance and hence intensity of patronage of the data sources, the mean rank was calculated. As shown in Table 3, the Annual Report and Statement of Accounts published by the Central Bank of Nigeria topped the list with a mean rank of 6.86. That is, for this study's set of respondents, this publication was considered the most important and hence most heavily patronized for their research work. The Annual Abstract of Statistics followed closely with a score of 6.43. The other publications not covered on Table 3 had very low mean rank compared to those indicated.

**Table 2**: Intensity of patronage of data sources - Frequency analysis

| Publication | Author | Classification* | Times cited |
|---|---|---|---|
| 1. Annual Abstract of statistics. | Federal Office of statistics | N | 23 |
| 2. Annual Report & Statements of Accounts. | Central Bank of Nieria | N | 21 |
| 3. Economic & Financial review. | Central Bank of Nigeria | N | 20 |
| 4. International Financial Statistics. | International Monetary Fund (IMF) | I | 19 |
| 5. Statistical Bulletin | Federal Office of Statistics | N | 15 |
| 6. Review of External Trade. | Federal Office of Statistics | N | 14 |
| 7. Statistical Bulletin | Central Bank of Nigeria | N | 10 |
| 8. National Integrated Survey of Households | Federal Office of Statistics | N | 10 |
| 9. Government Financial Statistical Yearbook | IMF | I | 10 |
| 10. Direction of Trade Statistics | IMF | I | 9 |
| 11. Balance of Payments Statistics. | IMF | I | 8 |
| 12. World Debt Tables | World Bank | I | 8 |
| 13. World Tables | World Bank | I | 8 |
| 14. World Bank Development Report | World Bank | I | 8 |
| 15. Economic & Statistical Review | National Planning Commission | N | 7 |
| 16. African Statistical Yearbook | United Nations Organisation | I | 6 |
| 17. Statistical Yearbook | United Nations | I | 6 |
| 18. Trade Statistics | United Nations | I | 5 |
| 19. World Outlook | International Monetary Fund | I | 4 |
| 20. Commodity Review and Outlook | Food and Agriculture Organisation | I | 4 |
| 21. Yearbook of Labour Statistics. | International Labour Organisation | I | 4 |
| 22. African Economic & Financial Data | World Bank/UNDP | I | 3 |
| 23. Quarterly Statistical Yearbook for Africa. | UN Economic Comm. for Africa | I | 3 |
| 24. Facts and Figures | O.P.E.C. | I | 2 |
| 25. Digest of Statistics | Federal Office of Statistics | N | 2 |
| 26. Statistical Bulletin | O.E.C.D. | I | 1 |
| 27. Statistical News | Federal Office of Statistics | N | 1 |
| 28. Manpower Statistics | National Manpower Board | N | 1 |
| 29. African Statistical Bulletin | ECOWAS | I | 1 |
| 30. Nigeria's Principal Economic & Financial Indicators | Central Bank of Nigeria | N | 1 |

* N = National publication      I = International publication

**Table 3**: Intensity of patronage of data sources - Weighted mean ranks

| Data source | Publisher | Mean rank |
| --- | --- | --- |
| Annual Report and Statement of Accounts | Central Bank of Nigeria | 6.86 |
| Annual Abstract of Statistics | Federal Office of Statistics | 6.43 |
| Economic and Financial Review | Central Bank of Nigeria | 6.20 |
| International Financial Statistics | International Monetary Fund | 5.89 |
| National Integrated Survey of Households | Federal Office of Statistics | 4.60 |
| Government Financial Statistical Yearbook | IMF | 4.40 |
| Statistical Bulletin | Central Bank of Nigeria | 4.30 |
| Review of External Trade | Federal Office of Statistics | 3.93 |
| Statistical Bulletin | Federal Office of Statistics | 3.20 |

There are some interesting conclusions derivable from the findings reported in Table 3. For example, out of the nine publications covered, only two (International Financial Statistics and the Government Financial Statistics Yearbook, both published by the International Monetary Fund) were from international organizations. This shows a heavy reliance on internal data sources by the class of researchers who participated in this study. Similarly, regarding these national publications, only those published by either the Central Bank of Nigeria or the Federal Office of Statistics were considered important by the respondents.

It appears desirable for the government to strengthen the data generation capabilities of these two organizations for whose output there is a high demand from the relevant set of users. It also appears necessary to streamline the data dissemination activities of these agencies. On this, there are two shades of opinion. First, it may be desirable to minimize the extent of overlap so that each agency could concentrate on the macroeconomic data for which it has a comparative advantage.

Another consideration, however, suggests that it is desirable for both agencies to independently collect and disseminate data on similar macroeconomic indexes. This will allow for the types of consistency checks discussed above. It will also act as a check and balance against deliberate manipulation of data series specifically "zoned" to an agency against which there will be no basis for verifying the accuracy. The important thing here is that the agencies should be independent, both in fact and in appearance, in their operations. Nevertheless, the relative merits or demerits of these options will be influenced by the underlying societal objectives and hence will await further research.

# Selection of macroeconomic indexes

A typical data publication contains several macroeconomic indexes, either on a specific country or on a group of countries. However, in an initial study of this nature, it will not be desirable to cover all indexes especially because of time and cost considerations. Hence, an acceptable choice of macroeconomic indexes had to be made.

As stated earlier, observations about characteristics of data that gave birth to this study arose mainly from the research workshops of the African Economic Research Consortium (AERC). Its focus is on applied, policy-oriented research. The scope also covers the whole of sub-Saharan Africa, and hence truly represents the various interests of the African continent. It was therefore decided to use the research activities of the AERC as an anchor for a decision on the issue.

Currently, there are three main sections of the AERC workshops. These are: external balance and macroeconomic management, external and internal debt management, and financial management and domestic resource mobilization. Given these, and in view of formal and informal discussions with the top officials of AERC, it was decided to choose three macroeconomic indexes, each of which will mirror the research focus of each of the three sections. Accordingly, we agreed on the following macroeconomic indexes for this pilot study. These are:
- Trade data: Exports and imports
- Debt: Internal and external
- Savings data: Public and private.

For example, Section A of the AERC workshop utilizes trade data, while the debt data constitute an important input into most of the studies in Section B. The savings data are obviously of relevance to the research focus of many of the participants in Section C. Hence, we will be able to draw some implications of our study's findings on these data items and will hopefully guide at least the design aspects of future research works under the auspices of the AERC.

