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The Relationship between Inflation and the Structure of the Nigerian Economy

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THE RELATIONSHIP BETWEEN INFLATION AND THE STRUCTURE OF THE NIGERIAN ECONOMY

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THE RELATIONSHIP BETWEEN INFLATION AND THE NIGERIAN ECONOMY.

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To my Uncle Chief C. D. Umeh who took the responsibility of training me from the Secondary School to the University.

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ABSTRACT

The focal problem of the study is to investigate the implications of the structure of the economy - both in terms of output composition and the relative size of the non-agricultural sector to the agricultural sector - for the behaviour of the general price level. Previous empirical studies have made use of aggregate output. This is questionable because some components of output may be directly related, whereas others may be inversely related, to the price level. The present study investigates the relevance of structural composition of output for the understanding of inflation in Nigeria. Relatedly, the size of non-agricultural production relative to agricultural production, as a factor responsible for inflation, is empirically tested.

The Ordinary Least Squares technique is used to estimate the functional relationships between inflation and the various variables that reflect the structural composition of the economy. The study relies on time - series data for the period, 1960 - 1977. Output variables at different levels of disaggregation are used to run the regressions, thus making it possible to test the hypothesis

It is found that the general price level is a positive function of aggregate output - the G.D.P. However, experiments with disaggregated output variables show that while the price level is positively related to petroleum exports, manufacturing output, and construction output, it is inversely related to agricultural output. Thus the inadequacy of using aggregate output as a regressor in empirical studies of inflation is highlighted. The study also shows that the size of non-agricultural production relative to agricultural production is positively related to the price level. This indicates that part of Nigeria's inflation can be traced to the absence of critical balancing of the agricultural and non-agricultural sectors in the process of growth.

The empirical findings are further applied to a number of empirical and theoretical issues: the condition for intertemporal stability of the parameter of an aggregated regressor, optimal partitioning of aggregated regressors for the purpose of estimation of functional relationship, explanation for 'wrongly' signed coefficients in regression models, and reason for the instability of the Philips Curve.

Policywise, inflationary tension can be reduced through efficient use of resources, through effective agricultural development, and through appropriately using

public expenditure to influence the composition of output.

The evidence from this study points to the fact that inflation in Nigeria is considerably a product of the structure of output in the process of economic growth. Thus anti-inflation policy should be formulated and implemented within the broader context of economic growth programming.

CHAPTER 1

THE PROBLEM

Inflation has become a persistently complex economic and social problem of all economies for several decades now. However, the rate and nature of inflation differ from economy to economy depending on, among other factors, the level of economic development, the structure of production, and the efficiency of resource utilization. Naturally, the reactions of most scholars to the problem have been to consult economic theory for possible explanations. But as Roy Weintraub (1977) has succinctly noted,

> Our knowledge of macro-economics is not so secure that prejudgement can be attempted lightly. Economics is not theology, where the articles of faith must be supported to the end of time.

In view of this, there is a compelling need for more empirical studies on inflation in diverse directions. Such studies will unravel new facts on the causes, nature and consequences of inflation for control policy formulations.

1.1 Statement of The Problem

Since 1960, Nigeria has witnessed an unprecedented skyrocketing of prices. For example, with 1970 as the base year, Nigeria's consumer price index (C.P.I.) which was 66.4% in 1960 had risen to 281.6% in 1977 (World Bank, 1976:178; 1980:151). The implication is that the internal

purchasing power of the naira had fallen considerably. Table 1 shows the movement of the C.P.I. from 1960 to 1977.

From the series of annual percentage changes in the C.P.I., two broad phases can be discerned. The first was 1960-1968, a period of generally moderate price increases. In contrast, the second period, 1969-1977, was a phase of more severe inflation. From negative growth rates of -3.72% and -0.37% in 1967 and 1968, respectively, the inflation rate became 9.89% in 1969 and turned into double digits by 1970. Although the upward trend in the growth rate was punctuated by single-digit rates of 3.44% and 4.66% in 1972 and 1973, respectively, the high double-digit growth rate was restored by 1974 and sustained thereafter. The last three years of the period, - 1975, 1976, and 1977 registered inflation rates of 34.27%, 21.49% and 21.48%, respectively. These high inflation rates arose mainly from the 'Udoji Salary Awards' of 1974 by which general salary increases and arrears were granted to public servants. There resulted excess liquidity which found outlet in increased demand for consumer durables and non-durables and led to the development of new tastes by Nigerians, particularly for imported goods.

It can be concluded from these developments that by the seventies, inflation had become a real threat to the Nigerian economy. This has become a great problem to the country because inflation brings with it many economic and

Table 1: Nigeria's Consumer Price Index, 1960–1977 (Base: 1970 = 100).

Year	Consumer Price Index	
	Level	Annual % Changes
1960	66.4	-
61	70.6	6.32
62	74.3	5.24
63	72.3	-2.69
64	73.1	1.12
65	76.0	3.97
66	83.3	9.60
67	80.2	-3.72
68	79.9	-0.37
69	87.8	9.89
1970	100.0	13.90
71	116.1	16.10
72	120.1	3.44
73	125.7	4.66
74	142.6	13.44
75	190.8	34.27
76	231.8	21.49
77	281.6	21.48

Source: World Bank, World Tables, 1976, p. 178 and 1980, (2nd Ed.), pp. 150–151.

(i) Aggravation Of Inequitable Income Distribution: A long-standing cause of dislike for inflation is that it aggravates the already existing problem of inequitable distribution of income. It redistributes income from poor wage earners, pensioners and others with relatively fixed money incomes, to rich profit earners (Bronfenbrenner and Holzman, 1963).

(ii) Destruction Of The Basis For Allocation Of Scarce Goods: A scholar who is of the opinion that there is a more serious problem associated with inflation, than its income distributional effects, is Reese (1977). One of the basic premises of a market economy is that income of people should be based on their productive contributions. But inflation renders this premise inoperative. This is because inflation encourages cost-plus pricing and "with cost-plus pricing there is no generally accepted basis for allocating scarce supply of goods and services."

(iii) Weakening Of The Functioning Of The Price System: Clark (1982) has pointed out another possible negative consequence of inflation. Inflation, by increasing the variance of relative prices, may reduce the ability of the price system to transmit information effectively. As a result, the optimality of economic decisions in a

market economy, will be jeopardized. Tobin (1972) has discussed specific ways by which such distortions of the market-signalling system by inflation can lead to mis-allocation of resources. First, they can lead to mis-allocation of time by workers who overestimate their real wages. Second, they can cause oversupply by sellers who contract for future deliveries without taking correct account of the increasing prices of the inputs necessary to fulfill contracts.

The evils of inflation notwithstanding, there is a growing trend of thought that it cannot be suppressed and that the best thing to do when it occurs is "to learn to live with it" (Curwen, 1976:134). But even if it is accepted that people should live with inflation, it still remains necessary to understand it. One can only live comfortably with what one understands. A diagnosis of inflation, thus, remains useful whether for the purpose of eliminating it or for the purpose of accommodating it. Such diagnosis should be carried out for individual countries because the causes and nature of inflation often reflect the peculiar characteristics of the given economy.

One major strand of explanations for inflation causality in Nigeria and other countries is that it is due

to excess demand over the supply of goods and services (see for example, Okurounmu, 1976). Implicit in such explanations is the view that increases in output of goods and services will, ceteris paribus, exert a downward pressure on the general price level. But this reasoning entails too much generalization. It is necessary to proceed further and analyze the structure of the economy as well as the composition of output before useful conclusions about the output-price relationships can be drawn.

It is of limited relevance to express price as a function of aggregate output and to argue that increases in the output variable will necessarily have a significantly repressing effect on the price level. Table 10 (infra, Chapter 2) shows that a considerable proportion of the GDP is exported. Given this fact, it would be unreasonable to expect that mere growth of the GDP will depress domestic prices. Though it may be possible to use export revenues to import goods and services, there is no guarantee that the items imported will be those that would satisfy current demands for consumer goods and services. Imports may be concentrated on capital goods that add to growth potential rather than on consumer goods. Moreover, it is the contention of this work that imports accentuate inflationary

pressure especially when they are purchased from economies with relatively high inflation rates. This is the case of imported inflation.

Nigeria's crude oil which is mainly for exports, exacerbates inflation in two ways. First, oil exports diminish the weight of real GDP in generally depressing prices. Second, the monetization of oil revenues is a major cause of increases in money supply which, ceteris paribus, has accentuating influence on the general price level. Thus Osagie (1982) pointed out that oil exports are "positively and significantly related to the index of domestic prices" in the Nigerian economy. Similarly, growth in output of construction industry that does not lead directly to increases in final consumer goods and services while increasing money income, accentuates inflation, in the short run at least. Moreover, this is to be expected given the high import content of construction output.

Therefore, it is necessary to disaggregate the GDP so as to investigate how the different components relate to the general price level. The results from the use of aggregate output in an empirical study, therefore, would be of limited relevance since they would obscure a lot of the underlying influences which are necessary for the understanding of the structure and dynamics of Nigeria's

inflation. It is for this reason that, a 'structure-of-the economy' approach is necessary in this study.

An emerging corollary is that while the price level may be inversely related to certain components of output, it may be positively related to other components. Deriving from this possibility is an important theoretical problem: the intertemporal stability of the parameters of an aggregated regressor composed of items, some of whose marginal impacts on the regressand are positive and others of whose marginal impacts on the regressand are negative.

Furthermore, as has been noted by Kaldor (1980:142) and Thirwall (1974:221), the relative sizes of certain sectors usually impart inflationary pressures on the economy. This is generally considered to be true with a rapid expansion of the nonagricultural sector relative to the agricultural sector in a developing country like Nigeria. As real income in the nonagricultural sector expands, there is likely to be increased demand for products of agriculture like food and raw materials. Where the growth of agriculture is lagging behind the growth of nonagriculture, and where because of weak export base and scarcity of foreign exchange, domestic raw materials and food deficits cannot be readily offset by imports, there develops excess demand

for food and raw materials and the prices of these items will rise. Other prices may rise in sympathy.

The focal problem of this study, therefore, is to investigate the implications of the structure of the economy - both in terms of output composition and the relative sizes of the agricultural and nonagricultural sectors - for the behaviour of the general price level. In the bid to achieve this objective, the relationship between the general price level and the following variables - aggregate output (GDP), agricultural output, nonagricultural output, manufacturing output, construction output, petroleum export, and the ratio of nonagricultural output to agricultural output, will be explicitly and empirically examined.

Certain questions which arise from the last paragraph which this study will try to answer are: How reliable is it to use aggregate output as an explanatory variable for the price level? Are all components of the GDP homogeneous in terms of the directions of their impacts on the price level? If they are not, what are the implications for model specification and estimation? In particular, what are the conditions for intertemporal stability of the parameter of an aggregated regressor? Is the size of

nonagricultural output relative to agricultural output an important determinant of price behaviour?

This research paper attempts to provide modest answers to these questions.

1.2 Importance Of The Study

This study is important for several reasons, the first of which is that it attempts to reveal to what extent inflation is an inevitable cost for desirable structural changes and to what extent it could be mitigated through deliberate adjustments in sectoral balance. Another importance of this study is the realization that the structure of economic activity is significantly influenced by public policy. From this point of view, it is hoped that the research will provide policy makers, with some indications of the inflationary repercussions of alternative structural patterns of growth. Anti-inflation policies can be better rationalized if they are based on empirical diagnosis of the problem. Specifically, the research highlights the connections between the concepts of 'balanced growth' and price stability.

From a more general point of view, the study is relevant by contributing to the understanding of the

problem of persistent disequilibrium which has characterized most developing economies since the 1960s. Simplistically stated, the study facilitates understanding of the problems of persistent disequilibrium.

The study has still one more importance that is theory-development oriented. It suggests a modified framework for the analysis of the role of output variations in price dynamics. It points out a special aspect of aggregation bias: that which arises from the non-homogeneity in the direction of the influences of components of an aggregated regressor, on a dependent variable. The sign heterogeneity referred to has implications for the inter-temporal stability of the estimate of the parameter of the aggregated regressor. This theoretical issue has a far-reaching practical implication for as Gupta (1969:4) has observed:

> Use of the macro structural coefficients for assessing the influence of a change in any macro variable/s will depend upon the continuation of the stability of these coefficients. Therefore, if this condition is not fulfilled their use as guide lines for policy formulation can lead to misleading results.

This research aims at designing a framework for circumventing the problem anticipated by Gupta through

appropriate model specification. This is achievable through the explicit recognition of the need to disaggregate the regressor, on the basis of differing directions of the marginal effects of its components, on the regressand. It may be stated that disaggregation of the output regressor in this study has not been carried to the lowest level. For example, agricultural output can further be disaggregated into fishing output, livestock output, crop output, etc. However the degree of disaggregation employed is considered adequate for the demonstration of the focal issues in the research problem.

1.3 Limitations Of The Study

This study, is by no means an exhaustive treatment of the problem of inflation in Nigeria. This is because the problem is both vast and complex. Consequently, such factors like trade union power, expectations and balance of payments conditions which are known to be important determinants of the price level, have not been explicitly included in the study. Furthermore,

the study does not treat the unique problem of stagflation, a situation of simultaneously increasing unemployment and prices. Because there are no reliable unemployment statistics for Nigeria, the possibility of extending the research to an empirical study of stagflation is considerably limited.

In view of the above limitations, whatever contribution the study makes, will be more meaningfully utilized if skillful cognizance is taken of the factors that have not been explicitly considered.

1.4 Period Covered By The Study

The study covers the eighteen-year period, 1960-1977. The choice has been influenced by the fact that the problem under investigation (inflation) was adequately exhibited during the period as well as by the

availability of mutually consistent data on the relevant variables.

1.5 Organisation Of The Thesis

Chapter 1 has treated the statement of the problem and the importance of the study. It also highlighted the limitations of the study and stated the period covered by the study. Chapter 2 discusses some characteristics of the Nigerian economy and their implications for the behaviour of the general price level. The characteristics discussed are: the agricultural-nonagricultural sector interaction, the composition of money supply and the nature of the financial system, public expenditure and Development Plans, and foreign trade. A critical survey of the literature on inflation is taken up in Chapter 3. In Chapter 4, the theoretical framework is

developed while in Chapter 5, the methodology is outlined.

The results of the econometric estimation are presented in Chapter 6 where the various statistical tests are also conducted and the working hypotheses of the paper are evaluated. In Chapter 7, the results are discussed in such a way that their policy, empirical and theoretical implications are revealed. Chapter 8 summarizes the thesis.

CHAPTER 2

SOME CHARACTERISTICS OF THE NIGERIAN ECONOMY CONTRIBUTORY TO INFLATION, 1960-1977

A discussion of the structure of the Nigerian economy is an overwhelming task given the large size and varied economic experience of the country. Be that as it may, some knowledge about that structure is a useful background to a study on inflation. This chapter is therefore limited only to a survey of the major and relevant characteristics of the economy.

2.1 Agricultural And Nonagricultural Sectors: Nature And Performance

It is common in a study of a developing economy to emphasize the relationship and/or the difference between the agricultural and nonagricultural sectors. This procedure owes much to the fact that after political independence, hitherto predominantly agricultural countries attempt to industrialize and modernize. The Nigerian economy as a developing one has, since independence, acquired many industries and is a dualistic one. But it is still a predominantly traditional, rural, agricultural-based economy. The agricultural sector is characteristically

a subsistence one that relies largely on nonwage labour for its production, with almost completely noncommercialized, communally-owned land, often regarded as sacred. It is in this regard that one remembers Ajayi's assertion that "it is impossible, perhaps ..... unrealistic, to write any economic survey of Africa without taking into account some non-economic factors" (1978:61). An important implication of this land tenure system and the world view on land in rural Nigeria, is that commercial and entrepreneural activities in this sector are rather limited.

