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A COMPARATIVE ANALYSIS OF STRUCTURES AND PROJECTIONS OF INPUT-OUTPUT TABLES IN THE PHILIPPINES

by

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A COMPARATIVE ANALYSIS OF STRUCTURES AND PROJECTIONS OF INPUT-OUTPUT TABLES IN THE PHILIPPINES*

by Gerardo P. Sicat

I. PROBLEM

Much work has been done on input-output models in many countries. If to have at least one input-output table per country means to close a statistical gap in terms of the tables of input-output transactions among less developed countries, then this lag has been almost closed. For one of the status symbols of development planning among less developed countries is to have an input-output table, which is why it is not uncommon for any one of them to have large statistical investments set aside to finance input-output studies. Of course, these studies have external economies to other statistical programs, notably national income accounting.

It is by a streak of fortune that the Philippines is unique for having two tables undertaken for the same year. Two separate statistical agencies of the government devoted some research resources to input-output tables; they each undertook their research under exclusive and independent auspices.

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*A condensed version of this study was presented to the Second World Econometric Congress, Cambridge, England, Sept. 8-14, 1970 (Session 76, Sept. 13, 1970). I was assisted in this study by three research assistants at three stages: Helen Reantaso (who helped in aggregating the NEC table), who is now with the Bicol Development Company; Reynardo Orbeta (who continued Miss Reantaso's work), who is now with the Board of Investments; and Gerardo Villaroman, who supplied the greatest bulk of research assistance, including the programming of my computations, with the help of Emmit Summers, at the University of the Philip-

The availability of competing tables enables us therefore to place input-output studies under a unique test. By feeding identical information into them, we are able to compare their structural and projection performance. The results should have obvious significance to work carried out in other countries. They provide some check on how much faith we have in input-output related studies for purposes of economic planning, especially when the statistical basis is only one input-output table, as in fact is often the case.

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pines' Computation Center. I am grateful to the University of the Philippines Computation Center for the computer time, the U.P. School of Economics, and the Rockefeller Foundation for financial and research assistance. The study was substantially completed in April, 1970. On July 10, 1970, the author assumed the position of Chairman of the National Economic Council, Government of the Philippines, and went on leave in his post as Professor of Economics at the University of the Philippines.

II. NOTES ON THE TWO TABLES AND AGGREGATION FOR COMPARABILITY

The National Economic Council (NEC) and the Bureau of the Census and Statistics (BCS), two different agencies of the Philippine government, came out with the two input-output tables for 1961. Both agencies used, as the basis of the statistical information, the 1961 Economic Census of the Philippines; and both estimated the tables independently of each other.

Both studies have caused a certain amount of professional, if not acerbic, controversy between the NEC and the BCS. This discussion, of course, had its own impact on issues affecting government statistical programs. The NEC is a planning agency of the government; and, on the basis of its table, it has made numerous policy statements concerning industrial development.[1]

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[1]The BCS table was undertaken in a joint project with the School of Economics, University of the Philippines. It was headed by Dr. Tito A. Mijares, Director of the Bureau and Professor of Statistics, University of the Philippines. The NEC table was undertaken under the direction of Director Bernardino G. Bantegui, Office of Statistical Coordination and Standards, at the National Economic Council. The technical assistance came from Japan.

Original Table Dimensions

The dimensions of the two tables are different. The BCS table is 29 by 29; the NEC table 50 by 50. The aggregation features of these two tables are as follows:

(1) Primary sectors. The BCS table had only two primary sectors, namely, mining and agriculture. The NEC table had a more detailed breakdown of agricultural sectors, as follows:

Palay
Corn
Fruits and nuts
Tubers and root crops
Vegetables
Coffee and Cacao
Coconut, including copra
Sugar cane
Fiber crops
Tobacco
Other crops
Livestock and poultry
Other agricultural activities
Fisheries
Forestry and logging
Gold mining
Other metal mining
Non-metal mining and quarrying

(2) Manufacturing sectors. The two tables are identical in these sectors, which are all by two-digit ISIC. However, they have minor differences in their treatment of certain sectors. For instance, in the BCS table, copra was classified under manufacturing, while in the NEC it came under agriculture.

(3) Services. There are many differences here. The differences are shown by the following:

NEC Service Sectors	BCS Service Sectors
Electricity, gas and water services	Construction
Trade	Wholesale & Retail
Banking and financial institutions	Transport services
Life and non-life insurance	Communication
Real estate	Electricity
Transportation	Banking, insurance and real estate
Storage and warehousing	Other Services
Communication	
Government Services	
Private Services	
Unallocated	

Aggregation for Comparability

To make the two tables comparable in dimension, some aggregation was required. The larger NEC table was reduced to sectors comparable with the BCS. This reduction led to a revised table of size 26 by 26. All the 15 agricultural primary sectors were aggregated as agriculture and three mining sectors as mining. This aggregation conformed almost exactly with the BCS level of aggregation.

