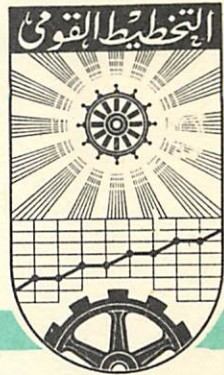# ARAB REPUBLIC OF EGYPT

THE INSTITUTE OF NATIONAL PLANNING

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A Social Accounting Matrix For
Egypt

by

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1. Introduction:

This paper relied heavily on the ruslts of a larger research work on Multisector General Equilibrium Models for Egypt, which has been a phase of the project on Improved Methods of Macro economic and Sectoral Planning. The project was started in 1977 as part of the Cairo University /MIT technological Planning program. The auther of the present monograph is a member of the project team. The results of the research undertaken have not been published elsewhere. Only a draft has been made available for purposes of comments and discussion. The leaders of the project are Professor R.S.Eckaus of MIT, and Professor Amr Mbhie Eldin of Cairo University. Neither of them nor any of the project team members bears any responsibility for the form of the present paper.

The present paper is devoted to sketching how a social accounting matrix (SAM) can provide a useful vehicle for organizing the data. This helps in designing an analytical scheme that can fit the available data, and give policy-relevant information. Thus, a general equilibrium model (GEM) has been built around the SAM. The requisites lead us to set up the data for the SAM around the Leontief type of an input-output table. Section 2 outlines the operations that were carried out to update an I/O table for 1976 SAM. Section 3 then describes the structure of the SAM for Egypt, and section 4 introduces the logic of constructing GEM using the SAM.

Yet, the GEM models and the data which they embody, represent a major potential advance for economic policymaking for Egypt. Some of the data have never before been estimated for Egypt and all of it has never before been organized in a consistent Social Accounting Matrix. Nor has an explicit model structure of this type ever been constructed for Egypt and solutions computed. However, further improvement and expansion of this work is quite persistent and fruitful.

2. Updating The Input-Output Table for 1976:

The 12x12 Input-Output table for 1976 was based on the 1970/71 27x27 Input-Output table. It represents an aggregation of the latter table and then was transformed to fit 1976 final demand vector. The 1970/71 Input-Output table was constructed according to the rows method and not by columns. This methodology was adopted because estimatation of the I/O table depends on the data available from estimates of commodity balances of physical production.

In order to make the 27x27 1970/71 Input-Output consistent with the 12 sector social accounting matrix and the model used, three operations were carried out.

    1. The restructuring of the 1970/71 Input-Output table to transform it into a 12x12 table.

This needed disaggregation of certain sectors and the aggregation of others to fit the new sectoral classification. It was also

necessary to take into account types of production activities which had been created after 1970/71, such as the new steel complex, the aluminum complex and the reopening of the Suez Canal.

2. The transformation of values of the flows in 1970/71 table to 1976 prices by using index numbers of production.

The rows were multiplied by index number of prices and the columns by index number of quantities and the consistency of the results were checked.

3. Adjustment of the new 12x12 table at 1976 prices to be consistent with 1976 final demand vector as obtained from actual national income accounts. This was carried out through the R.A.S. method.

3. Structure of the Social Accounting Matrix

The structure of the matrix that we used is set out schematically at the end of this note. It is composed of 40 rows and 40 columns. In the north western block of the matrix (Block No. I) is the interindustry matrix, composed of twelve sectors which represent an aggregation of the original 27X27 input-output table. These twelve sectors are:

1. Staple food.

2. Non-staple food.

3. Cotton

4. Other agriculture

5. Food processing industries

6. Textile industries

7. Other industries

8. Construction

9. Crude oil & products

10. Transport & Communication

11. Housing services

12. Other services

The final private consumption demands in block two (columns 15-20 and 21) are assumed to come from six socioeconomic classes. There are three income classes distinguished for urban and rural consumers separately with income recipients divided among the lowest 60%, the middle 30%, and the top 10%, of the household distribution in each case. However it should be noted that "rural" in this distinction of income classes means just the agricultural population and agricultural incomes. The final demands of the government sector were subdivided into three categories (columns 22 to 24): the public sector, conventional government, and the government trading sector. These categories made it possible to distinguish quite different types of activities. The special emphasis on

government trading sector is justified because through that sector the activities of the general supply authority are carried out by means of which basic consumer necessities are provided to the household sector in the ration shops (consumer cooperative and where subsidies are incurred..

