File Copy

ECONOMIC GROWTH CENTER

YALE UNIVERSITY

Box 1987, Yale Station
New Haven, Connecticut

CENTER DISCUSSION PAPER NO. 192

# DEVELOPMENT AND TRADE DEPENDENCE:

# THE CASE OF PUERTO RICO

Richard Weisskoff and Edward Wolff

November 1973

The authors would like to acknowledge the cooperation of the Puerto Rico Planning Board, especially Dr. Miguel Echenique, José Batista, and Alejandro Guzmán. Only the authors, however, are responsible for the data processing, analysis and conclusions. Work was supported under NSF Grant No. 2804A and travel under NBER grant for Latin American research.

# DEVELOPMENT AND TRADE DEPENDENCE:

# THE CASE OF PUERTO RICO

Richard Weisskoff and Edward Wolff
Department of Economics
Yale University
New Haven, Connecticut

The authors would like to acknowledge the cooperation of the Puerto Rico Planning Board, especially Dr. Miguel Echenique, Jose Batista, and Alejandro Guzmán. Only the authors, however, are responsible for the data processing, analysis and conclusions. Work was supported under NSF Grant No. 2804A and travel under NBER grant for Latin American research.

# DEVELOPMENT AND TRADE DEPENDENCE: THE CASE OF PUERTO RICO

The transformation of the Puerto Rican economy that began in the post-war period resulted by 1963 in the conversion of a sugar-dominated monoculture into a diversified manufacturing export economy. During this transition, gross national product tripled, while per capita income and labor productivity more than doubled. The rapidity of the industrialization and the completeness of its documentation[1] during the process provide an opportunity to evaluate the effect of development on trade dependence. How has the transformation enabled the economy to alter the importance of trade, or at least its dependence on imports? How transferrable are the lessons of export-led industrialization to other areas?

In certain respects the Commonwealth of Puerto Rico has enjoyed several major advantages over other small developing countries by virtue of its status within the U.S. market. Political stability which underscores an active program in search of outside capital has attracted large inflows of tax-exempt funds and freed the country from any binding balance of payments constraints on growth.[2] However, these

---

[1] The major data sets, reconciliations and verifications are presented in the technical appendices to R. Weisskoff with R. Levy, L. Nisonoff and E. Wolff, "A Multi-sector Simulation Model of Employment, Growth and Income Distribution in Puerto Rico: A Re-evaluation of 'Successful' Development Strategy." U.S. Department of Labor Research Report, July 1971.

The basic material used in this paper consists of full matrices of import and domestic flows for 1948 and 1963, which have been reconciled with national accouts, industrial cenuses, and import data for those years; and whose sectors have been aligned and deflated by sectoral price indices.

[2] See J. C. Ingram, "Some Implications of the Puerto Rican Experience," in R. N. Cooper, ed., International Finance (Penguin, 1969), p. 88.

advantages have not eliminated persistent high rates of unemployment, low productivity in agriculture, and massive internal migration which also characterize other developing areas.

This paper focuses on the change in the internal structure of the Puerto Rican economy with specific emphasis on its import structure. To anticipate our conclusions and contrary to the pattern of import substituting industrializations elsewhere in Latin America,[3] the success of this Caribbean export-promotion has not led to substantial alteration in the total degree of openness of the economy. The sugar exporting economy of 1948 ranked as the fourth most open economy among the small, single-commodity trading economies, yet changes in the relative importance of imports in either direction have been slight in spite of the transformation of industrial structure, the new export industries, and the decline of sugar. The stability of overall import share of gross domestic output, we shall find, is the net result of a rising import share in the intermediate demand needed to supply the export industries counteracted by a declining import share in both the consumption and capital formation components of final demand. More striking is the process of inadvertent import substitution that has occurred in the absence of tariff or trade restrictions. The export-propelled industrialization, the imports of machinery and parts, and the wholesale imitation of North American consumption habits have failed to create an even more open society than under the old sugar economy.

---

[3] See A. O. Hirschman, "The Political Economy of Import Substituting Industrialization," Quarterly Journal of Economics, 82, 1 (February 1968).

The comparison of trade dependence during this period is made with the use of two sets of aligned inter-industry accounting systems constructed for 1948 and 1963. Once defined, four differrent measures of imports are applied to segments of the economy in search of the underlying sectoral transformations. Does the changing mix on the level of production contribute to the continued openness of the economy? Which elements of final demand (C, G, I, or exports) have contributed more to import replacement? To distinguish the effects of changing levels and mixes, each segment of the 1963 structure is alternatively "rotated" into the original 1948 inter-industry economy and the effect on imports is measured. In this way, we seek to identify the sources of the import stability.

## I. The Circumstances of Underdevelopment

Hypotheses regarding the changing import dependence of Puerto Rico require an understanding of the character of the agrarian economy of 1948, the actions which were undertaken to attract industry, and the final consequences of the programs. The basic 1948 economy, dominated by sugar producing and refining, was trapped in a cycle of low labor productivity, wide seasonal fluctuations in agricultural employment, and limited derived demand for other sectors. Despite the rise in the absolute value of agricultural output by 11% for 1940 to 1948, sectoral employment fell by 6.6%; and with agriculture, the sugar cane sector had by 1948 released a full third of its 1940 labor force.[5] The general view of the Caribbean economy was one of extreme pessimism of a rapidly growing population locked into a resource-poor island surviving on a precarious, deteriorating base of sugar cane and handicrafts.[6] With the formal assumption of power by Muñoz Marín, the first Puerto Rican governor, and the successful negotiation of Commonwealth status, the insular government initiated aggressive efforts to attract external investment in manufacturing, modernize public infrastructure, and to some extent facilitate emigration to mainland U.S.A.

---

[5]The shares of agriculture to net income are calculated by using current dollar estimates for 1940 and 1948; the percentages are applied to product estimates in constant dollars of 1954 for both years. Total GDP from Puerto Rico Planning Board, Ingreso y Producto, 1940, 1947-1960, Tabla I-2, p. A-26; Net Income by Sector from Tabla I-8, p. A-40; Employment from Puerto Rico Planning Board, Economic Development of Puerto Rico, Table 4, p. 153, and Statistical Yearbook, 1957, Table 62, p. 105.

Some of the labor from sugar cane was absorbed in minor agricultural crops, but the two other mainstays of Puerto Rican agriculture, coffee and tobacco, have also continued to release labor.

[6]See R. Tugwell, The Stricken Land (New York: Doubleday, 1947).

The construction of a diversified export-oriented industrial base was to break the poverty cycle and its extreme dependence on rural monoculture.

As they evolved, three distinct policies are of particular relevance in the study of changing dependence. First, a series of factors including tax incentives, cheap labor, and subsidized energy, training and rent all guaranteed the "promoted" manufacturing plants an attractive, if not irresistable, rate of profit. Direct public investment in factory structures and in roads, industrial parks, power and ports complemented the private capital.

A second major policy resulted in the successful creation of the tourist industry. Starting with a single government-built hotel in 1950, tourism had, by 1963, grown into a major export earner. The major impact had fallen on food and complementary services, and sustained until quite recently, a boom in luxury hotel construction supplemented by public infrastructure in roads, power and public services. The non-stop airfare from New York to San Juan, maintained at a relatively low level, spurred the Caribbean tourism, while facilitating migration of Puerto Rican laborers to the mainland.

The arrangement by which the Commonwealth has lain securely behind the U.S. tariff barriers also subjects firms to Commonwealth laws. The incorporation within the U.S. monetary system has removed any exchange risk or constraint, and exempts Puerto Rico from the adverse effects due to balance of payments difficulties. In removing the insecurity typical of other countries due to remittance constraints, political instability, or tariff changes, the Commonwealth has encountered little difficulty in selling its bonds in

the New York market or in attracting short- or long-term capital.[7]

The consequences of these "successful" programs will be examined in a comparative static model.

## II. The Model

Following a general Leontief accounting framework, a vector of gross domestic output ($X^*$) is calculated as the sum of domestic inter-industry flows ($A_d^x$) plus domestic final demand ($Y_d^*$):

$$(1.1) \quad X^* = \sum_j A_d^* + Y_d^*$$

$$(1.2) \quad A_d^* = A^* - A_m^*$$

$$(1.3) \quad Y_d^* = Y^* - Y_m^*$$

$$(1.4) \quad [X^*]' = \sum_i A^* + V^*$$

Where $X^*$ = vector of gross domestic output;

$A^*$ = 26-order matrix of total intermediate flows;

$Y^*$ = vector of total final demand;

$V^*$ = vector of value added by sector;

d,m = subscripts indicating domestic and import flows, respectively.

* = indicate flows. Capital letters unaccompanied by asterisks indicate coefficient matrices.

In (1.4), GDO may be calculated also as the sum of total inter-industry flows and factor payments. Each sector of final demand, $Y_i$, is derived as the summation of five components of final demand as follows:

$$(1.5) \quad Y_i = \sum_j F_{ij}^*, \text{ where } F^* = (C^* \; K^* \; IN^* \; G^* \; E^*) \quad i=1,\ldots,26.$$

---

[7] The full panoply of promotion and development devices have been frequently described. Here, we are concerned with the skeletion of those schemes which will guide the reader in examining the empirical material. See D.F. Ross, The Long Uphill Path (San Juan: Talleres Gráficos Interamericana, 1966), Ch. VI-VIII.

$$(1.6) \quad (Y_m)_i = \sum_j (F_m^*)_{ij}, \qquad i = 1, \ldots, 26$$

where the components of final demand ($F^*$) are household consumption, capital formation (plant and equipment, construction), inventory change, government and exports; each, except the export component is decomposable into its domestic and imported segment, as follows:

$$(1.7) \quad F_d^* = F^* - F_m^*.$$

Analogous to and derived from the corresponding flow matrices, coefficient matrices were formed for total, domestic and import coefficients. The coefficients were computed as follows:

$$(1.8) \quad A_{ij} = \frac{A_{ij}^*}{X_j}$$

$$(1.9) \quad (A_m)_{ij} = \frac{(A_m^*)_{ij}}{X_j} \qquad \text{where } i,j = 1, \ldots, 26$$

$$(1.10) \quad \text{and } A_d = A - A_m$$

The matrix of final demand was distributed into an import and domestic component.

$$(1.11) \quad F_{ij} = F_{ij}^* / \sum_i F_{ij}^*$$

$$(1.12) \quad (F_m)_{ij} = (F_m^*)_{ij} / \sum_i F_{ij}^* \qquad i = 1, \ldots, 26. \quad j = 1, \ldots, 5.$$

$$(1.13) \quad (F_d)_{ij} = (F_d^*)_{ij} / \sum_i (F_d^*)_{ij}$$

Since $$(1.14) \quad X^* = [I - A_d]^{-1} Y_d^*$$

and $$(1.15) \quad \sum_j A_m^* = A_m X^*$$

therefore $$(1.16) \quad \sum_j A_m^* = [I - A_d]^{-1} Y_d^*$$

$$(1.17) \quad \text{Let } R = A_m [I - A_d]^{-1}, \qquad \text{where}$$

R is the "import inverse" matrix used in computing imports generated by final demand. Then,

$$(1.18)\quad M_k^{ij} = R^i[F_d]_k^j \cdot 100 \quad \text{where } i = 1948, 1963;\ j = 1948, 1963;\ k = C, K, G, E.$$

Thus the vector $M_k^{ij}$ is the import bundle generated by \$100 of final demand component k given import and technological requirements of year i and demand mix of year j.

