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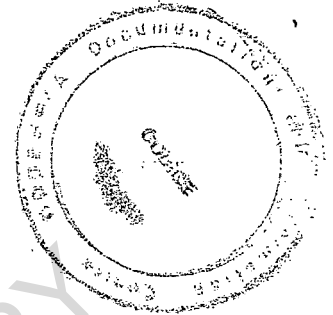
**DETERMINANTS OF IMPORT  
DEMAND FOR CAMEROON,  
1968-88**

**MARCH, 1993.**

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UNIVERSITY OF NIGERIA, NSUKKA  
DEPARTMENT OF ECONOMICS



DETERMINANTS OF IMPORT DEMAND FOR CAMEROON,  
1968-88

04 MAI 1995

A PROJECT REPORT SUBMITTED TO THE  
DEPARTMENT OF ECONOMICS, UNIVERSITY OF  
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APPROVAL PAGE

This Project Report has been approved for the award of the Degree of Master of Science (M.Sc.) of the Department of Economics, University of Nigeria, Nsukka.

By

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EXTERNAL EXAMINER

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DEDICATION

To my brothers and sisters.

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ACKNOWLEDGEMENT

It will be difficult for me to include the names of all the persons whose contribution made this research possible. However, mention must be made of Dr. F.E. Onah, my project supervisor. In spite of the state of his health, he still found time to read every word of this research, punctuating it with invaluable corrections and suggestions.

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Finally, I am grateful to the Lord Almighty for granting me the ability and stamina to withstand all the hurdles I had to go through before completing this research.

Nevertheless, all errors of commission or omission in this research are my sole responsibility.

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ABSTRACT

Cameroon has been facing a current account deficit since 1987 and will continue to do so in the nearest future. This will imply a net resource drain at a time when long-term capital investment looks bleak given the shift in emphasis of western financial commitment. The country must therefore make urgent moves at arresting this deficit.

Increasing exports for Cameroon will be a very difficult task and hence recourse has to be taken to reduce imports. The research therefore sought to find out the factors that influence import demand in the country. The variables that were considered likely suspects on theoretical and empirical ground are, relative prices, real Gross Domestic Product, export earnings and money supply. The method of analysis is econometric, the technique multiple regression analysis, the functional form log-linear and the nature of the data time series.

The results indicate that the traditional import demand function with relative prices and income as explanatory variables significantly account for variations in the level of imports in Cameroon. Export earning and money

supply also proved to be significant explanatory variables as they are found to increase significantly the coefficient of determination of the traditional import demand function.

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CHAPTER ONE  
INTRODUCTION

1.1 Preamble:

Adams Smith based his whole discussion on the division of labour upon what he called "a certain propensity in human nature, ... the propensity to truck, barter and exchange one thing for another (Condcliffe 1950; 11). Anthropological inquiries later sought to find out if this propensity was one of those original principles of human nature for which no further account could be given, or whether it was a necessary consequence of the facilities of reason and speech. The verdict was that the propensity to trade is not an original principle of human nature but a painfully acquired accomplishment which grow out of the exchange of gifts between persons (Condcliffe 1950; 11). Condcliffe (1950; 16) points out that modern trade derives from the beginnings of capitalist enterprise, from the twelfth century onwards, although he acknowledges trade and international intercourse long before the era of industrial capitalism. He adds further that the trade between China and other parts of Asia and Africa was extensive

and gave rise to trading controversies and controls very similar to the Mercantilist ideas and practices which were to prevail later in Europe from the sixteenth century and which, though submerged during the nineteenth century, were never lost and have re-emerged in our own time.

One such concept is the balance of International Transactions, more popularly known as the Balance of Payments (B.O.Ps). Ellsworth and Lerth (1975; 303) define it as a systematic record of all economic transactions between residents of one country and residents of the rest of the world over a given period of time, usually one year. Wasserman et al (1971; 28) are of the view that Balance of Payments, in its primitive form of Balance of Trade, is the oldest English tabulation in existence and that the first such document dates 1355; the second, 1570. However, despite its long history, Lederer (1963; 7) points out that the euphoria for the compilation of Balance of payments statistics is a recent development, while its use in policy formulation by governments and Central Bank authorities hardly goes back before the 1930s, and in most countries, only during and after the second world war.

Its compilation is based on double-entry-book-keeping principle, guaranteeing that technically, the Balance of Payments always balances, with total credits being equal to total debits. The Balance of Payment could be broken down into trade, current, basic, overall and official balances; autonomous and compensatory balances or simply, current and capital accounts. While technically the Balance of Payments always balances, these sub-balances may not always balance and it is in their imbalances that can better be conceived the idea of a deficit or surplus in the Balance of Payments of a country.

Wasserman et al (1971; 49) observe that the notion of Balance of Payments surpluses or deficits is a traditional concept which this tabulation inherited from the days of Mercantilism when the tabulation did not include all accounts, or the total of international transactions. Generally, the Mercantilist reckoned the surpluses and deficits on the merchandise and services accounts or merchandise, services and unilateral transfer accounts. When the capital accounts were added later economists perceived surpluses and deficits in increases or decreases in the net holding of certain short-term liquid assets. Thus, in the nineteenth and twentieth

century days of the international gold standard when monetary gold constituted the principal liquid reserve asset, its movement was usually held to measure the Balance of Payments surpluses or deficits. With the end of the gold standard, other short-term liquid assets took their place along side gold as international reserve assets. Presently, liquid reserve assets include gold, U.S. dollars, pound sterling and a few other convertible currencies, together with ordinary and special drawing rights of the International Monetary Fund (I.M.F.).

Salop and Spittaller (1980; 101) are of the view that since the onset of the generalized float in 1973, the current account has replaced the Balance of Payments as the barometer of the need for adjustment in a country's macro-economic policies. Villarreal (1982; 17), in his attempt at diagnosing the origin of external disequilibrium in Third World countries observes that, undoubtedly the symptoms are evident as a result of a growing deficit in the balance on current account. Aribisala (1987; 3) when tracing the origin of austerity measures in Nigeria identifies as the chief characteristic of economic crises, Balance of Payments disequilibrium brought about by drastic reduction in the country's

export earnings leading to a deficit in the current account.

International Monetary Fund - IMF (1987; 1) points out that the Year 1986 saw not only a sharp drop in the oil prices but also a further weakening in non-oil commodity prices, with lower export earnings imposing severe hardship on many developing countries. With their dwindling foreign earnings and the bleak prospect of increased external financing, partly due to the falls outs in Eastern Europe and the demise of the former Soviet Union, economic growth becomes a very difficult and uncertain task for them. One such country is Cameroon.