Unfortunately in the services sector, the BCS was more disaggregated than the NEC. To make them exactly comparable, we would have had to aggregate the BCS sectors in conformity with the NEC sectors. Since only three sectors were affected, the

work was not worth the additional effort, especially since we were working from the inverse Leontief matrix of the BCS table.[2]

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[2]The inverse table was made available by BCS Director Tito A. Mijares.

III. METHODOLOGY

(a) Theory

Let

$$A = \begin{Bmatrix} a_{11} & a_{12} \cdots a_{1n} \\ a_{21} & a_{22} \cdots a_{2n} \\ \cdot & \\ \cdot & \\ \cdot & \\ a_{n1} & a_{n2} \cdots a_{nn} \end{Bmatrix}$$

be the square matrix of input-output coefficients,

$$Y = \begin{Bmatrix} y_1 \\ y_2 \\ \cdot \\ \cdot \\ \cdot \\ y_n \end{Bmatrix}$$

a vector of final demand on all sectors, and

$$X = \begin{Bmatrix} x_1 \\ x_2 \\ \cdot \\ \cdot \\ \cdot \\ x_n \end{Bmatrix}$$

a vector of total industry production.

Total production of all sectors may be summarized by the following matrix relations,

(1) $$\underline{X} = \underline{AX} + \underline{Y},$$

that is, total production of different sectors is the net sum of interindustry demand and the final demand. We are interested in the value of total production required, given a specified final demand vector $\underline{Y}$ and the economic structure $\underline{A}$. Through usual matrix operations, we reduce our problem to a solution for $\underline{X}$, which is

$$\underline{X} = (\underline{I}-\underline{A})^{-1}\,\underline{Y} \tag{2}$$

where $(\underline{I}-\underline{A})^{-1}$ is the inverse Leontief matrix. The conditions for the viability of an economic system described by $\underline{A}$ are well-known in the literature.[3]

Our results for intermediate demand, then, are given by

$$\underline{AX} = \underline{X} - \underline{Y}. \tag{3}$$

The problem becomes simply that of getting the Leontief inverse and, given some specification of the final demand vector, of finding the solution for $\underline{X}$.

Sectoral Production and Intermediate Demand

Writing equations (1) in detail, we have

$$x_i = \sum_{j=1}^{n} a_{ij}x_j + y_i \qquad (i = 1,\ldots,n). \tag{1a}$$

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[3]For instance, see Dorfman, Samuelson, and Solow (1958).

Dividing (2a) by x_i, we get

$$(4) \qquad 1 = i_i + d_i \qquad (i = 1,\ldots, n)$$

where $i_i = \sum_{i=i}^{n} a_{ij}x_j/x_i$, the intermediate demand ratio and $d_i = y_i/x_i$, the final demand ratio. Thus, a computation of d_i gives the intermediate demand ratio per sector since

$$(5) \qquad i_i = 1 - d_i \qquad (i = 1,\ldots, n),$$

or, in percentage terms,

$$(5a) \qquad 100i_i\% = 100\% - 100d_i\% \quad (i = 1,\ldots, n).$$

In view of this, all that is sufficient is a knowledge of the final demand ratio (d_i) for each sector. Incidentally, i_i, or $1-d_i$, is more popularly known as a measure of forward linkages in an input-output system.

Sectoral and Total Primary Demand

The input-output tables are of the "open-Leontief type," in which coefficients of primary inputs are also estimated.

The next problem is to derive the total and sectoral primary input demand requirements. Let V_k be a column vector of primary input coefficient with n elements (for the n sectors), where k stands for the index of the m specific primary inputs -- for instance, labor, depreciation requirements, indirect taxes,

etc. (k = 1, 2,..., m). Thus,

$$V_k = \begin{Bmatrix} v_1^k \\ v_2^k \\ \cdot \\ \cdot \\ \cdot \\ v_n^k \end{Bmatrix}.$$

Given the known solutions for total production vector $\underline{X}$, the computation of sectoral and total primary demand requirements is easily done. For a given primary input $\underline{k}$, this is given by

$$(6) \qquad X'V_k = x_1 v_1^k + x_2 v_2^k \ldots + x_n v_n^k \qquad (k = 1,\ldots, m)$$

= total primary demand for input $\underline{k}$.

The sectoral requirement for sector $\underline{i}$, in terms of primary input $\underline{k}$, is

(7) sector $\underline{i}$ primary demand requirement

for input $R_i^k = x_i v_i^k$ $\qquad$ ($\underline{i}$ = 1, 2,..., n). ($\underline{k}$ = 1, 2,..., m).

(b) Application: total and intermediate demand requirements.

