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The Balance-of-Payments And Employment-Creation Effects of Import Substitution In Kenya - An Input-Output Approach

By

Kwan S. Kim

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Abstract

This paper attempts to empirically estimate the quantitative effects on domestic employment and foreign exchange saving when there is a substitution of final goods imports for domestically produced final deliveries. The framework employed for the numerical computations is based on an input-output approach. The main source of the data is the recently published Kenya Input-Output Tables for the year 1967.

The impact of import substitution as well as import substitution possibilities for a particular sector of the Kenyan economy are estimated on the basis of the existing input-output coefficients and the average import proportions of the base year. Since for some industries the effects on induced imports would seriously be affected by domestic capacity constraints, the upper and lower limits for the effects of import substitution are additionally computed for each sector considered as a possible candidate for import substitution. The numerical results specific for each sector of origin are given in details in Section 4 of this paper.

The Balance-of-Payments and Employment-Creation Effects of Import Substitution in Kenya - An Input-Output Approach. *

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1. Introduction

This paper is concerned with a quantitative assessment of the impact of an import substitution programme (ISP) upon domestic employment and the balance of payments from an examination of existing technological patterns in Kenyan industries. It attempts to determine empirically the extent to which replacement of final goods imports by domestic production will create employment and help alleviate balance-of-payments difficulties. The magnitude of the impact of an ISP is estimated through an input-output (I-O) analysis. A reasonably detailed input-output table for the Kenyan economy for the year 1967 has recently been published. The numerical computations in this paper are all based on this Table.

An input-output approach is chosen for this analysis because of the realization of the importance to take into account the effects an expansion of one industry will generate upon growth of another through interindustry repercussions. In this respect, it would be misleading to determine the feasibility of import-substitution solely on the basis of the extent of import dependence for a particular sector or an industry, as has been the case in a few aggregative models. We are thus led to rely on a multisectoral model approximated by an input-output system.

It must be stressed at the outset that this paper is not intended for an welfare analysis of the impact of an ISP. For policy purposes, it is undoubtedly important that the selection of industries as an early candidate for import substitution possibilities is based on efficiency considerations, other things remaining equal. Quantitative estimates of the "trade-creating or trade-diverting effects", as may result from an ISP, however, typically require reliable information

on the shape of demand and supply curves for each industry. At the moment, such data requirements are too stringent to permit an empirical assessment. Also the limitations inherent in an input-output model must be kept in mind. For one thing, there simply is no room for incorporating into an I-O model supply and demand functions. The efficiency aspect of the impact study callsfor an approach quite separate from an input-output technique employed in this paper.

2. The Model

The framework used for numerical computations is essentially based on a standard I-O model, adjusted where necessary to fit into the pattern ofthe existing Kenyan I-O Table. The model is illustrated below using the following matrix notations. The data in the model may be taken as expressed in some appropriate value terms, and the dimension of the vectors as representing the number of the sectors in the economy.

Let $\bar{A} = [a_{ij}]$ = matrix of input-output coefficients inclusive of input imports

X = column vector of total output.

D = column vector of total final demands consisting of consumption, investment expenditures, and exports.

M_f = column vector of final goods imports.

$M = [m_{ij}]$ = matrix of import coefficients m_{ij} where m_{ij} is the amount of intermediate goods i imported per one unit of output j produced.

M_i = column vector of intermediate goods imports

L = row vector of labor employment coefficients (L_i: units of labor employed per unit of output produced)

$M = M_f + M_i$ = column vector of total imports

$A = \bar{A} - M$ = matrix of the domestic input-output coefficients exclusive of import contents.

We begin by noting the basic identity relation, as reflected in the Kenyan 10 Table, that the total resource supply is equal to the total resource use for each sector. Specifically, for every sector the domestic output plus imports is identically equal to their use as inputs by the domestic sectors plus their use as final goods by households, businesses, governments and foreign countries.