Total (direct plus induced) imports stemming from \$100 of final demand for each component of final demand are computed as follows:

$$(1.19)\quad M_k^i = \{[F_m]_k^i + R^i[F_k^i - (F_m)_k^i]\} \cdot 100 \quad \text{where } i = 1948, 1963;\ k = C, K, G, E.$$

III. Measures of Trade Dependence

Four sets of indices of import dependence have been applied to measuring the most important dimensions and the changing structure of trade. See Chart A.

The first measure , the share of imports to intermediate sales, compares the value of imports by sector of origin to total supply (gross domestic output plus imports)[9]. Measure 1a, the ratio of intermediate imports to intermediate supply, identifies key industrial inputs like oil, metal products and chemicals, and Measure 1b, the ratio of final use imports to final demand, differentiates imports of important products in final demand, like food, clothing, construction and industrial machinery from less essential ones.[10]

The second set of measures stresses the dimension of import dependence as a share of purchased inputs and materials, by comparing the ratio of imports by sector of destination, (a) to the value of material inputs (Measures 2a) and, (b) to the value of material inputs plus value added (Measure 2b ). Using these two measures, changes in the import components of large domestic sectors such as food processing, sugar

---

[9] See Chenery and Watanabe, "International Comparisons of the Structure of Production," Econometrica XXVI (October, 1958), 488, for a discussion of this term.

[10] The distinction between the import content of consumer necessities and that of consumer luxuries is made in B.R. Hazari, "The Import Intensity of Consumption in India," Indian Economic Review, II, 2, (New Series), 1967.

Chenery has developed measure of import substitution involving a linear projection of imports, by sector of origin, as a function of per capita income. He then measures the difference between projected imports and actual imports. (See Chenery, H.B., "Patterns of Industrial Growth," American Economic Review, L, 4, (September, 1960), 640. This aggregate

Chart A

Measures of Import Dependence

Measures

1. Share of imports in the supply of

   a. Intermediate sales:

$$\alpha_1 = \frac{\sum_j [A_m^*]_{ij}}{\sum_j A_{ij}^*}$$

   i = 1, ..., 26. Identifies changes in import shares of major industrial inputs, like petrol. metals, chemicals.

   b. Final use sales:

$$\alpha_2 = \frac{\sum_j [F_m^*]_{ij}}{\sum_j F_{ij}^*}$$

   i = 1, ..., 26. Highlights imports due to changing household consumption, government and investment uses.

2. Share of imports in the purchases of:

   a. Intermediate inputs.

$$\beta_1 = \frac{\sum_i A_{m\,ij}^*}{\sum_i A_{ij}^*}$$

   j = 1, ..., 26. Illustrates imports as a share of material inputs and as a share of material inputs plus value added.

   b. Total inputs (material plus value added).

$$\beta_2 = \frac{\sum_i [A_m^*]_{ij}}{X_j}$$

Chart A, continued

| | | |
|---|---|---|
| 3. Total import content of final product (column sums of import inverse) | $\gamma = \sum_i R_{ij}$ | $j = 1,\ldots,26$. Used in summarizing the observed import content associated with each sector. |
| 4. Import component of final demand: | | |
| a. Direct import leakage | $\delta_1 = \sum_i (F_m)_{ij}$ | $j = 1,\ldots,5$. Used to compare the direct openess in final demand with "back-up" imports used in domestic production processes |
| b. Induced or "generated" import leakage: | $\delta_2 = \sum_i [R\ F_d]_{ij}$ | $j = 1,\ldots,5$. |

III. Measures of Trade Dependence (Cont.)

milling, construction, and personal services, can be compared to the import share of minor sectors such as furniture, paper products and printing.

A third measure, $\gamma$, reflects changes in the direct and indirect import content of the final output of each sector.[11]

The fourth measure traces the import leakage associated with the consumption, investment, government and export component of final demand. A measure of the direct import content (Measure 4a) and the indirect import content (Measure 4b) identify changes in the final demand source of import leakage and compare the relative importance of final use imports and induced intermediate imports in generating import leakages.[12]

---

[10] (Cont.) measure fails to capture the differential effects of changing input structure, changing composition of final demand, and changing weights among industries and components of final demand.

[11] Algebraically, a dollar's worth of the final product of a sector nets out into v worth of value added and (1 - v) worth of imports.

[12] Panchamukki thinks that this is the important dimension of import substitution. Cf. V.R. Panchamukki, "Import Substitution in Relation to Technical Change and Economic Growth," Artha Vijnana (July, 1965), 117.

## IV. Results:[13]

### A. General Survey of the Import Situation

The substantial overall change in the distribution of imports by sector of origin is summarized by a summary measure a.d. of .43, shown in Table 1, line 27.[14] The three most important imports--processed foods (Sector 1), textiles (5), and metals (13)--accounted for 56% of total imports in 1948 and 57% of imports in 1963. The share of imports of agricultural goods (Sector 1) declined from 10% to 3% between 1948 and 1963; imports of petroleum and coal (12) fell from 5% to 2% and the share of government imports rose from a negligible level to 5%.

The share of imports of intermediate goods by sector of origin as a fraction of total imports remained at the same level, 42.7% in 1948 and 43.0% in 1963. (Table 2, line 27).[15] The ratios by individual sector, however, reveal increases in the intermediate use of imported processed foods, leather, printing, and services (except for transport)

---

[13] The original 1948 Input-Output Table was constructed by Amos Gosfield in purchase prices for 65 domestic and 30 foreign exporting sector. 1963 data was supplied by the Puerto Rican Planning Board, Division of Social Accounts, on the 500 commodity level for domestic primary and subsidiary sectors and for imports. The aggregation of this latter table, its reconciliation with national accounts, its alignment with the 1948 table, and the conversion of the earlier data to 1963 prices, are all described in the Technical Appendix I to Weisskoff et al (U. S. Department of Labor, 1971), op. cit.

[14] The relative difference of x and y is defined as: $2\left[\frac{x - y}{x + y}\right]$ or the difference divided by the mean. The Measure a.d. is defined as: $\sum_i \left| V_i^2 - V_i^1 \right|$, where V is an arbitrary vector of distributive shares, a.d. is the weighted sum of absolute relative differences with average distribution shares as weights and ranges from 0 to 2.0. The a.d. value for the change in GDO is .39, for the change in value added is .33, and for the change in consumption is .05.

[15] The correcponding figure for Great Britain for the period 1954 to 1972 is approximately 60%. (See T.S. Barkley and J.R.C. Lecumber, "The Import Content of Final Expenditure for the U.K.", Bulletin of Oxford University, XXXII, 1 (February, 1970), 1. ).

TABLE 1
THE DISTRIBUTION OF IMPORTS BY SECTOR OF ORIGIN

| | | 1<br>1948 DIST.<br>OF IMPORTS | 2<br>1963 DIST.<br>OF IMPORTS | 3<br>REL. DIFF. OF<br>COLS (2) & (1) |
|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 9.61 | 3.12 | -1.02 |
| 2 | SUGAR CANE | 0.0 | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 0.0 | 0.01 | 2.00 |
| 4 | PROCESSED FOODS | 25.10 | 18.79 | -0.29 |
| 5 | TEXTILES | 11.18 | 12.10 | 0.08 |
| 6 | LEATHER | 3.04 | 2.99 | -0.02 |
| 7 | FURNITURE | 3.38 | 3.16 | -0.07 |
| 8 | PAPER PRODUCTS | 1.67 | 1.91 | 0.13 |
| 9 | PRINTING | 0.30 | 1.08 | 1.13 |
| 10 | CHEMICAL | 6.96 | 7.42 | 0.07 |
| 11 | NON METAL | 1.39 | 1.35 | -0.03 |
| 12 | PETROLEUM & COAL | 5.46 | 1.79 | -1.01 |
| 13 | METAL INDUSTRIES | 19.58 | 25.87 | 0.28 |
| 14 | MINING | 0.78 | 4.78 | 1.44 |
| 15 | OTHER MANUFACTURING | 5.07 | 4.58 | -0.10 |
| 16 | CONSTRUCTION | 0.0 | 0.0 | 0.0 |
| 17 | HOTELS & RESTAURANTS | 0.0 | 0.08 | 2.00 |
| 18 | ELECTICITY | 0.0 | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.0 | 0.13 | 2.00 |
| 21 | TRADE | 0.0 | 0.07 | 2.00 |
| 22 | BUSINESS SERVICES | 0.0 | 1.91 | 2.00 |
| 23 | PERSONAL SERVICES | 0.0 | 0.01 | 2.00 |
| 24 | REAL ESTATE | 0.0 | 0.02 | 2.00 |
| 25 | TRANSPORT | 6.48 | 2.14 | -1.01 |
| 26 | GOVERNMENT SERVICES | 0.0 | 6.67 | 2.00 |
| 27 | TOTALS | 100.00 | 99.99 | 0.43 |

