TABLE 4

CHANGES IN PRODUCTION LEVELS OF INDUSTRIES

R H S		1			2			3			4			5		
Matrix		A_0	A_1	A_2	A_0	A_1	A_2	A_0	A_1	A_2	A_0	A_1	A_2	A_0	A_1	A_2
1	Agriculture	U	U	U	U	U	U	U	U	U	U	U	U	+	+	+
2	Mining	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3	Food Manufactures	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4	Beverages	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
5	Tobacco Products	+	U	U	U	U	U	U	U	U	U	U	U	U	U	U
6	Textile Products	L	L	L	L	L	L	L	L	L	U	U	U	U	U	U
7	Footwear	L	L	L	+	U	U	+	U	U	U	U	U	x	x	x
8	Wood Products	L	L	L	+	+	+	+	U	U	+	U	U	+	U	U
9	Furniture & Fixtures	-	+	+	+	+	+	+	+	+	+	+	U	+	+	+
10	Paper Products	L	L	L	L	L	L	-	-	-	+	+	U	+	+	+
11	Printed Materials	L	L	L	L	L	L	+	+	U	+	U	U	+	+	+
12	Leather Products	L	L	L	L	L	L	+	U	U	+	U	U	U	U	U
13	Rubber Products	L	L	L	L	L	L	+	+	+	+	+	+	+	+	+
14	Chemicals	L	+	+	U	U	U	+	U	U	U	U	U	U	U	U
15	Petroleum Products	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
16	Non-Metallic Products	L	L	L	L	L	L	L	L	L	+	U	U	+	+	+
17	Ferrous-Metal Products	L	L	L	U	U	U	+	U	U	U	U	U	U	U	U
18	Non-Ferrous Metal	+	U	U	+	U	U	+	U	U	+	U	U	+	+	U
19	Non-Electrical Machinery	L	L	L	+	+	+	U	+	+	+	U	U	+	+	+
20	Electrical Machinery	L	L	L	-	L	L	U	U	+	+	U	U	+	+	U
21	Transport Equipment	L	L	L	-	L	L	U	+	-	+	U	U	+	+	+
22	Miscellaneous Manufac-	L	L	L	-	L	L	L	L	L	+	U	U	+	+	U
23	Construction tures	+	+	+	+	+	+	+	+	+	+	U	U	+	+	+
24	Wholesale & Retail	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
25	Transport Services	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
26	Communication	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
27	Electricity, Gas, Water	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
28	Banking, Insurance, Real	U	U	U	U	U	U	+	U	U	+	+	U	+	+	+
29	Other Services Estate	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

Symbols: U - expands to upper limit; + - expands; L - contracts to lower limit; - - contracts; x - disappears

TABLE 3

INDUSTRY OUTPUT AND RESOURCE VARIATION RATES ALLOWED IN THE MODEL

R H S	1	2	3	4	5
Agriculture	$1 \pm .025$	$1 \pm .05$	$1 \pm .05$	1 + .20	1 + .50
Non-Agriculture	$1 \pm .10$	$1 \pm .20$	$1 \pm .20$	1 + .20	1 + .50
Capital	1	1 + .05	1 + .10	deleted	deleted

Base values are 1961 values, expressed at free trade prices defined for each of the technology matrices.

