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EMPIRICAL STUDIES IN IMPORT DEMAND AND TARIFFS:
A CASE STUDY OF KENYA AND EAST AFRICA

by

Ronald Lee Friesen

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of the requirements for
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R.L.F.

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CHAPTER I

INTRODUCTION

This paper is concerned with a series of empirical investigations in import demand and tariffs, including the government revenue implications of tariffs, for the country of Kenya and the region of East Africa. Its rationale is twofold. First, it is an empirical test of several theories of import demand and an empirical test of several different forms in which the theory of import demand can be manifested. Secondly, it is an empirical study of import demand in East Africa and in Kenya, one country within East Africa, in an attempt to isolate the empirically relevant variables operative in importation, and to investigate the effect that tariffs on imports have had on government revenue and on the various income groups within Kenya. The major purpose in this latter case is not a test of economic theory, but it is an attempt to improve the basis for decision making with reference to imports and tariffs.

Rationale for Study

As indicated, the first rationale of this study is that of an empirical test of import demand theories and some of their various forms and modifications. The hope would be that one more case study of an underdeveloped area, East Africa, or an underdeveloped country, Kenya, might be able to add some additional evidence to the empirical relevance of the various demand theories and their forms. One reason for the selection of East Africa as a case study for import demand was the lack of an obvious positive relationship between imports and income in these countries for several of the years during the last two decades with the associated, and at least implicit, challenge to the application of traditional economic theory to East Africa. The relationship between imports, tariffs, and government revenue is investigated in an effort to contribute some information about domestic financing of less developed countries, which has been isolated as a field needing further study.[1]

It is hoped, through the second rationale for this study, that some aspects of this paper and its results may contribute to a more complete understanding of the forces operative in import demand for Kenya and East Africa and of the nature of its effects on government revenue and the various income groups in Kenya. Of the studies which have come out of East Africa, none has apparently analyzed in depth the import demand relationships in Kenya and East Africa, and none has apparently looked in depth at the empirical relationship between imports, tariffs, and government revenue for Kenya along with the tariff burden borne by Kenya residents. Most available studies, if they look at import demand, view it briefly as one component of a larger problem, such as Paul G. Clark's Development Planning in East Africa[2] and The

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[1]A.E. Ewing, "Some Recent Contributions to the Literature of Economic Development," The Journal of Modern African Studies, 4:3 November, 1966), 335-348.

[2]Paul G. Clark, Development Planning in East Africa, East African Studies No. 21 (Nairobi, Kenya: East African Publishing House, 1965).

Economy of Kenya[1] by Just Faaland and Hans-Erik Dahl, the latter of which has the more detailed import analysis. A study of government revenue for the East African country of Uganda by Dharam P. Ghai examines, among other factors, the general role played by import duty in government revenue for Uganda, by examining its "bouyancy" and working out the past trends of such revenue and tariff changes; but it does not attempt to "work out quantitatively the revenue effects of changes in import duties."[2] There is also a study on inter-territorial trade, not external trade, among the East African countries by Phillip Ndegwa.[3] A more recent study of imports for an East African country which applied to Tanzania and not to Kenya was conducted by M.J.H. Yaffey and was purposely a descriptive rather than econometric study.[4] On this basis,[5] an indepth study of import demand and tariffs, particularly with the encouragement given by Leamer and

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[1]Just Faaland and Hans-Erik Dahl, The Economy of Kenya (Bergen: The Chr. Michelsen Institute, July, 1967).

[2]Dharam P. Ghai, Taxation for Development: A Case Study of Uganda, East African Studies No. 23 (Nairobi: East African Publishing House, 1966), p. 39.

[3]Phillip Ndegwa, The Common Market and Development in East Africa, East African Studies 22 (Nairobi: East African Publishing House, 1968).

[4]M.J.H. Yaffey, Balance of Payments Problems of a Developing Country: Tanzania (New York: Humanities Press, Inc., 1970).

[5]A few additional writings available in these fields are discussed in the chapters of this study which relate to the subjects covered by these writings.

Stern to pursue empirical studies for specific countries,[1] would appear to serve a worthwhile purpose.

The East African Common Market

A brief introduction to the history and operation of East African cooperation would be relevant background for this study, particularly as it relates to and affects import demand and tariff policy. A defacto common market has been in operation in some form for over half a century, starting with cooperation between Kenya and Uganda and later, over a period of a decade, incorporating Tanganyika (now mainland Tanzania).[2] By 1954, the year when the statistical data utilized by this study originated, cooperation between these three countries was well established, both in terms of a common market and in terms of other types of cooperation such as the self-contained services of a common airways, railways, posts and telecommunications. In addition, these countries had common customs, excise, and income tax collections and common economic, statistical, and research services. Virtually all these forms of cooperation continued during the years covered by this study, particularly the import demand portions, despite a change in the official name of this organization with political independence and despite periods of serious conflict between the three partners during the latter two or three years. These periods of conflict led

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[1]Edward M. Leamer and Robert M. Stern, Quantitative International Economics (Boston: Allyn and Bacon, Inc., 1970).

[2]For a detailed history of East African cooperation and the development of its characteristics, see Donald Rothchild (ed.), Politics of Integration: An East African Documentary, East African Publishing House Political Studies No. 4 (Nairobi, Kenya: East African Publishing House, 1968).

to some activities during these few years which have implications for this study and will be enumerated later; but most serious ramifications of this conflict occurred after 1966.

The salient features of East African cooperation influencing the time period covered by this study are that it is a defacto common market with free trade among the countries, including free factor movements, with coordinated tariff rates which are with only a few minor exceptions equal for the whole area. In addition, all three countries have a common customs and excise department with responsibility for customs duty collections and international trade statistics and a common statistical department responsible for the collection and compilation of other statistical data, although each country also has a statistical department. The importance of the latter is the possibility of greater reliability in statistical data than might result from each country collecting and publishing only its own statistical data. Although East Africa like all underdeveloped areas does not have highly reliable statistics, its general reputation, especially for Kenya, is one of better than average reliability.

The major importance of the former feature of free trade in the area is its effect on trade statistics. The rather highly regarded accuracy of trade and tariff statistics, probably more accurate because of its being a common service, could lose some accuracy for any one country within East Africa if the transfer of an imported commodity across the border to one of the other countries is not recorded with the authorities. By law, all shipments across a border between any of the East African countries must be recorded in order to distribute customs duty to the ultimate importing country. Since the number of major land or water routes between these countries is limited, massive shipments of goods might not cross undetected; but undoubtedly some transfers of goods, including imports, are not detected, particularly if they are personal items or cross the border at unorthodox points.[1] For this reason, many of the empirical import demand studies in this paper are conducted with both Kenyan and East African data.

Specific complications for this study from actions taken by the East African countries or from the conflicts of interest between East African countries were encountered during the last few years of the import demand study. Three of these events which would tend to affect international trade would be exchange controls to regulate capital movements from East Africa, some restrictions by Tanzania on imports of Kenyan products announced on two different occasions in 1965, and each nation's replacement of the common East African currency starting in 1966.[2] In addition, some issues of principle and ideology concerning the degree of adherence to African socialism

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[1]For a more detailed discussion of intercountry trade in East Africa and its implications for development, see Philip Ndegwa, The Common Market and Development in East Africa, East African Studies 22 (Nairobi, Kenya: East African Publishing House, 1968). From personal experience in crossing the border between Kenya and Tanzania, small quantities of personal items could cross the border quite easily without detection; but larger quantities would be more easily detected and more likely to be recorded. So some error undoubtedly exists, but its magnitude, while unknown, is probably not great.

[2]See Africa Report, the East African Standard, or other news sources on Africa during the relevant years for further details of these events, some of which occurred while the author was resident in Tanzania from 1962-1965.

or world power neutrality tended to complicate relations, particularly between Kenya and Tanzania and in internal Kenyan political relations, during the last few years. All these events would tend to have an effect on import demand which would be difficult to incorporate into any analysis; but since they would tend to affect only the last observation or two, they would hopefully not have a major disruptive effect on the analyses or their results.

Data Sources and Some Complications

The Statistical Abstract, published annually by the Republic of Kenya, and the Economic and Statistical Review, formerly the Quarterly Economic and Statistical Bulletin, published monthly during the last decade by the East African Statistical Department, are the two major sources of statistical information for these studies on import demand and tariffs in Kenya and East Africa. These sources are supplemented or verified on occasion by other more specific sources which are identified in the study when utilized.

Among the statistics available on a consistent basis in the aforementioned two sources for the years 1954 through 1966 are the import quantity and price indices, for both aggregate imports and SITC classification for each East African country individually and for the whole of East Africa. These are calculated by the East African Statistical Department from the Annual Trade Reports prepared by the East African Customs and Excise Department. The import quantity index is a Laspeyre, or base-weighted, index of net imports. Net imports are direct imports minus transfers out of plus transfers into the

East African country under discussion. The import price index, technically a unit value index which is calculated and utilized as a price index, is a Paasche, or current-weighted, index for net imports.

A cost of living index (excluding rent) for Nairobi is also available in the Statistical Abstracts for the pertinent years. Some of the difficulties of using this index for a domestic price index are that it is based on all commodities, including imports, and that it is an index with a base of 1939 which measures the cost of maintaining a standard of living prevailing among European government servants with an annual base salary of £500 in 1947.[1] In an attempt to avoid some of these difficulties, another cost of living index available officially only since 1959, a wage earner's index, was combined with the cost of living index for earlier years. The hope was to construct a more appropriate index relevant for pre-independence years to the European who was the most likely to consume imports and relevant for the independence years to the African.

Monetary gross domestic product, calculated at factor cost, is also available in these two publications for both Kenya and East Africa for all the relevant years except for the year 1954 in the case of East Africa. Real gross domestic product is not officially calculated except for the years 1964 to 1966, so that for the purposes of this study it is estimated by the ratio of monetary gross domestic product and, alternatively, each of the two aforementioned domestic price indices.

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[1]Republic of Kenya, Statistical Abstract (1966), p. 115.

A ratio of the estimated annual wage bill to employment from an annual survey of private and public employment and the price of certain peasant-produced cash crops, both of which are proxies for the price of time variable, are also obtained from statistics in these two sources. The import quantity and import price statistics for specific imports relevant to the peasant producers of these cash crops were also available in these sources. Among the Kenyan events during 1964 and 1965 which would affect the first proxy for the price of time variable is the tripartite agreement by the government, labor, and private industry in Kenya to assist unemployment by increasing public employment by 15 percent and private employment by 10 percent. Although this agreement was terminated by mutual agreement after a little more than a year of operation, it would affect a couple of observations in the price of time import model tests.

The tariff index for aggregate and SITC class imports, calculated as a ratio of duty collected to import value, was also based on statistics available from these sources. The tariff data for specific peasant imports were obtained directly from the customs tariff schedule which indicates the rate of duty to be levied on various imports.[1]

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[1]These schedules are published in various sources and at various times. One source is the Laws of Kenya and another is in the Appendix of the East African High Commission, Some Notes on the Industrial Development in East Africa, Second edition, 1959. These schedules are also occasionally published as separate handbooks.

Methodology and Statistical Tests

The usual research methodology in economics, where a theoretical model with certain implications is derived and then tested empirically, is the methodology generally followed in this study. The empirical test is normally that of a time series least squares multiple regression. These regressions and other empirical results are summarized in tabular form in the Appendix to each chapter located at the end of that chapter. These tables contain the regression coefficients for each variable along with its calculated t value and the values of the multiple coefficient of determination (R^2), the analysis of variance F ratio, and the Durban-Watson statistic test of autocorrelation (D.W.) at the right side of each table.

The general goodness of fit statistical tests employed in the regressions of this study are the multiple coefficient of determination, R^2, and the analysis of variance F ratio. The more specific test of significance for the individual variables in the regressions is the t test to determine whether the coefficients of the variables are significantly different from zero. The calculated t values for the regression coefficients can be found in parentheses directly below the regression coefficients in the tabular summaries of regression results. All statistical results will be rounded to three significant figures. Unless specifically stated otherwise, the 95 percent level of confidence or 5 percent error level will be used for decision making. Two-tail tests at this level will be used in significance tests for regression coefficients.

Since the following regressions vary in the number of observations due to data availability, the critical values for the t tests and F values which depend on the number of degrees of freedom will also vary from one set of data to another. Table 1 contains these critical values for the range of observations encountered in these analyses and which will be used for decision making throughout this study.

Past experience suggests that empirical estimation by time series data such as the import demand estimates in this study is susceptible to positive serial correlation.[1] The significant points of the Durban-Watson statistical test for serial correlation subsequently utilized in this study also depend on the number of observations. However, Durban-Watson tables of significant points only extend as low as 15 observations which is slightly larger than the greatest number of observations encountered in this study. The Durban-Watson table entries for d_L and d_U with 15 observations at a 5 percent level for three independent variables are 0.82 and 1.75, respectively, and for four independent variables are 0.69 and 1.97, respectively. At a 1 percent level, d_L and d_U for three independent variables are 0.59 and 1.46, respectively, and for four independent variables are 0.49 and 1.70, respectively.

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[1] J. Johnston, Econometric Methods (New York: McGraw-Hill Book Company, 1963), pp. 195-199, and J. Durban and G.S. Watson, "Testing for Serial Correlation in Least-Squares Regression, Part II," Biometrica (1951), 159-161.

TABLE 1

CRITICAL VALUES USED IN REGRESSIONS

Values of t

Degrees of Freedom (df=n-k'-1)	$t_{0.025}$	$t_{0.005}$
5	2.571	4.032
6	2.447	3.707
7	2.365	3.499
8	2.306	3.355
9	2.262	3.250

Values of F

Degrees of Freedom		$F_{0.05}$	$F_{0.01}$
Numerator (df=k')	Denominator (df=n-k'-1)		
3	6	4.76	9.78
4	5	5.19	11.40
3	7	4.35	8.45
4	6	4.53	9.15
3	8	4.07	7.59
4	7	4.12	7.85
3	9	3.86	6.99
4	8	3.84	7.01
5	7	3.97	7.46
5	6	4.39	8.75

A rough estimate of the lower and upper significant points for the Durban-Watson statistic for fewer observations might be suggested by extrapolation of the available table entries, assuming that the differences between succeeding entries get progressively greater. On these assumptions, the entries for ten observations at a 5 percent level for three independent variables are a d_L of about 0.5 and a d_U of about 2.0, and for four independent variables about 0.35 and 2.2, respectively. At a 1 percent level the same extrapolation for ten observations and three independent variables yields a d_L and a d_U of approximately 0.3 and 1.65, respectively, while for four independent variables they are approximately 0.2 and 2.0, respectively. To generalize, a calculated Durban-Watson statistic value of approximately 2 will be necessary for the regressions of this study to exhibit insignificant positive serial correlation. Since this study utilizes annual rather than quarterly or monthly data, serial correlation problems may not be serious, but the calculation of the Durban-Watson statistic will serve as a check on this potential problem.

One other note of caution relevant to all the empirical import demand regression results relates to the problem of multicollinearity, a complication which is often encountered in empirical import demand studies. The import price variable, whose coefficient of determination (R^2) with respect to other independent variables is generally in the 0.1 range, is no problem. But multicollinearity is a more serious problem for the domestic price variable and the independent variables of gross domestic product, price of time, or tariffs, where the R^2 is as high as the 0.9 range, and to a lesser extent for the tariff variable and the independent variables of gross domestic product or price of time, where the R^2 was as high as the 0.7 range. Such a high correlation between independent variables creates problems in distinguishing between their respective effects on the dependent variable. Again, since the alleviation of this problem is difficult, if not impossible, the point is simply to add this note of caution to the others as part of the context in which to view the results of this study.

In the course of this study, abbreviations of various variables are employed, particularly in equations and tabular presentations of regression equations. A listing of these abbreviations and their explanation is included in this introduction for reference. A complete discussion of the variables and the statistical data employed to represent these variables is available in the Data Appendix at the end of this study.

List of Abbreviations

M	Import Quantity
P_m	Import Price
P_d^c	Domestic Price as measured by cost of living index
P_d^w	Domestic Price as measured by wage earner's cost of living index
GDP	Monetary Gross Domestic Product
GDP_r^c	Real Gross Domestic Product; monetary GDP deflated by P_d^c
GDP_r^w	Real Gross Domestic Product; monetary GDP deflated by P_d^w
T_m	Tariff Level
P_t	Price of Time
P_m/P_d^c	Relative Commodity Price; ratio of imports to domestic commodities as measured by cost of living index
P_m/P_d^w	Relative Commodity Price; ratio of imports to domestic commodities as measured by wage earner's cost of living index
P_t/P_m	Relative Price of Time; ratio between price of time and import price index
GDP_a	The Proportion of Gross Domestic Product which is primarily agricultural, originating in agriculture, livestock, forestry, and fishing and hunting
GDP_{na}	The Proportion of Gross Domestic Product which is primarily non-agricultural, originating in government, manufacturing, and the commercial sector
$GDP_{r,a}^c$	Real Agricultural Gross Domestic Product; GDP_a deflated by P_d^c
$GDP_{r,na}^c$	Real Non-agricultural Gross Domestic Product; GDP_{na} deflated by P_d^c

$GDP^{W}_{r,a}$	Real Agricultural Gross Domestic Product; GDP_a deflated by P^W_d
$GDP^{W}_{r,na}$	Real Non-agricultural Gross Domestic Product; GDP_{na} deflated by P^W_d
M_s	Quantity Index of Manufacturing Production (Import Substitution Index)
R^2	Coefficient of Determination
F	Analysis of Variance F Ratio Statistic
D.W.	Durban-Watson Statistic

CHAPTER II

AGGREGATE IMPORT DEMAND

The few, sometimes cursory, studies that have been done on import demand in East Africa appear to indicate no obvious or simple relationship between imports and income since even a negative relationship exists between income and imports for several years.[1] While this could indicate that imports and income are not positively related in the usual manner, it could also indicate that the demand relationship is sufficiently complex that a more detailed analysis could be useful.

Other work on import demand in East Africa is part of a forecasting model. One of these models by Clark makes producer imports a function of investment and/or output and makes consumer imports a function of income.[2] The latter was precisely the simple relationship which the previous study argued to be non-existent in East Africa.

Another study by Faaland and Dahl,[3] which the author obtained after completing this study, was also concerned with the construction of an

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[1]Idrian N. Resnick, "Foreign Trade and Payments in Tanzania," a chapter for a forthcoming book on the Economy of Tanzania, pp. 9-12 and Table 3. While this study referred to Tanzania--the East African country south of Kenya--a similar study of Kenyan data yields the same results.

[2]Paul G. Clark, Development Planning in East Africa (Nairobi: The East African Publishing House, 1965), pp. 57-77.

[3]Just Faaland and Hans-Erik Dahl, The Economy of Kenya (Bergen: The Chr. Michelsen Institute, July, 1967).

econometric model of the economy of Kenya and specified its relationships similarly. In their case, capital goods imports were a function of industrial output and investment activity; durable consumer imports were a function of per capita gross domestic product; non-durable consumer imports were a function of total gross domestic product, and intermediate goods imports were a function of industrial output and gross domestic product. Again, an output or income measure along with investment was used to explain imports, a relationship rejected by the first study.

These studies seem to indicate that a more careful and detailed analysis of import demand could be beneficial. An analysis of import demand employing the traditional variables will be the subject of the first portion of this empirical study. It could be considered of interest in and of itself, but it will also form the basis for the later study of modifications in the usual import demand relationships and for studies concerning government revenue implications of tariffs on imports.

Theoretical Model

The model to be tested in this section is that import quantity is determined by the import price level, domestic price level, income level, and tariff level. The latter is part of the model because tariffs are significant in East Africa and tariff changes in East Africa have occurred during the last several decades. Mathematically, $M = F(P_m, P_d, Y, T_m)$, where P_m is the import price level, P_d is the domestic price level, Y is income, and T_m is the tariff level. The first three variables will be tested in two forms, both individually and as ratios. Mathematically, the latter will be a model such that $M = F(P_m/P_d, Y/P_d, T_m)$ where the variables are defined as above.

The normal relationships suggested by economic theory will be expected for these traditional import demand variables. A negative relationship will be expected to exist between the dependent variable, imports (M), and two of the independent variables, the import price level (P_m), and the tariff level (T_m). A positive relationship will be anticipated between imports (M) and the other two independent variables, income (Y) and the domestic price level (P_d). When the variables are combined into ratio form, the expected relationship between imports (M) and the relative commodity price ratio (P_m/P_d) will be negative while that for the real income variable (Y/P_d) will be positive. Tariffs (T_m) and imports (M) would still be expected to be inversely related.

Empirical Methodology

The statistical method to be employed in these empirical tests of the import demand model is that of a time-series least squares multiple regression. While this method has been utilized for several decades in import demand analyses and severely criticized in the 1950's,[1] its applicability and reliability is now being reasserted, particularly in the case of a "small country that imports only a relatively small

[1]See particularly the path-breaking article by G.H. Orcutt, "Measurement of Price Elasticities in International Trade," Review of Economics and Statistics, 32 (May, 1950), 117-132.

fraction of total world exports."[1] This would seem appropriate for the small less developed parts of the world such as Kenya and East Africa.

The Identification Problem

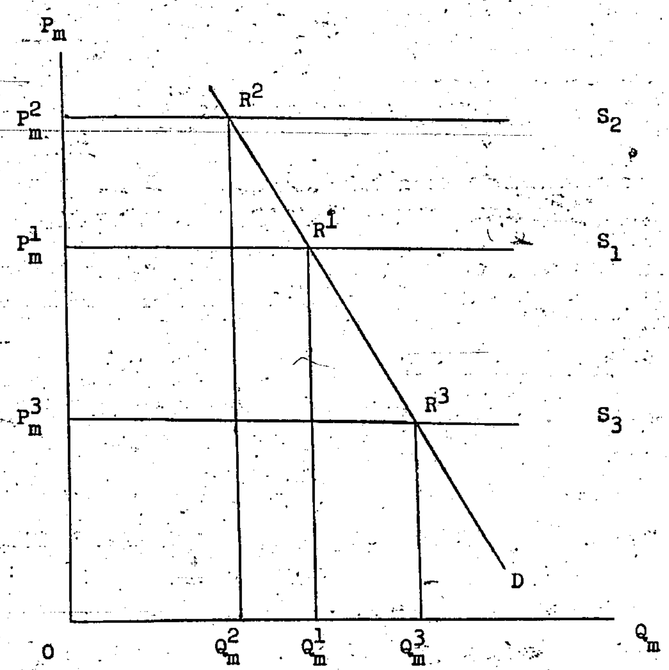
In empirical tests of demand equations, the identification problem can be a complication. However, if the assumption of a horizontal or infinitely elastic supply were valid, the price of imports would be determined solely by supply and movements in the supply curve would trace the equilibrium points of the demand curve. This is diagrammatically illustrated in Figure 1 where shifts in supply trace the points R_1, R_2, and R_3 on the demand curve associated with equilibrium import quantities Q_m^1, Q_m^2, and Q_m^3, respectively. By employing multiple regression procedures, separately identifiable shifts in demand would depend on changes in variables other than the import price variable, such as the price of domestic commodities and income. Tariffs, like changes in the import price variable, would result in an upward shift of the infinitely elastic supply and effectively raise the domestic price of imports by the amount of the import duty.

The assumption of an infinitely elastic supply of imports would be realistic only for a buyer who could not influence the price by his actions. This would be true for situations in which the buyer is simply one virtually insignificant buyer among many buyers. This

[1] Edward E. Leamer and Robert M. Stern, Quantitative International Economics (Boston: Allyn and Bacon, Inc., 1970), p. 31.

FIGURE 1

DEMAND AND SUPPLY OF IMPORTS
WHEN BUYING IN A PERFECTLY COMPETITIVE MARKET



would be the case in competition and would be the situation faced by a country which is merely one buyer among many of the world's commodities and which does not purchase a significant proportion of the world's commodities. This would appear to be a rather accurate description of a small developing region such as East Africa, or a country such as Kenya. By employing this apparently realistic assumption for Kenya or East Africa, regression analyses can be utilized in an attempt to empirically test the relevant import demand theory.[1]

Functional Form

Both the linear and log-linear functional forms for regressions will be utilized in the following empirical tests. The purpose for doing so is, partially, to test each form in order to ascertain the more appropriate explanatory relationship and, more importantly, to use the log-linear regression results to obtain additional estimates of elasticities. Paramount among these would be the elasticities associated with the tariff variables and their impact on government revenue.

Empirical Analysis of Alternative Data Sets

In the following tests of the preceding import demand model, the income variable is obtained from gross domestic product data, the

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[1]The point that it may be quite realistic to assume an infinitely elastic supply schedule for a small country that imports only a relatively small fraction of world exports is verified by Edward E. Leamer and Robert M. Stern, Quantitative International Economics (Boston: Allyn and Bacon, Inc., 1970), pp. 28-35.

import price variable is the import price index, and the domestic price variable will be either the cost of living index for government servants in Nairobi or a composite price index which uses the aforementioned cost of living index for the years 1954 through 1958 but uses the wage earner's index of consumer prices for the remaining years.

Data Problems

The details of all data are available in the Data Appendix, but two major problems should be re-emphasized here. First, it should be pointed out that the import price index is really a unit value index even though it is utilized as a price index and is calculated for that purpose. The second data problem, more extensively discussed in the Data Appendix, is the domestic price index. The cost of living index, which is the only index of domestic price level consistently available for the years 1954-1966, is for European civil servants on a basic salary below £500 in 1947 and is based on a consumer survey of this group in 1939. Both the base year and the consumer group tend to lose their relevance in the late fifties and early sixties with the approach of independence. In contrast, the composite wage earner's index has a base of July, 1964, and is derived from a survey of wage earners in Nairobi. For the years 1954-1958, since no other domestic price index is available for those years, this composite index does use the aforementioned cost of living index. While both the cost of living index and the wage earner's composite index include imports in their prices and are therefore not strictly domestic price indices, the wage earner and his price index would be expected to include fewer imports and therefore be somewhat more desirable but not entirely free of criticism. However, since these are the only available indicators of domestic price changes, they will of necessity be employed as a proxy for domestic prices, despite their shortcomings. Empirical tests will be utilized to indicate which of the two would appear more appropriate.

Regressions Employing Official Kenyan Data

The tabular summary of regression results with official Kenyan data are shown in Table 2 in the Chapter II Appendix. All the regressions employing Kenyan data, both linear and log-linear, have F values which are significant, some highly significant. The multiple coefficients of determination are also in the relatively high range of 0.71 to 0.81. The Durban-Watson statistic falls in the indeterminate range for all regressions.

The only significant coefficients in the regressions employing the cost of living index (P_d^c) as the domestic price level appear in the log-linear form. These are both of the tariff variables and one relative commodity price variable. In the linear form of the regression an additional tariff variable is nearly significant.

The composite wage earner's index (P_d^w) has more significant coefficients than does the cost of living index. In the linear form, one tariff variable and both the monetary and real gross domestic product variables have significant regression coefficients. However, the coefficient of the domestic price variable, although insignificant, has a negative rather than the anticipated positive sign. In the log-linear form, the real gross domestic product variable has a significant regression coefficient and the relative price variable is nearly significant.

To summarize, the tariff variable was significant in three regressions and was nearly significant in another. The relative commodity price variable was significant once and, in addition, was nearly significant another time. The real gross domestic product variable had a significant coefficient twice while the monetary gross domestic product variable was significant once. The coefficients of the import price variable and the domestic price variable were not significant in any regressions. In descending order, the variables with the more significant coefficients were the tariff variable, real gross domestic product, monetary gross domestic product, and the relative commodity price variable.

Regressions Employing Official East African Data

Commodities originally imported into one East African country can, and often do, find their way ultimately into one or more of the other East African countries before final consumption. These inter-state transfers, while they must be reported by law and can cross borders in larger quantities along only a limited number of main roads or waterways, can lead to inaccuracies in the import statistics for any one East African country. While these errors are normally assumed to be quite small, they do exist and suggest that an import demand analysis for East Africa as a whole would avoid these errors.

While the utilization of data for East Africa as a whole evades this potential inaccuracy, it unavoidably creates other errors non-existent for a one-country analysis. Perhaps the most serious of these is the lack of a domestic price variable for East Africa as a whole. While cost of living indices are officially calculated for Dar-es-Salaam and Kampala, although they are not always readily available at least in the desired form, any attempt to combine them in some manner to obtain a conglomerate East African index is fraught with problems of consistency and compatibility as well as the selection of proper weights for each of the three components. To avoid these difficulties and on the assumption that the Nairobi cost of living index tends to reflect the cost of living in other parts of East Africa since it was an East African center in many ways during most of the years with which this analysis is concerned, the present study will utilize the Kenyan domestic price indices as a proxy for the domestic price index for all of East Africa.

Another difficulty is that gross domestic product data for East Africa is a summation of the gross domestic product data of all three countries which are not strictly comparable. These two difficulties are compounded in the real gross domestic product calculations since the latter, somewhat inaccurate, East African figure is deflated by the former Kenyan data. Nonetheless, these difficulties could be offset by the benefits of more accurate East African trade data, and a test of the models with East African data could be fruitful.

As indicated in Table 3, all regressions employing official East African data have F ratios which are significant, even at the 99 percent confidence level, and are considerably higher values than were found for Kenyan data. The multiple coefficients of determination are also higher than for Kenya and fall in the 0.84 to 0.88 range. Again, the Durban-Watson statistic falls in the indeterminate range, although higher than for Kenyan data, and a couple with values of 1.91 and 1.81 could approach the point of insignificant serial correlation.

All the tariff variables for East Africa have significant coefficients. In fact, all but two coefficients of the tariff variable are significant at the 99 percent level. The other significant coefficients in all the regressions are the monetary and real gross domestic product variables. None of the import or domestic price variable coefficients are significant. One of the insignificant cost of living domestic price variable coefficients is of a sign opposite to that suggested by theory, and both of the wage earner's composite index domestic price variable coefficients are of improper sign.

In summary, all the tariff variables and all the gross domestic product variables, both monetary and real, have significant empirical effects on imports. The domestic price variables, based on Kenyan statistics, appear to be a poor proxy for movements in East African domestic price levels because none of the coefficients of this variable are significant with East African data, and in three cases even have improper signs. The relative commodity price variables employing the Kenyan domestic price index as one portion of the ratio, although never of improper sign, were not significant. While the domestic price variable did not significantly affect imports in the Kenyan case either; the relative commodity price variable was significant on one occasion and nearly significant a second time. The import price variable was not significant for either Kenya or East Africa but was never of improper sign and always had a t value in the 1.4 to 2.1 range.

Comparison of Kenya and East Africa

In general, East African data yields more statistically impressive results than does Kenyan data, although some price variables, such as the relative commodity price variable, which are significant in the Kenyan regressions are no longer significant with East African tests. The tariff variable coefficient, on the other hand, is consistently significant in the East African tests, but only significant in a minority of Kenyan tests.

In a comparison of the results obtained with the two alternative domestic price indices, East African data reveals only one improper coefficient sign for the cost of living index compared to two for the wage earner's composite index. However, consistently poorer overall results, as measured by the multiple correlation coefficients and F values, were obtained for East African regressions containing the cost of living index, although the differences were not great. Also suggesting the superiority of the wage earner's composite index was its larger t values for the relative commodity price variable.

Evidence in support of the wage earner's composite index is less substantial with Kenyan data where it, in one case, has an improper sign. Also, in only one regression does the wage earner's composite index have a larger F ratio, multiple correlation coefficient, and t value for its price variable or price ratio coefficient. This occurs in the linear regression employing price ratios.

In conclusion, the cost of living index (P_d^c) seems more appropriate for the Kenyan data while the second domestic price variable, the composite wage earner's index (P_d^w), seems generally preferable for East African data. Given this ambiguous situation, both domestic price indices will be retained for the other aggregate import demand tests, and they will again be compared at that time.

The combined experiences with official Kenyan and East African data suggest that the traditional theory has considerable validity in applications to this geographical region as indicated by the significant F values and quite large multiple coefficients of determination. The most consistent variable to have a significant effect on imports is the tariff variable. Both real and monetary gross domestic product reveal a significant effect on imports for East Africa and to a slightly lesser degree for Kenya. On the other hand, only with Kenyan data does the import or domestic price variable have any significance. This is in the form of a significant coefficient for the relative price variable, which is also nearly significant in one other regression.

Kenyan Data with East African Import Price Index

There have been suggestions that East African import price data should replace that published for any one East African country, even for analyses applicable to that country.[1] For some statistical purposes, this is now done even for official statistical data for the individual East African countries. The Kenyan Fisher's "ideal" index of net imports now uses Kenyan quantities and East African unit prices, except for gin and geneva, mineral fuel and lubricants.[2] The primary grounds for such a suggestion is that interstate transfers which could occur undetected and unrecorded create an uncertainty about the accuracy of trade statistics for any one East African country. The actual size of such errors, if indeed they exist to any significant degree, is unknown.

As a test of the hypothesis that East African import price data is preferable to that of any individual East African country for analyses applicable to that country, the traditional import demand model was tested for Kenyan data with the East African import price index replacing the Kenyan import price index as the import price variable. Table 4 contains the regression results. The behavior of the East African and Kenyan import price indices in the regressions can be directly compared line for line in Tables 2 and 4.

Such a comparison reveals that without exception the multiple correlation coefficient and the F ratio are greater for the regressions employing the Kenyan import price index than they are for the East African import price index.

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[1]One such suggestion was made by John Craig, "An East African Import Price Index, 1954-1963, calculated from supplying countries' export indices," The East African Economic Review, 2 (June, 1966), 39-54.

[2]Republic of Kenya, Kenya Statistical Abstract (1968), p. 40.

The regression coefficients of all the East African import price variables and all but one of the relative commodity price variables containing the East African price index are of positive sign rather than the negative sign suggested by economic theory. In contrast, the regressions containing the Kenyan price index as a variable yield the expected negative relationship between imports and the import price or relative commodity price variables. One of the Kenyan relative commodity price variable coefficients is even significant. All these empirical results contradict the hypothesis that East African import price data is preferable to individual country import price data in conducting analyses for one East African country. They suggest, instead, that Kenyan import price data is better than East African import price data for analyses applicable to the single East African country of Kenya.

Kenyan Data with Craig Import Price Index

On grounds equivalent to those found in the argument that East African import price data should be used for individual country analyses, an argument is made by Craig for the use of his alternative East African price index calculated from trade statistics of countries exporting to East Africa even in analyses applicable to only one East African country.

A test of the hypothesis that the Craig import price index is preferable to the Kenyan import price index in an analysis of Kenyan import demand was conducted by repeating the earlier regressions after replacing the Kenyan import price index with the Craig import index. Table 5 contains the regression summary.

A comparison of each row of Table 5 with the corresponding row of Table 2 indicates that without exception the Kenyan import price index yields a better fit than does the Craig import price index. This is revealed by the much greater F values and multiple correlation coefficients for the regressions in Table 2 employing the Kenyan import price index. The former, which is corrected for degrees of freedom, would be the more appropriate statistical comparison since the number of observations differs between the regressions in these two tables. While a greater F value coupled with a greater number of observations and hence degrees of freedom does not necessarily imply greater significance, in this comparison the difference in F values is sufficiently large to permit all the regressions in Table 2 to have F values of at least 95 percent confidence level while those of Table 5 are all below a 90 percent confidence level.[1] Likewise, the t values of the Craig import price variables and ratios are all inferior to those for the Kenyan import price index. One of the Craig relative price ratio coefficients even has a positive rather than the usual negative sign. All this evidence contradicts the hypothesis that the Craig import price index is superior to the Kenyan import price index in the import demand analysis for the single East African country of Kenya.

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[1]These tests are based on a table of cumulative F values with confidence levels of 90, 95, 97.5, 99, and 99.5 percent in Alexander McFarlane Mood, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Company, Inc., 1950), pp. 426 and 427.

East African Data with Craig Modifications

John Craig made several modifications to the official East African import price index to correct for some of the more obvious abnormalities. Among these corrections were the exclusion of aircraft and famine relief foods from the price indices.[1] As a test of the hypothesis that these modifications improve the official import price index and in order to determine whether these modifications should be included in future regressions employing the East African import price index, a regression of the traditional import model was run for East African data as modified by Craig.

Table 6 summarizes the regression results for the modified East African data which can be compared line for line with Table 3 which contains the regression results with the unmodified official East African data. Such a comparison reveals that the differences in the overall fit of the data to the regression line are minimal as indicated by the R and F values, but that those differences which do exist, with one exception, indicate a better fit for the official data rather than the modified data. Likewise, the minor differences of up to 0.29 in the t values for the coefficients of the import price or relative commodity price variables, with one exception where the difference is 0.05, support the official data rather than the modified data. The impact of these results, even if difference in magnitude

[1] John Craig, "An East African Price Index, 1954-1963, calculated from supplying countries' export indices," The East African Economic Review, 2 (June, 1966), 39-54.

is small, is to refute the hypothesis that the Craig modified import price index is preferable to official data in East African analyses. On these grounds the future regressions of aggregate import demand will utilize the official East African import price indices.

East African Data with Craig Import Price Index

As previously discussed, Craig calculated an alternative and hopefully superior import price index for East Africa from the trade statistics of countries exporting to East Africa.[1] The performance of this alternative import price index has already been tested with Kenyan data and will now be tested with East African data with which it could be expected to be more compatible. The hypothesis is that the Craig import price index is preferable to the official East African price index for empirical analyses applicable to East Africa.