# Data evaluation approaches

We discussed earlier two methods of assessing the quality of data that are considered appropriate for providing research evidence relating to this study's objectives. Hence, the mode of evaluating the macroeconomic indexes for this study will be influenced by these methods.

Accordingly, in this study, series of intra-source and inter-source pair-wise comparisons of data were undertaken. That is, the major approach is a comparison of data from independent sources. For this purpose, efforts were made to determine the extent of independence of each pair of data being compared. Subject to availability of relevant data, the following sets of comparisons were undertaken:
- Intra-internal data sources

- Intra-external data sources
- Inter-internal data sources
- Inter-external data sources, and
- Internal vs. external data sources.

The intra-source tests will evaluate the internal consistency among data produced by different units of the same organization. Ordinarily, agencies within the same organization should produce similar figures on identical indexes. If, for example, there were very significant differences, this would suggest that very little reliance should be placed on estimated figures for a given year. Hence, they should not be used for forecasting and policy-related studies unless there is a recognizable and stable pattern of difference. Given this, it would be possible to calibrate the estimated figures in the appropriate direction before being used for policy-oriented research. Short of this, even the organization would be at a loss regarding which data series to use for a given task. Information derived from this analysis will assist in designing the appropriate organizational reforms required to ensure data consistency and convergence.

The inter-source comparison suggests the need to ensure the independence of the data sources used for the analysis. It may also guide the future researcher regarding the research implications of relying on one source rather than another. It will also enhance the usefulness of the checks and balances among data sources noted earlier. An understanding of the data collection techniques will also assist in enhancing a meaningful ranking of the reliability of the various data sources.

# Definition of terms and units of measurement

Two or more data sets are comparable only if there is a similarity in definition of terms and the units of measurement employed. Hence, the definition of each of the chosen indexes by each agency will be analysed. This will enable us to identify the extent of similarities and differences in the definition and units of measurement adopted. This will thereby provide a basis for identifying the nature of transformations required to bring the data sets to a common basis with respect to both the definitions as well as units of measurement.

# Statistical analysis

The type of statistical analysis performed must be able to generate reliable research evidence bearing on the study's objectives. Hence, the pair-wise comparisons tests described in the literature (Siegal, 1956; Kraft and van Eden, 1968; Spurr and Bonini, 1975; Gibbons, 1976; Chou, 1975) were employed. However, the level of sophistication of statistical methods must be compatible with the characteristics of the data series.

Given the uncertainty regarding the quality of underlying data, the non-parametric statistical methods (see Siegal, 1956; Kraft and van Eden, 1968; Gibbons, 1976) will be

employed. The rationale is that our data may not satisfy many of the assumptions required for parametric tests (see Gibra, 1973; Chou, 1975). For our purpose, the non-parametric Wilcoxon tests were considered most appropriate for the pair-wise comparison tests and hence adopted. The features of the Wilcoxon tests are provided as follows.

## Wilcoxon (non-parametric) statistical model

As indicated earlier, the main objective of this research study was to evaluate the degree of consistency among some selected macroeconomic indexes, using Nigeria as a case study. Consistent with the discussion above on the methods of assessing data quality, we are expected to:

    (a)    compare the data from various sources to check for consistency and reliability of the chosen data series;

    (b)    determine, as much as possible, the most reliable source of a given characteristic (i.e., macroeconomic index); and

    (c)    identify some of the reasons for any observed inconsistencies.

    The second task is unachievable unless the true distributions are known. To provide evidence relating to the others, the Wilcoxon pair-wise comparisons tests was adopted. It's main features as described in Gibbons (1976), are as follows.

    Let 1, 2, 3, ...., $K$ represent the various independent sources of data. Also let A represent the (economic) characteristic (e.g., trade, debt or population figures) on which data were collected. Thus, $A_i$ represents the data set on economic characteristic A obtained from source $i$. To compare similar characteristics from two independent sources, the Wilcoxon tests suggest the following procedure.

    Let the sample $A_1$ and $A_2$ have $n_1$ and $n_2$ observations, respectively. Also, initially, assume that $n_1 \neq n_2$. In particular, assume $n_1 > n_2$. The Wilcoxon test requires that we rank the values of $n_1 + n_2$ observations in ascending order of magnitude as if they came from the same population. Define $W_1$, $W_2$ to represent the respective sums of ranks of observations from $A_1$ and $A_2$. The test statistic $U$ is then defined as:

$$U = \frac{1}{2} N(N+1) - W \tag{1}$$

    The null hypothesis is $H_0$: $u_1 = u_2$,

    where $u_1$, $u_2$, are means of samples $A_1$ and $A_2$, respectively. At a given $\alpha$ level of significance, the test is significant (i.e., $u_1 \neq u_2$) if:

$$Pr(U \leq u/H_0 \text{ is true}) \quad \text{for } n_1, n_2 \leq 9 \tag{2}$$

$$U \leq u \text{ for } n_i > 9 \tag{3}$$

where $U$, $u$ are the computed and tabulated values respectively.

Conversely, let us assume that $n_1 = n_2$, that is, the two samples contain equal number

of observations. In this case, we employ the Wilcoxon tests for paired observations. The absolute differences (without regard to sign) between each paired observation are obtained and ranked.

Let $W+$, $W-$ represent the sum of ranks of positive and negative differences, respectively, while $W = \min(w+, w-)$. The test is significant (i.e., we reject Ho) if and only if:

$$P_r (W \leq w/Ho \text{ is true})\alpha \text{ for } n < 5. \tag{4}$$
$$W \leq \text{tabulated } W \text{ for } 5 < n \leq 30 \tag{5}$$

for any given $\alpha$ and test statistic $W$, where $\alpha$ is the level of significance.

For purposes of completeness, we discuss the statistical test of comparing more than two data sets. This is referred to as the Kruskal-Wallis multiple comparisons test for more than two independent samples (i.e., $N > 2$).

The applicable test statistic is

$$H = \frac{12}{n(n+1)} \sum_{i=1}^{N} \frac{(R_i)^2}{N_i} - 3(n+1) \tag{6}$$

where $n$ is the total number of observations in all the data sets (samples).