We have[1]

$$X + M = \bar{A} X + D \qquad (1)$$

From this, by making use of relationships

$M = M^f + M^i$ and $A = \bar{A} - M$, we get

$$X = (I - A)^{-1} (D - M^f) \qquad (2)$$

In connection with (2) it is to be noted that the A matrix is the matrix of the input-output coefficients exclusive of imports. This distinction between the two types of the inverse matrices is important in the numerical computations given in Section 4.

For reasons of tractability, we shall now distinguish between two sets of import-substitution policies; one the programme applied to the set of final goods imports, and the other that applied to the set of intermediate goods imports.

The first step in evaluating the impact of import substitution is to assume replacement by one unit for each sector of final goods imports by the corresponding increases in domestic production in such a way as to leave the total final deliveries unchanged. This procedure is essentially the same as if final domestic demand for the import-substituting sectors' products were all increased by one unit. Here, we shall assume that the marginal increase in output for each domestic sector can be obtained without affecting per unit cost.

On the methodological aspect, a more complicated problem to handle is in regard to intermediate goods imports. The magnitude of the final impact on domestic employment following import substitution of final

goods depends inter alia on the degree of import substitution possibilities on the input side. Certain imported inputs may be considered technically indispensable in the production process, and therefore, "domestically irreplaceable". Thus, it seems possible to define the likely limits on import substitution possibilities by some notion of replaceability. Such information, however, is not only unavailable for Kenya, but even if it were, there would be conceptual difficulties in distinguishing between "replaceable and irreplaceable". The distinction would be basically a difference in costs of production. For example, Kenya could produce an atomic reactor if she is willing to pay any price for it.

For these reasons, we shall abandon the distinction of complements and substitutes, and instead, define the lower limit for the induced import increase as arising from a situation where increases in all required inputs following import-substitution on final goods are obtained from domestic production. The upper limit for induced imports then corresponds to the case where increased demand for intermediate goods is all covered by imports. In between stands the conventional method for estimating the impact.[2] The import coefficient data available on the I-O model are taken as a rough guide for future. That is, the proportion of the import content in the output of a sector is assumed to remain unchanged in future import substitution policies. The computational formulae for each of the three cases mentioned above are given as follows.

First, we shall posit for simplicity that with a substitution of imported inputs for domestic sources, the fall in the import coefficient is equally matched by the rise in corresponding domestic input-output coefficient for any given cell of the Leontief matrix. Mathematically, this is stated as

$$-\Delta^M = \Delta^A \qquad (3)$$

Let us suppose $M_f = -1$ (unit vector). The effect of this has been seen as equivalent to the increase in domestic final deliveries by one unit. We need to define the following symbols additionally.

$\Delta\bar{M}_i$ = Induced import increase as a result of the increase in domestic final delivery by one unit in the i sector.

$\Delta\bar{E}_i$ = Induced employment increase in the economy in response to the increase in domestic final delivery by one unit in the i sector.

Let the symbols $\Delta\bar{M}$ and $\Delta\bar{E}$ stand for the row vectors of $\Delta\bar{M}_i$ -s and $\Delta\bar{E}_i$-s respectively.

1. Case when the import coefficients are constant

In view of relation $M^i=MX$ and making use of (2), we obtain

$$M^i = M(I-A)^{-1}(D-M^f) \qquad (4)$$

It is easy to see from (4) that when there is a one-unit increase in final delivery in the i sector, the corresponding increase in induced import demand is identified by the row sum of the ith column of the $M(I-A)^{-1}$ matrix. Then, the general case when final deliveries are all increased by one unit in substitution possible industries follows immediately as

$$\Delta\bar{M} = 1'M(I-A)^{-1} \qquad (5)$$

where 1' is taken this time as a row unit-vector.