TABLE 2
INTERMEDIATE IMPORTS AS A FRACTION OF TOTAL IMPORTS BY SECTOR OF ORIGIN

| | | 1<br>1948 INTERMEDIATE/<br>TOTAL IMPORTS | 2<br>1963 INTERMEDIATE/<br>TOTAL IMPORTS | 3<br>RELATIVE DIFFERENCE<br>OF COLUMNS 2 AND 1 |
|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.3536 | 0.3650 | 0.0317 |
| 2 | SUGAR CANE | 0.0 | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 0.0 | 0.4555 | 2.0000 |
| 4 | PROCESSED FOODS | 0.1523 | 0.2725 | 0.5661 |
| 5 | TEXTILES | 0.4906 | 0.3918 | −0.2238 |
| 6 | LEATHER | 0.0595 | 0.2763 | 1.2914 |
| 7 | FURNITURE | 0.8059 | 0.6543 | −0.2077 |
| 8 | PAPER PRODUCTS | 0.9825 | 1.0167 | 0.0342 |
| 9 | PRINTING | 0.5205 | 1.1802 | 0.7759 |
| 10 | CHEMICAL | 0.4998 | 0.5374 | 0.0725 |
| 11 | NON METAL | 0.7320 | 0.8994 | 0.2053 |
| 12 | PETROLEUM & COAL | 0.8808 | 0.5688 | −0.4306 |
| 13 | METAL INDUSTRIES | 0.4048 | 0.3597 | −0.1181 |
| 14 | MINING | 1.0000 | 1.1191 | 0.1124 |
| 15 | OTHER MANUFACTURING | 0.4110 | 0.3439 | −0.1778 |
| 16 | CONSTRUCTION | 0.0 | 0.0 | 0.0 |
| 17 | HOTELS & RESTAURANTS | 0.0 | 0.9707 | 2.0000 |
| 18 | ELECTICITY | 0.0 | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.0 | 0.7016 | 2.0000 |
| 21 | TRADE | 0.0 | 0.9060 | 2.0000 |
| 22 | BUSINESS SERVICES | 0.0 | 0.5264 | 2.0000 |
| 23 | PERSONAL SERVICES | 0.0 | 1.0000 | 2.0000 |
| 24 | REAL ESTATE | 0.0 | 1.0000 | 2.0000 |
| 25 | TRANSPORT | 0.8015 | 0.3661 | −0.7459 |
| 26 | GOVERNMENT SERVICES | 0.0 | 0.2100 | 2.0000 |
| 27 | TOTALS | 0.4270 | 0.4303 | 0.0077 |

IV. Results (Cont.)

and a decline in the intermediate use of textiles, furniture, petroleum and coal, metal, other manufacturing, and transport.

Of particular interest are those imports which in 1948 were used almost exclusively as intermediate industrial inputs, such as furniture, paper, non-metals, petroleum and coal, mining, and transport. By 1963, several new intermediate imports appeared as a result of diversification such as printing, hotels and restaurants, communications, trade, personal services, and real estate.[16] Only the sectors of paper, non metals and mining appear as exclusive intermediate imports in both years.

Imports as a fraction of total supply (gross domestic output plus imports) remained relatively stable during period of industrialization--falling slightly from 28.8% in 1948 to 26.2% in 1963 (Table 3, line 27.)[17] The three new sectors of leather (6), petroleum and coal (12), and mining and quarrying (14), were created during this period, and the imports of these sectors declined from 100% to 56%, 15% and 82% respectively. Imports as a fraction of total supply also declined in non-metals (11), metals (13),

---

16 In Table 2, some ratios exceed 100% because of a net inventory loss recorded in imports in 1963.

17 However, the ratio of imports to gross domestic product (excluding imports in the denominator) has shown a considerable decline from .9202 in 1948 to .6786 in 1963. The gross domestic output generated by domestic final demand also declined as is illustrated by a multiplier of 2.27 in 1948 to 1.91 in 1963. That is, a dollar of final demand in 1963 generated less inter-industry demand that a dollar of final demand in 1948. Since the GDO multipliers rose in 16 sectors and fell in but 10 sectors, demand shifted to those sectors with falling GDO multipliers. The fall in imports relative to final demand between 1948 and 1963 was therefore caused by a fall in the total supply necessary to fill the final demand bill of goods.

TABLE 3
IMPORTS BY SECTOR OF ORIGIN AS A FRACTION OF TOTAL SUPPLY (GDO + IMPORTS)

| | | 1<br>1948 IMPORTS/<br>GDO + IMPORTS | 2<br>1963 IMPORTS/<br>GDO + IMPORTS | 3<br>RELATIVE DIFFERENCE<br>OF COLUMNS 2 AND 1 |
|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.4512 | 0.2168 | -0.7017 |
| 2 | SUGAR CANE | 0.0 | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 0.0 | 0.0009 | 2.0000 |
| 4 | PROCESSED FOODS | 0.3977 | 0.3398 | -0.1571 |
| 5 | TEXTILES | 0.5543 | 0.4939 | -0.1153 |
| 6 | LEATHER | 1.0000 | 0.5619 | -0.5610 |
| 7 | FURNITURE | 0.6999 | 0.5382 | -0.2612 |
| 8 | PAPER PRODUCTS | 0.8760 | 0.5741 | -0.4163 |
| 9 | PRINTING | 0.1453 | 0.4514 | 1.0258 |
| 10 | CHEMICAL | 0.6725 | 0.5953 | -0.1219 |
| 11 | NON METAL | 0.3575 | 0.2212 | -0.4709 |
| 12 | PETROLEUM & COAL | 1.0000 | 0.1453 | -1.4925 |
| 13 | METAL INDUSTRIES | 0.9126 | 0.6650 | -0.3139 |
| 14 | MINING | 1.0000 | 0.8178 | -0.2005 |
| 15 | OTHER MANUFACTURING | 0.7091 | 0.5584 | -0.2377 |
| 16 | CONSTRUCTION | 0.0 | 0.0 | 0.0 |
| 17 | HOTELS & RESTAURANTS | 0.0 | 0.0062 | 2.0000 |
| 18 | ELECTICITY | 0.0 | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.0 | 0.0535 | 2.0000 |
| 21 | TRADE | 0.0 | 0.0026 | 2.0000 |
| 22 | BUSINESS SERVICES | 0.0 | 0.1540 | 2.0000 |
| 23 | PERSONAL SERVICES | 0.0 | 0.0006 | 2.0000 |
| 24 | REAL ESTATE | 0.0 | 0.0010 | 2.0000 |
| 25 | TRANSPORT | 0.3294 | 0.1392 | -0.8121 |
| 26 | GOVERNMENT SERVICES | 0.0 | 0.1701 | 2.0000 |
| 27 | TOTALS | 0.2879 | 0.2619 | -0.0948 |

and transport (25). Overall, import substitution was observed in raw and processed foods (4), manufacturing goods, except for printing, and services, except for transport.[18]

B. Measures of Imports in Total Supply

Changes in the share of intermediate imports to intermediate supply, Measure 1a, shown in Table 4, indicate a steady proportion of 31% (line 27, columns 1 and 2). For most manufactured goods, the dependence on imports declined whereas the import share of intermediate services increased, suggesting import substitution in industrial goods offset by import expansion for other kinds of supplies. This observed substitution of imported intermediate goods was an accidental by-product of the Fomento program since the criterion of invitation was not import substitution but the creation of employment and net income on the Island. Sectors for which imports could not be

---

18 Other comparisons from H. Pack, Structural Change and Economic Policy in Israel, (New Haven, Yale University Press, 1971) 74.

| Imports/GDO and Imports: | ISRAEL 1950 | ISRAEL 1958 | PUERTO RICO 1948 | PUERTO RICO 1963 |
|---|---|---|---|---|
| Processed foods | 21.2 | 17.0 | 40.0 | 34.0 |
| Leather goods | 33.5 | .8 | 100.0 | 56.2 |
| Paper printing | 20.1 | 15.0 | 23.6 | 51.2 |
| Chemicals | 62.1 | 25.0 | 67.3 | 59.5 |
| Metals | 45.2 | 31.1 | 91.3 | 66.5 |

TABLE 4
INTERMEDIATE IMPORTS BY SECTOR OF ORIGIN AS A FRACTION OF INTERMEDIATE SUPPLY
AND FINAL USE IMPORTS BY SECTOR OF ORIGIN AS A FRACTION OF FINAL DEMAND