$N$ is the number of samples

$N_i$ is the number of observations in sample $i$

$R_i$ is the sum of ranks of observations in the $i^{\text{th}}$ sample.

The calculated $H$ is then compared with the table value of the Chi-square ($\chi^2$) variate with $N$-1 degrees of freedom at a given level of significance.

$$\text{If } H > \chi^2_{N-1|\alpha} \tag{7}$$

then we reject the null hypothesis

$$H_0: u_i = U. \tag{8}$$

That is, we reject the hypothesis that each of the sample means $u_i$ is not statistically significantly different from the population mean.

## Relevance to consistency tests

The findings of analyses from the comparison tests discussed above can also be utilized for consistency tests as follows: Let us assume that Ho was accepted. That is, $u_i = U \ \forall_i$. Then, to find the sample that is most consistent out of the whole lot, we obtain a sample $B$, if possible, of the same economic characteristic that can be used as an unequivocal benchmark. Then, the correlation coefficient $rA_i, B$ between sample $A_i$ and $B$ is computed for each i.

Since the paired samples are of the same characteristic, they are expected to be highly positively correlated. Therefrom, the sample i will be regarded as more consistent with B than any other sample j, if and only if

$$o < rA_j, B < rA_i, B \le 1 \ \ V_{ij}.$$

Alternatively, a sample $C$ of a characteristic that is a cause or effect of the characteristic being measured in $A_i$, is identified. From the theory of the characteristic in samples $A_i$ and $C$, there should be an acceptable knowledge about the nature of relationship between these two characteristics. This relationship will in turn define and determine the nature and degree of their correlation. Thus, the $rA_i, C$ is computed for each $i$. The sample corresponding to the $rA_i, C$ that appears to be most compatible with the acceptable knowledge of the relationship is considered the most consistent and most reliable sample.

On the other hand, let us assume that Ho was rejected. That is, we concluded that $\mu_1 \ne U$ for some $i$. To test for consistency, we do the following:

a) obtain an acceptable sample, if possible;

b) compute the correlation coefficient $rA_i, B$ between each sample $A_i$ and the acceptable sample $B$; and

c) compute the variance of the observations of $A_i$ using the mean value of $B$ ($\mu_B$).

Thereafter, the sample $A_i$ with the $r(A_i, B)$ that is most compatible with the expected relationship between $A_i$ and $B$ and has the minimum variance is considered the most consistent and reliable sample.

The above represent the procedural steps for comparison tests and their usefulness for consistency and reliability tests. For more detailed discussion of these issues, the interested reader is referred to Cochran (1977); Snedecor and Cochran (1967); Walpole and Myers (1972); and Zarkovich (1975).

This study cannot utilize all the statistical options and procedures discussed above for a number of reasons. We will thus confine our analyses to the Wilcoxon pair-wise comparison tests because of their perceived superiority to the multiple-comparison tests. For example, even if the multiple-comparison tests suggest the rejection of Ho, it does not mean that this finding will be applicable to each paired sample. Yet this is the most important aspect of our study, since a researcher can choose any data series from any of the sources being compared. Hence, for our purpose, the pair-wise comparison tests dominate the multiple comparison tests based on the Kruskal-Wallis procedures.

Second, we cannot conduct the consistency tests in the statistical sense described above. The major constraint is the inability to identify the sample to be used as a benchmark. In fact, we believe that the emergence of this benchmark sample is the expected achievement of this study. Hence, we will confine ourselves to a documentation of the degree of convergence of the data series from different sources with respect to each characteristic of interest. We will further attempt to identify the various causes of any observed significant divergences as a basis for determining the required procedures that will minimize these divergences.

# VI. Data analysis

This section presents the data base used for the analysis in accordance with the non-parametric statistical method described earlier. As indicated, three sets of macroeconomic indexes are covered in this report. These are trade (export and imports), debt (external and internal) and savings (private and public).

Data bearing on each index were collected from various sources. These sources, their origin and the currency denomination of each data set are summarized in Table 3. It should be observed that the data sources used include some of those highly ranked by the study's subjects, as reported in Table 2.

## Comparison of features

The extent of comparability of indexes across data sources depends on the similarities among the relevant concepts and data collection procedures. Of utmost importance in this regard is the similarity in definition of terms. To provide some evidence bearing on this, Table 4 presents a comparison of key features of each data source consulted for the study.

At least two major observations are identifiable from the table. First, it appears there are differences in data collection procedures for each publication source. Second, there are differences in the definition of each macroeconomic index across sources. Hence, care is required before embarking on a comparison of seemingly similar indexes from different sources.

This information is important for calibrating the findings of our analysis. For example, even though there may be differences in the definition and measurement of indexes, there may be no statistically significant differences in the findings of the analysis. This may be due to various reasons, such as compensating errors that may neutralize the underlying differences in the data series. Hence, it is desirable to know the basis for the definition adopted for each publication source.

## Data series

Data relating to the macroeconomic indexes of interest are provided with respect to

**Table 4**: Reporting currency by data sources

| Index | Sources | Origin | Currency |
|---|---|---|---|
| Trade | Direction of Trade Statistics International Financial Statistics | International Monetary Fund | US dollars |
| | Foreign Trade Statistics for Africa | UN Economic Commission for Africa | US dollars |
| International Trade Statistics | | United Nations | |
| | Review of External Trade | Federal Office of Statistics, Nigeria | Nigerian naira |
| | Annual Reports and Accounts of the Central Bank of Nigeria | Central Bank of Nigeria | Nigerian naira |
| Debt | World Debt Tables | World Bank | US dollars |
| | International Financial Statistics | International Monetary Fund | Nigerian naira |
| | Annual Report and Accounts of Central Bank of Nigeria | Central Bank of Nigeria | Nigerian naira |
| | Principal Economic Indicators | Central Bank of Nigeria | Nigerian naira |
| Savings | Annual Report and Accounts of the Central Bank of Nigeria | Central Bank of Nigeria | Nigerian naira |
| | Annual Abstract of Statistics | Federal Office of Statistics, Nigeria | Nigerian naira |
| | African Economic and Financial Data | World Bank/United Nations Development Programme | US dollars |

trade, debt and savings in that order. The data reported were those available for the Nigerian environment. The essence was not only to show types of data available but also their characteristics such as how current they are, and so on.