Cameroon's economic growth averaged 8 percent a year in real terms throughout the 1970s to 1985, while the 7 percent annual growth rate target of the fifth National Development Plan (NDP) which ran from 1980/81 to mid 1986 was also met. This growth however, came to a halt during the 1987 fiscal year and then reversed into severe recession from which the country is yet to emerge. World Bank (1991; 78) holds that between 1985-1987 Cameroon's export price index in C.F.A.F terms fell by 65 percent for crude oil, 24 percent for cocoa, 11 percent for coffee and 20 percent for rubber, all causing

a 41 percent deterioration in its terms of trade. The Bank further points that the fall in export earnings in the mid 1980s resulted in a dramatic decline in Cameroon's net foreign reserve assets from C.F.A.F. 156 billion in 1985 to a negative C.F.A.F. 117 billion in 1989. The Balance of Payments registered a current account deficit of 9.8 percent of Gross Domestic Product (G.D.P.) in 1986/87 compared to a surplus of 4.0 percent the previous year, with the Gross Domestic Product falling by 7.7 percent in 1987-88, 3.4 percent in 1988/89 and an estimated 1.2 percent in 1989-90.

These exogenous factors have greatly undermined Cameroon's economic and financial viability, making the success of the sixth National Development Plan very difficult. Indeed, the social objectives of the plan which include the maintenance of the country's food security, making health care, primary education, drinking water and electricity available to all by the year 2000 seem almost impossible to achieve.

World Bank (1991; 80) medium term outlook on Cameroon observes that even with growth in Agriculture and rapid growth in non-traditional exports, Cameroon will have to live with lower levels of imports. It goes



further to note that, though a minimum level of imports will nevertheless be required, the likelihood is that the current account will remain in deficit for at least, the next five years. This deficit is harmful since it implies a net outflow of resources at a time when foreign long-term capital has been steadily declining, thereby reducing the available resources needed for their industrial take-off. Arresting the current account deficit, therefore, emerges as an important step towards renewed economic growth for Cameroon.

#### 1.2 Statement of the Problem:

For Third World Countries to arrest external imbalance through correcting their current account deficits they must be able to control what Haberler (1965; 6) calls the chief item in the balance of payments - international trade in commodities. Hence, the most important macro-economic variables to achieve this are merchandise exports and imports. The options open to them are either increasing exportation or reducing importation or simultaneously increasing exports and reducing imports.

Increasing exports in the short-run will be a very difficult task for these countries at this time because

of weak external demand, protective barriers in industrialized countries, fragile and non-existent industrial base and other structural rigidities. Many studies on Third World countries exports, especially from Africa, indicate an inelastic supply curve in the short-run. [see Khan (1974), Bond (1985, 1987), Kirmani et al (1984) Mirakhor and Montiel (1987) Bahmani-Oskooee (1986), Maizels (1968)]<sup>7</sup>. Mirakhor and Montiel (1987; 59) observe that for a variety of reasons, external and internal, the brunt of the adjustment burden over the past years has fallen on imports. Import reduction has become very important in the adjustment process of the Less Developed Countries (LDCs).

An indisputable fact is that to control a variable one must clearly understand the other variables that influence it. Given the differences in the level of industrialization between the more Advanced countries and Third world countries, one is not sure if variables that influence the level of imports in former countries are the same for the latter countries. In fact, Khan (1974; 678) observes that for the less developed countries, the level of imports is determined by non-market forces. Bautista (1978; 199) emphasizes the role

of government in deciding the size and composition of imports in less developed countries. He goes further to point out that estimates of demand elasticities might not reflect the actual responsiveness of imports to price and income changes in the past or be relevant in the quantitative assessment of the probable effects on import demand on policy changes or external disturbances affecting prices and/or incomes.

In view of the above observations the problem becomes that of identifying, isolating and quantifying the variables that influence import demand in a less developed country like Cameroon.

### 1.3 Scope and Limitation of the Study:

The proposal for this research envisaged the period 1960-90 as the period of study. However, it was not possible to get relevant data on all of the macro-economic variables of interest in this research to cover the period. Hence, the period of study was reduced to include only 1968-88, a period long enough to yield meaningful results.

Attempts at comparing data from the International Monetary Fund with those from the Bank of Central African States to which Cameroon is a member failed as the

latter institution did not reply to my letter requesting for such information.

Getting disaggregated data according to the standard International Trade Categorisation on imports was also not possible; for these would have revealed the performance of the different sectors and sub-sectors. Hence an aggregated import demand function was estimated.

#### 1.4 Organisation of the Research:

Chapter one of this research is made up of four parts; preamble, statement of the problem, scope and limitation of the study and organisation of the research. The literature review which is divided into a theoretical and an empirical section, together with the objectives of the study and the working hypotheses form chapter two. In chapter three captioned, methodology, we have explained the rationale for the use of the model and justified the use of the explanatory variables in the research. Also included in this chapter is the model specification and the technique of evaluating the results obtained. Presentation of the results and evaluation of the results based on economic, statistical and econometric

criteria are undertaken and presented together with the evaluation of the working hypotheses, are included in chapter four. Chapter five is the conclusion.

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CHAPTER TWO  
LITERATURE REVIEW

2.1 Theoretical Literature Review:

The methods of adjusting external imbalances have undergone many stages of refinement with the underlining principles and concepts reflecting different economic epochs. Explaining the different approaches over time and showing the necessary evolution and conceptual need that called for the continuous refinement in the ideas of how a country adjusts to external imbalances will occupy us here. These ideas could be broadly classified under five headings; the specie-flow mechanism, the elasticities, absorption, monetary and structuralist approaches.

The specie-flow mechanism is the automatic correcting mechanism associated with the gold standard, the credit of which goes to David Hume (1711-76). Oser and Blanchfield (1975; 54) attest to this, calling it Hume's greatest contribution as an economist. According to the theory, there is a direct link between the amount of precious metal, the supply of money and the price level of an economy. When there is a deficit in the current account,



the country loses gold to the rest of the world which leads to reduction in the money supply and a subsequent reduction in the price level. The fall in the domestic price level will make exports of the depressed economy more attractive while imports become relatively expensive. Finally, exports will increase and imports will fall, thus reversing the deficit in the next accounting period.

Despite the automatic manner in which the specie-flow mechanism operated, it faced some theoretical and practical opposition by the end of the nineteenth century. Firstly, the supply of gold was not evenly distributed, which placed some trading nations at undue advantage. Secondly, with the intensification of the industrial revolution in Europe, the supply of goods and services far out-stripped the supply of gold. Finally, it was believed that nobler goals like full employment and price stability should not be compromised whenever there is an imbalance in the current accounts. The feeling gradually gained grounds that the domestic economy must be insulated to some extent from the uncertain international environment.

The result was the system of exchange rates. It could be free floating exchange rate, fixed rates reviewed from time to time, or rates that were permitted to fluctuate within a certain defined margin. It was to explain the circumstances or conditions for the effectiveness of the exchange rate system that the elasticities approach to balance of payments adjustment, commonly known as the Marshall-Lerner condition was conceived.

Basically, it states that, the sum of the elasticities of demand for a country's exports and of its demand for imports has to be greater than unity for devaluation to have a positive effect on a country's current account if it start from a position of balance. If the sum is less than unity a country instead improves its current account by revaluing. The condition is expressed mathematically as

$$dB = KX_f (e_{1m} + e_{2m} - 1) \dots\dots 2.1$$

where  $dB$  = change in trade balance

$K$  = devaluation in percentage

$X_f$  = Value of exports in foreign currency

$e_{1m}$  = the devaluing country's demand elasticity for imports.