Let

$$\underline{A}_N = \begin{Bmatrix} a_{11} \cdots a_{1,26} \\ \cdot \quad\quad \cdot \\ \cdot \quad\quad \cdot \\ a_{26,1} \cdots a_{26,26} \end{Bmatrix}$$ NEC 26 by 26 matrix of input-output coefficients

$$\underline{X}_N = \begin{Bmatrix} x_{N1} \\ \cdot \\ \cdot \\ \cdot \\ x_{N26} \end{Bmatrix}$$ NEC total demand sector of 26 elements

$$\underline{Y}_N = \begin{Bmatrix} y_{N1} \\ \cdot \\ \cdot \\ \cdot \\ y_{N26} \end{Bmatrix}$$ NEC final demand column vector of 26 elements

$$A_B = \begin{Bmatrix} a_{11} \cdots a_{1,29} \\ \cdot \quad\quad \cdot \\ \cdot \quad\quad \cdot \\ \cdot \quad\quad \cdot \\ a_{29,1} \cdots a_{29,29} \end{Bmatrix}$$ BCS 29 by 29 matrix of input-output coefficients

$$\underline{X}_B = \begin{Bmatrix} x_1 \\ \cdot \\ \cdot \\ \cdot \\ x_{29} \end{Bmatrix}$$ BCS total demand column vector of 29 elements

$$\underline{Y}_B = \begin{Bmatrix} y_1 \\ \cdot \\ \cdot \\ \cdot \\ y_{29} \end{Bmatrix}$$ BCS final demand column vector of 29 elements

Then, using equation (2), we have the following desired results:

$$\underline{X}_N = (I - A_N)^{-1} \underline{Y}_N$$

for the NEC tables and

$$\underline{X}_B = (I - A_B)^{-1} \underline{Y}_B$$

for the BCS.

Structurally, $\underline{A}_N$ and $\underline{A}_B$ should be similar since they describe the same economy. Thus, we devise a test to determine how similar, indeed, they are. We do not have to compare the 26 by 26 elements of the NEC matrix with the 29 by 29 elements of the BCS table. This method is unnecessarily cumbersome and therefore certainly pointless. The comparison can only be effectively undertaken by examining their structural implications. The sufficient test of structural similarity is by feeding similar information into the economic structure described by $\underline{A}_N$ and $\underline{A}_B$, respectively.

To make the comparison, the final demand vectors must be identical, except when the requirements of aggregation make it impossible. Taking the elements of the final demand vectors, the elements are identical, that is,

$$y_{Ni} = y_{Bi}$$

for all $(i = 1, 2, \ldots, 25)$, except for the following

$$y_{N26} = y_{B26} + y_{B27} + y_{B28} + y_{B29},$$

as required by our special aggregation problem.

Finally, therefore, we would expect that if the two tables are structurally identical, except for statistical errors of estimation,

$$x_{Ni} = x_{Bi}$$

or

$$x_{Ni}/x_{Bi} = 1$$

for all sectors ($i = 1,....25$) having the same description[4] and for the aggregated sectors

$$x_{N26} = x_{B26} + x_{B27} + x_{B28} + x_{B29}.$$

(c) Application: primary demand requirements.

Let

$$V_{kN} = \begin{Bmatrix} v^k_{N1} \\ \cdot \\ \cdot \\ \cdot \\ v^k_{N26} \end{Bmatrix}$$ NEC column vector of primary demand coefficients for input k with 26 elements.

$$V_{kB} = \begin{Bmatrix} v^k_{B1} \\ \cdot \\ \cdot \\ \cdot \\ v^k_{B29} \end{Bmatrix}$$ the corresponding BCS column vector with 29 elements.

We desire two additional vectors of primary demand coefficients to enable us to undertake further computations. These are:

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[4]Since the final demand vectors are identical, i.e., $y_{Ni} = y_{Bi}$, the difference can only be due to the structure of the input-output coefficients.

$$V^{*}_{KN} = \begin{Bmatrix} v^{k}_{N1} \\ \cdot \\ \cdot \\ v^{k*}_{N26} \\ \cdot \\ \cdot \\ v^{k*}_{N29} \end{Bmatrix}$$

an NEC column vector of primary demand coefficients for input k augmented to have 29 elements. To changed vectors, begin with index "26".[5]

$$V^{*}_{KB} = \begin{Bmatrix} v^{k}_{B1} \\ \cdot \\ \cdot \\ v^{k}_{B25} \\ \cdot \\ \cdot \\ v^{k*}_{B26} \end{Bmatrix}$$

a BCS column vector of primary coefficients for input k reduced to 26 elements; the changed vector is only the last one.[6]

Computations of the type suggested by equations (6) and (7) are needed to give the total and sectoral primary input requirements of each final demand vector. Moreover, a comparison of the specific results would be needed. To give as wide a catalogue of structural implications as possible, we desire the following computations (all written in matrix notation for brevity):

For the NEC input-output table:

(a) $X'_N V^{k}_N$ = total requirements of input k using NEC primary input coefficients.

(b) $X'_N V^{*k}_B$ = total requirements of input k using BCS primary input coefficients.

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[5]For the explanation, see Appendix A.

[6]Ibid.

For the BCS input-output table:

(c) $X^i_B \; V^k_B$ = total requirements of input k using BCS primary input coefficients.

(d) $X^i_E \; V^{*k}_E$ = total requirements of input k using EEC primary input coefficients.