The regressions on the basis of the traditional import model are tabularized in Table 7. A row by row comparison of this table with the regression results using official East African data in Table 3 reveals that the overall fit in terms of the multiple correlation coefficient and the F ratio, is much better for the official data than it is for the Craig import price index. Again, the latter, which corrects for degrees of freedom, is the more appropriate statistical comparison due to a difference in the number of observations between these two groups of regressions. As before, while a

[1]John Craig, "An East African Price Index, 1954-1963, calculated from supplying countries' export indices," <u>The East African Economic Review</u>, 2 (June, 1966), 39-54.

greater F value along with a greater number of observations does not guarantee a greater significance level, the differences are again sufficient to make all the regressions of Table 3 significant at no less than a 95 percent level while all the regressions in Table 7 have a significance level of less than 90 percent.[1] Thus, the regressions of Table 3 are more significant than those of Table 7. The t values for the coefficients of the import price or relative commodity price variables are better for the official data in six of the eight regressions. The two which are better for the Craig index are log-linear regressions using the cost of living index as the domestic price variable. The large difference in magnitude as well as the great majority of the regressions, recognizing two exceptions, tend to refute the hypothesis that the Craig index is superior to the official index for empirical studies, at least of import demand, in East Africa. One unusual result of these Craig regressions is the high Durban-Watson statistic values which exceed two for half the regressions. Three of the four are log-linear regressions.

The Choice of Domestic Price Variable

This would be an appropriate point to see what additional light the preceding regressions of alternative data sources shed on the choice between the cost of living index and the composite wage earner's

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[1]These tests are based on a table of cumulative F values with confidence levels of 90, 95, 97.5, 99, and 99.5 percent in Alexander McFarlane Mood, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Company, 1950), pp. 426 and 427.

index as a measure of the domestic price level. For Kenyan data using an East African import price index, the correlation coefficients and the F values are greater for the wage earner's composite index in three out of the four pairs of regressions. The remaining F ratio is greater for the cost of living index while the remaining correlation coefficient is the same for both. The t values for the coefficients of the two domestic price variables, both individually and as ratios, are divided. The linear regression results indicate preferable t values for the cost of living index while the log-linear regressions reveal the wage earner's index to be preferable, either as indicated by a higher t value for a coefficient of proper sign or as a coefficient of proper rather than improper sign. The conclusion must be one of inconclusion, although a numerical majority would slightly favor the composite wage earner's index.

The multiple correlation coefficients and F values for Kenyan data with the Craig import price index yield results opposite to that for Kenyan data with the East African import price index. This time the consumer price index regressions have higher correlation coefficients and F values in all but one pair of regressions, the exception being the linear regression employing ratios. The t values for the coefficients of the domestic price variables and relative commodity price variables are in all cases better for the cost of living index. Thus, both the specific and general statistical data favor the cost of living index, although none of the statistical results are impressive or significant.

East African data with Craig modifications indicate best fit differences which are minimal. Of the multiple correlation coefficients, two pairs are equal and the other two pairs are split with the cost of living a slight improvement in one pair and the composite wage earner's a slight improvement in the other pair. F values are slightly greater for the cost of living index in two pairs, with one pair identical and the other favoring the composite index. The only positive coefficient for the individual domestic price variables appears with the cost of living index. The relative price variables indicate greater t values for the ratio containing the wage earner's index. On balance there is a virtual standoff. The correlation coefficients are split, the t values for the coefficients are split, and only for the F values does the cost of living index have a slight numerical advantage.

East African regressions employing the Craig import price index indicate that the F values, the multiple correlation coefficients, and the t values of the domestic price variables are unanimously greater for the cost of living index. This is somewhat of a pyrrhic victory in that none of the correlation coefficients are large and none of the F values and only a few of the coefficient t values are significant.

The total evidence from these four sets of analyses is still not conclusive; but if any emerged with a slight advantage, it would appear to be the cost of living index which was given at least a slight advantage in all but the first of these three data sets. Putting this together with the conclusion from the earlier examination of official Kenyan and East African data in which East African results were somewhat better with the cost of living index as the domestic price variable while Kenyan data performed better with the composite wage earner's index, the cost of living index could be considered a slightly better performer. However, neither yields significant correlation coefficients nor emerges impressively in any way.

Elasticity Estimates

The coefficients of the log-linear regressions are also estimates of the elasticity between the independent variables and the dependent variable, imports. These calculations assume a constant elasticity relationship along the curve. Another measure of elasticity can be obtained by calculating the product of the inverse of the slope estimate from the regressions with the ratio of the relevant independent variable and import variable, both evaluated at some point on the curve. For these calculations, that point of evaluation is the mean of each of the two variables.[1]

Table 8 contains a summary of both types of elasticity estimates for all the variables employed in the tests for the traditional model. Only the regressions employing official Kenyan and East African data are utilized for these elasticity estimates since they were the regressions whose empirical performance was statistically superior to other data sources.

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[1]For more detail on the calculation of these elasticity estimates, consult the first section of Chapter V in which the method for calculating tariff elasticities is detailed.

Kenyan import price elasticities were in the range 1.65 to 1.85 while the domestic price elasticities were 1.20 and 3.22 for the cost of living index and 0.623 and of improper sign for the wage earner's index. None of these were based on significant regression coefficients. The relative commodity price elasticities were 1.91 and 2.07 when the cost of living index was employed and were 1.53 and 1.51 when the wage earner's index was employed. The 2.07 estimate was based on a significant coefficient. The Kenyan monetary gross domestic product, or income, elasticities had a wide range from 0.167 to 1.67, although the remaining two estimates of 1.00 and 1.02 were approximately unitary. The real gross domestic product, or income, elasticities were 0.824 and 1.08 when deflated by the cost of living index and were 1.09 and 1.28 when deflated by the wage earner's index. The latter two were based on significant regression coefficients. The tariff index will be the subject of an intensive analysis when government revenue implications of tariffs are investigated, but for now suffice it to say that their range was inelastic and varied from 0.646 to 0.856.

For East Africa, the import price elasticities ranged from 1.29 to 1.55. Three of the four domestic price coefficients were negative while the other was less than 0.1. The relative price elasticities based on the cost of living index were 0.984 and 1.20 while those based on the wage earner's index were 0.985 and 1.15. The income elasticities were all based on significant coefficients and ranged from 1.36 to 1.63 for monetary gross domestic product to 1.43 and 1.44 for real gross domestic product deflated by the cost of living index and

1.46 and 1.48 for real gross domestic product deflated by the wage earner's index. The tariff elasticities were also based on significant coefficients and ranged from 0.599 to 0.748.

To summarize, the import price elasticity estimate is consistently above unity, though not based on significant coefficients. The domestic price elasticity estimates are extremely variable among regressions and even of improper sign in several regressions. The relative commodity price elasticity estimate appears to be approximately unity, with some estimates slightly above and others slightly below unity. The income elasticity appears to be approximately unitary or greater. Half the income elasticities were between 1.30 and 1.65, and all of these were based on significant coefficients.

The Existence of Money Illusion

One of the controversies in import demand is the form which the independent variables should take in the demand function. One form, $M = F(P_m, P_d, Y)$ where P_m is import price, P_d is domestic price, and Y is income, utilizes the individual independent variables. The other form, $M = G(P_m/P_d, Y/P_d)$, utilizes these independent variables as ratios. The significance of the difference between the two is that the latter implies the absence of money illusion, which is normally assumed, but not universally accepted as realistic and appropriate.

> The point at issue is whether we are so confident concerning the absence of money illusion that we will impose this presumption on the data, or whether the data should be allowed to support or to contradict the absence of money illusion hypothesis. In our judgment,

> the theoretical support for the absence of money illusion is not sufficiently strong to justify [the use of ratio variables] . . . the form which has traditionally been employed in demand analysis in international trade.[1]

As suggested by Leamer and Stern, an attempt will be made to let the data itself suggest which of the two forms would appear the more appropriate. Following their lead, the hypothesis will be that money illusion does not exist. Table 9 summarizes the relevant data from regressions for the two sets of data which proved statistically stronger, official Kenyan and East African data.

Due to one less variable employed by the ratio regressions, the number of degrees of freedom will differ between the two regressions which are compared. Because of this difference, the F value which is adjusted for degrees of freedom rather than the multiple coefficient of determination will be the test statistic. However, significance does not always increase with a greater F value. Only when the F value is greater and the number of variables fewer would a greater significance be implied by a greater F value. For the money illusion tests, this means that when the ratio regressions have a greater F value than the corresponding non-ratio regressions the former is also more significant. But when the non-ratio regressions have a greater F value, the corresponding degree of significance for each F value must be determined to see if one is more significant. A cumulative F distribution with confidence levels of 90, 95, 97.5, 99, and 99.5

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[1]Edward E. Leamer and Robert M. Stern, <u>Quantitative International Economics</u> (Boston: Allyn and Bacon, Inc., 1970), p. 10.

percent will be employed in an effort to discern the difference in significance for comparative F values in this less obvious case.[1]

A comparison of F values for each successive pair of entries in Table 9 produces mixed results for Kenya but uniform results for East Africa. As measured by the F values, the Kenyan log-linear regressions support the absence of money illusion hypothesis, but the linear regressions do not.

The greater F values for the non-ratio regressions are in the same 99 to 99.5 significance range as are the lesser F values for the ratio regressions. Thus, the results of these comparisons are quantitatively indeterminate, although there is some qualitative evidence for the greater significance of the non-ratio regressions in that their F values are relatively closer to the 99.5 percent level while the F values of the ratio regressions are relatively closer to the 99 percent level. On this qualitative basis the non-ratio regressions could be imputed a slight edge in significance. All East African regression F value comparisons support the absence of money illusion hypothesis.

The greater t values for all real gross domestic product coefficients when compared to the coefficients of the monetary gross domestic product variables in both the Kenyan and East African regression comparisons also support the absence of money illusion hypothesis.

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[1]Such a table is available in Alexander McFarlane Mood, Introduction to the Theory of Statistics (New York: McGraw-Hill Book Company, Inc., 1950), pp. 426 and 427.

The latter evidence based on t values for real gross domestic product coefficients must be tempered somewhat by the possibility that the domestic price index used as a deflater of monetary gross domestic product may not be a particularly good measure of the domestic price level as revealed by the earlier discussions of data in the Data Appendix and the earlier discussion of the lack of significant domestic price variable coefficients in any of the regressions.*

The conclusion of whether the empirical evidence supports or refutes the money illusion hypothesis depends on whether Kenyan or East African data is considered more appropriate. If Kenyan data is used, the evidence is mixed with half the F tests and all the t tests supporting the absence of money illusion hypothesis. All the evidence from both tests for East African data supports the absence of money illusion hypothesis. The difficulty with Kenyan data is the possibility of inaccurate trade statistics while with East African data the domestic price index proxy, which is Kenyan data, may be inaccurate. Nonetheless, the weight of the evidence, even for Kenya, supports the absence of money illusion hypothesis. In addition, the unanimous support by the evidence from East African regressions, which yield the best statistical fit of all data utilized and indicate greater significance for the other variables such as tariffs for the ratio regressions, appears to carry more weight than the less powerful Kenyan results.

Source of Income as a Determinant of Imports

It has been suggested that who earns the income may be more important in the determination of imports than is the aggregate size of that income.[1] The implication would be that wage earners and public servants, for example, might have a different propensity to import than farmers, particularly peasant farmers, and other low income segments of the economy. Available statistics break down national income aggregates into a score of categories which in turn are roughly grouped into the three broad categories of government, primary, and secondary, or tertiary economic activities. One logical dichotomy for testing this hypothesis would be to designate government, commercial, and manufacturing income as the higher income and import sectors while that of agriculture, livestock, forestry, and fishing and hunting would be the lower income and import sectors. This breakdown would permit a statistical test of imports against these components of the income variable, in an effort to test the hypothesis that certain types of income are more important for the determination of imports than is aggregate income. Tables 10 and 11 in the Appendix to this chapter summarize the linear and log-linear regression results for Kenya and East Africa, respectively, when agricultural (GDP_a) and non-agricultural (GDP_{na}) gross domestic product are separated.

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[1] Idrian N. Resnick, "Foreign Trade and Payments in Tanzania," a chapter for a forthcoming textbook on the Economy of Tanzania, pp. 11-12.

Kenyan Analysis

As summarized in the upper portion of Table 10, the linear regression tests of this hypothesis for Kenya, as measured by the magnitude of the regression coefficients for each component of gross domestic product, indicate without exception that the regression coefficient of the non-agricultural variable exceeds that for the agricultural variable, one of which is of improper sign. When the two components of gross domestic product in each regression are statistically tested for a significant difference, however, the t values are not sufficiently large to reject the null hypothesis of no difference between them (i.e., $H_0: \beta_a - \beta_{na} = 0$). The t values for these tests of significant difference were -0.0291, -0.548, -1.23, and -0.318, respectively, for the first four rows of Table 10.

A supplementary test of the importance of each component of gross domestic product for imports could be that of the degree of significance for each of the variables. The results of this test also tend to support the hypothesis. The only Kenyan linear regression in which the t value of the regression coefficient for the non-agricultural variable did not exceed that for the agricultural variable was the first regression which employed the cost of living index as a proxy of the domestic price variable.

For the log-linear regressions the general conclusion is similar, but the case is not as strong. As measured by the size of the regression coefficient, there is a split decision. Two of the regressions support the hypothesis that the non-agricultural portion of gross domestic product is more important in that the regression coefficient of this variable exceeds that for the agricultural component. Of the two that do not support the hypothesis, one yields regression coefficients which differ only slightly; but the agricultural coefficient of 0.568 does exceed the non-agricultural coefficient of 0.560. This occurs in the regression employing real income variables in conjunction with the wage earner's index as a proxy for the domestic price level. The other exception is the same one encountered in the comparison of t values for linear regressions where the cost of living index was used as a proxy for the domestic price level in conjunction with monetary gross domestic product. In this case the non-agricultural income variable has a negative coefficient. The statistical tests of significant difference between the regression coefficients of these two income variables are again not sufficient to reject the null hypothesis of no difference. The t values for the last four rows of Table 10 were 0.405, -0.156, -0.705, and 0.00656, respectively.

With the supplementary test of significance for each variable as measured by the t value for the regression coefficient, the t value of the non-agricultural variable coefficient exceeds that for the agricultural coefficient for all but one regression. The exception is again the regression employing the cost of living index as a measure of domestic price level in conjunction with money income.

One tariff variable had a significant regression coefficient, while one domestic price variable, one non-agricultural gross domestic product variable, and both agricultural real gross domestic product variables deflated by the cost of living index had coefficients of improper sign. All but one F ratio for the regressions were significant at the 95 percent level, but all the F ratios for these regressions were below those obtained earlier with a combined gross domestic product variable.

East African Analysis

The result of the East African tests of the hypothesis that the effects of non-agricultural income on imports exceeds that for agricultural income is one of support without exception. As revealed by Table 11, this is true for both the major test of comparing the relative magnitude of regression coefficients and for the supplementary test of comparing the significance of regression coefficients for both linear and log-linear regressions. While the tests consistently support the hypothesis, the differences are not sufficient for the statistical test for differences between the regression coefficients to be significant. The t values in the test for significant differences for all eight rows of Table 11 were, respectively, -0.519, -0.446, -0.524, -1.08, -0.216, -0.0304, -0.216, and -0.458.

The variables with significant regression coefficients were three tariff variables and two real gross domestic product variables for the non-agricultural component. The variables with coefficients of improper sign were one agricultural real gross domestic product variable, one relative commodity price variable, and all domestic price variables, indicating again that the Kenyan proxy for the domestic price variable is not appropriate for East Africa although most of the relative price variables were of proper sign but not significant.

All the F ratios for the regressions were significant at the 95 percent level and half were even significant at the 99 percent level, again indicating better fit for East African data than for Kenyan data, despite the possibly inappropriate domestic price variable. All the F ratios for these regressions were also below those obtained earlier with a combined gross domestic product variable.

Summary

The hypothesis that the source of income has an impact on demand along with the size of that income was supported by a majority of the evidence for Kenya and all the evidence for East Africa in that the non-agricultural sources of income tended to affect imports more than agricultural sources of income. This was true for both the relative magnitude of the regression coefficients and their significance as measured by t value. The differences in magnitude of the regression coefficients for these two components of gross domestic product were not, however, statistically significant despite the consistency of their evidence.

Variables with significant coefficients in the East African regressions were three tariff variables and two non-agricultural gross domestic product variables, while the only significant coefficient in the Kenyan regressions was a tariff variable. All of the East African regressions and all but one of the Kenyan regressions had significant F values, but the fit of these regressions was consistently inferior to those obtained earlier with a combined gross domestic product variable. The fit of the East African regressions in terms of the F value exceeded that for the Kenyan regressions, again indicating better foreign trade data for East Africa as a whole than for one country within East Africa, despite problems of estimating domestic price levels for the whole of East Africa.

The apparent conclusion is that both components of gross domestic product are important for import demand, although there is empirical evidence that the non-agricultural component probably has a somewhat greater influence on imports than does agricultural income.

Comparison with Other Empirical Import Demand Studies

The conclusions of this aggregate import demand section which can be compared with other similar studies are essentially those of import price and income elasticity greater than unity and a tariff elasticity of slightly below unity, with the latter two variables tending to significantly affect imports. Early empirical studies which were based primarily on the interwar period and were concerned with the price elasticity of imports, consistently found the price elasticity of imports to be low and led to the conclusion of "elasticity pessimism."[1] More recent studies based on post-war statistics are concluding that price elasticities are considerably larger than earlier estimates indicated.[2]

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[1]For a summary of such studies see H.S. Cheng, "Statistical Estimates of Elasticities and Propensities in International Trade: A Survey of Published Studies," International Monetary Fund Staff Papers, 7:1 (April, 1959), 107-158.

[2]For some of these more recent studies, see the writings of R.J. Ball and K. Mavwah, "The United States Demand for Imports,

Other studies have also encountered the problem of improperly signed or insignificant price variables in empirical tests. Houthakker and Magee, for example, in their estimates of import demand for a range of countries encountered insignificant and improperly signed coefficients for the import price variable on numerous occasions.[1] While the present study also encountered somewhat disappointing price relationships in the sense that import price and/or domestic price variable coefficients were generally insignificant and on occasion of improper sign, the implied import price elasticities were generally greater than unity in support of the present trend toward rejecting import price "elasticity pessimism." However, if the tariff variable coefficients are employed as an estimate of import price elasticity, the elasticity estimate would be near or slightly below unity.

The relationship between imports and tariffs has been employed as a second method of estimating price elasticities and the results in these cases have been consistently greater elasticity estimates than when an import price variable was employed.[2] By comparison, the tariff

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1948-1958," The Review of Economics and Statistics, 44:4 (November, 1962), 395-401; H.S. Houthakker and Stephen P. Magee, "Income and Price Elasticities in World Trade," The Review of Economics and Statistics, 51:2 (May, 1969), 111-125, and Mordechai E. Kreinin, "Price Elasticities in International Trade," The Review of Economics and Statistics, 49:4 (November, 1967), 510-516.

[1]H.S. Houthakker and Stephen P. Magee, "Income and Price Elasticities in World Trade," The Review of Economics and Statistics, 51:2 (May, 1969), 589-595.

[2]See Mordechai E. Kreinin, "'Price' vs. 'Tariff' Elasticities in International Trade--A Suggested Reconciliation," The American Economic Review, 57:4 (September, 1967), 891-895, for a summary of both types of estimates and a possible explanation of the discrepancy.

variables in this study tended to be highly significant and in this sense preferable to the import price variables, but were not of high elasticity although they were close to unity. One possible explanation for the inelasticity of the tariff estimates in the present study could be that it did not utilize tariffs as an alternative to a price variable in estimating elasticities, but used both concurrently. Thus, the effects of import price and tariffs were accounted for separately, rather than combined in one price or tariff variable. Since the purpose of the tariff variable in this study was to isolate a separate variable operative in import demand and government revenue, the statistical estimates of import demand in this study contained both a price and tariff variable. However, this study's greater significance for tariff coefficients than for price coefficients does in that sense agree with the conclusions of other studies that tariffs have a greater impact on imports than do import prices.

Like many other recent import demand studies, income coefficients were generally of proper sign and significant, and generally had an elasticity greater than unity. For comparison, Houthakker and Magee also found generally elastic income elasticity estimates for their range of countries between 0.9 and 2.25.[1]

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[1]H.S. Houthakker and Stephen P. Magee, "Income and Price Elasticities in World Trade," The Review of Economics and Statistics, 51:2 (May, 1969), 113. See also the other recent import demand studies mentioned earlier.

The Faaland and Dahl econometric study of Kenya[1] which was primarily concerned with a general economic model of Kenya and, more specifically for imports, with the analysis of four major classes of imports in current value terms, was only tangentially interested in aggregate import demand estimates. Their one statistical estimate for total imports from both inside and outside East Africa utilized the gross domestic product and industrial output variables, which had been of major importance in their earlier analyses of the four disaggregated import components, and found an R^2 of 0.86 with regression coefficients which were not significant at the 95 percent level.[2] In comparison, the present study found values of R^2 approaching their result and falling in the range of slightly greater than 0.7 to slightly greater than 0.8, but also found significant coefficients for several of the tariff variables and some significant coefficients for the variables of gross domestic product, both real and monetary, and import price, both absolute and relative. The East African empirical results, while similar, were statistically even better. The present study, however, was concerned only with imports from outside East Africa, rather than from both within and without East Africa, so that the results of these two investigations are not strictly comparable. Since the Faaland and Dahl study had no elasticity estimates for total imports, no comparison with the aggregate import elasticities of the study can be made.

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[1]Just Faaland and Hans-Erik Dahl, The Economy of Kenya (Bergen: The Chr. Michelsen Institute, July, 1967), III, 8.

[2]Just Faaland and Hans-Erik Dahl, The Economy of Kenya (Bergen: The Chr. Michelsen Institute, July, 1967), III, 8.

Conclusion

The results of this aggregate import demand analysis indicate that what may appear to be a rather poor empirical relationship between imports and income when viewing only these two variables, either in the form of propensities to import or simple correlation, becomes a significant explanatory relationship when viewed as a partial relationship along with other relevant explanatory variables. When the impact of variables such as import and domestic prices and tariffs are introduced into the analysis and accounted for separately in a multiple regression analysis, the relationship between imports and income, as well as that between imports and some of the other variables such as tariffs, become empirically significant. The explanatory power of the more complex analysis as measured by correlation and the F value is also considerably enhanced as compared to a simple two variable explanatory relationship.

CHAPTER II APPENDIX

TABLE 2

LINEAR REGRESSIONS EMPLOYING KENYA DATA
(13 Observations)

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c	P_m/P_d^w	GDP_r^c	GDP_r^w	R^2	F	D.W.
Linear	-1.82 (-1.82)	0.465 (0.420)		0.741 (1.00)	-0.672 (-2.28)					0.807	8.37	1.26
Linear	-1.85 (-1.83)		-0.905 (-0.412)	1.23 (2.38)	-0.579 (-2.41)					0.807	8.37	1.40
Linear					-0.610 (-2.09)	-6.08 (-1.79)		2.39 (1.82)		0.704	7.15	1.01
Linear					-0.587 (-2.12)		-1.59 (-1.86)		0.926 (2.44)	0.718	7.65	0.951
Log-Linear	-1.86 (-2.07)	3.22 (1.52)		0.167 (0.218)	-0.856 (-2.68)					0.777	6.96	1.22
Log-Linear	-1.65 (-1.59)		0.623 (0.293)	1.02 (1.22)	-0.646 (-2.00)					0.714	5.00	0.843
Log-Linear					-0.706 (-2.39)	-2.07 (-2.52)		0.824 (1.70)		0.736	8.37	1.12
Log-Linear					-0.646 (-2.17)		-1.51 (-2.24)		1.09 (2.36)	0.720	7.73	0.833

TABLE 3

LINEAR REGRESSIONS EMPLOYING EAST AFRICAN DATA[a]
(12 Observations)

	P_m	P_d^c	P_d^W	GDP	T_m	P_m/P_d^c	P_m/P_d^W	GDP_r^c	GDP_r^W	R^2	F	D.W.
Linear	-1.50 (-1.47)	-0.275 (-0.369)		1.29 (2.64)	-0.471 (-2.65)					0.881	13.0	1.69
	-1.80 (-1.57)		-1.02 (-0.636)	1.35 (3.31)	-0.489 (-3.67)					0.885	13.5	1.91
					-0.545 (-3.33)	-3.42 (-1.31)		3.89 (6.04)		0.847	14.8	1.51
					-0.573 (-3.77)		-1.12 (-1.63)		1.27 (6.26)	0.850	15.1	1.57
Log-Linear	-1.29 (-1.43)	0.0971 (0.0620)		1.36 (2.47)	-0.746 (-3.55)					0.846	9.58	1.56
	-1.55 (-1.52)		-0.715 (-0.509)	1.63 (2.87)	-0.734 (-3.89)					0.851	9.99	1.81
					-0.718 (-3.68)	-1.20 (-1.70)		1.43 (5.86)		0.840	14.0	1.60
					-0.748 (-4.15)		-1.15 (-2.04)		1.48 (6.31)	0.850	15.1	1.61

[a]The domestic price indices are both Kenyan data; however, they are utilized along with East African data since comparable East African indices are not available.

TABLE 4

LINEAR REGRESSIONS EMPLOYING KENYAN DATA WITH EAST AFRICAN IMPORT PRICE INDEX
(13 Observations)

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c	P_m/P_d^w	GDP_r^c	GDP_r^w	R^2	F	D.W.
Linear	0.367 (0.257)	0.250 (0.190)		0.712 (0.760)	-0.574 (-1.63)					0.730	5.40	0.962
	0.458 (0.251)		0.359 (0.109)	0.785 (0.846)	-0.537 (-1.83)					0.729	5.37	0.970
					-0.281 (-0.828)	1.53 (0.385)		3.83 (2.82)		0.605	4.60	0.921
					-0.413 (-1.23)		0.0121 (0.0119)		1.20 (2.89)	0.610	4.69	1.61
Log-Linear	0.612 (0.526	2.47 (0.940)		0.0430 (0.0459)	-0.630 (-1.56)					0.668	4.03	0.859
	1.28 (1.05)		2.34 (0.976)	-0.0757 (-0.0741)	-0.461 (-1.30)					0.670	4.06	0.935
					-0.323 (-0.806)	0.131 (0.108)		1.41 (2.40)		0.550	3.66	0.693
					-0.433 (-1.12)		-0.0828 (-0.0906)		1.41 (2.57)	0.565	3.90	1.24

TABLE 5

LINEAR REGRESSIONS EMPLOYING KENYA DATA
WITH CRAIG IMPORT PRICE INDEX
(11 Observations)

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c
Linear	-2.91 (-0.757)	0.434 (0.349)		0.382 (0.710)	-0.400 (-0.756)	
	-1.95 (-0.675)		0.0869 (0.0478)	0.491 (1.09)	-0.251 (-0.779)	
					-0.0976 (-0.250)	-1.02 (-0.143)
					-0.0530 (-0.212)	
Log-Linear	-4.47 (-1.02)	3.43 (0.856)		0.148 (0.216)	-0.854 (-1.09)	
	-1.24 (-0.458)		0.161 (0.0862)	0.487 (0.764)	-0.252 (-0.630)	
					-0.475 (-0.841)	-1.90 (-0.735)
					-0.126 (-0.369)	

TABLE 5--Continued

P_m/P_d^W	GDP_r^c	GDP_r^W	R^2	F	D.W.
			0.297	0.633	1.20
			0.283	0.592	1.11
	0.698 (0.573)		0.202	0.592	1.05
0.0901 (0.0660)		0.284 (0.929)	0.207	0.609	1.10
			0.314	0.686	1.27
			0.225	0.435	0.954
	0.176 (0.342)		0.255	0.797	1.04
-0.0536 (-0.0369)		0.438 (1.02)	0.210	0.622	0.978

TABLE 6

LINEAR REGRESSIONS EMPLOYING CRAIG MODIFICATIONS TO EAST AFRICAN DATA[a]
(12 Observations)

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c
Linear	-2.83 (-1.52)	-0.276 (-0.373)		1.43 (2.69)	-0.460 (-2.62)	
	-2.99 (-1.51)		-0.589 (-0.392)	1.39 (3.16)	-0.487 (-3.62)	
					-0.561 (-3.12)	-4.67 (-1.21)
					-0.565 (-3.56)	
Log-Linear	-2.29 (-1.37)	0.277 (0.176)		1.47 (2.42)	-0.761 (-3.49)	
	-2.41 (-1.35)		-0.254 (-0.191)	1.63 (2.63)	-0.739 (-3.73)	
					-0.730 (-3.46)	-1.63 (-1.55)
					-0.729 (-3.83)	

[a]The domestic price index and the price of time are both Kenya data; however, they are utilized along with East African data since comparable East African indices are not available.

TABLE 6--Continued

$P_m P_d^W$	GDP_r^c	GDP_r^W	R^2	F	D.W.
			0.883	13.2	1.53
			0.883	13.2	1.57
	3.70 (5.46)		0.844	14.4	1.36
-1.37 (-1.44)		1.22 (5.90)	0.841	14.1	1.41
			0.843	9.36	1.35
			0.843	9.38	1.44
	1.33 (5.15)		0.833	13.3	1.38
-1.41 (-1.75)		1.40 (5.82)	0.836	13.6	1.38

TABLE 7

LINEAR REGRESSIONS EMPLOYING EAST AFRICAN DATA
WITH CRAIG IMPORT PRICE INDEX
(10 Observations)

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c
Linear	-0.507 (-1.19)	1.10 (0.695)		0.618 (1.22)	-0.719 (-1.12)	
	-4.04 (-1.10)		1.41 (0.519)	0.840 (1.45)	-0.529 (-1.07)	
					-0.690 (-0.947)	-11.0 (-0.797)
					-0.115 (-0.222)	
Log-Linear	-6.79 (-2.17)	4.96 (1.67)		0.722 (1.40)	-1.35 (-2.34)	
	-4.33 (-1.40)		1.82 (0.818)	1.15 (1.84)	-0.906 (-1.54)	
					-1.20 (-2.24)	-5.12 (-1.91)
					-0.619 (-1.11)	

TABLE 7--Continued

P_m/P_d^W	GDP_r^c	GDP_r^W	R^2	F	D.W.
			0.339	0.642	2.08
			0.312	0.567	1.86
	1.56 (1.04)		0.187	0.461	1.64
0.147 (0.0534)		0.368 (0.653)	0.121	0.275	1.19
			0.566	1.63	2.40
			0.406	0.853	2.18
	0.547 (1.22)		0.486	1.89	2.06
-1.70 (-0.732)		0.823 (1.44)	0.256	0.694	1.53

TABLE 8

KENYAN AND EAST AFRICAN ELASTICITIES BASED ON OFFICIAL DATA

		Proxy for Domestic Price Variable	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c	P_m/P_d^w	GDP_r^c	GDP_r^w
Kenya	Linear	Cost of	-1.68	1.20		1.00	-0.807				
		Living Index					-0.733	-1.91		1.08	
		Wage Earner's	-1.71		nega-	1.67	-0.696				
		Index			tive		-0.705		-1.53		1.28[a]
	Log-Linear	Cost of	-1.86	3.22		0.167	-0.856[a]				
		Living Index					-0.706[a]	-2.07[a]		0.824	
		Wage Earner's	-1.65		0.623	1.02	-0.646				
		Index					-0.646		-1.51		1.09[a]
East Africa	Linear	Cost of	-1.30	nega-		1.45[a]	-0.599[a]				
		Living Index		tive			-0.694[a]	-0.984		1.44[a]	
		Wage Earner's	-1.55		nega-	1.52[a]	-0.622[a]				
		Index			tive		-0.729[a]		-0.985		1.46[a]
	Log-Linear	Cost of	-1.29	0.0971		1.36[a]	-0.746[a]				
		Living Index					-0.718[a]	-1.20		1.43[a]	
		Wage Earner's	-1.55		nega-	1.63[a]	-0.734[a]				
		Index			tive		-0.748[a]		-1.15		1.48[a]

[a]For linear regression elasticity estimates, the calculation is based on significant regression coefficients. For log-linear regressions, these elasticity estimates are significant regression coefficients.

TABLE 9

TESTS FOR MONEY ILLUSION:
KENYA

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c
Linear	-1.82 (-1.82)	0.465 (0.420)		0.741 (1.00)	-0.672 (-2.28)	
					-0.610 (-2.09)	-6.08 (-1.79)
	-1.85 (-1.83)		-0.905 (-0.412)	1.23 (2.38)	-0.579 (-2.41)	
					-0.587 (2.12)	
Log-Linear	-1.86 (-2.07)	3.22 (1.52)		0.167 (0.218)	-0.856 (-2.68)	
					-0.706 (-2.39)	-2.07 (-2.52)
	-1.65 (-1.59)		0.623 (0.293)	1.02 (1.22)	-0.646 (-2.00)	
					-0.646 (-2.17)	

TABLE 9--Continued

P_m/P_d^W	GDP_r^c	GDP_r^W	R^2	F	D.W.
			0.807	8.37	1.26
	2.39 (1.82)		0.704	7.15	1.01
			0.807	8.37	1.40
-1.59 (-1.86)		0.926 (2.44)	0.718	7.65	0.951
			0.777	6.96	1.22
	0.826 (1.70)		0.736	8.37	1.12
			0.714	5.00	0.843
-1.51 (-2.24)		1.09 (2.36)	0.720	7.73	0.833

TABLE 9--Continued

TESTS FOR MONEY ILLUSION:
EAST AFRICA

	P_m	P_d^c	P_d^w	GDP	T_m	P_m/P_d^c
Linear	-1.50 (-1.47)	-0.275 (-0.369)		1.29 (2.64)	-0.471 (-2.65)	
					-0.545 (-3.33)	-3.42 (-1.31)
	-1.80 (-1.57)		-1.02 (-0.636)	1.35 (3.31)	-0.489 (-3.67)	
					-0.573 (-3.77)	
Log-Linear	-1.29 (-1.43)	0.0971 (0.0620)		1.36 (2.47)	-0.746 (-3.55)	
					-0.718 (-3.68)	-1.20 (-1.70)
	-1.55 (-1.52)		-0.715 (-0.509)	1.63 (2.87)	-0.734 (-3.89)	
					-0.748 (-4.15)	

TABLE 9--Continued

P_m/P_d^W	GDP_r^c	GDP_r^W	R^2	F	D.W.
			0.881	13.0	1.69
	3.89 (6.04)		0.847	14.8	1.51
			0.885	13.5	1.91
-1.12 (-1.63)		1.27 (6.26)	0.850	15.1	1.57
			0.846	9.58	1.56
	1.43 (5.86)		0.840	14.0	1.60
			0.851	9.99	1.81
-1.15 (-2.04)		1.48 (6.31)	0.850	15.1	1.61

TABLE 10

SOURCE OF INCOME AS DETERMINANT OF KENYAN IMPORTS
(13 Observations)

	P_m	P_d^c	P_d^w	GDP_a	GDP_{na}	T_m	P_m/P_d^c
Linear	-2.02 (-1.61)	0.656 (0.510)		0.340 (0.542)	0.375 (0.469)	-0.736 (-1.92)	
	-1.86 (-1.53)		-0.809 (-0.323)	0.309 (0.485)	0.906 (1.50)	-0.576 (-1.89)	
						-0.301 (-0.765)	-4.93 (-1.10)
						-0.591 (-1.70)	
Log-Linear	-1.99 (-1.90)	3.50 (1.34)		0.338 (0.491)	-0.133 (-0.159)	-0.933 (-2.47)	
	-1.99 (-1.62)		0.187 (0.0758)	0.561 (0.739)	0.764 (0.865)	-0.714 (-1.87)	
						-0.567 (-1.49)	-2.17 (-2.11)
						-0.723 (-2.07)	

TABLE 10--Continued

P_m/P_d^W	$GDP^c_{r,a}$	$GDP^c_{r,na}$	$GDP^W_{r,a}$	$GDP^W_{r,na}$	R^2	F	D.W.
					0.806	5.81	1.37
					0.801	5.65	1.39
	-2.12 (-0.915)	2.43 (1.41)			0.676	4.18	1.55
-1.67 (-1.47)			0.285 (0.406)	0.638 (1.27)	0.706	4.80	0.944
					0.779	4.93	1.42
					0.722	3.64	1.04
	-0.228 (-0.316)	0.606 (1.01)			0.708	4.85	1.61
-1.89 (-2.24)			0.568 (0.829)	0.560 (0.996)	0.729	5.38	1.03

TABLE 11

SOURCE OF INCOME AS DETERMINANT OF IMPORTS
LINEAR REGRESSIONS OF EAST AFRICAN DATA
(12 Observations)

	P_m	P_d^c	P_d^w	GDP_a	GDP_{na}	T_m	P_m/P_d^c
Linear	-1.20	-0.379		0.377	0.837	-0.437	
	(-0.707)	(-0.436)		(0.597)	(1.99)	(-1.92)	
	-1.42		-1.14	0.335	0.849	-0.441	
	(-0.811)		(-0.466)	(0.443)	(1.69)	(-2.10)	
						-0.505	-2.09
						(-2.22)	(-0.405)
						-0.420	
						(-1.94)	
Log-Linear	-1.58	-0.166		0.657	0.880	-0.757	
	(-0.964)	(-0.0793)		(0.873)	(1.61)	(-0.161)	
	-1.82		-0.150	0.780	0.819	-0.750	
	(-1.09)		(-0.0778)	(0.975)	(1.28)	(-3.08)	
						-0.768	-1.47
						(-3.26)	(-1.10)
						-0.718	
						(-3.06)	

TABLE 11--Continued

P_m/P_d^W	$GDP^c_{r,a}$	$GDP^c_{r,na}$	$GDP^W_{r,a}$	$GDP^W_{r,na}$	R^2	F	D.W.
					0.884	9.18	1.48
					0.873	8.25	2.44
	0.973 (0.463)	2.57 (2.49)			0.852	10.1	1.36
0.429 (0.232)			-0.278 (-0.317)	1.07 (2.69)	0.863	11.0	1.31
					0.843	6.44	1.61
					0.829	5.83	2.24
	0.632 (1.02)	0.846 (2.03)			0.845	9.56	1.58
-0.881 (-0.536)			0.359 (0.395)	1.02 (1.83)	0.843	9.39	1.47

CHAPTER III

PRICE OF TIME IMPORT ANALYSIS

A possible alternative to the traditional import demand analysis is a model which explicitly incorporates non-market activity as well as market activity through a price of time variable. Such a model could be argued to be more relevant than the traditional model in a situation where considerable economic activity is only marginally market activity while the remainder is subsistence or household activity. Economists are becoming more and more concerned about time and its allocation, particularly the time not spent at work which is the major and growing portion of available time.[1] The importance of time and fore-gone earnings in education are now recognized by many economists.[2] The allocation of non-market as well as market time in situations other than education is also being investigated by economists, including a study on the allocation of time between subsistence work and market participation in Africa.[3] These and other studies[4]

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[1]See Gary S. Becker, "A Theory of the Allocation of Time," The Economic Journal (September, 1965), 493-517.