$e_{2m}$  = the rest of the world's demand

= elasticity for exports from the devaluing country.

The problem of ascertaining the effectiveness is thus reduced to a simple calculation of elasticities which is possible if data is available.

By the 1950s, criticism of the elasticities approach had gathered momentum due to its emphases on price elasticities alone. Scammell (1977; 46) points out that this approach is over simplified since not only prices alter, incomes are also affected. He points out that "the approach gives only a partial or initial effect; that which will happen if incomes were held constant .... But, in fact, incomes will usually change as a result of devaluation and this income change will induce a whole train of price and quantity changes". While it is possible for these elasticities to be calculated, the calculation becomes, if not unmanageable, at least unintelligible to any but the most dogged reader, he adds.

The need for a more embracing approach became apparent. Alexander Sydney (1958) conceived of the Absorption approach in which he tries to capture the effect of price, income and money changes. He starts

his analysis by restating the Keynesian income equilibrium condition

$$Y = C + I + G + X - M \dots 2.2$$

where  $Y$  = National output

$C$  = Private domestic consumption

$I$  = Private investment Demand

$G$  = Government expenditure

$X$  = Exports

$M$  = Imports

By rearranging the terms in equation 2.2 he arrives at

$$(X - M) = Y - (C + I + G) \dots\dots\dots 2.3$$

if  $X - M = B$

and  $C + I + G = A$

equation 2.3 become

$$B = Y - A \dots\dots\dots 2.4$$

where  $B$  is the difference between total output of the economy ( $Y$ ) and the absorption of such output by the domestic economy, ( $A$ ).

The  $B$  in equation 2.4 could be affected by changing either  $Y$  or  $A$ , or both. In the case of full employment,

Y will not increase in the short-run and A will have to decrease to improve the balance on current account. Put differently, increases in the supply of exports will not be possible, implying that, the balance on current account can only be improved by a reduction in the levels of imports.

With the emergence of the Chicago School and their 'money-matters-most' philosophy of the economy, equation 2.4 of Sydney's absorption equations was transformed into

$$B = R_f - P_f \dots\dots 2.5$$

where B = difference between receipts by residents from foreigner and payments by residents to foreigners.

$R_f$  = receipts from foreigners

$P_f$  = Payments to foreigners.

The Monetarists view Balance of Payments as aggregates payments and receipts with their implication for the cash balances of residents. This approach holds that, if there is a deficit in the current account, it implies that cash balances of residents are being depleted by excess foreign payments and they can be

renewed by open market operations or other monetary instruments. They believe that Balance of Payments disequilibria are monetary phenomenon; a belief which makes it possible to integrate balance of payments with monetary theory and policy.

The Structuralist approach put forward by Villarreal (1980) and other Third World economists point out that monetary prescriptions cannot be adequate in economies that are not completely monetised while price and income changes cannot galvanise their economies because of structural rigidities. This approach holds that the origins of external disequilibrium are eminently structural in nature and are due to intrinsic maladjustment in the growth and foreign trade processes. They propose that to solve external disequilibrium, devaluation should be considered jointly with an expansionary but selective demand policy and, at the same time, a supply policy that directly stimulate production and investment in the export and import substitution sectors of the economy.

## 2.2 Empirical Literature Review:

There was a lively discussion among economists in the late nineteen fourties and early fifties about

empirical measurement of import demand elasticities. Sodersten (1980; 362) points out that the first published studies by Hinshaw (1945, 1946) and Adler (1945, 1946) showed very low values for import demand elasticities. Other early studies with low elasticities include Chang (1945-46, 1946, 1947, 1948), Derken and Rombouts (1939), Holzman (1949), Neisser (1945, 1948) Polak and Chang (1949). These results were criticised by Orcutt (1950) and Harberger (1957) and two Schools of thought developed: elasticity pessimists and elasticity optimists.

Orcutt (1950) who articulated the attack on these early estimates hinged his argument on the use of classical regression method and its inherent simultaneous equation bias. This bias, Prais (1972; 561) points out, is due to the fact that prices and quantities may be due to supply or demand, or both, and elasticities obtained using the ordinary least squares method will be a weighted average of a negative demand elasticity and a positive supply elasticity. Since then, the balance in the literature has hung between those who like Harberger (1957) feel that the traditional method of estimating elasticities from time

series data is likely to prove fruitless and those who feel the estimation meets the same degree of difficulty as any other problem of econometric analysis of demand.

Ball and Marwah (1962) carried out a study of U.S. demand for imports for the period 1948-58 in which total demand was broken down into crude materials, semi manufacture manufactured food stuff, crude food stuff, manufactures and services. Applying the basic hypothesis that variations in import demand are explained by variations in incomes and import prices relative to the domestic price level and making use of log-linear ordinary least squares, they came out with results that were consistent with the basic hypothesis. That is, United States imports are influenced by changes in relative prices and incomes.

Kreinin (1967; 514) notes that the period of Study of Ball and Marwah included the Korean war and it's aftermath which might have introduced a bias in their results. He then computed the elasticities using the same technique but with data for 1954-64 period, which were broken down to yeild 43 quarterly observations.



He concludes that an almost identical would be obtained from Ball and Marwah by adding two standard errors to their estimates and that the difference was due to the introduction of lagged values.

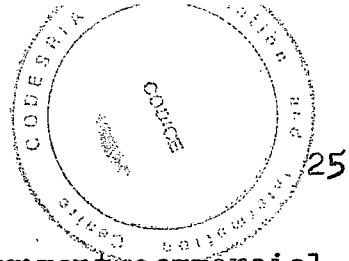
Houthakker and Magee (1969) estimated demand elasticities for imports and exports with respect to incomes and prices for a number of countries, most of them developed. Annual observations used were from 1951-66, thus providing time series data not too short for meaningful results. Their analysis followed the same general line as earlier works by Ball and Marwah (1962) and Kreinin (1967). Their results were also in agreement.

Khan (1974) did a study on imports and exports which he notes is an extension of Houthakker and Magee (1969), on 15 countries that could be categorized as developing. The countries include Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Ghana, India, Morocco, Pakistan, Peru, The Philippines, Sri Lanka, Turkey and Uruguay. He used data for 1951-69 and the hypothesis tested was that changes in prices of traded and non-traded goods exert no significant influence on the trade flows of these countries. Using the ordinary least squares technique, he concludes that

prices play an important role in the determination of imports and exports of these countries. The price elasticities were found to be relatively high (indeed higher than unity) for most of the 15 countries, which implies that the Marshall-Lerner condition for a successful devaluation would be satisfied. These results again are similar to those of Houthakker and Magee (1969).