The complement to the claim of dualism arises from the existence of a relatively modern, non-agricultural sector consisting of manufacturing, construction and service industries. These are characterized by wage-type employment, commercially organized production, a relatively high degree of monetization and keen entrepreneural activities.

In dualistic models, the relationship between the agricultural and nonagricultural sectors is provided by rural-urban migration which links rural and urban labour markets. Workers migrate from rural to urban areas "in response to perceived differential in income" (Mynth, 1965). This phenomenon is true of Nigeria. However, the Lewis (1954) and Fei-Ranis (1964) views on "surplus labour" - that

part of the rural labour force which can be absorbed by the urban sector without causing declines in the output of the rural sector - seems inapplicable to Nigeria. This is particularly because rural urban migration is one of the major causes of the secularly declining agricultural production in Nigeria. Moreover, the rain-fed status of farming and the inherent seasonality of farm activities and employment, make it extremely difficult to identify what constitutes surplus labour in the Lewis-Fei Ranis sense.

Table 2 shows the real values of the GDP and the contributions of agriculture and nonagriculture at 1974 constant prices as well as their respective annual percentage changes over 1960-1977 period. Over the period it can be observed that the GDP grew from a 1960 figure of N6322.8 million to a 1977 figure of N16137.8 million - an increase of about 155%. Agricultural output which grew from N3346.6 million to N3657.4 million only registered a 9% increase over the same period. On the other hand, nonagricultural production rose from N2976.2 million to N12480.4 million, a phenomenal increase of 319% over the same period.

One can have further insight into the behaviour of the above three variables by studying fluctuations in

Table 2: Nigeria's GDP, Agricultural Output And Industrial Output - Value (at 1974 constant prices) and Annual Percentage Change, 1960-1977.

Year	GDP		Agriculture		Non-agriculture	
	Value (Nm)	Annual % Change	Value (Nm)	Annual % Change	Value (Nm)	Annual % Change
1960	6322.8	-	3346.6	-	2976.2	-
61	6352.2	0.46	3250.4	-2.87	3101.8	4.22
62	6652.5	4.72	3367.1	3.59	3285.4	5.92
63	7210.4	8.39	3643.1	8.20	3567.3	8.58
64	7401.1	2.64	3626.1	-0.47	3775.0	5.82
65	7803.6	5.44	3643.7	0.48	4159.9	10.20
66	7550.7	-3.24	3390.1	-6.96	4160.6	0.02
67	6384.3	-15.45	2864.5	-15.50	3519.8	-15.40
68	6308.4	-1.19	2822.6	-1.46	3485.8	-0.96
69	7999.2	26.80	3247.2	15.04	4752.0	36.32
1970	10267.0	28.35	3815.7	17.51	6451.3	35.76
71	11542.6	12.42	4015.7	5.24	7526.9	16.67
72	11929.8	3.35	3723.3	-7.28	8206.5	9.03
73	12585.0	5.49	3425.2	-8.00	9159.8	11.62
74	13915.1	10.57	3457.4	0.94	10457.7	14.17
75	13652.7	-8.88	3362.1	-2.76	10290.6	-1.60
76	15309.7	12.14	3480.8	3.53	11828.9	14.95
77	16137.8	5.41	3657.4	5.07	12480.4	5.51
Average annual % change		5.73		0.84		9.46

Source: Developed from World Bank, World Tables, 1976 p. 178 and 1980 (2nd Ed.) pp. 150-151.

their values. These are indicated by the annual percentage changes in Table 2. The GDP, agricultural and nonagricultural productions, dropped from 1966 to 1968. The growth rates for GDP in 1966, 1967 and 1968 were respectively, -3.24%, -15.45% and -1.19%; for agriculture, they were -6.96%, -15.5% and -1.4%, respectively, and for nonagriculture, they were 0.02%, -15.4% and -0.96%, respectively. The GDP growth rates averaged 5.73% while those of agriculture and nonagriculture were 0.84% and 9.46% respectively, over 1960-1977. A marked feature was the phenomenal growth rate of the nonagricultural sector compared to the relative stagnation of the agricultural sector.

A striking feature of trend study of dualistic Nigeria is the gain in strength of nonagricultural production, as a ratio of the GDP, over agricultural production. Table 3 proves this assertion correct for the 1960-1977 period. One can infer from this observation that poor agricultural performance is an important cause of the prevailing inflation: increasing income in the nonagricultural sector has led to increased demand for food from a sector that is shrinking.

Table 3: Percentage Shares Of Agriculture and Non-agriculture in Nigeria's Real GDP, 1960-1977.

Year	% Share of Agriculture in G.D.P.	% Share of Non-agriculture in G.D.P.
1960	53	47
61	51	49
62	51	49
63	46	54
64	49	51
65	47	53
66	45	55
67	45	55
68	45	55
69	45	55
1970	41	59
71	37	63
72	35	65
73	31	69
74	27	73
75	25	75
76	23	77
77	23	77

Source: Computed from Table 2.

Another point worth noting is that expanding industrial sector requires proportionately increasing amounts of raw materials from the agricultural sector. However, this demand is unlikely to be satisfied in the face of the declining weight of agriculture in the GDP. Inevitably, therefore, this situation is a boost to the already existing inflation.

Weakened weight of agriculture in GDP has another adverse impact on the economy. It leads to increased reliance on imports for food and raw materials. This is a precarious reliance by Nigeria whose chief export, crude oil, accounted for over 90% of total foreign exchange earnings in the 1970's. Even if foreign exchange were available, importation may lead to higher domestic prices if the sources of major imports are experiencing high inflation rates.

Within nonagricultural production, a comparison of the performances of two of the subsectors - manufacturing and, wholesale-and-retail, is also revealing. Manufacturing which is usually branded an index of industrialization, still accounts for a very small percentage of the GDP as Table 4 shows. It rose from 4% in 1960 to 7% in 1970 and dropped to 5% by 1975. The poor performance of this sector

Table 4: Percentage Contributions of Manufacturing and Wholesale-and-Retail To Nigeria's GDP (1960-1977).

Year	% Contribution of Manufacturing to GDP	% Contribution of Wholesale-and-Retail to GDP
1960	4	12
61	5	11
62	5	11
63	6	12
64	6	1.
65	6	12
66	6	12
67	7	12
68	7	12
69	7	12
1970	7	12
71	6	11
72	7	10
73	4	19
74	4	16
75	5	20
76	5	20
77	5	21
Mean	5.7	13.7

Source: United Nations, Yearbook of National Accounts Statistics 1979, Vol. II, p. 59.

derives from its high dependence on imported inputs. Adejugbe (1982) gave the weight of this dependence as averaging 40%. Opposed to the behaviour of manufacturing is the behaviour of the wholesale-and-retail subsector, whose contribution to the GDP lay between 11% and 12% in the sixties and grew to an average of 20% towards the end of the seventies. These facts indicate that Nigerian entrepreneurs concentrate on quick-yielding distributive trade while shying away from real productive investment in manufacturing and agriculture.

It should not be misconstrued from the above analysis that distributive trade is unimportant to Nigeria. Distributive trade creates place utility which is a stage in the production process. The growing size of wholesale-and-retail is necessary to link producers and consumers. But payments for services done by distributors no doubt increase the final costs of commodities to consumers, thus contributing to inflation.

It can be concluded that agricultural production lagged behind nonagricultural production during the study period. This has had undesirable implications for price behaviour. Secondly, both agriculture and manufacturing which were supposed to provide vendible goods to the

growing economy did not grow adequately. This added fuel to the existing inflationary pressure. Finally, because the Nigerian economy was predominantly a trading rather than a manufacturing one, distributive trade expanded more than real industrial production. This, too, had the undesirable consequence of accentuating price increases because middlemen mark up prices successively.

2.2 Money Supply And The Financial Market

One could begin a discussion on the financial market with an examination of money supply because a clear understanding of the structure of the latter gives useful insights into the nature of that market. For the Nigerian case, time-series data on the composition of money supply between 1960 and 1977 are given on Table 5. A marked feature is the decline of the currency component of money supply from about 66% of the total in 1960 to about 40% in 1977. In contrast to the behaviour of the currency component, the demand deposits component increased from about 34% to about 60% over the same period. If one accepts the view that high ratio of currency to money supply is an index of underdeveloped banking habit and the inadequacy of banking facilities, (Ajayi, 1978:58) then one can conclude that the

Table 5: Composition of Nigeria's Money Supply: 1960-1977.

Year	(1) Value (₦ million)			(2) % of Total Money Supply	
	Total Money Supply	Currency in Circulation	Demand Deposits	Currency in Circulation	Demand Deposits
1960	240.4	158.2	82.2	65.80	34.20
61	242.0	158.6	83.4	65.50	34.50
62	250.2	159.9	90.6	63.78	36.22
63	266.6	169.0	97.6	63.40	36.60
64	313.6	198.0	115.6	63.14	36.86
65	323.0	201.0	122.0	62.23	37.77
66	351.8	217.2	134.6	61.74	38.26
67	317.8	207.4	110.4	65.26	34.74
68	330.0	183.2	146.8	55.52	44.48
69	438.3	252.7	185.6	57.65	42.35
1970	631.3	342.3	289.0	54.22	45.78
71	639.8	354.5	285.3	55.40	44.60
72	722.2	385.3	336.9	53.35	46.65
73	866.6	435.9	430.7	50.30	49.70
74	1290.5	569.8	720.7	44.15	55.85
75	2297.5	1030.7	1266.8	44.86	55.14
76	3536.3	1351.2	2185.1	38.20	61.80
77	4951.5	1971.4	2980.1	39.81	60.19

Source: Derived from IMF, International Financial Statistics, Nov. 1967, p. 234, March 1974, p. 272, Oct. 1979, p. 292.

declining trend of currency and increasing trend of demand deposits, are indicative of improvements in both banking habit and banking facilities over time.

Table 6 shows the historical series on the annual growth rates of money supply and its components which fall into two main parts. The first period, 1960-1968 was a period of moderate growth rates punctuated by exceptionally high growth rates in 1964. The second period, 1969-1977 was a period of persistently high growth rates of money supply and its components with a drop in the series in 1971. The highest growth rates were recorded in 1975. They were 78%, 80% and 75% for total money supply, currency in circulation and demand deposits, respectively. The oil boom years, 1973-1977 with uncautious monetization of oil export revenues, registered high growth rates for money supply and its components. This period coincided with high inflation rates averaging over 46% between 1974 and 1977 (See Table 1, in Chapter 1).

Generally, the ratio of currency to total money supply is considered a rough measure of the degree of organization of the financial market. A high currency ratio is taken to indicate a low level of organisation of the financial market, and vice versa. Although, as we have seen, the currency ratio

Table 6: Annual % Growth Rates of Money Supply and Its Components: 1960-1977

Year	Total Money Supply	Currency in Circulation	Demand Deposits
1960	-	-	-
61	0.66	0.25	1.46
62	3.39	0.82	8.63
63	6.55	5.69	7.73
64	17.63	17.16	18.44
65	3.00	1.52	5.54
66	8.92	8.06	10.33
67	-9.66	-4.51	-17.98
68	3.84	-11.67	32.97
69	32.82	37.94	26.43
1970	44.03	35.46	55.71
71	1.35	3.50	-1.28
72	12.08	8.69	18.09
73	19.99	13.13	27.84
74	48.92	30.71	67.33
75	78.03	80.89	75.77
76	53.92	41.10	72.49
77	40.02	45.90	33.31

Source: Developed from Table 5.

has been declining in the Nigerian economy, the financial market is still far from being organised compared with those of say Great Britain, U.S.A. or Western Germany. It is due to the unorganised nature of the market that conventional tools of monetary policy have proved ineffective, in controlling inflation. The Central Bank of Nigeria, therefore, has "discarded the traditional techniques of open market operation, variable liquidity ratios and Bank rate" and has relied more on direct action to control the volume, direction and cost of money and credit in the economy (Nwankwo, 1984:5). Specifically, since 1969, the Central Bank gives directives not only on the percentage allocation of credits to different sectors, but also on the interest chargeable on loans and advances to such sectors.

Under such regimentation, there was no guarantee that financial resources were efficiently allocated to competing uses. Given the limited ability of Nigerian entrepreneurs to employ credit productively, the liberal credit terms in the 1970's must have added to the inflationary spiral.

2.3 Public Expenditure, National Development Plans And Government Regulations

Governments in modern societies play the role of

providing social and economic infrastructure and regulating the economy. For LDCs such governments have an additional raison de etre: to accelerate growth and development. These governments wish to close the gap between their countries and the advanced countries. Leaving the task to private entrepreneurs would make the attainment of the goal uncertain. On the other hand, active government participation will guarantee rapid economic growth, it is argued.

Table 7 shows the rising size of the public sector in Nigeria. The stimulus for this growth is derived mainly from the export of crude oil. This export's contribution to Federal Government revenues as shown in Table 8 rose from 1.8% in 1959/60 to 77.7% in 1976/77. One could rightly rationalize that with a larger revenue at its disposal, the Federal Government was able to undertake several capital projects.

Olaloku et al. (1979:8) have aptly summarized the other pressures that have expanded public expenditure:

> The beginning of such developments lay in the country's political crisis which culminated in a civil war and greatly expanded the armed forces. The second factor is the creation of states and the resultant growth of state bureaucracies. Also, the increasing interventionist role of the government in the economic and social life of the nation has been an important factor in the growth of the government sector.

Table 7: Size of Public Expenditure in the Nigerian Economy, 1960-1977.

Year	Government Expenditure (Nominal Value in Million ₦)*	G.D.P. (Nominal Value in Million ₦)	Size of Govt: (a)÷(b)X100%
1960	144.5	2247.3	6.4
61	179.0	2359.8	7.6
62	161.8	2597.6	6.2
63	285.1	2745.7	10.4
64	316.6	2894.4	10.9
65	364.7	3110.1	11.8
66	398.2	3374.8	11.8
67	413.2	2752.4	15.0
68	437.7	2656.2	16.5
69	495.3	3497.8	14.2
1970	860.3	4920.0	17.5
71	1040.3	6282.0	16.6
72	1283.7	7066.0	18.2
73	1165.0	9660.0	12.1
74	-	13915.1	-
75	4944.9	15723.7	31.4
76	5973.3	20353.5	29.3
77	7061.8	24655.4	28.6

Source: (1) World Bank, World Tables, 1976 p.357 and 1980 (2nd Ed.) p. 334.

(2) Federal Office of Statistics Analyses Of Government Accounts 1958/59 - 1976/77, Lagos, October, 1979.

*Because of incomplete data for State Governments, only Central Government Expenditure is used.

Table 8: Contribution Of Petroleum To Federal Government Revenue, 1959/60 - 1976/77.

Year	Federal Government Current Revenue (N'000)	Petroleum Revenue (N'000)	Petroleum's Share of Total Revenue (%)
1959/60	177,648	3,335	1.80
60/61	223,700	2,452	1.08
61/62	228,962	17,070	7.45
62/63	231,638	16,938	7.31
63/64	249,152	11,036	4.43
64/65	299,132	16,084	5.38
65/66	321,870	29,175	9.06
66/67	339,196	44,977	13.26
67/68	300,176	41,884	13.95
68/69	299,986	29,582	9.86
69/70	435,908	75,443	17.31
70/71	758,068	218,942	28.88
71/72	1,305,724	263,037	47.72
72/73	1,389,911	705,362	50.75
73/74	2,171,370	1,189,908	54.80
74/75	5,177,063	4,189,908	80.80
75/76	5,861,543	4,611,683	79.3
76/77	7,070,609	5,493,842	77.70

Source: Angaye, G. "Petroleum and the Political Economy Of Nigeria" in The Political Economy of Nigeria (Nigerian Economic Society Annual Conference, Port-Harcourt, 12th - 15th May 1982).