The comparisons that emerge, in line with the approach taken in the comparison of total and primary demand, are computations of the following types for each sector:

$$(8.a) \qquad \frac{x_{Ni} \; v^k_{Ni}}{x_{Bi} \; v^{k*}_{Bi}} \gtrless 1 \qquad \text{for all } (i = 1, \ldots, n) \; (k = 1, \ldots, m)$$

$$(8.b) \qquad \frac{\sum_i (x_{Ni} \; v^k_{Ni})}{\sum_i (x_{Ni} \; v^{k*}_{Bi})} \gtrless 1$$

$$(9.a) \qquad \frac{x_{Bi} \; v^k_{Bi}}{x_{Bi} \; v^{k*}_{Ni}} \gtrless 1 \qquad \text{for all } (i = 1, \ldots, n) \; (k = 1, \ldots, m)$$

$$(9.b) \qquad \frac{\sum_i (x_{Bi} \; v^k_{Bi})}{\sum_i (x_{Bi} \; v^{k*}_{Ni})} \gtrless 1$$

$$(10.a) \qquad \frac{x_{Bi} \; v^k_{Bi}}{x_{Ni} \; v^k_{Ni}} \gtrless 1 \qquad (i = 1, \ldots, n) \; (k = 1, \ldots, m)$$

$$(10.b) \qquad \frac{\sum_i (x_{Bi}\, v_{Bi}^{k})}{\sum_i (x_{Ni}\, v_{Ni}^{k})} \stackrel{?}{=} 1$$

$$(11.a) \qquad \frac{x_{Bi}\, v_{Bi}^{k*}}{x_{Ni}\, v_{Ni}^{k*}} \stackrel{?}{=} 1 \qquad \text{for all} \quad \begin{matrix}(i = 1,\ldots, n)\\ (k = 1,\ldots, m)\end{matrix}$$

$$(11.b) \qquad \frac{\Sigma x_{Bi} v_{Bi}^{k*}}{\Sigma x_{Ni}\, v_{Ni}^{k*}} \stackrel{?}{=} 1$$

Obviously, they are structurally the same if the equality with unity of the ratios is attained.

Appendix A is a discussion of the methodology for changing vector dimensions.

IV. STRUCTURAL COMPARISONS: TOTAL PRODUCTION AND INTERMEDIATE DEMAND

(a) Assumptions About Final Demand

Identical final demand vectors are fed to the two input-output systems. In order to show the differences in the structure of the two systems, four sets of final demand vectors are fed to the economic systems. To make a reporting of results easier -- with all values in million pesos -- the final demand vectors are labelled as follows:

Final Demand A. The current price net value added by sectors in accordance with NEC-computed national income accounts for 1961, the date for the NEC income accounts.

Final Demand B. Net value added by sectors, using the 1967 national income accounts values.

Final Demand C. Net value added by sectors for 1968 based on different assumptions about sectoral growth in 1967. This final demand is hypothetical, because it was simply generated from national income information for 1967 and was adjusted for a variety of assumptions which were made on the basis of intuitive growth factors. The basis for the computation of this vector is shown in an appendix, and they do not coincide with factual information about the economy.

Final Demand D. The final demand vector originally used in the 1961 BCS input-output study.

(b) Results

The final demand vectors ($\underline{Y}$), their corresponding solution vectors ($\underline{X}$), and the values of the ratio of the vector elements per sector (x_{Ni}/x_{Bi}) are shown in Tables 1 to 4.

Table 1: RESULTS USING FINAL DEMAND VECTOR A

(In million pesos where applicable)

ISIC	Description	Yi Final Demand A (1961) (million pesos)	Total Production Vector, Solution X		x_{Ni}/x_{Bi}
			x_{Bi}	x_{Ni}	
00	Agriculture	3916	4192.6	4984.1	1.188
10	Mining	137	174.2	557.9	3.202
20	Food	715	1014.8	942.2	.928
21	Beverages	144	157.2	146.5	.931
22	Tobacco	98	101.1	98.6	.975
23	Manufactures of Textile	105	185.7	351.8	1.894
24	Footwear	183	204.6	189.6	.926
25	Products of Wood	96	154.1	212.6	1.379
26	Furniture	36	37.4	40.3	1.077
27	Paper	50	106.7	423.4	3.968
28	Printing	76	77.4	242.9	3.138
29	Leather products	9	21.0	33.2	1.580
30	Rubber products	76	92.7	255.9	2.760
31	Chemical products	170	329.2	677.7	2.058
32	Petroleum and coal	142	263.3	947.1	3.597
33	Non-metallic mineral	75	112.6	303.9	2.698
34	Basic metal	78	112.3	549.6	4.894
35	Metal products	67	74.1	213.5	2.881
36	Machinery	47	54.2	91.3	1.684
37	Electrical Machinery	71	81.3	141.8	1.744
38	Transport equipment	73	79.2	163.6	2.065
39	Miscellaneous	38	53.4	106.2	1.988
79	Construction	446	573.1	452.0	.788
42	Wholesale and Retail	1538	2119.5	2503.0	1.137
41	Electricity	98	182.0	461.2	2.534
70	Transport services	431	554.0*	-	-
71	Communication	58	71.3*	-	-
60	Banking, Insurance and Real Estate	360	2085.0*	-	-
80	Other services	3116	6385.0	5367.3	.840

*Added to the value of other services.