Regarding trade, Table 5-A reports the data series on exports in Nigerian naira. Table 5-B, on the other hand, reports export values in US dollars. Similar data series for imports are reported in Tables 6-A and 6-B, while Tables 7-A and 7-B present data on external debt and domestic debt, respectively. Finally, Table 8 presents data on savings from the limited sources available.

There are some noteworthy observations from the data series. First, the series were not available for the same period for all the indexes. For example, no export data were available beyond 1985 for the International Trade Statistics and the International Financial Statistics. Also, no data were available before 1973 and beyond 1985 for dollar-denominated exports reported in the Direction of Trade Statistics as well as the Foreign Trade Statistics for Africa. Regarding debt data, our investigation shows the decomposition of data series into internal and external debt in the International Financial Statistics was discontinued in 1983. Rather, aggregate debt figures are being reported as from that year. These suggest that some of the data series available in Nigeria may be stale for some policy-related or projective studies.

Second, the data series are not all available in the same currency. Some were reported in naira, the Nigerian currency, while others were reported in US dollars. Ideally, the

data should be converted into the same currency before any comparison is made. However, given the differences between the official and the parallel market exchange rates, there may be disagreement among interested parties regarding the exchange rate to use for the conversion especially into the naira. For this analysis, conversion into naira was reduced to the minimum. Hence, some of the data series are reported in naira while others are reported in US dollars.

# Data analysis

The non-parametric statistical methods described earlier were employed to analyse the data series with respect to each macroeconomic index. We herewith present some details and discussions for each macroeconomic index.

## *Trade*

The findings with respect to trade data are presented in Table 9. Generally, the results are encouraging, since statistically non-significant differences were reported in most cases for both exports and imports. The perfect match between $CBN_A$ and $CBN_p$ is particularly pleasing. Nevertheless, the existence of some significant differences is still of concern. For example, regarding exports, significant differences were reported for IFS vs ITS, ITS vs CBN and CBN vs RET. The first relates to differences between two international data sources, while the second relates to differences between a national source and an international source. The last relates to national data sources.

For imports, significant differences were reported only in two of the pair-wise comparisons. These are ITS vs CBN and CBN vs RET. The former relates to differences between an international source compared to a national source. The latter refers to national sources alone. The perfect match $CBN_A$ and $CBN_p$ is also encouraging.

Of additional interest is the similarity in sources of data inconsistency for both exports and imports. These reflect some fundamental differences in data collection and measurement procedures. The existence of this problem between CBN and the Federal Office of Statistics (publishers of RET) is of particular concern, as both are indigenous sources of data. It is desirable to bring this observation to the attention of the appropriate authorities for possible remedial actions.

Regarding the international sources, the findings suggest the need for a dialogue between the International Monetary Fund (publishers of IFS) and the United Nations Organization (publishers of International Trade Statistics). The importance of the envisaged dialogue lies in the fact that one way or the other these two organizations influence the policy directions of, most especially, developing and highly-indebted nations such as Nigeria. Since each organization's posture will be greatly influenced by their respective data sets, they are likely to sing discordant tunes about a country like Nigeria.

**Table 5-A:** Comparison of features of data sources - Macroeconomic index: External debt

| Source | Definition of terms | Independence of source | Data collection procedures | Remarks on comparability |
|---|---|---|---|---|
| World Debt Tables | Public and publicly guaranteed long-term; private non-guaranteed long-term debt; the use of IMF credit and *estimated* short-term debt | Source of data is World Bank's Debt Reporting System (DRS) of member countries that have received loans from international agencies. | Not stated | Wider in scope than CBN and IFS. |
| Central Bank of Nigeria | No explicit definition of external debt but a listing of sources: Canada, Hungary, IBRD/FDA, etc. Public comments suggest that govt. recognizes debts under the auspices of the London and Paris clubs. | Claims to generate its data as part of its normal operations. Also claims to collect some data from the Official Gazette of the Federal Republic of Nigeria. | Not stated | Similar to those used by IFS and hence fairly comparable. More concrete definition required however. |
| International Financial Statistics | Direct and *estimated* debts of the central government, excluding loans guaranteed by the government. | Data from the Bureau of Statistics of the IMF. The main source is the Government Financial Statistics Year Book of the IMF. | Not stated | Similar to CBN but more clarification on estimation procedure employed. Needs reasons for exluding debts guaranteed by government, since all external debts have now been taken over the central government. |

**Table 5-B:** Comparison of features of data sources - Domestic debt

| Source | Definition of terms | Independence of source | Data collection procedures | Remarks on comparability |
|---|---|---|---|---|
| International Financial Statistics | Defines net domestic borrowing as the net change in government liabilities to all other sectors of the economy | Bureau of Statistics of the IMF | Not stated | Definition of domestic debt almost similar between the two sources. There may be significnt differences in data collection procedures. The two data sources appear indepen dent of each other but need to identify extent of overlap with respect to data sources and collection procedures. |
| Central Bank iof Nigeria | Defines domestic debt as those owed by the government to the Central Bank, commercial banks and other non-bank public | Through routine operations and from the Federal Ministry of Finance | No explicit explanation of data collection procedures | |

**Table 5-C:** Comparison of features of data sources - Trade data

| Source | Definition of terms | Independence of source | Data collection procedures | Remarks on comparability |
|---|---|---|---|---|
| International Financial Statistics | Exports are free-on-board, while imports encompass cost and freight. | Bureau of Statistics of the IMF. | Not described | |
| Central Bank of Nigeria | Exports are free-on-board, while imports include cost and freight. | Central Bank, Federal Office of Statistics, and Official Gazette of the Federal Government of Nigeria. | Not described | |
| Direction of Trade Statistics (a publication of the IMF) | FOB data converted to CIF basis using CIF/FOB factor used for calculating CIF import for the world export table. | Sources of data are the importing and exporting countries. Late reporting common hence those of partner countries used as estimate. | Extrapolation used for data on developing countries | |
| International Trade Statistics | | Published by the Dept. of International Economic & Social Affairs Statistical Office, UN (New York) import/Export | Not described | |
| Foreign Trade Statistics for Africa (ECA) | | Published by the ECA in the Direction of Trade Series. | Not described | |
| Review of External Trade (FOS) | Export FOB and import include c, i and f. | Published by Federal Office of Statistics but quotes its source as CBN | Not described | |