One may say that much of government expenditure is directed at services like defence and general administration which do not add directly and significantly to purchaseable output. Spending on these service programmes means pumping a lot of money into the economy. Similarly, a sizeable proportion of government expenditure is channelled into physical infrastructural development (Ukpong, 1979). Such projects are characterized by lumpiness of capital and irreducible minimum cost. One fact of spending on social goods is that they generate incomes to their producers without corresponding immediate increases in goods that such income earners would buy. This asymmetry leads to excess demand and hence, upward pressure on prices.

Governments of less developed countries depend on development planning for achieving their goals of social and economic development. A development plan can be regarded as a programme of action for bringing about growth and development in a more predictable manner. It has a special appeal to LDCs who are anxious to develop. Over the period 1962-1985, Nigeria has had four development plans, each characterized by distortions that emanated from overfulfillment of planned expenditure on administrative

machinery and under-fulfilment of planned expenditure on the more productive economic sectors (Tomori and Fajana, 1979). This bias one would expect is favourable to inflation.

Another important issue relates to the distorting effects of government regulatory activities. The World Bank Report (1983:57) argues that in most cases the distortion of prices of goods and services as well as of capital and labour, results from government intervention. Table 9 shows indices of price distortion prepared by the World Bank for thirty-one developing countries in the 1970s.

The preparation of the index is based on seven items, namely, "exchange rate", "protection of manufacturing", "protection or taxation of agriculture", "capital", "labour", "power tariff" and "inflation". For each country, the distortion associated with each of the seven items is classified as low, medium or high, with numerical values of 1, 2 or 3, respectively. The composite distortion index is then obtained as a simple unweighted average of the individual distortions (World Bank, 1983:62-63). The table shows that only Ghana has a higher distortion index than Nigeria.

The very high distortion index for Nigeria is explainable in terms of the following government policies:

Table 9: Indices of Price Distortion For 31 Developing Countries in the 1970's.

Country	Distortion Index	Simple Group Average
Malawi	1.14	
Thailand	1.43	
Cameroon	1.57	
Korea, Republic of	1.57	
Malaysia	1.57	1.56
Phillipines	1.57	(LOW)
Tunisia	1.57	
Kenya	1.71	
Yugoslovia	1.71	
Colombia	1.71	
Ethiopia	1.86	
Indonesia	1.86	
India	1.86	
Sri Lanka	1.86	
Brazil	1.86	1.95
Mexico	1.86	(MEDIUM)
Ivory Coast	2.14	
Egypt	2.14	
Turkey	2.14	
Senegal	2.29	
Pakistan	2.29	
Jamaica	2.29	
Uruguay	2.29	
Bolivia	2.29	2.44
Peru	2.29	(HIGH)
Argentina	2.43	
Chile	2.43	
Tanzania	2.57	
Bangladesh	2.57	
Nigeria	2.71	
Ghana	2.86	

Source: World Bank, World Development Report 1983, Table 6.1, p. 60.

(1) As part of measures to protect home manufacturing, there has been a series of foreign trade and foreign exchange restriction legislations. For example, from the mid 1960's through the 1970's, such direct control measures as quotas, bans, and licensing were introduced by the government (Obadan and Ihimodu, 1980).

(2) Since 1969, the price as well as the sectoral allocation of money capital has been extensively regulated by the government leading to distortion of the capital market (See Section 2.2).

(3) In 1970, the Federal Government set up the Price Control Board to fix and police the price of various commodities (Awosika, 1980). This policy encouraged black-marketeering and hoarding.

(4) In 1973, the government introduced uniform pricing for petroleum products. To make the policy work, a price equalization fund was introduced to absorb the differential transport costs for different locations while state governments whose taxes and duties were abolished were to be reimbursed by the Federal Government (Onah, 1980). These measures infringed on the free working of demand and supply forces in the energy and power market.

(5) A notable control of labour prices was the minimum wage legislation of 1979 (and later of 1980). Moreover, since 1976, employers are prohibited by law to change wages

without the approval of the Productivity, Prices and Incomes Board (P.P.I.B.). All these measures contributed to Nigeria's high distortion index.

According to the World Bank (1983:63) the higher the distortion index, the lower the value added per unit of investment. Such a situation of lower productivity increases the inflationary pressure.

2.4 Foreign Trade

The impressive growth of the Nigerian economy over the last two decades owes much to the rapid expansion of foreign trade. The country needs imports of capital equipment and machinery to achieve rapid industrialization. It also needs considerable exports in order to earn foreign exchange with which to import. Table 10 shows that import and export trades grew considerably between 1960 and 1977. The openness of the economy has grown phenomenally, too, as shown by the import - GDP, export - GDP, and import-plus-export - GDP ratios. Another important development in foreign trade is illustrated by Table 11. Over the period, 1960-1977, the percentage contribution of agriculture to export earnings declined from 96% to 4.9% while that of crude oil rose from 2.6% to 92.7%

Table 10: Indicators Of Openness of the Nigerian Economy (1960-1977)

Year	1 Exports (nominal in M ₦)	2 Imports (nominal in M ₦)	3 Exports Plus Imports (in M ₦)	4 G.D.P. (nominal in M ₦)	5 Exports / GDP X 100%	6 Imports / GDP X 100%	7 (Exports + imports) ÷ GDP X 100%
1960	349.8	487.2	837.0	2247.3	15.6	21.7	37.2
61	370.8	499.2	870.0	2359.8	15.7	21.1	36.9
62	366.8	456.4	823.2	2597.6	14.1	17.6	31.7
63	409.8	479.4	889.2	2745.7	14.9	17.5	32.4
64	462.2	587.0	1049.2	2894.4	16.0	20.3	36.2
65	578.2	645.4	1223.6	3110.1	18.6	20.8	39.3
66	599.0	623.6	1237.6	3374.8	17.7	18.9	36.7
67	520.8	621.4	1142.2	2752.4	18.9	22.6	41.5
68	466.2	561.4	1027.6	2656.2	17.6	21.1	38.7
69	632.8	702.9	1385.7	3497.8	19.5	20.1	39.6
1970	953.0	936.0	1889.0	4920.0	19.4	19.0	38.4
71	1422.0	1317.0	2739.0	6282.0	22.7	21.0	43.6
72	1581.0	1281.0	2812.0	7066.0	21.7	21.7	39.8
73	2467.0	1806.3	4273.3	9660.0	25.5	18.7	44.2
74	6243.7	2743.3	8987.0	13915.1	44.9	19.7	64.6
75	5302.7	5030.9	10333.6	15723.7	33.7	32.0	65.7
76	6593.2	6573.4	13166.6	20353.5	32.4	32.3	64.7
77	7676.0	8874.0	16550.0	24655.4	31.1	36.0	67.1

Source: Derived from World Bank World Tables 1976 pp. 178 and 1980 (2nd Ed.), pp. 150-151.

Table 11: Contributions of Agriculture and Petroleum to Nigeria's Export (1960-1977)

Year	Contribution of Agriculture to Export (%)	Contribution of Petroleum to Export (%)
1960	96.2	2.6
61	94.6	6.6
62	90.5	9.9
63	78.8	10.2
64	69.6	15.0
65	60.1	25.4
66	50.5	32.5
67	53.1	30.0
68	65.8	17.4
69	45.4	41.3
1970	30.0	57.6
71	18.8	73.7
72	12.0	82.0
73	10.0	83.1
74	4.6	92.3
75	4.7	92.7
76	4.1	93.6
77	4.9	92.7

Sources: (1) Central Bank of Nigeria, Annual Report And Statement Of Accounts, (Various Issues).

(2) Federal Office of Statistics, Annual Abstract of Statistics, 1964.

(3) Federal Office of Statistics, Digest of Statistics Jan. 1963, Vol. 12.

What are the possible consequences of these features for the stability of the Nigerian economy? One is that adverse developments in the export market which result in foreign exchange scarcity will lead to shortages of both consumer and producer goods in the Nigerian economy. Such shortages will add to inflation. Another is that with the rising import - GDP ratio, the susceptibility of Nigeria to imported inflation, has increased. Moreover, the structural shift from an agricultural products-dominated, to a crude oil-dominated export trade has a spectacular consequence. Revenues from the later type of exports accrue mainly to the state. As Adeyeye and Fakiyesi (1980) have noted the expansion of petroleum exports meant that the government could undertake development projects "without resorting to fiscal measures which could have reduced the incomes of individuals and companies". Thus the period was marked by rapid expansion of aggregate liquidity with the consequent excess demand and inflation effects.

An incontrovertible conclusion from the analysis in this chapter is that a lot of inflationary impulses are embedded in the Nigerian economy.

CHAPTER 3

LITERATURE REVIEW

The literature on inflation is copious. The following is a review of the main strands.

3.1 The Basic Theories

Forerunner economists like David Hume, John Locke and Adam Smith identified increases in money supply as the major cause of inflation. But it was Irving Fisher who formalized the "Quantity Theory of Money" - as this strand of thought came to be known - with the exchange equation. The Fisherine equation formulates a relationship between money supply (M), income velocity of circulation (V), the average price level (P), and real national income (Y), thus:

$$MV = PY.$$

Proponents of the Quantity Theory concluded that a change in money supply produces a directly proportionate change in the price level.

The Quantity theory is deficient because it recognised only transactions demand for money and was based on the unrealistic assumptions of full employment equilibrium and

perfect flexibility of prices. The assumption of perfect flexibility of prices is particularly unrealistic for an underdeveloped country like Nigeria characterized by institutional and cultural inhibitions. For example wages and interest rates are regulated by government legislation so that these prices cannot be adequately flexible. The idea of full employment is also absurd. A developing country like Nigeria does have a lot of unemployed human and material resources and what are to be sought are ways of removing bottlenecks to expand production and reduce involuntary unemployment.

In reaction to the flaws of the Quantity Theory, Keynes (1936) showed, among other things, that exogenously induced increases in aggregate demand could generate price rises even when money supply remains unchanged. According to him, there is an additional motive for holding money - the speculative motive. People will hold money if they expect interest rate to rise in the future so that they can make capital gains. On the other hand, when people expect a fall in interest rate, they will reduce their cash holdings. Thus total demand for money (M) is composed of two major parts: transactions demand (M_T) which is a positive function of income (Y) and speculative

demand for money (M_{sp}) which is an inverse function of interest rate(r)Notationally,

$$\begin{aligned} M_D &= M_T + M_{sp} \\ &= M_T(Y) + M_{sp}(r) \\ &= f(Y) + g(r);\ f' > 0,\ g' < 0. \end{aligned}$$

(In this model, the precautionary demand for money is subsumed under the transactions demand). By implication, an increase in money supply may not produce a price rise if the excess money supply is absorbed into speculative balances. Thus, an increase in money supply is not a sufficient condition for a price rise, as the Quantity Theorists had reasoned.

Keynes gave the neo-Keynesians a cue by which they argued that fiscal rather than monetary policy should be relied upon to stabilize prices. Contrary to the Keynesians, the Monetarists, notably Friedman (1956), insist that monetary policy should be relied upon for economic stabilization because money supply is the major variable influencing, not only price level, but also the money national income. Even though both Monetarists and Fiscalists saw excess demand as a cause of inflation, their analyses are inadequate for an economy with

undeveloped financial system like Nigeria's and where the economy is under-monetized. Moreover, they considered only the demand side of the problem while neglecting the supply side.

As a result, 'cost push' theorists like Hines (1964) maintain that inflation is caused by rising factor costs, particularly, wage rises. When trade unions successfully raise wages, for example, producers will mark up prices in order to maintain existing profit margins. The contribution of the cost-push school notwithstanding, the problem is that once inflation is in process, it is not practicable to separate demand pull from cost-push inflation because, they become mutually reinforcing.

Philips (1958) provided statistical evidence of an inverse functional relationship between the rate of change of money wage rates and the rate of unemployment implying that there is a conflict between the policies of full employment and price stability. Samuelson and Solow (1960) have argued that changes in money wage rate have a direct causal relationship to the inflation rate and have therefore modified Philips curve by replacing the rate of change of money wage rates with the rate of inflation. The Philips-Samuelson-Solow unemployment-inflation trade-off

theory has not tallied with the experience of many economies where inflation gets worse as unemployment rises. This situation of stagflation suggests the existence of rigidities in the economies.

Thus Schultze (1969) in his "intersectoral demand shift" theory gives a picture of such rigidities. He argues that prices rise in expanding industries but do not fall in declining ones, the result being an upward bias in the average price level. But Schultze did not concern himself with how the operation of transnational corporations could be a possible source of market rigidity.

The "profit push" theory of Levinson (1971) is an attempt to fill this gap. Levinson traces inflation to the activities of multinational corporations who "fix" prices on an international basis to maximize global profits. While the recognition of the importance of multinationals in influencing local market outcomes is praiseworthy, it is questionable whether such multinationals can afford to neglect to a reasonable extent, the demand situations in individual countries when they fix prices.

The basic theories outlined in this section have been developed along various directions as illustrated

in the following section.

3.2 Some Extensions Of The Basic Theories

An interesting development is the explanation of inflation in terms of "expectations" of which there are two major versions. The "adaptive" expectations model (Cagan: 1956) proceeds from the assumption that economic agents correct their errors step by step. The process is represented by the expression:

$$\Pi^{*}t + 1 = \Pi^{*}t + \lambda(\Pi_t - \Pi^{*}t),$$

where Π_t is the actual rate of inflation in the present period, Π^{*}_t is the rate of inflation expected for the present period and Π^{*}_{t+1} is the expected rate of inflation in the next period. The adaptation coefficient, λ, is subject to the constraint:

$$0 < \lambda \leq 1.$$

If the observed rate, Π_t is greater than the expected rate Π^{*}_t, then the inflation rate is raised in proportion to the error, $(\Pi_t - \Pi^{*}_t)$. Similarly, if the error is negative, the expectation is corrected downwards.

This version has been criticized by proponents of rational expectation on the ground that it neglects the

ability of economic agents to utilize information provided by economic theory. According to J. F. Muth (1961), for example, there exists a relevant economic theory into which all available information enters and whose predictions are the best possible. Therefore, expectations are rational when they occur with the predictions of the relevant economic theory. Put in another language, rational expectations of inflation, π_t^* are unbiased estimators of the actual rate, π_t, given all information at the beginning of the period, Z_{t-1} thus:

$$\pi_t^* = E(\pi_t / Z_{t-1}).$$

The expectations models are very idealistic; it is unlikely that in practice, people will have the knowledge and convenience to undertake the complicated calculations entailed in theories before taking decisions. However, the theories have provided the base for further scholarly contributions.

Friedman (1968) and Phelps (1972) have applied the adaptive expectations model in criticizing the Philips curve. They argue that different values of the expected rate of inflation will generate different Philips curves at given unemployment rates. Thus, the Philips curve

cannot be located with certainty. However, like the Philips-Samuelson-Solow model, the Friedman-Phelps model neglected the role of labour productivity in the wage-inflation problem.

It was Turnovsky (1970: 88) who extended the wage-inflation relationship to incorporate the rate of change of labour productivity. The rate of change of price, p, he argues, is equal to the rate of change of money wage rate, w, minus the rate of chang of labour productivity, θ thus:

$$p = w - \theta.$$

Practical application of Turnovsky's principle faces a serious difficulty because the measurement of labour productivity is not a settled issue. In fact it is confounding to know labour's contribution to the total product because labour is often combined with other factors, notably technology whose quality is continually changing.

Brecher (1979) has propounded that for a given wage rate, the higher the ratio of labour-intensiveness to capital intensiveness in production, the less severe is the inflation-unemployment trade-off and vice versa. This

view is relevant to Nigeria's recent experience with inflation and unemployment. The oil industry which has dominated the economy since the 1970s is capital intensive while at the same time, the rapid monetization of oil export revenue is inflationary. A stagflationary tendency is, therefore, inherent in such a capital intensive sector.