| | 1<br>1948 INT. IMP/<br>INT. SUPPLY | 2<br>1963 INT. IMP/<br>INT. SUPPLY | 3<br>REL. DIFF. OF<br>COLS (2) & (1) | 4<br>1948 F.D. IMP/<br>FINAL DEMAND | 5<br>1963 F.D. IMP/<br>FINAL DEMAND | 6<br>REL. DIFF. OF<br>COLS (5) & (4) |
|---|---|---|---|---|---|---|
| 1 AGRICULTURE NEC | 0.2434 | 0.1545 | -0.4465 | 0.8465 | 0.2822 | -1.0000 |
| 2 SUGAR CANE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 SUGAR MILLING | 0.0 | 0.0024 | 2.0000 | 0.0 | 0.0006 | 2.0000 |
| 4 PROCESSED FOODS | 0.2434 | 0.4039 | 0.4959 | 0.4488 | 0.3207 | -0.3329 |
| 5 TEXTILES | 0.9971 | 0.9176 | -0.0830 | 0.3883 | 0.3807 | -0.0198 |
| 6 LEATHER | 1.0000 | 0.8884 | -0.1182 | 1.0000 | 0.4927 | -0.6797 |
| 7 FURNITURE | 0.9060 | 0.8734 | -0.0366 | 0.3600 | 0.3118 | -0.1435 |
| 8 PAPER PRODUCTS | 0.8841 | 0.6426 | -0.3164 | 0.5791 | -0.1046 | -2.8820 |
| 9 PRINTING | 0.1118 | 0.6139 | 1.3839 | 0.2156 | -0.6155 | 4.1566 |
| 10 CHEMICAL | 0.5363 | 0.7390 | 0.3179 | 0.9012 | 0.4855 | -0.5995 |
| 11 NON METAL | 0.3137 | 0.2165 | -0.3666 | 0.5775 | 0.2744 | -0.7117 |
| 12 PETROLEUM & COAL | 1.0000 | 0.1573 | -1.4562 | 1.0000 | 0.1320 | -1.5336 |
| 13 METAL INDUSTRIES | 0.8719 | 0.6660 | -0.2678 | 0.9425 | 0.6644 | -0.3461 |
| 14 MINING | 1.0000 | 0.8190 | -0.1990 | 0.0 | 0.8290 | 2.0000 |
| 15 OTHER MANUFACTURING | 0.8432 | 0.7781 | -0.0802 | 0.6383 | 0.4864 | -0.2700 |
| 16 CONSTRUCTION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 HOTELS & RESTAURANTS | 0.0 | 0.0152 | 2.0000 | 0.0 | 0.0003 | 2.0000 |
| 18 ELECTICITY | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 WATER & SANITATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 COMMUNICATION | 0.0 | 0.0497 | 2.0000 | 0.0 | 0.0654 | 2.0000 |
| 21 TRADE | 0.0 | 0.0045 | 2.0000 | 0.0 | 0.0005 | 2.0000 |
| 22 BUSINESS SERVICES | 0.0 | 0.1150 | 2.0000 | 0.0 | 0.2469 | 2.0000 |
| 23 PERSONAL SERVICES | 0.0 | 0.0021 | 2.0000 | 0.0 | 0.0 | 0.0 |
| 24 REAL ESTATE | 0.0 | 0.0036 | 2.0000 | 0.0 | 0.0 | 0.0 |
| 25 TRANSPORT | 0.7350 | 0.1398 | -1.3608 | 0.1020 | 0.1388 | 0.3053 |
| 26 GOVERNMENT SERVICES | 0.0 | 0.4640 | 2.0000 | 0.0 | 0.1456 | 2.0000 |
| 27 TOTALS | 0.3080 | 0.3198 | 0.0379 | 0.2749 | 0.2308 | -0.1744 |

IV. Results (Cont.)

reduced include products which require special resources or specialized business services controlled from the Mainland such as banking, insurance and management services.[19]

The analogous measure of import dependence of final demand, Measure 1b, calculated as a ratio of final demand, declined from .27 in 1948 to .23 in 1964 (Table 4, line 27, columns 4 and 5). This decrease contrasts with the stability of Measure 1a and is due to the fall in the import share in final demand of processed foods (4) with the establishment of food canning and processing plants. (A further analysis of final use imports is presented in Section E).

C. Imports by Sector of Destination

Similar to the stability of Measure 1a, the ratio of intermediate imports to material inputs, Measure 2a, rose a neglible level from .3080 in 1948 and .3198 in 1963 (line 27, columns 1, 2). The upward shifts in the import-using sectors occurred in sugar cane (2) with increased fertilizer and inputs required by mechanization; in shoes and leather good (6) requiring imports of American-produced leather; in petroleum and coal (12); in hotels and restaurants (17) from the needs of processed foods, printing and metal products; and in

---

19 The fall in the import share of agricultural produce (1) was due to the increased domestic production of grains for animal feeds. The existence of a minor share of imported processed sugar (3) in 1963 was traced to packaged sugar cubes, such as used in coffee, from a New Jersey refinery. The increased import share in intermediate government services (26) between 1948 and 1963 reflected the increased importance of postal, insurance and other specialized federal government services in production.

IV. Results (Cont.)

real estate (24). Downward shifts in imports as a share intermediate GDO occurred in agriculture (1) due to the substitution of domestically-produced animal feeds; in furniture (7) due to the shift toward domestically-produced upholstered furniture using imported textiles; in printing (9) due to the substitution of domestic paper; in chemicals (10), trade (21), and transport (25) due to the rise of domestically-produced petroleum inputs in 1963.

The share of imports to total inputs as indicated by Measure 2b fell from .17 to .15, or by a relative difference of -.12, and suggests reduced import dependency (line 27 of Table 5). The decline in Measure 2b is more comprehensive than Measure 2a, since a change in the ratio of imports to GDO probably reflects the following three factors: (1) a change in the share of value-added in each sector, (2) a change in the use of domestic inputs for previously imported inputs, or (3) a change in input mix due to changing technology which results in a new import composition. We suspect that the decline in Measure 2b in contrast to the slight rise in Measure 2a was due, for the most part, to the rise in the value-added intensity of production, as the share of value added in GDO had rose from 44% in 1948 to 52% in 1963.[20]

---

20 The rise in the share of value added was due, we hypothesize, to the following three factors: (1) the rise in the wage rate relative to the cost of intermediate inputs, (2) the rise in the contribution of fixed capital relative to intermediate inputs and the consequent rise of the profit share relative to current account inputs, (3) tax exemptions on corporate profits which created an incentive for American branch plants to record profits in Puerto Rico rather than the United States through accounting and inventory practices.

TABLE 5
IMPORTS BY SECTOR OF DESTINATION AS A FRACTION OF INTERMEDIATE GDO AND OF GDO

| | | 1<br>1948 INT. IMP/<br>INT. GDO | 2<br>1963 INT. IMP/<br>INT. GDO | 3<br>REL. DIFF OF<br>COLS (2) & (1) | 4<br>1948 IMP/GDO<br>(M48 COL SUMS) | 5<br>1963 IMP/GDO<br>(M63 COL SUMS) | 6<br>REL. DIFF. OF<br>COLS (5) & (4) |
|---|---|---|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.4329 | 0.2632 | -0.4876 | 0.1288 | 0.0708 | -0.5807 |
| 2 | SUGAR CANE | 0.1519 | 0.3126 | 0.6922 | 0.0626 | 0.0798 | 0.2426 |
| 3 | SUGAR MILLING | 0.0732 | 0.0934 | 0.2425 | 0.0536 | 0.0751 | 0.3342 |
| 4 | PROCESSED FOODS | 0.2556 | 0.2253 | -0.1258 | 0.1978 | 0.1584 | -0.2212 |
| 5 | TEXTILES | 0.8377 | 0.7288 | -0.1389 | 0.5145 | 0.4035 | -0.2417 |
| 6 | LEATHER | 0.0 | 0.8073 | 2.0000 | 0.0 | 0.4737 | 2.0000 |
| 7 | FURNITURE | 0.6488 | 0.4740 | -0.3113 | 0.3980 | 0.3216 | -0.2123 |
| 8 | PAPER PRODUCTS | 0.6652 | 0.5560 | -0.1610 | 0.4541 | 0.4038 | -0.1175 |
| 9 | PRINTING | 0.6980 | 0.3949 | -0.5547 | 0.5092 | 0.1721 | -0.9897 |
| 10 | CHEMICAL | 0.8202 | 0.5464 | -0.4007 | 0.6098 | 0.2902 | -0.7102 |
| 11 | NON METAL | 0.4880 | 0.1455 | -1.0811 | 0.2747 | 0.0830 | -1.0715 |
| 12 | PETROLEUM & COAL | 0.0 | 0.5772 | 2.0000 | 0.0 | 0.4877 | 2.0000 |
| 13 | METAL INDUSTRIES | 0.8278 | 0.4625 | -0.5662 | 0.4085 | 0.2977 | -0.3137 |
| 14 | MINING | 0.0 | 0.1683 | 2.0000 | 0.0 | 0.1054 | 2.0000 |
| 15 | OTHER MANUFACTURING | 0.7741 | 0.6756 | -0.1358 | 0.5700 | 0.4477 | -0.2403 |
| 16 | CONSTRUCTION | 0.3664 | 0.3855 | 0.0508 | 0.2586 | 0.2018 | -0.2471 |
| 17 | HOTELS & RESTAURANTS | 0.0517 | 0.1181 | 0.7812 | 0.0381 | 0.0365 | -0.0433 |
| 18 | ELECTICITY | 0.8265 | 0.3239 | -0.8737 | 0.2740 | 0.0782 | -1.1123 |
| 19 | WATER & SANITATION | 0.4238 | 0.3358 | -0.2317 | 0.1186 | 0.0577 | -0.6904 |
| 20 | COMMUNICATION | 0.3983 | 0.2028 | -0.6505 | 0.1274 | 0.0457 | -0.9437 |
| 21 | TRADE | 0.2400 | 0.1503 | -0.4594 | 0.0627 | 0.0278 | -0.7721 |
| 22 | BUSINESS SERVICES | 0.5023 | 0.4104 | -0.2014 | 0.1933 | 0.2236 | 0.1456 |
| 23 | PERSONAL SERVICES | 0.2658 | 0.2680 | 0.0083 | 0.0867 | 0.1022 | 0.1641 |
| 24 | REAL ESTATE | 0.0 | 0.1740 | 2.0000 | 0.0 | 0.0474 | 2.0000 |
| 25 | TRANSPORT | 0.8555 | 0.2086 | -1.2159 | 0.4814 | 0.0904 | -1.3677 |
| 26 | GOVERNMENT SERVICES | 0.1689 | 0.2040 | 0.1882 | 0.0817 | 0.0772 | -0.0567 |
| 27 | TOTALS | 0.3080 | 0.3198 | 0.0379 | 0.1726 | 0.1527 | -0.1229 |

IV. Results (Cont.)

Of the original eight sectors which had depended on imports in 1948 for more than half their inputs, only three (textiles, paper, other manufacturing) retained by 1963 a high import share; moreover, two new industries (petroleum and leather) joined as "open" sector. In three sectors (construction, hotels and government), Measure 2b, the import share of GDO fell following the island-wide trend, despite the rise in Measure 2a, the import share of intermediate GDO. The reverse occurred in business services in which Measure 2b rose from 19.3% to 22.4% while Measure 2a fell from 50.2% to 41.0%. In this case, value added fell to a greater extent that the substitution of imported for domestic raw materials.