Table 2. RESULTS USING FINAL DEMAND VECTOR B

(In million pesos, where applicable)

ISIC	Description	Final Demand, B (1967)	Total Production, Solution for X		NEC/BCS
			BCS	NEC	
00	Agriculture	7048	7513.2	8784.1	1.169
10	Mining	346	406.2	1039.2	2.558
20	Food	972	1494.5	1353.7	.918
21	Beverages	328	350.6	332.3	.947
22	Tobacco	174	179.3	175.1	.976
23	Manufactures of Textile	169	292.0	571.7	1.957
24	Footwear	264	298.4	275.5	.923
25	Products of wood	174	282.0	379.6	1.346
26	Furniture	59	61.5	66.5	1.081
27	Paper	84	182.4	729.1	3.997
28	Printing	129	131.4	419.0	3.188
29	Leather products	11	28.6	48.7	1.702
30	Rubber products	124	149.9	431.9	2.881
31	Chemical products	381	674.9	1278.0	1.893
32	Petroleum and coal	146	358.1	1511.6	4.221
33	Non-metallic mineral	162	231.9	553.6	2.387
34	Basic metal	141	203.2	975.7	4.801
35	Metal products	121	133.1	382.4	2.873
36	Machinery	47	59.9	123.4	2.060
37	Electrical machinery	136	154.0	254.2	1.650
38	Transport equipment	112	122.1	266.4	2.181
39	Miscellaneous	39	65.8	154.8	2.352
79	Construction	805	1026.3	815.3	.797
42	Wholesale and Retail	2459	3467.1	4100.4	1.182
41	Electricity	144	283.3	746.4	2.634
70	Transport services	682	885.7*	-	-
71	Communication	92	115.2*	-	-
60	Banking, Insurance and Real Estate	865	3895.5*	-	-
80	Other Services	5294	11169.4	9360.5	.838

*Added to the value of other services.

Table 3: RESULTS USING FINAL DEMAND VECTOR C

(In million pesos, where applicable)

ISIC	Description	Final Demand C (1968, hypothetical)	Total Demand		NEC/BCS
			BCS	NEC	
00	Agriculture	8472	9033.1	10566.2	1.169
10	Mining	480	553.0	1307.4	2.364
20	Food	1166	1798.0	1629.3	.906
21	Beverages	434	461.2	439.2	.952
22	Tobacco	208	214.4	209.3	.976
23	Manufactures of Textiles	206	354.0	690.3	1.950
24	Footwear	317	358.4	330.9	.839
25	Products of Wood	209	341.9	457.8	1.338
26	Furniture	68	71.0	77.0	1.084
27	Paper	104	224.2	886.7	3.954
28	Printing	155	157.9	503.0	3.185
29	Leather products	13	34.1	58.2	1.706
30	Rubber products	149	179.6	519.5	2.602
31	Chemical products	501	862.7	1596.1	1.850
32	Petroleum and coal	161	419.4	1790.4	4.268
33	Non-metallic mineral	210	296.5	677.7	2.285
34	Basic metal	170	245.8	1177.7	4.791
35	Metal products	146	160.7	463.0	2.881
36	Machinery	47	62.8	139.7	2.224
37	Electrical Machinery	168	189.8	309.1	1.628
38	Transport equipment	134	146.0	319.4	2.187
39	Miscellaneous	43	75.8	183.3	2.418
79	Construction	969	1236.4	981.4	.793
42	Wholesale and Retail	2833	4058.4	4814.2	1.186
41	Electricity	173	341.6	885.5	2.592
70	Transport Services	783	1028.9*	-	-
71	Communication	106	134.5*	-	-
60	Banking, Insurance and Real Estate	1173	4834.2*	-	-
80	Other Services	6353	13531.8	11240.9	.830

*Added to the value of other services.

Table 4. RESULTS USING FINAL DEMAND VECTOR D

(In million pesos, where applicable)