Bahmani-Oskooee (1984) attempts to provide new estimates of aggregate import and export functions for seven developing countries using quarterly data for the economic activities. For many Less Developed Countries (LDCs) he points out that this relationship is questionable because of the effect of trade and foreign exchange restrictions. In his study (1974) he presents an alternative approach to import behaviour of less developed countries based on foreign exchange receipts. A model of reserve behaviour is introduced to determine how the response of short-term imbalances is divided between changes in reserves and in imports, giving rise to an import-exchange equation for less developed countries.

Kemel and Alvie (1975) estimated an import demand function in which price and income variables were



supplemented with a proxy for government commercial policy as explanatory variables. Applying it to the Pakistani economy in which they were interested in the effect of the 1972 devaluation on the balance of trade, conclude that neither Gross National Product (G.N.P) nor relative prices is a significant explanatory variable in explaining variations in imports. The proxy is also not significant. However, the disaggregated model was more illuminating. In the case of grain imports neither price nor income was significant, while domestic food production was significant for the period 1973-1980. The countries include Brazil, Greece, India, Israel, South Africa, South Korea and Thailand. Using log-linear ordinary least squares technique with quantity of imports as dependent variable and ratio of import price to domestic price and domestic real income and exchange rates as independent variables come out with results showing low price elasticities. This indicates that relative prices do not have a significant effect on imports of the developing countries under study. Elasticity estimates associated with exchange rates were also insignificant, while those associated with incomes were significantly different from Zero.

Khan's (1975) disaggregated study of a developing country's import demand using log-linear ordinary least squares for the period 1953-1973 concludes that "it appears from the results of this paper that simple specifications involving only relative prices and real income as explanatory variables are adequate in explaining a large proportion of Venezuelan imports. This is true for the aggregate and disaggregated models" (p.227).

Hemphill (1974; 636) observes that theoretical and empirical studies of aggregate import behaviour generally show the flow of imports to be determined by aggregate significant. Index of industrial production was significant for capital goods and raw materials.

Bautista (1978) in dealing with the quantification of import control measures introduced a dummy for periods in which restrictions were in effect and made use also of lagged values of exports and level of international reserve. He applied this model to the Philippine's import of food from 1952-74 and notes a strong influence of domestic supply factors on food imports and a relatively weak influence of the capacity to import variable on domestic food output and prices.

Olayide (1968) estimated import demand for specific farm crops using time series data from 1946-62 for Nigeria. Applying log-linear formulation and taking imports as dependent variable with price of farm product and time trend as explanatory variables, he concludes that the goodness of fit is fairly reasonable since in none of the results do the two explanatory variables explain less than 57 percent of the variations in the dependent variable. He notes further that on a priori grounds, the goodness of fit could increase if indices of trade barriers, industrial production, capacity to import and prices of close substitutes were added.

A ten-year (1960-70) time series analysis of Nigeria's import demand was undertaken by Ajayi (1975). Applying ordinary least squares technique with price and income as explanatory variables, he has long and short-run price and income elasticities as -2.7, 0.26 and -3.71, 0.35 respectively. He however, does not state the level of significance for rejecting or accepting the hypothesis that price and income affect the level of imports.

From the survey of empirical literature it is clear that in developed and some developing countries, the standard import demand function with price and income as explanatory variables explain variations in imports. Evidence from other developing countries however, contradict this assertion. In spite of these contradiction, the method of analysis is the same all through with the number of variables increasing to incorporate other explanatory variables to take care of Third World peculiarities.

It can be observed also that despite the wide range of countries covered, at no time was Cameroon included in these studies, and it is not possible to adequately infer it's aggregate demand function from so conflicting a bulk of literature. The researcher therefore is applying the tools, concepts and principles used in the analysis of import demand function to a country yet uncovered by other studies. It is therefore, no overstatement to note that this is the first econometric analysis of Cameroon's aggregate import demand function.

### 2.3 Objectives of the Study:

This research will be carried out with the following objectives in mind.

- I. To empirically find out if the traditional import demand function with price and income as explanatory variables significantly account for Cameroon's import demand during the period of the study.
- II. To find out the effect of export earnings and money supply on the coefficient of determination ( $R^2$ ) of the traditional import demand equation.
- III. To ascertain the stability of the explanatory variables over time.

The findings of this study are intended to help in understanding the probable relationship between the explanatory variables and levels of imports in the short and medium term periods.

### 2.4 Hypotheses of the Study:

The working hypotheses of this research can be stated as follows;

- I. Changes in imports are not due to changes in prices or incomes.
- II. Export earnings and money supply do not improve the coefficient of determination of the traditional import demand function.
- III. There are no changes in the parameter estimates over time.

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## CHAPTER THREE

### METHODOLOGY

#### 3.1 Rationale For Use of Model:

Prais (1962; 560) observes that of the various branches of Economics, international trade is the area in which statistical information is most extensive. Given their practical uses in foreign trade policy it is not surprising that these data have been estimated in various ways in order to obtain quantitative estimates of the responses of imports and exports to changes in prices and the like. Khan and Ross (1977; 149) point out that the theory of international trade gives little guidance on the appropriate functional form to use when specifying and estimating an import demand function.

Boylan et al (1980; 561) however, note that, for estimation purposes, the choice of the functional form is made from a restricted class of functions comprised of a linear formulation and a log-linear formulation. When the standard goodness of fit criteria is used the log-linear formulation is preferred to the linear formulation. This is the one used by Khan (1974, 1975) Khan and Ross (1977) Kreinin (1967) Houthakker and

Magee (1969), Olayide (1968), Ajayi (1975), Bahmani-Oshoee (1984), Bautista (1978), Kemel and Alvie (1975) and others.

Khan and Ross (1977) and Boylan et al (1980) sought to find out the appropriate form for an aggregate and disaggregated import demand function. They both applied the Box-Cox procedure (1964) which is a special case of the maximum likelihood method. Basically, the method consists of considering the generalized functional forms of linear and non-linear formulations for a series of powers and obtaining and comparing their maximum likelihood estimates (Boylan et al 1980; 564). In both cases the log-linear formulation proved more appropriate.

A large number of elasticity estimates in the 1930s and 40s used time series annual data. This method was criticized in the 50s and Neisser (1958; 130) after having finished an extensive survey on time series put forward the view "that the traditional multiple regression of time series is dead" (also see Harberler 1957; 508). Objections to the time series was systematically articulated by Orcutt (1950) where he challenged

the low elasticity estimates obtained from such data. Prais (1972; 561) points out that among Orcutt's reasons was the possible identification problem. Since the relationship between prices and quantities may be due to supply or demand or both, estimated elasticities will in principle be a weighted average of a negative demand elasticity and positive supply elasticity - implying that the estimates will be biased toward zero. Harberger (1953) made an attempt at disentangling the pure demand elasticity from the mixture of demand and supply elasticities and points out the need to make a priori judgement about the size and weight of the supply elasticity in the mixture. [This needed a priori judgement is not easy to make (Prais 1972; 562).] Other attempts have not been successful and those that succeeded yielded results close to those obtained by the use of ordinary least squares and applying time series data. Prais (1972; 563) concludes that it now appears in practice that the bias is less than at first suspected. Klein (1960; 871), one of the early critics of time series, in an article on "New Estimation Techniques", observes that "international trading relationship putting a small country's demand

or supply against an overwhelming world market may be properly estimated by the application of the multiple regression analysis using time series data".