Bronfenbrenner and Holzman (1963) have reviewed another aspect of the inflation-unemployment problem: inflation is the cost of the movement from a lower full-employment to a higher full-employment position. That is, there is no unique full-employment position. Okun (1970) agrees with the former and established that a reasonably stable relationship exists between output and the rate of employment. A one percent increase in the unemployment rate was associated with about a three percent decrease in real output. Okun's law is thus a justification for the drive to higher full-employment with its inflation cost.

Tobin (1972) argues that in any labour market, the rate of increase of money wages is the sum of two components - the equilibrium component and the disequilibrium component. "The disequilibrium components

are relevant only if the disequilibria persist" and the disequilibria persist because of an underlying "never-ending flux" caused by new products and processes, new tastes and fashions, new developments of land and natural resources, etc. Based on this, Tobin concludes that a "substantial amount of unemployment compatible with zero inflation is "involuntary and nonoptimal". This analysis is relevant to an economy like Nigeria's where rapid structural changes are bound to take place as the economy drives to modernization. The move to reorientate production and consumption practices from outward-looking to inward-looking is a likely source of disequilibria.

Hicks (1974: 62-63) is of the view that:

> Something has been overlooked; the obvious fact of specialization of labour. Particular labour scarcities are bound to be revealed while there is still in total, considerable unemployment. Thus wages will start rising much before "full employment".

The monetarist model of inflation has been extended along the acceleration and temporariness theorems (Frisch, 1977). The acceleration theorem implies that only a change in the rate of growth of money supply induces real effects - employment and output effects. In contrast, every constant rate of growth of money

supply is consistent with equilibrium in the real sector although at different rates of inflation.

The temporariness theorem states that a monetary impulse influences the unemployment rate for only a short period; over the long period, money wages and market interest rates will adjust to the higher inflation rate and the real effect will disappear.

The acceleration and temporariness theorems are aspects of the "monetary neutrality" hypothesis: real output and employment respond only to that part of inflation that is unanticipated. However, some empirical findings are not in agreement with this hypothesis. For example, Garner (1982) tested the hypothesis for the United Kingdom and found out that "anticipated money growth significantly affects real variables" and that "monetary suprises are at best, marginally significant".

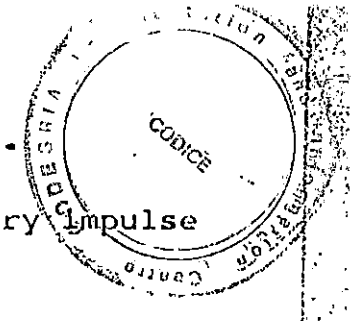
The limitation of all monetarist models is that they are based on the assumptions of efficient market signalling and rationality of economic agents. Nothing could be further from the truth. Even in highly industrialized and monetized economies, monopolistic and oligopolistic market structures, and externalities impair the efficiency of the market signalling process. In an

LDC, the limitations are certainly more serious because of cultural and institutional bottlenecks. In either case, rational behaviour by economic agents is greatly constrained.

The literature already surveyed reflect the reactions of scholars to inflation in the now industrialized countries. In recent times attempts have been made to explain inflation in LDCs against the background of their peculiar characteristics. In this regard, the structuralist school in Latin America is outstanding.

3.3 Structuralism, The Latin American Experience And Other LDCs

The "Structuralist" school of thought emerged in Latin America in the 1950s and questioned the applicability of orthodox monetarist theories of inflation to the LDCs. As portrayed in the work of their leader, Osvaldo Sunkel (1960), the structuralists contend that inflation in LDCs is caused by certain structural bottlenecks like inelastic food supply, foreign exchange constraint, imported high prices, etc., associated with a developing economy. It is these structural inhibitions that are the root causes of inflation. Money supply only



plays a permissive role, allowing the inflationary impulse to manifest itself, the structuralists argue.

Lioi (1974:3) has observed that the main difference between monetarists and structuralists is in their conceptions of how the economy really works. In the pure monetarist view, the real structure of the economy can generate stability and growth. Inflation and stagnation are the products, not of inadequate structure, but of erroneous policies. In the extreme structuralist view, on the other hand, the structure cannot generate stability and growth; therefore, to stop inflation and to increase growth, the structure should be changed.

The monetarist-structuralist controversy has led to a number of empirical studies. One such work was by Harberger (1963). Using the ordinary least squares regression method, he found out that money supply and real income influence the price level positively and negatively, respectively. Vogel's (1974) study for sixteen Latin American countries confirmed Harberger's findings. Vogel concluded that differences in rates of inflation in Latin American countries cannot be attributed to structural differences but rather to differing behaviour of money supply in these countries.

Diaz-Alajandro (1965) had used a synthesis of the monetarist and structuralist models to study Argentina's inflation. The results showed that both monetary and structural variables were significant explanators of inflation although structural variables had less proportionate impact on the rate of inflation than monetary variables.

In a similar study of twenty LDCs, Argy (1970) found out that money supply influences the rate of inflation significantly, while structural variables do not. Adolfo Diz's (1970) study produced results similar to Argy's.

It can be deduced from the empirical studies reported that there is a tendency for monetary variables to be consistently significant in explaining inflation while structural variables yield mixed results. However, on the basis of available evidence, neither the extreme monetarist nor the extreme structuralist view can be accepted. Each approach contributes to the understanding of some aspect of the inflation process. To that extent one will agree with Oliveira Campos' (1967: 108-109) argument that the controversy between the monetarists and structuralists is a spurious one. For according to him, the structuralists if in power would have to adopt

monetarist policies as a short-term measure and the monetarists would in the long run, accept the need for structural change. The monetarist is "a structuralist in a hurry" and the structuralist is "a monetarist without policy-making responsibility".

While debate and research on inflation in Latin America has been outstanding, there has also been research in other LDCs. For example, Aboagye (1982) studied the role of imported inflation for the Ghananian economy during the period 1952-1977. He found out that imported inflation was not a serious problem but that excess demand and expectations-induced inflations were serious.

Like other studies, Aboagye's own no doubt throws some light on certain aspects of inflation in LDCs. But the use of such omnibus explanatory variables like "excess demand" limits the usefulness of the findings. Is excess demand not a reflection of structural composition of output and sectoral interactions in the economy? Would it then not be advisable to introduce these latter factors as explicit explanatory variables in the study of inflation in LDCs?

3.4 The State Of The Art In Nigeria

Recorded accounts of inflation in Nigeria go back to as far as the 1920s. For example, Hopkins (1973: 257-258) has described how consumers, especially urban wage earners, suffered declines in their standards of living during the Second World War, as a result of rising prices of imports and food, and rising urban house rents.

Akinnifesi and Philips (1973) have concluded from their study that a "way to curb the inflationary trend effectively is through a rational supply of money process....." These researchers, however, did not say how money supply can be rationalized in an economy with numerous structural constraints.

In another empirical study based on ordinary least squares regressions, Adeyeye and Fakiyesi (1980) concluded that money supply and government expenditure are important determinants of the rate of inflation. They, however, failed to discuss government expenditure behaviour within the context of the structure of the economy.

Obinna (1981) reasons that fiscal drag, which operates through progressive marginal tax rates produces implicit surplus for the government while retarding production in the private sector. As one solution to inflation,

therefore, he recommends that part of the public sector surplus should be recycled into the private sector through subsidies and lower tax rates. Obinna's observation is in consonance with the view of Bacon and Eltis (1975) that greater control of economic resources by the government produces a shift from a low to a high non-marketed output with the possibility that growth declines and inflationary pressure heightens.

Some empirical studies have investigated the impact of output changes (among other variables) on the price level, using the econometric technique of ordinary least squares regression. In one such study, Adejugbe (1982) found out that money supply and real output influence the price level directly and inversely, respectively. However, since the price index for the lower income group rather than that for all groups of consumers was used, the resulting estimates may only be used with caution. Adejugbe himself expressed reservation over the method he used to derive the price index.

The inverse and direct relationships between output and money supply, respectively, and the average price level have been confirmed by another study by Falegan and Ogundare (1982). In this case though, monthly data

were used for the regressions and this may have introduced a bias in the model. As Curwen (1976:1) has noted, "it is necessary to measure inflation over periods sufficiently long so as to eliminate any bias arising from purely short-term phenomena." Moreover the monthly data on GDP used by Falegan and Ogundare were not observed but were predicted from a regression of annual GDP on annual exports.

Discordant results were obtained by Owosekun and Odama (1982). Their regression produced a negatively signed coefficient for money supply and a positively signed coefficient for real GDP. This anomally is likely to have arisen from serious multicollinearity between real GDP and real money supply since both variables were derived by dividing their respective nominal values with the price index.

Ladipo and Adeyokunnu in their own investigation used nominal GDP to serve as a measure of excess demand. They found that both money supply and nominal GDP influence the price level positively.

In his study which "takes into consideration the internal structure of the economy, and foreign trade factors", Osagie (1982) concluded that both import prices

and crude oil exports are positively and significantly related to the index of domestic prices. Credit goes to Osagie for recognising the importance of the concept of the structure of the economy in an empirical study. Although he did not develop the idea within the theoretical and empirical contexts of the use of aggregate output as a regressor in an empirical study of inflation, his study has a closer bearing to the present study than any other empirical study on Nigeria's inflation. Indeed, Osagie's study provides a useful background to this study.

3.5 Limitations Of Previous Studies

Previous studies have made useful contributions to the understanding of the problem of inflation, especially in respect of how output changes affect the price level. A major limitation of such studies, generally and particularly in the Nigerian case, is that they were based on data on aggregate output and had neglected the importance of the structural composition of that aggregate to price behaviour. It is the contention of the present study that different components of output relate

to the price level differently: some positively, others inversely. These underlying variations are lost sight of when aggregate output is used as a regressor in a price equation. But such details are of practical importance for anti-inflation policy formulation. The present study will fill the gap by using disaggregated output variables as regressors.

A second limitation of previous studies is that they have not investigated, empirically, the sectoral interaction between agricultural and non-agricultural sectors as a factor in inflation. This study investigates the problem of sectoral interaction within the context of the structural problems of a growing economy.

Derived from the first limitation of previous studies is the third which is that previous studies did not analyse the problem of intertemporal stability of the parameter estimate of the aggregated output regressor. Since aggregate output can be dichotomized in terms of whether they are inversely or directly related to the average price level, the sign of an aggregate output regressor is likely to be unstable. The present study attempts an exposure of this special case of the aggregation problem.

3.6 Statement Of The Hypotheses

The study is guided by two interrelated hypotheses. The first is that in Nigeria, growth of real GDP will not necessarily dampen price rises; the former may even accentuate the latter. This hypothesis is based on the contention that some components of Nigeria's output affect the price level positively while others affect the price level inversely.

The second hypothesis is that in Nigeria, the price level is positively related to the ratio of nonagricultural to agricultural output. This is justified by the argument that, in a developing economy like Nigeria's, where agriculture is more or less stagnant, the growth of real income in nonagriculture will lead to excess demand for agricultural products with inflationary consequences (Kaldor, 1980: 142). This type of inflationary potential materializes because domestic food and raw materials deficits cannot be readily offset by imports - because of shortage and instability of foreign exchange earnings, for such a developing country.

CHAPTER 4

THEORETICAL FRAMEWORK

The study relies on a conceptualization of the essentials of the Nigerian economy and how they relate to the price level, rather than on any universalist models such as those of the Monetarists and the Keynesians. A simple macro-model of the economy reflecting the structure of output and sectoral interactions is developed as follows.

4.1 Basic Observations

Nigeria is a developing, oil exporting economy. Broadly, the economy can be divided into a largely traditional agricultural sector and a relatively modern more monetized nonagricultural sector. Also, the GDP could be divided into the export and nonexport components with crude oil exports as an important distinctive part of the export component.

In terms of their role in the inflationary process, aggregate output may be partitioned into two groups: (i) those whose growth exerts a downward pressure on prices and (ii) those whose growth accentuates price

rises. Elements in the first group include agricultural output while elements in the second group include construction output and petroleum exports. The comparative sizes of components of output may also be a factor in price level behaviour; the rapid expansion of nonagriculture and the lagging of agriculture is likely to lead to rising food prices and subsequently to a possible rise in the general price level.

4.2 Notations

The operational variables (including ratios) resulting from this conceptual framework, can be summarized notationally as follows.

Y = GDP

Y_A = agricultural component of GDP,

Y_{NA} = nonagricultural component of GDP,

Y_E = exported GDP,

Y_{NE} = nonexported GDP,

Y_{CE} = crude petroleum export,

Y_{NCE} = non-crude petroleum export,

Y_D = sum of components of GDP, that influence the price level, positively,

Y_V = sum of components of GDP that influence the price level inversely,

Z = nonagricultural-agricultural output ratio,

P = the average price level.

4.3 Identities

From the above notations, some definitional equations or identities of the national income can be formulated as follows.

$$Y \equiv Y_A + Y_{NA} \quad \text{..... (i)}$$

$$Y \equiv Y_E + Y_{NE} \quad \text{..... (ii)}$$

but, $$Y_E \equiv Y_{CE} + Y_{NCE} \quad \text{..... (iii)}$$

so that (ii) becomes:

$$Y \equiv Y_{CE} + Y_{NCE} + Y_{NE} \quad \text{..... (iv)}$$

Finally, $$Y \equiv Y_D + Y_V \quad \text{..... (v).}$$

4.4 Functional Relationships

Based on the foregoing reasonings, the following price behaviour equations can be formulated.

(A) $$P = P(Y) = P(Y_D, Y_V);$$

$$\frac{\partial P}{\partial Y_D} > 0 \quad ,$$

$$\frac{\partial P}{\partial Y_V} < 0 \quad ,$$

and, $\frac{d\mathcal{P}}{dY} \gtrless 0.$

Equation (A) together with the accompanying sign constraints on the parameters, $\frac{\partial \mathcal{P}}{\partial Y_D}$, $\frac{\partial \mathcal{P}}{\partial Y_V}$ and $\frac{d\mathcal{P}}{dY}$, reflects the problem of the intertemporal instability of the marginal effect of the aggregate output variable, Y, on the average price level, $\mathcal{P}$. This problem was stated in 1.1.

(B) $\mathcal{P} = \mathcal{P}\left(\frac{Y_{NA}}{Y_A}\right) = \mathcal{P}(Z);$

$$\frac{d\mathcal{P}}{dZ} > 0.$$

Equations (A) and (B) can be combined thus:

(C) $\mathcal{P} = \mathcal{P}(Y_D, Y_V, Z);$

$$\frac{\partial \mathcal{P}}{\partial Y_D} > 0,$$

$$\frac{\partial \mathcal{P}}{\partial Y_V} < 0,$$

$$\frac{\partial \mathcal{P}}{\partial Z} \gtrless 0.$$

Since $\{Y_D\} \longrightarrow \{Y_{D_1}, Y_{D_2}, Y_{D_3} \ldots\}$

and, $\{Y_V\} \longrightarrow \{Y_{V_1}, Y_{V_2}, Y_{V_3} \ldots\}$

(C) can be written as

$$(C)' \quad P = P(Y_{D_1}, Y_{D_2}, Y_{D_3}, \ldots, Y_{v_1}, Y_{v_2}, Y_{v_3} \ldots, Z);$$

$$\frac{\partial P}{\partial Y_{D_i}} > 0 \quad (i=1,2,3, \ldots),$$

$$\frac{\partial P}{\partial Y_{v_i}} < 0 \quad (i = 1,2,3, \ldots.),$$

$$\frac{\partial P}{\partial Z} > 0.$$

4.5 Comparison With An Alternative Framework

It may be useful to compare the framework which has been developed in the foregoing, with that most commonly used in investigating the role of output changes in inflation. That is the Harberger model, in its various forms, which is derived from the exchange equation as follows.

$$MV = PY$$

where M = money supply,

V = income velocity of circulation

P = average price level

Y = real national income.