ISIC	Description	Final Demand D (BCS, 1961)	Total Demand		NEC/BCS
			BCS	NEC	
00	Agriculture	3274	3940.4	6047.3	1.534
10	Mining	167	228.0	687.4	3.014
20	Food	3380	3822.3	3887.7	1.017
21	Beverages	230	235.3	232.8	.989
22	Tobacco	474	476.1	474.7	.997
23	Manufactures of Textiles	399	535.2	749.4	1.400
24	Footwear	199	217.2	209.7	.965
25	Products of Wood	262	370.5	445.2	1.201
26	Furniture	128	131.3	132.6	1.009
27	Paper	81	200.3	694.3	3.466
28	Printing	143	146.2	326.1	2.23
29	Leather Products	26	40.3	54.3	1.347
30	Rubber Products	123	162.2	342.2	2.109
31	Chemical Products	479	723.6	1265.7	1.749
32	Petroleum and Coal	205	457.1	1174.5	2.569
33	Non-metallic mineral	156	217.6	423.4	1.945
34	Basic metal	150	211.6	827.2	3.909
35	Metal products	165	179.2	333.2	1.859
36	Machinery	203	211.2	269.3	1.275
37	Electrical Machinery	120	139.4	229.5	1.646
38	Transport Equipment	173	185.3	296.2	1.598
39	Miscellaneous	85	120.6	213.1	1.766
79	Construction	399	526.4	405.8	.770
42	Wholesale and Retail	1210	2339.5	2805.6	1.199
41	Electricity	167	302.1	602.5	1.994
70	Transport Services	1843	2024.1*	-	-
71	Communication	19	40.7*	-	-
60	Banking, Insurance and Real Estate	1361	3447.5*	-	-
80	Other Services	735	1425.2	5694.8	3.995

*Added to the value of other services.

These results show stark contrasts in the structural implications of both tables, irrespective of the final demand vector used. The solution vectors for total production ($\underline{X}$) show this, especially when the ratios of each total production vector elements are computed.

For convenience, we may assume two criteria of equality of the estimates:

(a) weak (or liberal) criterion:

$$0.80 \leq x_{Ni}/x_{Bi} \leq 1.25$$

(b) strong (or restrictive) criterion:

$$0.9 \leq x_{Ni}/x_{Bi} \leq 1.10$$

are two ranges of values[7] in which

$$x_{Ni}/x_{Bi} \approx 1$$

that is, the implied total production elements from both BCS and NEC tables are approximately equal. Since estimating procedures for the original input-output transaction matrix are obviously not error-free, this assumption of a possible disparity of actual results from the two input-output tables is only a reasonable

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[7]Note that the inverse value of the ratio (x_{Ni}/x_{Bi}) is $(x_{Ni}/x_{Bi})^{-1} = x_{Bi}/x_{ni} = 0.80^{-1} = 1.25$.

thing to undertake. However, it must be pointed out that the assumption of a difference corresponding to plus or minus 25 per cent is a very generous one, and that it should be taken in this light.

After making these remarks, we are now able to assert more meaningful statements about the structural similarities (dissimilarities) of the two tables. Of the 26 sectors[8] that we compare directly, it is to be noted that only about 8 sectors may be classified as nearly structurally equal, using the weak criterion of equality. These are:

agriculture
food
beverages
tobacco
footwear
construction
wholesale
other services.

Of these, only three or four sectors -- tobacco, beverages, footwear and, perhaps, food -- satisfy the strong criterion.

The range of the values of the ratios x_{Mi}/x_{Bi} for all different specifications of final demand is quite wide, from 4.89 for basic metal to 0.78 for construction.

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[8]The reader should remember that the intermediate demand of the service sectors of the BCS tables were all added up and compared with the "other service" sector intermediate demand solution of the NEC table.

On the other hand, there is a wide range of differences in the estimates for the manufacturing sectors. The disparity depended of course on the particular specifications concerning final demand, viz., on the effects of varying final demands on the levels of intermediate demand. But the disparities are so wide as to be disturbing.

For instance, in at least eleven sectors, the disparity of required total production computed from the NEC input-output table is more than twice that computed for the BCS input-output table. These sectors are:

paper
printing
rubber products
chemical products
petroleum products
non-metallic mineral products
basic metal products
metal products
transport equipment
miscellaneous
electricity

In three of the above sectors -- petroleum, basic metal, and paper -- the difference has been most significant. In some results, the NEC table yielded total production estimates four times those generated by the BCS table.

All the above differences are so wide that we can only express alarm that the two tables seem to be describing two different economies, or one economy at different time periods.

Yet, as we have stated at the very beginning, the two input-output tables define the same economy at the same time -- 1961. (In Table 5, the ratios x_{Ni}/x_{Bi} for the four different vectors of final demand are summarized all together. Moreover, we add Table 6, which shows the ratios of final demand to total production corresponding to each final demand vector assumption.)

(c) Brief Summary

The results above may be further summarized by aggregating the 19 manufacturing sectors into a single sector. Using the input-output tables of 29 and 26 sector dimensions, we compared the total final demand and the resulting total production solutions and derived exactly the same ratios.

All the results are shown in Table 7.

In three of the final demand vectors, the total production requirements for mining are very different, with the results using the NEC input-output table exceeding the requirements projected from the BCS table in the range of from 2.3 to 3.3 times as much.