Given the above considerations, the method of analysis is econometric, the technique, multiple regression, the functional form, log-linear and the nature of the data time series annual data from 1968-88.

Having chosen ordinary least squares multiple regression analysis as the technique of analysis the assumptions of the model are those normally associated with the ordinary least squares technique.

### 3.2 Notations:

The following notations are used in this research;

IM = Import of Merchandise Goods

EX = Export of Merchandise Goods

P = Ratio of Consumer Domestic Price index to import price index.

E = Exchange earnings

Y = Real gross domestic output

M<sub>2</sub> = Money Supply (means of payment) broadly defined

CPI = Consumer Price Index (domestic)

IPI = Import Price Index

### 3.3 Justification for use of Explanatory Variables in the Model:

Mirakhor and Montiel (1987; 68) point out that economic theory suggests that imported consumer goods should be treated like other consumer goods. The demand for such imports should therefore depend on the relative prices as well as those variables that determine household demand. The income hypotheses of Keynes, Duesenbury, Friedman and Modigliani all recognise income as a very important element that determines the level of consumption and by extension the demand of import of consumer goods.

Wasserman et al (1971; 299) opine that where economic forces have free play the tendency is for balance of payments disequilibria to be automatically corrected by forces quite similar to those that caused the imbalance in the first place. They identify movements in exchange rate, prices, interest rates and income as the forces. Changes in imports due to changes in National income is known in the literature as induced imports. Besides the theoretical footing, studies have proved the price and income variables as significant explanatory variables in explaining

variations in imports of countries (see Ball and Marwah (1962) Kreinin (1967) Houthakker and Magee (1969) Khan (1974, 1975), etc).

Hemphill (1974; 638-9) notes that the notion that Third World countries' imports are determined by their foreign exchange receipts is found in the literature in connection with:

- (1) the behaviour ascribed to less developed countries in world trade models [see Polak and Rhomberg (1962), Polak (1954), Rhomberg (1968)]\_7.
- (2) re-spendings of foreign exchange by less developed countries in studies of the effect of foreign <sup>exchange</sup> changes in the flow of U.S. foreign aid [Hicks (1963), Ullman (1967), Piekarz and Steckler (1967)]\_7.
- (3) the foreign exchange constraint in the two-gap programming models of economic growth [McKinnon (1964), Chenery and Strout (1966)]\_7.

Polak and Rhomberg (1962; 113) observe that "as a group, these countries have had to adjust their foreign exchange, mostly for imports, to the foreign exchange receipts on account of exports .... Broadly speaking therefore, it is not an inaccurate description



of the behaviour of these countries as a group to say that they have had to adjust their imports to their exports; that is, they should be considered to have an international reflection ratio of the order of unity".

Piekarz and Stekler's (1967) study on "Induced Changes in Trade and Payments" in which one of their objectives was to determine the impact of changes in a country's export earnings on its import come out with results that were statistically significant at 95 percent confidence interval for both developed and developing countries. Hemphill's (1974) research on the effect of foreign exchange receipts on imports of developing countries concludes "that such a relationship exists has long been hypothesized casually in the literature, and is an important idea in light of the flaws inherent in the standard import function when applied to these countries" (p.672). The reported empirical findings are broadly consistent with the hypothesized behaviour that the level of export earnings influence the level of imports.

Since World War II, members of the Chicago School - headed by Friedman have rehabilitated the quantity

theory of money. Villarreal (1982; 24) observes that during the 1970s, Robert Mundell and Harry Johnson introduced the monetary approach to balance of payments in academic circles, but that the International Monetary Fund (IMF) under the direction of J.J. Polak developed its own both in theory and in practise. The IMF research group recognises that its monetary approach first arose while analysing the problems of developing countries because

- (1) of lack of detailed National income and product accounts necessary for an analysis of National income and balance of payment determination along Keynesian, or income absorption lines; nor was it feasible to apply the elasticities approach satisfactory ... in the 1950s and 60s.
- (2) less developed countries typically have a simpler financial structure than do more developed countries. In the absence of well developed assets markets and financial instruments there are relatively very few alternatives to either holding funds in monetary form or spending them on domestic or foreign goods or on foreign financial instruments.

In these circumstances the implication for external balance of a difference between the amount of newly supplied money through domestic credit creation and the additional amount that residents wish to hold is more obtrusive than in the circumstances with a more complex financial structure. Hence, the introduction of the money supply variable.

### 3.4 Model Specification:

We have twelve equations. In the first three equations, the level of merchandise import is made a function of the ratio of domestic consumer price index to import price index and the real gross domestic product.

$$IM = f (P, Y) \dots\dots 3.4.1$$

Equation 3.4.1 is estimated for the periods 1968-1988, 1968-1978, 1978-1988. In the explicit form, equation 3.4.1 becomes

$$IM = b_0 \cdot P^{b_1} \cdot Y^{b_2} \dots\dots 3.4.2$$

which when put in log-linear form gives

$$\log IM = b_0 + b_1 \log P + b_2 \log Y \dots\dots 3.4.3$$

$$b_1 \quad 0 \quad b_2$$

In the next three equations export earning is introduced into equation 3.4.1 to give

$$IM = f (P, Y, E) \dots\dots\dots 3.4.4$$

which when put in explicit form becomes

$$\log IM = b_0 + b_1 \log P + b_2 \log Y + b_3 \log E \dots 3.4.5.$$

when transformed into log-linear gives

$$\log Im = b_0 + b_1 \log P + b_2 \log Y + b_3 \log E \dots 3.4.6$$

$$b_1 \neq 0, b_2, b_3.$$

In the subsequent three equations money supply is introduced into equation 3.4.1

$$Im = f(P, Y, M_2) \dots 3.4.7$$

In explicit form equation 3.4.7 becomes

$$Im = b_0 + b_1 \log P + b_2 \log Y + b_4 \log M_2 \dots 3.4.8$$

In log-linear form, it gives

$$\log Im = b_0 + b_1 \log P + b_2 \log Y + b_4 \log M_2 \dots 3.4.9.$$

$$b_1 \neq 0, b_2, b_4$$

Finally in the last three equations, export earnings and money supply variables are added simultaneously to equation 3.4.1 to give

$$Im = f(P, Y, E, M_2) \dots 3.4.10.$$

which in explicit form gives

$$Im = b_0 + b_1 \log P + b_2 \log Y + b_3 \log E + b_4 \log M_2 \dots 3.4.11.$$

In log-linear form it becomes

$$\log Im = b_0 + b_1 \log P + b_2 \log Y + b_3 \log E + b_4 \log M_2 \dots 3.4.12.$$

$$b_1 \neq 0, b_2, b_3, b_4$$

Equations 3.4.6, 3.4.9 and 3.4.12 are estimated for periods 1968-88, 1968-78 and 1978-88 like equation 3.4.3.