TABLE 2

COMPUTED "FREE TRADE" PRICES AND IMPLIED SUBSIDIES ON FINISHED GOODS

No.	Industry	Prices when Subsidy on Input is 50 %	Implied Subsidy on Finished Good	Prices When Subsidy on Input is 200 per cent	Implied Subsidy on Finished Good
1	Agriculture, Fishing & Forestry	0.98644	0.01374	0.97482	0.02583
2	Mining	.96815	.03289	.94085	.06286
3	Food Manufactures	.98933	.01078	.98019	.02021
4	Beverages	.98938	.01073	.98028	.02011
5	Tobacco Products	.97983	.02058	.96254	.03891
6	Textile Products	.98214	.01818	.96684	.03429
7	Footwear	.96647	.03469	.93773	.06640
8	Wood Products	.98599	.01420	.97398	.02671
9	Furniture and Fixtures	.97714	.02339	.95754	.04434
10	Paper Products	.95817	.04365	.92232	.08422
11	Printed Materials	.95415	.04805	.91485	.09309
12	Leather Products	.97812	.02236	.95725	.04235
13	Rubber Products	.97698	.02356	.95725	.04465
14	Chemicals	.95800	.04384	.92200	.08459
15	Petroleum Products	.98011	.02029	.96307	.03834
16	Non-Metallic Products	.96606	.03513	.93696	.06728
17	Ferrous Metal Products	.87282	.14571	.76381	.30926
18	Non-Ferrous Metal Products	.92273	.08374	.85650	.16748
19	Non-Electrical Machinery	.96397	.03737	.93308	.07171
20	Electrical Machinery	.93219	.07274	.87407	.14407
21	Transport Equipment	.95292	.04940	.91256	.09581
22	Miscellaneous Manufactures	.96717	.03394	.93903	.06492
23	Construction	.97287	.02788	.94962	.05305
24	Wholesale and Retail Trade	.99823	.00177	.99672	.00329
25	Transport Services	.99254	.00751	.98615	.01404
26	Communication	.98762	.01253	.97701	.02353
27	Electricity, Gas and Water	.98551	.01470	.97310	.02764
28	Banking, Insurance, and Real Estate	.99943	.00057	.99894	.00106
29	Other Services	0.99632	0.00369	0.99317	0.00687

TABLE 1

INDUSTRY CLASSIFICATION AND INDUSTRY CAPITAL COEFFICIENTS

No.	Industry	ISIC Classification	Capital Coefficient	Capital Intensity Ranking
1	Agriculture, Fishing, and Forestry	013-019, 021-022, 0111-0114, 0121-0123, 044, 043		
2	Mining	--		
3	Food Manufacturers	201-209	0.190	14
4	Beverages	211-312, 214	.195	13
5	Tobacco Products	221-322	.100	19
6	Textile Products	231-233, 239	.436	2
7	Footwear	241, 243-244	.165	16
8	Wood Products	251-253, 259	.213	10
9	Furniture and Fixtures	261	.207	11
10	Paper Products	271-272	.334	5
11	Printed Materials	281-283	.266	8
12	Leather Products	291-293	.157	17
13	Rubber Products	301-302, 309	.314	6
14	Chemicals	311-313, 319	.169	15
15	Petroleum Products	321, 329	.088	20
16	Non-Metallic Products	331-334, 339	.622	1
17	Ferrous Metal Products	341-342	.201	12
18	Non-Ferrous Metal Products	351-357, 359	.134	18
19	Non-Electrical Machinery	362-365, 367-369	.241	9
20	Electrical Machinery	371-374, 379	.281	7
21	Transport Equipment	381, 383-385, 389	.340	4
22	Miscellaneous Manufactures	394, 399	.378	3
23	Construction	441, 419, 412	0.020	21
24	Wholesale and Retail Trade	611-619		
25	Transport Services	711-717		
26	Communication	731-732		
27	Electricity, Gas, and Water	511-512, 521		
28	Banking, Insurance, and Real Estate	--		
29	Other Services			

Source: Mijares and Valdepenas (15).
For capital coefficients, Bautista (1).

tries with lower capital-output ratios and contracted industries with higher capital-output ratios.

With respect to foreign trade, the composition of trading industries would have been different. In general, the difference would have been in the form of fewer net importing and more neutral industries. Capital intensity was not a factor in the determination of the industries' trading status. There is no straightforward evidence that the so-called import substituting industries had comparative disadvantage. More important in the determination of comparative advantage were factors that affected the mobility of resources in the economy as a whole.

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per cent to 0.75 per cent of national income, and larger than the estimates cited in Leibenstein [21] arrived at through partial equilibrium analysis. However, they are much smaller than the general equilibrium estimates of Pedro Cabezon [3] on the welfare impact of the Chilean tariff, which range from 0.4 per cent to 5.7 per cent, or Johnson's [8] and McKinnon's [14] general equilibrium parametric simulation estimates which range from a high 25 per cent to a low 3 per cent, respectively.