[2]See T.W. Schultz, "The Formation of Human Capital by Education," Journal of Political Economy (December, 1960), and other published material on the subject of human capital.

[3]Edwin Dean, The Supply Responses of African Farmers: Theory and Measurement in Malawi (Amsterdam: North-Holland Publishing Company, 1966).

[4]See Jacob Mincer, "Market Prices, Opportunity Costs, and Income Effects," in Measurement in Economics: Studies in Mathematical Economics

indicate that time is an important consideration for economic decision making and for the results of traditional economic theory, even for an agrarian economy.[1]

After development of this price of time import model, two different types of empirical tests of the model could be conducted. The first would be to use as a proxy for the price of time a wage variable, on the assumption that the opportunity cost of non-market activity is what could be earned in the labor market. The second would be to use the value of peasant-produced agricultural production as a proxy for the opportunity cost of time spent in non-market activity. The second approach assumes that wage labor may not be a realistic option for the peasant farmer in a dualistic less developed economy but that agricultural activity is a viable alternative. In the second case several imports which would be most likely to be purchased by peasant farmers are to be isolated and analyzed over time for their relationship to the returns from a cash crop and the other relevant variables.

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and Econometrics in Memory of Yehuda Grunfeld (Stanford: Stanford University Press, 1963), and J. Owen, "The Supply of Labor and the Demand for Recreation," unpublished Ph.D. dissertation, Columbia University, 1964.

[1]An attempt to incorporate into a model of an agrarian economy not only agricultural activities and leisure but also time spent in a variety of activities from manufacturing to ceremony is made by Stephen Hymer and Stephen Resnick, "A Model of an Agrarian Economy with Non-agricultural Activities," The American Economic Review, 59:4, part 1 (September, 1969), 493-506.

Price of Time and Aggregate Imports

For the price of time aggregate import demand analysis the other relevant variables would be the price of imports, the price of domestic commodities, and the tariff level. The income variable, normally measured by gross domestic product, would be replaced by the price of time variable which could have the substitution effects of the price variables in addition to the income effects of the income variable.

Price of Time Import Model

In this study an attempt is made to integrate the allocation of time with import demand in a price import model. This model is based on the contention that the population's market activities such as the sale of some produce or the sale of some labor time in the market enable them to purchase, with the cash obtained, desired goods and services, either imports or domestic commodities.

This model explicitly assumes that the household, like a firm, is a producing unit which uses purchased commodities, both imports and domestic produce, and personal services or labor to produce goods and services. The household employs its own time or personal services not spent in producing cash products or working for wages to produce its own desired goods and services within the household where they are also consumed. This household production could be either tangible goods such as bread and clothes, or intangibles such as reading, listening to the radio, sleeping, eating, talking in the village, or even prestige.[1] Alternatively, in an effort to relate this analysis to traditional theory, the household could be viewed as "producing" utility. In this latter interpretation the usual indifference curve analysis can be utilized if time is viewed as a "commodity" consumed by the household. In all of these interpretations, this analysis views the use of personal services, domestic commodities, and imports as a function of the price of imports, price of domestic goods, and the price of time. Thus, the model incorporates an income change due to productive activity as a change in the price of personal services rather than as income, per se. As a consequence, the impact of a change in the price of personal services would normally be the usual combination of two effects, the income and substitution effects. Other income not due to market sales of labor, such as gifts, would be pure income changes.

For given commodity prices of imports and domestic commodities, a change in the price of time, say a rise via an increase in wages or in the price of cash crops, would tend to have the following two effects. The substitution effect of the rise in the price of time to the household would be a tendency to substitute goods and services for time used in the household. Among these increased goods and services would be imports. The opposite effect of substituting time in the household for goods and services including imports would exist for a decline in the price of time. The substitution effect of a

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[1]This emphasis on characteristics was formulated by Kelvin S. Lancaster, "A New Approach to Consumer Theory," The Journal of Political Economy, 74 (April, 1966), 132-157.

change in the price of time is a positive relationship between the price of time and imports.

The income effect of a rise in the price of time, and therefore a rise in income, is ceteris paribus, an increase in the purchase of commodities, including imports, assuming normal rather than inferior goods. The opposite decline in income and imports of normal goods would be the income effect of a fall in the price of time. The income effect is also a positive relationship between imports and the price of time.

Since both the income and substitution effects lead to a positive relationship between imports and the price of time, the combined income and substitution effect of a change in the price of time must also be a positive relationship between imports and the price of time. The other variables will retain their traditional relationships to imports. This would imply a negative relationship between imports and the import price and tariff variables and a positive relationship between imports and the domestic price variable. Mathematically, $M = F(P_m, P_d, P_t, T_m)$ where M is import volume, P_m is import price, P_d is domestic price, P_t is the price of time, and T_m is the tariff level. The first and last variables are negatively related to imports while the second and third are positively related to imports.

Putting the first three variables in ratio form produces a model with comparable implications. The relative commodity price variable, P_m/P_d, can, as in the traditional import demand model, be expected to be inversely related to imports. The relative price of time, P_t/P_m, can be inferred from the preceding discussion of the price of time variable itself to be positively related to imports. If the price of time, say, rises relative to the price of imports, the substitution effect would be to substitute imports for time in the household. The income effect of the rise in the relative price of ~~time,~~ which could, ceteris paribus, be expected to be an increase in income, would tend to lead to an increase in the purchase of normal goods, including imports. Mathematically, $M = F(P_m/P_d, P_t/P_m, T_m)$ where the variables are as defined earlier and where the first and the last variables can be expected to be negatively related to imports while the second variable, the relative price of time, can be expected to be positively related to imports.

Empirical Tests for Kenya

As a test of the comparative empirical performance of the two models, Table 12 summarizes the results of regressions employing Kenyan data for the two alternative import demand models, the traditional import demand model with gross domestic product income variables and the price of time import demand model. The hypothesis will be that the price of time model is more appropriate to Kenyan society than is the traditional import demand model. In terms of overall fit as measured by the multiple correlation coefficient and the F ratio, the regressions employing a price of time variable either individually or in a ratio have, without exception, a larger F ratio and multiple correlation coefficient. In the linear regressions, the overall fit, particularly as measured by the F values, is much better for the price of time model than the traditional import demand model.

A check of the significance of the coefficients for the price of time variables as compared to the income variables could be a more specific test of the relative performance of the two models. As indicated in Table 12, the t values of the price of time variables or relative price of time variables are without exception greater than the t values for the associated coefficients of the gross domestic product variables. In fact, with only one exception, the price of time variables are all significantly different from zero, whereas only three of the eight gross domestic variables are significantly different from zero.

While the hypothesis that the East African import price index as well as the Craig import price index would be more accurate reflections of import price movements for Kenya was rejected, an indication of which model these series of regressions support might be useful as supplementary evidence. As Tables 13 and 14 indicate, both the general and specific evidence in both test cases support the hypothesis that the price of time import model is more appropraite. Compared to the traditional model variables and regressions, the price of time variable coefficients have greater t values and the regressions employing the price of time variables have greater F values and multiple regression coefficients.

The only disconcerting note, which is also true to some extent in the traditional model regressions, is the existence of an improper sign for the coefficients of many, although not all, domestic price variables or relative commodity price variables in regressions employing price of time variables. In most cases these coefficients with improper signs are not significant.

With the exception of this rather common problem of improper coefficients for the domestic price variables and ratio variables, all of this evidence is unanimous in its support of the hypothesis that the price of time import model is appropriate to the situation found in a less developed country. It is also consistent with the view that decisions about time allocations are important in and relevant to the less developed countries where much of the activity of the households are non-market activities. At least for the country of Kenya, the price of time model yields empirical evidence of its relevance and statistical superiority to the traditional import demand model.

Empirical Tests for East Africa

A logical extension of the preceding hypothesis would be the hypothesis that the price of time import model would also be more appropriate than the traditional import demand model to the whole of East Africa. This test would be particularly interesting in the light of improved results for the traditional import demand model in empirical tests with East African as compared to Kenyan data. These improved results for East Africa were obtained despite the necessity of using the Kenyan domestic price indices as a proxy of the non-existent East African domestic price indices and despite the necessity of using East African gross domestic product data which was a summation of strictly incomparable individual country data. Apparently, the more accurate trade data for East Africa as a whole which avoids the inevitable though unspecified errors of unrecorded or inaccurately recorded interstate transfers more than compensated for these other inaccuracies in data and assumptions.

With the anticipation that the improved trade data for East Africa may again compensate for the other errors, the price of time and traditional models were also tested with East African data. However, in doing this for the price of time model one additional difficulty emerges. There are no earnings data applicable to East Africa comparable to that found for Kenya, although employment figures, which were the second data series used in the calculation of the price of time proxy for Kenya, are published. Due to this problem of earnings data availability, the Kenyan earnings and employment data and therefore the Kenyan price of time index were used as a proxy of the behavior of the price of time for all of East Africa. This is an additional assumption under which the price of time model will labor but which will be non-existent for the traditional import model which employs official East African gross domestic product data.

Table 15 contains the results of the regressions for both models for East African data as supplemented by Kenyan data where East African statistics are non-existent. The multiple correlation coefficients and the F values in this table reveal, with three exceptions, better results for the traditional import demand model. The exceptions are identical multiple correlation coefficients in the linear regression employing the wage earners index as the domestic price variable and larger multiple correlation coefficients and F values for the two linear regressions employing ratio variables. All of the log-linear regressions indicate better overall fits for the traditional model. It is interesting, however, to note that the two largest F values are associated with regressions employing price of time ratio variables and that the highest Durban-Watson statistic of 1.98 which is close to the approximate value of two necessary to indicate a lack of serial correlation is associated with a linear regression employing a price of time variable.

The specific test of significance of the regression coefficients of the income and price of time variables tells a similar story. For the log-linear regressions the t values of the coefficients of the gross domestic product variables all exceed those for the price of time variables. In the linear regressions, the t values for the two coefficients of the relative price of time variables exceed those for the gross domestic product variables, but the opposite result emerges for the t values of the independent price of time variables in comparison to the monetary gross domestic product variables.

While the Craig import price index and the Craig modifications to the official East African import price index were not proved superior to the official East African import price index in empirical tests of the traditional import demand model, their performance with the price of time import model would, again, be interesting as supplementary evidence in tests of the two models. Table 16 contains the regression summary for the Craig modified East African price index and, except for the one pair of identical multiple correlation coefficients for the East African regressions, is a literal replay of the results in Table 15. As in the preceding series of East African tests and with the exception of the same two linear regressions employing ratio variables, the traditional import demand model regressions have the greater F values and multiple correlation coefficients. Incidentally, the two greatest F values and the highest Durban-Watson statistic are still associated with regressions employing a price of time variable.

Also a replay of the official East African tests are the results that the t values for the coefficients of the gross domestic product variables are greater than those for the price of time variables with the same two exceptions for linear regressions containing the relative price of time variables.

For the East African regressions with the Craig import price index, tabularized in Table 17, another about face is encountered, and the results are identical to those yielded by the Kenyan tests. As was true for Kenya, this series of tests unanimously indicates superior multiple correlation coefficients and F values for the price of time regressions and indicates superior t values for the coefficients of the price of time variables compared to those for their gross domestic product counterparts.

The problem with improper signs for the coefficients of the domestic price and relative commodity price variables in regressions employing the price of time variables exists for East African data as it did for Kenyan data. The major difference is that with East African data this improper sign problem is also quite common for the traditional model regression tests. Again, virtually all of these regression coefficients with improper signs are not significant.

While the evidence of the East African regressions for the hypothesis that the price of time model is more appropriate than the traditional import model is mixed; its general impact is a reversal of the unanimous support for the hypothesis obtained from the Kenyan analyses. One of two interpretations could be given for this phenomenon. It could either indicate that the price of time model is not as appropriate as the traditional model for East Africa, or it could indicate that the Kenyan price of time index based on Kenyan wage and employment data which was a proxy for the East African price of time index is simply not an adequate reflection of what happened in the whole of East Africa. If the latter is accepted, then the model could still be appropriate but the data used to test it was not relevant. Further tests would be necessary to distinguish between the two interpretations, and these will either need to await the acquisition of additional East African statistics which are presently not available, or will need to be based on statistics of other countries which do have appropriate data. The second series of tests based not on wage estimates as a price of time proxy but on the returns from peasant-produced crops should shed some additional light on the appropriateness of the price of time model to the East African situation.

Crop Prices as Price of Time

A second test of the price of time model could be the relation of imports with the prices of commodities produced by the household as opposed to the earnings in the labor force by members of the household. In this test the relevant imports would not be aggregate imports, but those commodities imported by the producers of the particular crop under consideration. This approach assumes that wage labor may not be a realistic option for a farmer in a dualistic less developed economy, but that agricultural activity is a viable alternative.

Methodology

Since households are the importing unit, they would also need to be the producing unit. This indicates that crops produced by peasant farmers or small farms would be the most relevant crop prices for this test of the model. The five crops for which prices to producer are available for an extended period are wheat, maize, clean coffee, pyrethrum, and sisal.[1] Of these five crops, the production of small farms is sizeable for maize, where the small farm output was as much as 111,000 tons and more than half of total maize output.[2] The difficulty with the price of maize as a measure of the price of time in its effect on imports is that maize production is also the major traditional subsistence crop and insofar as its

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[1]These are available in the Kenya Statistical Abstract for various years.

[2]Republic of Kenya, Kenya Statistical Abstract (1966), p. 63.

production is non-market it may not directly affect imports which are monetary. The other two crops in this group of five which have, at least proportionally, sizeable small farm output are clean coffee and pyrethrum. The small farm output of both has been growing over the years with coffee output reaching over 26,000 tons in 1966, approximately half total output, and pyrethrum output reaching nearly 7,000 tons in 1966, approximately three fourths of total output. The prices of these three crops were selected as the independent price of time variables in this series of price of time model tests.

As for the dependent variable in these tests, the problem was to select imports by the producers of these products. This was extremely difficult, but a rather detailed study of the imports for the neighboring country of Tanzania was used as a guide to the types of imports utilized by peasant producers in East Africa, including Kenya.

> The chief imports for the rural market are textiles and clothing, rice, soap, kerosene, tea, tinned milk, cooking oils, patent medicines, enamelware and crockery, biscuits, mirrors and ornaments, and cotton thread; in small towns one finds also primitive agricultural implements, bicycles and spare parts, radios, watches, paraffin-fired lamps, stoves and irons.[1]

Of the listed imports, several were readily available for the relevant years in both quantity and value terms in the statistical abstracts. In the former group, the imports selected for tests of this model were evaporated or condensed milk, rice, tea, and cotton piece goods, while

[1]M.J.H. Yaffey, Balance of Payments Problems of a Developing Country: Tanzania (New York: Humanities Press, Inc., 1970), pp. 23 and 24.

in the latter group radios and bicycles were selected. The reason for selecting those which were available in both quantity and value terms was to permit the calculation of an import price variable estimate in the form of a ratio of these two pieces of data. It should be noted that all the items listed, although they are major imports by the rural areas, are not exclusively imported by the rural areas. That is, bicycles, radios, clothing, tea, rice, and tinned milk are purchased by urban as well as rural residents. The implications of this for the empirical tests is that these are not the ideal commodities to be employed in these tests and that the explanatory power of these tests and the specific variables employed may not be great. But given the impossibility of selecting imports consumed solely by rural residents, and ideally solely the producers of the three agricultural products utilized, these imports will be used as at least an approximate test of the role of commodity prices and their associated price of time variable in the demand for imports. The one commodity which might appear the least likely to be consumed in urban areas would be tinned milk, since fresh milk would be available in at least the major urban areas. Even tinned milk, however, could be consumed in the major urban areas as a substitute for cream.

In addition to the variables of import quantity, import price, and crop price as a proxy of the price of time, the empirical tests utilized a tariff variable and in a few cases a domestic price variable, when available and considered relevant. A complete discussion of the data and its sources is available in the Data Appendix to this study.

Empirical Tests

The results of the regression tests of the price of time model using the crop price as a proxy for the price of time are available in the Chapter III Appendix in Tables 18 through 23. These tables contain, for each of the selected import commodities, regressions which employed all variables and also those which excluded variables that originally tended to have improperly signed coefficients. As indicated by the results in these tables, the implications for the price of time model are mixed and tend to depend on the particular import commodity selected.

Tinned Milk

For tinned milk imports, the import commodity which was earlier isolated as possibly being somewhat more applicable to rural areas, the results are equally divided in their support of the price of time model. As measured by the sign of the price of time variable coefficient, both of the linear regressions with the coffee price variable tend to support the hypothesis, both of the pyrethrum price regressions tend to reject the hypothesis, while the linear regression employing the maize price variable supports the hypothesis but the log-linear regression does not. However, none of the price of time coefficients are significant, a result which was earlier anticipated because producers of these crops are not the sole, nor probably the major, purchasers of these products. The remaining variables are of proper sign and the F values are significant, as are a few of the import price and tariff variable coefficients.

Rice

All but one set of the rice import demand regressions had the proper positive sign for the crop price as the price of time variable coefficient. The exception was for the log-linear regressions employing the pyrethrum price. This was true independent of whether the import price variable was or was not employed. The regressions were run both with and without this variable since its coefficient had an improper sign on several occasions. Again, none of the t or F values were significant in these regressions, although a couple of the tariff variable coefficients were nearly significant.

Tea

For the test of the model with tea imports, all the price of time proxy variable coefficients are of negative sign, contrary to the price of time hypothesis, although not significant. The import price variable coefficients are all of proper sign. They are also significant for the linear regression employing the price of pyrethrum and for all log-linear regressions. The latter also had easily significant F values as did the linear regression employing the coffee price as a proxy for the price of time. The performance of the log-linear regressions was greatly superior to that for the linear regressions, and none supported the price of time hypothesis.

Cotton Piece Goods

With cotton piece goods imports as a test of the hypothesis, the results are again mixed with the price of maize test supporting the hypothesis but the prices of pyrethrum and clean coffee refuting the hypothesis. This was true whether the domestic price and tariff variables, which often had improperly signed coefficients, were employed or omitted. None of the F values for the regressions or t values for the variable coefficients were significant.

Radios

The last two imported commodities were listed among the imports of the small towns as opposed to the rural areas, but are also associated as prestigious and useful commodities in the rural areas. For the radio import demand regressions, the signs of the price of time variable coefficients are consistently improper and significant on two occasions. All of the import price variable coefficients are significant as are all of the F values for the regressions. These results remained, whether or not the tariff variable, which on most occasions had an improper sign, was employed.

Bicycles

All of the import demand regressions for bicycles which excluded the import price variable, whose coefficients were consistently of improper sign, had coefficients of proper sign for the price of time variable, irrespective of whether this variable was the price of maize, pyrethrum, or clean coffee. Even with the import price variable, all but two of the coefficients for the price of time variables were of proper sign. None of the coefficients nor the F values for the regressions were significant, however.

Summary

These tests of the price of time model based on crop prices as a proxy for the price of time for imports relevant to these producers, among other purchasers, yield mixed results. The import regressions of rice and bicycles, particularly when perversely performing variables are excluded for the latter, tend to support the price of time model hypothesis. The import demand regressions of tinned milk, and cotton piece goods are mixed in their results. The regressions for tea and radios tend to refute the price of time model hypothesis.

Both of the regressions which support the hypothesis and several of those with mixed results tend to have insignificant F values suggesting that additional variables of significance have been omitted. This could be due to the previously mentioned difficulty that the producers of these three crops are not the sole, nor perhaps the primary, importers of the tested imported commodities, despite the fact that these commodities are among the major imports into rural areas. The impossibility of isolating imports solely consumed by one of these producer groups makes a definitive test of the hypothesis in this form extremely difficult.

Conclusions

The conclusion to be gleaned from these empirical analyses, both the crop price and wage tests for the price of time model, is that when measured by the opportunity cost of time in the form of wage earnings, the model seems to perform better for Kenya but is less conclusive in its performance for all East Africa. The interpretation could be either that the model is not relevant or that the Kenyan price of time index is irrelevant for all East Africa. The latter interpretation would argue the possible relevance of the model but irrelevance of the data.

In the second type of test for the price of time model, where the proxy for the price of time is based on crop prices as the opportunity cost of time, the conclusion is ambiguous. This could be interpreted as a lack of support for the price of time hypothesis, but it could also be interpreted as a less than ideal test of the hypothesis due to the difficulty of isolating imports consumed solely by one particular group of producing units.

An alternative explanation for the better performance of the price of time tests in at least some situations could be that the ratio of earnings to employment used as a proxy for the price of time might be a better measure of income than is the official gross domestic product statistic, since they appear to be calculated differently.[1] Whereas the gross domestic product statistics attempt to compute the value of economic activity at factor cost throughout the entire economy, the statistics of employment and earnings are based on less inclusive annual enumerations of employees and self-employed persons. This enumeration, which since 1956 has taken place at the end of June, includes in employment all apprentices and part-time workers

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[1] I am indebted to Professor Ronald Findlay for pointing out this possibility.

but excludes directors and partners not serving on a basic salary contract while earnings or wages, which are put on an annual basis by multiplying by twelve the reported monthly earnings, "cover all cash payments, including basic salary, cost of living allowances, profit bonus, together with the value of rations and free board, and an estimate of the employer's contribution towards housing."[1] Included in the enumeration are such public services as the Kenya Government, Local Government Authorities, and the expenditures in Kenya of The East Africa Common Services Organization, East African Railways and Harbours, East African Post and Telecommunications, East African Airways Corporation and East African Cargo Handling Services, Ltd., while private sectors responding were in agriculture and forestry, mining and quarrying, manufactures and repairs, building and construction, electric light, power and water supply, commerce, and transport and communications.[2] Thus, these figures are limited solely to employees and their compensation during the reporting month which is then generalized into an annual estimate from data reported, presumably voluntarily, by employers who are sufficiently visible and of sufficient size to be part of the enumeration. While all these factors inhibit the accuracy of this data, national income accounting also has its inaccuracies. Thus, it is somewhat difficult to judge on this basis whether these enumeration earnings ratios or the official

[1]Republic of Kenya, Kenya Statistical Abstract (1968), p. 163.

[2]Republic of Kenya, Kenya Statistical Abstract (1968), pp. 163-166.

gross domestic product statistics would be the more accurate reflection of income. But if the former are a more accurate income estimate, this could also be an explanation for the superior statistical performance of the price of time model. Whether this explanation on the basis of data accuracy or the explanation on the basis of greater applicability of the price of time model is the more appropriate is difficult to judge.

CHAPTER III APPENDIX

TABLE 12

KENYA REGRESSIONS INCLUDING PRICE OF TIME
(13 Observations)

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Linear	-1.82	0.465		0.741		-0.672	
	(-1.82)	(0.420)		(1.00)		(-2.28)	
	-1.85		-0.905	1.23		-0.579	
	(-1.83)		(-0.412)	(2.38)		(-2.41)	
	-0.405	-0.963			1.57	-0.669	
	(-0.438)	(-1.03)			(2.76)	(-3.16)	
	-0.873		-1.43		1.28	-0.752	
	(-1.17)		(-0.937)		(3.90)	(-3.87)	
						-0.650	5.62
						(-3.52)	(1.47)
						-0.730	
						(-3.91)	
						-0.610	-6.08
						(-2.09)	(-1.79)
						-0.587	
						(-2.12)	

TABLE 12--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.807	8.37	1.26
				0.807	8.37	1.40
				0.889	16.0	1.85
				0.887	15.6	1.86
	1.44 (4.51)			0.876	21.2	1.35
1.21 (1.33)	1.32 (4.88)			0.871	20.3	1.49
		2.39 (1.82)		0.705	7.15	1.01
-1.59 (-1.86)			0.926 (2.44)	0.718	7.65	0.951

TABLE 12--Continued

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Log-Linear	-1.86 (-2.07)	3.22 (1.52)		0.167 (0.218)		-0.856 (-2.68)	
	-1.65 (-1.59)		0.623 (0.293)	1.02 (1.22)		-0.646 (-2.00)	
	-1.38 (-1.37)	1.22 (0.425)			0.876 (0.884)	-0.896 (-2.93)	
	-1.07 (-1.31)		-0.693 (-0.392)		1.52 (2.29)	-0.895 (-2.93)	
						-0.873 (-3.09)	0.267 (0.195)
						-0.910 (-3.13)	
						-0.706 (-2.39)	-2.07 (-2.52)
						-0.646 (-2.17)	

TABLE 12--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	G	D.W.
				0.777	6.96	1.22
				0.714	5.00	0.843
				0.796	7.81	1.18
				0.796	7.79	1.32
	1.37 (2.47)			0.792	11.4	1.20
0.453 (0.492)	1.45 (3.32)			0.797	11.8	1.21
		0.824 (1.70)		0.736	8.37	1.12
-1.51 (-2.24)			1.09 (2.36)	0.720	7.73	0.833

TABLE 13

KENYA REGRESSIONS, INCLUDING PRICE OF TIME, WITH EAST AFRICAN IMPORT PRICE INDEX
(13 Observations)

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Linear	0.367	0.250		0.712		-0.574	
	(0.257)	(0.190)		(0.760)		(-1.63)	
	0.458		0.359	0.785		-0.537	
	(0.251)		(0.109)	(0.846)		(-1.83)	
	-0.288	-1.23			1.77	-0.670	
	(-0.317)	(-1.61)			(3.55)	(-3.07)	
	-1.00		-2.58		1.63	-0.834	
	(-0.917)		(-1.43)		(3.42)	(-3.86)	
						-0.701	7.94
						(-3.39)	(3.14)
						-0.820	
						(-3.84)	
						-0.281	1.53
						(-0.828)	(0.385)
						-0.413	
						(-1.23)	

TABLE 13--Continued

P_m/P_d^W	P_t/P_m	GDP_r^C	GDP_r^W	R^2	F	D.W.
				0.730	5.40	0.962
				0.729	5.37	0.970
				0.888	15.8	1.81
				0.880	14.6	1.74
	1.63 (6.91)			0.882	22.5	1.74
1.96 (2.89)	1.55 (6.62)			0.872	20.4	1.64
		3.83 (2.82)		0.605	4.60	0.921
0.0121 (0.0119)			1.20 (2.89)	0.610	4.69	1.61

TABLE 13--Continued

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Log-Linear	0.612	2.47		0.0430		-0.630	
	(0.526)	(0.940)		(0.0459)		(-1.56)	
	1.28		2.34	-0.0757		-0.461	
	(1.05)		(0.976)	(-0.0741)		(-1.30)	
	0.397	-1.29			1.55	-0.786	
	(0.395)	(-0.505)			(1.67)	(-2.19)	
	0.112		-0.986		1.51	-0.862	
	(0.101)		(-0.465)		(1.64)	(-2.29)	
						-0.794	2.38
						(-2.45)	(2.22)
						-0.901	
						(-2.70)	
						-0.323	0.131
						(-0.806)	(0.108)
						-0.433	
						(-1.12)	

TABLE 13--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.668	4.03	0.859
				0.670	4.06	0.935
				0.754	6.13	0.983
				0.753	6.09	0.987
	1.94 (4.52)			0.774	10.3	1.18
1.65 (2.05)	1.78 (4.42)			0.762	9.60	1.13
		1.41 (2.40)		0.550	3.66	0.693
-0.0828 (-0.0906)			1.41 (2.57)	0.565	3.90	1.24

TABLE 14

KENYA REGRESSIONS, INCLUDING PRICE OF TIME, WITH CRAIG IMPORT PRICE INDEX
(11 Observations)

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Linear	-2.91	0.434		0.382		-0.400	
	(-0.757)	(0.349)		(0.710)		(-0.756)	
	-1.95		0.0869	0.491		-0.251	
	(-0.675)		(0.0478)	(1.09)		(-0.779)	
	-4.34	0.237			0.983	-0.812	
	(-1.33)	(0.263)			(1.87)	(-1.72)	
	-4.01		0.292		1.03	-0.764	
	(-1.51)		(0.206)		(2.15)	(-1.93)	
						-0.308	1.31
						(-0.903)	(0.216)
						-0.314	
						(-1.04)	
						-0.0976	-1.02
						(-0.250)	(-0.143)
						-0.0530	
						(-0.212)	

TABLE 14--Continued

$P_mP_d^W$	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.297	0.633	1.20
				0.283	0.592	1.11
				0.518	1.61	1.51
				0.516	1.60	1.50
	0.580 (1.32)			0.331	1.16	1.10
0.441 (0.348)	0.575 (1.56)			0.338	1.19	1.11
		0.698 (0.573)		0.202	0.592	1.05
0.0901 (0.0660)			0.284 (0.929)	0.207	0.609	1.10

TABLE 14--Continued

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Log-Linear	-4.47 (-1.02)	3.43 (0.856)		0.148 (0.216)		-0.854 (-1.09)	
	-1.24 (-0.458)		0.161 (0.0862)	0.487 (0.764)		-0.252 (-0.630)	
	-4.33 (-1.11)	1.78 (0.528)			0.858 (1.09)	-0.978 (-1.41)	
	-2.57 (0.966)		-0.0177 (-0.0113)		1.08 (1.48)	-0.697 (-1.37)	
						-0.528 (-1.04)	-0.820 (-0.291)
						-0.388 (-0.983)	
						-0.475 (-0.841)	-1.90 (-0.735)
						-0.126 (-0.369)	

TABLE 14--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.314	0.686	1.27
				0.225	0.435	0.954
				0.412	1.05	1.05
				0.377	0.909	0.996
	0.507 (0.803)			0.308	1.04	0.889
0.358 (0.252)	0.694 (1.47)			0.307	1.03	0.940
		0.176 (0.342)		0.255	0.797	1.04
-0.0536 (-0.0369)			0.438 (1.02)	0.210	0.622	0.978

TABLE 15

EAST AFRICAN REGRESSIONS INCLUDING PRICE OF TIME[a]

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Linear	-1.50	-0.275		1.29		-0.471	
	(-1.47)	(-0.369)		(2.64)		(-2.65)	
	-1.80		-1.02	1.35		-0.489	
	(-1.57)		(-0.636)	(3.31)		(-3.67)	
	-0.462	-0.878			1.50	-0.550	
	(-0.493)	(-0.843)			(2.42)	(-3.12)	
	-1.18		-2.65		1.57	-0.637	
	(-1.17)		(-1.29)		(3.30)	(-4.43)	
						-0.573	6.20
						(-3.67)	(2.12)
						-0.641	
						(-4.41)	
						-0.545	-3.42
						(-3.33)	(-1.31)
						-0.573	
						(-3.77)	

[a]The domestic price indices and the price of time index are all Kenya data, but are utilized along with East African data since comparable East African indices are not available.

TABLE 15--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.881	13.0	1.69
				0.885	13.5	1.91
				0.870	11.8	1.78
				0.885	13.4	1.98
	1.45 (6.50)			0.865	17.0	1.76
1.61 (2.33)	1.41 (6.95)			0.874	18.5	1.77
		3.89 (6.04)		0.847	14.8	1.51
-1.12 (-1.63)			1.27 (6.26)	0.850	15.1	1.57

TABLE 15--Continued

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Log-Linear	-1.29	0.0971		1.36		-0.746	
	(-1.43)	(0.0620)		(2.47)		(-3.55)	
	-1.55		-0.715	1.63		-0.734	
	(-1.52)		(-0.509)	(2.87)		(-3.89)	
	-0.341	-0.213			1.39	-0.807	
	(-0.381)	(-0.0976)			(1.82)	(-3.31)	
	-0.578		-1.14		1.74	-0.846	
	(-0.625)		(-0.599)		(2.25)	(-3.50)	
						-0.787	1.45
						(-3.51)	(1.56)
						-0.838	
						(-3.96)	
						-0.718	-1.20
						(-3.68)	(-1.70)
						-0.748	
						(-4.15)	

TABLE 15--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.846	9.58	1.56
				0.851	9.99	1.81
				0.802	7.09	1.35
				0.811	7.52	1.51
	1.79 (5.21)			0.807	11.2	1.52
1.20 (1.82)	1.74 (5.68)			0.822	12.3	1.59
		1.43 (5.86)		0.840	14.0	1.60
-1.15 (-2.04)			1.48 (6.31)	0.850	15.1	1.61

TABLE 16

EAST AFRICAN REGRESSIONS INCLUDING PRICE OF TIME WITH CRAIG MODIFICATIONS TO EAST AFRICAN IMPORT PRICE INDEX
(12 Observations)

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Linear	-2.83	-0.276		1.43		-0.460	
	(-1.52)	(-0.373)		(2.69)		(-2.62)	
	-2.99		-0.589	1.39		-0.487	
	(-1.51)		(-0.392)	(3.16)		(-3.62)	
	-0.935	-0.908			1.56	-0.553	
	(-0.579)	(-0.881)			(2.45)	(-3.17)	
	-1.78		-2.31		1.56	-0.634	
	(-1.04)		(-1.16)		(3.11)	(-4.32)	
						-0.576	5.48
						(-3.38)	(1.24)
						-0.630	
						(-4.19)	
						-0.561	-4.67
						(-3.12)	(-1.21)
						-0.565	
						(-3.56)	

TABLE 16--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.883	13.2	1.53
				0.883	13.2	1.57
				0.872	11.9	1.76
				0.881	12.9	1.75
	1.42 (5.86)			0.860	16.4	1.70
1.37 (1.42)	1.37 (6.58)			0.867	17.4	1.63
		3.70 (5.46)		0.844	14.4	1.36
-1.37 (-1.44)			1.22 (5.90)	0.841	14.1	1.41

TABLE 16--Continued

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Log-Linear	-2.29 (-1.37)	0.277 (0.176)		1.47 (2.42)		-0.761 (-3.49)	
	-2.41 (-1.35)		-0.254 (-0.191)	1.63 (2.63)		-0.739 (-3.73)	
	-0.444 (-0.288)	-0.242 (-0.110)			1.41 (1.80)	-0.802 (-3.17)	
	-0.697 (-0.455)		-0.898 (-0.486)		1.67 (2.09)	-0.831 (-3.33)	
						-0.799 (-3.45)	1.15 (0.821)
						-0.829 (-3.85)	
						-0.730 (-3.46)	-1.63 (-1.55)
						-0.729 (-3.83)	

TABLE 16--Continued

P_m/P_d^W	P_t/P_m	GDP_r^c	GDP_r^W	R^2	F	D.W.
				0.843	9.36	1.35
				0.843	9.38	1.44
				0.800	7.02	1.33
				0.806	7.29	1.41
	1.74 (4.72)			0.809	11.3	1.44
0.940 (1.00)	1.68 (5.43)			0.817	11.9	1.43
		1.33 (5.15)		0.833	13.3	1.38
-1.41 (-1.75)			1.40 (5.82)	0.836	13.6	1.38

TABLE 17

EAST AFRICAN REGRESSIONS INCLUDING PRICE OF TIME WITH CRAIG IMPORT PRICE INDEX[a]

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Linear	-0.507 (-1.19)	1.10 (0.695)		0.618 (1.22)		-0.719 (-1.12)	
	-4.04 (-1.10)		1.41 (0.519)	0.840 (1.45)		-0.529 (-1.07)	
	-5.10 (-1.31)	0.594 (0.390)			1.04 (1.66)	-0.839 (-1.40)	
	-3.79 (-1.27)		-0.109 (-0.0501)		1.12 (1.89)	-0.638 (-1.42)	
						-0.680 (-0.976)	-6.11 (-0.470)
						-0.259 (-0.549)	
						-0.690 (-0.947)	-11.0 (-0.797)
						-0.115 (-0.222)	

[a]The domestic price indices and the price of time index are all Kenya data, but are utilized along with East African data since comparable East African indices are not available.