The exchange equation can be rearranged to get,

$$P = V \frac{M}{Y}$$

which when transformed logarithmically yields the linear form:

$$\log P = \log V + \log M - \log Y.$$

If the logged equation is differentiated with respect to time, it yields:

$$\frac{1}{p}\frac{dp}{dt} = \frac{1}{v}\frac{dv}{dt} + \frac{1}{m}\frac{dm}{dt} - \frac{1}{Y}\frac{dY}{dt}.$$

Some researchers who rely on this model use the logarithmic form, some use the rates of change form and others even use the ordinary linear form of the variables. However, the essence of the model is summarized by the general form:

$$P = P(M, Y)$$

$$\frac{\partial P}{\partial M} > 0,$$

$$\frac{\partial P}{\partial Y} < 0.$$

As can be observed, this model is based on aggregate real income and regards the marginal effect of changes in output on the price level as definitely negative in sign. On the other hand, the model which has been developed in this chapter (4.1 - 4.4), partitions aggregate real income (GDP) into two subsets each containing elements with identically signed marginal effects on the price level.

Based on this differentiation, the model also recognises the possibility of the marginal effect of aggregate output on the price level being positively signed or negatively signed (see 4.4).

In concluding this chapter, we refer back to equations (C) and (C)* and note that the model developed for the present study incorporates two broad ways through which the structure of the economy can generate inflation. First, the growth of some components of output is directly a source of price rises. Second, the growth of the nonagricultural sector relative to the agricultural sector favours price rises.

CHAPTER 5

METHODOLOGY

The econometric approach is employed for the study. In this chapter, the functions to be estimated are specified, the method of estimation is chosen, the nature of the data required and how they are collected are discussed. The data for the estimation are also presented.

5.1 Specification

All variables appearing in the estimation equations including those already introduced in Chapter 4, will for convenience be denoted as follows:

Average Price Level (measured by the consumer price index).	P
G.D.P.	X_1
Agricultural Output	X_2
Nonagricultural Output	X_3
Manufacturing Output	X_4
Construction Output	X_5
Petroleum Export	X_6
Nonagricultural-Agricultural Output Ratio	X_7

Import Price Index ..... X_8

Money Supply ..... X_9

War Dummy Variable ..... X_{10}

The import price index caters for the possibility of inflation being imported from other countries. A significant proportion of domestically traded goods is imported; rising prices in other countries can thus be transmitted to the domestic economy through such imports. This, in fact, derives from an aspect of the structure of the Nigerian economy - its openness (see 2.4). To reduce specification error, money supply which is often a strong explanator of inflation, is included among the explanatory variables. The war dummy variable is included so as to isolate any shift impact which the Nigerian Civil War (July, 1967 - January, 1970) might have had on the price determination functions.

The causal relationships between the price level and the explanatory variables are encapsulated in the general function:

$$P = P(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}) \quad \ldots\ldots\ldots\ldots \quad (G)$$

An important modification of (G) is necessary to make it

amenable to econometric estimation. (G) is deterministic but economic relationships are stochastic. The stochasticity is provided for by the inclusion of the disturbance term, U, thus:

$$P = P(X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, U) \quad \ldots\ldots\ldots\ldots (G)^*$$

The expected signs of the parameter estimates are:

$$\frac{\partial P}{\partial X_1} \gtrless 0,$$

$$\frac{\partial P}{\partial X_2} < 0,$$

$$\frac{\partial P}{\partial X_3} > 0,$$

$$\frac{\partial P}{\partial X_4} < 0,$$

$$\frac{\partial P}{\partial X_5} > 0,$$

$$\frac{\partial P}{\partial X_6} > 0,$$

$$\frac{\partial P}{\partial X_7} > 0,$$

$$\frac{\partial P}{\partial X_8} > 0,$$

$$\frac{\partial P}{\partial X_9} > 0,$$

$$\frac{\partial P}{\partial X_{10}} \gtrless 0.$$

The following key functional combinations will be estimated:

$$P = P(X_1, X_9, U) \quad \ldots\ldots\ldots\ldots (1)$$

$$P = P(X_2, X_3, X_9, U) \quad \ldots\ldots\ldots (2)$$

$$P = P(X_4, X_5, X_9, U) \quad \ldots\ldots\ldots (3)$$

$$P = P(X_6, X_8, X_9, U) \quad \ldots\ldots\ldots (4)$$

$$P = P(X_7, X_9, U) \quad \ldots\ldots\ldots (5).$$

The combinations of the explanatory variables have been designed mainly to reflect the impact of the output variable at different levels of aggregation. Money supply (X_9) has been included in each equation as a regressor to avoid the bias which the omission of such an important variable would introduce in the estimates. The results from the specified functions, will make it possible for the hypothesis that the direction of the impact of the growth of aggregate output on the price level could be positive, or negative, to be tested. The formulation also allows for testing the hypothesis that the price level is directly related to the nonagricultural-agricultural output ratio.

To find out whether the Civil War significantly affected price behaviour or not, some price equations

including the dummy variable as regressor, will be estimated.

What functional forms do the specified equations take: ordinary linear, Cobb-Douglas, exponential or quadratic? Pilot estimations show that the ordinary linear form produces more realistic results, in terms of goodness of fit and statistical significance of parameter estimates, than the other functional forms. Therefore the linear functional form will be applied to the functions to be reported.

The relationships between the average price level (P) and the various variables that reflect the structure of the economy and money supply have been expressed in single equations. This would mean that causation is unidirectional and runs from the X'_s to P. If causation is actually, bidirectional, the use of single equation models will produce simultaneous equations bias. Theoretically, it is ideal and desirable to build a simultaneous equations system. In practice, many difficulties, including those of inherent arbitrariness in the choice of number of equations and variables, and insufficient data, often render simultaneous equations specification and estimation unjustified. Thus, Rao and

Miller (1972: 185) have noted that single equation estimation procedure does not necessarily yield bad estimates; and that it may happen that in some situations, single equations procedure yields better estimates "even though the true model involves simultaneous equations". They also note that:

> As a practical policy, whenever the computed R^2 is close to unity, even though the estimated equation is a part of a simultaneous equations model, direct least squares is doing a "good job". (ibid: 195).

Walters (1980: 189) also notes that simultaneous equations specification and estimation yield biased estimates for small samples. It may be noted at this point that the sample size for this study is small - eighteen time-series points. Another consideration in choosing between single equation and simultaneous equations models, is the purpose of the study and the type of information needed to satisfy that purpose (Johnston, 1960: 342; Koutsoyiannis, 1972: 16). The purpose of the present study is to find out whether and how the structure of output affects price behaviour. The purpose is not necessarily to generate specific precise structural coefficients. Based on these facts, it is clear that

the series of single equations specified, is appropriate for the study.

5.2 Estimation Procedure: OLS Technique

There are alternative techniques for estimating econometric models. These include the ordinary least Squares (OLS) technique - a single equation technique - and various techniques for estimating simultaneous equations models. The OLS method will be used for estimating the single equations specified in 5.1. Although simultaneous equations methods attempt to take into account the complex interrelationships among economic variables, they often fail to yield better results than the relatively simple OLS method. According to Maddala (1977: 231),

> .... it has been found that the OLS method is more robust against specification errors than many of simultaneous-equation methods and also that predictions from equations estimated by OLS often compare favourably with those obtained from equations estimated by the simultaneous-equation methods.

The essentials of the OLS are outlined as follows.

Suppose that for any given equation, the regressand is P, the explanatory variables are X'_s and the error term is U. Using matrix notation, the relationship

between the regressand on the one hand and the regressors and error term on the other hand, can be expressed thus,

$$P = Xa + U$$

where P = an nx1 column vector of the regressand,

X = an nxk matrix of the regressors,

a = a kx1 column vector of parameters,

U = an nx1 column vector of disturbance terms;

n is the sample size and k is the number of parameters to be estimated including the intercept term.

The error, U, is not observable; therefore, for the OLS method which depends on the minimization of the sum of squares of the error to be applied, certain explicit assumptions must be made about the behaviour of U. These are (in non-matrix form):

(1) $E(U) = 0$

(2) $E(U_s U_t) = 0;\ s \neq t$

(3) $E(U^2) = Var(U) = \sigma_u^2$; a fixed, finite number

(4) $E(UX) = 0$.

In addition, the validity of the OLS technique requires the following assumptions:

(5) $E(X_s, X_t) = 0$.

(6) Causation is unidirectional: $X \longrightarrow P$, not $P \longrightarrow X$.

The violation of one or more of these assumptions will render the estimates unreliable. If assumption (1) is violated, that is $E(U) > 0$ or $E(U) < 0$, the OLS estimates will be biased. This situation is likely to arise when an important variable is omitted from the linear regression model. The violation of assumption (2) (absence of autocorrelation) does not lead to biased estimates but the minimum variance quality of the OLS no longer holds. The OLS technique will underestimate the variance of the regressor and of the error term so that a statistically insignificant parameter estimate could be accepted as significant - 'Type I error'. The violation of assumption (3) is known as heteroscedasticity: the variance of the error term is no longer constant leading to unreliable confidence intervals and significance tests. Assumption (4) is violated when the disturbance term is correlated with one or more regressors so that the disturbance term is no more randomly distributed.

When two or more regressors in a multiple regression are sufficiently correlated, assumption (5) is violated. Such violation known as multicollinearity leads to indeterminacy of the estimates of the individual parameters.

Of these assumptions, those of absence of autocorrelation and absence of multicollinearity are the ones usually tested in empirical studies. Those two assumptions will be tested for the equations specified in 5.1.

5.3 Data Collection And Presentation

Estimation of the functions requires time-series data on the underlisted quantitative variables:

1. Consumer price index (C.P.I.) as measure of the average price level
2. Gross domestic product (at constant prices)
3. Agricultural output (at constant prices)
4. Nonagricultural output (at constant prices)
5. Manufacturing output (at constant prices)
6. Construction output (at constant prices)
7. Petroleum exports (at constant prices)
8. Nonagricultural-Agricultural output ratio

9. Import price index

10. Money supply

There is also need to quantify the qualitative variable - the Nigerian Civil War - for its impact to be investigated in this quantitative study.

For the quantitative variables, annual time-series data for the eighteen-year period 1960-1977, were collected from the 1976 and 1980 (2nd Edition) issues of the World Bank's "World Tables" and from the Nigerian Federal Office of Statistics sources. For the war dummy variable, the value '1' is assigned to each of the years ending 1968, 1969, 1970 and 1971 to capture any shift impact on the functions during and immediately after the war; each of the other years is assigned a dummy value of '0'. The regression data are shown in Table 12. The derivation of the import price index series is shown in Appendix I.

Table 12: Data For Regression

Year	P: Consumer Price Index (1970=100)	X_1: GDP at 1974 Constant Prices (₦ M)	X_2: Agricultural Output at 1974 Constant Prices (₦ m)	X_3: Nonagricultural output at 1974 Constant Prices (₦ m)	X_4: Manufacturing output at 1974 Constant Prices (₦ m)	X_5: Construction output at 1974 Constant Prices (₦ m)	X_6: Petroleum Export at 1974 Constant Prices (₦ m)	X_7: Nonagricultural - Agricultural Output Ratio (%)	X_8: Import Price Index (1974=100)	X_9: Money Supply (₦ m)	X_{10}: Dummy Variable
960	66.4	6322.8	3346.6	2976.2	216.4	119.9	30.5	88.9	53.6	215.2	0
61	70.6	6352.2	3250.4	3101.8	242.2	125.3	46.0	95.4	54.3	229.8	0
62	74.3	6652.5	3367.1	3285.4	288.2	124.4	123.9	97.6	52.9	223.6	0
63	72.3	7210.4	3643.1	3657.3	291.6	142.8	187.3	97.9	55.7	234.6	0
64	73.1	7401.1	3626.1	3375.0	299.2	140.6	205.4	104.1	56.8	249.6	0
65	76.0	7803.6	3643.7	4159.9	348.2	173.1	321.8	114.2	57.9	283.8	0
66	83.0	7550.7	3390.1	4160.6	349.1	171.0	783.7	122.7	59.1	300.0	0
67	80.2	6384.3	2864.5	3519.8	299.4	144.9	1058.7	122.9	59.1	330.8	0
68	79.9	6308.4	2822.6	3485.8	315.7	124.9	823.5	123.5	57.4	257.3	1
69	87.8	7999.2	3247.2	4752.0	415.0	178.9	383.6	146.3	59.1	326.8	1
970	100.0	10267.0	3815.7	6451.3	530.7	234.4	1483.7	169.1	60.0	490.3	1
71	116.1	11542.6	4015.7	7326.9	514.1	331.0	2869.9	187.4	63.8	638.4	1
72	120.1	11929.8	3723.3	8206.5	632.2	408.0	4024.5	220.4	69.5	629.9	0
73	125.7	12585.0	3425.2	9159.8	700.2	511.7	4717.4	267.4	82.0	749.5	0
74	142.6	13915.1	3457.4	10457.7	911.2	643.5	5329.3	302.5	100.0	898.0	0
75	190.8	13652.7	3362.1	10290.6	924.6	817.7	5365.7	306.1	112.0	1630.2	0
76	231.8	15309.7	3480.8	11828.9	1124.9	959.0	4545.7	339.8	117.7	2508.9	0
77	281.6	16137.8	3657.4	12480.4	1127.5	1111.2	5339.2	341.2	123.5	3941.8	0

Sources: (1) Columns 1, 2, 3, 4, 5, 6, 8, 9 - developed from World Bank, 1976 World Tables p. 178 and 1980 World Tables (2nd Ed.), pp. 150-151.

(2) Col. 7: - Federal Office of Statistics, Annual Abstract of Statistics, 1969, p. 92 and 1981, p. 113.

(3) Col. 10: Central Bank of Nigeria, Economic and Financial Review. (Various issues).

CHAPTER 6

REGRESSION RESULTS

The results of the OLS regressions of the key functions specified in 5.1 are presented in this chapter. The estimates are subjected to various statistical tests. On the basis of the empirical evidence provided by the results, the hypotheses of the thesis are evaluated. The results of the regression equations that contain the war dummy variable as regressor are reported in Appendix II. They will, however, be referred to in the main text whenever necessary.

6.1 Presentation Of Regression Results

The OLS estimates of the key functions specified in 5.1 are as follows:

(1) $\hat{P} = 23.3 + \underset{(7.5)}{0.006X_1} + \underset{(13.3)}{0.04X_9}$

$R = 0.99$

$\bar{R}^2 = 0.98$

$F^* = 715.3$

$D.W. = 1.42$

(2) $\hat{P} = 69.0 - \underset{(-2.25)}{0.009X_2} + \underset{(10.0)}{0.007X_3} + \underset{(20.0)}{0.04X_9}$

$R = 0.997$

$\bar{R}^2 = 0.992$

$F^* = 791.8$

D.W. = 1.87

(3) $\hat{P} = 45.4 + \underset{(2.5)}{0.05X_4} + \underset{(1.3)}{0.04X_5} + \underset{(7.5)}{0.03X_9}$

$R = 0.997$

$\bar{R}^2 = 0.994$

$F^* = 980.0$

D.W. = 1.87

(4) $\hat{P} = 34.6 + \underset{(2.5)}{0.005X_6} + \underset{(2.3)}{0.53X_8} + \underset{(10.0)}{0.04X_9}$

$R = 0.996$

$\bar{R}^2 = 0.990$

$F^* = 612.5$

D.W. = 1.44

$$(5)\quad \hat{P} = 38.7 + \underset{(12.0)}{0.24X_7} + \underset{(20.0)}{0.04X_9}$$

$$R = 0.997$$

$$\bar{R}^2 = 0.993$$

$$F^* = 1378.9$$

$$D.W. = 1.80$$

The figures in brackets under the parameter estimates are the corresponding t-ratios. R, the coefficient of multiple correlation measures the degree of association of the regressors taken jointly, and the regressand. $\bar{R}^2$ is the adjusted coefficient of multiple determination. It is a general indication of the goodness of fit or the explanatory power of the equation. F^* is the variance ratio used to test whether the joint influence of the regressors on the regressand is statistically significant. The Durbin-Watson statistic (D.W.) is useful for testing autocorrelation.