Similarly, the increase in total employment resulting from a unit increase in final demand for the i sector's output is given by the inner product of vector L and the ith column of the Leontief inverse $(I-A)^{-1}$. The general case then is

$$\Delta\bar{E} = L(I-A)^{-1} \qquad (6)$$

2. Case: All required inputs are met by domestic production

If all inputs are considered "replaceable," we will simply have

$$\Delta\bar{M} = 0. \qquad (7)$$

As for the employment effect, we first notice that the ith column vector of the Leontief Inverse reflects the vector of output increases as would result from a unit increase in final demand for the i sector good. Then as before,

$$\Delta\bar{E} = L(I-A)^{-1} \qquad (8)$$

As compared with (6), notice the change into the A matrix in (8). The change is made in view of our definition of import substitution given by (3).

3.- Case: All required inputs are covered by imports

The increase in imports induced by increased final demand for the i sector good is given by the row sum of the ith column of the $\bar{A}$ matrix. Hence, the general case is given by

$$\triangle \bar{M} = 1'\bar{A} \qquad (9)$$

where 1' is a row unit-vector.

The induced increase in employment with a unit rise in final delivery of the i good is equal to the labor coefficient of the corresponding sector. Thus,

$$\triangle \bar{E} = L \qquad (10)$$

It is worth pointing out that the case of maximally induced import, as shown by (9), corresponds to the case of minimally induced employment given by (10); and similarly the maximal employment case (8) corresponding to the minimal import (7). Alternatively interpreting, expressions (10) and (8) give the likely limits on the employment effect of import substitution, while (7) and (9) suggesting the limits on the induced import effect.

3. Exposition of the Data

The recent report on the 30 sector I-O model for Kenya for the year 1967 consists of five basic tables [illegible] including the main input-output matrix plus the tables for the Technical and Full Input coefficients. The structure of the system is well-explained and given in details at fairly disaggregated levels of the economy. For these reasons, there have been little difficulties in numerical computations. There are, however, a few points that must be noted in regard to usage made of the data.

The first point to note is that the Kenyan I-O Table is divided into two broad categories of monetary and non-monetary sectors with the latter composed of two specific sectors - Agriculture, fishing and forestry; and Building and constructions. The values of non-monetary inputs were estimated on an "opportunity" basis using the factor reward paid for an alternative source of earnings. Thus, estimates are typically crude and their reliability becomes of questionable value. Besides, the non-monetary sectors are mostly self-contained. There are almost no flows of inputs from the non-monetary to the monetary sectors according to the intermediate goods

flow matrix. Imports into the non-monetary economy are non-existent. For these reasons, the two non-monetary sectors have been left out of consideration in this paper.

The second point is in regard to the method of valuing imports. In the Table all output figures from domestic sectors were estimated at producers' selling prices. Thus in order to bring the import price as close to the domestic seelling price as possible, it has been necessary to use the import price cif plus import duties minus any subsidies. The figures for import duties are, separately by sectors of origin, compiled next to imports cif in the Table.

The third point to note is that all the data in the tables are in value terms. Quantitative estimates in physical units are almost impossible to obtain. In particular, the employment effect of import substitution, regretfully, has to be expressed in value of man-years and not in physical man-years.

Fourthly, as for the method of deriving the A matrix. The I-O Table gives a separate compilation of the matrix showing the intersectoral flows of intermediate goods imports. The A matrix is obtained by a simple subtraction of per unit-output import content from the main table of the input-output coefficients which already include imported inputs.

Finally, it may be noted that the expenditures on domestically produced final goods are separated from the expenditures on imported final goods in a table compiled for the end-use analysis (Table IV). Based on this table, it can be observed that five sectors, in addition to the two non-monetary sectors (Sector Nos. 1 and 2), have no imports of final goods. Hence, they are excluded from computations given in the next section. These additionally excluded sectors are Prospecting, Mining and Quarrying (Sector No.4), Sawmilling (Sector No. 12), Building and Construction (Sector No. 21), Ownership of Business Premises (Sector No. 29), and unspecified (Sector No. 30).[3]

4. Numerical Results

Table 1 presents by sectors of origin quantitative estimates of the effects on foreign exchange saving and domestic employment when final demand for goods and services delivered by the domestic sectors is each increased by K£ 1000. The estimates have been obtained using the computational formulae derived in Section 2. The wording "Constant import Coeffi-

cients" should be understood as representing the situation where intermediate goods are assumed to be imported in the same proportion as before. The two extreme cases of all imported inputs and all domestically produced inputs are treated in the table as constituting upper and lower limits for induced imports and employment. The figures for "Net Import Saving" are obtained by subtracting the quantities of induced imports from initial saving on final goods imports.