D. The Import Content of the Final Product (Table 6)

Intermediate imports generated per dollar of final demand for 1948 and 1963 or the column sums of the import inverse matrices,R, indicate that the import content of the total final product, Measure 3, fell from .30 in 1948 to .25 in 1963. The decline in Measure 3 is due to a rise in the share of value added in the 1963 technology since a relatively stable import content of material inputs has already been observed in Measure 2a (See Footnote 7). The sectored values for Measure 3 give the absolute magnitude of import dependence. In 1948, the final sales of eight sectors reflect an import content greater than 40%, compared to five sectors in 1968.

E. Components of Final Demand

1. Consumption--Intermediate imports generated by $100 of domestic household consumption in 1948 and 1963, as specified in

TABLE 6
THE IMPORT CONTENT OF THE FINAL PRODUCT

| | | 1<br>COLUMN SUMS<br>OF R48 | 2<br>COLUMN SUMS<br>OF R63 | 3<br>REL. DIFF.<br>OF COLS 2 & 1 |
|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.1884 | 0.1104 | -0.5218 |
| 2 | SUGAR CANE | 0.2178 | 0.1267 | -0.5290 |
| 3 | SUGAR MILLING | 0.2054 | 0.1825 | -0.1178 |
| 4 | PROCESSED FOODS | 0.3242 | 0.2442 | -0.2817 |
| 5 | TEXTILES | 0.5316 | 0.4349 | -0.2000 |
| 6 | LEATHER | 0.0 | 0.5084 | 2.0000 |
| 7 | FURNITURE | 0.4311 | 0.3578 | -0.1859 |
| 8 | PAPER PRODUCTS | 0.5483 | 0.5245 | -0.0443 |
| 9 | PRINTING | 0.5960 | 0.2201 | -0.9214 |
| 10 | CHEMICAL | 0.6619 | 0.3465 | -0.6255 |
| 11 | NON METAL | 0.3749 | 0.1693 | -0.7556 |
| 12 | PETROLEUM & COAL | 0.0 | 0.5357 | 2.0000 |
| 13 | METAL INDUSTRIES | 0.4278 | 0.3460 | -0.2113 |
| 14 | MINING | 0.0 | 0.1793 | 2.0000 |
| 15 | OTHER MANUFACTURING | 0.6195 | 0.4819 | -0.2498 |
| 16 | CONSTRUCTION | 0.4513 | 0.2739 | -0.4894 |
| 17 | HOTELS & RESTAURANTS | 0.2615 | 0.0833 | -1.0339 |
| 18 | ELECTICITY | 0.2889 | 0.1495 | -0.6358 |
| 19 | WATER & SANITATION | 0.1677 | 0.0830 | -0.6753 |
| 20 | COMMUNICATION | 0.1789 | 0.0790 | -0.7741 |
| 21 | TRADE | 0.1098 | 0.0638 | -0.5296 |
| 22 | BUSINESS SERVICES | 0.2588 | 0.2918 | 0.1199 |
| 23 | PERSONAL SERVICES | 0.1537 | 0.1461 | -0.0509 |
| 24 | REAL ESTATE | 0.0762 | 0.0980 | 0.2511 |
| 25 | TRANSPORT | 0.5047 | 0.1811 | -0.9437 |
| 26 | GOVERNMENT SERVICES | 0.2352 | 0.1671 | -0.3386 |
| 27 | TOTALS | .3006 | .2456 | -0.2012 |

IV. Results (Cont.)

Equation 1.18 appears in Table 7, columns 1 and 4. Measure 4b, consumption-induced imports fell from $28.59 to $19.51, per $100.00 of household demand. This decline reflects the weakening import content of consumer goods in the face of slight changes in domestic consumption mix.

The change in consumption-induced imports may be decomposed into an effect of technology[21] and an effect from the changing composition of final demand, as expressed in Equation 1.18. With 1948 'technology' held constant, the change in consumption mix from 1948 to 1963 results in import-saving, with a decline from $28.59 to $25.34 per $100.00 of domestic consumption (Table 7, columns 1 and 2). But if the 1963 technology is applied to both the 1948 and 1963 mix of consumption, then the import effect is of the opposite sign.

Given the 1948 consumption basket, a change in technology from 1948 to 1963 (column 1 to column 3) shows a reduction of imports from $28.59 to $18.98. With 1963 consumption, the technology effect still results in a decline in imports from $25.34 to $19.51 (columns 2 and 4). In both cases, the technology effect (the change in R) led to a greater import savings than the import growth due the change in consumption mix.

Import leakages due to final demand are divided into two effects: direct imports by each component of demand, and generated imports

---

[21] In this discussion, "technology" is used to refer to the joint effect of inter-industry coefficients (the A matrix) and the import content of production (the $A_m$ matrix.) Therefore, as we use the term, technological change may take the form of innovation and technique substitution ($\Delta$ A) or the form of import substitution ($\Delta A_m$).

TABLE 7
IMPORTS GENERATED BY $100 OF DOMESTIC CONSUMPTION
WITH 1948 AND 1963 TECHNOLOGY

| | | 1<br>1948 TECH.<br>1948 HH CONS. | 2<br>1948 TECH.<br>1963 HH CONS. | 3<br>1963 TECH.<br>1948 HH CONS. | 4<br>1963 TECH.<br>1963 HH CONS. |
|---|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 3.97 | 2.60 | 1.02 | 0.81 |
| 2 | SUGAR CANE | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 0.0 | 0.0 | 0.00 | 0.00 |
| 4 | PROCESSED FOODS | 4.27 | 3.40 | 3.79 | 3.20 |
| 5 | TEXTILES | 2.06 | 1.25 | 1.49 | 0.97 |
| 6 | LEATHER | 0.09 | 0.06 | 0.06 | 0.07 |
| 7 | FURNITURE | 1.42 | 1.60 | 0.46 | 0.58 |
| 8 | PAPER PRODUCTS | 1.13 | 0.99 | 1.28 | 1.08 |
| 9 | PRINTING | 0.14 | 0.14 | 0.83 | 0.80 |
| 10 | CHEMICAL | 2.06 | 2.51 | 1.32 | 1.77 |
| 11 | NON METAL | 0.84 | 0.56 | 0.40 | 0.38 |
| 12 | PETROLEUM & COAL | 2.98 | 3.20 | 0.51 | 0.62 |
| 13 | METAL INDUSTRIES | 3.89 | 3.68 | 3.21 | 3.55 |
| 14 | MINING | 0.46 | 0.34 | 1.31 | 2.69 |
| 15 | OTHER MANUFACTURING | 1.37 | 1.38 | 0.80 | 0.81 |
| 16 | CONSTRUCTION | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 | HOTELS & RESTAURANTS | 0.0 | 0.0 | 0.09 | 0.05 |
| 18 | ELECTICITY | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.0 | 0.0 | 0.06 | 0.06 |
| 21 | TRADE | 0.0 | 0.0 | 0.08 | 0.04 |
| 22 | BUSINESS SERVICES | 0.0 | 0.0 | 0.66 | 0.68 |
| 23 | PERSONAL SERVICES | 0.0 | 0.0 | 0.01 | 0.01 |
| 24 | REAL ESTATE | 0.0 | 0.0 | 0.01 | 0.01 |
| 25 | TRANSPORT | 3.93 | 3.62 | 0.49 | 0.46 |
| 26 | GOVERNMENT SERVICES | 0.0 | 0.0 | 1.10 | 0.87 |
| 27 | TOTALS | 28.59 | 25.34 | 18.98 | 19.51 |

IV. Results (Cont.)

by domestic sectors (See Equation 1.18). In Table 8, we compare the distribution of total household consumption (columns 1 and 2) in 1948 and 1963 with the direct (columns 3 and 4), induced (columns 5 and 6), and total imports due to household demand.

The changes in the pattern of overall household consumption (columns 1 and 2) are understandable as conventional Engel effects in the face of doubling per capita income. The shares in consumption of processed foods and leather goods fell substantially while the agricultural share was constant and textiles rose slightly.[22] The shares of non-necessities all increased significantly: furniture, chemicals (detergents and soaps), petroleum, reflecting the increased use of automobiles, metals (consumer durables), electricity, reflecting the widespread use of electrical appliances such as air conditioners, and services (sectors 17 through 26).[23]

However, direct leakages for all sectors (columns 3 and 4, line 27) held stable at 40.9% in 1948 and 39.5 in 1963, while indirect leakages declined more noticeably from 16.9% in 1948 to 11.8% in 1963 (columns 5 and 6). Nevertheless, the total import leakage, 57.8% in 1948 and

---

[22] The constant agricultural share reflects the rise of poultry, dairy, fruits and vegetables. The rising textile share, contrary to the normal behavior of "necessities" may have been the result of the shift to ready-made clothing from bulk cotton fabrics.

[23] The decline in the share of expenditures on hotels and restaurants may reflect accounting differences in the two years. In the 1948 table, both processed foods sold to hotels and the total value were recorded in sales to households; in the second year only the mark-up on food was recorded as a sale to household. Aggregation prohibits the separation of the food from mark-up in the earlier year.