6.2 Statistical Tests Of Significance

Two sets of tests of significance are carried out for each equation:

(1) the F-test, to ascertain the joint impact of the explanatory variables;

(2) the t-test, to ascertain the significance of individual explanatory variables.

The generalized format for these tests are developed while a tabular summary of the results of the tests for individual regressions is drawn.

In a given regression equation with k regressors, there are k+1 or k* parameters that are estimated; the regressor coefficients are b_1, b_2, ... b_k. The tests are conducted at the 95% confidence level.

For the joint test of significance, the 'null' and 'alternative' hypotheses are, respectively,

$H_o : b_1 = b_2 = \ldots b_k = 0$

H_1 : not every b_i is zero, (i=1,2, ...,k).

For a decision, the observed F-ratio, F*, is compared with the theoretical F-ratio, $F_{0.05}$, which has as degrees of freedom, $V_1 = k^* - 1$ and $V_2 = n-k^*$; n is the sample size and k* is the total number of parameters estimated. The decision rules are:

(A) If $F^* > F_{0.05}$, Reject Ho $\Longrightarrow$ the explanatory variables have a significant joint influence on the regressand;

(B) If $F^* < F_{0.05}$, Accept Ho $\Longrightarrow$ the joint influence of the explanatory variables on the regressand is not significant.

For the individual parameters, two-tailed tests are conducted by comparing the observed t-ratio, t^*_i (i=1,2, ..., k; k = number of regressors), with the theoretical t-ratio, $t_{(0.05/2)}$ which has degrees of freedom n-k*. The observed t-ratio for each parameter estimate is the result of dividing that estimate by its standard error. The null and alternative hypotheses are, respectively,

$$H_0 : b_i = 0$$

$$H_1 : b_i \neq 0$$

The decision rules are:

A. If $|t^*_i| > |t(0.05/2)|$, Reject H_0,

$\Longrightarrow$ b_i is not zero and the ith explanatory variable influences the regressand significantly;

B. If $|t^*_i| < |t(0.05/2)|$, Accept H_0,

$\Longrightarrow$ b_i is not statistically different from zero and the ith regressor does not influence the regressand significantly.

From the distribution of the F variate shown in statistical tables, the theoretical F-ratios at 5% significance level are 4.49, 3.68 and 3.34 for the cases of one, two and three regressors, respectively. The theoretical t-ratios for two-tailed tests at 5% significance level for the cases of one, two and three regressors are 2.12, 2.13 and 2.14, respectively. The F- and t-tests of the estimates conducted as described above produce the results summarized in Table 13.

The F-tests show that the joint influence of the explanatory variables on the average price level is statistically significant for all the equations. The results of the F-tests coupled with the high coefficients of multiple determination (at least 98% for each equation), attest to the high goodness of fit of the specified equations. The coefficient of determination of close to unity in the equations is also a testimony that the OLS method used, is performing well (Rao and Miller, 1972: 195). The t-tests show that except for construction output (X_5) each of the output variables, as well as money supply and import price index, influences the average price level significantly. The statistical insignificance of the coefficient of construction output

Table 13: Results Of Statistical Tests Of Significance

Estimated Equation	F-test	t-test (two-tailed)
(1) $P = 23.3 + 0.006X_1 + 0.04X_9$	S	X_1 (GDP) :S X_9 (Money supply) :S
(2) $P = 69.0 - 0.009X_2 + 0.007X_3 + 0.04X_9$	S	X_2 (agric. output) :S X_3 (nonagric. output) :S X_9 (money supply) :S
(3) $P = 45.4 + 0.05X_4 + 0.04X_5 + 0.03X_9$	S	X_4 (manufacturing output) :S X_5 (construction output) :NS X_9 (money supply) :S
(4) $P = 34.6 + 0.005X_6 + 0.53X_8 + 0.04X_9$	S	X_6 (petroleum export) :S X_8 (import price index) :S X_9 (money supply) :S
(5) $P = 38.7 + 0.24X_7 + 0.04X_9$	S	X_7 (nonagric./agric. output ratio) :S X_9 (money supply) :S

KEY TO RESULTS:

S = Significant $\Rightarrow$ Reject H_o, Accept H_1.

NS = Not significant $\Rightarrow$ Accept H_o, Reject H_1.

variable could be due to collinearity in the multiple regression. A simple regression of the average price level on construction output yields a statistically significant parameter estimate for construction output thus:

$$\hat{P} = 41.2 + \underset{(9.5)}{0.19X_5}$$

$$\bar{R}^2 = 0.95$$

If money supply is included in the regression, construction output still yields a statistically significant parameter estimate as follows:

$$\hat{P} = 54.7 + \underset{(11.0)}{0.11X_5} + \underset{(7.5)}{0.03X_9}$$

$$\bar{R}^2 = 0.99$$

From these additional regressions one can safely conclude that construction output is also an important factor influencing the average price level.

Application of the t-test, to the coefficients of the war dummy variable in various equations (see Appendix II) shows that in none of the equations is the coefficient of the war dummy variable statistically significant. This is a clear indication that the inclusion of the war dummy variable in the price determination equations is superflous.*

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*See Note (3) on page 136 for explanations.

6.3 Examination Of Algebraic Signs Of Parameter Estimates

How far do the directions of the influences of the various explanatory variables on the price level conform with a priori expectations as listed in 5.1? Aggregate output has a positive sign which is one of the possibilities expected. Nonagricultural output, construction output, petroleum exports, nonagricultural-agricultural output ratio, import price index and money supply, each has the expected positively signed coefficient. Agricultural output coefficient is negative as hypothesized. However, the coefficient of manufacturing output (X_4) is positive instead of negative as hypothesized.

Could it be that manufacturing output is actually positively, and not inversely related to the average price level? This question is relevant since the coefficient of manufacturing output is statistically significant in equation (3) which in addition to manufacturing output (X_4), included construction output (X_5) and money supply (X_9) as regressors. When a simple regression of the price level on manufacturing is run, the result leaves the coefficient of manufacturing still statistically significant but positive:

$$\hat{P} = 45.5 + \underset{(2.8)}{0.14X_4}$$

$$\bar{R}^2 = 0.29$$

Inclusion of money supply as a regressor gives the result,

$$\hat{P} = 41.2 + \underset{(10.0)}{0.08X_4} + \underset{(20.0)}{0.04X_9}$$

$$\bar{R}^2 = 0.99;$$

the coefficient of manufacturing output is statistically significant but positive. From these additional empirical evidence, one would conclude that in Nigeria, manufacturing output is actually related to the average price level positively.

Although this situation requires further investigation of its own, a number of probable explanations can be advanced here as follows:

(1) The expansion of manufacturing in an economy characterized by resource shortages may have encouraged price rises. This explanation is in consonance with Musgrave and Musgrave (1982:631) who hold that ".... as output and employment increase, the labour market and availability of other resources tightens, so that prices are bid up by competing firms".

(2) Another probable explanation is the fact that manufacturing in Nigeria is highly dependent on imported inputs. Between 1973 and 1975, about 60.0% of the total raw materials consumed in the manufacturing sector was imported. Dependence on imported raw materials was high, as in the following cases: knitted goods industry, 98.7%; fabricated metal products industry, 95.7%; carpets and rugs industry, 93.6%; grain mill products industry, 91.9% and dairy products industry, 90.7% (Federal Republic of Nigeria, 1981:139). Given the evidence from this study which shows that part of Nigeria's inflation is imported, the high dependence of Nigeria's manufacturing on imported inputs means that expansion of manufacturing would encourage domestic price rises.

(3) A third probable reason can be seen in the oligopolistic structure of manufacturing in Nigeria. According to Teriba, Edozien and Kayode (1981:33), most manufacturing industries in Nigeria have over 80% of their sales controlled by three largest firms. The authors further observed that such a concentration reduces the likelihood of competitive behaviour among firms and increases the chance of firms colluding to

create a mutual monopoly "to the detriment of the consuming public" (Teriba, Edozien and Kayode, 1981:35). Although it should be noted that the findings and conclusions of the study may have been affected by the fact that the data used were collected in 1970, just after the civil war, there is equally no doubt that oligopolistic and monopolistic characteristics exist in the Nigerian manufacturing industry.

The above-listed three factors may explain, in part, the direct causal relationship between the average price level and manufacturing output. But as was indicated earlier, there is need for a study specifically directed to the investigation of that phenomenon.

6.4 Tests For Multicollinearity And Autocorrelation

In order to ascertain the reliability of the parameter estimates, the realism of the assumptions of non-multicollinearity and non-autocorrelation are tested.

Multicollinearity Test Procedure:

The coefficient of multiple correlation, R, is compared with the simple correlation coefficient between two regressors (when there are only two regressors in a multiple regression), r_s; or with the partial correlation coefficient between any two regressors (when there are three regressors in a multiple regression, r_p. If $R > r_s$ or

$R > r_p$, it is very likely that there is no serious multicollinearity in the equation concerned. This conclusion is stronger when none of the regressors has an algebraic sign different from that which it would have in a simple regression. If $R < r_s$, or $R < r_p$, it is likely that there is serious multicollinearity in the equation concerned.

Autocorrelation Test Procedure:

The theoretical lower and upper limits of the Durbin-Watson statistics d_L and $4 - d_L$ respectively, are compared with the observed D.W. statistics, d^*. If $d_L < d^* < (4-d_L)$ autocorrelation is not a serious problem in the equation; if $d^* < d_L$ or $d^* > (4 - d_L)$, there is serious autocorrelation. In this test, the D.W. limits are based on a 5% level of significance and k degrees of freedom, where k is the number of regressors in the equation under examination.

Tables 14 and 15 contain the results of the multicollinearity and autocorrelation tests, respectively. The results show that all the regression equations are free of both serious multicollinearity and

Table 14: Results Of Multicollinearity Tests

Equation No.	Multiple Correlation Coefficient	Coefficient of Correlation Between Regressors	Test Result
(1)	0.99	$r(X_1, X_9) = 0.82$	FM
(2)	0.99	$r(X_2, X_3 \cdot X_9) = 0.35$ $r(X_2, X_9 \cdot X_3) = -0.15$ $r(X_3, X_9 \cdot X_2) = 0.82$	FM
(3)	0.99	$r(X_4, X_5 \cdot X_9) = 0.94$ $r(X_4, X_9 \cdot X_5) = -0.56$ $r(X_5, X_9 \cdot X_4) = 0.79$	FM
(4)	0.99	$r(X_6, X_8 \cdot X_9) = 0.83$ $r(X_6, X_9 \cdot X_8) = -0.41$ $r(X_8, X_9 \cdot X_6) = 0.86$	FM
(5)	0.99	$r(X_7, X_9) = 0.82$	FM

KEY TO RESULTS:

FM = free of serious multicollinearity

Table 15: Results Of Autocorrelation Tests

Equation No.	Observed D.W. (d^*)	Theoretical D.W. Limits		Test Result
		d_L	$4 - d_L$	
(1)	1.42	1.05	2.95	FA
(2)	1.87	0.93	3.07	FA
(3)	1.87	0.93	3.07	FA
(4)	1.44	0.93	3.07	FA
(5)	1.80	1.05	2.95	FA

KEY TO RESULTS:

FA = free of serious autocorrelation

autocorrelation. This implies that the variances of the parameter estimates calculated on the assumption of absence of both serious multicollinearity and autocorrelation, are valid. Consequently, the t-ratios and the statistical tests of significance of the parameters are valid. Reliable interpretations can therefore be made of the estimates in 6.1.

6.5 Summary Of Findings

The empirical results can be summarized as follows. Growth of construction output, manufacturing output, and petroleum exports cause the average price level to rise. On the other hand, growth of agricultural output causes the average price level to fall. For the study period, (1960-1977) growth of aggregate output led to inflation. The growth of nonagricultural-agricultural output ratio is also favourable to price rises. The coefficient of import price index is positive and statistically significant showing that part of Nigeria's inflation is imported. The result in respect of money supply is in conformity with the commonplace evidence that growth of money supply is an important cause of inflation.

6.6 Evaluation Of The Working Hypotheses

The empirical evidence supports the hypothesis that growth of real GDP does not necessarily dampen price rises but may rather accentuate price rises. It has been found that the real GDP influenced the average price level positively for the data and period under consideration. The supporting premise that in Nigeria, some components of aggregate output influence the price level positively while other components influence the price level inversely, has also been borne out by empirical evidence. Not only does nonagricultural output influence the price level positively, but also specific components of nonagricultural output - manufacturing, construction and petroleum exports, influence the price level positively. On the other hand, agricultural output affects the price level inversely. The overall effect of the opposing effects of the components was that growing aggregate output accentuated price rises in the Nigerian economy during the period under study, 1960-1977.

The second hypothesis that the average price level is a positive function of the ratio of nonagricultural

to agricultural output is also confirmed by empirical evidence. This shows that sectoral interaction is an important factor contributing to inflation in Nigeria.

CHAPTER 7

IMPLICATIONS OF THE RESULTS

A number of theoretical, empirical and policy implications can be derived from the results examined in the last chapter. An attempt is made in this chapter to formalize those implications.

7.1 Theoretical And Empirical Implications

(i) The Inappropriateness Of Using Aggregate Output As Regressor

The study has shown that it is inappropriate to use aggregate output as a regressor in the empirical study of inflation. This is because the average price level is inversely related to some components of output but directly related to other components. As a result, the impact of aggregate output is not definitely inverse or positive, but could be inverse or positive.

Thus, the longstanding procedure whereby the GDP is used as a regressor in the estimation of inflation functions is called to question on empirical grounds. This suggests that it is more rewarding, analysiswise, to use the output of individual sectors rather than the

GDP, in such studies. Such an approach reveals the varied effects which different types of production have on price behaviour and thus places policy-makers on a better footing to monitor and control inflation.

(ii) Condition For Intertemporal Stability Of Macro Parameters

The effect of aggregation bias on temporal stability of relationships has been a matter of serious concern for quantitative researchers. Thus Gupta (1969: 72) suggests as an item for research, the examination of "the temporal behaviour of the aggregation bias for a given model". The findings of this study provide some useful insights in this regard: For the macro parameters to be temporally stable, the relative weights of the inflation-accentuating components and the inflation-dampening components of the GDP must remain constant over time. Suppose the weight of the inflation-accentuating component of the GDP is 'W' and that of the inflation-dampening component is 'V'. Then a condition for the stability of the macro parameter over time is that

$$\Delta \left(\frac{W}{V}\right)_t = 0 .$$

for all the time periods, t = 1,2,3, ..., where Δ is

the first difference operator. It is plausible to reason that, if all other factors that influence the value of the macro parameter are held constant, it is variations in $\frac{W}{V}$ that will determine the behaviour of the macro parameter. If the relative weight is not constant, not only the sign but also the magnitude of the macro parameter may change in response to the changing composition of aggregate output.