**Table 6-A**: Export data: Series A (₦m)

| Year | | Sources | | |
|------|------|------|------|------|
| | ITS | IFS | RET | CBN |
| 1970 | 885.4 | 886.0 | 885.4 | 885.4 |
| 1971 | 1293.3 | 1293.0 | 1293.3 | 1293.4 |
| 1972 | 1434.2 | 1434.0 | 1434.2 | 1434.2 |
| 1973 | 2277.4 | 2278.0 | 2278.4 | 2278.4 |
| 1974 | 5794.9 | 5795.0 | 5794.8 | 5794.8 |
| 1975 | 4925.5 | 4829.0 | 4925.5 | 4925.5 |
| 1976 | 6751.1 | 6623.0 | 6754.0 | 6754.1 |
| 1977 | 7630.7 | 7631.0 | 7630.7 | 7630.6 |
| 1978 | 6324.8 | 6328.0 | 6324.8 | 6064.4 |
| 1979 | 10400.0 | 10398.0 | 16397.7 | 10836.8 |
| 1980 | 13712.7 | 14199.0 | 13712.6 | 14186.7 |
| 1981 | 11034.2 | 11023.0 | 11034.2 | 11023.3 |
| 1982 | 9196.4 | 8206.0 | 9223.4 | 8206.4 |
| 1983 | 7751.8 | 7503.0 | 7751.8 | 7502.5 |
| 1984 | 9607.6 | 9088.0 | 9118.8 | 9088.0 |
| 1985 | 11720.8 | 11215.0 | 11720.8 | 11720.8 |
| 1986 | | | 8433.5 | 8920.5 |
| 1987 | | 29578.0 | 29577.9 | 30360.6 |
| 1988 | | 31193.0 | 31192.8 | 31192.8 |
| 1989 | | 57971.0 | | |

ITS = International Trade Statistics
IFS = International Financial Statistics
RET = Review of External Trade
CBN = Central Bank of Nigeria (Annual Report and Accounts)

There was an interesting observation regarding the identical data series for the $CBN_A$ and $CBN_p$. Both are publications of the Central Bank of Nigeria. The $CBN_A$ refers to the Annual Report and Statement of Accounts of the Central Bank of Nigeria, published annually. The $CBN_p$ refers to the Principal Economic Indicators, a publication that usually covers several years per issue. The likeness suggests insignificant differences in the extent of revision to provisional figures reported in the $CBN_A$, which is usually the major source of input into the $CBN_p$. Hence, the $CBN_p$ time-series data on trade appear to be a reliable source of relevant data for applied research.

## External debt

Table 10-A presents the findings of our statistical analysis with respect to external debt. They indicate reasonable convergence among the data series reported by IFS and those reported by $CBN_A$. The former is an international source, while the latter is national. On the other hand, the findings indicate statistically significant differences between WDT

**Table 6-B:** Export data: Series B (US$m)

| Year | Sources | |
| --- | --- | --- |
| | DOTS | FTSA |
| 1970 | 1240 | |
| 1971 | 1813 | |
| 1972 | 2147 | |
| 1973 | 3461.3 | 3466.0 |
| 1974 | 9219.0 | 9194.0 |
| 1975 | 7995.0 | 7994.0 |
| 1976 | 10771.0 | 10771.0 |
| 1977 | 11823.0 | 11838.0 |
| 1978 | 9956.0 | 9857.0 |
| 1979 | 17122.0 | 17328.0 |
| 1980 | 26958.0 | 24953.0 |
| 1981 | 17860.0 | 18049.0 |
| 1982 | 13695.0 | 13660.0 |
| 1983 | 12510.0 | 10695.0 |
| 1984 | 13091.0 | 11958.0 |
| 1985 | 14289.0 | 13113.0 |

DOTS = Direction of Trade Statistics      FTSA  = Foreign Trade Statistics for Africa

**Table 7-A**: Import Data: Series A (m)

| Year | Sources | | | |
| --- | --- | --- | --- | --- |
| | ITS | IFS | RET | CBN |
| 1970 | 756.4 | 757 | 756.4 | 756.4 |
| 1971 | 1075.1 | 1079 | 1078.9 | 1079.0 |
| 1972 | 990.1 | 990 | 990.1 | 990.1 |
| 1973 | 1224.8 | 1225 | 1222.8 | 1224.8 |
| 1974 | 1737.3 | 1737 | 1737.3 | 1736.5 |
| 1975 | 3721.5 | 3722 | 3721.5 | 3721.5 |
| 1976 | 5148.5 | 5148 | 4078.5 | 5148.1 |
| 1977 | 7089.7 | 7160 | 7089.7 | 7116.6 |
| 1978 | 8140.8 | 8137 | 8140.5 | 8211.7 |
| 1979 | 6169.2 | 6166 | 8058.3 | 7472.5 |
| 1980 | 8217.1 | 9096 | 8217.2 | 9095.6 |
| 1981 | 2602.6 | 12920 | 12602.6 | 12719.8 |
| 1982 | 10100.1 | 10771 | 100091 | 10770.5 |
| 1983 | 6555.7 | 9804 | 6551.9 | 8903.7 |
| 1984 | 4481.0 | 7178 | 5481.1 | 7178.3 |
| 1985 | 5536.9 | 7933 | 5536.9 | 7062.6 |
| 1986 | | | 5974.7 | 5983.6 |
| 1987 | | | 15698.1 | 17861.7 |
| 1988 | | | 17645.1 | 21445.7 |

ITS = International Trade Statistics
IFS = International Financial Statistics
RET = Review of External Trade
CBN = Central Bank of Nigeria (Annual Report and Accounts)

**Table 7-B**: Import data:  Series B (US$m)

| Year | Sources | |
|------|---------|---|
| | DOTS | FTSA |
| 1970 | – | – |
| 1971 | – | – |
| 1972 | – | – |
| 1973 | 1861.2 | 1865.0 |
| 1974 | 2774.0 | 2772.0 |
| 1975 | 6932.0 | 6041.0 |
| 1976 | 8213.0 | 8213.0 |
| 1977 | 11021.0 | 10987.0 |
| 1978 | 12811.0 | 12763.0 |
| 1979 | 9268.0 | 10253.0 |
| 1980 | 16478.0 | 15025.0 |
| 1981 | 20397.0 | 20453.0 |
| 1982 | 14997.0 | 15003.0 |
| 1983 | 8850.0 | 9062.0 |
| 1984 | 7067.0 | 5868.0 |
| 1985 | 7577.0 | 6205.0 |
| 1986 | – | – |
| 1987 | – | – |
| 1988 | – | – |