TABLE 8
LEAKAGES FROM HOUSEHOLD CONSUMPTION:
DIRECT AND INDUCED IMPORTS PER $100 OF HOUSEHOLD CONSUMPTION

| | 1<br>1948 TOTAL HH CONS | 2<br>1963 TOTAL HH CONS | 3<br>1948 DIRECT HH IMPORTS | 4<br>1963 DIRECT HH IMPORTS | 5<br>48 INDUCED HH IMPORTS | 6<br>63 INDUCED HH IMPORTS | 7<br>1948 TOTAL HH IMPORTS | 8<br>1963 TOTAL HH IMPORTS |
|---|---|---|---|---|---|---|---|---|
| 1 AGRICULTURE NEC | 5.26 | 5.07 | 5.01 | 1.57 | 2.34 | 0.49 | 7.35 | 2.06 |
| 2 SUGAR CANE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 SUGAR MILLING | 0.05 | 1.74 | 0.0 | 0.00 | 0.0 | 0.00 | 0.0 | 0.01 |
| 4 PROCESSED FOODS | 34.67 | 23.50 | 17.17 | 9.74 | 2.52 | 1.94 | 19.69 | 11.68 |
| 5 TEXTILES | 6.56 | 7.18 | 4.58 | 6.23 | 1.21 | 0.59 | 5.80 | 6.82 |
| 6 LEATHER | 2.30 | 1.71 | 2.30 | 1.71 | 0.06 | 0.04 | 2.36 | 1.75 |
| 7 FURNITURE | 1.26 | 2.48 | 0.39 | 0.97 | 0.84 | 0.35 | 1.22 | 1.33 |
| 8 PAPER PRODUCTS | 0.02 | 0.29 | 0.02 | 0.22 | 0.67 | 0.65 | 0.68 | 0.88 |
| 9 PRINTING | 0.53 | 0.60 | 0.12 | 0.20 | 0.08 | 0.48 | 0.20 | 0.68 |
| 10 CHEMICAL | 3.07 | 3.74 | 2.77 | 2.99 | 1.22 | 1.07 | 3.99 | 4.06 |
| 11 NON METAL | 0.28 | 0.19 | 0.28 | 0.14 | 0.49 | 0.23 | 0.77 | 0.37 |
| 12 PETROLEUM & COAL | 0.52 | 2.47 | 0.52 | 0.39 | 1.76 | 0.37 | 2.28 | 0.76 |
| 13 METAL INDUSTRIES | 4.66 | 7.76 | 4.41 | 6.84 | 2.30 | 2.15 | 6.71 | 8.99 |
| 14 MINING | 0.0 | 0.0 | 0.0 | 0.0 | 0.27 | 1.63 | 0.27 | 1.63 |
| 15 OTHER MANUFACTURING | 2.85 | 2.49 | 2.35 | 2.19 | 0.81 | 0.49 | 3.16 | 2.68 |
| 16 CONSTRUCTION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 HOTELS & RESTAURANTS | 8.84 | 2.68 | 0.0 | 0.0 | 0.0 | 0.03 | 0.0 | 0.03 |
| 18 ELECTICITY | 0.53 | 1.38 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 WATER & SANITATION | 0.12 | 0.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 COMMUNICATION | 0.10 | 0.43 | 0.0 | 0.04 | 0.0 | 0.03 | 0.0 | 0.07 |
| 21 TRADE | 0.04 | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 0.0 | 0.02 |
| 22 BUSINESS SERVICES | 2.40 | 2.01 | 0.0 | 0.74 | 0.0 | 0.41 | 0.0 | 1.15 |
| 23 PERSONAL SERVICES | 4.13 | 9.13 | 0.0 | 0.0 | 0.0 | 0.01 | 0.0 | 0.01 |
| 24 REAL ESTATE | 7.35 | 9.62 | 0.0 | 0.0 | 0.0 | 0.01 | 0.0 | 0.01 |
| 25 TRANSPORT | 5.87 | 6.15 | 1.04 | 1.08 | 2.32 | 0.28 | 3.36 | 1.36 |
| 26 GOVERNMENT SERVICES | 7.04 | 8.95 | 0.0 | 4.43 | 0.0 | 0.53 | 0.0 | 4.96 |
| 27 TOTALS | 98.45 | 100.00 | 40.95 | 39.48 | 16.88 | 11.81 | 57.84 | 51.28 |

IV. Results (Cont.)

51.3% in 1963, remained rather high, compared to a 9.4% direct and 11.3% indirect import leakage for the United Kingdom[24], and a 40.0% total import leakage for India.[25]

The stability at 40% of the direct import leakage, Measure 4a, (Table 8, columns 3 and 4), is striking, representing a balance between two sets of forces working for and against an increase in the direct openness. First, an income effect from a doubling of per capita income led to the view of American products as "superior" goods, and to an overall shift in preferences toward mainland-style commodities, and a price effect from declining shipping costs lowered the "natural" protective tariff of distance and led to increased import leakage. Working in the opposite direction was the establishment of American branch plants for the purpose of exporting to the mainland market and finding an expanding domestic market, producing for local demand as well.

The constancy of the overall direct import leakages summarizes dramatic changes in the sectoral distribution of imports. Direct imports of agricultural goods (1) declined substantially despite its constant share in consumption, indicating greater home production of beef, pork, poultry and vegetables. The decline in the direct import share of processed foods (4) was greater than the decline in its consumption share, indicating significant import

---

24 Barker and Lecumber, op. cit., p. 4.

25 Hazari, B. R., op. cit., p. 167.

IV. Results (Cont.)

substitution. The import share of metals (13) rose pari passu at the same rate as its consumption share, reflecting imports of American durables. The import share of petroleum (12) despite its increased use, remained stable due to the establishment of oil refineries in Puerto Rico. The import share of government services (26) which include postal services and Social Security rose from a low level in 1948 to 5% in 1963.[26]

## 2. Capital Formation

Imports by sector of origin induced by $100.00 of domestic capital formation declined from $44.75 in 1948 to $27.43 in 1963. (See Table 9, columns 1 and 4 for Measure 4b applied from Equation 1.18). Is the cause of this decline in investment-induced imports related to the changing mix of final investment demand or due to the "technology-and-import-substitution" in the capital goods industry? By "rotating" the 1963 investment mix into an economy with the 1948 technology (compare column 2 with column 1), and then by rotating the 1948 mix with the 1963 technology (column 3 with column 4), we conclude that mix alone exerted little influence on induced imports and that the technology-substitution effects led to a decline in imports. The observation of falling

---

[26] Note that in 1948, 70% of the total household consumption of textiles was directly imported while in 1963, 87% of textile consumption was satisfied by direct imports. However, in 1948, 72% of domestically-produced textiles were exported, and by 1963 the fraction had risen to 91%. Elsewhere, we have called this the "criss-cross" effect, with more expensive textiles exported to the U. S. and cheaper ones imported. The same "criss-cross" effect occurred in leather goods (6) as 100% of household consumption was imported in both years, despite the establishment of a leather goods export industry in this period. (See R. Weisskoff and E. Wolff, "Linkages and Leakages: The Industrial Transformation of Puerto Rico," Economic Growth Center Discussion Paper, forthcoming.).

TABLE 9
IMPORTS GENERATED BY $100 OF DOMESTIC INVESTMENT
WITH 1948 AND 1963 TECHNOLOGY

| | | 1<br>1948 TECH.<br>1948 INVEST. | 2<br>1948 TECH.<br>1963 INVEST. | 3<br>1963 TECH.<br>1948 INVEST. | 4<br>1963 TECH.<br>1963 INVEST. |
|---|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.01 | 0.01 | 0.03 | 0.05 |
| 2 | SUGAR CANE | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 0.0 | 0.0 | 0.00 | 0.00 |
| 4 | PROCESSED FOODS | 0.10 | 0.18 | 0.19 | 0.30 |
| 5 | TEXTILES | 0.16 | 0.09 | 0.44 | 0.44 |
| 6 | LEATHER | 0.00 | 0.01 | 0.06 | 0.06 |
| 7 | FURNITURE | 11.24 | 11.30 | 6.43 | 6.38 |
| 8 | PAPER PRODUCTS | 0.95 | 0.92 | 0.77 | 0.77 |
| 9 | PRINTING | 0.01 | 0.01 | 0.42 | 0.43 |
| 10 | CHEMICAL | 3.45 | 3.45 | 0.98 | 0.98 |
| 11 | NON METAL | 2.05 | 2.02 | 2.04 | 1.99 |
| 12 | PETROLEUM & COAL | 3.47 | 3.40 | 0.62 | 0.61 |
| 13 | METAL INDUSTRIES | 21.32 | 20.86 | 10.81 | 10.56 |
| 14 | MINING | 0.36 | 0.38 | 2.16 | 2.17 |
| 15 | OTHER MANUFACTURING | 0.91 | 0.88 | 0.96 | 0.97 |
| 16 | CONSTRUCTION | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 | HOTELS & RESTAURANTS | 0.0 | 0.0 | 0.02 | 0.02 |
| 18 | ELECTICITY | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.0 | 0.0 | 0.04 | 0.04 |
| 21 | TRADE | 0.0 | 0.0 | 0.01 | 0.01 |
| 22 | BUSINESS SERVICES | 0.0 | 0.0 | 0.27 | 0.28 |
| 23 | PERSONAL SERVICES | 0.0 | 0.0 | 0.00 | 0.00 |
| 24 | REAL ESTATE | 0.0 | 0.0 | 0.01 | 0.01 |
| 25 | TRANSPORT | 0.73 | 0.72 | 0.20 | 0.20 |
| 26 | GOVERNMENT SERVICES | 0.0 | 0.0 | 1.18 | 1.17 |
| 27 | TOTALS | 44.75 | 44.22 | 27.66 | 27.43 |

IV. Results (Cont.)

investment-induced imports (Measure 4b) primarily in the furniture and metal sectors and the stability or rise in intermediate imports, Measure 1a, suggests the growth of domestic construction and furnishing industries geared to this demand.

Total leakage due to investment demand must be seen in light of changes in distribution of domestic capital formation. From columns 1 and 2 of Table 10, we note that the share of construction (16) in investment rose almost as much as the share of metal construction efforts of factories, homes, schools, hospitals, and other public facilities. Thus, the decline of direct imports of metals (columns 3 and 4) parallels the reduction of that sector in the investment mix and is not due to import substitution of heavy machinery.