Sensitivity

Characteristic of linear models, the linear programming model employed in this study proved to be sensitive to both changes in the input-output structure as well as the boundary conditions imposed on the activity levels. This sensitivity should not be forgotten in the course of appreciating the estimates just cited.

6. Conclusions

On the assumption that idle or underutilized capacity ranged from zero to 20 per cent of the aggregate capital stock in the Philippines in 1961, the production cost of exchange control in the country at that time ranged from 0.18 per cent to 1.65 per cent of gross national product. This cost can be viewed as the percentage of national output foregone because the peso was overvalued. Moreover, the structure of domestic production would have been different if there had been no exchange restriction. The structure would have been characterized by expanded industri

hand-side, it is necessary to answer the question as to which matrix and right-hand-side are relevant. It is recalled that matrices A_1 and A_2 reflect a moderately adjusted and a liberally adjusted exchange rate, respectively. That being the case, it is no problem to assume that between them they encompass "the" equilibrium exchange rate. It follows then that both matrices are relevant.

With regard to the right-hand-side, it is true that there is no theoretical reason to suppose that one right-hand-side is more reasonable than another. It is equally true, however, that in the short-run, on the basis of empirical considerations, it is not reasonable to assume that any economy is capable of varying output and capital stock by 50 per cent. In the Philippines the rate of variation on the basis of rates of capacity underutilization and idleness will have to be in the neighborhood of 20 per cent.[10] If that is the case then the relevant right-hand-side is right-hand-side 4. This will indicate that the economic cost of exchange control in the Philippine economy of 1961 must be anywhere between 0.18 per cent and 1.65 per cent of national income of that year.

The foregoing approximations are larger than Gerald Lage's [11] estimates of the cost of the Japanese tariff, i.e., 0.33

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[10]Even for the industrialized Japanese economy, Lage's[11] implicit estimate of capacity underutilization is only 20 per cent.

Products, became net exporters or neutral. Under liberal right-hand-sides, only Ferrous Metal, Non-Ferrous Metal, and Electrical Equipment had unambiguous comparative disadvantage.

On the basis of these changes, it is difficult to say that the so-called import-substituting industries, except in so far as they refer to Ferrous Metals, Non-Ferrous Metals, and Electrical Equipment, had comparative disadvantage. The most that can be said seems to be that the advantage or disadvantage of the various industries critically depended less on the exchange rate than on the policies affecting conditions of flexibility and mobility in the economy as a whole.

The Production Cost of Exchange Control

Estimates of production costs under varying assumptions are summarized in Table 6. It can be seen that production cost is uniformly higher under matrix A_2 than under matrix A_1. This cost ranges from 0.18 per cent to 3.00 per cent on the basis of matrix A_1 and from 0.27 per cent and 3.53 per cent on the basis of matrix A_2, as the right-hand-side is liberalized.

Here we are left with a range of estimates, not with a fixed single value that can be pointed to as the estimate of the production cost of exchange restriction. What needs to be done is to determine which of the several estimates can be regarded as satisfying our purpose. Since the percentages are sensitive to both changes in the matrix and changes in the right-

This development follows from the changes taking place in the domestic production sector. As was seen earlier, domestic production levels went up as the right-hand-side was liberalized. As a result of these increases in domestic production levels, more industries could afford to make net exports and fewer industries needed to make net imports, although the volumes of net exports and net imports were equal, as required by the balance of payments constraint.

The location of comparative advantage can be inferred from the foregoing changes in the industries' trading status. Comparative advantage and comparative disadvantage can be said to lie in those industries which became net exporters and net importers, respectively, in the optimal solutions. These industries varied with respect both to the technology matrices and the right-hand-sides. On the basis of the matrices, the industries which had advantage would include Mining, Food Manufacturing, Tobacco, Footwear, Chemicals, and Services. Those which had disadvantage would include Paper Products, Printed Materials, Non-Metal Products, Ferrous Metal, Non-Ferrous Metal, Non-Electrical Machinery, Electrical Machinery, Transport Equipment, and Miscellaneous Manufactures.

Comparative advantage and disadvantage is seriously modified, however, as the right-hand-side is liberalized. Under liberal right-hand-sides, Textiles, Wood, Furniture and Fixtures, Paper, Printed Materials, Leather, Rubber, and even Non-Metal

a net importer in the optimal solutions.