**Table 8-A:** External debt data (Nm)

| Year | Sources | | | |
|------|---------|---------|---------|---------|
| | IFS | $CBN_A$ * | $CBN_P$ ** | WDT |
| 1973 | 277 | 276.4 | 276.9 | 795.3 |
| 1974 | 322 | 322.4 | 322.4 | 802.6 |
| 1975 | 350 | 349.9 | 349.9 | 708.7 |
| 1976 | 376 | 374.6 | 374.6 | 570.8 |
| 1977 | 364 | 365.1 | 365.1 | 2013.4 |
| 1978 | 1252 | 1252.1 | 1252.1 | 3258.2 |
| 1979 | 1614 | 1611.5 | 1611.5 | 3741.0 |
| 1980 | 1864 | 1866.8 | 1866.8 | 4913.7 |
| 1981 | 3024 | 2331.2 | 2331.2 | 7451.2 |
| 1982 | 2595 | 8819.8 | 6801.0 | 8679.2 |
| 1983 | Discontinued | 10577.7 | 8576.8 | 13348.1 |
| 1984 | | 14536.6 | 12077.3 | 14273.5 |
| 1985 | | 17230.6 | 13963.0   17400.4 | |
| 1986 | | 41451.9 | 30956.5 | 42075.3 |
| 1987 | | 100787.6 | 100787.6 | 125359.9 |
| 1988 | | 133956.6 | 133956.3 | 145080.0 |
| 1989 | | 212750.7 | 212750.8 | 241361.4 |
| 1990 | | | | 301056.0 |

\*        Annual Report and Accounts of the Central Bank of Nigeria
\*\*        Nigeria's Principal Economic Indicators, published by the Central Bank of Nigeria
WDT      World Debt Tables

**Table 8-B**: Domestic debt data (Nm)

| Year | Sources | | |
|------|---------|---------|---------|
|      | IFS | $CBN_A$ | $CBN_P$ |
| 1973 | 1057.0 | 1158.6 | 1061.2 |
| 1974 | 1262.3 | 1266.6 | 1266.6 |
| 1975 | 1674.3 | 1678.3 | 1678.3 |
| 1976 | 2630.1 | 2630.1 | 2630.0 |
| 1977 | 3408.4 | 4636.0 | 4636.0 |
| 1978 | 5980.2 | 5983.1 | 5983.1 |
| 1979 | 7216.9 | 7282.3 | 7282.3 |
| 1980 | 7919.0 | 7918.5 | 7918.5 |
| 1981 | 11446.0 | 11445.5 | 11445.5 |
| 1982 | 14848.0 | 14847.5 | 14847.5 |
| 1983 | Discontinued | 22224.3 | 22224.3 |
| 1984 |  | 25675.0 | 25675.0 |
| 1985 |  | 27952.0 | 27952.0 |
| 1986 |  | 28451.2 | 28451.2 |
| 1987 |  | 36790.6 | 36790.6 |
| 1988 |  | 47031.1 | 47031.1 |
| 1989 |  | 47051.1 | 54555.8 |

vs $CBN_A$, as well as $CBN_A$ vs $CBN_p$. WDT is an international source, while the others are internal.

The convergence of IFS and $CBN_A$ is pleasing, given that each source independently generates its own data series. However, some areas of inconsistency must be pointed out. For example, WDT is acknowledged to be an authoritative source on external debt figures. Hence, the inconsistency of its data series with that of $CBN_A$ is of much concern. In fact, this finding tends to reinforce the fear in some quarters in Nigeria that the country's alleged external debt is suspect. In particular, the annual figures reported by WDT are uniformly greater than those reported by $CBN_A$. The relevant authorities definitely need to reconsider these huge differences.

Of greater surprise is the inconsistency in data series between $CBN_A$ and $CBN_p$, both of the Central Bank of Nigeria. As indicated earlier, $CBN_A$ ordinarily serves as the major source for the $CBN_p$ time-series data. The statistically significant difference between the two sources further highlights the basic problem with the external debt position of the country. Again, the identification of the major causes of the divergences is highly desirable.

## Gross national savings

Finally, Table 10-B presents the analysis of savings data between the $CBN_A$ and the Statistical Bulletin of the Federal Office of Statistics. The findings suggest a statistically significant difference in the data series from the two sources. We have to point out that

**Table 9**: Gross national savings (₦m)

| Year | Source | |
|------|--------|--------|
| | CBN[1]BUL | WT |
| 1970 | – | – |
| 1971 | – | – |
| 1972 | – | – |
| 1973 | – | – |
| 1974 | – | – |
| 1975 | 4796.9 | 4160 |
| 1976 | 7371.4 | 6610 |
| 1977 | 8017.5 | 9840 |
| 1978 | 4896.0 | 8100 |
| 1979 | 10257.8 | 11460 |
| 1980 | 11189.1 | 11760 |
| 1981 | 5604.3 | 8160 |
| 1982 | 4167.1 | 5910 |
| 1983 | 3607.5 | 4810 |
| 1984 | 2678.7 | 5370 |
| 1985 | 3964.4 | 6300 |
| 1986 | (1494.7) | 3180 |
| 1987 | 3573.7 | 8000 |
| 1988 | 361.1 | 7760 |
| 1989 | 18489.9 | 32110 |
| 1990 | 67699.2 | 57780 |
| 1991 | 110264.1 | 52730 |
| 1992 | – | – |
| 1992 | – | – |

Note:

| | |
|---|---|
| CBN[1]BUL | = CBN's Statistical Bulletin |
| WT | = World Tables |

there was a unique problem regarding savings data on Nigeria. First, not many publications report savings data on Nigeria. The most reliable so far has been the Statistical Bulletin of the Central Bank of Nigeria.