From the table it can be seen that although the lower limit for import saving varies from sector to sector, the figures for induced imports for the case where input imports are assumed to continue in the same proportion appear, uniformly for all industries, lower than K£400 per K£1000 increases in final deliveries, that is, less than 40 percent of original import saving. The same cannot, however, be said of the employment figures. The marginal increments in employment induced from increased final deliveries appear generally lower than the counterparts in induced imports. In particular, the potential for expansion of employment seems very limited for industries in the manufacturing sector (18 and 19). On the other hand, such industries as Textiles (9 and 10), Footwear (11), Rubber Products (14) and Petroleum Products (16) show great potential in the expansion of employment if import substitution programmes on the input side were also to be pushed to a maximal limit. It must be noted, however, that for the latter two industries (14 and 16) the actual upper limits for employment are much lower. Presumably, these industries rely on the import of "irreplaceable" intermediate goods in relatively large quantities.

For ease of the reading of Table 1, a scatter diagram for the case of constant import coefficients is depicted in Figure 1. Each point in the diagram is identified by the sector number, and represents the magnitudes of the effects of increased final demand for the particular sector's output on import saving and employment. For purposes of comparison, these magnitudes are expressed as the proportion in the amount of initial import saving. To avoid the clutter in the diagram, the boundary cases have been omitted. The general pattern that would emerge from the limiting cases would not be greatly different from that depicted in Figure 1.

On the whole, it seems that the sectors that would result in relatively large import saving are likely to be the ones with the correspondingly high rate of employment creation. These are manufacturing industries (18 and 19) and service industries (22, 26, 27 and 28).[4] For instance, per K£ 1000 increase in the use of potential domestic products of the manufacturing sector 19, K£571 would be used for creating new employment,

and net foreign exchange saving after the deduction of all induced input imports required for the production process would still amount to K£913. The corresponding figures for the rest five sectors do not much differ from the previous.

It is worth noting that the scope of the import demand that can be shifted to the use of potential domestic substitutes is much larger for the manufacturing sectors than for the service sectors. As can be seen from Table 2, total final goods imports in the categories of the two manufacturing sectors were a little over K£47.5 million in 1967. By comparison, gross value added for the two sectors combined was only K£14.4 million, roughly a third of finished manufactured goods imports. In contrast, final imports for the group of the four services sectors together were only K£ 5 million for the same year. They accounted for less than 10 percent of the total domestic final demand for these services.

Figure 1 also reveals the set of industries that constitute the lower boundary line of the scatter points. The lower boundary, of course, identifies the sectors of the economy which with import substitution would give rise to a minimal employment and import-saving. This set is largely represented by textiles, clothing, paint and soap products, shoes and petroleum products industries (Sectors 16, 10, 14, 9, 15 and 11). Taking the example of Finishing Textiles (9), it can be read from the diagram that roughly 30 percent of original import saving would be required for intermediate imports; and some 19 percent of it for expansion of employment.

Table 3 shows by Sectors the proportion of input imports in the value of gross output. As may be noticed from this table, these industries on the lower boundary without any exception rely heavily on imported inputs in the production process. We have seen, as would be expected, that these industries with relatively high degrees of the import content show a great potential in the expansion of employment if an ISP were carried out on the input side. Thus, the case for import substitution for these industries must be based on the input side, and certainly not on final goods.

Elsewhere it has been argued that based on the historical experiences of a few countries generally considered as a successful case in their import-substitution venture, the textiles and clothing sectors should seriously be considered for import substitution possibilities in East Africa.[5] It suffices to note that in the case of Kenya the textiles and clothing sectors are possibly the worst selection in terms of the employment or import-saving effect.