The final demands also include exports (column 25,26, & 27), which cover the government trade exports, a price differential realized on government trade exports and other exports. The next component of final demand is capital formation or final investment demands(columns 24 to 38) which is divided into private investment, the investment corresponding to the three sectors of the government and foreign investment. However, in the present matrix, due to the unavailability of the necessary data, all investments are aggregated into a single category of total investment (column 40).

The last final demand vector is inventory investment or the change in stocks (DTS) in column 30.

Columns from 28 to 33 represent import tariffs, indirect taxes, direct taxes, and transfers. There are four rows that correspond to these columns. The final column, 40, is gross production of the sectors concerned.

After the rows for each of the first twelve producing sectors, row 13 of Block I, the inter-industry flow matrix, represents the total inputs into the 12 sectors.

Row 14 represents gross value added of the twelve sectors concerned. It is disaggregated in rows 21 and 22. Row 21, though "household value added", actually represents the gross income of the household sector. Thus, this row includes both value added in the private sector and wages generated in the government and the public sectors. Row 22 then represents just the surplus of public sector enterprise. Part of it is retained by the public sector, the other is transferred to the government. However, we treat it as one unit in row 22 which corresponds to column 22 of the SAM.

Corresponding to the columns 15 to 20 which represent household consumption of the six socioeconomic classes, rows 15 to 21 represent, the gross income of the households from each sector distributed among the six socioeconomic groups. Added to that in row 22 under column 26 there are remittances of Egyptians abroad which are treated here as a household export. This is also distributed among the five income classes and added to the gross income which appears in column 41 corresponding to rows 15 to 2 .

Rows 23 and 24 represent the two rows corresponding to columns 23 and 24. Row 23 is conventional government revenue derived from import tariffs, indirect taxes, direct taxes and other revenues. The

government trade row, 24, represents revenue from sales of intermediate goods by the government to producing sectors and sales directly to the household sector, box 24, 21, which is again distributed among the six socioeconomic classes. Row 24 also includes government direct sales abroad, i.e., government exports.

Row 23 and column 23 must balance and the balancing item is government deficit which appears in the box in row 36 column 23. An analogous balancing must occur with government trade purchases in column 24 and government trade sales in row 24: the balancing item in this case is government trade deficit, in the box in column 37 and row 24.

Row 27, represents total imports which are subdivided into rows 25 and 26. Row 25 represents government trade imports which are imports directly by the government. Imports in this row corresponding to columns 1 to,12 represent intermediate imports for the twelve sectors. They are treated here as non-competitive imports, i.e., as if none of them are producible domestically and so are not competitive with domestic production. There is also government trade imports directly to the household sector in row 24, column 21 which is again divided among the six income classes.

The second type of imports in row 26 are "other imports". These include: first, both public sector and household imports - imports in the row corresponding to columns 1 to 12 represent intermediate goods; second, direct imports to the household sector in the box in row 26,

column 21, which is again divided among the six income classes as part of their expenditure. Rows 28 to 32 represent types of government revenues. Thus, row 28 shows import tariffs paid by each of the twelve production sectors and tariffs paid by the household sector on its own imports. Row 29 contains indirect taxes considered as part of government revenues. These are also divided among the 12 production sectors. Column 21 in row 29 shows indirect taxes paid by the household sector on its own expenditure. This also has been divided among the six income classes.

Row 30 contains government subsidies. These go either to the production sectors which appear in the row corresponding to columns 1 to 12[x], or are paid directly to household sector. These affect the prices of the commodities sold directly to the household. The effect appears in row 30, column 21. This last item is again divided among the six socioeconomic classes in row 30, columns 15 to 20.