TABLE 17--Continued

P_m/P_d^w	P_t/P_m	GDP_r^c	GDP_r^w	R^2	F	D.W.
				0.339	0.642	2.08
				0.312	0.567	1.86
				0.447	1.01	2.35
				0.431	0.945	2.17
	0.661 (1.17)			0.218	0.556	1.41
0.877 (0.432)	0.628 (1.09)			0.213	0.542	1.18
		1.56 (1.04)		0.187	0.461	1.64
0.147 (0.0534)			0.368 (0.653)	0.121	0.275	1.19

TABLE 17--Continued

	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c
Log-Linear	-6.79	4.96		0.722		-1.35	
	(-2.17)	(1.67)		(1.40)		(-2.34)	
	-4.33		1.82	1.15		-0.906	
	(-1.40)		(0.818)	(1.84)		(-1.54)	
	-6.93	4.53			1.03	-1.48	
	(-2.27)	(1.51)			(1.48)	(-2.55)	
	-3.55		0.293		1.46	-0.887	
	(-1.28)		(0.143)		(1.89)	(-1.57)	
						-1.36	-4.53
						(-2.48)	(-1.70)
						-0.747	
						(-1.28)	
						-1.20	-5.12
						(-2.24)	(-1.91)
						-0.619	
						(-1.11)	

TABLE 17--Continued

P_m/P_d^w	P_t/P_m	GDP_r^c	GDP_r^w	R^2	F	D.W.
				0.566	1.63	2.40
				0.406	0.853	2.18
				0.589	1.79	2.53
				0.420	0.903	2.05
	0.776 (1.39)			0.520	2.17	1.90
-0.561 (-0.288)	1.07 (1.59)			0.298	0.848	1.30
		0.547 (1.22)		0.486	1.89	2.06
-1.70 (-0.732)			0.823 (1.44)	0.256	0.694	1.53

TABLE 18

CROP PRICE REGRESSIONS FOR TINNED MILK IMPORTS

	Crop	No. of Obser-vatns.	P_m	P_t	T_m	R^2	F	D.W.
Linear	Maize	12	-0.709 (-1.15)	0.675 (1.50)	-0.937 (-2.03)	0.811	11.4	2.04
	Pyrethrum	12	-0.501 (-0.533)	-0.166 (-0.184)	-1.19 (-1.98)	0.759	8.38	2.01
	Coffee	11	-1.26 (-1.72)	1.00 (1.99)	-0.405 (-0.299)	0.857	14.0	2.35
Log-Linear	Maize	12	-5.57 (-3.46)	-1.00 (-0.932)	-4.86 (-3.75)	0.922	31.7	2.36
	Pyrethrum	12	-3.84 (-1.81)	-1.97 (-1.23)	-5.55 (-3.81)	0.928	34.2	2.61
	Coffee	11	-6.34 (-2.86)	0.773 (0.521)	-3.68 (-1.75)	0.918	26.2	2.20

TABLE 19

CROP PRICE REGRESSIONS FOR RICE IMPORTS

	Crop	No. of Obser-vatns.	P_m	P_t	T_m	R^2	F	D.W.
Linear	Maize	13	0.241 (0.186)	0.568 (0.435)	-2.92 (-1.84)	0.353	1.64	2.59
	Maize	13		0.577 (0.466)	-2.77 (-2.12)	0.351	2.70	2.59
	Pyrethrum	13	0.446 (0.285)	0.455 (0.211)	-3.12 (-1.97)	0.343	1.57	2.55
	Pyrethrum	13		0.115 (0.0670)	-2.89 (-2.22)	0.337	2.54	2.54
	Coffee	12	-1.00 (-0.610)	1.35 (0.942)	-0.527 (-0.299)	0.457	2.24	2.52
	Coffee	12		1.73 (1.40)	-0.934 (-0.593)	0.432	3.42	2.46

TABLE 19--Continued

	Crop	No. of Observatns.	P_m	P_t	T_m	R^2	F	D.W.
Log-Linear	Maize	13	-0.275 (-0.148)	1.00 (0.709)	-3.33 (-1.60)	0.364	1.71	2.57
	Maize	13		0.998 (0.743)	-3.48 (-2.05)	0.362	2.84	2.56
	Pyrethrum	13	-0.790 (-0.356)	-0.912 (-0.456)	-3.48 (-1.66)	0.343	1.57	2.44
	Pyrethrum	13		-0.537 (-0.330)	-3.86 (-2.24)	0.334	2.51	2.43
	Coffee	12	-2.18 (-0.836)	0.447 (0.237)	-1.33 (-0.237)	0.377	1.61	2.39
	Coffee	12		1.09 (0.640)	-2.17 (-0.848)	0.322	2.14	2.34

TABLE 20

CROP PRICE REGRESSIONS FOR TEA IMPORTS

	Crop	No. of Observatns.	P_m	P_t	R^2	F	D.W.
Linear	Maize	14	-12.7 (- 1.40)	-44.1 (- 0.888)	0.388	3.49	0.548
	Pyrethrum	14	-17.6 (- 2.32)	- 6.21 (- 0.109)	0.345	2.90	0.548
	Coffee	13	-18.1 (- 0.961)	-43.8 (- 0.908)	0.497	4.93	0.723
Log-Linear	Maize	14	- 5.67 (- 8.12)	- 0.349 (- 0.141)	0.904	51.5	1.32
	Pyrethrum	14	- 5.64 (- 9.52)	- 1.16 (- 0.463)	0.905	52.5	1.37
	Coffee	13	- 5.74 (- 4.37)	- 1.28 (- 0.474)	0.888	39.5	1.43

TABLE 21

CROP PRICE REGRESSIONS FOR COTTON PIECE GOODS IMPORTS

	Crop	No. of Obser-vatns.	P_m	P_d	P_t	T_m	R^2	F	D.W.
Linear	Maize	13	-0.575 (-1.59)	-0.447 (-0.368)	0.466 (1.21)	0.700 (0.700)	0.339	1.02	1.47
	Maize	13	-0.619 (-1.82)		0.287 (0.914)		0.250	1.67	1.37
	Pyrethrum	13	-0.419 (-1.17)	0.644 (0.410)	-0.296 (-0.495)	-0.350 (-0.264)	0.240	0.633	1.47
	Pyrethrum	13	-0.410 (-1.36)		-0.188 (-0.485)		0.206	1.30	1.36
	Coffee	12	-0.264 (-1.17)	-0.311 (-1.12)	-0.414 (-0.515)	0.380 (0.492)	0.632	3.00	1.59
	Coffee	12	-0.287 (-1.46)		-0.373 (-2.43)		0.617	7.26	1.58

TABLE 21--Continued

	Crop	No. of Observatns.	P_m	P_d	P_t	T_m	R^2	F	D.W.
Log-Linear	Maize	13	-0.542 (-1.40)	-0.927 (-0.297)	0.371 (0.962)	0.744 (0.699)	0.318	0.934	1.46
	Maize	13	-0.601 (-1.65)		0.204 (0.627)		0.221	1.42	1.33
	Pyrethrum	13	-0.408 (-1.08)	1.06 (0.271)	-0.186 (-0.376)	-0.0564 (-0.0424)	0.253	0.676	1.43
	Pyrethrum	13	-0.430 (-1.34)		-0.174 (-0.510)		0.211	1.33	1.35
	Coffee	12	-0.319 (-1.31)	-0.453 (-0.208)	-0.371 (-1.12)	0.188 (0.197)	0.626	2.92	1.49
	Coffee	12	-0.330 (-1.58)		-0.409 (-2.55)		0.623	7.44	1.51

TABLE 22

CROP PRICE REGRESSIONS FOR RADIOS

	Crop	No. of Obser-vatns.	P_m	P_t	T_m	R^2	F	D.W.
Linear	Maize	14	-2.73 (-4.98)	-2.31 (-2.38)	1.47 (0.528)	0.826	15.8	1.78
	Maize	14	-2.65 (-5.19)	-2.40 (-2.61)		0.821	25.3	1.72
	Pyrethrum	14	-3.14 (-4.85)	-0.902 (-0.568)	0.230 (0.670)	0.736	9.28	1.73
	Pyrethrum	14	-3.03 (-4.97)	-1.10 (-0.723)		0.724	14.4	1.60
	Coffee	13	-2.57 (-2.74)	-1.40 (-0.888)	-0.200 (-0.333)	0.739	8.49	1.62
	Coffee	13	-2.79 (-4.29)	-0.975 (-1.11)		0.736	13.9	1.68

TABLE 22--Continued

	Crop	No. of Obser-vatns.	P_m	P_t	T_m	R^2	F	D.W.
Log-Linear	Maize	14	-2.40 (-6.60)	-1.21 (-1.80)	0.311 (1.04)	0.874	23.0	2.21
	Maize	14	-2.36 (-6.50)	-1.30 (-1.94)		0.860	33.8	2.09
	Pyrethrum	14	-2.59 (-6.68)	-0.648 (-0.757)		0.842	17.7	2.17
	Pyrethrum	14	-2.54 (-6.61)	-0.779 (-0.921)	0.337 (1.00)	0.826	26.0	2.01
	Coffee	13	-2.20 (-4.25)	-1.04 (-1.06)	-0.227 (-0.380)	0.852	17.2	2.31
	Coffee	13	-2.33 (-6.10)	-0.728 (-1.42)		0.849	28.2	2.27

TABLE 23

CROP PRICE REGRESSIONS FOR BICYCLES

	Crop	No. of Obser-vatns.	P_m	P_t	T_m	R^2	F	D.W.
Linear	Maize	14	3.66 (1.20)	0.659 (0.643)	-0.277 (-0.174)	0.388	2.11	1.73
	Maize	14		0.729 (0.699)	-1.81 (-1.87)	0.301	2.36	1.53
	Pyrethrum	14	3.44 (0.815)	0.225 (0.116)	-0.470 (-0.247)	0.364	1.91	1.53
	Pyrethrum	14		1.30 (0.921)	-1.81 (-1.92)	0.322	2.61	1.39
	Coffee	13	3.06 (0.792)	0.570 (0.381)	-0.229 (-0.131)	0.392	1.94	0.972
	Coffee	13		1.23 (1.01)	-0.877 (-0.576)	0.350	2.69	0.950

TABLE 23--Continued

	Crop	No. of Obser-vatns.	P_m	P_t	T_m	R^2	F	D.W.
Log-Linear	Maize	14	4.80 (1.56)	0.0514 (0.0499)	0.267 (0.135)	0.394	2.16	1.76
	Maize	14		0.145 (0.133)	-2.24 (-1.83)	0.246	1.80	1.62
	Pyrethrum	14	5.45 (1.34)	-0.389 (-0.242)	-0.528 (-0.234)	0.397	2.19	1.77
	Pyrethrum	14		1.02 (0.810)	-2.09 (-1.76)	0.288	2.22	1.67
	Coffee	13	5.54 (1.44)	-0.506 (-0.324)	-0.0468 (-0.0208)	0.400	2.00	1.47
	Coffee	13		0.711 (0.516)	-1.43 (-0.673)	0.262	1.77	1.41

CHAPTER IV

DISAGGREGATED IMPORT DEMAND

Along with aggregate import demand, the demand for the various classes of imports is useful in understanding the impact of imports on an economy. The theoretical models and variables employed for aggregate demand are operative for the various import classes and need not be repeated here. The data sources and computations are available in the Data Appendix. The empirical results for each of the import classes analyzed in this chapter are available in Tables 25 through 42 in the Appendix to this chapter.

To put this analysis by import classes into perspective, Table 24 in the Appendix to this chapter summarizes the percentage of net imports accounted for by each SITC class for each of the three years, 1954, 1960, and 1966, as well as indicating the importance of tariffs in each class in terms of import duty collected. The general impact of this table is that classes 6 and 7, followed by classes 3 and 0 and 1 are the largest import classes, while classes 2 and 4 are the smallest with less than 2 percent each. Import duty collections are the largest in classes 6, 3, 0 and 1, and 7, the same four classes which were the largest import classes but in a different order of magnitude, while import duty collections are negligible in class 4 and minor in classes 2 and 9.

Coordination of Data

The primary problem preliminary to any import demand analysis or test of import models is the construction of consistent data series for imports and domestic commodity substitutes to be used in regression equations. In most cases a precise matching of categories from these two diverse sources is not possible, but normally several of the major imports found in a SITC class were also contained in a cost of living category.

Only the cost of living index (excluding rent) for Nairobi was employed as a proxy for the domestic price level in the analysis of disaggregated imports. The primary reason for not trying to reconstruct a wage earner's index of consumer prices in Nairobi, as done for aggregate imports, was that previous aggregate import tests did not reveal any consistently superior performance for the wage earner's index so that the costs of reconstructing such an index for individual SITC classes would appear to outweigh the apparent benefits from such an exercise.

Since the SITC classes 0 and 1, "food and live animals" and "beverages and tobacco," were both part of the same category in the cost of living index, entitled "Food, Drink, and Tobacco," coordination meant the amalgamation of the first two SITC classes. This was done by merging the import price and quantity indices from category 0 and category 1 into two new weighted indices, where the weights were the net import value in each class for the years 1954 through 1966. For the tariff index which is an index of the ratio of duty collected to import value in each class, the value of duty collected and the import value were summed for SITC classes 0 and 1 prior to the calculation of the ratio and index.

Imports in SITC classes 2 through 5 and class 7 were judged to have no relevant domestic price variable for one or both of two reasons: either the cost of living breakdown contained no comparable category or the production of close substitutes for imports in those classes was negligible. In SITC class 2, "crude materials, inedible--except fuels," both reasons were applicable. The major imports in this class are crude rubber, jute, and synthetic fibres, none of which is produced domestically in significant quantities, nor is a comparable cost of living category available.

"Mineral fuels, lubricants, and related materials," SITC class 3, would have had insignificant domestic production prior to 1963 and 1964 when crude petroleum imports originated. Even after these dates, crude petroleum, which is within this import class, is imported and not available domestically. Even now, true domestic substitutes for imports in this import class are insignificant so that a domestic price variable would not be relevant, and the applicable domestic cost of living categories, "transport" and "fuel and light" would reflect primarily import prices rather than prices of domestic production.

For SITC class 4, "animal and vegetable fats and oils," similar products may be produced domestically, but a domestic price variable was not assigned because a comparable cost of living category was not available. Imports of this class are also very minor, amounting to only one or two percent of total import value for the years 1954 through 1966, so that any errors resulting from this difficulty should not be serious for the import analysis as a whole.

"Chemicals," which are SITC class 5, would largely fall into the category of perhaps some but probably not major competition from domestic substitutes. Major imports in this class are medicinal and pharmaceutical products, manufactured fertilizers, insecticides, fungicides, disinfectants, etc., and chemical elements and compounds. Few of these are produced directly in the monetary economy in any significant quantities domestically. One possibly significant exception could be some local processing of pyrethrum competing with imported insecticides. Other exceptions could be traditional organic fertilizers and some locally produced processed fertilizers as competition for imported manufactured fertilizers and traditional medicines as competition with medicinal and pharmaceutical product imports. The one relevant entry in the cost of living index, pharmaceutical products, is likely to reflect import price changes more than pure changes in prices of domestic products and would not be an appropriate proxy for the domestic price variable in this import class. On these grounds a domestic price variable was omitted from empirical tests in SITC class 5.

"Machinery and transport equipment," SITC class 7, is represented, at least partially, in the cost of living index by a transport cost entry, but this could again be expected to reflect import costs more than domestic production costs. Transportation equipment and machinery, particularly capital equipment, are well known import items for virtually all the less developed countries, including Kenya. This again indicates that imports in SITC class 7 are unlikely to face significant competition from domestic production.

SITC class 6, "manufactured goods, classified chiefly by materials," vies with machinery and transport equipment as the largest import class by value and, since it contains considerable consumer goods, would be susceptible to competition from domestic production, particularly in simple manufactures. Many other imports of a more complex production process, while also in this import class, would not be in this position. This same mix of simple and complex manufactures would be expected in the remaining import class, SITC class 8, "miscellaneous manufactured articles."

Since the imports in these classes would face some domestic competition, the selection of a relevant domestic price variable arises. The two groups of commodities in the cost of living index containing manufactured commodities would be "household" and "clothing and footwear" categories. Which of these would be more appropriate for SITC class 6 and which for class 8 is problematical. Since household expenditures would tend to contain a wide range of manufactured commodities, it might be considered more relevant for the larger import class of manufactures, SITC 6, while both footwear and clothing, the latter presumably ready made to be sold off the rack, are imports in SITC class 8, and on this basis could be considered more appropriate as the domestic price variable for SITC class 8. The difficulty with this dichotomy is that yarns, fabrics, and piece goods, which could be made into clothing, are imports in SITC class 6, but could be part of the domestic cost of living category "clothing and footwear," if made into clothing before being sold to the consumer. However, among the available cost of living categories, the preceding dichotomy is the only feasible alternative if SITC classes 6 and 8 are to be analyzed individually.

If these two import classes 6 and 8 were to be combined into one import class labeled "manufactured commodities," this perhaps arbitrary dichotomy of the cost of living categories could be avoided. The method of aggregation could be a weighted average of the two classes, where the weights would be the import value of each class for each year.

In the empirical analysis, tests were run for both the combined and individual SITC classes 6 and 8. In the combined tests, a weighted average was employed in calculating the relevant domestic price, import price, and import quantity indices. For the individual import class tests, the household entries of the cost of living index were employed as a proxy for the domestic price variable in SITC class 6 while the clothing and footwear entries were employed as a proxy for SITC class 8.

The Theoretical Models and Their Applicability

Regression tests were obtained for both the traditional model and the price of time model in each of the import classifications. A discussion of the applicability of the latter model to each of the SITC import classes prior to the discussion of empirical results would help to clarify expectations. The former traditional model would, of course, be expected to apply to all import classifications.

Because the earnings proxy for the price of time is directly relevant only to the household from which the worker comes and to which wage earnings accrue, the effect on imports of changes in this statistic could be expected to be primarily felt in the importation of products familiar to the household. This could tend to make the analysis most relevant for imports which compete with products produced in the household or, at the least, for those imports which the household tends to consume as opposed to those imports utilized primarily by non-households such as commercial or industrial establishments.

Both of these requirements would largely be satisfied by the imports of food and drink, SITC classes 0 and 1, and possibly by import class 4, "animal and vegetable fats and oils," in that the latter commodities would be closely related to food and drink. SITC class 2, "crude material, inedible--except fuels," would appear to be primarily of interest to non-households, implying the likely poor performance of the model for this import class. All the other import classes would appear to contain a variety of commodities, some of which would satisfy the preceding dual requirements while others would not. SITC classes 3, "mineral fuels, lubricants and related materials" and 5, "chemicals," would likely be primarily industrial commodities, although they contain household commodities such as automobile and household fuels in the former class and such commodities as soaps, medicines, and perfumes in the latter class. Likewise, SITC class 7, "machinery and transport equipment," which contains household commodities such as automobiles and bicycles, would be primarily of industrial interest. Virtually all of the manufactured commodities in SITC classes

6 and 8 would be of mixed composition. The relevance of the model in these classes would tend to be directly related to the proportion of this commodity mix which would satisfy the above dual requirements. Unfortunately, it is difficult if not impossible to accurately determine these proportions for these classes either because the same commodity could be used by either party or because the description is insufficient to shunt a particular import into either grouping.

To summarize, the model on a priori grounds would appear to be irrelevant for SITC class 2 and should be relevant for SITC classes 0 and 1, and probably class 4. Of the remaining mixed classes, the bulk of the commodities in SITC classes 3, 5, and 7 would probably not qualify so that the model could perform poorly in these classes, while in the manufactured goods classes 6 and 8 a dichotomy is impossible to accurately determine so that the applicability of the price of time model for these classes is unknown.

SITC Classes 0 and 1

Table 25 in the Appendix to this chapter contains the import demand regression results for the combined imports in SITC classes 0 and 1. This table reveals good fits in terms of high correlation coefficients and F values, all of which are easily significant even at the 99 percent level, with the log-linear regressions yielding the better fits.

Traditional Model

For this import class, the variables with significant coefficients in both the linear and log-linear forms of the traditional model (first and last rows in each part of Table 25) are all the import price variables (P_m) and the relative commodity price variables ($P_m^{0,1}/P_d^{0,1}$). All of the above are also easily significant at the 99 percent level. A domestic price variable (P_d) and two tariff variables (T_m) also have significant coefficients in the log-linear regressions. Both of the monetary gross domestic product variables have improper negative coefficients while the real gross domestic product coefficients have proper signs but are not significant.

Price of Time Model

In the regressions of the price of time model, the import price coefficients are again all significant, as are all but one of the relative commodity price variables ($P_m^{0,1}/P_d^{0,1}$). One each of the domestic price and tariff variables is also significant.

While both of the monetary gross domestic product variable coefficients had improper signs, only one of the individual price of time variables has an improper sign, with a t value less than that for the improperly signed gross domestic product coefficient, while the other properly signed price of time coefficient is not significant. This indicates a somewhat better, but not admirable, performance for the price of time model than for the traditional model.

The comparison between the t values of the relative price of time and real gross domestic product variables for the linear regressions indicates the former is unanimously preferable. However, for the log-linear regressions, the general relative price of time variable (P_t/P_m) has a greater t value, but the specific relative price of time variable for this import class $(P_t/P_m^{0,1})$ does not have a t value greater than that for gross domestic product. Such a comparison of t values for ratio variables reveals that in all but one case the price of time variable is preferable to the gross domestic product variable. When monetary and relative variable coefficient comparisons are combined, the conclusion is that neither gross domestic product nor the price of time variables have powerful effects in this import class, but that the performance of the price of time variable is better than that for the gross domestic product variable.

In terms of R^2 and F values, the evidence is again mixed, but with some preference for the price of time variable. A comparison of regression pairs which differ only in that one uses the gross domestic product variable while the other substitutes the price of time variable for the gross domestic product variable, indicates that in terms of the value of R^2 two pairs favor the regressions containing the gross domestic product variables, two pairs favor the price of time variable, and for two pairs the correlation coefficients are of equal value. In terms of the F values, which tend to make finer distinctions, all but two of the regression pairs favor the price of time variable.

The majority of the evidence while not very powerful would indicate that in these first two SITC import classes, the price of time model has somewhat more support than does the gross domestic product import model.

Famine Variable

Table 26 contains, in addition to the preceding variables for the first two import classes, a dummy variable to account for famine conditions and their effect on food imports. The result is that none of the variables has a significant coefficient, and that the dummy famine variable has a negative coefficient on two occasions rather than the expected positive effect on food imports due to famine. In addition, the regressions of Table 26 are inferior to those of Table 25 as measured by the F value which would be the relevant measure since the degrees of freedom vary between Table 25 and Table 26. This failure of famine to show up as an effect on imports in these empirical tests may be due to the fact that not only do these famine imports tend to affect import quantity, but in most cases they also affect import price as measured by the unit value index since sizeable quantities are normally acquired at subsidized prices or as aid. Thus, the addition of the famine variable as an independent variable should be coupled with a modified import price variable which excludes the effect of these famine imports on the import price, or unit value index. When the famine variable is omitted, the result of famine food imports is that the relationship of greater import quantity during famine at a lower than normal import price is consistent with the stipulated model where lower prices for food imports could be the reason for larger imports of food during famine.

The Existence of Money Illusion

The hypothesis that money illusion does not exist can be tested with disaggregated data as was done earlier for analyses of aggregate data. Evidence in support of this hypothesis would be of the type where ratio variables yield better statistical results than that found for individual, or non-ratio, variables.

One test of this hypothesis was that of better fits for regressions employing ratios in comparison to individual variables. In SITC class combination 0 and 1, such a comparison indicates a greater F value for the regression employing monetary GDP as compared to real GDP for the linear regression, but not for the log-linear regression. The evidence for the absence of money illusion hypothesis is split with tests of the traditional model.

The price of time model tests reveal better fits for the ratio regressions, both for the specific $(P_t/P_m^{0,1})$ and the general (P_t/P_m) relative price of time variables, than for the individual variables, although the differences are not great. This evidence supports the absence of money illusion hypothesis.

A second test of the hypothesis was conducted with a comparison of the t values for ratio and non-ratio variables. In this import class, the individual import price variables had greater t values than did the relative commodity price ratio $(P_m^{0,1}/P_d^{0,1})$, although again the differences in several comparisons were not large. This result was valid for both the traditional and price of time import models and does not support the absence of money illusion hypothesis.

The monetary gross domestic product variable coefficients had improper signs in both the linear and log-linear regressions while the real gross domestic product coefficient, although not significant, had the proper sign and t value. Likewise, the t values of both the specific $(P_t/P_m^{0,1})$ and the general (P_t/P_m) relative price of time coefficients exceed those for the individual price of time variable

(P_t), one of which has an improper negative coefficient. Both the gross domestic product and price of time t values for coefficients support the absence of money illusion hypothesis.

To summarize, in terms of statistical fit, the traditional import model indicated that the linear regression results refuted the hypothesis but that the log-linear regressions supported the hypothesis. All the statistical fit results for the price of time model supported the hypothesis. In terms of individual coefficients, the commodity price variable results tended to refute the hypothesis but those for gross domestic product and the price of time variables supported the absence of money illusion hypothesis. The evidence is mixed, but the weight of the evidence leans toward supporting the absence of money illusion hypothesis.

SITC Class 2

Table 27 again indicates good fits, easily significant at the 99 percent level, for the regressions of import demand in SITC class 2. The linear form is slightly superior to the log-linear regression results.

Traditional Model

Both of the gross domestic product variables have coefficients significantly different from zero. All of the coefficients of the import price variables and the tariff variables are of improper sign and, except for one tariff variable coefficient, are not significant. For reasons indicated early in the chapter, domestic price variables were omitted from this, and several subsequent import classes.

Price of Time Model

As indicated by the second and third rows of Table 27, the two price of time variables are again the only source of coefficients significantly different from zero while the remaining coefficients are of improper sign, but insignificant. This would imply that in this import class income or price of time variables are the significant factors in determining import demand.

In this import class, the traditional model employing the gross domestic product variable is superior to the price of time model. The coefficients of the gross domestic product variables have greater t values than do the coefficients of the price of time variables, although all are highly significant. Likewise, the correlation coefficients and the F values are greater for the regressions employing the gross domestic product variables. One rationale for this not unexpected result discussed previously could be that the major commodities in this class, crude rubber, jute, and synthetic fibres, are primarily intermediate products which depend more on production level as measured by gross domestic product than on the price of time. This could also be an explanation for the insignificant roles played by the import price and tariff variables.

SITC Class 3

As can be noted from Table 28, the fit of the regressions in SITC class 3 is also good and easily significant, even at the 99 percent level, although not as large in magnitude, measured by the correlation coefficients and F values, as was true in previous SITC classes. The linear regressions yield better results than the log-linear regressions.

Traditional Model

The significant coefficients are again the gross domestic product coefficients with that for the linear regression being significant at even the 99 percent level. The tariff variables, while of proper sign, are not significant. The import price variable coefficients, while not significant either, are of proper sign only for the log-linear regressions. For reasons cited earlier, the domestic price variable was again omitted.

Price of Time Model

The significant coefficients for the price of time model are analogous to those for the traditional model. The only significant coefficients were for the price of time variable (including 99 percent significance in the linear regression) while the tariff variables were again of proper sign but insignificant, and the import price variables were of proper sign only for log-linear regressions.

In this import class, contrary to expectations, the price of time model is superior to the traditional model in all respects. The t values of the coefficients for the price of time variable exceed those for the gross domestic product coefficients. Likewise, the correlation coefficients and the F values of the regressions employing the price of time variable exceed those for regressions employing the gross domestic product variables.

SITC Class 4

The Kenyan regressions for SITC class 4 imports, "animal and vegetable oils and fats," yield good fits with F values between 18.8 and 24.5 and values of R^2 between 0.862 and 0.891. For both the traditional and price of time models, the linear regressions yield better fits than do the log-linear forms, although the differences between the linear and log-linear fits in the latter are negligible.

Traditional Model

The F values of both the linear and log-linear regressions of the traditional model are easily significant at the 99 percent level. The properly signed variables with significant coefficients are the gross domestic product variables. The variables with coefficients of improper sign are both of the import price variables and the tariff variables, one of which is just significant.

Price of Time Model

The F values of the price of time model regressions are also easily significant at the 99 percent level. The price of time variables have significant coefficients in both the linear and log-linear regressions, while again both tariff variables have coefficients of improper sign.

A comparison of the regressions for the two models reveals that for the linear regressions the traditional model has superior fit as measured by both the correlation coefficient and the F value. The t value of the coefficient for the gross domestic product variable exceeds that for the price of time variable. However, for the log-linear regressions the results are reversed. The F values and multiple correlation coefficients for the price of time log-linear regressions are greater than those for the traditional model. The t value of the coefficient for the price of time variable exceeds that for the gross domestic product variable. The statistical evidence from SITC class 4 is split in its support of the two import demand models. The expectation was one of possible, though not definite, relevance for the price of time model.

SITC Class 5

As indicated in Table 30, the fit of the demand regressions in import class 5 are again excellent. For the traditional model, the log-linear regressions yielded slightly better fits than did the linear regressions, while for the price of time model, the opposite was true.

Traditional Model

The gross domestic product coefficients are the only significant coefficients in the test of the traditional model. The tariff variable coefficients are not significant and one even has an improper sign. None of the import price variables has a significant coefficient, although all are of proper sign. The domestic price variables were again omitted for previously indicated reasons.

Price of Time Model

Again, the price of time variable was the only source of significant coefficients. The other coefficients were not significant but of proper sign.

In this import class, as expected, the traditional model yields results superior to those obtained by tests of the price of time model. The t values of the coefficients for the gross domestic product variables exceed those for the price of time variables, and the correlation coefficients and F values of the regressions containing the gross domestic product variables exceed those for regressions containing the price of time variables. The previously discussed reason for this might be that the major imports in this class which are medicinal and pharmaceutical products, manufactured fertilizers, insecticides, fungicides, disinfectants, etc., and chemical elements and compounds, would tend to be intermediate products more sensitive to production levels as measured by gross domestic product than to the price of time. This again could also explain the insignificant coefficients for the import price and tariff variables.

SITC Class 6

The empirical results for SITC class 6 are poor, with those for the log-linear regressions an improvement over the linear regression results. The multiple correlation coefficients and F values are very low and none of the latter are significant.

Traditional Model

None of the coefficients of the variables in the regressions are significant, although only the import and domestic price variables and ratios are of improper sign. All of the import price variables (P_m) and all of the relative price variables (P_m^6/P_d^6) are of improper sign while the two domestic price variables in the linear regressions have coefficients of improper sign.

The usual tariff and income or price of time variables, while having an influence in the direction expected, do not have a significant influence on imports of manufactured commodities which can be classified by material. Among the reasons for this failure of the empirical test of the models could be the deletion of another relevant variable, import substitution, much of which could be expected to occur in the field of simple manufactured goods, particularly consumer manufacturers. An attempt will later be made to test this hypothesis.

Price of Time Model

Again, none of the coefficients are significant, and several improper signs appear among the coefficients of the import and domestic price variables and their ratios. Among these poor empirical results, those for the price of time model are inferior to those for the traditional import demand model with gross domestic product as a variable. The multiple correlation coefficient and F values for the regressions with the monetary and real gross domestic product variables exceed those for the absolute and relative price of time variables. The t values of the gross domestic product coefficients also exceed those for the price of time coefficients. Of the relative price of time variables, the price of time relative to the price of imports in import class 6 (the specific price of time variable) has better empirical results than the price of time relative to imports in general as measured both by the t values of the coefficients and by the F values and correlation coefficients.

The Existence of Money Illusion

While the statistical results for SITC class 6 were poor and many of the variable coefficients were of improper sign, they might still have some marginal use in testing the absence of money illusion hypothesis. The overall fit as measured by the F values was consistently better for the regressions employing ratio variables than for the regressions containing non-ratio variables. This support for the absence of money illusion hypothesis was true for both the price of time and traditional import models.

All the import price variables and relative commodity price variables had improper positive signs, but for the traditional import model regressions, the relative price variable (P_m^6/P_d^6) had a lower t value and might on this basis be considered somewhat preferable. The opposite was true for the price of time model regressions. In this case, the coefficient t values for the traditional model marginally support the absence of money illusion hypothesis, but for the price of time model refute it.

The t values of the real gross domestic product coefficients in the traditional import model regressions exceed those of the monetary gross domestic product coefficients. Likewise, the coefficient t values for the relative price of time, both specific (P_t/P_m^6) and general (P_t/P_m) exceed that for the individual price of time variable. Both of these results support the absence of money illusion hypothesis.

In summary, the statistical fit tests supported the absence of money illusion hypothesis. The individual variable tests for the income and price of time variables were also in support of the hypothesis. Only in the traditional import model regressions, but not in the price of time model regressions, was the relative commodity price ratio somewhat preferable to the individual import price variable in support of the absence of money illusion hypothesis. With this one exception the statistical results of this import class, for what they are worth, support the absence of money illusion hypothesis.

SITC Class 7

The empirical results for import demand in SITC class 7, available in Table 32, are again poor. None of the F values is significant. For the traditional import model the log-linear regressions are slightly better while for the price of time model the reverse is true.

Traditional Model

None of the coefficients are significant. However, all are of proper sign.

Price of Time Model

While none of the coefficients of the variables in the regressions for the traditional model are significant, all but one of the coefficients in the regressions testing the price of time model are significant. The exception is the almost significant coefficient of the tariff variable in the log-linear regression. All of the regression coefficients are of proper sign.

The preceding discussion of the significance of all variables in the price of time regressions, including greater t values for the coefficients of the price of time variables than for the gross domestic product variables indicates that in this import class the price of time model has greater empirical validity than the traditional model. This somewhat unexpected conclusion is also supported by the greater multiple correlation coefficients and F values for the price of time regressions.

SITC Class 8

Unlike the preceding two import classes of manufactured commodities, and rather surprisingly since this is a miscellaneous manufactured commodities class, the empirical results in SITC class 8 are quite good and available in Table 33. All of the F values are significant, even at the 99 percent level. Although all are significant, the F values and multiple correlation coefficients of the log-linear regressions are consistently greater than for the linear regressions.

Traditional Model

All of the coefficients of the import price variables are significant at the 99 percent level. Both of the coefficients of the relative commodity price variables (P_m^8/P_d^8) are significant. None of the coefficients of the tariff variables or the gross domestic product variables are significant, and most of the former and one of the latter have improper signs.

Price of Time Model

In the regressions of the price of time model, both of the import price coefficients are significant, one at 99 percent, and one of the two domestic price variables is significant. The two relative commodity price variables linked with the general relative price of time (P_t/P_m) are significant, but those linked with the specific relative price of time (P_t/P_m^8) are not. None of the price of time variables nor the tariff variables are significant and many are of improper sign. The two specific relative price of time variables (P_t/P_m^8), however, have coefficients of proper sign. Since similar results were obtained for the traditional model, these tests indicate that prices rather than income or tariff variables exert the major influence in this miscellaneous manufactured commodity class.

With the one exception for the linear regression of monetary gross domestic product compared to that of the price of time, the multiple correlation coefficient and F values of the gross domestic product regressions exceed those for the price of time regressions.

In terms of t values for coefficients the test results are more complex because of a proliferation of improper signs. For the linear regression results with variables in absolute rather than relative terms, both the gross domestic product and price of time variables have improper signs, but the t value of the gross domestic product coefficient is not as great as the price of time coefficient so that the former might be considered somewhat preferable. In the comparison of the real gross domestic product and the relative price of time coefficients, the former is preferable to the specific relative price of time variable due to a larger t value and preferable to the general price of time variable because of its improperly signed coefficient. In all these comparisons, the gross domestic product variable is preferable to the price of time variable.

Precisely the same argument is valid for the relative price of time and real gross domestic product variable coefficients in the log-linear regressions. In the comparison of the monetary gross domestic product and the price of time variable coefficients for the log-linear regressions, the gross domestic product variable is again preferable; but this time both have proper signs and the t value of the coefficient for the gross domestic product variable exceeds that for the price of time variable.

To summarize, the traditional model has the greater explanatory power in five out of six comparisons, and the gross domestic product variable is at least marginally preferable to the price of time variable in all six comparisons.

The Existence of Money Illusion

For the traditional import model the statistical fit as measured by the F value is considerably better for the ratio variables than for the individual variables, tending to support the absence of money illusion hypothesis. For the price of time model, the same result is true for the log-linear regressions. The opposite is true for the linear regressions where the individual variable yield preferable results and tend to refute the absence of money illusion hypothesis.

For the traditional model, better t statistic values for the relative commodity price variable are indicated by both the linear and log-linear regressions. For the price of time model, the log-linear regressions yield better t values for the individual import price variable. In the price of time linear regressions, the regression containing the specific relative price of time (P_t/P_m^8) indicates that the individual import price ratio is preferable, but that containing the general relative price of time (P_t/P_m) does not. To generalize, the import price variable t value comparisons in the traditional model regressions tend to support the absence of money illusion hypothesis, while all but one of the price of time regression import price t value comparisons refute the absence of money illusion hypothesis.

The t values of the real gross domestic product variable are preferable to those for monetary gross domestic product and tend to support the hypothesis. In one case, the monetary gross domestic product variable coefficient is of improper sign and in the other its t value is below that for the real gross domestic product variable coefficient.