Table I. The Balance-of- Payments and Employment Effects of Import Substitution For Kenya

Unit: Per K£1000 increase in final delivery substitution.

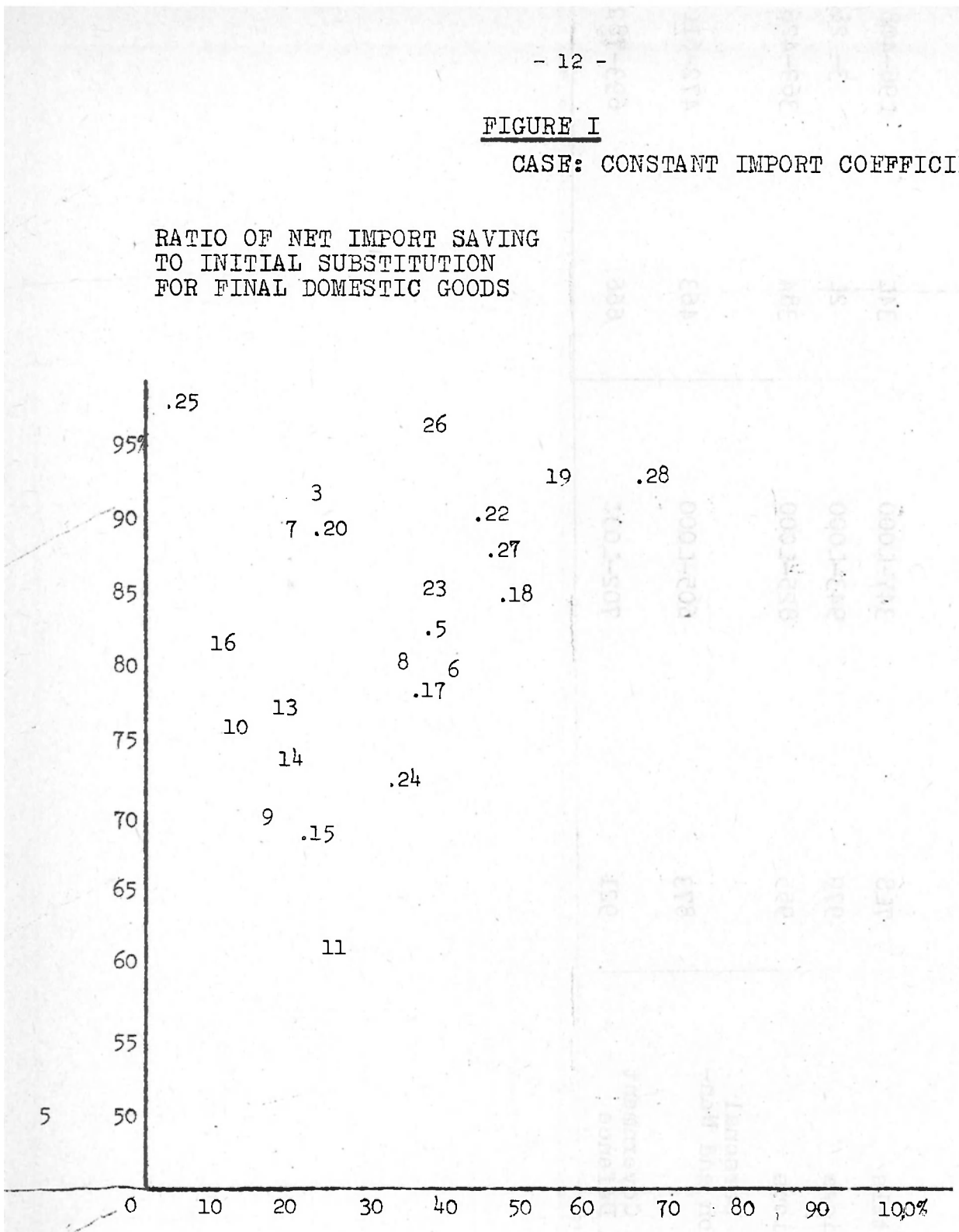
Sector Number	Sectors	Net Import Saving(in K£)		Induced Employment Increase (in value of man-years)	
		Costant Import Coefficients	Limits for Import Saving	Costant Import Coefficients	Limits for Employment Creation
1	Agriculture, Fishing and Forestry	903	802-1000	222	257-344
5	Food Manufacturing excluding Bakeries	822	156-1000	362	72-383
6	Bakery Products including Cocoa and Chocolate Products	796	246-1000	408	142-445
7	Beverages and Tobacco Manufacturing	895	670-1000	232	124-262
8	Textiles Raw Materials	798	305-1000	350	195-444
9	Finishing Textiles	693	318-1000	192	188-486
10	Knitting, Garment Making and Made-up Textiles.	749	314-1000	133	183-497
11	Footwear, Leather and Fur Products	605	238-1000	252	115-443
13	Wood Products, Printing and Publishing	768	393-1000	299	241-534
14	Rubber Products	734	331-1000	198	142-415
15	Paints, Varnishes and Soaps	684	346-1000	204	120-401
16	Petroleum Products and Other Chemicals	821	222-1000	93	42-406
17	Cement, Pottery and Miscellaneous Nonmetallic Minerals.	782	412-1000	352	138-420
18	Basic Metal Products, Machinery and Miscellaneous Manufacturing	842	397-1000	480	232-517
19	Manufacturing, Building and Repair of Transport Equipment	913	539-1000	571	374-611
20	Electricity and Water	890	698-1000	234	224-334
22	Distribution	895	666-1000	429	318-603
23	Transport and Communication	848	534-1000	365	283-434