Row 31 represents government transfers considered from the revenue side and not the expenditure side. This includes the net contribution by households to the social security and pension funds in row 31, column 21. This item is again divided among the six income classes in row 31, columns 15 to 20. Row 32 represents direct taxes as revenue to the government. These include: Direct taxes paid by the production sectors 1 to 12, as, for example, the corporate tax; and direct taxes paid directly by the household sector, like wage tax, land tax etc.

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[x] For example, subsidies for the first four sectors are subsidies on fertilizers and pesticides, in sector five subsidies are on wheat flour and other items, etc.

The latter appears in line 32 column 21. The last item is again divided among the six income classes, corresponding to columns from 15 to 29 in row 32.

Row 34 shows private savings which appear as figure corresponding to that row under column 21. This is divided among the six income classes. It appears as a balancing item between household income and household expenditure. Thus, the totals of rows 15 to 20 which represent the income accruing to the six income classes must balance with the totals of columns 15 to 20 which represent their expenditure. The balancing item is private savings whether positive or negative.

Row 35 represents government & public sector savings which is the surplus realized in government and public sector enterprises. Row 36 shows the deficit of conventional government which is the balancing item between conventional government revenue, and conventional government revenue, and conventional government. Row 37 shows government trade deficit which is again the balancing item between sales and purchases. Row 38 shows foreign savings which represent the balancing item between total exports in column 27, and total imports, row 27.

Line 39 shows total savings which balances with the sum of column 40 of total investment. Total savings equals private savings plus government and public sector savings minus government conventional deficit minus government trade deficit plus foreign finance.

Row 41 shows gross production which corresponds to column 41 for the 12 sectors. Data in row 41, from columns 1-12, could be arrived at in this way. Gross production equals total inputs plus value added plus imports plus import tariffs plus indirect taxes minus subsidies.

4. Structure of the Planning Model and Policy Options:

Given the data layout in the SAM, it is straight-forward to
construct a general equilibrium model around them. Table 1 gives the
equations, with variables and parameter names explained in tables 2-3.

The model in its various versions is a simplified multisector,
static, general equilibrium model (GEM). In the different versions
it achieves macroeconomic consistency, identifies descrepancies in
resource demands and availabilities as well, and also adjusts resource
prices and uses to resource availabilities. The GEM is useful for simple
macroeconomic effective demand analysis and for the study of the macro-
economic and some limited microeconomic effects of expenditure, export
and import and tax and subsidy policies affecting prices and factor re-
turns and distributional issues.

The GEMS are not well suited, however, for the exploration of
the growth implications of alternative resource allocations and invest-
ment policies, for which additional models will be developed.

The devising of the alternative policies to be tested and the
comparison and analysis of the resulting solutions is as essential a
part of the use of the models as the calculations which are called for
by the formal structure of the model. The Egyptian economy is widely
regarded as characterized by a variety of goods and factor price dis-
tortions created by market imperfections and government interventions