### 3.5 Technique of Evaluation:

Firstly, the signs and magnitude of the parameter estimates are observed to see if they conform to a priori economic expectation. Next, the statistical test are conducted to find out if the estimates are statistically significant. Use is made of the student 't' test and the F-ratio test. Finally, for the second order test, that is, the econometric test, the Durbin Watson statistic is used for autocorrelation, a comparison of the overall correlation coefficient and the correlation coefficients among the independent variables for severity of multicollinearity, while the correlation coefficient between the residual and the independent variables is used for homoscedasticity.

The Chow test is used to ascertain the stability of the parameter estimates over time.

### 3.6 Source of Data:

The international financial statistics, an IMF publication, for several years forms the main source of data. Because of data treatment some of the data might not be seen in the same form in any of the publications.

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CHAPTER FOURPRESENTATION AND ANALYSIS OF RESULTS4.1 Presentation of Results:

The results have been presented in table 1 below, showing the parameter estimates for the twelve equations. Included in the table are; the calculated F-ratios of the regressions, and the t-values of the parameter estimates together with the tabulated F-ratios and t-values at 95 percent confidence interval. Other relevant statistics are the Correlation Coefficient (R), the coefficient of determination ( $R^2$ ) the adjusted  $R^2$  ( $R^2$ ) and the Durbin Watson statistics.

## 4.2 Evaluation of Results:

Koutsoyiannis (1977; 25) points out that evaluation consists of deciding whether the estimates of the parameters are theoretically meaningful and statistically satisfactory. To do these, the various criteria could be classified into three groups: economic a priori criterion which is determined by economic theory, statistical criterion determined by statistical theory and econometric criterion determined by econometric theory.

### 4.2.1 Economic Criterion:

Economic theory suggests that price and quantity of imports should have a negative relationship. A look at the result sheet indicate that the price variable is negative for all the equations, that is, 1-12. The values which lie between -1.49 and -0.11 are reasonable. We therefore, conclude that they meet a priori economic expectation.

The income variable has a positive value in all the equations and lie between 3.2 and 0.127. Economic theory suggests that as incomes increase, import increases, indicating a positive relationship between

income and imports. Hence the sign conforms with a priori economic expectation.

From the works of Polak and Rhomberg (1962), Piekarz and Skeckler (1967), Mckinnon (1964) and Chenery and Strout (1966), we expect a positive relationship between imports and export earnings. From the results we notice that they also conform with economic theory.

Given the financial system with the absence of well developed asset markets and financial instruments, increases in money supply will lead to increases in the demand for imports because of the few alternatives open to investors. A priori economic expectation dictates a positive relationship between money supply and imports. All the money supply parameter estimates meet the expectations of economic theory.

#### 4.2.2 Statistical Criteria:

Koutsoyiannis (1977; 69) points out that the two most commonly used statistical tests in econometrics include the coefficient of determination ( $R^2$ ), and the standard error. The former shows the percentage of the total variation of the dependent variable being explained by changes in the explanatory variables, while the latter are applied for judging the statistical reliability of

the regression coefficient (parameter estimates).

From table 1, the coefficient of determination ( $R^2$ ) and the adjusted  $R^2$  show that for equations 1,2,4,5,7,8,10 and 11, more than 90 percent of the changes in imports were due to changes in the explanatory variables. For equations 3,6,9 and 12 the  $R^2$  and adjusted  $R^2$  are very low.

When the F-ratio test is applied to test the overall significance of the different regressions, equation 1,2,4,5,7,8,10 and 11 are significant while equations 3,6,9 and 12 are insignificant at the 95 percent confidence interval. This is done by comparing the tabulated F-ratios with the observed F-ratios all of which can be seen from table 1.

When the observed t values of the parameter estimates are compared with the tabulated t-values at 95 percent confidence interval the following results are obtained. The price and income variables are significant in equation 1, only income is significant in equation 2 and neither income nor price was significant in equation 3. In equation 4, only the price variable is significant, equation 5, export earnings and income are significant, while none of the variables is significant

in equation 6. In equation 7, price and money supply variables are significant, in equation 8 only the money supply is significant, while none is significant in equation 9. For equation 10, price and money supply are significant, with price and export earning appearing significant in equation 11, while none is significant in equation 12.

#### 4.2.3 Econometric Criteria:

To validate the results of the regression carried out so far and guarantee that they have the optimal properties ascribed to the model, it was imperative to carry out econometric tests known as second order test. It is only when these tests have proved satisfactory that the parameter estimates can be accepted as Best Linear Unbiased and Efficient (BLUE). These tests include, the test for homoscedasticity, multicollinearity and autocorrelation.

#### Autocorrelation:

To test for serial independence of the random variables we use the Durbin Watson statistic. The results of autocorrelation test are presented in Appendix I. The tables shows the upper (du) and lower

(dL) limits, from which areas have been calculated to show the presence, nature and severity of autocorrelation, by observing where the Durbin Watson values in table 1 fall. The Durbin Watson statistic table is updated to include values for the case of a sample size of eleven.

The results in the appendix II indicate that of all the equations, it is only in equation 1 that positive autocorrelation poses a serious problem. The solution to be adopted, Koutsoyiannis points out, depends on the source of the autocorrelation. If the source is omitted variables, the appropriate procedure is to include these variables. When export earnings and the money supply variables are individually and collectively added to equation 1, autocorrelation, we can see, ceased to be a serious problem. We thus concluded that autocorrelation, though present, did not pose a serious problem since from appendix II most of the Durbin Watson statistics ( $d^*$ ) indicate not serious positive autocorrelation or no autocorrelation.

#### Multicollinearity:

The condition of multicollinearity suggests that the independent variables should not be perfectly



linearly correlated since this will make the parameter estimates indeterminate. Klein's (1962) test, which has been used makes use of the correlation coefficient among the independent variables and suggests that when any of the correlation coefficient among the independent variables is greater than the overall correlation coefficient, then multi-collinearity is serious. It should be noted that multi-collinearity is bound to appear in economic relationship because of their cyclical nature, hence, interest is not focused on multicollinearity per se, but on the severity of it.

From appendix III, we notice in equations 1,2,4,5, 7,8,10 and 11, multicollinearity was not detected as a serious problem. It was serious only in equations 3,6,9 and 12. We however, over-looked the multi-collinearity in equations 3,6,9 and 12 on the following grounds.

In none of the cases did two independent variables appear perfectly linearly correlated. The presence of multicollinearity, if not perfect, does not lead to bias estimates. Koutsoyiannis (1977; 236) states that "the estimates of the coefficients are statistically

unbiased even when multicollinearity is strong". Also the signs and magnitudes in the cases with strong multicollinearity still meet a priori economic expectations. Further, Koutsoyiannis (1977; 236) points out that if the purpose of estimation is to forecast the value of the dependent variable, then we may include the intercorrelated variables and ignore the problem of multicollinearity, provided that, we are certain that the pattern of multicollinearity will continue in the period of the prediction. Finally, the law of average suggests that since multicollinearity is serious only in 4 out of the 12 equations and not even present in nearly all the equations that will be required in the evaluation of the working hypotheses, we safely assume that multicollinearity is not a serious problem.