It will also be noted that the 15 industries that become net importers included industries with fairly low capital intensities, i.e., Food Manufacturing (14), Chemicals (15), Leather (17), Non-Ferrous Metal (18), as well as fairly capital-intensive ones, i.e., Non-Metallic Products (1), Transport Equipment (4), Paper Products (5), Rubber (6), Electrical (7), Printed Materials (8), Non-Electrical Machinery (9), Furniture and Fixtures (11), and Ferrous metal (12). Capital intensity, in other words, was not an important factor in determining whether an industry was to become net exporter, or neutral, or net importer.

The responses of the trading industries to changes in the right-hand-sides can also be observed. When the right-hand-side was restrictive as under right-hand-side 1, only five industries were net exporters. These are Mining, Food Manufacturing, Tobacco, Banking, and Services. The rest were net importers or neutral. However, as the right-hand-side was liberalized the number of net exporters grew. Under right-hand-side 4, net exporters include Agriculture, Food Manufacturing, Tobacco, Textiles, Wood, Leather, and Chemicals, Under right-hand-side 5, many previously net importing industries became neutral, including Furniture, Paper, Printed Materials, Rubber, Petroleum, Non-Metallic Products, Non-Electrical Machinery, and Transport Equipment. In general, the number of net exporters and neutral industries increased as the right-hand-side was liberalized.

Foreign Trade

A summary of the changes occurring in the trading status of industries as both technology matrices and right-hand-sides are varied is given in Table 5.

It is possible to see how the trading industries responded to alterations in the matrix. Not counting the home industries (namely, Construction, Wholesale and Retail, Transport Services, Communications, and Electric And Gas), 15 industries were sensitive in varying degrees to changes in the matrix. These are: Agriculture, Mining, Footwear, Furniture and Fixtures, Paper Products, Printed Materials, Leather, Rubber, Chemicals, Non-Metallic Products, Ferrous Metal, Non-Ferros Metal, Non-Electrical Machinery, Electrical Machinery, and Transport Equipment. Most sensitive were: Ferrous Metal, Non-Ferrous Metal, Electrical Machinery, and Transport Equipment. In general these 15 industries changed from either net exporters or neutral to net importers as the matrix was adjusted.

It is of interest to explain the change in the status of Agriculture from net exporter to net importer. In the input-output classification on which the present study is based, Agriculture includes only basic agricultural production. It does not include processing and milling activities, which are embraced in the Food Manufacturing industry. Given that the country is in fact a consistent importer of basic farm products such as rice, it is not surprising that Agriculture should become

The only exception was Textiles which declined under restrictive policies and expanded under buoyant policies. The remaining 15 industries in the indigeneous manufacturing and capital-intensive sectors were sensitive to changes in internal policies as they were to changes in the exchange rate. While several of these industries (including Furniture and Fixtures, Chemicals, and Non-Ferrous Metal) expanded even when policies were restrictive, all of them expanded when policies were liberal. Generally, the capital intensive industries declined when internal policies were restrictive and expanded when these policies were permissive.

In any case, the structure of the economy that emerges when the exchnage rate is adjusted and policies affecting mobility in the economic system are liberalized is different from the structure that results when these adjustments and modifications are not implemented. However, when internal economic policies become so favorable as to permit a 20 to 50 percent expansion in output and capacity, the impact of the exchange rate on industrial structure becomes small.

regardless of the right-hand-side were the relatively less capital intensive industries. These are: Food Manufacturing (14), Beverages (13), Tobacco (19), and Petroleum (20). This kind of behavior is of course precisely what should be expected when capital is the scarce resource which is being economized by the society as a whole.

The conclusion is that almost one-half of the industries included in the inter-industry study, i.e., 14 industries (Agriculture, Mining, Food Manufacturing, Beverages, Tobacco, Textiles, Petroleum, Banking, Services and the five home industries) out of 29, were quite indifferent to the exchange rate. They expanded (and in the case of Textile declined and expanded) regardless of what exchange rate was in effect. More sensitive to exchange rate modifications were the 15 remaining industries. These are the industries that belong to the indigenous sector of the manufacturing industry, and the capital intensive sector. While these industries responded in the same direction to the various exchange rates, the magnitude or severity of their responses was greater under adjusted exchange rates. Exhibiting particularly wider fluctuations as the exchange rate was more liberally adjusted were the capital intensive industries.