SOCIAL ACCOUNTING MATRIX FOR EGYPT

RECEIVING SECTORS \ PAYING SECTORS	1. STAPLE FOOD	2. non-STAPLE FOOD	3. COTTON	4. Other Agriculture	5. Food Processing ind.	6. Textile Industry	7. Other industries	8. Construction	9. Crude oil & Products	10. Transport & Comm.	11. Housing	12. Other Services	13. Total Inputs Σ1-12	14. FINAL DEMAND	15. Urb Low Inc 67%	16. Urb Midle 30%	17. Urb Top 10%	18. Rur Low 65%	19. Rur Mille 30%
1. Staple Food	466722	—	—	—	179.6283	—	—	—	—	1.3611	—	1018230	238	217	22.0	13.5	5.3	22.6	7.1
2. non-staple Food	167513	37.25629	0.47093	5.91269	35072.48	4.05422	238918	—	—	10.61618	—	17.64671	416	852	177.6	156.6	110.7	114.0	65.8
3. Cotton	—	—	249303	—	153937	73.09583	220489	—	—	—	—	—	75	160	1.6	0.3	0.4	1.6	0.6
4. Other Agriculture	545914	132.05090	9.92137	2.13755	5.95715	37.46799	186421	—	—	0.61798	—	8.27845	392	72	143	164	11.8	7.2	4.3
5. Food Processing ind.	—	39.81283	—	—	100.30160	3.77228	161876	—	—	2.17585	0.00846	93.21643	290	1232	324.5	275.1	140.4	234.6	100.6
6. Textile Industry	1.85642	0.05167	3.29833	0.02107	1.41447	510.59285	1.3099	1.11537	0.22504	0.26195	0.01569	53.05055	373	512	73.9	97.2	55.1	33.2	30.7
7. Other industries	2.35269	0.16335	2.9491	0.21883	1.54634	13.57468	84.4093	11.2837	9.00784	8.51700	0.16177	70.89046	292	1100	95.6	97.1	60.3	45.1	23.3
8. Construction	—	1.17015	0.13579	—	0.57014	1.77530	0.9940	0.57402	2.42426	9.24610	566571	144585	37	599	—	—	—	—	—
9. Crude oil & Products	12.77104	50.59453	3.91502	2.00618	3.91795	12.06315	11.05788	386.550	132.0586	35.3659	—	80.81433	355	254	21.9	18.4	9.4	11.5	4.7
10. Transport & Comm.	0.20957	0.40542	0.21584	0.03967	0.54438	2.08350	0.68208	2.16599	0.24176	2.10863	8.00697	3184770	40	537	30.0	45.4	170.8	7.8	6.3
11. Housing	0.03104	0.01099	0.0114	0.00192	1.00936	0.65231	0.48390	0.73597	0.47105	0.35143	—	631525	10	152	16.7	37.4	55.3	4.4	3.9
12. Other Services	8.90142	1.47459	7.31460	0.63209	91.94595	55.86751	415930	325.3451	12.75550	26.38226	2.14439	4713434	968	2150	209.3	223.2	152.7	78.1	63.1
13. Total Inputs Σ1-12	130	408	29	11	719	487	201	382	157	87	8	867	3486	7817	977.1	1014.6	772.2	565.4	311.9
14. VALUE ADDED Σ15-40	317	806	202	438	166	330	503	256	324	456	134	2069	6061						
15. Urb. Low Inc 67%	2.0	0.0	0.0	0.0	40.566	91.863	66793	36.260	0.923	52.356	34.076	631.467							
16. Urb. Middle 30%	0.0	0.0	0.0	0.0	45.177	83.520	67.166	35473	23.425	64.263	45.122	646.961							
17. Urb. Top 10%	0.0	0.0	0.0	0.0	64.255	72.637	73.165	95.261	45.618	79.331	50.551	653547							
18. Rur. Low 65%	35.440	265.710	79.312	152.231	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
19. Rur. Middle 30%	37.227	295.555	58.553	125.271	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
20. Rur. Top 10%	7.554	265.541	53.177	127.415	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1962	4923						
21. House owners Σ15-22	2.2	755	202	438	159	277	276	170	75	193	125	87	1118						
22. Gov. Direct Σ23-24	15	51	—	—	16	53	195	86	249	261	9								
23. Gov. Consumption												25	25		20.2	15.2	7.6	19.7	11.4
24. Gov. Trade				25								96	552		50.7	45.2	31.7	47.1	29.5
25. Gov. Trade Imports	12	37	10	8	398				66	51			656		15.5	30.4	57.3	11.5	19.5
26. Other Imports	7	22	6	15	9	67	635		66	51		96	1208						
27. TOTAL IMPORTS	19	59	16	23	425	67	635		66	51		96	326						
28. Imp. TARIFFs	1	5			166	12	100		62			20	340		37.9	37.2	31.1	173	15.0
29. IND. TAXES					205	65	35		15			-12	-346		-63.8	-48.4	-23.6	-12.9	-7.8
30. Subsidies (-)	-12	-10	-10	-8	-182	-86	-3		-8	-15					98.7	94.3	123.0	—	
31. Gov. Transfers									13			100	223		6.2	33.7	70.7	3.7	15.1
32. Dir. TAXES					25	30	55												
33. Σ28-30															-96.8	-78.2	202.5	67.9	173.1
34. Priv. Savings																			
35. Corp. Ptd. Savings																			
36. Gov. Cons. Deficit																			
37. Gov. Trade Deficit																			
38. Foreign Finance																			
39. Changes in Stocks																			
40. TOTAL SAVINGS															1043	1126	1305	721	537
41. GROSS PROD.	455	1268	235	466	1522	885	1392	636	609	577	162	3118	7303		12773	6319	2.133	10131	556
Population (m)															0.3002	0.3241	0.3757	0.4077	0.30
Income Shares																			
Population Shares															81.497	115.965	611.914	71.112	155
Per Capita Income															260.77	563.10	1957.30	227.56	337
Income Per Earner																			