Second, no disaggregated data are available on Nigeria. Hence, it is not possible to separate public sector savings from those of the private sector. Since most public sector savings are generally insensitive to interest rate manipulation as well as to other monetary tools, it might be difficult to meaningfully measure the impact of some monetary policy tools on savings. For policy purposes, this problem deserves immediate attention. It also suggests the need for an in-depth appraisal of the data base used for previous applied research on savings. Furthermore, appropriate support should be provided to enhance the disaggregation of savings data into the public and private components.

**Table 10:** Trade data - Results of analysis

| Comparison | Imports | Exports |
|---|---|---|
| IFS vs ITS | w = 23.5* | w = 36.5 |
| IFS vs RET | u = 148 | u = 130 |
| IFS vs $CBN_A$ | u = 181.5 | u = 178.5 |
| ITS vs RET | u = 132 | u = 135.5 |
| ITS vs CBN | w = 1* | w = 28* |
| CBN vs RET | w = 10* | w = 36* |
| $CBN_A$ vs $CBN_P$ | The data from both sources are identical for both import and export trade | |
| DPTS vs FTSA | w = 33 | w = 20 |

* Test significant at $\alpha = 0.05$
U = Unequal samples
W = Equal samples

**Table 11-A**: Debt data

| Comparison | External |
|---|---|
| IFS vs $CBN_p$ | w = 17.5 |
| WDT vs $CBN_A$ | w = 6* |
| $CBN_A$ vs $CBN_p$ | w = 1* |

**Table 11-B**: Gross national savings

| | |
|---|---|
| $CBN_{BUL}$ vs WT | 4 = 26* |

*Test significant at 0.05 l.s.

U = Unequal samples

W = Equal samples

# VII.  Discussion of findings

The results of our analysis indicate a mixture of both consistency and inconsistency among macroeconomic data series covered therein.  Most of the sources of data on trade showed a reasonable degree of convergence, among both national and international sources.  This is somehow encouraging, especially relative to other research results in respect of trade data on sub-Saharan Africa (e.g. Yeats, 1990).  However, the few cases of inconsistencies are also of concern, given the seemingly fundamental nature of the problem with respect to both exports and imports.  Nevertheless, the most spectacular finding on trade data is the perfect match between export and import data series released by the two publications of the Central Bank of Nigeria.

The findings for external debt are not so pleasing.  Of particular concern is the inconsistency reported for WDT and $CBN_A$, both international and national authorities, respectively, on debt data series.  The inconsistency between the two CBN sources was also a surprise.  Overall, these results reinforce the suspicion regarding the non-reliability of the external debt figures being used to assess Nigeria's debt burden.  It was also observed that the CBN's figures were uniformly lower than those reported by WDT.  These observations obviously deserve the attention of the relevant authorities if there is genuine concern for reliability of external debt data series.  In effect, the findings suggest that there is still a basic problem in determining the actual external debt position of Nigeria.

We also consider it appropriate to reveal the discontinuation of the external debt series by the IFS as from 1985.  Ever since, the IFS seems to have combined both external debt and internal debt data series.  It might be desirable to know the reason for the preference for aggregated data that obviously is less informative than hitherto.

The results on gross national savings data also indicate data inconsistency between the two sources consulted, and the nature of the inconsistency is interesting as well.  For example, for 1986, the CBN Bulletin reported a negative gross national saving of ₦1.495 billion, against a positive figure of ₦3.180 billion reported by the World Tables.  Also, the greatest difference — ₦13.521 billion — was reported between the two sources for 1989.  Given the importance of this macroeconomic index, this finding should be of concern to policy analysts.

Of equal concern is the non-disaggregation of the savings data into their public and private components.  This is even more important in an era of deregulation of interest rates that is expected to encourage private savings.  This constraint will hinder a reliable estimation of the response of savings to economic reform programmes, since public

savings are usually insensitive to their environmental situation, especially in Nigeria.

There are also some observations from the data series that deserve attention. Even for those analyses that showed convergence overall, the year-to-year comparison of figures showed some huge differences. Hence, for policy-oriented research, an absence of significant differences does not necessarily imply a good match in the figures for each of the years covered by the study.

For example, for the year 1976, there was a difference of ₦128.1 million in the export data reported by ITS compared to that of IFS. Depending on the size of the country's gross domestic product, such a large difference may trigger some policy reactions. The same thing applies to import trade data between DOTS vs FTSA for the year 1980 when a difference of US$1.453 billion was recorded. This appears a colossal sum for a single year. Similar observations are discernible in other indexes. Hence, an in-depth appraisal of the annual absolute differences between the paired sources can be rewarding.

Further on the issue of data inconsistency, there are two dimensions to this problem. There are intra-source data inconsistencies, especially with publications by the Central Bank of Nigeria. This raises an issue regarding the credibility of data sources being used by agencies under the control of the same organization. It is desirable for the Central Bank to look into this matter with a view to enhancing the convergence and hence the credibility of its various publications.

The inter-source comparisons also indicate lack of convergence. Given that each organization is independent of the other, several factors may account for the lack of convergence. One factor that readily comes to mind is the issue of sampling design, especially the definition of concepts. As shown in Table 4, there are differences in definitions of concepts as well as in data collection procedures. In fact, the definition of debt was so divergent across sources that the net effect was the lack of convergence among virtually all the data sources.

There were also differences in data collection procedures. While some sources implicitly claimed to have generated their own data, others admitted having adapted from publications of other organizations. The latter procedure is prone to magnifying the problem, given the lack of understanding of the data collection methods employed by the data generating agency. In this case, it might be desirable to be cognizant of Emory's (1980) warning that one must especially be on guard when a study (or data source) does not adequately report the methodology and sampling design employed.

Of additional concern are the implications of this study's findings on research activities. The lack of convergence amounts to data inconsistency, implying lack of reliability of the data series. Consequently, the validity of research findings based thereon is in serious doubt. This inference calls for extreme caution in accepting the results of applied or theoretical research especially as they relate to the macroeconomic indexes covered by this study.

As for the empirical aspect, the consequences are fairly discernible in divergent findings of research using these data series. In fact, as indicated earlier, it was this casual observation that gave birth to this research. Then as now, different researchers arrive at different conclusions based on the data source used for their studies. It therefore follows that the accuracy or societal desirability of policy decisions based on any of these findings

cannot be guaranteed.