24	Restaurants and Hotels	718
25	Ownership of Dwellings	979
26	Financial Institutions	955
27	Business Services, Personal Services, Recreation and Non-Business Services	873
28	Education, Health, Government Administration and Defence	921

347-1000	341	196-408
943-1000	21	3- 28
825-1000	384	369-426
605-1000	463	472-610
702-1000	666	693-782

FIGURE I

CASE: CONSTANT IMPORT COEFFICIENTS



Source: Table I.

Table 2 Final Goods Imports By Sectors (1967)

Sector Number		Imports of Goods For End-Use(K£1000)	Final goods imports as percent of Total Domestic Final Delivery
3	Agriculture, Fishing and Forestry	1487	7.48
5	Food Manufacturing excluding Bakeries	3881	16.72
6	Bakery Products including Cocoa and Chocolate Products	780	19.50
7	Beverages and Tobacco Manufacturing	1123	7.15
8	Textiles Raw Materials	32	15.09
9	Finishing Textiles	6587	76.84
10	Knitting, Garment Making and Made-up Textiles	3309	50.14
11	Footwear, Leather and Fur Products	668	26.47
13	Wood Products, Printing and Publishing	1489	31.67
14	Rubber Products	458	46.07
15	Paints, Varnishes and Soaps	550	14.86
16	Petroleum Products and Other Chemicals	2350	40.41
17	Cement, Pottery and Miscellaneous Nonmetallic Minerals	232	33.96
18	Basic Metal Products, Machinery and Miscellaneous Manufacturing	19424	82.06
19	Manufacturing, Building and Repair of Transport Equipment	18145	92.85
20	Electricity and Water	29	1.11
22	Distribution	30	0.001
23	Transport and Communication	4508	18.22
24	Restaurants and Hotels	1189	18.52
25	Ownership of Dwellings	163	1.05
26	Financial Institutions	915	8.06
27	Business Services, Personal Services, Recreation and Non-Business Services	1971	15.91
28	Education, Health, Government Services and Defence	3132	3.84

Source: the I-O Table (V)

Note: "Domestic Final Use" excludes exports.

Table 3. Ratios of Intermediate Goods Imports to the Value of Gross Output by Sectors.