Based on this rule a prediction can be made for the data of the present study: If over time in the future the relative share of agricultural output in the GDP is increasing while the relative share of non-agricultural output is declining, the sign of the GDP parameter estimate in the price determination functions will, eventually, turn from the observed positive to negative. Notationally expressed, the condition reads thus:

If for any time, $t > 0$,

$$\Delta \left(\frac{Y_A}{Y}\right)_t > 0$$

and

$$\Delta \left(\frac{Y_{NA}}{Y}\right)_t < 0$$

then

$$\left(\frac{\partial P}{\partial Y}\right)_t \longrightarrow \text{negative}$$

as

$$t \longrightarrow \infty$$

where Y_A = agricultural output,

Y_{NA} = nonagricultural output,

Y = GDP,

Δ = the first difference operator.

(iii) A View On Optimal Partitioning

Partitioning of an aggregate into similar groups, has been suggested by some scholars as one method of generating valid parameters in a macro-model of functional relationships. Amidst the controversy about the relative gains and losses in error through the use of aggregated economic variables (Theil, 1954; Grunfeld and Griliches, 1960), Gupta (1969: 22-23) has argued that aggregation bias can be considerably reduced through partitioning. The partitioning is to be done in such a way that "(i) the independent variables in each partition move together and (ii) the micro coefficients in each partition are close to each other." Gupta's first rule means that for aggregation bias to be reduced, correlation among components in each partition should be high. The second rule requires the marginal effects of the components in each partition to be as near as possible to each other (Gupta, 1969:21).

This research suggests another condition for optimal partitioning and reduction of aggregation bias. This is that the micro coefficients of the elements in each partition should have the same algebraic sign. This condition was not satisfied when the average price level was regressed on the GDP and this led to a positive ('wrong') sign for the coefficient of the GDP. The removal of this aggregation error requires the partitioning of the GDP into: (1) those components that influence the price level inversely and (2) those components that influence the price level positively. Economic theory will, in some cases provide information for the classification. But as the evidence from this study shows, the predictions of economic theory do not always hold. For this reason and because, there are cases in which economic theory does not have any explicit information, economic theory should be complemented with empiricism. Empiricism would involve experimenting with different components of the aggregated variable as regressors to find the directions of their various impacts on the relevant dependent variable.

This new condition posited for optimal partioning is shown diagramatically in Figure 1 for the case of the

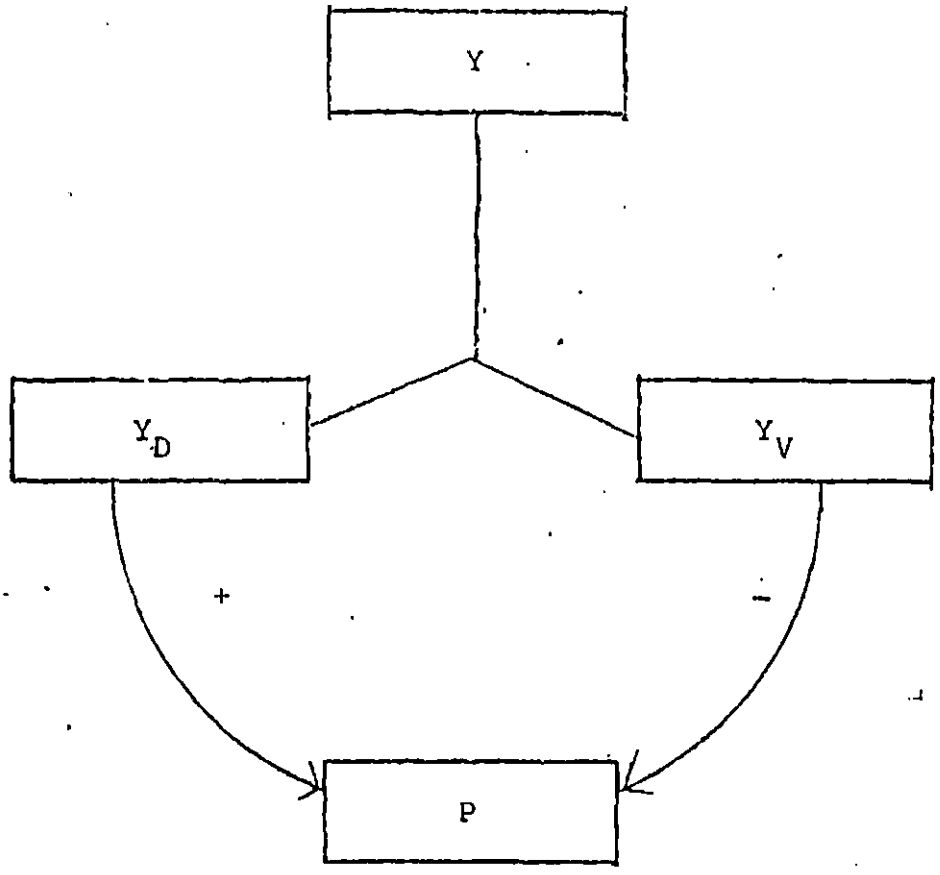

Figure 1: Optimal Partitioning For Valid Causal Relational Specification.

effects of changes in output on the average price level. Y is the GDP in real terms. It is partitioned into two components: Y_D contains components of the GDP whose impact coefficients on the average price level are positive while Y_V contains components of the GDP whose impact coefficients on the average price level are negative. The partitioning is indicated by the bifurcation of the ray from the Y box. Y_D and Y_V are then related to the average price level. The causal flows from Y_D and Y_V to the average price level, P, are indicated by the arrows that originate from the Y_D and Y_V boxes and feed into the P box. The positive and negative flows from Y_D and Y_V, respectively, to P, reflect the essence of the partitioning.

(iv) An Explanation For Statistically Significant But Wrongly Signed Coefficients

A common cause of worry in empirical research is the appearance of 'wrongly' signed coefficients in regression models. It is the view of Rao and Miller (1972:46) that "when the coefficient is significantly different from zero and has the wrong sign, then some aspect of the problem has not been unveiled." Such a wrong sign, they note, may be "a warning, inter alia,

of incorrect definitions, specifications or interpretations" (Rao and Miller, 1972:44).

This research enables one to suggest one possible source of the wrong sign: the misconception of an explanatory macro variable as influencing a dependent variable in a particular direction, whereas, such an explanatory macro variable is actually made up of components which influence the dependent variable in opposing directions. For example, the common prediction of an inverse relationship between the GDP and the average price level, assumes that all components of the GDP influence the price level inversely. This is erroneous. The signs of the impacts of output components on the price level as the results of the regressions in this study show, differ. Some are positive, others are negative; and, the sign of the overall impact of aggregate output on the price level could be positive or negative. In view of this, an important consideration about data used in an econometric research should relate to the homogeneity or otherwise of the impact signs of the aggregated components of the explanatory variables.

(v) Additional Reason For Instability Of The Phillips Curve

It may be recalled that the Phillips-Samuelson-Solow model established an inverse functional relationship between the rate of inflation, $\dot{P}$, and the rate of unemployment, $\dot{U}$. Friedman (1968) and Phelps (1972) have argued that the Phillips curve is not a steady state situation: for any specific unemployment rate, different expected rates of inflation, $\dot{P}^e$ will yield different actual inflation rates. Thus instead of a unique Phillips curve, there will be a family of Phillips curves.

In the present study it has been argued and confirmed by empirical findings that, a given level of real GDP can be made up of different ratios of inflation-accentuating and inflation-dampening components: For any given level of aggregate output, Y, the higher the share of the inflation-accentuating component, Y_D, the greater will be the attendant inflationary pressure, ceteris paribus. Since the ratio,

$$\frac{Y_D}{Y} = \phi$$

is a variable, there is an additional reason why a given unemployment rate may be associated with varying rates of inflation and why the Philips curve, may be thus unstable. At any unemployment rate and given the expected rate of inflation, the actual rate of inflation will depend on ϕ .

The versions of the Philips curve can be summarized as follows:

Original Philips-Samuelson-Solow Model:

$$\dot{P} = f(\dot{U}) \quad \ldots\ldots\ldots\ldots\ldots \quad (P.1)$$

Friedman-Phelps Extension:

$$\dot{P} = f(\dot{U}/\dot{P}^{e}) \quad \ldots\ldots\ldots\ldots \quad (P.2)$$

The Suggested New Extension:

$$\dot{P} = f(\dot{U}/\dot{P}^{e}/\phi) \quad \ldots\ldots\ldots \quad (P.3).$$

Equation (P.1) states that the rate of inflation is dependent functionally on the rate of unemployment. Equation (P.2) states that the rate of inflation is dependent on the rate of unemployment, given the expected rate of inflation. Equation (P.3) states that the rate of inflation is a function of the rate of unemployment, given the expected rate of inflation and, given the proportion of the GDP that is made up of

inflation-accentuating components.

7.2 Policy Implications

This study indicates that Nigeria's inflation is, to a large extent, a cost of the attempt by the economy to achieve rapid growth. Since growth is desirable, the challenge is how to stop inflation without stopping growth of the economy. To that extent, the attempt should be to find ways of limiting inflation to less distorting proportions rather than of completely eliminating it.

Clearly, it is possible to choose between different growth rates and different degrees of inflationary stress; greater growth rates are associated with greater inflationary stress generally, and vice versa. Since a minimum level of price stability is itself necessary for an orderly economic and social development, one option to anti-inflationary policy is to choose a less explosive growth rate. Particularly, the growth of social and physical infrastructure is desirable for greater future national production. However, given their inflationary consequences, such infrastructural development must necessarily be limited.

The idea of 'balanced growth' has a peculiar meaning in this context. A given level of aggregate output can be more or less inflationary depending on its composition. The larger the inflation-accentuating components of aggregate output compared to the inflation-dampening components, the higher the inflationary pressure associated with a given level of aggregate output, and vice versa. Policy makers can, therefore, choose between different output mix points and their corresponding inflationary pressure points. The combination chosen will depend on whether or not, in the evaluation of policy makers, it is more beneficial for the society to increase production, for example, of investment goods that will enhance future growth, while worsening the inflationary pressure, in the short run.

The expansion of output that may accentuate inflation is often undertaken because it is a means to a goal desirable to society, for example, economic growth. A trade-off relation thus exists between growth and inflation. Therefore, one cannot recommend an optimal mix of the national product because this would depend on the subjective evaluation of policy makers: how much disutility from inflation is

considered worth bearing for a given value of future growth?

The task of economic analysis in this regard is to point out the implications of alternative lines of policy choice and to emphasize that the usual broad recommendation for greater output is deficient. The composition of that greater output is important. But the choice of what is considered 'good' for the society is to be left to policy makers.

How efficiently resources are used in the process of growth is an important issue. Even if inflation is growth-induced, a given level of growth and structural composition of output could be more or less inflationary depending on how efficiently resources are used and the resultant real output of goods and services for a given monetary outlay. This possibility is demonstrated in Figure 2 which shows two members of a family of transformation curves, E_1 and E_2 (growth-inflation efficiency curves). If the economy is operating on E_1, a growth rate of G_1 leads to an inflation rate of C_{1A} while a growth rate of G_2 leads to an inflation rate of C_{2A}. But if the economy is operating on E_2, the growth rates of G_1 and G_2 would produce inflation rates of C_{1B} and

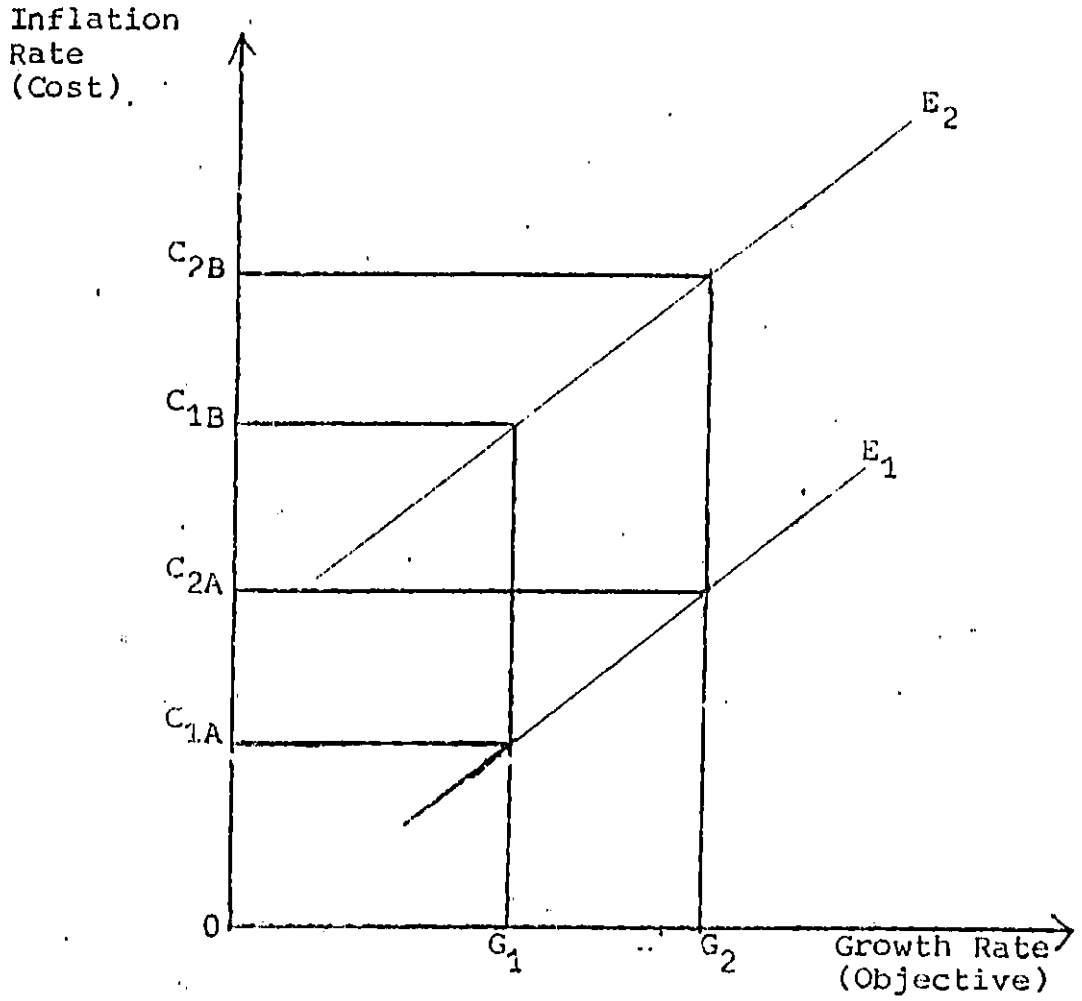

Figure 2: Growth-Inflation Efficiency Curves

C_{2B}, respectively. Since $C_{1B} > C_{1A}$ and $C_{2B} > C_{2A}$, E_1 is a preferable growth-inflation efficiency curve. For any given growth rate, E_1 yields a lower cost (inflation rate) than E_2.

For an economy to operate along E_1 rather than E_2, policy makers should ensure that public expenditure is directed to the more production-stimulating infrastructure like railways, road networks, water supply and electric power supply, rather than to showplace and showpiece projects like football stadia, arts theatres and administrative secretariats. The emphasis on public expenditure should be functionalism at minimum cost.

Two critical questions are thus to be answered by policy makers about public expenditure. (1) What will be the relative allocations between prestige programmes and economic programmes? (2) Within economic programmes allocation, what will be the allocations between production of currently consumed goods and services on the one hand and the development of growth potentials, on the other. For any given period, the more the allocation of resources to economic programmes as well as to production for current consumption, the less the inflationary pressure associated with a given level of

aggregate output, ceteris paribus.

The research findings with respect to the nonagricultural-agricultural sector interaction suggest that a crucial anti-inflationary measure is that of improving agricultural production. While it is desirable that the industrial sector be expanding, the rate of expansion may be limited because of the stress it places on the agricultural sector. Conceivably, there are two approaches to reducing such stress: limit industrial expansion or improve agricultural production to keep pace with the demands of expanding industrial sector. Ceteris paribus, the second option is more desirable because it puts the economy on a higher production curve.