22	23. Gov. Consumed	24. Gov. Trade	25. Price Diff.	26. Exports	27. Total Exports	28. Import Ind. Tarr. Taxes	29.	30. Subsidies	31. Gov. Dir Trans. Taxes	32.	33. Σ	34. Priv Invs.	35. Gov+ Pub Invs.	36. Inv. Gov. Invs.	37. Gov. Trade Invs.	38. Foreign Invs.	39. ΔS	40. Total Invs.	41. ΣΣ Gross Production	#
14	95	17		17	17											16		16	455	1
60	28	4		49	53													1	1268	2
	100	55			55														235	3
				16	16														664	4
50				26	26											10		10	1522	5
27				109	109									3		46		49	885	6
268				89	89										360	40		400	1392	7
															599			599	636	8
35		100		49	149											1		1	609	9
100				172	172														577	10
4																			142	11
1013	42			171	171									122				122	3118	12
1571	265	176		681	857									1085			113	1198	11303	13
					310				296										6647	14
				65.1															1043	15
				81.4															1126	16
				93.0															1305	17
				25.42															721	18
				20.46															535	19
				18.12															503	20
				510	310														5233	21
									296										1414	22
						477	469		378										1324	23
	768			119	119		21												1012	24
																			768	25
														391				391	1172	26
																		391	1940	27
														91				91	477	28
																			490	29
																			—	30
	146	368																	296	31
																			578	32
																			—	33
																			594	34
																			1414	35
																			−378	36
	−393																		−389	37
		−389			654														654	38
																			—	39
−393	−389				654														1680	40
1324	1012	176		1110	1940	477	490	—	296	378				1567			113	1680		

f Desn... C

through taxes and subsidies and direct regulation. These distortions, in turn, are often thought to be major barriers to the efficient use of intermediate and final products and primary resources although, at the same time, the interventions may offset market distortions and help achieve distributive goals. In fact there is a high priority for analysis which can deal with this set of issues. This is the basic vertue of the SAM used. One of the distinguishing features of the SAM is a relatively detailed accounting of government taxes and subsidies, tarrifs and government trading activities etc. On the other hand, to a considerable extent the model structure follows from the accounting presented in the Social Accounting Matrix and consists largely of the identities in that matrix.

The effects of removing subsidies, increasing direct taxes and import tarrifs, and other policy alternatives on output and price levels, budget deficit, and balance of payments have been computed and analysed.

5. Summary:

Data preparation and organization has always been re-
cognized as a necessary prerequisite for development planning.
Both literature and practice point out that for planning purposes,
a social accounting matrix provides a useful vehicle for organiz-
ing the data.

Moreover, the structur of social accounting matrix (SAM)
can take a detailed account of all government activities, taxes,
subsdies, tarrifs and trading, which play a decisive role in determin-
ing output and price levels, and income distribution, etc. For the
first time in Egypt a social accounting matrix was constructed
for 1976. This necessitated updating the Input-Output table of
1970/71. Then, given the data layout in the SAM, it is straight-
forward to build a general equilibrium model (GEM) around them.
This model has been used to test the macroeconomic impacts of some
policy options (removing food subsidies, increasing taxes and tarrives,
etc).