The total production requirements for manufacturing are also high for the NEC compared to the BCS, as we would expect from the previous discussion. But construction and services production requirements are very high for the BCS and, in all

Table 5. RATIOS OF REQUIRED TOTAL PRODUCTION, NEC TO BCS (x_{Ni}/x_{Bi})

ISIC	Description	Final Demand Vector Assumed			
		A	B	C	D
00	Agriculture	1.188	1.169	1.169	1.534
10	Mining	1.116	2.558	2.364	3.014
20	Food	.928	.918	.906	1.017
21	Beverages	.931	.947	.952	.989
22	Tobacco	.975	.976	.976	.997
23	Manufactures of Textiles	1.894	1.957	1.950	1.400
24	Footwear	.926	.923	.839	.965
25	Products of Wood	1.379	1.346	1.338	1.201
26	Furniture	1.077	1.081	1.084	1.009
27	Paper	3.968	3.997	3.954	3.466
28	Printing	3.138	3.188	3.185	2.23
29	Leather Products	1.580	1.702	1.706	1.347
30	Rubber Products	2.760	2.881	2.602	2.109
31	Chemical Products	2.058	1.893	1.850	1.749
32	Petroleum and Coal	3.597	4.221	4.268	2.569
33	Non-Metallic Mineral	2.698	2.387	2.285	1.945
34	Basic Metal	4.894	4.801	4.791	3.909
35	Metal Products	2.881	2.873	2.881	1.859
36	Machinery	1.684	2.060	2.224	1.275
37	Electrical Machinery	1.744	1.650	1.624	1.646
38	Transport Equipment	2.065	2.181	2.187	1.598
39	Miscellaneous	1.988	2.352	2.418	1.766
79	Construction	.788	.797	.793	.770
42	Wholesale and Retail	1.137	1.182	1.186	1.199
41	Electricity	2.534	2.634	2.592	1.994
70	Transport Services				
71	Communication				
60	Banking, Insurance and Real Estate	.840	.834	.830	3.995
80	Other Services				

Table 6. RATIOS OF FINAL DEMAND TO TOTAL PRODUCTION
(In Per Cent)

ISIC	Description	Final Demand Vector A		Final Demand Vector B		Final Demand Vector C		Final Demand Vector D	
		Total Production		Total Production		Total Production		Total Production	
		BCS	NEC	BCS	NEC	BCS	NEC	BCS	NEC
00	Agriculture	93.4	78.6	93.8	80.2	93.8	80.2	83.1	54.1
10	Mining	78.7	24.6	85.2	33.3	86.8	36.7	73.2	24.3
20	Food	70.5	75.9	65.0	71.8	64.9	71.6	88.4	86.9
21	Beverages	91.5	98.3	93.6	98.7	94.1	98.8	97.8	98.8
22	Tobacco	96.3	99.3	97.0	99.4	97.0	99.4	99.6	99.9
23	Manufactures of Textiles	56.5	29.9	57.9	29.6	58.1	29.8	74.6	53.2
24	Footwear	89.4	96.5	88.5	95.8	88.5	95.8	91.6	94.9
25	Products of Wood	62.3	45.2	61.7	45.8	61.1	45.7	70.7	58.9
26	Furniture	96.2	89.3	96.0	88.7	95.8	88.3	97.5	96.6
27	Paper	46.9	11.8	46.1	11.5	46.4	11.7	40.4	11.7
28	Printing	98.2	31.3	98.2	30.8	98.2	30.8	97.8	43.9
29	Leather products	42.8	27.1	38.5	22.6	38.2	22.3	64.5	47.9
30	Rubber products	82.0	29.7	82.7	28.7	83.0	28.7	75.9	36.0
31	Chemical products	51.7	25.0	56.5	29.8	58.1	31.4	66.2	37.8
32	Petroleum and coal	53.9	15.0	40.8	9.6	38.4	9.0	44.9	17.5
33	Non-metallic mineral	66.6	24.7	69.9	29.3	70.8	31.0	71.7	36.8
34	Basic metal	69.5	14.2	69.4	14.5	69.2	14.4	70.9	18.1
35	Metal products	90.5	31.4	90.9	31.6	90.9	31.5	92.1	49.5
36	Machinery	86.9	51.5	78.5	38.1	74.9	33.6	96.1	75.4
37	Electrical machinery	87.3	50.1	88.3	53.5	88.5	54.4	86.1	52.5
38	Transport equipment	92.1	44.6	91.7	42.0	91.8	42.0	93.4	58.4
39	Miscellaneous	71.2	35.7	59.3	25.2	56.7	23.5	70.5	39.9
79	Construction	77.8	98.7	78.4	98.7	78.4	98.7	75.8	98.3
42	Wholesale and retail	72.6	61.5	70.9	56.0	69.8	58.9	51.7	43.1
41	Electricity	53.9	21.3	50.8	19.3	50.7	19.5	55.3	27.7
70	Transport services	77.7	-	77.0	-	76.1	-	91.1	-
71	Communication	81.3	-	79.9	-	78.8	-	46.7	-
60	Banking, Insurance and Real Estate	17.3	-	22.2	-	24.3	-	39.5	-
80	Other Services	84.8	73.9	84.4	74.1	84.3	74.0	51.6	69.5