The t values of the coefficients for the relative price of time variable, with the exception of the log-linear regression employing the general relative price of time (P_t/P_m), are preferable to those for the individual price of time variable. Three out of the four comparisons in this import class support the hypothesis.

In summary, all the tests of the traditional model and approximately half the tests of the price of time model support the absence of money illusion hypothesis. The general impact of empirical tests in SITC class 8 is that the absence of money illusion hypothesis has considerable support.

SITC Classes 6 and 8 Combined

To test the possibility that a dichotomy between SITC classes 6 and 8 is arbitrary and inappropraite for tests of import demand, these two classes of manufactured goods were combined for import demand regressions tabularized in Table 34. As is evident from a glance at the correlation coefficients and F values in that table, the results are inferior to that obtained from each class separately. None of the individual coefficients are significant and many are of improper sign. Since the individual classes yield superior results, they will be utilized in the place of combined regressions in this and all further disaggregated analyses.

Supplementary Regressions by SITC Classes

Because of the proliferation of coefficients of improper sign for the import price, domestic price and/or tariff variables in many of the regressions for all SITC classes except class 0 and 1 and class 7, supplementary regressions were run without the offending variable or variables. Tables 35 through 42 in the Chapter IV Appendix contain these regression results for SITC classes 2 through 8.

SITC 2

Both the tariff and import price variables were of improper sign in this import class. The regressions omitting these variables had F values between 50 percent and 200 percent greater and increased the t value for both of the price of time coefficients and one of the gross domestic product coefficients, all of which were already significant. The traditional model still performed better, both in terms of F value and t value. The statistical fit of the log-linear regressions was now better than the linear regressions.

SITC 3

While the log-linear regressions had no improper signs in this import class, the linear regressions yielded improper signs for the import price variable coefficients. The regressions without this import price variable generated F values over 50 percent greater than the previous regressions and slightly increased the t values for the gross domestic product and price of time variable coefficients, all of which were previously significant, and for three of the four tariff variable coefficients, none of which are or were significant. The price of time model was still preferable to the traditional model both in terms of F and t values, while the linear regressions were still preferable to the log-linear regressions.

SITC 4

In this import class, the import price variables for the traditional model and all the tariff variables were plagued with improper signs. The regressions without these two variables have F values two to three times greater and slightly larger t values for the previously significant coefficients of the gross domestic product and price of time variables. In these regressions the performance of the price of time model as measured by both the F and t values was now preferable to that of the traditional model, as originally expected. In the earlier regressions the results were mixed. The statistical performance of the log-linear regressions are now slightly better than the linear regressions, a reversal of the original regression results.

SITC 5

While only one of the tariff variables in this import class had a coefficient of improper sign, supplementary regressions without the tariff variable were attempted. The results were F values approximately 50 percent greater and slightly improved t values for all the previously significant gross domestic product and price of time variable coefficients and one of the import price variable coefficients. None of the latter is significant. The performance of the traditional model by both tests is still preferable to the price of time model. The evidence for the linear vs. log-linear choice is still split with the log-linear results preferable for the traditional model while the reverse is true for the price of time model.

SITC 6

For this import class, where the statistical fit was the poorest of any class, all the coefficients of the import price variable and relative price variable as well as the linear regression portion of the domestic price variable coefficients were of improper sign. When the former import and relative price variables were dropped from the regressions, the F values of the traditional model regressions improved while those of the price of time model regressions declined, as indicated in Table 39. The t values of the coefficients for the gross domestic product variable, the price of time variable, the general relative price of time variable, and all except two of the tariff variables increased. The two specific relative price of time variable coefficients and their associated tariff variable coefficients decreased, as did the two coefficients for the domestic price variables in the log-linear regressions which were of proper sign. The remaining two domestic price variable coefficients were still of improper sign.

When the domestic price variable was also dropped from the regressions, the F values for the traditional model regressions improved some more while those for the price of time model increased to the point where they exceeded those for the original regressions. The t values of the coefficients of all the remaining variables also increased. None of the F or t values, despite some improvement, became significant.

With the exception of two price of time regressions, the linear regressions still outperformed the log-linear regressions. Unlike the original regressions, the general price of time variable now is preferable to the specific price of time variable. The implication for the absence of money illusion hypothesis, when employing the price of time and gross domestic product variables but no commodity price variables, is one of support by the traditional model but non-support by the price of time model, while previously both supported the hypothesis. While both models still performed poorly, the traditional model performed somewhat better than the price of time model.

Import Substitution Model

In an attempt to improve the statistical fit of the regressions in SITC class 6, an import substitution variable (M_s) in the form of an index of manufacturing output was added to the regressions. The coverage of this index is greater than that of imports in SITC class 6,[1] but should nonetheless be generally representative of changes in the domestic output of substitutes for imports in this class.

The addition of this variable to the original regressions improves the F value for the regressions of the traditional model but decreases it for the price of time model regressions. The addition of this variable to supplementary regressions which excluded improperly performing variables increased the F values for all regressions except those employing the individual price of time variable.

[1]See the Data Appendix for a full discussion.

Performance of the Import Substitution Variable

The import substitution variable, when added to the initial regressiosn containing all the variables, is of proper sign in all of the traditional model regressions, and approaches significance in one of the linear regressions. For the price of time model regressions, the import substitution variables were not significant and were of improper sign for the two regressions containing the general relative price of time variable.

In the regressions which excluded all domestic, import, and relative price variables, the traditional model yielded import substitution variables of proper sign, and in one regression it was significant while in the remaining regressions it was nearly significant. For the price of time model regressions, all the import substitution variable coefficients were now of improper sign.

For the regressions containing the full complement of variables, all the domestic price and import price variable coefficients both absolute and relative were now of improper sign. The t values of two real and one monetary gross domestic product variable coefficients improved sufficiently to become significant. A slight improvement occurred in the t value for the individual price of time variable coefficients, but a fall occurred for the t values of the specific relative price of time variable coefficients and the general relative price of time variable coefficient now has an improper sign. The t values of all except two tariff variable coefficients declined.

When the domestic and import price variables, including the relative price variable, are excluded from the regressions with the import substitution variable, all but one of the F values for the traditional model further improves, but none are yet significant. The F values of the individual price of time and general relative price of time regressions improve slightly, but that for the specific relative price of time falls slightly. The t values of the real gross domestic product variable coefficients improve and remain significant, but those for the monetary gross domestic product variable coefficients decline and are no longer significant. The t values of the individual price of time variable coefficients decline and those for the relative price of time are now both of improper sign.

When compared with the supplementary regressions which excluded the domestic and import price variables, including the relative price variables, the addition of the import substitution variable leads to an improvement in the t values of the gross domestic product variables while those for the tariff variables declined. For the price of time model regressions, the t values of the individual price of time variable coefficients declined and all the relative price of time variables were now of improper sign.

Money Illusion Test

The test of the absence of money illusion hypothesis with the substitution variable in this import class reveals support as indicated by the F values of regressions with ratio variables exceeding those for the individual variables in all but one comparison for the price of time model where the F values were identical. This exception was the price of time model regression which excluded the improperly signed variables. The t test for the money illusion hypothesis was less consistent. For the traditional model, the regressions employing all variables indicated lower t values for the ratio variables than for the individual variables, but the reverse was true for the supplementary regressions with excluded variables tending to have coefficients of improper sign. For the price of time model, most regressions tended to have lower t values and even improperly signed coefficients for the ratio variables in comparison with the individual variables. The only exceptions were the regressions employing all variables along with the specific relative price of time. Consistent with this result is the tendency for the specific relative price of time to perform better than the general relative price of time.

Conclusion for SITC 6 Supplementary Regressions

The general conclusion is that for the traditional model both the addition of an import substitution variable and the exclusion of the import, domestic, and relative price variables tended to statistically improve the regressions for the import demand in SITC class 6. For the price of time model, however, the regressions yielded mixed results.

SITC 7

The regressions of this import class had no coefficients of improper sign, but consistently had very poor statistical fits. Since the coefficient with greatest t value in each of these regressions was the gross domestic product or price of time variable, supplementary regressions with these as the sole variables were run to see if better fits might result. The conclusion, verified by Table 41, is that the results of these supplementary regressions were not as good as the original regressions, both as measured by the F value and by the t value of the coefficients of each variable.

SITC 8

The tariff variable had an improper sign in all but two of the regressions in this import class. When omitted, the already significant F values increased in all regressions. The increases were up to 50 percent. The monetary gross domestic product and the individual price of time variables still had improper signs in the linear regressions, although the log-linear regressions and the remaining variables were correct. The coefficients of the relative price of time variables and the real gross domestic product variables were now significant, whereas previously none were significant. The import price variables and four of the six relative price variables, whose t values increased in these supplementary regressions, remained significant. Thus, the exclusion of the tariff variable improves the performance of the data in this import class of miscellaneous manufactured articles, indicating that tariffs do not play an empirically important role in the import of these commodities.

As was the case initially, log regressions performed better and with one exception the traditional model outperformed the price of time model, in terms of F value for the regressions and in terms of t value for the coefficient of the gross domestic product variable as compared to the coefficient of the price of time variable. The exception, the same as in the previous regressions, was the comparison between the linear regression with the individual price of time variable and that with the gross domestic product variable.

The traditional model supported the absence of money illusion hypothesis by its greater F values for regressions with relative variables and by its greater t values for the relative variables. The t values for all relative price of time variable coefficients exceeded those for the individual price of time variable, but the F value of the relative variable regressions consistently exceed those for the individual variable regressions only in the linear regressions. In the log-linear regressions the F value for the specific relative price of time regression exceeded that for the individual price of time regression but that for the general relative price of time regression was slightly below that for the individual price of time regression.

Summary of Supplementary Tests

The major emphasis that emerges from these supplementary regressions is that, except for import class 6 where the complex results were mixed and import class 7 where proper signs but poor fit were originally obtained, the exclusion of coefficients of improper sign generally improved the empirical results. The addition of an import substitution variable in SITC Class 6 tended to improve the performance of the traditional model but not the price of time model.

Summary and Conclusions

The impact of this disaggregated import demand analysis is that except for SITC classes 6 and 7 which are "manufactured goods classified chiefly by material" and "machinery and transport equipment," respectively, both the traditional and price of time import models yield empirically good results.

Original Regressions

In the initial regressions employing the full complement of variables, the price of time model yielded better empirical results than did the traditional model for SITC classes 0 and 1, 3, and 7. The results of class 4 were split, with the linear regressions supporting the traditional model and the log-linear regressions supporting the price of time model. While the results in class 6 were extremely poor with either model, those in classes 2, 5, and 8 tended to support the traditional model as opposed to the price of time model. Except for the mixed results for class 4 which earlier were considered as possibly relevant to the price of time model and the support for the price of time model in classes 3 and 7 where imports were considered mixed and probably primarily commercial or industrial rather than household imports, these results are according to expectations. Apparently automobiles and related imports in class 7 and various types of household and automobile fuels in class 3 were sufficient to empirically support the price of time model in these import classes.

In the comparison of the general with the specific relative price of time variables, import class 0 and 1 was split with the specific variable yielding better results in the linear regressions and the general price of time variable yielding better results in the log-linear regressions. The specific price of time variable performed unambiguously better in import classes 6 and 8.

Linear regressions performed better than the log-linear regressions in import classes 2, 3, and 4. The reverse was true for classes 0 and 1 and class 8, while results were split in import classes 5 and 7, and poor in all cases for import class 6.

The evidence from tests of the money illusion hypothesis was also mixed. The bulk of the evidence in SITC class 0 and 1 and class 8 supported the absence of money illusion hypothesis, as did the evidence from analyses of SITC class 6, where the statistical results were quite poor. The general conclusion from this disaggregate import analysis is one of support for the absence of money illusion hypothesis.

The independent variables which had significant effects on imports varied among classes. The domestic price variable was significant several times in class 0 and 1, once in class 8, and not at all significant in its effect on imports in class 6. The domestic price variable was not employed in the other import classes. The import price variable had significant coefficients in all regressions in import classes 0 and 1 and class 8 and was significant for the two price of time regressions in import class 7. In import classes 2, 3, and 4, it was plagued with improper signs and in the remainder played an insignificant role. The relative commodity price variable was again insignificant in its effects on import class 6, but was significant in four of six regressions in import class 8 and all but one of the regressions for combined import class 0 and 1. The tariff variable was significant on three occasions in import class 0 and 1, and in one price of time regression in import class 7. The tariff variable was of improper sign in import classes 2 and 4 and on one occasion in import class 5. In the remaining import classes, tariffs played an insignificant role. The gross domestic product and price of time variables were both significant in import classes 2, 3, 4, and 5, but only the price of time variable was significant in import class 7. In the remaining classes both had insignificant impacts on imports.

Supplementary Regressions

Except for SITC classes 0 and 1 and 7, where variables with coefficients of improper sign were not prevalent, supplementary regressions which excluded variables susceptible to improperly signed coefficients tended to improve the statistical fit of such regressions, as measured by F values. The primary exception would be the price of time model regressions for SITC class 6. Even here the traditional model regressions were improved by such exclusions.

The primary modifications which these supplementary regressions suggested to the aforementioned conclusions for the original regressions include strengthening the case for the statistical superiority of the log-linear regressions compared to the linear regressions.

In SITC classes 2 and 4, where previously linear regressions were superior, the log-linear regressions are now statistically preferable. Linear regressions still performed better in import class 3 while evidence was split in import classes 5 and 7 and poor in all cases in class 6.

The case for the price of time model was also strengthened by the supplementary regressions in that SITC class 4 regressions now indicate better results for the price of time model as compared to the previous mixed evidence. This result is in agreement with prior expectations. Import classes 0 and 1, 3, 4, and 7 now yield better results for the price of time model than for the traditional model. SITC class 6 results are still poor with either model but tend to support the traditional model as do classes 2, 5, and 8. The previous rationale for these results would still apply.

In addition to the variables isolated previously as having significant coefficients, the supplementary regressions for SITC class 8 indicate significant coefficients for the real gross domestic product variable and both of the relative price of time variables.

The bulk of the evidence from the supplementary regression tests for money illusion, although still mixed, points to support of the absence of money illusion hypothesis. The supplementary regression SITC 6 results, although still poor, indicate support of the absence of money illusion hypothesis for tests of the traditional model but not for the price of time model. SITC 8 regressions for both models tend to support the hypothesis.

The addition of an import substitution variable for SITC 6 imports improved the performance of the traditional model regressions but not that of the price of time model regressions. The implications of money illusion tests which included this import substitution variable were generally in support of the absence of money illusion hypothesis in terms of the F values, but were less conclusive in terms of the t value comparisons. For the traditional model tests, most of the t value comparisons supported the absence of money illusion hypothesis, particularly when variables with improperly signed coefficients were excluded; but for the price of time model tests, most of the ratio variables were of improper sign and thus tended to refute the absence of money illusion hypothesis.

Comparison with Other Disaggregated Import Demand Studies

While other studies of disaggregated import demand have utilized varying degrees of disaggregation and have found various results or degrees of success in explaining import demand, many have found income or price in some form, among other variables, to be significant factors. In addition, some studies[1] and considerable prevailing opinion indicate that crude or primary products tend to be price and income inelastic while manufactured commodities tend to be price and income elastic. These two aspects of elasticity and significant

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[1] See, for example, Mordechai E. Kreinin, "Price Elasticities in International Trade," The Review of Economics and Statistics, 49:4 (November, 1967), 514-515, and H.S. Houthakker and Stephen P. Magee, "Income and Price Elasticities in World Trade," The Review of Economics and Statistics, 51:2 (May, 1969), 120-121.

variables would appear to be one appropriate basis of comparison for this study with others, while a second more specific basis for comparison would be another Kenyan study which, as part of an economic model for the Kenyan economy, briefly analyzed the demand for disaggregated imports.

The present study found import prices and/or relative commodity prices to be significant in SITC classes 0 and 1, 8, and to a lesser extent, class 7; while both income and price of time variables were significant in classes 2, 3, 4, and 5, with only the price of time variable significant for class 7. In addition, tariffs were a significant factor in class 0 and 1 and to a lesser extent in class 7. So, not unlike other studies, price or income variables were significant factors in many of the import classes, but other variables such as tariffs also played a significant role in some import classes.

The estimated income and price of time elasticities, employing only significant log-linear regression coefficients, were found in this analysis to be greater than one for SITC classes 2, 4, and 5; slightly above one for supplementary regressions in class 8; but less than one for class 3. Only the price of time coefficient was significant in class 7 where the elasticity was also greater than one; but the relative price of time elasticities in SITC class 8 supplementary regressions were less than one. The price elasticity estimates were greater than one for class 0 and 1, approximately unitary for class 8, and mixed for class 7. For import class 6, containing manufactured goods classified by material, results were consistently poor, although with an import substitution variable one monetary and two real gross domestic product coefficients were significant, one of which was an elastic log-linear coefficient. All the significant tariff elasticities were less than one.

All these elasticity results yield mixed and inconclusive evidence for price or income elasticity for manufactured commodities, but considerable evidence of price elasticity for class 0 and 1 (food, beverages, and tobacco) and also for income elasticity in SITC classes 2, 4, and 5, which are not manufactured commodities import classifications. SITC 3 (mineral fuels, lubricants, and related materials) did support the original contention of price inelasticity for other than manufactured commodities.

Just as other aggregate import demand studies had some variables with insignificant or improperly signed coefficients, other studies on disaggregated import demand had similar problems. To cite one example from among the less developed countries, the study of import demand in Nigeria for 15 commodities by S.O. Olayide encountered both problems.[1]

The study specifically relevant to East Africa which spent some time in estimating the demand for four groups of imports while constructing a general model of the Kenyan economy is by Faaland and Dahl.[2] Their disaggregation was not by SITC class, but by the categories of

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[1] S.O. Olayide, "Import Demand Model: An Econometric Analysis of Nigeria's Import Trade," The Nigerian Journal of Economic and Social Studies, 10:3 (November, 1968), 303-319.

[2] Just Faaland and Hans-Erik Dahl, The Economy of Kenya (Bergen: The Chr. Michelsen Institute, July, 1967), III,3-III,12.

capital goods, consumer durables, consumer non-durables, and input goods and their dependent variables were stated in value terms rather than volume. While their classifications are not directly comparable to those of this study, it might be interesting to comapre the performance of the non-durable consumer goods and input goods imports from outside East Africa with those of some of the SITC classes to which they are related.

For non-durable consumer goods imports composed primarily of food, textiles, and clothing, it is interesting to note that the present study found a statistical fit of the data in terms of R^2 for the food category in SITC class 0 and 1 which was more than 50 percent greater than that of their broader classification. For textiles and clothing, to the extent they fall into SITC class 8 which contains some clothing and footwear[1] the results of the present study were also considerably better in terms of an R^2 approximately 50 percent greater.

Likewise, to the extent that the input import class which contains "imports of intermediate products of all kinds, including *inter alia* heavy fuels, industrial raw materials and semi-manufactures, as well as fertilizers, seeds and other inputs in the agricultural production process,"[2] corresponds with imports in SITC classes 2 through 5, the statistical fit in terms of R^2 is also better for the SITC class

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[1]See the net import sections of any Republic of Kenya, *Kenya Statistical Abstract* such as that for 1968, pp. 55 and 58.

[2]Just Faaland and Hans-Erik Dahl, *The Economy of Kenya* (Bergen: The Chr. Michelson Institute, July, 1967), p. III,7.

import demand regressions found in this study. However, to the extent that imports in their broader import classes, such as capital goods and consumer durables, fall into SITC class 6 or even 7 where the results of the present study were rather poor, the Faaland and Dahl results would be preferable.

Another difference between these two studies is in the specific variables employed in import demand related to food. The present study found that import price or relative price variables along with tariffs were the major significant variables, whereas Faaland and Dahl utilized only the gross domestic product variable for consumer non-durable import demand.

With reference to income elasticities, Faaland and Dahl found the income elasticity for non-durable consumer goods to be less than 0.5. For intermediate goods the income elasticity was about 0.67 with respect to gross domestic product when it was the sole variable or 1.2 with respect to industrial output when it was the sole variable, and about 0.8 for industrial output and 0.3 for gross domestic product when both were employed simultaneously.[1]

In comparison, the food demand log-linear regression coefficients in this study found income to have an insignificant effect on food imports, and occasionally even having a negative coefficient, while price and tariff variables played the significant roles. For SITC class 8, the other primary component of consumer non-durables the

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[1]Just Faaland and Hans-Erik Dahl, The Economy of Kenya (Bergen: The Chr. Michelson Institute, July, 1967), p. III,12.

real income elasticity was slightly greater than one. Thus, while the combined elasticity would be less than one and perhaps near the 0.5 they found, considerable variation between food and the other non-durable consumer goods appear hidden within that composite figure.

In intermediate goods, the present study found imports in all SITC classes 2 through 5 to be elastic, sometimes as high as 2 or 3, except for SITC class 3. This highly elastic estimate would tend to be inconsistent with their estimates for income elasticity associated with gross domestic product and would even be greater than that associated with industrial output.

In general, it appears that further disaggregation into SITC classes is useful for certain purposes such as statistical fit or forecasting or for certain commodity classes such as consumer non-durables or intermediate commodities. But for other commodities such as the large group of heterogeneous manufactured goods classified by material, the broader disaggregations into capital goods and consumer durables utilized by Faaland and Dahl lead to perferable results.

CHAPTER IV APPENDIX

TABLE 24

RELATIVE IMPORTANCE OF SITC CLASSES

SITC Class	Percentage of Total Net Import Value			Import Duty Collected (£1,000)		
	1954	1960	1966	1954	1960	1966
0 and 1	8.99	6.58	11.39	2,331	2,343	4,066
2	0.59	1.18	1.73	34	23	165
3	1.36	11.43	10.52	676	1,788	4,965
4	0.39	0.69	1.42	22	8	10
5	3.69	7.44	7.84	173	273	588
6	34.91	30.57	23.69	1,913	3.103	6,387
7	26.77	29.91	32.29	604	1,449	3,247
8	4.90	7.40	6.84	365	922	1,728
9	8.39	4.81	4.28	787	513	288

TABLE 25

KENYA IMPORT DEMAND REGRESSIONS FOR SITC
CLASSES 0 and 1 COMBINED
(13 Observations)

	P_m	P_d	GDP	P_t	T_m	$P_m^{0,1}/P_d^{0,1}$
Linear	-3.08 (-5.92)	1.78 (1.73)	-0.145 (-0.194)		-0.436 (-0.925)	
	-3.12 (-6.03)	1.39 (1.24)		0.149 (0.200)	-0.374 (-0.756)	
					-0.195 (-0.401)	-4.30 (-1.26)
					-0.307 (-0.584)	-9.45 (-5.29)
					-0.491 (-0.924)	-10.2 (-5.73)
Log-Linear	-1.44 (-7.19)	3.50 (3.15)	-0.510 (-1.30)		-0.587 (-2.57)	
	-1.44 (-7.00)	3.51 (2.90)		-0.479 (-1.18)	-0.634 (-2.58)	
					-0.599 (-2.20)	-1.48 (-3.83)
					-0.557 (-2.07)	-1.52 (-6.78)
					-0.597 (-2.36)	-1.54 (-7.04)

TABLE 25--Continued

$P_t/P_m^{0,1}$	P_t/P_m	GDP_r	R^2	F	D.W.
			0.944	33.4	1.20
			0.944	33.5	1.04
0.779 (2.09)			0.937	44.9	0.695
	0.586 (1.51)		0.926	37.4	0.635
		1.69 (0.969)	0.916	32.6	0.659
			0.970	64.6	1.36
			0.969	62.3	1.42
0.0733 (0.251)			0.956	65.4	0.902
	0.139 (0.558)		0.957	67.2	0.920
		0.139 (0.386)	0.957	66.0	0.900

TABLE 26

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASSES 0 and 1 COMBINED WITH A DUMMY FAMINE VARIABLE

P_m	P_d	GDP	P_t	T_m	$P_m^{0,1}/P_d^{0,1}$
-3.63 (-2.03)	1.96 (1.60)	-0.177 (-0.221)		-0.510 (-0.929)	
-3.60 (-2.01	1.54 (1.18)		0.123 (0.154)	-0.440 (-0.764)	
				-0.0338 (-0.0612)	-0.114 (-0.0162)
				-0.241 (-0.405)	-7.73 (-1.28)
				-0.411 (-0.672)	-8.16 (-1.25)

TABLE 26--Continued

$P_t/P_m^{0,1}$	P_t/P_m	GDP_r	Famine	R^2	F	D.W.
			-26.9 (-0.327)	0.944	23.8	1.22
			-23.2 (-0.282)	0.944	23.7	1.05
0.856 (2.14)			54.8 (0.687)	0.941	31.8	0.780
	0.605 (1.46)		25.9 (0.301)	0.927	25.3	0.682
		1.84 (0.971)	30.2 (0.322)	0.917	22.1	0.707

TABLE 27

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 2
(13 Observations)

	P_m	GDP	P_t	T_m	R^2	F	D.W.
Linear	0.832 (0.958)	2.91 (11.8)		1.11 (3.26)	0.956	65.6	2.11
	1.08 (0.928)		2.48 (8.58)	0.729 (1.59)	0.921	35.1	1.86
Log-Linear	0.308 (0.748)	1.89 (11.7)		0.148 (1.71)	0.953	60.3	2.31
	0.491 (0.929)		1.61 (8.79)	0.0401 (0.360)	0.920	34.5	1.77

TABLE 28

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 3
(13 Observations)

	P_m	GDP	P_t	T_m	R^2	F	D.W.
Linear	0.0427 (0.0892)	0.783 (3.87)		-0.0152 (-0.255)	0.871	20.2	1.16
	0.0372 (0.0806)		0.764 (4.10)	-0.0380 (-0.622)	0.880	22.0	1.97
Log-Linear	-0.0827 (-0.201)	0.841 (2.89)		-0.0398 (-0.273)	0.849	16.9	0.899
	-0.000393 (-0.00101)		0.813 (3.03)	-0.0592 (-0.407)	0.856	17.9	1.63

TABLE 29

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 4

	P_m	GDP	P_t	T_m	R^2	F	D.W.
Linear	0.285 (0.104)	9.61 (7.02)		3.94 (2.33)	0.891	24.5	2.14
	-0.568 (-0.201)		7.48 (6.65)	2.19 (1.37)	0.881	22.2	2.37
Log-Linear	0.00301 (0.00265)	4.33 (3.07)		0.287 (0.962)	0.862	18.8	2.09
	-0.692 (-0.797)		3.01 (3.47)	0.0628 (0.302)	0.880	21.9	2.27

TABLE 30

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 5
(13 Observations)

	P_m	GDP	P_t	T_m	R^2	F	D.W.
Linear	-1.74 (-1.84)	2.14 (13.8)		0.0628 (0.104)	0.961	74.9	2.77
	-1.64 (-1.51)		1.79 (11.9)	-0.715 (-1.07)	0.949	55.8	2.60
Log-Linear	-0.703 (-1.53)	1.56 (14.4)		-0.0996 (-0.442)	0.965	83.5	2.84
	-0.570 (-0.999)		1.32 (11.4)	-0.395 (-1.46)	0.946	53.1	2.38

TABLE 31

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 6
(13 Observations)

	P_m	P_d	GDP	P_t	T_m	P_m^6/P_d^6
Linear	0.653	-0.135	0.296		-0.191	
	(0.687)	(-0.157)	(0.623)		(-1.01)	
	0.865	-0.0704		0.154	-0.147	
	(0.962)	(-0.0646)		(0.302)	(-0.691)	
					-0.180	3.22
					(-0.966)	(1.47)
					-0.109	2.44
					(-0.636)	(1.14)
					-0.195	1.31
					(-1.22)	(0.566)
Log-Linear	0.650	0.262	0.217		-0.218	
	(0.738)	(0.144)	(0.384)		(-0.823)	
	0.786	0.378		0.0738	-0.163	
	(0.935)	(0.177)		(0.121)	(-0.541)	
					-0.226	0.950
					(-0.799)	(1.25)
					-0.155	0.746
					(-0.578)	(0.998)
					-0.251	0.425
					(-1.08)	(0.522)

TABLE 31--Continued

P_t/P_m^6	P_t/P_m	GDP_r	R^2	F	D.W.
			0.260	0.702	2.52
			0.233	0.606	2.68
0.306 (0.853)			0.222	0.856	2.63
	0.150 (0.494)		0.181	0.664	2.83
		1.65 (1.12)	0.262	1.06	2.53
			0.225	0.581	2.69
			0.212	0.539	2.79
0.317 (0.647)			0.180	0.657	2.73
	0.175 (0.404)		0.157	0.557	2.87
		0.635 (0.929)	0.216	0.829	2.64

TABLE 32

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 7
(13 Observations)

	P_m	GDP	P_t	T_m	R^2	F	D.W.
Linear	-0.483 (-0.852)	0.796 (1.10)		-2.78 (-1.07)	0.125	0.428	1.25
	-1.14 (-2.29)		1.68 (2.75)	-0.585 (-2.58)	0.461	2.57	1.90
Log-Linear	-0.840 (-1.04)	1.25 (1.06)		-0.504 (-0.981)	0.142	0.498	1.23
	-1.62 (-2.26)		2.44 (2.49)	-0.915 (-2.22)	0.429	2.26	1.86

TABLE 33

KENYA IMPORT DEMAND REGRESSIONS FOR SITC CLASS 8
(13 Observations)

	P_m	P_d	GDP	P_t	T_m	P_m^8/P_d^8
Linear	-1.26 (-4.33)	2.79 (2.26)	-0.170 (-0.229)		0.0582 (0.133)	
	-0.990 (-2.69)	3.28 (2.97)		-0.788 (-1.03)	0.437 (0.832)	
					-0.101 (-0.190)	-0.839 (-0.477)
					0.714 (1.25)	-2.93 (-2.76)
					0.0708 (0.180)	-3.72 (-5.42)
Log-Linear	-1.04 (-6.60)	2.07 (1.24)	0.529 (0.940)		-0.0569 (-0.159)	
	-0.995 (-4.37)	2.79 (1.58)		0.162 (0.217)	0.0828 (0.160)	
					0.142 (0.264)	-0.485 (-0.886)
					0.708 (1.34)	-0.829 (-3.70)
					0.0390 (0.128)	-1.02 (-7.30)

TABLE 33--Continued

P_t/P_m^8	P_t/P_m	GDP_r	R^2	F	D.W.
			0.852	11.5	2.28
			0.868	13.2	2.28
0.897 (1.38)			0.809	12.7	2.25
	-0.161 (-0.233)		0.771	10.1	1.43
		3.34 (1.47)	0.814	13.1	1.98
			0.893	16.6	2.31
			0.882	14.9	2.32
0.552 (0.762)			0.854	17.6	2.12
	-0.201 (-0.334)		0.847	16.6	1.63
		1.06 (1.80)	0.886	23.3	2.19

TABLE 34

KENYA IMPORT DEMAND REGRESSIONS FOR
SITC CLASSES 6 and 8 COMBINED
(13 Observations)

	P_m	P_d	GDP	P_t	T_m	$P_m^{6,8}/P_d^{6,8}$
Linear	-0.346 (-0.467)	-1.74 (-1.01)	0.785 (1.17)		-0.0951 (-0.406)	
	0.0428 (0.0504)	-0.269 (-0.123)		-0.0414 (-0.0497)	0.0897 (0.315)	
					0.0372 (0.140)	-0.268 (-0.150)
					0.250 (1.09)	1.02 (0.530)
					-0.158 (-0.799)	-1.33 (-0.720)
Log-Linear	-0.190 (-0.321)	-2.21 (-0.796)	0.601 (0.969)		-0.0572 (-0.201)	
	-0.0154 (-0.0238)	-1.07 (-0.317)		0.0916 (0.115)	0.0984 (0.278)	
					0.834 (0.248)	-0.0959 (-0.188)
					0.386 (1.25)	0.306 (0.543)
					-0.135 (-0.537)	-0.359 (-0.638)

TABLE 34--Continued

$P_t/P_m^{6,8}$	P_t/P_m	GDP_r	R^2	F	D.W.
			0.168	0.404	2.28
			0.0253	0.0519	2.27
-0.0215 (-0.0406)			0.0135	0.0410	2.16
	-0.414 (-1.03)		0.117	0.399	2.41
		1.81 (1.01)	0.114	0.388	1.97
			0.154	0.364	2.34
			0.0562	0.119	2.34
-0.0447 (-0.0755)			0.0381	0.119	2.19
	-0.540 (-1.12)		0.155	0.549	2.47
		0.593 (0.839)	0.107	0.361	2.01

TABLE 35

SUPPLEMENTARY REGRESSIONS FOR SITC 2

	GDP	P_t	R^2	F	D.W.
Linear	3.00 (9.95)		0.900	98.9	1.15
		2.62 (9.55)	0.892	91.2	1.25
Log-Linear	1.91 (12.3)		0.933	152.0	1.82
		1.68 (10.6)	0.911	112.0	1.53

TABLE 36

KENYA REGRESSIONS FOR SITC 3

	GDP	P_t	T_m	R^2	F	D.W.
Linear	0.787 (4.24)		-0.0185 (-0.424)	0.871	33.7	1.13
		0.767 (4.48)	-0.0411 (-0.893)	0.880	36.6	1.95
Log-Linear	0.815 (3.27)		-0.0189 (-0.195)	0.848	28.0	0.968
		0.813 (3.44)	-0.0591 (-0.570)	0.856	29.8	1.63

TABLE 37

SUPPLEMENTARY REGRESSIONS FOR SITC 4

	GDP	P_t	R^2	F	D.W.
Linear	7.43 (7.20)		0.825	51.8	1.55
		6.63 (8.08)	0.856	65.3	1.94
Log-Linear	3.35 (7.30)		0.829	53.4	1.45
		3.04 (8.14)	0.858	66.3	1.79

TABLE 38

SUPPLEMENTARY REGRESSIONS FOR SITC 5

	P_m	GDP	P_t	R^2	F	D.W.
Linear	-1.78 (-2.11)	2.13 (15.8)		0.961	125.0	2.75
	-1.22 (-1.19)		1.84 (12.8)	0.943	82.0	2.83
Log-Linear	-0.645 (-1.53)	1.58 (16.4)		0.965	136.0	2.90
	-0.315 (-0.550)		1.38 (11.8)	0.934	70.6	2.63

TABLE 39

SUPPLEMENTARY KENYA REGRESSIONS FOR SITC 6

	P_d	GDP	P_t	T_m	P_t/P_m^6
Linear	-0.206 (-0.249)	0.484 (1.29)		-0.253 (-1.57)	
		0.424 (1.54)		-0.245 (-1.63)	
	-0.253 (-0.237)		0.388 (0.870)	-0.229 (-1.18)	
			0.305 (1.16)	-0.208 (-1.27)	
				-0.0961 (-0.513)	0.0127 (0.357)
				-0.137 (-0.794)	
				-0.237 (-1.74)	
Log-Linear	0.362 (0.205)	0.440 (0.947)		-0.305 (-1.32)	
		0.489 (1.29)		-0.311 (-1.42)	
	0.343 (0.162)		0.331 (0.611)	-0.273 (-0.989)	
			0.391 (1.03)	-0.289 (-1.18)	
				-0.130 (-0.465)	0.132 (0.276)
				-0.203 (-0.770)	
				-0.307 (-1.54)	

TABLE 39--Continued

P_t/P_m^6	GDP_r	R^2	F	D.W.
		0.216	0.827	2.29
		0.210	1.33	2.29
		0.144	0.504	2.44
		0.138	0.804	2.43
		0.0357	0.185	2.61
0.198 (0.649)		0.0629	0.336	2.65
	2.06 (1.67)	0.236	1.54	2.36
		0.172	0.625	2.44
		0.168	1.01	2.44
		0.126	0.434	2.53
		0.124	0.706	2.53
		0.0373	0.194	2.67
0.254 (0.595)		0.0632	0.337	2.70
	0.811 (1.42)	0.193	1.19	2.49

TABLE 40

SUPPLEMENTARY REGRESSIONS FOR SITC 6, INCLUDING AN IMPORT SUBSTITUTION VARIABLE
(12 Observations)

	P_d	P_m	GDP	P_t	T_m	M_s
Linear	-1.38 (-1.18)	0.716 (0.785)	3.31 (2.82)		-0.145 (-0.670)	-0.831 (-2.35)
			2.42 (2.19)		-0.150 (-0.958)	-0.298 (-1.78)
	-0.370 (-0.188)	1.05 (0.776)		0.508 (0.519)	-0.132 (-0.380)	-0.0521 (-0.322)
				0.196 (0.292)	-0.223 (-1.15)	0.0245 (0.208)
					-0.187 (-0.870)	-0.0428 (-0.355)
					-0.189 (-0.872)	0.0660 (1.03)
					-0.150 (-0.688)	0.0500 (0.433)
					-0.202 (-1.04)	0.0908 (0.965)
					-0.104 (-0.661)	-0.254 (-2.08)
					-0.119 (-0.858)	-0.259 (-2.28)

TABLE 40--Continued

P_m^6/P_d^c	P_t/P_m^6	P_t/P_m	GDP_r	R^2	F	D.W.
				0.666	2.39	2.63
				0.459	2.27	1.99
				0.256	0.413	2.78
				0.146	0.456	2.45
5.14 (1.06)	0.674 (0.751)			0.265	0.631	2.73
	-0.140 (-0.296)			0.146	0.456	2.62
1.89 (0.657)		-0.0876 (-0.132)		0.208	0.459	2.76
		-0.266 (-0.457)		0.159	0.503	2.52
0.536 (0.270)			10.5 (2.55)	0.588	2.49	3.07
			10.8 (2.93)	0.583	3.73	3.02

TABLE 40--Continued

	P_d	P_m	GDP	P_t	T_m	M_s
Log-Linear	-1.07 (-0.481)	1.15 (1.27)	4.36 (2.39)		0.0298 (0.0883)	-3.83 (-2.20)
			3.60 (2.09)		-0.185 (-0.781)	-2.81 (-1.74)
	-0.0114 (-0.00342)	1.08 (0.853)		0.633 (0.465)	-0.0997 (-0.214)	-0.664 (-0.425)
				0.289 (0.282)	-0.317 (-1.11)	0.188 (0.170)
					-0.253 (-0.761)	-0.329 (-0.261)
					-0.258 (-0.793)	0.566 (0.986)
					-0.210 (-0.632)	0.419 (0.393)
					-0.276 (-0.943)	0.741 (0.891)
					-0.0568 (-0.221)	-2.44 (-1.96)
					-0.103 (-0.456)	-2.44 (-2.06)

TABLE 40--Continued

P_m^6/P_d^c	P_t/P_m^6	P_t/P_m	GDP_r	R^2	F	D.W.
				0.593	1.75	2.94
				0.436	2.06	2.12
				0.232	0.363	2.86
				0.135	0.419	2.56
1.55 (0.802)	0.784 (0.562)			0.210	0.465	2.81
	-0.202 (-0.312)			0.138	0.426	2.74
0.541 (0.522)		-0.115 (-0.122)		0.177	0.375	2.83
		-0.325 (-0.402)		0.144	0.450	2.65
0.326 (0.458)			4.98 (2.34)	0.537	2.03	3.15
			5.13 (2.58)	0.523	2.92	3.02

TABLE 41

SUPPLEMENTARY REGRESSIONS FOR SITC 7

	GDP	P_t	R^2	F	D.W.
Linear	0.0896 (0.400)		0.0144	0.160	1.06
		0.0678 (0.345)	0.0107	0.119	1.09
Log-Linear	0.0210 (0.0616)		0.000345	0.00380	1.06
		-0.0140 (-0.0463)	0.000195	0.00214	1.07

TABLE 42

SUPPLEMENTARY KENYA REGRESSIONS FOR SITC 8

	P_m	P_d	GDP	P_t	P_m/P_d
Linear	-1.29 (-6.02)	2.79 (2.39)	-0.100 (-0.204)		
	-1.22 (-5.45)	3.17 (2.94)		-0.258 (-0.620)	
					-1.15 (-1.69)
					-3.90 (-5.20)
					-3.79 (-6.52)
Log-Linear	-1.03 (-8.10)	2.06 (1.31)	0.466 (1.23)		
	-1.02 (-7.22)	2.73 (1.67)		0.265 (0.728)	
					-0.349 (-2.01)
					-1.05 (-6.64)
					-1.02 (-8.55)

TABLE 42--Continued

P_t/P_m^8	P_t/P_m	GDP_r	R^2	F	D.W.
			0.851	17.2	2.29
			0.857	17.9	2.29
0.780 (3.78)			0.809	21.1	2.18
	0.651 (2.70)		0.731	13.6	2.02
		3.70 (3.86)	0.813	21.8	2.01
			0.892	24.8	2.29
			0.881	22.3	2.26
0.736 (4.05)			0.853	29.0	2.22
	0.572 (3.34)		0.816	22.2	2.15
		1.13 (4.90)	0.886	38.8	2.20

CHAPTER V

THE EFFECT OF TARIFFS ON GOVERNMENT REVENUE AND INCOME GROUPS

Tariffs are an important variable not only in the import demand function, but also in the determination of government revenue for many less developed countries and in the tax burden from import duties borne by households at various levels of income. These two remaining implications of tariffs are explored in this chapter.