The same 14 industries that were indifferent to exchange rate changes were also insensitive to changes in other policies affecting freedom of movement in the economic system. These industries expanded whether policies were liberal or restrictive.

city expanded, the last two to the allowable maximum in all three matrices, implying that these industries as should be expected, are insensitive to exchange rate adjustments.

It is also possible to see how the industries responded to changes in the right-hand-side. The first five industries (Agriculture, Mining, Food Manufacturing, Beverages, and Tobacco) expanded and, except for Beverages, expanded to the permissible limit under all five right-hand-sides.

The 15 industries belonging to the rest of the manufacturing sector (already enumerated) behaved differently. These industries expanded or contracted depending on the liberality or restrictiveness of the right-hand-side. Almost all these industries contracted under right-hand-sides 1 and/or 2, and expanded under right-hand-sides 3 to 5.

The home industries expanded under all five right-hand-sides.

The expansion becomes general, with only the degree of expansion varying, under the extremely liberal right-hand-sides 4 and 5.

On closer examination, it turns out that the industries which contracted when the right-hand-sides were restrictive and which expanded when the right-hand-sides were liberal were the relatively more capital intensive industries. These, with capital intensity ranking in parenthesis, are: Textiles (2), Non-Metallic Products (1), Rubber (6), Non-Electrical Machinery (9), Electrical Machinery (7), Transport Equipment (4), and Miscellaneous Manufactures (3). On the other hand, the industries which expanded

Changes in Production Levels

Table 4 summarizes the changes in the production levels of the various industries under the several technology matrices and right-hand-sides. The response of the industries to changes in the technology matrix can be noted. Five industries, namely, Agriculture, Mining, Food Manufacturing, Beverages, and Tobacco were completely insensitive to alterations in the matrix. Regardless of the matrix these industries expanded, four of them to the permissible maximum.

More sensitive to matrix changes were 15 other industries.[9] While these industries changed in the same direction regardless of the matrix, the extent of the change they exhibited was generally greater under the adjusted than under the unadjusted matrices. Among these industries which exhibited the widest fluctuations, as the technology matrix was altered, were the industries belonging to the so-called capital-goods producing sector, which were also generally capital-intensive.

The five home industries, namely, Construction, Wholesale and Retail Trade, Transport Services, Communication, and Electri-

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[9]These industries, with their capital intensity ranking (in parenthesis), are: Textiles (2), Footwear (16), Wood (10), Furniture and Fixtures (11), Paper and Paper Products (5), Printed Materials (8), Leather Products (17), Rubber Products (6), Chemicals (15), Non-Metallic Products (1), Ferrous Metal Products (12), Non-Electrical Machinery (9), Electrical Machinery (7), Transport Equipment (4), Miscellaneous Manufactures (3).

Two other industries not behaving in the same way as the above industries, are: Petroleum (20), and Non-Ferrous Metal Products (18).

it from coming up with runaway solutions. These boundary conditions can be viewed as proxy for policies affecting mobility and flexibility in the economic system. For instance, under right-hand-side 1, the output of Agriculture was allowed to vary by 2.5 per cent and that of the other industries by 10 per cent while the aggregate capital stock was held down to 1961 utilization levels. Under right-hand-side 4, the variation rate was increased to 20 per cent for all industries, the aggregate capital constraint was deleted, and all lower bounds were eliminated to allow the disappearance of any industry. Under right-hand-side 5, the variation rate was incresed to 50 per cent while all modifications embodied in right-hand-side 4 were retained. While this latter rate is obviously too large for the short-run horizon of the model, its inclusion is useful for purposes of judging the response of the industries to practically unlimited freedom of movement in the economy.

These variation rates are shown in Table 3.

The model has 93 row constraints, including the objective function, and 156 column variables, including the positive and negative slacks. It has 857 non-zero elements, including slacks, yielding a density of 5.91. When the infeasibilities are deleted, the effective row constraints decline to 64, the non-zero elements decrease to 734, and the density accordingly rises to 18.51.