Table 7. SUMMARY OF RESULTS, AGGREGATED FURTHER, BY SECTORS USING DIFFERENT VECTOR ELEMENTS

ISIC	Description	Final Demand Vector (Million Pesos)	Total Production (Million Pesos)		Final Demand Vector/Total Production		NEC/BCS
			BCS	NEC	BCS (%)	NEC (%)	(%)
A.	Final Demand Vector A						
00	Agriculture	3,916	4,192.6	4,984.1	93.4	78.6	118.8
10	Mining	137	174.2	557.9	78.7	24.6	111.6
20-39	Manufacturing (19 sectors)	2,349	3,312.3	6,131.7	70.0	38.0	185.0
79	Construction	446	573.1	452.0	77.8	98.7	78.8
42-80	Services	5,601	11,396.8	8,331.5	49.0	67.0	73.0
00-80	All Sectors	12,449	19,649.0	20,457.2	63.3	60.8	104.1
B.	Final Demand Vector B						
00	Agriculture	7,048	7,513.2	8,784.1	93.8	80.2	116.9
10	Mining	346	406.2	1,039.2	85.2	33.3	255.
20-39	Manufacturing (19 sectors)	3,773	5,453.6	10,283.2	67.0	36.0	188.
79	Construction	805	1,026.3	815.3	78.4	98.7	79.
42-80	Services	9,536	19,816.2	14,207.3	48.0	67.0	71.
00-80	All Sectors	21,508	34,215.5	35,129.1	62.8	61.2	102.
C.	Final Demand Vector C						
00	Agriculture	8,472	9,033.1	10,566.2	93.8	80.2	116.
10	Mining	480	553.0	1,307.4	86.8	36.7	236.
20-39	Manufacturing (19 sectors)	4,609	6,654.2	12,457.6	69.0	36.0	187.
79	Construction	969	1,236.4	981.4	78.4	98.7	79.
42-80	Services	11,421	23,929.4	16,940.6	47.0	67.0	70.
00-80	All Sectors	25,951	41,406.1	42,253.2	62.6	61.4	102.
D.	Final Demand Vector D						
00	Agriculture	3,274	3,940.4	6,047.3	83.0	54.1	153.
10	Mining	167	228.0	687.4	73.2	24.2	301.
20-39	Manufacturing (19 sectors)	7,181	8,782.4	12,580.1	81.7	57.0	143.
79	Construction	399	526.4	405.8	75.7	98.3	77.
42-80	Services	5,335	9,579.0	9,102.9	55.6	58.6	95.
00-80	All Sectors	16,356	23,056.2	28,823.5	70.9	56.7	125.

cases, they fall below the liberal range we have used as a criterion of "equality" of the results.

We have to note that in the case of manufacturing the total production requirements are higher in the NEC input-output table, but (as found in earlier explanation) these requirements fall within the liberal criterion of equality of results of the solutions. If we use a more strict criterion of 10 per cent range, even the results for the agricultural sector will be judged differently.

(d) Analysis of Forward and Backward Linkages; Value Added Ratios

The above results are best understood by analyzing the nature of the forward and backward linkages of the two sectors. These measurements are very straightforward.

Earlier, we have defined $(1-d_i)$ {in equation (5)} as forward linkage measures, that is, replacing i_i for f_i (to indicate "forward"),

$$f_i = (1-d_i) = \sum_j a_{ij}x_j/x_i \qquad (i = 1,\ldots, n),$$

where $\sum_j a_{ij}x_i$ = total intermediate demand for sector $\underline{i}$ and x_i = total final demand for $\underline{i}$ (the required total production).

As some ratio of total production of the sector, backward linkage, or the total purchases of a sector from differ-

ent sectors, may be similarly estimated by examining the ratio

$$b_j = \sum_i a_{ji} x_i / x_j \qquad (j = 1, \ldots, n)$$

where b_j is the backward linkage ratio for sector j, $\sum_i a_{ji} x_i$ is the total purchases of sector j from all sectors, and x_j the total production required for j.[9]

These linkage ratios are shown in Table 8. For easier comparison, the ratios of the NEC to the BCS linkage ratios were made. It is now obvious from the ratios that the structural appearances of the two input-output tables should be very different; and this is derived from the economic implications of such ratios.

The forward linkage ratios differ even more. The NEC figures are larger in most cases. In the case of printing, the largest difference exists. In seven of the sectors, there is a great difference in the ratios, with the BCS forward linkage about four times greater in the case of beverages and five times greater in the case of footwear.

In the backward ratios, the BCS ratios are larger in a majority of cases compared to the NEC ratios. However, in

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[9]Those who are not familiar with this may find profitable the following references: Chenery and Watanabe (1956); Chenery & Clark (1960), which summarizes the first cited paper, too, in chapter 8; and Hirschman (1958). In the traditional discussion, $1-d_i$ is symbolized as $w_i = W_i/Z_i$, where W_i is total interindustry demand and Z_i is total demand; b_j is equivalent to $u_j = U_j/X_j$ where U_j = total interindustry purchases; X_j = total production of sector j.