Imports, Tariffs, and Government Revenue

The importance of tariffs for government revenue in Kenya can be seen in the proportion of central government revenue yielded by import taxes since 1960 which has been rising and has varied between 35 percent and 40 percent.[1] This

> . . . heavy reliance on customs duties follows the world-wide pattern on this question; in countries in which a high percentage of goods other than basic staples is imported and the levels of domestic commercial activities and of education are relatively low, the customs duty is the simplest means of collecting most government revenue. . . .[2]

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[1]Republic of Kenya, Kenya Statistical Abstracts for the relevant years.

[2]John F. Due, Taxation and Economic Development in Tropical Africa (Cambridge, Massachusetts: MIT Press, 1963), p. 28.

Legislative records also reveal that many of the tariff changes in East Africa were motivated by the desire to raise revenue. However, as tariffs increase, theory and the preceding empirical results indicate that import volume tends to fall. While the tariff increases tend to increase revenue collected, the import volume declines would tend to decrease revenue from import duties. Thus, the overall effect on government revenue is not obvious.

Since this reliance on import duties for revenue is common among less developed countries but its success in raising revenue not necessarily certain on theoretical grounds, an extension of the preceding import demand analysis which included a tariff variable to an analysis of its effect on government revenue would be useful. Another argument for the extension of an import and tariff analysis to include its government revenue effects is the alleged neglect in economic literature of studies on domestic sources of finance for developing nations in favor of studies of foreign aid and finance.[1]

Methodology

The methodology for this analysis could have several dimensions. One approach would be to use the import demand function directly by analyzing the coefficient of the tariff variable, particularly the elasticity estimate. This could be done for both aggregate imports in an effort to estimate the overall possibilities of raising revenue in

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[1] A.F. Ewing, "Some Recent Contributions to the Literature on Economic Development," The Journal of Modern African Studies, 4:3 (November, 1966), 335-348.

this manner and for selected imports or import categories to determine revenue possibilities for specific import classes.

Since elasticity estimates can be calculated several ways, the empirical elasticity results will contain both a linear and log-linear regression estimate for the tariff elasticity. The latter is obtained directly from the regression coefficient of the tariff variable in log-linear regressions and assumes the curve to be of constant elasticity. The former is calculated from the product of the regression coefficient of the tariff variable in the linear regressions and the ratio of the mean for the tariff and import quantity indices in the formula, $E = (T/Q)X(\partial Q/\partial T) = (T/Q)X$ (regression coefficient) where T and Q are evaluated at their means. This means the linear regression estimate of the tariff elasticity is evaluated on the curve at the point of mean value for each of the two variables.

Another approach would be to make government revenue a function of the relevant variables, many of them found in the import demand function, such as income and tariffs. This approach would be a more direct attempt to statistically investigate the role that tariffs, as opposed to income, played in the determination of government revenue.

Tariff Elasticity Analysis

The partial elasticity of the tariff variable for the import demand regressions discussed in Chapter II and reproduced in the Appendix to this chapter in Table 43 for the traditional import demand model and in Table 44 for the price of time import demand model is consistently a little less than unity for both Kenya and East Africa. All of these regressions are based on official government statistics.

The range of tariff elasticities encountered for Kenya was 0.696 to 0.807 in the linear regressions and 0.646 to 0.856 in the log-linear regressions. If only regression coefficients significantly different from zero are considered relevant, the range drops to 0.696 to 0.733 and 0.706 to 0.856, respectively.

For East Africa the range of tariff elasticities was 0.599 to 0.729 for linear regressions and 0.718 to 0.748 for log-linear regressions, with all East African tariff variable coefficients being significant. The impact of these results is that the tariff elasticity with respect to import volume is likely to be in the 0.6 to 0.8 range.

For the price of time import model summarized in Table 44, the tariff elasticity is still consistently below unity, but somewhat greater than 0.6 to 0.8. For Kenya, the linear regression estimates range from 0.781 to 0.904 and the log-linear estimate range is from 0.873 to 0.910. For East Africa, the ranges are 0.700 to 0.815 and 0.787 to 0.846, respectively. All price of time tariff variable coefficients were significant. The result is a tariff elasticity with respect to import volume of approximately 0.7 to 0.9.

The tariff elasticities of individual import classes also tend to be inelastic but are generally even smaller in magnitude, at least for the traditional import demand model. These elasticities, tabularized in Table 46 and 47, range from 0.0319 to only 0.597 for the traditional model and 0.0800 to 1.06 for the price of time model regressions, excluding some cases with low positive elasticities. SITC classes 2 and 4 are excluded from the table since all tariff coefficients were of improper sign. The only elasticities based on significant coefficients were in SITC class 0 and 1, where tariff elasticity estimates were 0.587 and 0.597 for the traditional model and 0.634 for the price of time model, and also in SITC class 7 for the price of time model, where the elasticity estimate was 1.06. SITC class 7 for the price of time model also had a tariff elasticity based on an insignificant regression coefficient of magnitude 0.915, the only other tariff elasticity to approach unity.

By SITC classes, the tariff elasticity estimate for SITC class 0 and 1 was around 0.6 for the log-linear regressions and between 0.1 and 0.3 for the linear regressions. For SITC class 3 the tariff elasticity was less than 0.1 for the linear regressions and around 0.3 or 0.4 for the log-linear regressions. SITC class 5 had either a positive or very small negative elasticity in the 0.1 range for the traditional model and a tariff elasticity of around 0.3 or 0.4 for the price of time model. In SITC class 6 the tariff elasticity range was approximately 0.15 to 0.35. SITC class 7 tariff elasticities were 0.5 for the traditional model and, as already discussed, were around unity for the price of time model. SITC class 8 was plagued with positive elasticities, but those which were negative were about 0.15 for the traditional model and less than 0.1 for the price of time model.

The implication of these import demand tariff elasticities for government revenue is that, with the possible exception of SITC class 7 where the price of time tariff elasticities were unitary, tariff rate changes are likely to be successful in raising additional government revenue due to inelastic tariff elasticities. In the aggregate, however, tariff rate changes may not be extremely successful, since the upper range of the aggregate tariff elasticities is near unity. If the import demand tariff elasticity were unitary, tariff changes would have no impact on revenue since the marginal tariff increase would be precisely cancelled by the concommitant import decrease and revenue which equals the product of tariff rate and import volume would be unchanged. However, an import demand tariff elasticity of less than unity implies that imports decline less than tariffs increase and revenue would increase. The upper range of the aggregate tariff elasticity estimates of 0.8 or 0.9 are not greatly less than unity, so that if the true tariff elasticity were in the upper range the impact on revenue would not be great. The further the true tariff elasticity slips toward the lower portion of the empirical range, the greater the impact of tariff changes on government revenue. For several SITC classes with rather small tariff elasticities the implication is that revenue possibilities should be promising.

Government Revenue Analysis

In an effort to statistically test more directly the impact of tariffs and revenue from customs duties on government revenue, several regressions were run between revenue data and tariffs and/or income, the other major variable likely to be an important determinant of government revenue. Table 47 in the Appendix to this chapter contains the regressions with total recurrent revenue as a proxy of government revenue and Table 48 contains the regressions with revenue from taxes as the relevant proxy of government revenue which is influecned by tariffs and national income. The revenue data series and their sources as well as a discussion of this data are available in the Data Appendix.

In addition to the usual regression coefficient and t value for that coefficient in parentheses below the regression coefficient, these tables have revenue elasticity estimates for the tariff and gross domestic product variables above the regression coefficient and a column containing the coefficient of determination (R^2), between the two relevant independent variables in those regressions where more than one variable was utilized.

With recurrent revenue as the dependent variable, the tariff variable and the variable measuring revenue obtained from import taxes have a significant and elastic impact on recurrent revenue only when they are the sole explanatory variable. Even then the maximum implied elasticity is only 1.09, approximately unity. When regressed along with a gross domestic product variable both variables lose their significance and yield only small revenue elasticities of a magnitude less than 0.2. The revenue elasticity of the tariff variable is 0.0780 for the linear regression estimate and 0.0765 for the log-linear regression estimate. In contrast, the revenue elasticities of the income variable range from 1.09 to 1.39 after accounting for customs duty. Except for the linear regression coupling the gross domestic product variable with the variable representing revenue obtained from import duties, all the gross domestic product variable coefficients were significant.

The regressions with revenue from taxes as a proxy of the relevant government revenue variable yield similar results. Again, the tariff variables and the variable representing revenue obtained from import duties were significant only when they were the sole explanatory variables. Likewise, the tariff variable had a revenue elasticity either slightly above unity (1.04) or approaching unity (0.964) only when it was the sole independent variable. On other occasions, the revenue elasticity of the tariff variable was either insignificant (0.0154) or negative (-0.0699) and insignificant. Again by contrast, except for the regressions coupling revenue obtained from import duties with gross domestic product, the coefficients of the gross domestic product variable were significant and their implied elasticities greater than unity, ranging from 1.33 to 1.46.

The conclusion that can be drawn from these regressions of government revenue with several relevant variables is that tariffs and revenue obtained from import duties, at least when separately accounting for income changes, do not have a significant influence of government revenue and are very inelastic in their effect on government revenue.

This conclusion must be tempered somewhat by two considerations. The measure of tariff level was the ratio of duty collected to import value. It must be remembered that this measure is susceptible to the index number problem[1] and to the extent tariff changes are not

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[1]See page 217 for a more detailed explanation.

accurately reflected by this ratio the preceding discussion could be misleading.

Secondly, several of these regressions, particularly those employing the import duty revenue variable with the gross domestic product variable are plagued with multicollinearity problems. As the tables indicate, the coefficient of determination (R^2) between gross domestic product and the variable measuring revenue obtained from customs duty was over 0.9 but that between gross domestic product and the tariff variable varied between 0.6 and 0.7. The tariff variable regressions should not be seriously impaired, but the revenue from import duty regression results could suffer from multicollinearity.

Summary

The tariff elasticity obtained from import demand equations suggests tariff inelasticity with respect to import volume. Consequently, the impact of tariff changes on government revenue is likely to be favorable, but probably not greatly favorable since the tariff elasticity with respect to imports may not be greatly below unity, except for some SITC classes of imports where empirical elasticities were low.

The direct empirical impact of tariffs and revenue obtained from customs duty on government revenue is neither very great nor significant when income is accounted for separately, although statistical problems of multicollinearity and measurement of tariff changes decrease the significance of this conclusion.

The appropriate conclusion appears to be that tariffs are likely to have played a role in government revenue, but the available empirical evidence does not indicate that their role has been very great.

The Effect of Tariffs on Different Income Groups

The intent of this section is to analyze the tax burden implications of the tariff structure for various income classes. The hypothesis will be that the tariff burden is progressive so that the greater the income group the greater will be the tariff burden.

Methodology

The proposed means by which this comparison by income class might be made is to obtain from expenditure surveys the proportion of expenditure by each income class on each commodity, represented by e, and multiply that by the tariff rate on this commodity, represented by t. The total impact of the tariff, represented by T, on this income class would then be the summation of each of these products. Mathematically, the formulation would be: $T = \sum et$. These values of T for each income group could also be interpreted as a weighted average of the tariff rates where the weights, e, are the importance of that tariff rate in the expenditure pattern of the income group being analyzed.

Such a calculation implicitly assumes that tariffs affect the price of domestic commodities as well as imports, an assumption which is likely true for many but not all domestically produced commodities.

If expenditure statistics were separately available for imported and domestically produced commodities, only the former could be employed in the calculation of a tariff burden index. But even if this information were available, which it is not, such a calculation would also be an imprecise measure of the expenditure burden derived from the tariff since it would disregard any protective effects of a tariff for domestic production.

While the lack of data does not allow separation of expenditure into import and domestic components, an arbitrary assumption about the proportion of income spent by each income class on imports or their domestic substitutes benefitting from tariffs could and will be made to test the implications of such an assumption for the pattern of tariff burden distribution. Each of these two assumptions is used in turn to calculate two alternative tariff burden indices. One will reflect the assumption that all expenditure in an income class is affected by tariffs and the other will assume that only a proportion of expenditure in each class is affected by the tariff. This proportion will be assumed to be greater the greater the income of the group. This assumption would be in agreement with the appraisal that the more wealthy the family or group the greater its consumption of imports.

In practice, the methods of ascertaining both t and e and relating them to each other becomes complex. First, expenditure classes are diverse groups containing more than one commodity and relevant to several tariff rates. Second, tariff rate classifications and expenditure classifications need to be synchronized and made comparable to each other. If both were available with identical classifications, the problem would not exist. If each was available in sufficient detail, aggregation could lead to new comparable groupings and the problem would be minimized. Unfortunately, neither exists for Kenya. The tariff schedule has considerable detail,[1] but the expenditure surveys do not, at least not in the summaries readily available.

In order to make the two lists comparable on the basis of the summary information, an aggregation of the more detailed tariff rates for several classifications would be necessary. This aggregation raises the question of what kind of average would be appropriate. An unweighted average would probably not be particularly appropriate since all tariff rates whether near 100 percent or zero would carry the same weight in aggregation whether or not they were actually important. If a weighted average is more appropriate, the question raised is: What should be used as weights? Often the weight or importance of a tariff is taken to be the magnitude of imports at that rate or in that import classification. But this is the same as duty collected in that rate or import class since the tariff rate, t, multiplied by import quantity, m, is tm, or import duty resulting from import quantity, m. This result simplifies the coordination for numerous classifications in the Kenyan expenditure surveys which are closely comparable to SITC trade classifications for which data on duty collected is available. On these grounds, the (weighted) average

[1]Periodically a tariff schedule is published. One of these was updated to 1968 in an earlier research project. The tariff rate schedule is also available in the Laws of Kenya, published sporatically.

ad valorem tariff rate for any expenditure classification will be defined to be the duty collected in that classification divided by total import value in that classification. This would mean that any specific tariff rates in the tariff schedule would be changed to an ad valorem equivalent.

This would also mean that this average tariff rate could be susceptible to the index number problem. For example, if all tariff rates on all commodity groups were to increase by a certain proportion, P, the ratio of duty collected to import volume would also rise by the proportion, P, only if the proportion of imports in each commodity group to total imports remained unchanged. If these weights were redistributed, the average tariff rate would not accurately reflect the change in tariff rates.

The third complication is that of determining which imports and therefore which tariff rates are to be included in a given expenditure class and thus in the average ad valorem tariff rate. Some explanations of the definitions for each expenditure class are available with the expenditure surveys themselves, and others are available in studies which have used these expenditure surveys.[1] From this information on definitions, the most important import groups falling into each expenditure classification could be identified. Import and tariff duty

[1]Among them are Benton F. Massell and Judith U. Heyer, "Household Expenditure in Nairobi: A Statistical Analysis of Consumer Behavior," Discussion Paper No. 48, Institute for Development Studies, University College, Nairobi (April, 1967), and Benton F. Massell, "Determinants of Household Expenditure in Rural Kenya," Discussion Paper No. 49, Institute for Development Studies, University College, Nairobi (April, 1967).

data could then be obtained for these import groups to calculate the average ad valorem tariff rate as described earlier.

A second source of tariff rate information would be to glean from a study of the tariff schedule the rate of duty commonly applied to the type of commodity contained in each expenditure class. While the tariff rates obtained by such methods are necessarily to some extent subjective, every attempt is made to extract the rate which is most representative of the rate applied to the relevant type of commodity. Where more than one rate is common, an intermediate rate between the common rates will be utilized. Each of these tariff rates, the ratio of duty collected to imports and the representative tariff rates, will form, in turn, the basis for the tariff burden calculation.

Tariff Burden Indices

Data on tariffs, duty collected, and expenditure relevant to the calculation of a tariff burden index are available in Kenya trade and statistical publications. The summary results of a recent expenditure survey, available for several years in the Kenya Statistical Abstract, is reproduced in Table 10 in the Data Appendix where a discussion of this data and its coordination with tariff rates can also be found. This expenditure data was coordinated with two different sets of tariff rate data. The first set of tariff data was based on the ratio of duty collected to import value by SITC class. Each expenditure classification then had the most relevant SITC class average tariff rate applied to it for purposes of calculating the tariff burden for the various income classes. Table 49 summarizes these tariff burden indices for several years.

The second set of tariff rate data was based on what was judged to be a "representative" tariff rate for commodities likely to be part of each expenditure class. These rates were then used to calculate the tariff burden for each income class for several years. Table 50 contains these calculations.

For each set of tariff rates, an alternative tariff burden was also calculated to abstract from the abnormally large entry for transport equipment in one income class due to the purchase of an automobile by one family during the survey time period.[1] This alternative entry ignores the transport equipment expenditure in calculating the tariff burden index.

Three general conclusions emerge from a study of these tariff burden calculations and their distribution among income classes. The first is that the tariff burdens are somewhat greater with the representative rate than for the average tariff rate calculated from the ratio of duty collected to import value in each SITC class, probably due to some lower duty or duty free imports in the duty collected statistics. The second is that the tariff burden by either measure has been increasing over the years for all income classes but tended to increase less for the highest income level than for the lower and middle income levels. The third is that the tariff burden tends to be greater for the lower and middle income classes than for the higher income class. These last two observations gleaned from the available

[1] A discussion of this complication is discussed in the Data Appendix where it is noticeable in Table 10.

statistical data indicate that most of the burden at present and progressively more of the burden over time tends to fall on lower rather than the higher income groups.

As already discussed, an implicit assumption of the foregoing tariff burden calculations was that either all income classes spent the same proportion on imported commodities, or that if they spent different proportions on imported commodities, the domestically produced commodities reflected in their price an upward bias equal to the import duty of similar commodities, such as could occur with import substitutes produced behind tariff protection.

If this assumption is dropped, and it is assumed (probably realistically) that the higher the income level the greater the proportion spent on imports or domestically produced items increased in price by tariffs on similar commodities, a different set of conclusions emerges. Tables 51 and 52 repeat the tariff burden calculations of Tables 49 and 50 with the modification that the lowest income class spends 5 percent of its expenditure on imports or tariff influenced commodities and that each successive income class spends an additional 5 percent on such commodities until the highest income class spends 35 percent of its total expenditure on such commodities.

Under these undoubtedly more realistic assumptions, the tariff burden increases successively as income rises, particularly for the alternative set of tariff burden calculations, for any year and with either type of tariff rate. Likewise, the increases in tariff burden over the years appear to be generally greater the higher the income class. Under these assumptions, the more wealthy tend to have the greater tariff burden.

Special note should be taken, however, that this latter conclusion of greater and rising tariff burdens for the more wealthy was obtained from applying an assumption that the wealthy have a successively greater tendency to import. This can be construed as simply getting out of the statistics what we put into them. The data without modification do not support this conclusion. In fact, the reverse tends to occur. On the other hand, if this assumption which is imposed on the statistics is realistic, the results should also be realistic and appropriate. Since expenditure surveys to date have not separated expenditures on imported commodities from expenditures on domestically produced commodities, which may or may not reflect higher prices due to tariff protection, this assumption cannot be empirically verified. Thus, the conclusion must be that the data itself without additional assumptions will not support the hypothesis that the higher the income level the greater the tariff burden, nor will it support the hypothesis that the greater the income level the greater the increase of tariff burden over time; but with the imposition of what is likely to be a realistic assumption that the more wealthy import a greater proportion of each expenditure classification, all these hypotheses are supported.

CHAPTER V APPENDIX

TABLE 43

AGGREGATE TARIFF ELASTICITY ESTIMATES
TRADITIONAL MODEL

Additional Variables Employed								Kenya		East Africa	
P_m	P_d^c	P_d^w	GDP	P_m/P_d^c	P_m/P_d^w	GDP_r^c	GDP_r^w	Linear	Log-Linear	Linear	Log-Linear
x	x		x					-0.807	-0.856[a]	-0.599[a]	-0.746[a]
x		x	x					-0.696[a]	-0.646	-0.622[a]	-0.734[a]
				x		x		-0.733[a]	-0.706[a]	-0.694[a]	-0.718[a]
					x		x	-0.705	-0.646	-0.729[a]	-0.748[a]

[a]The coefficients on which these estimates are based were significantly different from zero in a two-tail test at a 95 percent confidence level.

TABLE 44

AGGREGATE TARIFF ELASTICITY ESTIMATES
PRICE OF TIME MODEL

Additional Variables Employed							Kenya		East Africa	
P_m	P_d^c	P_d^w	P_t	P_m/P_d^c	P_m/P_d^w	P_t/P_m	Linear	Log-Linear	Linear	Log-Linear
x	x		x				-0.805[a]	-0.896[a]	-0.700[a]	-0.807[a]
x		x	x				-0.904[a]	-0.895[a]	-0.811[a]	-0.846[a]
				x		x	-0.781[a]	-0.873[a]	-0.729[a]	-0.787[a]
					x	x	-0.877[a]	-0.910[a]	-0.815[a]	-0.838[a]

[a]The coefficients on which these estimates are based were significantly different from zero in a two-tail test at a 95 percent confidence level.

TABLE 45

KENYA TARIFF ELASTICITIES FOR SELECTED SITC CLASSES
TRADITIONAL IMPORT MODEL

SITC Class	Additional Variables Employed					Linear	Log-Linear
	P_m	P_d	GDP	P_m/P_d	GDP_r		
0 and 1	x	x	x			-0.287	-0.587[a]
0 and 1				x	x	-0.323	-0.597[a]
3	x		x			-0.0319	-0.273[a]
5	x		x			positive	-0.0996
6	x	x	x			-0.345	-0.218
6				x	x	-0.352	-0.251
7	x		x			-0.505	-0.504
8	x	x	x			positive	-0.159
8				x	x	positive	positive

[a]The coefficients on which these estimates are based were significantly different from zero in a two-tail test at a 95 percent confidence level.

TABLE 46

KENYA TARIFF ELASTICITIES FOR SELECTED SITC CLASSES
PRICE OF TIME MODEL

SITC Class	Additional Variables Employed						Linear	Log-Linear
					Specific	General		
	P_m	P_d	P_t	P_m/P_d	P_t/P_m	P_t/P_m		
0 and 1	x	x	x				-0.246	-0.634[a]
0 and 1				x	x		-0.128	-0.599
0 and 1				x		x	-0.202	-0.557
3	x		x				-0.0800	-0.407
5	x		x				-0.295	-0.395
6	x	x	x				-0.265	-0.163
6				x	x		-0.325	-0.226
6				x		x	-0.197	-0.155
7	x		x				-1.06[a]	-0.915
8	x	x	x				positive	positive
8				x	x		-0.0870	positive
8				x		x	positive	positive

[a]The coefficients on which these estimates are based were significantly different from zero in a two-tail test at a 95 percent confidence level.

TABLE 47

KENYA GOVERNMENT REVENUE REGRESSIONS
RECURRENT REVENUE AS DEPENDENT VARIABLE
(11 Observations)

	Tariff	Gross Domestic Product	Revenue from Import Duties	Coefficient of Determination Between Independent Variables ($\bar{R}^2$)	R^2	F	D.W.
Linear	(0.0780) 0.0710 (0.537)	(1.32) 1.06 (8.47)		0.672	0.968	121.0	1.45
	(1.09) 0.989 (4.38)				0.681	19.2	0.714
		(1.39) 1.12 (16.2)			0.967	263.0	1.62
		(1.09) 0.768 (2.39)	0.212 (1.12)	0.955	0.971	136.0	1.86
			0.653 (13.2)		0.951	175.0	2.51

TABLE 47--Continued

	Tariff	Gross Domestic Product	Revenue from Import Duties	Coefficient of Determination Between Independent Variables (R^2)	R^2	F	D.W.
Log-Linear	0.0765 (0.509)	1.29 (7.40)		0.710	0.964	105.0	1.30
	1.01 (4.75)				0.715	22.5	0.771
		1.36 (15.1)			0.962	231.0	1.45
		1.03 (2.89)	0.191 (0.961)	0.936	0.966	115.0	1.51
			0.746 (11.0)		0.931	122.0	2.16

TABLE 48

KENYA GOVERNMENT REVENUE REGRESSIONS
REVENUE FROM TAXES AS DEPENDENT VARIABLE
(10 Observations)

	Tariff	Gross Domestic Product	Revenue from Import Duties	Coefficient of Determination Between Independent Variables (R^2)	R^2	F	D.W.
Linear	(-0.0699) -0.0605 (-0.323)	(1.46) 1.13 (6.57)		0.606	0.936	50.8	1.63
	(1.04) 0.899 (3.05)				0.538	9.31	0.668
		(0.517) 0.363 (0.913)	0.425 (1.86)	0.950	0.956	76.4	0.938
		(1.41) 1.08 (10.7)			0.935	114.0	1.48
			0.629 (12.5)		0.951	155.0	0.999

TABLE 48--Continued

	Tariff	Gross Domestic Product	Revenue from Import Duties	Coefficient of Determination Between Independent Variables (R^2)	R^2	F	D.W.
Log-Linear	0.0154 (0.0731)	1.33 (5.64)		0.639	0.928	44.9	1.52
	0.964 (3.46)				0.600	12.0	0.632
		0.678 (1.52)	0.376 (1.55)	0.925	0.946	61.5	0.888
		1.34 (10.1)			0.928	103.0	1.55
			0.731 (10.2)		0.929	104.0	0.814

TABLE 49

TARIFF BURDEN BASED ON RATIO OF DUTY COLLECTED TO IMPORT VALUE AND EXPENDITURE SURVEY

Income Class (shs./month)	1954	1954 alt.	1960	1960 alt.	1964	1964 alt.	1967	1967 alt.
355-399	0.268	0.268	0.286	0.286	0.302	0.302	0.326	0.326
400-499	0.268	0.269	0.281	0.282	0.295	0.296	0.318	0.319
500-599	0.220	0.224	0.242	0.246	0.265	0.269	0.284	0.288
600-699	0.266	0.266	0.282	0.282	0.300	0.300	0.320	0.321
700-799	0.259	0.259	0.271	0.271	0.288	0.288	0.304	0.304
800-999	0.200	0.238	0.217	0.252	0.236	0.271	0.251	0.289
1000-1399	0.266	0.266	0.271	0.271	0.283	0.283	0.300	0.300

TABLE 50

TARIFF BURDEN BASED ON REPRESENTATIVE TARIFF RATES AND EXPENDITURE SURVEY

Income Class (shs./month)	1960	1960 alt.	1964	1964 alt.	1967	1967 alt.
335-399	0.274	0.274	0.355	0.355	0.421	0.421
400-499	0.267	0.268	0.346	0.346	0.410	0.411
500-599	0.246	0.248	0.320	0.321	0.382	0.385
600-699	0.273	0.273	0.352	0.352	0.417	0.417
700-799	0.263	0.263	0.338	0.338	0.401	0.401
800-999	0.225	0.243	0.303	0.313	0.372	0.397
1000-1399	0.240	0.240	0.311	0.311	0.373	0.373

TABLE 51

TARIFF BURDEN BASED ON RATIO OF DUTY COLLECTED TO IMPORT VALUE AND INCREASING PROPORTION OF EXPENDITURE SURVEY

Income Class (shs./ month)	Assumed Import Expendi- ture (%)	1954	1954 alt.	1960	1960 alt.	1964	1964 alt.	1967	1967 alt.
335-399	5	0.0134	0.0134	0.0143	0.0143	0.0151	0.0151	0.0163	0.0163
400-499	10	0.0268	0.0269	0.0281	0.0282	0.0295	0.0296	0.0318	0.0319
500-599	15	0.0330	0.0336	0.0363	0.0369	0.0397	0.0403	0.0426	0.0432
600-699	20	0.0532	0.0532	0.0564	0.0564	0.0600	0.0600	0.0640	0.0642
700-799	25	0.0647	0.0647	0.0677	0.0677	0.0720	0.0720	0.0760	0.0760
800-999	30	0.0600	0.0714	0.0651	0.0756	0.0708	0.0813	0.0753	0.0867
1000-1399	35	0.0931	0.0931	0.0948	0.0948	0.0990	0.0990	0.1050	0.1050

TABLE 52

TARIFF BURDEN BASED ON REPRESENTATIVE TARIFF RATES AND INCREASING PROPORTION OF EXPENDITURE SURVEY

Income Class (shs./ month)	Assumed Import Expendi- ture (%)	1960	1960 alt.	1964	1964 alt.	1967	1967 alt.
335-399	5	0.0137	0.0137	0.0177	0.0177	0.0218	0.0210
400-499	10	0.0267	0.0268	0.0346	0.0346	0.0411	0.0410
500-599	15	0.0369	0.0372	0.0480	0.0481	0.0577	0.0573
600-699	20	0.0546	0.0546	0.0704	0.0704	0.0834	0.0834
700-799	25	0.0657	0.0657	0.0845	0.0845	0.1002	0.1002
800-999	30	0.0675	0.0729	0.0909	0.0939	0.1191	0.1116
1000-1399	35	0.0840	0.0840	0.1088	0.1088	0.1305	0.1305

CHAPTER VI

CONCLUSION

The intent of this concluding chapter is twofold. First, projections will be made of the principal variables employed in this study to derive some of the implications of these empirical relationships for the near future and to compare these projections with those of the Kenya Development Plan.[1] Second, a summary of the major findings of this study and their policy implications will close this study.

Projections and Plan Implications

Some of the data collected for this study which were employed to derive regression equations will be projected to the year 1974 and utilized in the statistical relationships developed in this study. These projections are based on anticipated growth rates derived from the development plan, except for those statistical measures which are not projected in the plan. The latter will be projected on the basis of extrapolated annual growth rates during the years 1954-1966.

Some problems of coordination exist in relating plan data to the data utilized in this study and in relating past extrapolations to

[1] Government of Kenya, Kenya Development Plan for the period 1970-1974.

contemporary data series. First, several of the official statistical series were modified after 1966 and therefore are no longer strictly comparable to the preceding data series utilized in this study. This is true, for example, for the national income statistics which were modified in 1968. However, since the projections either in the plan or from extrapolation, are not likely to be exceedingly precise and since the statistical data modifications are not total redefinitions of previous statistical data, the analysis in this section will assume data comparability between all plan data and the data for preceding years utilized by this study as well as between the latter and contemporary data.

Second, all plan projections are based on 1967 data which were the latest data available to the planners, while the last year utilized for import demand data in this study was 1966. Hence, the plan projections in this study will utilize the growth rates found in the development plan, but will use these assumed growth rates for projections of 1966 data as opposed to the plan projections of 1967 data. The differences in projections resulting from this one year difference for a total of eight years are likely to be minor; however, the differences caused by the previously discussed changes in the definitions of statistical series are difficult to determine.

The projected growth rate of monetary gross domestic product is 7.8 percent per annum.[1] The projected rate of increase for import

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[1]Government of Kenya, Kenya Development Plan for the Period 1970-1974, p. 142.

prices is 1 percent per annum.[1] The plan does not directly project changes in domestic price levels, but does heavily emphasize an incomes policy aimed at keeping prices down and mitigating the maldistribution of income by keeping urban incomes down.[2] On this basis, domestic prices will, for the sake of the plan projections, be assumed to remain unchanged; but they will be complemented by supplementary calculations based on extrapolation from the past. The only comment in the Development Plan which relates to the price of time variable is this incomes policy aimed at slowing and hopefully stemming the rise of urban incomes, so when the price of time model is employed for projections, the 1974 magnitude of the price of time variable will be extrapolated from the past rather than obtained from the plan. Likewise, the plan does not directly speak to tariff changes but does expect fewer imports in high duty categories, primarily due to import substitution, so that tax increases of various kinds, presumably including tariffs, would be possible.[3] No further details are given. On this basis, the tariff variable will be assumed constant, for the initial plan projections and will be supplemented later by extrapolations from the past. The volume of commodity imports is expected to increase by 7.5 percent per annum which is "more or less in line

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[1]Government of Kenya, Kenya Development Plan for the Period 1970-1974, p. 154.

[2]Government of Kenya, Kenya Development Plan for the Period 1970-1974, pp. 132-139.

[3]Government of Kenya, Kenya Development Plan for the Period 1970-1974, p. 154.

with the growth of Monetary Gross Domestic Product."[1] The application of these rates of increase to the relevant variables in the import demand model, including the assumptions of an effective incomes and price policy and no import duty increases, yields the 1974 magnitudes summarized in the middle of Table 53.

When the assumptions of an effective incomes and price policy and no import duty increases are dropped and replaced by an assumption that these variables will continue to behave as they have in the preceeding thirteen years, the 1974 magnitudes of these variables, some of which were based on planned increases and others on past performance, are as indicated in the last row of Table 53. These extrapolations of past performance were obtained by calculating an average annual rate of change for the years 1954 through 1966 for each variable and then applying this average annual rate of change to 1966 data in order to estimate their 1974 values. The implications of this shift in assumptions are greater tariffs and domestic prices, with their concommitant decreases in relative commodity prices and in real gross domestic product as compared to monetary gross domestic product. Real gross domestic product does, however, increase between 1966 and 1974, even though the higher price level deflates the monetary figures.

These two alternative sets of 1974 data projections form the basis for the two sets of projected import volume in the four right hand columns of Table 54. The first two of these four columns utilize the

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[1] Government of Kenya, Kenya Development Plan for the Period 1970-1974, p. 154.