The same implications apply to theoretical or projective research. The former relates to model building based on inconsistent data. The usefulness of such exercises will continue to be in doubt unless and until data convergence can be assured. In the latter case, projections are usually made regarding macroeconomic targets considered attainable within a specified time period. Given the unreliability of the underlying data, the targeted objectives may not be realizable.

In summary, this study's findings have indicated inconsistencies among macroeconomic data available for Nigeria. This problem is also a matter of degrees, as earlier indicated, which implies that the data series may not be reliable. Consequently, research findings based thereon may be of doubtful validity.

# VIII.  Some suggestions and concluding remarks

The existence of inconsistencies among various data sources does not augur well for research, since it suggests lack of reliability of data and consequently doubtful validity of research findings based thereon.  Given the results reported above, there is need for concerted efforts to enhance data consistency from the different data sources on identical indexes. The following suggestions are offered for further consideration.

First, with regard to intra-source data inconsistency, the organizations concerned should endeavour to identify the causes. This suggestion is of particular relevance to the Central Bank of Nigeria, which controls several publications. Among these are the Annual Reports and Accounts of the Central Bank, the Statistical Bulletin, Nigeria's Principal Economic Indicators and the Economic and Financial Review.  Interestingly, all these publications are domiciled in the Research Department of the Central Bank.  Given the intensity of use of these publications, the Central Bank needs to address the issues as soon as possible.

The inter-source comparison also dictates the type of suggestions to be made.  Of particular importance here is the need for homogeneity of perception of what each concept means. For example, the concept of external debt means different things to different data-generating agencies.  Furthermore, there should be homogeneity in definitions. Otherwise, one might end up comparing apples and oranges.  This will also make invalid the combination of data series from different sources especially for applied research or those based on time-series analysis.

## The ideal situation

One utopian suggestion is the standardization of methodology and sampling design among data-generating organizations.  Although this is attainable, we recognize that no organization may want to subjugate its independence to another or to a union, unless and until the advantages therefrom can outweigh the disadvantages, in the context of data consistency as the overall objective. Pending the realization of this laudable objective, it is recommended that each organization adequately describes its objective, methodology and sampling techniques employed.  This will allow for a transformation of data from one source to another to enhance the construct validity of each index being measured.

# Future course of action

As indicated earlier, this study is expected to have a continental focus. Nigeria was chosen as a case study as a basis for evolving an appropriate methodology for extending the study to other sub-Saharan African economies. Hence, an appropriate submission will be made taking cognizance of the major comments and observations of participants during the presentation of this report.

Also, it was agreed early on that the research coordinator should visit some selected international organizations responsible for some of these publications. However, such a selective approach might not be adequately representative. And as the cost of undertaking the required trips may be prohibitive, the approach may therefore not be cost-effective. As an alternative, a new proposal will be submitted whereby sufficient information about the data-collection techniques of the various international organizations could be generated and analysed. A similar approach may be adopted for other sub-Saharan African countries, in addition to specific studies similar to this one for Nigeria.

# Appendix: Survey Instrument

Department of Economics
University of Ibadan

24th April, 1992

Dear Sir/Madam,

SOURCES OF MACROECONOMIC DATA ON NIGERIA: A SURVEY

As you are aware, there are various organisations, both internal and external, which publish macroeconomic data on Nigeria. There are also some overlaps regarding the indices covered by each data source. However, we have observed that there are inconsistencies in data on similar items across the data sources. This poses a danger to the reliability and/or validity of research findings on these data sources.

Given this, there is an on-going study aimed at identifying the cause of the observed inconsistencies. Since there is a legion of data sources, it becomes necessary to select a few appropriate ones for in-depth analysis. This is to be guided by the level of familiarity with, and intensity of patronage of the various data sources. This is the rationale for this survey.

We therefore solicit your cooperation by filling the attached questionnaire. You are requested to rank-order the data sources in descending order of importance, in terms of intensity of usage. That is, the most intensively used data source will have a ranking of 1. The next will have a ranking of 2, and so on. You are also free to list other sources with which you are familiar but not listed.

Your timely action will be highly appreciated.

Yours faithfully,


Ademola Ariyo
(Study Coordinator)

| Publisher | Title of Publication | Rank (in terms of intensity of use/ Consultation |
|---|---|---|
| A.   INTERNAL | | |
| 1.   Federal Office of Statistics | (1)   National Integrated Survey on Households (NISH) | |
| | (ii)   Statistical Bulleting | |
| | (iii)   Annual Abstract of Statistics | |
| 2.   Central Bank of Nigeria | (i)   Annual Report and Statement of Accounts. | |
| | (ii)   Statistical Bulleting (new) | |
| | (iii)   Economic and Financial Review | |
| B.   EXTERNAL | | |
| 3.   International Monetary Fund | (i)   Internal Financial Statistics | |
| | (ii)   Direction of Trade Statistics | |
| | (iii)   Balance of Payment Statistics | |
| | (iv)   Government Finance Statistics Yearbook. | |
| | (v)   Annual Report on Exchange Arrangement and Exchange Restruction | |
| 4.   World Bank (IBRD) | (i)   World Bank Development Report | |
| | (ii)   World Debt Tables | |
| | (iii)   World Tables | |
| 5.   World Bank and United Nation Development Programmes | African Economics and Financial Data. | |
| 6.   Economic Community of West African States (ECOWAS) | Annual Statistical Bulletin | |

| 7. | Organisation of Petroleum Exporting Countries (OPEC) | Facts and Figures | |
|----|----|----|----|
| 8. | Organisation for Economic Coopera-tion and Develop-ment (OECD) | Statistical Bulletin | |
| 9. | Food and Agriculture Organisation (FAO) | Commodity Review and Outlook | |
| 10. | United Nations (UN) | (i) | African Statistical Yearbook |
| | | (ii) | Trade Statistics |
| | | (iii) | Statistical Yearbook |
| 11. | United Nations Economic Commission for Africa (UN-ECA) | (i) | Quarterly Statistical Bulletin for Africa |
| | | (ii) | Statistical Bulleting for Africa |
| | | (iii) | Foreign Trade Statistics for Africa |
| 12. | International Labour Organisation (ILO) | Yearbook of Labour Statistics | |
| 13. | Others: Please List | | |

    (a)

    (b)

    (c)

    (d)

    (e)

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