Despite the decline in the direct plus indirect imports (columns 7 and 8) from \$68 to \$48 generated by \$100 of capital formation, the "openness" of investment is high compared to direct imports of \$12.80, indirect of \$5.80, and total openness of \$18.60 per \$100 capital formation in the United Kingdom.[27]

3. Government-induced Imports

Imports induced by \$100 of government services declined from \$24 in 1948 to \$17 in 1963 and reflects the changing role of government between 1948 and 1963. In 1948, the main activity of a sluggish bureaucracy was the maintenance of an infrastructure for agriculture. The major

---

27 See Barker and Lecumber, op. cit., p. 9.

TABLE 10
LEAKAGES FROM CAPITAL FORMATION:
DIRECT AND INDUCED IMPORTS PER $100 OF INVESTMENT

| | 1 1948 TOTAL INVESTMENT | 2 1963 TOTAL INVESTMENT | 3 1948 DIRECT INVEST. IMP | 4 1963 DIRECT INVEST. IMP | 5 48 INDUCED INVEST. IMP | 6 63 INDUCED INVEST. IMP | 7 1948 TOTAL INVEST. IMP | 8 1963 TOTAL INVEST. IMP |
|---|---|---|---|---|---|---|---|---|
| 1 AGRICULTURE NEC | 0.0 | 0.49 | 0.0 | 0.07 | 0.00 | 0.03 | 0.00 | 0.10 |
| 2 SUGAR CANE | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 SUGAR MILLING | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 |
| 4 PROCESSED FOODS | 0.0 | 0.0 | 0.0 | 0.0 | 0.06 | 0.21 | 0.06 | 0.21 |
| 5 TEXTILES | 0.10 | 0.0 | 0.0 | 0.0 | 0.09 | 0.32 | 0.09 | 0.32 |
| 6 LEATHER | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.04 | 0.00 | 0.04 |
| 7 FURNITURE | 0.51 | 1.94 | 0.18 | 0.89 | 6.41 | 4.60 | 6.59 | 5.49 |
| 8 PAPER PRODUCTS | 0.0 | 0.0 | 0.0 | 0.0 | 0.54 | 0.55 | 0.54 | 0.55 |
| 9 PRINTING | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.31 | 0.00 | 0.31 |
| 10 CHEMICAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.97 | 0.71 | 1.97 | 0.71 |
| 11 NON METAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.17 | 1.43 | 1.17 | 1.43 |
| 12 PETROLEUM & COAL | 0.0 | 0.0 | 0.0 | 0.0 | 1.98 | 0.44 | 1.98 | 0.44 |
| 13 METAL INDUSTRIES | 45.61 | 29.72 | 42.78 | 26.65 | 12.16 | 7.61 | 54.94 | 34.26 |
| 14 MINING | 0.0 | 0.0 | 0.0 | 0.0 | 0.21 | 1.56 | 0.21 | 1.56 |
| 15 OTHER MANUFACTURING | 0.0 | 0.38 | 0.0 | 0.30 | 0.52 | 0.70 | 0.52 | 1.00 |
| 16 CONSTRUCTION | 53.33 | 65.69 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 HOTELS & RESTAURANTS | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.02 | 0.0 | 0.02 |
| 18 ELECTICITY | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 WATER & SANITATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 COMMUNICATION | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.03 | 0.0 | 0.03 |
| 21 TRADE | 0.45 | 0.0 | 0.0 | 0.0 | 0.0 | 0.01 | 0.0 | 0.01 |
| 22 BUSINESS SERVICES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.21 | 0.0 | 0.21 |
| 23 PERSONAL SERVICES | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 |
| 24 REAL ESTATE | 0.0 | 0.50 | 0.0 | 0.0 | 0.0 | 0.00 | 0.0 | 0.00 |
| 25 TRANSPORT | 0.0 | 0.0 | 0.0 | 0.0 | 0.42 | 0.15 | 0.42 | 0.15 |
| 26 GOVERNMENT SERVICES | 0.0 | 1.28 | 0.0 | 0.0 | 0.0 | 0.84 | 0.0 | 0.84 |
| 27 TOTALS | 100.00 | 100.00 | 42.95 | 27.91 | 25.53 | 19.78 | 68.48 | 47.68 |

IV. Results (Cont.)

government inputs were metals (13) and furniture (7).

By 1963, the Commonwealth government had taken an active promotional and administrative role in the economy. The "technology" of government services[28] required increases in the demands for processed foods for hospitals, schools, and penitentiaries; for petroleum to run government vehicles; for metal products, such as office supplies; for business services needed in the industrial and tourist promotion, and for personal services of the enlarged bureaucracy including government-paid funerals.

The change in the nature of government demand translates (Table 11) into increased induced imports of processed foods and business services and declines of government-induced imports of furniture and metals. The fall in petroleum imports was due to the establishment of oil refineries on the Island.[29]

. Export-induced imports

The transformation of the basket between 1948 and 1963 from sugar to a diversity of manufactures led, surprisingly to stability in the

---

28 The final demand delivery of "government services" Sector 26, consists of one entry of government service expenditure, and no compositional changes are recorded. Thus changes in the "basket" of government services (26) must be traced directly to the input structure and related to the performance and programs of the insular government.

29 Also note that government-induced imports for the U.K. total $10.80 compared to $23.52 in 1948 and $16.71 for Puerto Rico in 1963. (See Barker and Lecumber, op. cit., p. 9.) Part of the decline in Puerto Rico is due to a shift of government construction from government demand in 1948 to capital formation in 1963.

The increase in imports of business services is traced to the treatment of the Commonwealth's promotional and advertising expenditures in New York as imports (Table 11, line 22).

TABLE 11
IMPORTS GENERATED BY $100 OF GOVERNMENT EXPENDITURE
WITH 1948 AND 1963 TECHNOLOGY

| | | 1<br>1948 TECH.<br>AND 1948 GOVT. | 2<br>1963 TECH.<br>AND 1963 GOVT. |
|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.24 | 0.62 |
| 2 | SUGAR CANE | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 0.0 | 0.00 |
| 4 | PROCESSED FOODS | 0.36 | 4.73 |
| 5 | TEXTILES | 0.15 | 0.47 |
| 6 | LEATHER | 0.00 | 0.15 |
| 7 | FURNITURE | 3.49 | 0.14 |
| 8 | PAPER PRODUCTS | 0.49 | 0.46 |
| 9 | PRINTING | 0.17 | 0.92 |
| 10 | CHEMICAL | 1.95 | 1.28 |
| 11 | NON METAL | 0.68 | 0.27 |
| 12 | PETROLEUM & COAL | 1.54 | 0.28 |
| 13 | METAL INDUSTRIES | 12.12 | 3.00 |
| 14 | MINING | 0.12 | 2.35 |
| 15 | OTHER MANUFACTURING | 1.34 | 0.45 |
| 16 | CONSTRUCTION | 0.0 | 0.0 |
| 17 | HOTELS & RESTAURANTS | 0.0 | 0.02 |
| 18 | ELECTICITY | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.0 | 0.05 |
| 21 | TRADE | 0.0 | 0.01 |
| 22 | BUSINESS SERVICES | 0.0 | 0.56 |
| 23 | PERSONAL SERVICES | 0.0 | 0.00 |
| 24 | REAL ESTATE | 0.0 | 0.00 |
| 25 | TRANSPORT | 0.87 | 0.61 |
| 26 | GOVERNMENT SERVICES | 0.0 | 0.33 |
| 27 | TOTALS | 23.52 | 16.71 |

IV. Results (Cont.)

level of export-induced imports. The changing composition of exports is noted in Table 12. Twenty-three sectors exported in 1963 compared to 16 in 1948. The summary measure r.a. of .8068 indicates substantial changes on the sectoral level. Sugar milling (3) fell from 34% to 11% of exports, trade from 21% to 15%, and government[30] from 13% to 8%. Export diversification led to expansion of processed food exports from 7% to 15%, textiles from 10% to 14%, and lesser increases in petroleum, metal products, other manufacturing and hotels.

The measure of export-induced imports (Measure 4b) indicates that $27 in 1948 and $26 in 1963 were imported per $100 of exports (Table 13, columns 1 and 4, line 27). Yet this stability masks two counter-balancing trends. First, had technology remained constant (R from Equation 1.18) between 1948 and 1963 while export composition shifted to the 1963 mix, imports would have risen to $31.39 from $26.57 (Table 13, column 2). On the other hand, had the 1948 export mix been produced with 1963 technology, imports would have dropped to $18.96 (column 3). The export mix thus became more import intensive while technological change became import-saving, and the stability in induced imports was due to the balancing of these opposing effects. In particular, Measure 4b remained constant because of the shift away from a relatively import-free export, sugar milling,[31] toward other import-intensive exports. However, the import substitution process was, at the same time, leading

---

[31] Exports of government services include the sale of land to American companies and individuals.

[32] See Table 4 above. The import content of sugar milling was 20.6% in 1948 and fell to 18.4% in 1963.

TABLE 12
THE DISTRIBUTION OF EXPORTS

| | | 1<br>1948 DIST.<br>OF EXPORTS | 2<br>1963 DIST.<br>OF EXPORTS | 3<br>REL. DIFF.<br>OF (2) AND (1) |
|---|---|---|---|---|
| 1 | AGRICULTURE NEC | 0.80 | 1.07 | 0.29 |
| 2 | SUGAR CANE | 0.0 | 0.0 | 0.0 |
| 3 | SUGAR MILLING | 34.08 | 10.71 | -1.04 |
| 4 | PROCESSED FOODS | 6.74 | 14.91 | 0.75 |
| 5 | TEXTILES | 10.46 | 13.90 | 0.28 |
| 6 | LEATHER | 0.0 | 2.84 | 2.00 |
| 7 | FURNITURE | 0.07 | 0.15 | 0.78 |
| 8 | PAPER PRODUCTS | 0.05 | 0.49 | 1.62 |
| 9 | PRINTING | 0.01 | 0.16 | 1.72 |
| 10 | CHEMICAL | 0.0 | 3.45 | 2.00 |
| 11 | NON METAL | 0.36 | 0.50 | 0.33 |
| 12 | PETROLEUM & COAL | 0.0 | 3.95 | 2.00 |
| 13 | METAL INDUSTRIES | 0.0 | 8.00 | 2.00 |
| 14 | MINING | 0.0 | 0.01 | 2.00 |
| 15 | OTHER MANUFACTURING | 1.79 | 4.15 | 0.79 |
| 16 | CONSTRUCTION | 0.0 | 1.04 | 2.00 |
| 17 | HOTELS & RESTAURANTS | 1.43 | 6.18 | 1.25 |
| 18 | ELECTICITY | 0.0 | 0.0 | 0.0 |
| 19 | WATER & SANITATION | 0.0 | 0.0 | 0.0 |
| 20 | COMMUNICATION | 0.04 | 0.16 | 1.22 |
| 21 | TRADE | 21.36 | 15.13 | -0.34 |
| 22 | BUSINESS SERVICES | 0.61 | 1.71 | 0.95 |
| 23 | PERSONAL SERVICES | 0.44 | 0.13 | -1.07 |
| 24 | REAL ESTATE | 0.0 | 0.03 | 2.00 |
| 25 | TRANSPORT | 8.54 | 3.57 | -0.82 |
| 26 | GOVERNMENT SERVICES | 13.22 | 7.76 | -0.52 |
| 27 | TOTALS | 100.00 | 100.00 | 0.81 |

IV. Results (Cont.)

to a decline in the import needs of these other industries compared to their 1948 requirements.