TABLE 53

PROJECTED RATES OF INCREASE FOR VARIABLES EMPLOYED IN REGRESSION EQUATIONS

	M	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c	P_m/P_d^w	GDP_r^c	GDP_r^w	P_t/P_m
1966	174	108	342	110	217	227	167	31.6	98.0	63.4	197	210
Plan Rate of Increase percent per annum	7.5	1.0	a	a	7.8	a	a	1.0	1.0	7.5	7.5	a
1974	319	117	342	110	380	227	167	34.2	106.0	111.0	345	-
Extrapolated Rate of Increase	b	b	2.5	2.25	b	6.4	4.4	c	c	c	c	c
1974	319	117	417	131	380	373	236	28.1	89.3	91.1	290	319

[a]Plan does not specify a rate of increase.

[b]Planned rate is employed.

[c]The rate of increase is a combination of the planned rates for import prices and gross domestic product and extrapolated rates for the domestic price levels and the price of time.

TABLE 54

IMPORT VOLUME PROJECTIONS

	Variables Employed in Model											Import Volume Projections				
												Planned Import Volume	Plan Growth Rates		Plan & Extra-polated Growth Rates	
	P_m	P_d^c	P_d^w	GDP	P_t	T_m	P_m/P_d^c	P_m/P_d^w	GDP_r^c	GDP_r^w	P_t/P_m		Kenya	E.Africa	Kenya	E.Africa
Traditional Import Model	x	x		x		x						310	263	398	251	345
	x		x	x		x							341	407	283	352
						x	x		x				343	373	197	279
						x		x		x			277	375	212	285
Price of Time Import Model	x	x			x	x									273	
	x		x		x	x									263	
						x	x				x				258	
						x		x			x				247	

planned rates of increase obtained from the middle row of the previous table while the last two columns utilize the combined planned and extrapolated rates of increase for the relevant variables obtained from the last row of the previous table. The regression equations are obtained from the first eight rows of Table 12 for Kenya and the first four rows of Table 3 for East Africa.

With each of these alternative sets of data, two different sets of regression equations are employed, one set derived from Kenyan data, the other from East African data. While the Kenyan regressions are more directly applicable to projections of imports for Kenya, the East African regressions were statistically superior and were derived from variables of similar magnitude so that these projections could be a supplement to and check on the Kenyan statistical projections. A similar rationale exists for the price of time model import projections in the lower half of Table 54. Despite the fact that no official price of time projections were available in the plan, other than the attempt to keep wages down by an incomes policy, the regressions for this model were statistically preferable to the traditional import demand model for Kenya and could also be a supplement to and check on the traditional model import projections.

For each of these alternative models and data projections, import volume is projected on the basis of two pairs of regressions: one pair employing individual variables and the other pair employing ratios. Within each of these pairs each of the two alternative domestic price indices are utilized.[1]

The projections of import volume derived from the Kenyan regression equations and based on plan data projections are variable around the plan estimate with half of the estimates approximately 10 percent above planned imports and the other half about 10 percent below planned imports. With the East African equations based on plan data, the import projections are consistently above the plan estimate.

When the import projections are based on a combination of plan data and data extrapolations from the past, import projections decrease so that Kenyan import projections are consistently below the plan estimate while the average East African projection is approximately equal to the plan estimate. The primary reasons for this decline in imports with combined plan and extrapolated data are the increase in tariffs and the lower real income due to domestic price rises.

The projections of import demand for the price of time model regressions which also utilized a combination of plan and extrapolated data projections, including the crucial price of time estimate which the planners hoped to keep stable with an incomes policy, are comparable to the traditional import demand projections with combined plan and extrapolated data. The import projections by these equations are consistently below the plan estimate.

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[1]The official discussions of domestic prices in the plan appear to be based on the wage earner's index. See Government of Kenya, Kenya Development Plan for the Period 1970-1974, pp. 133-140.

To summarize, the econometric import projections of this study for Kenya indicate that if there are no major anticipated changes in the structure of import demand and if there are no explicit policy changes planned for imports, the plan estimate is generally of the proper magnitude. However, if the statistically preferable East African regressions are employed, the projected estimates of import volume are greater than planned imports, particularly if suggested plan policies for prices, incomes, and tariffs succeed, even if there were no anticipated or explicitly planned policy changes in the structure of import demand. One explicit plan policy which could put additional pressure on imports are substantial imports of capital goods for planned development and imports of raw materials and inputs for the producing sectors, such as crude petroleum, chemicals, and base metals, which despite the exploitation of import substitution,[1] could increase imports more than indicated by the preceding analysis, at least for the next several years.

Summary and Conclusions

This study investigated numerous aspects of import demand and tariffs. The purpose of this section is to summarize the major findings on the substantive questions investigated.

The tests of the traditional import demand model employing official Kenyan and East African statistics had empirical results

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[1]Government of Kenya, Kenya Development Plan for the Period 1970-1974, p. 154.

which were good for all regressions, linear and log-linear. These regressions all had significant F values at the 95 percent level, and many, including all the East African regressions, were significant at the 99 percent level. The multiple coefficients of determination (R^2) were between 0.71 and 0.81 for Kenyan regressions and 0.84 to 0.88 for East African regressions. The variables with significant coefficients were tariffs, which were all significant for East Africa, followed closely by real and monetary gross domestic product, which again were all significant for East African regressions, and the relative commodity prices. No individual import price or domestic price variables were significant, but the former did generally have t values in the 1.4 to 2.1 range, indicating that it did tend to have some effect, although not significant.

The substitution of East African import price statistics for official Kenyan import price statistics did not improve the statistical performance, nor did the substitution of Craig import price statistics for official Kenyan data. For East African regressions, official data performed better empirically than did either the Craig modifications of the official East African import price index or the independent Craig import price calculations.

None of the domestic price variables performed well empirically. This was particularly true for the East African regressions when the Kenyan price index was utilized as a proxy for East African price behavior. This would indicate that Kenyan domestic price indices are not a good proxy for East African price behavior. Of the two alternative domestic price index calculations employed neither performed unambiguously better, so that regressions for disaggregated imports utilized the unmodified official Kenyan statistical series.

The test of the hypothesis that the source of income as well as its magnitude affects imports did not yield a statistically significant difference in the coefficients of the agricultural as compared to the non-agricultural component of income and thus no statistically significant difference in their impact on imports is indicated. However, the differences in Kenyan regressions generally supported the hypothesis and the differences in the East African regressions unanimously supported the hypothesis, despite the fact that these differences were not statistically significant. Hence, the general conclusion must be that while the differences between these two sources of income on imports are not statistically significant, there is some evidence of a somewhat greater impact on imports for non-agricultural income as compared with agricultural income. The statistical performance of these regressions with a split income variable did not attain that for the earlier regressions employing a single income variable.

Tests of the traditional import model with disaggregated imports yielded good statistical fits for all except SITC import classes 6 and 7. This was particularly true for the supplementary regressions which excluded any variables tending to perform perversely, in which case statistical fits improved substantially. A famine variable for food import demand did not improve results, probably due to a failure to correct the import price variable for famine imports. Increased imports of food during famine at subsidized prices is not inconsistent with normal demand relationships. The poor statistical results for SITC classes 6 and 7 are disturbing and may be at least partially due to the heterogeneous nature of the imports in these classes which contain a wide range of consumer and producer goods. Explicit political policy decisions which could exclude the usual economic variables might also be operative in these two classes of equipment, machinery, and manufactured goods imports. The supplementary regressions which excluded perversely performing variables and added an import substitution variable did improve the performance of import demand for SITC class 6, at least for the traditional import demand model, but these improvements were insufficient to make the regressions statistically significant.

The empirical tests of the price of time import demand model employing a wage index as a proxy for the price of time were also generally good, and in many cases, better than the traditional model test results. The Kenyan tests for aggregate imports of the price of time model, both with official Kenyan statistics and with the East African import price indices replacing the official Kenyan index, statistically outperformed the previously discussed good results of the traditional aggregate import demand model. In the East African tests of the price of time model which had to utilize the Kenyan wage index as a proxy of the price of time for the whole of East Africa, the results were statistically not as good as the traditional model tests when official East African data and the Craig modifications to the East African data were employed. However, even in these regressions, the best single statistical fit was obtained with a regression containing a price of time variable. The East African test which utilized the Craig import price index was the only East African set of regressions in which the price of time model generally performed statistically better than the traditional model.

To summarize, the price of time model was superior to the traditional model in the Kenyan tests, but the East African test results were mixed. The interpretation of these results could be twofold: First, the model could be concluded to be appropriate for Kenya but not for East Africa as a whole; secondly, the model could be considered appropriate for Kenya, but the test of the model for East Africa could be considered irrelevant since Kenyan wage statistics had to be employed as a probably not particularly relevant proxy of the price of time for all East Africa. If the latter view is accepted, a more relevant test of the price of time model will need to await the compilation of East African wage statistics or be tested for the data of some other countries with appropriate statistics.

For the disaggregated import demand regressions, the price of time model was judged likely to be most appropriate on an a priori basis for import class 0 and 1 and possibly class 4 since the food imports in class 0 and 1 and most of the food related imports of fats and oils in SITC class 4 would be most likely to compete with household production and to be purchased primarily by households. On this same basis the price of time model was judged to be irrelevant for imports in SITC class 2. Of the remaining import classes, the relevance of the price of time model would depend on the relative number of consumer vs. producer imports, but was judged likely to be questionable for import classes 3, 5, and 7 and impossible to determine for classes 6 and 8.

The statistically superior performance of the price of time model for class 0 and 1 imports supported these expectations. The mixed results for the original regressions in import class 4 were changed to support for the price of time model in the supplementary regressions, ultimately also not an unexpected result. The statistically superior performance of the price of time model in import classes 3 and 7 was not judged likely, although the relevance of the price of time model depended on the weight of consumer as opposed to producer imports in the classes. Apparently the importation of machinery and transport equipment, primarily motor vehicles and parts, bicycles, wireless sets, or other consumer equipment along with the fuels associated with such equipment, was sufficient to permit the price of time model to be appropriate in these classes. The price of time results improved the aforementioned poor fit of the traditional model in import class 7, including significant coefficients for all variables with the exception of one tariff variable.

A second series of tests for the price of time model employed an index of crop prices as a proxy for the price of time rather than a wage index on the assumption that in an underdeveloped economy agricultural activities are a more viable option than wage employment so that the returns from the former would be a more appropriate proxy for the price of time than the latter. The methodological problems of this test were severe since the isolation of both crop prices for production by the household (peasant producers) and imports consumed solely by these households would be necessary for an accurate test of the price of time model in this framework. Prices for several crops which had considerable production by small farmers, such as maize, coffee, and pyrethrum, were available. Four imported commodities which were among the major rural imports were tinned milk, rice, tea, and cotton piece goods, and two commodities which were major small town imports of prestige value and utility in the rural areas also were radios and bicycles. All of these imports, while major rural area imports, are not limited to rural areas. Imports going solely to rural areas, let alone to the producers of maize, coffee, and pyrethrum, are impossible to isolate. Thus, due to the exclusion of important variables, the statistical fit of these equations could be expected to be poor. The important aspect of the regressions for a test of the model is the sign and perhaps the significance of this crop price proxy for the price of time, although the latter could also be expected to be low.

As could be expected with these difficulties, the empirical results were statistically poor and their implications for the price of time model were mixed and depended on the particular import commodity and crop price. The import commodities of rice and bicycles tended to support the price of time model. The import demand regressions for tinned milk and cotton piece goods yielded mixed results. The imports of tea and radios did not support the model. Among the various crop prices, the price of maize followed by the price of coffee were the better price of time proxy variables. In general, given the methodological difficulties of this test and the inconclusive results, the best conclusion would appear to be that this second test is not a particularly appropriate test of the price of time model.

The general impact of these tests of the price of time model is a mixture of support and lack of support probably due to improper tests. For aggregate import demand, the price of time model performed better than the traditional model for Kenya but not for East Africa where due to a lack of data the Kenyan price of time proxy had to be utilized, probably improperly, for East Africa. In the disaggregated import demand analysis the price of time model was applicable to the two expected import classes and two additional classes where its applicability was dependent on the precise import composition. In the crop price as proxy for the price of time tests methodological problems again tended to make the tests inappropriate. Thus, where most appropriate, the tests tended to support the price of time model; but where the test was of doubtful relevance, the evidence was inconclusive. An alternative explanation for the superior performance could be that the earnings data more accurately reflect income change than do the gross domestic product statistics.

The tests of the money illusion hypothesis were generally one of support for the absence of money illusion hypothesis. For the aggregate demand tests, the Kenyan evidence was mixed, but the East African evidence supported the absence of money illusion hypothesis. But the weight of all the evidence, even for Kenya, was in support of the absence of money illusion hypothesis. In the disaggregated import demand analysis, the evidence from SITC class 0 and 1 was mixed, but the weight of the evidence supported the absence of money illusion hypothesis. The regressions for SITC classes 6 and 8 also supported the hypothesis.

The variables which generally tended to have statistically significant coefficients were the tariff, real and gross domestic product, and price of time variables. In the disaggregated import demand analysis gross domestic product and the price of time variables had significant coefficients in SITC classes 2, 3, 4, and 5, with only the price of time variable having a significant coefficient in class 7. The tariff variable was significant in several regressions in class 0 and 1 and once in class 5. In addition, the domestic price variable was significant on several occasions in class 0 and 1 and once in class 8, but not significant in class 6 which was the only other class in which that variable was employed. The import price variable had significant coefficients in all the regressions in class 0 and 1 and class 8 and twice in class 7.

In the comparison of the statistical performance of linear as compared to the log-linear regressions, the traditional import model test employing official Kenyan data had better results for the linear regressions while the price of time model was the opposite. For the East African regressions with both models employing official data, the linear regressions were preferable. For the disaggregated import demand analyses, the original set of regressions with all variables indicated that linear regressions were preferable in SITC classes 2, 3, and 4, while the log-linear regressions were better in classes 0 and 1 and in class 8, while the results for classes 5 and 7 were split and class 6 were poor in both cases. The only change made by the supplementary regressions was a shift in classes 2 and 4 to a situation where the log-linear regressions were now preferable. The impact of these results is that for aggregate demand analyses the linear regressions appear generally preferable while for disaggregated demand regressions the evidence is mixed with log-linear regressions having a slight advantage.

The estimates of income elasticity for imports were approximately unity or greater. Half of the aggregate import demand income elasticities were between 1.30 and 1.65, and all of these were based on significant coefficients. The import price elasticities were consistently above unity, but they were not based on significant coefficients. The domestic price elasticity estimates were unreliable in that they were variable and often negative. The relative commodity price elasticity appeared to be approximately unitary.

The tariff elasticity was consistently less than unity with estimates in the 0.6 to 0.8 range for the traditional model and 0.7 to 0.9 range for the price of time model. For the SITC import classes, the tariff elasticity was again less than unity but tended to be somewhat lower than for aggregate imports. The importance of these tariff elasticities for government revenue is that tariff changes are likely to be successful in raising additional government revenue. However, since the range of aggregate tariff elasticities is only slightly below unity at its upper levels, the revenue response to tariff changes may not be very great.

When revenue is directly regressed with income and the tariff rate or revenue from tariffs as the independent variables, the partial elasticity of revenue with respect to income is greater than unity but is inelastic with respect to tariff duty or revenue from tariffs. Two notes of caution were relevant to these conclusions. The first was that tariffs were measured as a ratio of duty collected to imports, and if this measure, due to the index number problem does not accurately reflect tariff changes, the conclusion would be misleading. The second was the problem of multicollinearity in the revenue regressions between revenue from customs duty and income.

The tariff burden analysis yielded three basic conclusions. First, the tariff burden with representative rates of duty for the various expenditure classes yielded greater tariff burdens than did the ratio of duty collected to imports. This is probably due to some rebates of import duty and to the importation of some commodities at lower than representative rates or even duty free within each import or expenditure class. Second, the tariff burden has increased over time and this is likely the result of tariff rate increases and increased imports in higher rate categories. Third, the tariff burden is somewhat lower at the highest income classes than at several lower and middle income classes, and it has been increasing more slowly for the highest income classes. One interpretation of this result could be that tariff changes which may have been intended to affect the more wealthy may have hit the lower income groups, or that imports with higher tariffs became more attractive to lower income classes, thus increasing their burden. On the other hand, and this is likely the more realistic, this result could simply be due to the assumption that all income classes spend equal proportions of their income on imports. For example, while expenditure on food, which tends to have high tariffs, is relatively great for low income groups, they are not as likely to purchase imported foods as are the more wealthy. When the probably realistic assumption is made that the higher income classes purchase a greater proportion of imports in each expenditure class, the tariff burden of the higher income classes is greater and has also been increasing faster. This is the more logical result and probably based on a realistic assumption. However, since expenditure data is not available separately for imports and domestic production, the empirical validity of this assumption cannot be tested.

Policy Implications

The policy implications of this study, most of which have previously been stated in technical economic and statistical terms, might be worthy of summary in conclusion. A general policy implication is that the economic theory of import demand and the factors such as income, domestic prices, import prices, and tariffs which it indicates to be important for import demand is empirically relevant for imports into Kenya and East Africa, both for aggregate imports and for all SITC classifications of imports except manufactured goods classified by material and, to a lesser extent, machinery and transport equipment. An alternative economic model which uses the price of time instead of income along with the other factors is even more appropriate for explaining imports into Kenya and East Africa for aggregate imports and for those imports relevant to the household.

Imports appear to be quite responsive to income and import price changes. Non-agricultural income appears to have a somewhat, though not significantly, greater effect on imports than does agricultural income. Official Kenya government statistics are more appropriate for an explanation of imports than are modified Kenyan data or data from East Africa as a whole.

Imports do not appear to be as responsive to tariff changes as they are to income and price changes, although tariffs do significantly affect imports. The impact of this result for government revenue from tariff duties is that an increase in tariffs by a certain proportion will not be counteracted by a similar proportion decrease in imports, so that increases in tariff rates will lead to an increase in government revenue. However, this increase in revenue from tariff rate changes may not be great because the decrease in aggregate imports as a result of these tariff increases, according to the estimates found in this study, may be almost as great as the increase in duty rates. This is less true for many individual classifications of imports than it is for aggregate imports.

When recurrent government revenue over the years is compared directly with changes in income and either tariff level or revenue from import duties, this study found that most of the change in government revenue could be explained by income and little additional was explained by tariffs or revenue from tariffs. In addition, it was found that government revenue tended to increase more than income, so that government revenue tended to be responsive to income changes. The conclusion must be that while tariffs likely have played a role in government revenue, available empirical evidence does not indicate that the role of tariffs has been great.

An attempt was also made to see how different income groups are affected by tariffs and to see whether the higher income groups tend to pay more of the tariffs or whether their share of the tariff burden has been growing over time. An ealier government expenditure survey which broke down expenditure by income groups was used to analyze the tariff burden of each of these income groups. The results of this analysis, when the survey was combined with tariff rates paid on various types of expenditures revealed that the higher income groups did not have a greater tariff burden and that, while the tariff burden had increased over the years for all income groups, the burden of the higher income groups had not increased more than those of many of the other income groups. However, the use of this survey, which does not break down expenditures into imports and domestic expenditures, in a tariff burden analysis assumes that the type of expenditure made by the higher income groups tends to be in expenditure categories which carry greater tariff rates than for those expenditure categories where the lower income groups spend their income. For example, it assumes that the higher the income group the more of their income is spent on cars and transportation which carry higher tariffs, and in this case the assumption may be valid. That this is not necessarily true in all cases is indicated by a second example. Imported food is also in a relatively high tariff class, at least for recent years. But for several reasons it is not necessarily true that the higher the income the greater the proportion of expenditure on food which is liable to that tariff rate. First, while the higher income groups may have absolutely greater expenditures on food, they may not spend proportionately more on food so that the tariff burden may be similar. Second, the difference in the income groups may not be in their expenditure on food as a whole but on the specific type of food they purchase. The higher income groups may, for example, tend to purchase more prepared foods, many of which may be imported, and other exotic imported foods which will bear a high duty. The expenditure survey which asks only for the total food expenditure of various income groups, but not for kinds of food expenditures such as imports, will not be capable of answering the question of who purchases the food which bears the high tariff. Thus, the unexpected result that the higher income groups do not necessarily pay a higher tariff burden and have not necessarily had a tariff burden which was increasing faster, while this may be a correct observation, may simply be due to the assumption implicit in the expenditure survey.

To attempt to correct for this implicit assumption, an alternative tariff burden index was calculated with the assumption that successively higher income groups spend proportionately more of their expenditure in each expenditure class on imports. In this case the tariff burden was greater for each higher income class, and the tariff burden had been increasing faster over time for the higher income classes. The conclusion must be that available data, which implicitly makes an apparently unrealistic assumption, does not support the contention that the higher income groups pay a higher tariff burden which has been increasing faster over time than that of lower income groups; but when a more realistic assumption that the higher income groups spend more on imports in each expenditure category is imposed on the available data, the tariff burden calculations do indicate that the higher income groups have a tariff burden which is greater and has been increasing faster than that for lower income groups.

DATA APPENDIX

APPENDIX

DATA

In 1954, East Africa adopted the Standard International Trade Classification of the United Nations for external trade statistics and used this system of classification as a basis for all its trade statistics, including the external trade indices with the base 1954. This same year, or a few years prior to 1954, was also the time when other statistical series were developed. Among them was Gross Domestic Product (GDP). Consequently, 1954 was selected as the origin for the data series compiled for this study.

The selection of 1966 as the terminal year for each data series was a result of changes in several of the series after this date. The changes in the new series included a shift in base year but also substantial modifications in construction. Among these major modifications was a more comprehensive calculation of gross domestic product and a shift to a Fisher's "Ideal" index for external trade indices. Both of these revisions were considered sufficient to imperil the continuity of the data series beyond the 1966 date.

Every effort was made to cross check various sources for the same data in order to insure accuracy and continuity and the conflict between sources was minimal. Whenever two sources differed, the source with the later publication date was assumed to be correct.

Import Quantity Index

Tables 1 and 2 contain the official Kenyan and East African aggregate statistics used in the import demand regressions. The import quantity index (M) calculated by the East African Statistical Department from the Annual Trade Reports prepared by the East African Customs and Excise Department is a Laspeyre, or base weighted, index of net imports which was revised during 1962 to correct for changes in coverage over the years.[1] The definition of net imports is direct imports minus transfers out of plus transfers into the East African country under discussion. Direct imports are imported goods which entered at the time of importation for consumption and warehousing in one of the three East African countries, including goods which are subsequently re-exported. These interstate transfers between East African countries, even though they must by law be reported and the major travel routes are few, create some uncertainty for the accuracy of imports for any one East African country. This is the reason for using both Kenya and East Africa in this study. The import quantity index is calculated for the whole of East Africa and for each country and is published and readily available for East Africa and the country of Kenya for both aggregate imports and imports by SITC section.

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[1]Complete information on the compilation of the external trade indices is available in East African Statistical Department, The External Trade of East Africa, Indices 1954-1958 and Commentary (September, 1960), and East African Common Services Organization, East African Statistical Department, East African Trade Indices, Revised External Trade Indices 1954-1961 with Commentary (January, 1963).

Import Price Index

The import price index (P_m) prepared by the same source as the import quantity index, is a Paasche, or current weighted, index for net imports.[1] It is strictly a unit value index, but its raison d'etre and normal use is that of a price index for imports. It, too, is calculated for East Africa and each country and is readily available for East Africa and Kenya for both aggregate imports and imports by SITC section.

John Craig attempted to improve on the official East African import price indices both in terms of modifying the official index and in terms of calculating an alternative index based on the trade data of countries exporting to East Africa.[2] Both the modifications and the alternative index appear in Table 3.

Domestic Price Index

The cost of living index (excluding rent) for Nairobi ($\widehat{P_d^c}$) is the only consistent series available for the years 1954 through 1966 which attempts to measure the level of domestic prices in Kenya. Unfortunately, this is not a particularly appropriate index for import demand

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[1]Complete information on the compilation of the external trade indices is available in East African Statistical Department, The External Trade of East Africa, Indices 1954-1958 and Commentary (September, 1960), and East African Common Services Organization, East African Statistical Department, East African Trade Indices, Revised External Trade Indices 1954-1961 with Commentary (January, 1963).

[2]John Craig, "An East African Import Price Index, 1954-1963, Calculated from Supplying Countries' Export Indices," The East African Economic Review, II (June, 1966), 39-54.

studies because it includes imported commodities in the calculation of the cost of living and is, thus, not a price index of only domestic commodities. The other difficulty is that it is a cost of living index which "measures, with a base of 1939, the cost of maintaining a standard of living prevailing among European Government servants with a basic salary of less than £500 per annum in 1947."[1] Not only is the base year of 1939 likely to reflect a situation completely different from the decades of the fifties and sixties, but the expenditure pattern of the European abroad, who was a significant economic force despite his small numbers until the independence movements, is likely to be different from that of the African citizen.

For these reasons, a composite domestic price index (P_d^W) was also calculated. This index used the wage earner's index of consumer prices in Nairobi for the years 1959, the year when this index originated, through 1966. This was an attempt to minimize the weaknesses of the cost of living index by removing the 1939 base and the expatriot orientation. However, the cost of living index was the only index available for the years 1954 through 1958 and had to be employed for those years. It was incorporated with the wage earner's index by multiplying the cost of living figure for each of the years 1954 through 1958 by the average ratio between the wage earner's index and the cost of living index for the years 1959 through 1968. This average was 0.3269. The range of ratios was from 0.3156 to 0.3338. That these two indices have behaved quite similarly during these years is

[1] Republic of Kenya, Kenya Statistical Abstract (1966), p. 115.

indicated by the correlation coefficient of 0.985 between these two price indices. This composite domestic price index could more accurately reflect the domestic price situation between 1954 and 1966 for several reasons. First, it reflects the fact that with political independence European expenditures become less important while they are retained for the earlier colonial years. Second, since it does not reflect European expenditures, it should tend to include fewer imported items familiar to European residents and, therefore, reflect more accurately the domestic price level. Both of these domestic price indices are tested empirically to determine which appears more appropriate.

Gross Domestic Product

Official gross domestic product data (GDP), which measures the value of the output of goods and services produced each year by residents of Kenya, is calculated at factor cost.[1] East African gross domestic product data is essentially a summation of the gross domestic products of the three East African countries.

A gross domestic product estimate for 1954 in East Africa could not be located in the East African statistical publications so that East African analyses using gross domestic product variables will originate with the 1955 data entry rather than the usual 1954 data entry.

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[1]For complete information on the methods and source for gross domestic product calculation, see the description in Republic of Kenya, Statistical Abstract and the report by the East African High Commission, Statistical Department, Domestic Income and Product in Kenya; A Description of Sources and Methods with Revised Calculations from 1954 to 1958, Nairobi, 1959.

Real gross domestic product data has not been officially calculated prior to 1964. An estimate of real output has been constructed by deflating the monetary gross domestic product data by the domestic price index, using both indices which attempt to estimate this domestic price level.

Price of Time

The price of time index (P_t) is calculated from the ratio of the estimated annual wage bill and the numbers employed in an annual survey of private and public employers. Earnings include all cash payments and the value of rations and free board including an estimate of the employer's contribution toward housing. Employment figures include apprentices and part-time workers but not directors and partners who do not receive a basic salary.

Tariff Index

The tariff index (T_m) is based on the ratio of the annual amount of customs duty collected and the value of net imports. Both of these statistics are collected and published by the East African Customs and Excise Department and are readily available for East Africa and Kenya for both aggregate imports and SITC classes.

Data for Crop Price as Proxy for Price of Time Analysis

Table 4 contains additional data employed in the price of time analysis based on crop price as a proxy for the price of time and indicates the source of the data on which these indices are based.

For each of the imported commodities, the import quantity index (M) is obtained directly by translating the quantity import data for each of the years for the commodity under consideration into an index with the base 1960. The import price indices for each commodity are obtained by translating into an index with base 1960 the ratio of import value obtained directly from the statistical abstract and the import quantity already discussed, resulting in a per unit value index for each commodity.

The tariff index is derived directly from the tariff rates in effect for each year for the commodity under consideration. If the tariff rate changed during any particular year, and most changed in the middle of the calendar year with the budget for the new fiscal year, the new rate was utilized for the whole of that year. Many tariff rates are in the form of a minimum specific tariff or an ad valorem tariff rate, which ever is greater. While both tended to change simultaneously, the percentage rate of change in the specific rate was normally different from that of the ad valorem rate. When this happened, the ad valorem rate change entered the index. The tariff index for tea was omitted since the tariff rate remained unchanged over the years for this commodity.

A domestic price index obtained from the cost of living index discussed previously was also employed on one occasion. This was in the analysis of cotton piece goods.

The price of maize is based on the guaranteed price for a 200 pound bag of grade II maize and until 1963 was strictly relevant for the large-farms sector only. For the purposes of this study, this price will also be assumed to reflect the prices paid for production by small farm producers for the period prior to 1963. The crop year for this crop overlaps two calendar years, and in order to coordinate this data with calendar year trade data, the latter portion of the crop year was assumed to be the relevant calendar year for trade data. This implicitly assumes a lag in the effect of crop prices on import demand of several months.

The pyrethrum price data translated into index number form was based on the average price for flowers with a 1.5 percent pyrethrum content. These prices referred to calendar years.

The clean coffee price data was based on the annual total appropriation to producers by the Coffee Marketing Board divided by total production and is therefore an average price for the year. The price, as that for maize, refers to the crop year which overlaps two calendar years. The same assumptions leading to a lag in the effect of crop price on imports were made for clean coffee as were made for maize.

Relative Price Variables

The relative price variables are ratios of the two relevant variables. For the relative commodity price variable, (P_m/P_d), the two relevant variables in the ratio are the import price variable (P_m) and each of the two domestic price variables (P_d^c and P_d^w). For the relative price of time (P_t/P_m), the two variables in the ratio are the price of time (P_t), or the earnings index, and the import price variable (P_m).

Per Capita Variables

The per capita variables are calculated by dividing the relevant variable by the population figure (N) for that year. For example, per capita gross domestic product (GDP/N) is the gross domestic product for any year (GDP) divided by the population for that year (N).

Disaggregated Data

While much of the preceding discussion is applicable to both aggregated and disaggregated data series, the latter present some problems not applicable to aggregated data. The major additional task is that of coordinating import statistics with domestic data, specifically that of relating the SITC classes which are the breakdown applicable to import quantity, import price, and customs duty, to the cost of living classifications which are employed for the domestic price variable. The import quantity, import price, and tariff data series by SITC section are contained in Table 5 through 7, and the cost of living price index by category is available in Table 8, as published by the statistics department, and in Table 9, as modified to fit the SITC classes in those classes where domestic substitutes were judged to be significant. The rationale for the inclusion or exclusion of a domestic price variable in each of the SITC classes can be found at the beginning of Chapter IV.

Import Substitution Variable

For some import demand tests there is reason to believe that import substitution may have been considerable, so that some data on the extent of this substitution would be beneficial. To meet this need, the Quantity Index of Manufacturing Production available in the Kenya Statistical Abstract was selected as the most appropriate. The index includes food, beverages, and tobacco as well as clothing and other manufactures of wood, paper, metal, and mineral products, and may only be a rough indication of production which would fall into any one of the SITC classes. The weights of the various subclasses of this index are not available to permit the construction of an index for commodity classes comparable to SITC import classes.

The entry for 1966 was available only with a new base year. An estimate of its value for the previous base year was calculated by increasing the new base year entry by a factor representative of the ratio between the old base entry and the new base entry in the three years prior to 1966 when data were available with both bases. The possible error in this entry is not extreme since its range of possible values was from a low of 1363 to a high of 1389. All of these indicate a considerable increase for the year 1966, although the precise size of this increase is not accurately known.

Kenya Government Revenue Data

Table 10 contains in index number form the three types of government revenue data necessary for analyzing the implications of tariffs for government revenue. On those few occasions when a later statistical abstract differed slightly from an earlier source, the latter was assumed to be the corrected figure. Except for the omitted early years of 1954 and 1955 when the figures were not consistent with later years due to different data organization or substantial differences between the statistical abstracts for these years and those for later years, any differences were negligible and could be considered corrective modifications in the data.

The other two series used in this analysis, the tariff and monetary gross domestic product indices were calculated earlier for import demand analyses and are employed here unchanged. A problem of consistency between these two data series and the government revenue series arises from revenue data being recorded for fiscal years but tariff and gross domestic product data being recorded for calendar years. This problem was solved by using that calendar year entry which was the same year as the first half of the fiscal year entry. For example, revenue data for the 1957-1958 fiscal year was combined with 1957 calendar year data while 1962-1963 fiscal year data was combined with 1962 calendar year data, etc. This implicitly assumes that the receipt of government revenue lags six months behind the generation of income and tariffs responsible for that revenue. This lag in revenue data is not at all implausible due to the time lag in collecting government revenues.

Tariff Burden Data

Data employed in the calculation of tariff burdens was of two basic types which had to be coordinated. The first was the expenditure pattern for various income classes, presented in Table 11, and the second was the tariff rate pattern presented in Table 12 by SITC class and in Table 13 by expenditure class for the relevant years.

The limitations of such expenditure surveys are numerous. Most important, they are strictly relevant only for the specific group surveyed. In this case that was apparently a particular group of wage earners in Nairobi whose basic income was between £200 and £750 per annum.[1] This is apparently the situation because the expenditure table in several statistical abstracts has no cited source, but there are several points of agreement between the middle income index of consumer prices and this table of average expenditure data by income group. This statistical table is the only available set of expenditure data disaggregated simultaneously by type of expenditure and income class. While the published survey on which these tables of expenditure and cost of living are evidently based states that the study was planned in order to estimate consumer demand rather than construct a cost of living index as had been the purpose of previous surveys, the latter end result apparently materialized anyway.

If the cost of living index was a primary objective for the survey, the resulting income data may be inaccurate. This is particularly true

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[1]Republic of Kenya, Kenya Statistical Abstract (1968), p. 169.

with the normal hesitation of households to accurately reveal their income, even if accurately known. In addition, the usual problems of surveys, such as consistency of interviewers in addition to full knowledge and honesty of the interviewee, are relevant to these statistics.

One rather blatant inconsistency evident in the expenditure data is in transport equipment where several classes had no expenditure, others had low expenditures, and one income class had an extremely high expenditure over ten times greater than any other income class. On further investigation, the apparent reason for this is that one family happened to have purchased an automobile during the survey period, artificially inflating this particular expenditure item for their income class.[1] Consequently, the tariff burden for each year is calculated in two ways. The first calculation uses the expenditure survey as published including the transport equipment item. The second calculation yields an alternate tariff burden for which the transport equipment item is eliminated from expenditure.

Additional approximations and inaccuracies occur in the coordination of tariff data to the various classes of expenditure, which inevitably match imprecisely. With all these inaccuracies in expenditure, income, and tariff data, the tariff burden calculations based on this data should not be imputed precise accuracy but should be considered

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[1]This is verified by Benton F. Massell and Judith U. Heyer, "Household Expenditure in Nairobi: A statistical analysis of consumer behavior," Discussion Paper No. 48, Institute for Development Studies, University College, Nairobi, April, 1967, which also contains other criticism of the expenditure survey.

indicative of the nature of the interrelationships among income classes with respect to tariff impact.

An attempt at such coordination of expenditure and tariffs is necessary for an analysis of the impact which import duties might have on various income groups. The result of such an attempt is summarized in Table 13. Except for utilities ("rates and water"), rent, education, recreation, taxes, and insurance, which were assumed to be domestic production, primarily services, more dependent on local supply and demand conditions than on tariffs or imports, all expenditure classes are assigned a tariff rate existing on imports of a similar nature, whose SITC class is indicated in the first column.

The left hand portion of the table uses the ratio of duty collected to import value for the relevant SITC class, summarized in Table 12, as a proxy of the tariff rate, while the right hand portion uses a "representative tariff rate" to approximate the relevant rate of import duty. The latter tariff rates in the right hand portion of Table 13 were gleaned from a study of the East African tariff rates in existence for each of those years to estimate the actual tariff rate charged on imports in each expenditure class. While personal judgment is involved in such a selection of tariff rates, an effort was made to use the most frequent rate encountered, or some intermediate rate if two or more rates were common. While differences in the pattern of tariff burdens for various income classes with these two measures of tariff rates could have been great, in retrospect the pattern of results for both are very similar, even though the size of the burden for any given income class is greater with the representative rate.

TABLE 1

KENYA DATA

Year	Import Quantity Index (1954=100) (M)	Import Price Index (1954=100) (P_m)	Cost of Living Index (August, 1939=100) (P_d^c)	Wage Earners Index of Consumer Prices (July, 1964=100) (P_d^w)	Monetary Gross Domestic (1954=100) (GDP)	Real Gross Domestic Product	
						GDP/P_d^c (GDP_r^c)	GDP/P_d^w (GDP_r^w)
1954	100	100	254	83[a]	100	39.4	120
1955	115	103	267	87[a]	120	44.9	138
1956	107	108	277	91[a]	129	46.6	142
1957	108	110	284	93[a]	137	48.4	147
1958	95	106	288	94[a]	138	48.0	147
1959	95	107	289	94	144	49.8	153
1960	105	110	291	96	156	53.6	162
1961	114	100	296	98	157	53.2	160
1962	112	104	307	101	161	52.4	159
1963	111	110	316	101	171	54.1	169
1964	115	110	321	101	189	59.0	187
1965	141	105	331	107	198	59.9	185
1966	174	108	342	110	217[b]	63.4[b]	197[b]

[a]The wage earner's Index is not available prior to 1959. The entries for 1954-1958 were obtained by multiplying the corresponding entries of the cost of living index by 013269 which is the average ratio between the wage earner's index and the cost of living index for the years 1959 through 1966.