Sector Number	SECTOR TITLE	
3	Agriculture, Fishing and Forestry	.070
5	Food Manufacturing excluding Bakeries	.046
6	Bakery Products including Cocoa and Chocolate Products	.060
7	Beverages and Tobacco Manufacturing	.063
8	Textile Raw Materials	.140
9	Finishing Textiles	.409
10	Knitting, Garment Making and Made-up Textiles	.502
11	Footwear, Leather and Fur Products	.329
13	Wood Products, Printing and Publishing	.369
14	Rubber Products	.354
15	Paints, Varnishes and Soaps	.322
16	Petroleum Products and Other Chemicals	.604
17	Cement, Pottery and Miscellaneous Nonmetallic Minerals	.095
18	Basic Metal Products, Machinery and Miscellaneous Manufacturing	.042
19	Manufacturing, Building and Repair of Transport Equipment	.028
20	Electricity and Water	.091
22	Distribution	.052
23	Transport and Communication	.086
24	Restaurants and Hotels	.101
25	Ownership of Dwellings	.013
26	Financial Insitutions	.016
27	Business Services, Personal Services, Recreation and Non-Business Services	.095
28	Education, Health, Government Services and Defence.	.044

Source: Computed from I-O Table (I).

5. Limitations and extensions

We give below a few comments on the limitations and possible extensions of this study.

1). One important omission from our discussions so far has been the problem relating to the capacity limit of an industry. The previous results have been based on the presumption that either there is extra capacity for the marginal expansion of an industry or new required capital is available through domestic sources or foreign borrowing. To the extent that output expansion for an industry is restricted by the presence of capital bottlenecks, the feasibility of an import substitution programme will adversely be affected in a commensurate degree. There have been to date no published estimates of the capacity limits classified by sectors for Kenya. As a consequence, it was necessary to construct the upper and lower limits for the effects of import substitution.

2). Related to the above issue is the assumption of constant cost. Per unit cost can, of course, vary with the level of output for reasons other than the capital constraint. In particular, we have to assume that all sorts externalities to the firm are absent. If changes in the value of output following import substitution are reflected largely by price changes instead of quantity, the numerical results shown in this paper would then be either an over or underestimate of the real effects of import substitution.

3). Another limitation of the paper, already mentioned before, is the absence of opportunity cost analysis. That is, no attempt has been made in this paper to assess the feasibility of import substitution on a comparative cost basis against alternative use of resources. It is important to keep in mind that depending on a point of view, efficiency may well be a more fundamental issue in a consideration of the overall effect of an import substitution programme. This certainly is another vital area for empirical investigation.

4). Finally, the model used in this study is that of a static equilibrium in a world of constant final demand.[6] It is clear that the evidence for the import substitution case must not be based solely on the production or technological side of the economy. Any exercise attempting to identify industries for possible import substitution must involve a projection analysis of future demand. The limitations of the study of this kind for possible use of its results for policy issues should be clearly understood.

* An early version of this paper dealing primarily with the computational model was presented at a Economics Department seminar. Appreciation is due to many colleagues for constructive comments.

Footnotes

1. For a detailed explanation of this identity relationship, the readers are referred to the footnote explanations in the original report on the Kenyan Input-Output Model (1967). Section on Imports (ii), pp. 5-6.

2. For example, see Chenery and Clark, Interindustry Economics, John Wiley & Sons Inc. New York 1967, pp. 22-5, 253-54.

3. Although both the Ownership of Business Premises sector and the Unspecified sector are treated as delivering sectors in the Kenyan I-O Table, details on costs of production for these two sectors have not been made available.

4. Historically, in many developing countries the shares of manufacturing and services in the domestic final demand has been increasing as development proceeds. In this respect, developing countries will have ample opportunities for greater expansion of manufacturing and service industries.

5. B. Van Arkadie, "Import Substitution And Export Promotion As Aids to Industrialization in East Africa," in (Witham And Currie ed.) Readings in the Applied Economics of Africa. Cambridge Press, 1967, p. 154.

6. Export possibilities have not been discussed in this paper. The feasibility of export expansion crucially depends on foreign market conditions. Thus, the method used for computing the effect of import substitution under the assumption of unchanged domestic demand pattern cannot directly be applied to the case of export expansion.