#### Homoscedasticity:

The Spearman rank-correlation test is one of the simplest test for establishing homoscedasticity. A high rank correlation coefficient suggests the absence of homoscedasticity and hence, the presence of heteroscedasticity. Koutsoyiannis (1977; 185) points out an even much simpler approach at establishing homoscedasticity.

According to him if we take the absolute values of the  $e$ 's and regress them on the independent variables, a low correlation coefficient will establish homoscedasticity. The results have been presented in appendix IV. From the results we note that in none of the cases was the correlation coefficient between the residual and the independent variables as high as 0.7. Though 0.7 is not a recognised bench mark, the overall observation shows that the correlation coefficients are low. We therefore conclude that the variances are constant in all the equations.

Having established the validity of the estimates, first on a priori economic theory, then on statistical grounds and finally on econometric criteria we now evaluate the working hypotheses of the study.

#### 4.3 Evaluation of Working Hypotheses:

##### Hypothesis One:

Changes in quantity of imports are not due to changes in relative prices and income.

From table 1, we observed that the parameter estimates in equation 1 have the expected signs and their magnitudes are significant at 95 percent confidence interval since the observed  $t^*$  for  $b_1$  and  $b_2$  are -4.47674

and 15.5806 respectively and greater than 2.552 which is the tabulated value for  $t$ . The F-ratio of the equation is 121.37933 which is greater than 3.55, the tabulated F-ratio at 95 percent confidence interval, indicating that the overall regression is significant. The  $R^2$  which shows the total variations in the dependent variable caused by variations in the independent variables is 0.93097 which is high. Autocorrelation is serious as indicated in appendix II but disappears as additional variables are added, multicollinearity is present but not serious (Appendix III) while homoscedasticity is established in Appendix IV.

From the above observations, we have to reject the Null hypothesis that relative price and income do not affect the level of imports. The alternative which is accepted states that relative prices and income affect the level of imports in Cameroon over the period of study, 1968-1988.

#### Hypothesis Two:

Export earnings and money supply do not improve the coefficient of determination of the traditional import demand equation.

From table 1, when export earnings was introduced the coefficient of determination ( $R^2$ ) and the adjusted  $R^2$  increased from 0.93078 and 0.92330 to 0.94183 and 0.93157 respectively. When money supply was introduced the  $R^2$  and adjusted  $R^2$  increased from 0.93078 and 0.92330 to 0.95736 and 0.94984 respectively. However, since these increases in the coefficient of determination are not by themselves sufficient to decide if the increases are statistically significant, an analysis of variance technique was applied before rejecting or accepting the Null hypotheses.

From the analysis of variance table (table 2) it can be inferred that the introduction of export earning into the traditional import demand equation significantly increased the coefficient of determination.

Table 2Analysis of Variance Table

Source of variation	Sum of Squares	Degree of Freedom	MSE	F
P, Y	$\sum \hat{Y}^2 = 11.96800405$	$M-1=3-1=2$		
P, Y, E	$\sum \hat{Y}^2 = 12.11008536$	$K-1=4-1=3$		
Additional variation from E	$\sum \hat{Y}^2 - \sum \hat{Y}^2 = 0.14208$	$(K-1) - (M-1) = 3-2=1$	$\frac{0.14208}{1}$ $= 0.14208$	$F^* = 3.229$
Residual variation from P, Y, E	$\sum e^2 = 0.747952035$	$N-K=21-4=17$	$\frac{0.747952035}{17}$ $= 0.0439972$	
Total variation	$\sum Y^2 = 12.8580374$	$N-1=21-1=20$		$F_0 = 05-320$ $V_1 = 3$ $V^2 = 17$

Table 3  
Analysis of Variance Table

Source of variation	Sum of Squares	Degree of Freedom	MSE	F
P, Y	$\sum \hat{Y}^2 = 11.96800405$	$M-1=3-1=2$		
P, Y, M	$\sum \hat{Y}^2 = 12.30977069$	$K-1=4-1=3$		
Additional variation from M	$\sum \hat{Y}^2 - \sum \hat{Y}^2 = 0.3417$	$(K-1) - (M-1)$	$\frac{0.3417766635}{1}$ = 0.34178	F* = 10.597
Residual variation from P, Y, M	$\sum e^2 = 0.54826671$	$N-K=21-4=17$	$\frac{0.54826671}{17}$ = 0.03225	
Total variations	$\sum Y^2 = 12.8580374$	$N-1=21-1=20$		$F_{0.05} = 3.20$ $V_1 = 3$ $V_2 = 17$

Note: M = number of parameters in first regression IM = (P, Y)

K = number of parameters in second regression IM =

F(P, Y, E)

IM =  
F(P, Y, M)

This is because the F value of  $3.229 > 3.20$  which is the tabulated value for  $F_{0.05}$  with  $V_1=3$  and  $V_2=17$  degree of freedom. The money supply is also significant since  $F^*=10.597$  is greater than  $3.20$  which is the tabulated value for  $F_{0.05}$  with  $V_1=3$ ,  $V_2=17$  degree of freedom.

We thus reject the null hypothesis and accept the alternative that export earnings and money supply significantly increase the co-efficient of determination of the traditional import demand equation with only price and income as independent variables.

#### Hypothesis Three:

There are no changes in the parameter estimates over time.

For the evaluation of hypothesis three, we made use of equation 10, 11 and 12. The choice was based on the fact that these equations contain the export earnings and money supply variables, both of which statistically and significantly improved the determination co-efficient of the standard import demand function. The technique was the Chow test which makes use of the  $\chi^2$  of the three equations and given as



$$F^* = \frac{\sum e_{i0}^2 - (\sum e_{i1}^2 + \sum e_{i2}^2) / K}{\sum e_{i1}^2 + \sum e_{i2}^2 / n_{11} + n_{12} - 2k}$$

Where the subscripts indicate the equation, k the number of parameter estimates, and n the sample size.

The  $F^* = 1.977$ , is less than the tabulated  $F_{0.05}$  (with  $V_1=5$  and  $V_2=12$  degrees of freedom) given as 3.11. Since  $F^* < F_{0.05}$ , we accept the null hypotheses of no changes in the parameter estimates over time.

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## CHAPTER FIVE

### CONCLUSION

This research was prompted by the current account deficit that Cameroon has been facing for some times now and will continue into the near future. Recognising that long-term capital investment to Africa has been falling since the 1980s and the inelastic nature of export supply curves of these nations the external adjustment mechanism will have to rely on reduction of imports to arrest the net resource outflow occasioned by the current account deficits. Hence, the research focused on identifying the factors that influence import demand in Cameroon over the period 1968-88.

Specifically, it sought to find out the following; firstly if the traditional import demand equation with relative prices and real Gross Domestic Product (G.D.P.) significantly account for variations in the quantity of imports in Cameroon. Secondly, if export earnings and money supply are significant additional variables to be included to the traditional import demand equation, and finally, to test the stability of the independent variables over time.