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TABLE 1

EQUATIONS FOR THE EGYPTIAN GENERAL EQUILIBRIUM MODELS

Input-output relations

(1.1) $X_i \equiv \sum_{j=1}^{12} a_{ij} X_j + \sum_{k=1}^{6} QH_{ik} + QG1_i + QG2_i + QG3_i$

$\qquad + PD_i + E_i + INV_i + DST_i$ $\qquad\qquad$ i=1,...,12

Household consumption

(2.1) $\hat{S}_k = \sum_{i=1}^{12} \Theta_{ik} B_i$ $\qquad\qquad\qquad$ k=1,..., 6
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ i=1,...,12

(2.2) $QH_{ik} = \Theta_{ik} + \dfrac{\alpha_{ik}}{B_i} [S_k - \hat{S}_k]$ $\qquad\qquad$ k=1,..., 6
$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ i=1,...,12

Price determination

(3.1) $B_j = \sum_{i=1}^{12} a_{ij} B_i + HP_j + HG_j + a_{24j} B_j + a_{25j} BI_j$

$\qquad + a_{26j} BI_j + a_{28j} BI_j + a_{29j} B_j + a_{30j} B_j$

$\qquad + a_{32j} B_j$ $\qquad\qquad\qquad\qquad\qquad\qquad$ j=1,...,12

Determination of value added by sector

(4.1) $VHP_j = WAGE_j^{SPL_j} \, KAP_j^{SPK_j} \, RENT_j^{SPT_j}$ $\qquad\qquad$ j=1,...,12

(4.2) $SPL_j + SPK_j + SPT_j = 1$ $\qquad\qquad\qquad$ j=1,...,12

(4.3) $HP_j = CH_j \cdot VHP_j$ $\qquad\qquad\qquad\qquad$ j=1,...,12

(4.4) $HM_j = HP_j \cdot X_j$ $\qquad\qquad\qquad\qquad$ j=1,...,12

$$(4.5) \quad VHG_j = WAGEG_j^{SGL_j} \ KAPG_j^{SBK_j} \qquad j=1,\ldots,12$$

$$(4.6) \quad SGL_j + SBK_j = 1 \qquad j=1,\ldots,12$$

$$(4.7) \quad HG_j = CG_j \cdot VHG_j \qquad j=1,\ldots,12$$

$$(4.8) \quad GM_j = HG_j \cdot X_j \qquad j=1,\ldots,12$$

5. Income generation

$$(5.1) \quad YH_k = \sum_{j=1}^{12} HM_j \ [SPL_j \cdot SSPL_{jk} + SPK_j \cdot SSPK_{jk} + SPT_j \cdot SSPT_{jk}]$$

$$\sum_{j=1}^{12} GM_j \ [SGL_j \cdot SSGL_k] + RM \cdot SRM_k \qquad k=1,\ldots, 6$$

$$(5.2) \quad YD_k = [1-a_{30,k} - a_{31,k} - a_{32,k}] \ YH_k \qquad k=1,\ldots, 6$$

$$(5.3) \quad YET_k = [1-a_{34,k} \ YH_k/YD_k] \ YD_k \qquad k=1,\ldots, 6$$

$$(5.4) \quad YE_k = [1-(a_{24,k}^{BI} + a_{25,k}^{BI} + a_{29,k}) \ YH_k/YET_k] \ YET_k \qquad k=1,\ldots, 6$$

6. Government expenditure and revenue

(6.1) $\quad G1R = \sum\limits_{j=1}^{12} GM_j \cdot SGK_j + \sum\limits_{k=1}^{6} a_{31,k} YH_k$

(6.2) $\quad G2E = \sum\limits_{i=1}^{12} Z_{i23} B_i - 0.284 \left[\sum\limits_{j=1}^{12} a_{30,j} B_j X_j + \sum\limits_{k=1}^{6} a_{30k} YH_k \right]$