$[p_i/p_j)']$ are ratios expressing the new free trade prices of the appropriate inputs and outputs.

$[A_1]$ is a new technology matrix.

Precisely the same procedure will be followed with respect to the assumed 200 per cent subsidy except that the appropriate scalar is 0.35. The derivation of the second "free trade" technology matrix will then be straightforward.

$$(12)\quad [(a_{ij})^{nxn}\ (p_i/p_j)''] = [A_2]^{nxn}$$

$[(p_j/p_j)'']$ are ratios expressing the new free trade prices of the appropriate inputs and outputs.

$[A_2]$ is another new technology matrix.

These "free trade" prices, p_i' and p_i'' $(i = 1, \ldots, n)$, and the subsidy or tariff on final product that they imply are shown in Table 2.

Using matrix A_0, A_1, and A_2 to represent, respectively, the original controlled situation of the economy, the moderately adjusted "free trade" situation, and the liberally adjusted "free trade" situation, it is now possible to obtain an approximation of the production cost of exchange control.

5. Some Results

Boundary Conditions

In keeping with established practice in the use of linear models, boundary conditions were imposed on the model to prevent

The purpose in making these two extreme estimates is to encompass the "true" rate, which was nominal in some industries but fairly large (exceeding 200 per cent) in some of the import-competing industries.

What must now be done is to eliminate the subsidy from the cost of the imported intermediate inputs and find out how the total cost and, hence, the price of output is affected. After that we can calculate the technology matrix, reflecting the derived "free trade" prices which will be used to represent a "free trade" version of our model.

Algebraically, this is saying that the import vector is multiplied by a scalar 0.65 to reflect the removal of the assumed 50 per cent subsidy on imported inputs,[8] making the necessary matrix multiplication indicated by equations (8) and (9), and then multiplying each element of the original technology matrix by the corresponding new prices, to yield a new technology matrix, viz.:

$$(11) \quad [a_{ij})^{nxn} (p_i/p_j)'] = [A_1]^{nxn}$$

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[8]The derivation can be shown as follows. Suppose the import input coefficient (f_{mj}) is .300. We know that this coefficient embodies the subsidy, viz.: $f_{mj}(1+s) = .300$, where s is the percentage subsidy. If we assume that s is 50 per cent, then $1.50f_{mj} = .300$, $f_{mj} = .200$ = the price of the imported input under "free trade." To find the value of the appropriate scalar h with which to multiply the import input coefficient, we have: $.300h = .200$, $h = .666...$ The scalar h is .666... to reflect the 50 per cent subsidy on the imported intermediate input.

embody any distortion. In the Philippine case, however, it is the distortion that makes the devaluation necessary to begin with. Exchange control, in effectively implementing import control, becomes another name for a subsidy program for imports and import-competing goods, where the subsidy is paid both by the exporters and the public.

If the prices of goods are equal to unity in the period of control, they must fail below unity once the subsidy or implied "tariff" is eliminated. The subsidy or implied traiff may fall either on finished products or intermediate materials or both. In any case, a subsidy on a finished product can be expressed on an appropriately adjusted subsidy on intermediate products.

In view of the type of data that are available, it is more convenient computationally to view the subsidy as falling upon imported intermediate inputs. This in fact turns out to be the realistic view in the Philippine case, because the Philippine government tried to encourage import-substitution precisely by making importers pay less for their imported intermediate inputs via an overvalued exchange rate but collect more on their finished products via higher domestic prices generated by a shortage of import goods. The procedure is to calculate the rate of subsidy extended to domestically produced as well as imported goods, where the subsidy is assumed to fall on intermediate inputs. In the present study, two assumptions of the rate of subsidy are used: a low rate of 50 per cent and a high rate of 200 per cent.

[C] is a product matrix whose coefficients show the direct and indirect costs of inputs per unit of output.

$$(9)\quad \underset{1xm}{[\hat{1}]}\ \underset{mxn}{[C]} = \underset{1xn}{[1.00]}$$

If we assume that prices equal costs, then prices also equal unity as indeed we have already assumed, viz.:

$$(10)\quad \underset{1xn}{[P]} = \underset{1xm}{[\hat{1}]}\ \underset{mxn}{[C]} = \underset{1xn}{[1.00]}$$

[P] is a vector of prices, one price for each of the commodities (P_i, i = 1, ..., n).