The method of analysis is econometric, the technique, multiple regression analysis, the functional form, log-linear and the nature of the data annual time series data for the period 1968-88.

The results indicate that relative prices and real Gross Domestic Product (G.D.P) significantly explain variations in the level of imports in Cameroon over the period of the study. Export earnings and money supply emerge as significant explanatory variables. Finally, the results of the Chow test indicate that the variables have been relatively stable over the period of the study.

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## APPENDIX II

## AUTOCORRELATION RESULTS

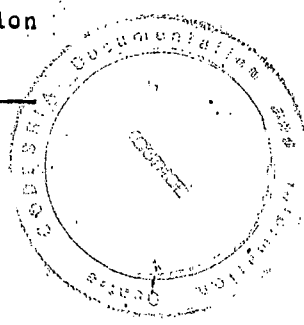
N	D.W.	dL	du	4-du	4-dL	DECISION RULE	CONCLUSION
1	1.05818	1.13	1.54	2.45	2.87	$d^* < d_L$	SPA
2	0.85414	0.84	1.52	2.48	3.16	$d_L < d^* < d_u$	NSPA
3	0.98110	0.84	1.52	2.48	3.16	$d_L < d^* < d_u$	NSPA
4	1.04588	1.03	1.67	2.33	3.97	$d_L < d^* < d_u$	NSPA
5	2.05048	0.68	1.76	2.24	3.32	$d_u < d^* < (4-d_u)$	NA
6	1.43663	0.68	1.76	2.24	3.92	$d_L < d^* < d_u$	NSPA
7	1.23358	1.03	1.67	2.33	3.97	$d_L < d^* < d_u$	NSPA
8	2.44442	0.68	1.76	2.24	3.32	$d_u < d^* < (4-d_u)$	NA
9	1.01689	0.68	1.76	2.24	3.32	$d_L < d^* < d_u$	NSPA
10	1.23316	0.93	1.89	2.11	3.07	$d_L < d^* < d_u$	NSPA
11	2.45390	0.59	1.90	2.10	3.41	$d_u < d^* < (4-d_u)$	NA
12	1.90111	0.59	1.90	2.10	3.41	$d_u < d^* < (4-d_u)$	NA

SPA = Serious positive autocorrelation

NSPA = Not serious positive autocorrelation

NA = No autocorrelation.

Equation	Correlation Co-efficient among independent variables	Overall Correlation Co-efficient	Conclusion
1	RP.Y = 0.28939	RIM.P.Y. = 0.96487	MNS
2	RP.Y = 0.79878	RIM.P.Y. = 0.96811	MNS
3	RP.Y = 0.82764	RIM.P.Y. = 0.47553	SM
4	RP.Y = 0.28412	RIM.P.Y.E = 0.97048	MNS
	RP.E = 0.10213	RIM.P.Y.E = 0.97048	
	RY.E = 0.96871	RIM.P.Y.E = 0.97048	
5	RP.Y = 0.80018	RIM.P.Y.E = 0.98675	MNS
	RP.E = 0.83545	RIM.P.Y.E = 0.98675	
	RY.E = 0.94219	RIM.P.Y.E = 0.98675	
6	RP.Y = 0.83162	RIM.P.Y.E = 0.63765	SM
	RP.E = 0.69305	RIM.P.Y.E = 0.63765	
	RY.E = 0.91907	RIM.P.Y.E = 0.63765	
7	RP.Y = 6.30034	RIM.P.Y.M = 0.97845	MNS
	RP.M = 0.21229	RIM.P.Y.M = 0.97845	
	RY.M = 0.97430	RIM.P.Y.M = 0.97845	
8	RP.Y = 0.80384	RIM.P.Y.M = 0.99135	MNS
	RP.M = 0.78113	RIM.P.Y.M = 0.99135	
	RY.M = 0.97209	RIM.P.Y.M = 0.99135	
9	RP.Y = 0.84178	RIM.P.Y.M = 0.49188	SM
	RP.M = 0.89616	RIM.P.Y.M = 0.49188	
	RY.M = 0.96034	RIM.P.Y.M = 0.49188	
10	RP.Y = 0.31207	RIM.P.Y.E.M = 0.98059	MNS
	RP.E = 0.12598	RIM.P.Y.E.M = 0.98059	
	RP.M = 0.22681	RIM.P.Y.E.M = 0.98059	
	RY.E = 0.97452	RIM.P.Y.E.M = 0.98059	
	RY.M = 0.96871	RIM.P.Y.E.M = 0.98059	
	RE.M = 0.97811	RIM.P.Y.E.M = 0.98059	
11	RP.Y = 0.80018	RIM.P.Y.E.M = 0.99149	MNS
	RP.E = 0.83545	RIM.P.Y.E.M = 0.99149	
	RP.M = 0.78113	RIM.P.Y.E.M = 0.99149	
	RY.E = 0.97213	RIM.P.Y.E.M = 0.99149	
	RY.M = 0.94219	RIM.P.Y.E.M = 0.99149	
	RE.M = 0.97580	RIM.P.Y.E.M = 0.99149	
12	RP.Y = 0.84372	RIM.P.Y.E.M = 0.69397	SM
	RP.E = 0.68439	RIM.P.Y.E.M = 0.69397	
	RP.M = 0.90385	RIM.P.Y.E.M = 0.69397	
	RY.E = 0.91907	RIM.P.Y.E.M = 0.69397	
	RY.M = 0.96009	RIM.P.Y.E.M = 0.69397	
	RE.M = 0.90448	RIM.P.Y.E.M = 0.69397	



S.M = Serious multicollinearity  
MNS = Multicollinearity not serious.

Equation

1	$R/e/.P = 0.032159$
	$R/c..Y = 0.446583$
2	$R/e/.P = 0.068863$
	$R/e/.Y = 0.323939$
3	$R/e/.P = -0.091857$
	$R/e/.Y = 0.458868$
4	$R/e/.P = 0.093475$
	$R/e/.Y = 0.38067$
5	$R/e/.P = -0.334029$
	$R/e/.Y = 0.135585$
	$R/e/.E = 0.042218$
6	$R/e/.P = 0.368913$
	$R/e/.Y = 0.224629$
	$R/e/.E = 0.488569$
7	$R/e/.P = 0.20743$
	$R/e/.Y = 0.53748$
	$R/c/.M = 0.526281$
8	$R/e/.P = -0.52678$
	$R/e/.Y = 0.226491$
	$R/e/.M = 0.176794$
9	$R/e/.P = 0.680647$
	$R/e/.Y = 0.533877$
	$R/e/.M = 0.186325$
10	$R/e/.P = 0.146111$
	$R/e/.Y = 0.391336$
	$R/e/.E = 0.392998$
	$R/e/.M = 0.3856199$
11	$R/e/.P = -0.536662$
	$R/e/.Y = 0.061752$
	$R/c/.E = 0.221457$
	$R/e/.M = 0.154925$
12	$R/e/.P = 0.224573$
	$R/e/.Y = 0.102643$
	$R/e/.E = 0.052395$
	$R/e/.M = 0.046584$