Important declines in induced imports occurred in textiles, petroleum, other manufacturing, and transport, due to import substitution (Table 13, columns 1 and 3), while mining showed an increase in import-inducement due to a change in technology. The compositional shift toward already import-intensive sectors such as processed foods, metals and mining also resulted in increasing imports.

TABLE 13
IMPORTS (BY SECTOR OF ORIGIN) GENERATED BY $100 OF EXPORTS
WITH 1948 AND 1963 TECHNOLOGY

| | 1<br>1948 TECH.<br>AND 1948 EXP. | 2<br>1948 TECH.<br>AND 1963 EXP. | 3<br>1963 TECH.<br>AND 1948 EXP. | 4<br>1963 TECH.<br>AND 1963 EXP. |
|---|---|---|---|---|
| 1 AGRICULTURE NEC | 0.84 | 1.93 | 0.31 | 0.52 |
| 2 SUGAR CANE | 0.0 | 0.0 | 0.0 | 0.0 |
| 3 SUGAR MILLING | 0.0 | 0.0 | 0.01 | 0.00 |
| 4 PROCESSED FOODS | 1.10 | 2.34 | 1.47 | 2.27 |
| 5 TEXTILES | 6.43 | 7.36 | 3.57 | 4.94 |
| 6 LEATHER | 0.18 | 0.33 | 0.15 | 0.93 |
| 7 FURNITURE | 0.82 | 0.74 | 0.21 | 0.32 |
| 8 PAPER PRODUCTS | 1.16 | 1.29 | 0.76 | 1.22 |
| 9 PRINTING | 0.07 | 0.06 | 0.64 | 0.58 |
| 10 CHEMICAL | 2.50 | 3.52 | 2.82 | 2.93 |
| 11 NON METAL | 0.31 | 0.48 | 0.58 | 0.59 |
| 12 PETROLEUM & COAL | 3.64 | 2.39 | 0.59 | 0.52 |
| 13 METAL INDUSTRIES | 3.73 | 5.37 | 3.86 | 5.03 |
| 14 MINING | 0.68 | 1.52 | 1.67 | 3.60 |
| 15 OTHER MANUFACTURING | 1.46 | 1.71 | 0.72 | 0.92 |
| 16 CONSTRUCTION | 0.0 | 0.0 | 0.0 | 0.0 |
| 17 HOTELS & RESTAURANTS | 0.0 | 0.0 | 0.03 | 0.05 |
| 18 ELECTICITY | 0.0 | 0.0 | 0.0 | 0.0 |
| 19 WATER & SANITATION | 0.0 | 0.0 | 0.0 | 0.0 |
| 20 COMMUNICATION | 0.0 | 0.0 | 0.04 | 0.05 |
| 21 TRADE | 0.0 | 0.0 | 0.02 | 0.04 |
| 22 BUSINESS SERVICES | 0.0 | 0.0 | 0.59 | 0.46 |
| 23 PERSONAL SERVICES | 0.0 | 0.0 | 0.00 | 0.00 |
| 24 REAL ESTATE | 0.0 | 0.0 | 0.01 | 0.01 |
| 25 TRANSPORT | 3.63 | 2.33 | 0.40 | 0.38 |
| 26 GOVERNMENT SERVICES | 0.0 | 0.0 | 0.52 | 0.61 |
| 27 TOTALS | 26.57 | 31.39 | 18.96 | 25.96 |

## V. Summary of Findings and Conclusions:

The effect of the economic transformation of Puerto Rican import dependence presents a complex picture which we have attempted to analyze in terms of the conditions which characterized the Island's development and the development strategy of export promotion. The most important findings with respect to changing import dependence are summarized in Table 14 and 15. First, despite the magnitude of the overall metamorphosis and in the absence of tariffs and exchange constraints, the share of imports in total supply failed to increase during the fifteen years. In "decomposing" this ratio into its various components, we noted, first, that the overall share of intermediate imports in intermediate supply (See Table 14, Measure 1a) rose only slightly despite the large increase of import-intensive manufacturing. This import stability is hypothesized to be the outcome of two offsetting "phases" of export-propelled industrialization. In the first phase, American branch plants were established on the Island and relied on imports of mainland materials. In the next phase, suppliers of the first-wave industries settled on the Island, partially closing the leakages created in the first phase and importing only lower-valued, raw materials.

A second finding indicated that share of final use imports to final demand (Measure 1b) declined slightly from .275 to .231. On a sector by sector basis, the changes in this measure paralleled in direction and magnitude the decline in the sectoral ratio of intermediate imports

TABLE 14

Summary Table of Import Measures

| | 1948 | 1963 |
|---|---|---|
| 1. Import Share of Sales: (Rows) | | |
| a. Share of intermediate sales (A) | .308 | .319 |
| b. Share of final use sales (Y) | .275 | .231 |
| 1. Share of consumption (C) | .410 | .395 |
| 2. Share of capital formation (K) | .430 | .279 |
| 2. Import share of Purchases: (Columns) | | |
| a. Share of material purchases (A) | .308 | .319 |
| b. Share of total purchases (A + V) | .173 | .153 |
| 3. Average Import Content of Domestic Product (R) | .301 | .246 |
| 4. Import Component of $100 Total Demand, Distributed As: | | |
| a. Direct imports into final demand: | | |
| 1. Consumption ($C_m$) | .410 | .395 |
| 2. Capital formation ($K_m$) | .431 | .279 |
| b. Induced imports by components: | | |
| 1. Consumption (RC) | .169 | .118 |
| 2. Capital formation (RK) | .255 | .198 |
| c. Imports generated by $100 of domestic demand components: | | |
| 1. Consumption ($RC_d$) | .286 | .195 |
| 2. Capital formation ($RK_d$) | .448 | .274 |
| 3. Government ($RG_d$) | .235 | .167 |
| 4. Exports ($RE_d$) | .266 | .260 |
| 5. Total final demand ($RY_d$) | .384 | .229 |

V. Summary of Findings and Conclusions (Cont.)

to intermediate supply, indicating import-substitution in similar sectors in the intermediate and in final use markets. Food processing, however, experienced import substitution only in final demand and sustained the same share of intermediate imports.

Third, imports as a share of material purchases (Measure 2a) rose slightly but declined as a fraction of material inputs plus value added (Measure 2b). The fall in the ratio of imports to total purchases as well as the decline in the average import content of the final product (Measure 3) may both reflect the rising share of value added, the result of higher labor productivity and higher profit rates with tax exemptions and the change in industrial mix.

Fourth, the share of direct imports in total consumption declined slightly (Measure 4a), we hypothesize, as the outcome of two counteracting sets of influences. Rising per capital income, emulation of the American "style of living", and the regard of imports as superior goods in part led to increasing direct imports, while a counter-balancing influence was exerted by the diversion to domestic supply of export-intended produce and by the establishment of many francished consumer industries in Puerto Rico. Imports generated by the domestic component of consumption demand (See Table 14, line 4C1) declined by more than the decline in the average import content of the final product. In capital formation, the reduced direct import leakage (Measure 4a) was traced to the increased share of construction and to declining share of machinery and equipment in investment despite continued reliance on American produced machinery. The decline in imports induced by capital formation

V. Summary of Findings and Conclusions (Cont.)

(Measure 4b) is accountable by the domestic production in the metal and furniture industries. Government-induced imports (Measure 4b and presented in line 4C3 of Table 14) also declined, reflecting the changing basket of government services. The almost constant level of export-induced imports (Measure 4b in line 4C4) reflects the balancing effect of a decline in the import intensity of exported products and the diversification of exports away from sugar, a product of relatively low generated import intensity.

By "substituting" alternatively the composition of each component of final demand (F) and the import technology (R) of each year, we attempted to identify the cause of the generated imports. The fall from $28 to $23 in the imports generated by $100 of total final demand (See Table 15, line 5) was due to the swamping of the import-bias of the 1963 composition (line 5a and b, column 1), by the import-saving bias of the 1963 industrial structure (line 5a and b, column 2). In the cases of consumption and capital formation (lines 1 and 2), the effect of 1963 composition on imports is mildly negative, and the import-absorbing effect of the later technology dominates. Only in the case of the export component of final demand (line 4) is the composition-induced increase in imports so great that the import-substituting bias of 1963 technology is fully neutralized.

We conclude, then, that the first fifteen years of export-led industrialization, performed in the absence of tariff and import restrictions led to a stable or unchanged level of import dependence overall,

TABLE 15

Summary of Imports Generated by
Final Demand with Different Production Structures

| $100 of Final Demand with Composition of Year | | Import and Technology Structure of Year | |
|---|---|---|---|
| | | 1948 | 1963 |
| *1. Consumption | 1948 | $28.59 | $18.98 |
| | 1963 | 25.34 | 19.51 |
| 2. Capital Formation | 1948 | 44.75 | 27.66 |
| | 1963 | 44.22 | 27.43 |
| 3. Government | 1948 | 23.52 | --- |
| | 1963 | --- | 16.71 |
| 4. Exports | 1948 | 26.57 | 18.96 |
| | 1963 | 31.39 | 25.96 |
| 5. Total Final Demand | 1948 | 28.26 | 19.27 |
| | 1963 | 29.89 | 22.88 |

* Rows 1 through 5 are measures of the impact of a change in mix for $100 change in final demand. Columns 1 and 2 measure the change in the inter-industry structure.

V. Summary of Findings and Conclusions (Cont.)

covering major currents due to composition, technology and a "natural" import-replacement. In one sense, the full cost of avoiding the "distortions" which have accompanied more autonomous industrialization elsewhere in Latin America lies in its absorption by and extension of the mainland economy.