If any of the vectors of primary or imported inputs is altered, either by an increase or a decrease in the cost of these inputs, the vector of prices will also be altered, that is, prices will also increase or decrease. Thus it is possible to trace the total effect of a change in the cost of any single input upon the price of the corresponding output.

How then will abolition of exchange restriction affect the cost of inputs, specifically inported inputs, and hence the price of outputs? It is important to indicate at this point that in the Philippine case we are analyzing a movement from a position of disequilibrium to a position of equilibrium, instead of examining a change from a position of equilibrium to another position of equilibrium, as in standard devaluation analysis. In standard devaluation analysis, devaluation leads to an increase in the price of imported goods in terms of domestic currency, since domestic prices at the initial position do not

The technology matrix which is expressed, as has already been indicated, in domestic prices embodying the distortions created by exchange control must be redefined in domestic prices that are free of the distortion. This involves the calculation of domestic prices that would prevail in the economy if foreign exchange were not controlled, i.e., the calculation of Pd = 1/(1+e), where e is the percentage of the subsidy arising from exchange control.

Transformation of the Data

In competitive valuation models of the input-output type, costs of commodities are determined solely by the costs of factors or resources used in their production. Thus, if the matrix of primary input coefficients, including import coefficients, is postmultiplied by the inverse of the technology matrix,[7] we obtain a new matrix showing the direct and indirect costs of inputs per unit of output. These costs add up to unity.

In matrix notation:

$$(8) \quad \underset{mxn}{[f_{ij}]} \; \underset{nxn}{[I-A^{-1}} = \underset{mxn}{[C]}$$

$[f_{ij}]$ is a matrix of primary input coefficients.

$[I-A]^{-1}$ is the inverse of the technological coefficient matrix.

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[7] In the course of transforming the data, it was found that the inverse reported in Mijares and Valdepenas is not $[I-A]^{-1}$. To obtain the inverse $[I-A]^{-1}$ used here, another inversion had to be carried out. The correct inverse is reported in Jurado [9], Appendix Table 3.

consequent replacement of lost domestic output by imports. On the demand side, the formulation rests on the implicit assumption of an infinite elasticity of foreign demand for the country's exports. This assumption is not damaging to the model since, as has been said, we are dealing with a small trading country.

With both imports and exports being treated as variables, the optimal solution will also indicate which industries will become net exporters and which industries will become net importers. The identification of industries which have a natural comparative advantage and of industries that have a potential for producing import substitutes then naturally follows.

4. The Empirical Basis

The Data Input

The principal data to be used will be those provided by the 1961 inter-industry study of the Philippine economy by Mijares and Valdepenas [15]. This study disaggregates the economy into 29 industries ranging from agriculture to services. These industries and their International Standard Industrial Classification (ISIC) are presented in Table 1. The input-output coefficients are the basic parameters of the model. Other data required are those pertaining to gross domestic production, exports, imports, final demand, labor- and capital-output coefficients of the industries included in the inter-industry study.

prices. (The matrix transformation involved here will be shown on pp. 22-24.)

In terms of the objective function defined by equation (5), the optimal national income derived from each "free trade" version of the model will then be compared with the optimum national income in the actual "controlled" version, which is also expressed in appropriate "free trade" prices. The difference will then serve as an approximation of the production component of the economic cost of foreign exchange control.

The power of the model in isolating the production cost of exchange control arises from the fact that while the technological structure of the industries and the economy as a whole does not change over the horizon of the model, the configuration of price changes. Thus, any difference in the behavior of the industries in the three versions of the model in terms of output levels and other variables can only be the result of the difference in prices that confront these industries.

Foreign Trade

Imports and exports are treated as separate variables whose levels are to be determined, rather than as parameters established by the magnitudes of previously specified final demand levels as in conventional input-output analysis. On the supply side, this permits not just the reduction but the complete abolition of production in any industry if that is optimal, and the