[b]This entry is a provisional estimate and would normally have been subject to minor revision the following year, if the series had been continued unchanged.

TABLE 1--Continued

Year	Relative Commodity Price Index		Import Duty (£000) (D)	Net Import Value (£000) (V)	Tariff Index (1954=100) D/V (T_m)	Price of Time (1954=100) (P_t)	Relative Price of Time (P_t/P_m)
	(P_m/P_d^c)	(P_m/P_d^w)					
1954	39.4	120	6,904	60,329	100	100	100
1955	38.6	118	8,617	71,523	105	114	111
1956	39.0	119	8,435	69,823	106	120	111
1957	38.8	118	8,576	72,003	104	131	119
1958	36.8	113	8,589	60,869	123	136	129
1959	37.0	114	10,000	61,508	142	139	130
1960	37.8	115	10,421	70,069	130	143	130
1961	33.8	102	10,973	68,937	139	159	159
1962	33.9	103	12,579	69,494	158	160	154
1963	34.8	109	15,177	73,688	180	181	164
1964	34.3	109	14,971	76,595	171	187	170
1965	31.7	98	17,108	89,037	168	205	195
1966	31.6	98	21,444	112,396	167	227	210

TABLE 1--Continued

Year	Quantity Index of Manufac-/turing Production (1961=100) (M_s)	Popula-tion (1954=100) (N)	Import Quantity per Capita (1954=100) M/N	Monetary Gross Domestic Product per Capita (1954=100) GDP/N	Real Gross Domestic Product per Capita	
					GDP_r^c/N	GDP_r^w/N
1954	-	100	100	100	39.4	120
1955	-	103	112	116	43.5	134
1956	801	106	101	121	43.8	134
1957	817	110	99	125	44.1	134
1958	832	113	84	123	42.6	130
1959	916	116	82	124	42.8	132
1960	959	120	88	130	44.8	135
1961	1,000	123	93	128	43.2	130
1962	1,026	127	88	127	41.3	125
1963	1,061	130	85	131	41.5	130
1964	1,225	134	86	141	44.0	140
1965	1,308[b]	138	102	144	43.4	134
1966	1,371[c]	142	123	152[b]	44.6[b]	139[b]

[b]This entry is a provisional estimate and would normally have been subject to minor revision the following year if the series had been continued unchanged.

[c]This entry, officially available only with a new base year was modified to conform to the old base year (see the Data Appendix).

TABLE 1--Continued

GROSS DOMESTIC PRODUCT IN PRIMARY AND NON-PRIMARY INDUSTRIES

Year	Monetary GDP (1954=100)		Real GDP			
			Cost of Living Index as Deflater		Wage Earner's Index as Deflater	
	Primary (GDP_a)	Non-Primary (GDP_{na})	Primary (GDP^c_a)	Non-Primary (GDP^c_{na})	Primary (GDP^W_a)	Non-Primary (GDP^W_{na})
1954	100	100	39.4	39.4	120	120
1955	103	126	38.5	47.1	118	144
1956	123	131	44.6	47.3	136	144
1957	118	144	41.6	50.5	127	154
1958	122	144	42.3	49.9	130	153
1959	125	150	43.4	51.9	133	160
1960	141	161	48.4	55.3	147	168
1961	136	164	46.1	55.5	139	168
1962	140	168	45.7	54.6	139	166
1963	156	176	49.5	55.7	155	174
1964	169	196	52.7	61.6	167	194
1965	156	212	47.2	64.2	146	198
1966	179	229	52.4	67.0	163	208

TABLE 1--Continued

Sources:

Import Quantity Index and Import Price Index:

1954-1961: East African Authority, East African Statistical Department, *Economic and Statistical Review*, 30 (March, 1969), p. 36.

East African Statistical Department, *East African Trade Indices: Revised External Trade Indices 1954-1961 with Commentary* (January, 1963).

1962-1966: East African Authority, East African Statistical Department, *Economic and Statistical Review*, 25 (December, 1967), p. 31: 1966 data were changed from a base year 1964 to a base year 1954 by multiplying the 1966 entry by the ratio 1964 Index/100. This method yields 1966 data consistent with the 1966 entries found in the 1967 Kenya Statistical Abstract for Kenyan import quantity and unit value.

Cost of Living Index (as of 31 December):

1953: Republic of Kenya, *Kenya Statistical Abstract* (1963), p. 95.
1954-1956: Republic of Kenya, *Kenya Statistical Abstract* (1964), p. 105.
1957-1967: Republic of Kenya, *Kenya Statistical Abstract* (1967), p. 158.

Wage Earner's Index of Consumer Prices:

1959-1960: Republic of Kenya, *Kenya Statistical Abstract* (1966), p. 116.
1961-1966: Republic of Kenya, *Kenya Statistical Abstract* (1969), p. 175.

Gross Domestic Product:

1954-1956: Republic of Kenya, *Kenya Statistical Abstract* (1964), p. 100.
1957-1966: Republic of Kenya, *Kenya Statistical Abstract* (1967), p. 33.

Tariff Index, Import Duty Collected:

1954-1958: Republic of Kenya, *Kenya Statistical Abstract* (1964), p. 38.
1959-1966: Republic of Kenya, *Kenya Statistical Abstract* (1969), p. 61.

TABLE 1--Continued

Net Import Value:
- 1954-1955: Republic of Kenya, Kenya Statistical Abstract (1964), p. 37.
- 1956-1957: Republic of Kenya, Kenya Statistical Abstract (1966), p. 37.
- 1958-1966: Republic of Kenya, Kenya Statistical Abstract (1968), p. 55.

The sources for Import Duty and Net Import Value Data are supplemented by and in agreement with the data in East African Community, East African Customs and Excise, Annual Trade Reports of Tanzania, Uganda, and Kenya for each of the years 1954-1966.

Price of Time Index, Earnings and Employment Data:
- 1954-1955: Republic of Kenya, Kenya Statistical Abstract (1964), p. 112.
- 1956-1957: Republic of Kenya, Kenya Statistical Abstract (1966), p. 122.
- 1958-1966: Republic of Kenya, Kenya Statistical Abstract (1968), p. 163.

Population (as of 30 June):
- 1954-1959: Republic of Kenya, Kenya Statistical Abstract (1964), p. 7.
- 1960-1966: Republic of Kenya, Kenya Statistical Abstract (1967), p. 13.

Quantity Index of Manufacturing Production:
- 1956-1965: Republic of Kenya, Kenya Statistical Abstract (1966), p. 80.
- 1966: Republic of Kenya, Kenya Statistical Abstract (1968), p. 84.

TABLE 2

EAST AFRICAN DATA

Year	Import Quantity Index (1954=100) (M)	Import Price Index (1954=100) (P_m)	Monetary Gross Domestic Product (1955=100) (GDP)	Real Gross Domestic Product[a]	
				$GDP_r^c = GDP/P_d^c$	$GDP_r^w = GDP/P_d^w$
1954	100	100	-	-	-
1955	127	100	100	37.5	115
1956	110	103	106	38.3	116
1957	116	103	112	39.4	120
1958	103	101	113	39.2	120
1959	102	101	118	40.8	126
1960	108	105	128	44.0	133
1961	117	99	130	43.9	133
1962	117	97	133	43.3	132
1963	116	107	148	46.8	147
1964	119	109	167	52.0	165
1965	137	109	172	52.0	161
1966	175	112	204	59.6	185

[a]Since domestic price indices are not available for East Africa, the domestic price indices for Nairobi, Kenya, are used as proxy indices for East Africa as a whole.

TABLE 2--Continued

Year	Relative Commodity Price Index[a]		Import Duty (£000)	Net Import Value (£000)	Tariff Index (1954=100) (T_m)	Relative Price of Time[b] P_t/P_m
	P_m/P_d^c	P_m/P_d^w				
1954	39.4	120	14,761	117,490	100	100
1955	37.5	115	19,222	149,030	103	114
1956	37.2	113	17,751	133,814	106	117
1957	36.3	111	19,220	140,147	109	127
1958	35.1	107	19,837	121,440	130	135
1959	34.9	107	23,163	121,497	152	138
1960	36.1	109	24,617	133,916	146	136
1961	33.4	101	25,937	135,170	153	161
1962	31.6	96	30,144	135,517	177	165
1963	33.9	106	36,231	145,028	199	169
1964	34.0	108	38,074	153,376	198	172
1965	32.9	102	42,868	179,953	190	188
1966	32.8	102	49,099	219,594	178	203

[a]Since domestic price indices are not available for East Africa, the domestic price indices for Nairobi, Kenya, are used as proxy indices for East Africa as a whole.

[b]Since earnings data for all East Africa are not available, the earnings data for Kenya is used as an estimate for the earnings of East Africa as a whole.

TABLE 2--Continued

Year	Population (1954=100) N	Import Quantity per Capita (1954=100) M/N	Monetary Gross Domestic Product per Capita (1954=100) GDP/N	Real Gross Domestic Product per Capita	
				GDP_r^c/N	GDP_r^w/N
1954	100	100	-	-	-
1955	102	124	98	36.6	112
1956	106	138	100	36.0	109
1957	109	106	103	36.1	110
1958	112	92	101	35.1	108
1959	114	89	103	35.7	110
1960	117	92	109	37.6	114
1961	120	98	109	36.6	111
1962	123	95	108	35.3	108
1963	126	92	118	37.2	117
1964	129	92	130	40.4	128
1965	132	104	130	39.4	122
1966	135	130	151	44.1	137

TABLE 2—Continued

Year	Monetary GDP (1955=100)		Real GDP			
			Cost of Living as Deflater		Wage Earner's Index as Deflater	
	Primary (GDP_a)	Non-Primary (GDP_{na})	Primary (GDP^c_a)	Non-Primary (GDP^c_{na})	Primary (GDP^W_a)	Non-Primary (GDP^W_{na})
1954	-	-	-	-	-	-
1955	100	100	37.5	37.5	115	115
1956	106	106	38.2	38.2	116	116
1957	108	115	38.0	40.5	116	124
1958	106	118	36.7	41.0	112	126
1959	111	123	38.3	42.6	118	131
1960	115	138	39.6	47.3	120	143
1961	111	144	37.5	48.5	113	147
1962	110	149	35.8	48.7	109	148
1963	134	159	42.5	50.2	133	157
1964	154	176	47.9	54.9	152	175
1965	140	195	42.2	59.0	131	183
1966	163	234	47.5	68.4	148	213

TABLE 2--Continued

Sources:

Import Quantity Index and Import Price Index:

1954-1961: East African Authority, East African Statistical Department, Economic and Statistical Review, 30 (March, 1969), p. 36.

East African Statistical Department, East African Trade Indices: Revised External Trade Indices 1954-1961 with Commentary (January, 1963).

1962-1966: East African Authority, East African Statistical Department, Economic and Statistical Review, 25 (December, 1967), p. 31. 1966 data were changed from a base year 1964 to a base year 1954 by multiplying the 1966 entry by the ratio 1964 Index/100. This method yields 1966 data consistent with the 1966 entries found in the 1967 Kenya Statistical Abstract for Kenyan import quantity and unit value.

Gross Domestic Product:

1955 and 1956: East African Authority, East African Statistical Department, Economic and Statistical Review, 2 (March, 1962), p. 102.

1957-1959: East African Authority, East African Statistical Department, Economic and Statistical Review, 13 (December, 1964), p. 114.

1960: East African Authority, East African Statistical Department, Economic and Statistical Review, 17 (December, 1965), p. 101.

1961-1964: East African Authority, East African Statistical Department, Economic and Statistical Review, 21 (December, 1966), p. 101.

1965: East African Authority, East African Statistical Department, Economic and Statistical Review, 25 (December, 1967), p. 79.

1966: East African Authority, East African Statistical Department, Economic and Statistical Review, 29 (December, 1968), p. 87.

Import Duty:

East African Community, East African Customs and Excise, Annual Trade Reports of Tanzania, Uganda, and Kenya, 1954-1966, respectively.

TABLE 2--Continued

Net Import Value:

1954 and 1955: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 46 (December, 1959), p. 13.

1956: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 1 (December, 1961), p. 26.

1957-1958: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 5 (December, 1962), p. 20.

1959: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 13 (December, 1964), p. 15.

1960-1965: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 17 (December, 1965), p. 18.

1966: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 25 (December, 1967), p. 14.

The sources for import duty and net import value are supplemented by and in agreement with the data in East African Community, East African Customs and Excise, _Annual Trade Report of Tanzania, Uganda, and Kenya_ for each of the years 1954-1966.

Population (Kenya, Uganda, and mainland Tanzania, excluding Zanzibar):

1954-1955: Official 1954 and 1955 population estimates are inconsistent with later years because estimates of population growth were revised upward in 1956 to correct what were obvious underestimates. Consistent population estimates for this study were derived by applying these revised population growth assumptions to these two pre-1956 years.

1956: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 17 (December, 1956), p. 5.

1957-1966: East African Authority, East African Statistical Department, _Economic and Statistical Review_, 21 (December, 1966), p. 5.

TABLE 3

CRAIG EAST AFRICAN IMPORT PRICE DATA

Year	Craig Modified East African Import Price Index (1954=100) (P^m_m)	Craig Modified East African Relative Commodity Price Index (P^m_m/P^c_d)	Craig Modified Relative Price Index (P^m_m/P^w_d)	Craig Import Price Index (P^c_m)	Craig Relative Commodity Price Index (P^c_m/P^c_d)	Craig Relative Commodity Price Index (P^c_m/P^w_d)	Craig Modified Relative Price of Time Index (P_t/P^m_m)	Craig Relative Price of Time Index (P_t/P^c_m)
1954	100	39.4	120	100	39.4	120	100	100
1955	100	37.5	115	100.5	37.6	116	114	113
1956	103	37.2	113	103.9	37.5	114	117	115
1957	103	36.3	111	106.9	37.6	115	127	123
1958	101	35.1	107	104.1	36.1	111	135	131
1959	101	34.9	107	102.8	35.6	109	138	135
1960	105	36.1	109	104.7	36.0	109	136	137
1961	103	34.8	105	104.7	35.4	107	154	152
1962	101	32.9	100	104.2	33.9	103	158	154
1963	107	33.9	106	105.0	33.2	104	169	172
1964	109	34.0	108	106.4	33.1	105	172	176

Source: John Craig, "An East African Import Price Index," The East African Economic Review, 2 (June, 1966), 39-54, and data from previous tables.

TABLE 4

DATA FOR CROP PRICE AS PROXY FOR PRICE OF TIME REGRESSIONS
1960=100

Year	Milk Evaporated or Condensed			Rice		
	M	P_m	T_m	M	P_m	T_m
1954	80	111	100	212	153	100
1955	93	104	100	65	126	100
1956	115	97	100	67	122	100
1957	145	111	100	205	109	100
1958	84	105	100	112	121	100
1959	80	108	100	214	115	100
1960	100	100	100	100	100	100
1961	83	95	114	85	121	114
1962	116	89	114	87	146	114
1963	74	107	114	97	143	114
1964	15	123	152	14	140	114
1965	0.5	154	170	44	139	136
1966	-	-	170	43	140	136
1967	-	-	170	-	-	136

TABLE 4—Continued

Year	Tea		Cotton Piece Goods			
	M	P_m	M	P_m	T_m	Cost of Living Index Clothing & Footwear
1954	1	325	122	102	100	275
1955	12	163	77	118	100	274
1956	4	195	82	107	100	271
1957	17	192	78	123	100	272
1958	22	139	80	86	100	274
1959	115	96	95	87	100	270
1960	100	100	100	100	100	272
1961	675	97	109	95	111	274
1962	1,356	72	105	86	111	276
1963	3,792	75	98	91	122	280
1964	5,480	76	98	81	122	285
1965	5,601	80	105	90	122	292
1966	4,464	67	96	107	133	299
1967	3,244	62	52	117	133	-

TABLE 4--Continued

Year	Radios			Bicycles		
	M	P_m	T_m	M	P_m	T_m
1954	36	112	100	94	101	100
1955	61	105	100	195	97	100
1956	39	108	100	177	105	100
1957	52	115	100	186	103	100
1958	36	117	100	40	100	100
1959	52	112	100	86	106	100
1960	100	100	100	100	100	100
1961	133	82	114	29	85	114
1962	150	76	114	56	90	114
1963	284	74	114	69	88	114
1964	268	60	114	88	93	114
1965	249	64	136	47	90	136
1966	51	148	227	58	84	136
1967	74	90	227	75	88	136

TABLE 4--Continued

Year	Crop Prices		
	Maize	Pyrethrum	Clean Coffee
1954	121	88	-
1955	110	93	96
1956	110	93	106
1957	119	92	133
1958	109	91	112
1959	84	96	101
1960	100	100	100
1961	111	83	81
1962	111	68	87
1963	75	70	72
1964	84	87	86
1965	102	102	82
1966	102	86[a]	77
1967	102	86[a]	65

[a]Provisional estimate

TABLE 4--Continued

Sources: M and P_m for tinned milk, rice, tea, and cotton piece goods:

1954-1957: Republic of Kenya, Kenya Statistical Abstract (1964), pp. 30-35.
1958-1967: Republic of Kenya, Kenya Statistical Abstract (1968), pp. 33-38.

M and P_m for radios and bicycles:

1954-1959: Republic of Kenya, Kenya Statistical Abstract (1964), pp. 30-35.
1960-1967: Republic of Kenya, Kenya Statistical Abstract (1970), pp. 54-59.

Cost of Living Index for Clothing and Footwear:
See Table 7.

Tariff Index:
Periodic Customs Duty Handbooks and Laws of Kenya, supplemented by Acts of Kenya.

Maize Price:
1954: Republic of Kenya, Kenya Statistical Abstract (1959), p. 66.
1955-1959: Republic of Kenya, Kenya Statistical Abstract (1962), p. 65.
1960-1967: Republic of Kenya, Kenya Statistical Abstract (1967), p. 75.

Pyrethrum Price:
1954-1958: Republic of Kenya, Kenya Statistical Abstract (1962), p. 65.
1959-1967: Republic of Kenya, Kenya Statistical Abstract (1967), p. 75.

Clean Coffee Price:
1955-1958: Republic of Kenya, Kenya Statistical Abstract (1962), p. 65.
1959-1967: Republic of Kenya, Kenya Statistical Abstract (1967), p. 75.

TABLE 5

KENYA IMPORT QUANTITY INDEX BY SITC CLASS (M)
1954=100

Year	0 and 1	2	3	4	5	6	7	8	6 and 8
1954	100	100	100	100	100	100	100	100	100
1955	82	131	111	106	159	100	139	142	106
1956	97	155	122	154	145	95	111	155	105
1957	106	195	116	158	174	99	102	184	114
1958	84	166	115	193	163	92	73	201	112
1959	104	199	109	124	178	84	79	212	110
1960	85	204	123	285	212	134	98	227	152
1961	254	242	123	463	211	86	67	196	109
1962	185	183	134	657	211	89	74	215	115
1963	97	224	137	440	263	104	79	207	126
1964	108	330	154	537	292	86	100	198	111
1965	301	366	154	797	265	92	95	139	101
1966[a]	325	471	194	837	365	109	147	115	110

[a]This entry is a provisional estimate and would normally have been subject to minor revision the following year if the series had been continued unchanged.

Sources: 1954-1961: East African Common Services Organization, East African Statistical Department, East African Trade Indices 1954-1961 with Commentary, Table 2 (January, 1963), Nairobi, Kenya.

1962-1966: Republic of Kenya, Kenya Statistical Abstract (1967), p. 64.

TABLE 6

KENYA IMPORT PRICE INDEX BY SITC CLASS (P_m)

Year	0 and 1	2	3	4	5	6	7	8	6 and 8
1954	100	100	100	100	100	100	100	100	100
1955	102	115	105	90	104	101	106	88	99
1956	102	113	112	87	108	106	113	89	103
1957	108	109	121	91	112	107	115	90	104
1958	111	105	106	89	121	89	125	71	86
1959	104	95	100	86	112	101	133	75	96
1960	101	113	95	71	110	110	132	77	104
1961	61	124	90	70	110	106	172	78	100
1962	78	106	89	66	111	102	159	78	97
1963	110	105	90	63	104	105	149	99	104
1964	116	108	88	71	104	107	141	94	104
1965	69	129	98	95	111	111	142	118	112
1966[a]	79	116	89	80	108	111	196	196	130

[a]This entry is a provisional estimate and would normally have been subject to minor revision the following year if the series had been continued unchanged.

Sources: 1954-1961: East African Common Services Organization, East African Statistical Department, East African Trade Indices 1954-1961 with Commentary, Table 2 (January, 1963), Nairobi, Kenya.

1962-1966: Republic of Kenya, Kenya Statistical Abstract (1967), p. 64.

TABLE 7

KENYA TARIFF INDEX BY SITC CLASS (T_m)
1954=100

Year	0 and 1	2	3	4	5	6	7	8	6 and 8
1954	100	100	100	100	100	100	100	100	100
1955	152	53	157	43.1	87	104	90	114	107
1956	119	42	143	20.3	99	103	115	108	105
1957	92	45	142	24.3	90	103	128	123	110
1958	104	52	150	21.2	86	150	151	133	149
1959	101	39	183	21.2	91	200	170	144	191
1960	118	29	226	17.9	67	160	185	144	160
1961	74	38	301	22.4	79	194	137	169	193
1962	79	35	404	41.6	82	217	168	181	213
1963	98	39	460	34.4	97	219	287	189	217
1964	85	41	443	7.2	84	247	236	205	244
1965	72	62	425	3.6	81	233	289	179	225
1966[a]	74	89	426	6.8	86	264	239	182	249

[a]This entry is a provisional estimate and would normally have been subject to minor revision the following year if the series had been continued unchanged.

Sources: Import Duty Collected:
1954-1955: Republic of Kenya, Kenya Statistical Abstract (1964), p. 38.
1956-1957: Republic of Kenya, Kenya Statistical Abstract (1966), pp. 33-37.
1958-1966: Republic of Kenya, Kenya Statistical Abstract (1968), pp. 53-55.
Net Import Value:
1954-1955: Republic of Kenya, Kenya Statistical Abstract (1964), p. 38.
1956-1957: Republic of Kenya, Kenya Statistical Abstract (1966), p. 41.
1958-1966: Republic of Kenya, Kenya Statistical Abstract (1968), p. 60.

TABLE 8

COST OF LIVING INDEX (EXCLUDING RENT)--NAIROBI
1954-1966
(August, 1939=100)

Group	1954	1955	1956	1957	1958	1959	1960
Food, Drink and Tobacco	277	292	298	300	292	296	296
Clothing and Footwear	275	274	271	272	274	270	272
Household	240	245	249	265	262	263	263
Domestic Servants' Wages	320	368	384	415	432	431	447
Transport	199	215	213	222	223	223	222
Pharmaceutical Products	145	147	149	153	158	161	161
Amusements	159	161	168	171	174	186	186
Papers and Periodicals	158	158	158	158	188	188	188
Miscellaneous	242	252	254	264	267	275	273
Average Weighted Index of all Groups	259	275	279	288	288	290	292

TABLE 8--Continued

Group	1961	1962	1963	1964	1965	1966
Food, Drink, and Tobacco	303	320	319	329	351	355
Clothing and Footwear	274	276	280	285	292	299
Household	265	272	268	271	274	286
Domestic Servants' Wages	472	509	511	520	528	537
Transport	228	242	250	255	264	271
Pharmaceutical Products	166	186	188	193	196	205
Amusements	189	191	197	204	210	213
Papers and Periodicals	188	206	206	206	206	244
Miscellaneous	273	275	297	302	316	322
Average Weighted Index of all Groups	299	315	317	324	338	345

Sources: 1954-1960: Republic of Kenya, Kenya Statistical Abstract (1964), p. 105.
1961-1966: Republic of Kenya, Kenya Statistical Abstract (1967), p. 158.

TABLE 9

KENYA DOMESTIC AND RELATIVE PRICE INDICES, BY SITC CLASSES, WHERE APPLICABLE

Year	SITC Class 0 and 1		
	Domestic Price P_d	Relative Commodity Price P_m/P_d	Specific Relative Price of Time $P_t/P_m^{0,1}$
1954	272	36.1	100
1955	292	34.9	112
1956	298	34.2	118
1957	300	36.0	121
1958	292	38.0	123
1959	296	35.1	134
1960	296	34.1	142
1961	303	20.1	261
1962	320	24.4	205
1963	319	34.5	165
1964	329	35.3	161
1965	351	19.7	297
1966	355	22.3	287

TABLE 9--Continued

Year	SITC Class 6		
	Domestic Price P_d	Relative Commodity Price P_m/P_d	Specific Relative Price of Time P_t/P_m^6
1954	275	36.4	100
1955	274	36.9	113
1956	271	39.1	113
1957	272	39.3	122
1958	274	32.5	153
1959	270	37.4	138
1960	272	40.4	130
1961	274	38.7	150
1962	276	37.0	157
1963	280	37.5	172
1964	285	37.5	175
1965	292	38.0	185
1966	299	37.1	205

TABLE 9--Continued

Year	SITC Class 8		
	Domestic Price P_d	Relative Commodity Price P_m/P_d	Specific Relative Price of Time P_t/P_m^8
1954	240	41.7	100
1955	245	35.9	130
1956	249	35.7	135
1957	265	34.0	146
1958	262	27.1	192
1959	263	28.5	185
1960	263	29.3	186
1961	265	29.4	204
1962	272	28.7	205
1963	268	36.9	183
1964	271	34.7	199
1965	274	43.1	174
1966	286	68.5	116

Source: Preceding tables and mathematical manipulations on data from those tables.

TABLE 10

KENYA GOVERNMENT REVENUE DATA

Fiscal Year	Recurrent Revenue (1956-1957=100)	Revenue from Taxation (1957-1958=100)	Revenue from Import Duties (1957-1958=100)	Tariff[a] Index (1954=100)	Monetary[a] Gross Domestic Product (1954=100)
1956-1957	100	-	104	106	129
1957-1958	103	100	100	104	137
1958-1959	104	106	118	123	138
1959-1960	105	106	131	142	144
1960-1961	113	103	123	130	156
1961-1962	121	112	144	139	157
1962-1963	128	126	170	158	161
1963-1964	151	133	169	180	171
1964-1965	156	143	196	171	189
1965-1966	170	160	212	168	198
1966-1967	194	193	247	167	217

[a]This is a calendar year index for the earlier part of the fiscal year.

Sources for Revenue Data: 1960, 1961, 1962, 1963, 1964, 1965, 1966, 1968, and 1970, Republic of Kenya, Kenya Statistical Abstract, pp. 96, 96, 102, 82, 92, 91, 99, 146, and 150, respectively. Tariff Index and Monetary Gross Domestic Product are obtained from Table 1 in the Appendix.

TABLE 11

AVERAGE EXPENDITURE
(By Income Group)

Item	335-399	400-499	500-599	600-699	700-799	800-999	1000-1399
Food	161.75	178.05	207.65	239.10	236.85	232.15	238.65
Alcoholic Beverages and Tobacco	30.65	37.50	35.55	51.15	61.65	55.05	78.80
Clothing	37.65	40.95	53.90	55.40	77.65	65.70	88.15
Fuel and Light	12.40	15.05	12.50	17.30	18.65	24.15	20.75
Rates and Water	4.25	13.50	4.45	3.45	8.00	4.55	12.80
Housing (net rent)	24.55	30.65	31.80	33.25	50.65	72.00	82.10
Furniture and Utensils	13.85	14.70	21.40	40.20	65.20	53.15	49.25
Medical and Personal Health	11.00	12.55	15.95	13.65	32.55	19.45	27.40
Education	0.90	2.15	10.25	7.40	0.55	22.40	10.65
Recreation	7.15	7.20	11.05	12.25	16.80	15.70	16.80
Household Operation	12.60	15.10	18.55	23.45	19.30	24.85	32.10
Transport Equipment	-	1.25	14.95	0.55	-	191.40	-
Travel	24.95	26.05	44.60	40.40	45.95	51.50	60.35
Building Materials	6.85	3.60	5.30	15.55	3.75	0.55	17.55
Taxes	3.55	2.30	8.55	4.20	5.45	13.15	28.45
Insurance	4.90	15.30	33.05	25.65	49.30	54.95	100.30
Remittances	36.90	45.90	60.95	80.20	113.85	76.80	81.75
Miscellaneous	7.55	21.50	20.05	8.55	28.30	19.75	17.05
TOTALS	401.45	483.20	610.50	671.70	834.45	997.25	962.90

Source: Republic of Kenya, Kenya Statistical Abstract (1966).

TABLE 12

DUTY COLLECTED AS A PERCENTAGE OF IMPORT VALUE BY SITC CLASS

SITC Class	1954	1960	1964	1967
0	9.87	16.2	17.6	22.1
1	242.0	200.0	163.0	179.0
2	9.52	2.79	3.87	10.5
3	9.86	22.3	43.7	47.1
4	9.24	1.67	0.665	1.15
5	7.78	5.24	6.52	5.80
6	9.08	14.5	22.5	19.9
7	3.74	6.91	8.83	9.42
8	12.4	17.8	25.4	20.1
All Imports	11.4	14.9	19.6	18.1

TABLE 13

TARIFF RATES FOR TARIFF BURDEN INDEX

Item	Associated SITC Class	Tariff Rate: Duty Collected/ Import Value				Representative Tariff Rate		
		1954	1960	1964	1967	1960	1964	1967
Food	0	0.09869	0.1624	0.1757	0.2212	0.2600	0.3330	0.3750
Alcoholic Beverages and Tobacco	1	2.4249	1.9965	1.6321	1.7869	1.0000	1.3000	1.6667
Clothing	8	0.1235	0.1779	0.2536	0.2008	0.3000	0.3667	0.4000
Fuel and Light	3	0.09860	0.2233	0.4370	0.4707	0.2200	0.2800	0.3000
Rates and Water	none	-	-	-	-	-	-	-
Housing (net rent)	none	-	-	-	-	-	-	-
Furniture and Utensils	6	0.09485	0.1513	0.2311	0.1990	0.3000	0.3330	0.3750
Medical and Personal Health	5	0.7775	0.05236	0.06521	0.05796	0.0000	0.0800	0.1000
Education	none	-	-	-	-	-	-	-
Recreation	none	-	-	-	-	-	-	-
Household Operation	6	0.09083	0.1449	0.2247	0.1985	0.2200	0.3330	0.3750
Transport Equipment	7	0.03740	0.06914	0.08833	0.09423	0.1500	0.2600	0.5000
Travel	3	0.09860	0.2233	0.4370	0.4707	0.1500	0.2500	0.4000
Building Materials	6	0.09485	0.1513	0.2311	0.1990	0.1100	0.1350	0.1500
Taxes	none	-	-	-	-	-	-	-
Insurance	none	-	-	-	-	-	-	-
Remittances	all	0.1144	0.1487	0.1955	0.1811	0.2800	0.3500	0.3875
Miscellaneous	all	0.1144	0.1487	0.1955	0.1811	0.2200	0.2500	0.3000

BIBLIOGRAPHY

BIBLIOGRAPHY

Ball, R.J. and K. Mavwah. "The U.S. Demand for Imports, 1948-1958," The Review of Economics and Statistics, 44:4 (November, 1962), 395-401.

Becker, Gary S. "A Theory of the Allocation of Time," The Economic Journal (September, 1965), 493-517.

Cheng, H.S. "Statistical Estimates of Elasticities and Propensities in International Trade: A Survey of Published Studies," International Monetary Fund Staff Papers, 7:1 (April, 1959), 107-158.

Clark, Paul G. Development Planning in East Africa, East African Studies No. 21. Nairobi: The East African Publishing House, 1965.

Craig, John. "An East African Import Price Index, 1954-1963, Calculated from Supplying Countries' Export Indices," The East African Economic Review, 2 (June, 1966), 39-54.

Dean, Edwin. The Supply Responses of African Farmers: Theory and Measurement in Malawi. Amsterdam: North-Holland Publishing Company, 1966.

Due, John F. Indirect Taxation in Developing Countries. Baltimore: The Johns Hopkins Press, 1970.

______. Taxation and Economic Development in Tropical Africa. Cambridge, Massachusetts: MIT Press, 1963.

Durban, J. and G.S. Watson. "Testing for Serial Correlation in Least-Squares Regression, Part I," Biometrica, 37 (1950), 409-428.

______. "Testing for Serial Correlation in Lease-Squares Regression, Part II," Biometrica, 38 (1951), 159-178.

East African Authority, East African Statistical Department. Economic and Statistical Review, 46 (December, 1959).

______. Economic and Statistical Review, 1 (December, 1961).

______. Economic and Statistical Review, 2 (March, 1962).

______. Economic and Statistical Review, 5 (December, 1962).

East African Authority, East African Statistical Department, Economic and Statistical Review, 13 (December, 1964).

______. Economic and Statistical Review, 17 (December, 1965).

______. Economic and Statistical Review, 21 (December, 1965).

______. Economic and Statistical Review, 25 (December, 1967).

______. Economic and Statistical Review, 29 (December, 1968).

______. Economic and Statistical Review, 30 (March, 1969).

East African Community, East African Customs and Excise. Annual Trade Report of Tanzania, Uganda, and Kenya, 1954-1966.

East African Common Services Organization, East African Statistical Department. East African Trade Indices, Revised External Trade Indices 1954-1961 with Commentary (January, 1963).

______. The External Trade of East Africa, Indices 1954-1958 and Commentary (September, 1960).

East African High Commission, Statistical Department. Domestic Income and Product in Kenya: A Description of Sources and Methods with Revised Calculations from 1954-1958 (Nairobi, 1959).

______. Some Notes on Industrial Development in East Africa, 2nd edition, 1959.

East African Statistical Department. East African Trade Indices: Revised External Trade Indices 1954-1961 with Commentary (January, 1963).

Ewing, A.F. "Some Recent Contributions to the Literature on Economic Development," The Journal of Modern African Studies, 4:3 (November, 1966), 335-348.

Faaland, Just, and Hans-Erik Dahl. The Economy of Kenya. Bergen: The Chr. Michelsen Institute, July, 1967.

Ghai, Dharam P. Taxation for Development: A Case Study of Uganda, East African Studies No. 23. Nairobi, Kenya: East African Publishing House, 1966.

Government of Kenya. Kenya Development Plan for the period 1970-1974.

Houthakker, H.S. and Stephen P. Magee. "Income and Price Elasticities in World Trade," The Review of Economics and Statistics, 51:2 (May, 1969), 111-125.

Hymer, Stephen and Stephen Resnick. "A Model of an Agrarian Economy with Non-agricultural Activities," The American Economic Review 59:4, part 1 (September, 1969), 493-506.

Johnston, J. Econometric Methods. New York: McGraw-Hill Book Company, 1963.

Kreinin, Mordechai E. "Price Elasticities in International Trade," The Review of Economics and Statistics, 49:4 (November, 1967), 510-516.

______. "'Price' vs. 'Tariff' Elasticities in International Trade--A Suggested Reconciliaition," The American Economic Review, 57:4 (September, 1967), 891-895.

Lancaster, Kelvin S. "A New Approach to Consumer Theory," The Journal of Political Economy, 74 (April, 1966), 132-157.

Laws of Kenya, various issues.

Leamer, Edward E. and Robert M. Stern. Quantitative International Economics. Boston: Allyn and Bacon, Inc., 1970.

Massell, Benton F. "Determinants of Household Expenditure in Rural Kenya," Discussion Paper No. 49 (April, 1967). Nairobi, Kenya: Institute for Development Studies, University College.

Massell, Benton F. and Judith U. Heyer. "Household Expenditure in Nairobi: A Statistical Analysis of Consumer Behavior," Discussion Paper No. 48 (April, 1967). Nairobi: Institute for Development Studies, University College.

Mincer, Jacob. "Market Prices, Opportunity Costs, and Income Effects," Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld. Stanford: Stanford University Press, 1963.

Mood, Alexander McFarlane. Introduction to the Theory of Statistics. New York: McGraw-Hill Book Company, 1950.

Ndegwa, Phillip. The Common Market and Development in East Africa, East African Studies 22. Nairobi, Kenya: East African Publishing House, 1968.

Norton, W.E., G.H. Jackson, and K.M. Sweeny. "A Demand Equation for Imports," Economic Record, 45 (December, 1969), 589-595.

Olayide, S.O. "Import Demand Model: An Econometric Analysis of Nigeria's Import Trade," The Nigerian Journal of Economic and Social Studies, 10:3 (November, 1968), 303-319.

Orcutt, G.H. "Measurement of Price Elasticities in International Trade," Review of Economics and Statistics, 33 (May, 1950), 117-132.

Owen, J. "The Supply of Labor and the Demand for Recreation," Unpublished Ph.D. Dissertation, Columbia University, 1964.

Republic of Kenya. Kenya Statistical Abstract for the years 1959-1970.

Resnick, Idrian N. "Foreign Trade and Payments in Tanzania," Economy of Tanzania.

Rothchild, Donald (ed.). Politics of Integration: An East African Documentary, East African Publishing House Political Studies No. 4. Nairobi, Kenya: East African Publishing House, 1968.

Schultz, T.W. "The Formation of Human Capital by Education," Journal of Political Economy (December, 1960).

Yaffey, M.J.H. Balance of Payments Problems of a Developing Country: Tanzania. New York: Humanities Press, Inc., 1970.

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