One obvious reason for the poor performance of agriculture in Nigeria is that it is based on the "static hoe-cutlass technology" (Olayide, 1980). The uneasy interaction between agriculture and nonagriculture is a result of the slow rate of modernization of the former. As can be learnt from the experience of such countries like England in the eighteenth century, the uneasy interaction can be minimized if fundamental transformations and innovations in the agricultural sector

occur simultaneously with, or before, industrial expansion. Hence in England of the eighteenth century, while the industrial revolution led to growth in real income and increased demand for agricultural products, the agricultural sector responded adequately because such innovations as the enclosure system and mechanization, made possible large-scale, commercial farming.

There is, therefore, need for technical as well as organisational changes in Nigeria's agriculture. To meet the challenge of the time, agricultural modernization entails that scientific farming by formally-trained agronomists, biologists, animal scientists, veterinary scientists, agricultural engineers and agricultural economists should replace subsistence farming by illiterate, though hardworking, old farmers. This analysis accepts Arthur Lewis' (1971) view that one of the ways in which a country achieves economic growth is to get the educated to do jobs formerly done by the illiterate.

Anti-inflation policy should favour integrated rural development programme. Good roads, electric power and water supplies should be extended to rural areas. These measures will, among other desirable effects, encourage

the educated to remain in rural areas and take up farming as a profession.

It is implied from the above considerations that for an effective check of Nigeria's inflation, agricultural modernization policies must be designed and effectively implemented. Otherwise, the expansion of the nonagricultural sector will generate stresses that transmit into inflationary pressures.

The preceding discussions may lead to the question: What nonagricultural-agricultural output ratio is optimum in terms of minimising inflationary stress? The location of an optimum position on a function presupposes that the function has at least one turning point. But as has been stated in section 5.1, test runs show that the relationships being studied are better represented by linear rather than non-linear functions. In particular, the estimation results show that over the range of observed data, the relationship between the average price level (P) and the non-agricultural-agricultural output ratio (X_7) is linear, thus:

$$\hat{P} = 38.7 + 0.24X_7 + 0.04X_9.$$

For such a linear function, there is no 'maximum' or 'minimum' point. The marginal effect of X_7 on P is constant at about 0.24. But given the nature of the price level/agricultural-nonagricultural output functional relationship in Nigeria, policy makers can still reduce the inflationary pressure by taking measures that reduce the value of the ratio. A one point reduction in the ratio decreases the average price level by about 0.24 points, ceteris paribus. The ratio can be reduced by increasing agricultural production relative to nonagricultural production; or by reducing the latter relative to the former, at any level of aggregate output.

Another salutary approach is to introduce measures that will make it possible, for any given nonagricultural-agricultural output ratio to produce a lower inflationary pressure than was the case previously. Such an improvement requires changing some underlying characteristics of the economy.

One such measure is to increase efficiency in the use of agricultural products by the nonagricultural (particularly manufacturing) sector, so that there is greater industrial output per unit of agricultural input. If such efficiency is achieved (through technological

improvements that reduce wastage and enable intensive use of inputs by processing what was formerly considered disposable waste, into useful products), for a given desired industrial output level, there would be a lower requirement for agricultural inputs.

A second way is to make more efficient, agricultural sector's use of its own products, through for example, the reduction of food wastage and prevention of spoilage of agricultural products due to inadequate preservation measures. Home economics education will be useful in this regard. If the purported efficiency is achieved, the surplus production of agriculture over its own needs will increase and the requirements of the nonagricultural sector can be satisfied with less friction. In sum, efficiency in the use of agricultural products by both the agricultural and nonagricultural sectors, will reduce the inflationary stress at any given nonagricultural-agricultural output ratio.

Thirdly, the inflationary stress can be reduced by finding and making use of nonagricultural substitutes for the raw materials which nonagriculture requires from agriculture. For example, some cotton-, leather- and rubber-based products of industries, can be replaced

with synthetic substitutes derived from Nigeria's rich crude petroleum deposits. With such substitution, the needs of nonagricultural sector from the agricultural sector will fall at any level of the nonagricultural-agricultural output ratio. Hence, there will be lower inflationary stress.

A programme of action is also required against imported inflation. In so far as the country's industrialization depends heavily on imported capital goods, raw materials and spare parts, part of the structural inflation will be outside the control of domestic economic management. The country should thus reduce its dependence on imported goods, particularly of consumer goods and raw materials, if imported inflation is to be reduced. New industries should be approved only if they will be based considerably on local raw materials. Existing industries should be encouraged to change to locally produced raw materials. This can be done by granting 'research rebates' or 'innovation rebates' to firms that successfully find local substitutes for formerly imported inputs. Such firms would be refunded the amount they spend in researching for the substitution.

Although control of money supply may be useful as an anti-inflation measure, the bulk of the evidence from this research shows that the root of the matter lies much deeper. Inflation is inherent in the structure of growth of the economy and is likely to persist even under the best designed monetary and fiscal policies.

In conclusion, anti-inflation policy should be seen as part and parcel of the total task o' national economic and social development. Anti-inflation policy should be designed within the context of overall economic growth programming. Moreover, because the structure of the economy changes over time, anti-inflation policy must also be dynamic; it should keep track of changes in structural relatives and be redesigned accordingly.

CHAPTER 8

SUMMARY AND CONCLUSIONS

This research has been concerned with how the composition of output and the interaction between agriculture and nonagriculture affect the general price level. The possibility of the growth of some components of output accentuating inflation, as well as the condition for intertemporal stability of the parameter estimate of the marginal effect of aggregate output on the average price level, are also issues of interest. An examination of the characteristics of the Nigerian economy leads to the conclusion that a lot of inflationary impulses are embedded in the structure of the economy. A survey of the literature on inflation reveals that the problem has not been investigated within the context of the structural composition of output.

Aggregate output can be divided into two groups: those components that influence the price level inversely and those components that influence the price level positively. OLS regression results show that the average price level is a direct function of aggregate

output. However, while nonagricultural output, manufacturing output, construction output and petroleum exports influence the price level positively, agricultural output influences the price level inversely. The nonagricultural-agricultural output ratio, import price index and money supply also affect the price level positively.

The theoretical and policy implications of the results are discussed. The fact that components of aggregate output affect the price level diversely - some positively, others inversely - implies that it is inappropriate to use aggregate output as an explanatory variable for the price level.

This result is further used to advance the following arguments.

(i) For the coefficient representing the marginal effect of aggregate output on the average price level to be temporally stable, the relative weights of the inflation-accentuating components and the inflation-dampening components of the GDP must remain constant over time.

(ii) To improve the optimality of partitioning of an aggregated regressor (as a way of reducing aggregation bias), the coefficients of the components in each partition should have the same algebraic sign.

(iii) One of the reasons for the appearance of 'wrongly' signed regressor coefficients in regression models, is the misconception of an explanatory macro variable as influencing a dependent variable in a particular direction, whereas, such an explanatory macro variable, is actually made up of components which influence the dependent variable in opposing directions.

(iv) At any given rate of unemployment and given the expected rate of inflation, the actual rate of inflation will vary directly with the proportion of the GDP that is made up of inflation-accentuating components. Thus, the non-uniformity of the directions of the impacts of changes in the components of the GDP on the average price level, is a reason for the instability of the Philips curve.

Policywise, inflation can be mitigated through efficient use of resources, through appropriate output mix, and through the reduction of sectoral imbalance, particularly between agriculture and nonagriculture, in the process of growth. However, some measure of inflation seem to be an inevitable cost for structural transformation and growth.

The research demonstrates the theoretical and policy relevance of the structure-of-the-economy approach to the study of inflation. Inflation being a complex problem, the analyses herein do not provide a complete solution of the riddle. Rather, the issues raised, particularly the theoretical ones, provide an agenda for further research. In view of this, the writer intends to undertake further research along the following lines: a more elaborate study of the nature and consequences of the aggregation bias arising from heterogeneity in the directions of the impacts of the components of an aggregated regressor; a more formal integration of the effects of the composition of output on the stability of the Philips Curve, into existing theoretical framework; and the examination of the applicability of the model of this research to other LDCs and industrialized countries.

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APPENDIXES

I. Derivation of Import Price Index Series

The import price index series is derived from the formula:

$$\text{Import Price Index} = \frac{\text{Imports at Current Prices}}{\text{Imports at Constant Prices}} \times 100.$$

Year	Col.1 Imports at Current Prices (KM)	Col.2 Imports at 1974 Constant Prices	Col.3 Import Price Index (1974=100)
1960	487.2	908.6	53.6
61	499.2	919.9	54.3
62	456.4	862.1	52.9
63	479.4	860.8	55.7
64	587.0	1033.3	56.8
65	645.4	1114.5	57.9
66	638.6	1081.1	59.1
67	621.4	1052.0	59.1
68	561.4	978.7	57.4
69	702.2	1188.9	59.1
1970	936.0	1559.6	60.1
71	1317.0	2062.7	63.8
72	1281.0	1844.2	69.5
73	1806.3	2208.8	82.0
74	2743.3	2743.3	100.0
75	5030.9	4491.8	112.0
76	6573.4	5584.9	117.7
77	8874.0	7185.4	123.5

Source: Cols. 1 and 2:- World Bank, World Tables, 1976 p. 178 and 1980 (2nd Ed.) pp. 150-151.

II. Results of Regressions including The War Dummy Variable as Regressor

(i) $\hat{P} = 29.5 + \underset{(2.25)}{0.0098X_1} - \underset{(1.5)}{47.7X_{10}}$

$\bar{R}^2 = 0.03$

(ii) $\hat{P} = 225.4 - \underset{(1.5)}{0.03X_2} - \underset{(1.2)}{41.8X_{10}}$

$\bar{R}^2 = 0.14$

(iii) $\hat{P} = 59.8 + \underset{(2.5)}{0.01X_3} - \underset{(1.5)}{47.3X_{10}}$

$\bar{R}^2 = 0.3$

(iv) $\hat{P} = 57.3 + \underset{(3.3)}{0.13X_4} - \underset{(1.5)}{44.6X_{10}}$

$\bar{R}^2 = 0.3$

(v) $\hat{P} = 46.6 + \underset{(9.0)}{0.18X_5} - \underset{(2.1)}{15.9X_{10}}$

$\bar{R}^2 = 0.85$

(vi) $\hat{P} = 87.4 + \underset{(3.3)}{0.02X_6} - \underset{1.3)}{39.4X_{10}}$

$\bar{R}^2 = 0.3$

(vii) $\hat{P} = 59.2 + \underset{(2.5)}{0.37X_7} - \underset{(1.4)}{46.3X_{10}}$

$\bar{R}^2 = 0.3$

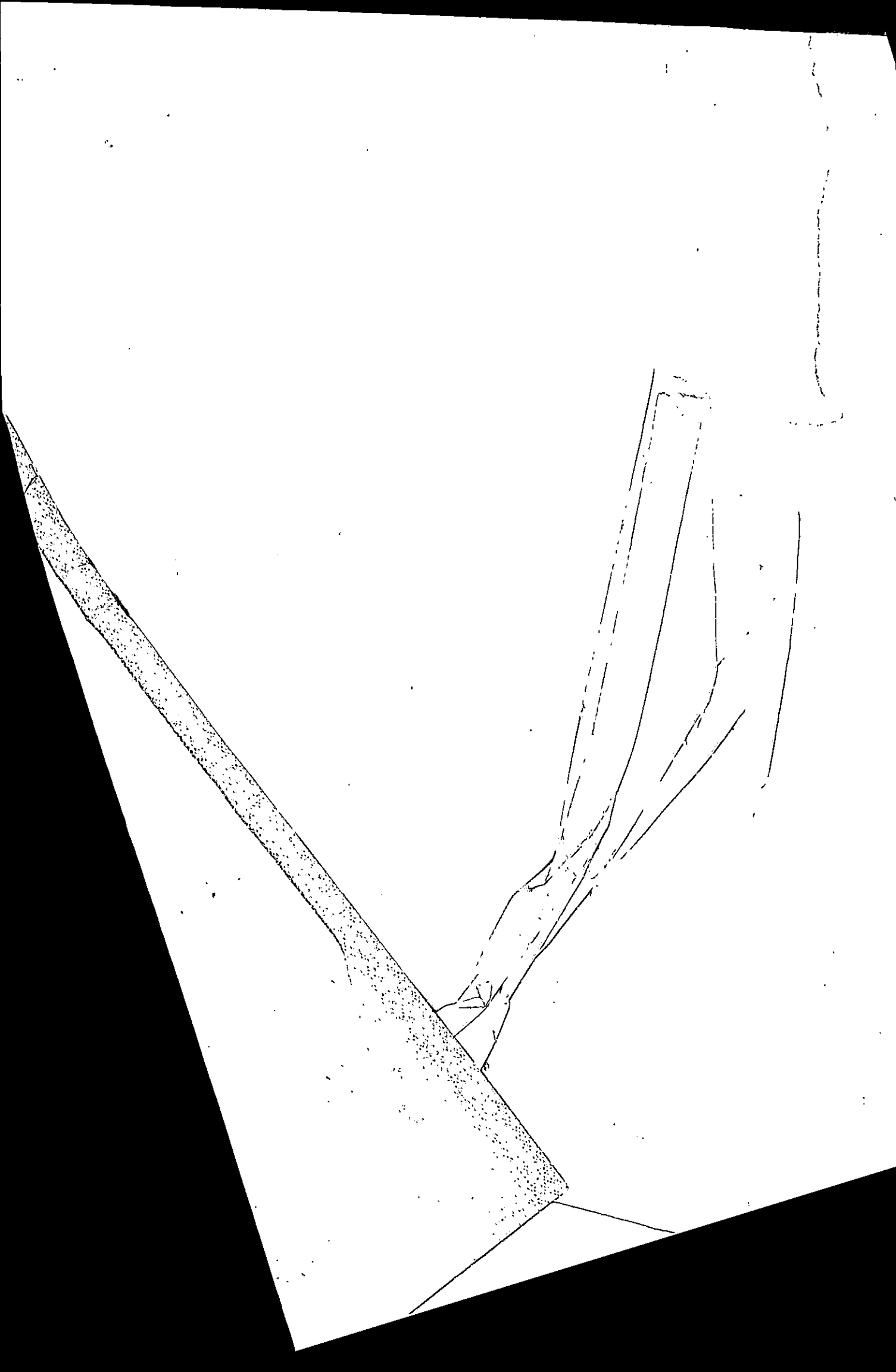
$$(viii)\quad \hat{P} = 42.6 + \underset{(1.93)}{1.14X_8} - \underset{(1.2)}{40.4X_{10}}$$

$$\bar{R}^2 = 0.2$$

Notes: (1) Figures in brackets are the t-ratios for the corresponding parameter estimates.

(2) The coefficient of the war dummy variable, X_{10}, is not statistically significant in any of the equations at the 95% confidence level.

(3) The insignificance of the war dummy variable can be probably explained by the fact that the battle fields were in the eastern states - Biafra - while the rest of the country did not experience the acute disruptive effects of the war. It is also to be noted that published data for the war years excluded the eastern states.



(viii) $\hat{P} = 42.6 + 1.14X_8 - 40.4X_{10}$
$(1.93) \quad (1.2)$

$\bar{R}^2 = 0.2$

Notes: (1) Figures in brackets are the t-ratios for the corresponding parameter estimates.

(2) The coefficient of the war dummy variable, X_{10}, is not statistically significant in any of the equations at the 95% confidence level.

(3) The insignificance of the war dummy variable can be probably explained by the fact that the battle fields were in the eastern states - Biafra - while the rest of the country did not experience the acute disruptive effects of the war. It is also to be noted that published data for the war years excluded the eastern states.