(6.3) $\quad G2R = \sum\limits_{j=1}^{12} a_{28,j} BI_j X_j + 0.324 \sum\limits_{k=1}^{6} QH_{26,k} BI_{26}$

$\qquad\qquad + 0.2327 \, Z_{26,40} BI_{26}$

$\qquad\qquad + 0.957 \left[\sum\limits_{j=1}^{12} a_{29j} B_j X_j + \sum\limits_{k=1}^{6} a_{29,k} YH_k \right]$

$\qquad\qquad + \sum\limits_{j=1}^{12} a_{32j} B_j X_j + \sum\limits_{k=1}^{6} a_{32k} YH_k$

(6.4) $\quad G3E = \sum\limits_{i=1}^{12} Z_{i24} B_i + \sum\limits_{j=1}^{12} a_{25j} BI_j X_j$

$\qquad\qquad + \sum\limits_{k=1}^{6} (a_{24k} + a_{25k}) \, YH_k$

$\qquad\qquad - 0.716 \left[\sum\limits_{j=1}^{12} a_{30j} B_j X_j + \sum\limits_{k=1}^{6} a_{30k} YH_k \right] + \sum\limits_{i=1}^{12} Z_{i,24'} \cdot B_i$

$$(6.5) \quad G3R = \sum_{j=1}^{12} a_{25j}BI_jX_j + \sum_{k=1}^{6} a_{25k}YH_k + \sum_{k=1}^{6} a_{24k}YH_k$$

$$+ a_{24,5}BI_5X_5 + \sum_{i=1}^{12} Z_{i,25}BE_i$$

$$+ 0.043 \left[\sum_{j=1}^{12} a_{29,j}B_jX_j + \sum_{k=1}^{6} a_{29k}YH_k \right] \sum_{i=1}^{12} Z_{i24'} \cdot BI$$

$$(6.6) \quad PD = - Z_{1,25}(BE_1 - B_1) - Z_{2,25}(BE_2 - B_2) - Z_{3,25}(BE_3 - B_3)$$

$$- Z_{9,25}(BE_9 - B_9)$$

7. Exports and imports

$$(7.1) \quad EXP = \sum_{i=1}^{12} Z_{i26}BE_i + RM \, BE_{21} + Z_{1,25}BE_1 + Z_{2,25} \, BE_2 + Z_{3,25} \, BE_3 + Z_{9,25}$$

$$(7.2) \quad IMP = \sum_{j=1}^{12} a_{25j}BI_jX_j + \sum_{k=1}^{6} a_{25k}YH_k$$

$$+ \sum_{j=1}^{12} a_{26j}BI_jX_j + 0.676 \sum_{k=1}^{6} QH_{26,k}BI_{26} + Z_{26,36}BI_{36}$$

8. Savings and investment

$$(8.1) \quad SP = \sum_{k=1}^{6} a_{34k}YH_k$$

$$(8.2) \quad SG1 \equiv G1R - G1E$$

$$(8.3) \quad SG2 \equiv G2R - G2E$$

$$(8.4) \quad SGE \equiv G3R - G3E$$

8. Savings and investment (continued)

(8.5) $SF \equiv IMP - EXP$

(8.6) $SSS \equiv SP + SG1 + SG2 + SG3 + SF$

(8.7) $INV = \sum_{i=1}^{12} INV_i B_i + Z_{26,36} BI_{36} (1.232)$

(8.8) $DST = \sum_{i=1}^{12} Z_{i,39} B_i$

(8.9) $INVT \equiv INV + DST$

(8.10) $SSS = INVT$

9. Resource demands

(9.1) $LP_i = SPL_i HM_i / WAGE_i$ $i=1,\ldots,12$

(9.2) $KP_i = SPK_i HM_i / KAP_i$ $i=1,\ldots,12$

(9.3) $TP_i = SPT_i HM_i / RENT_i$ $i=1,\ldots,12$

(9.4) $LG_i = SGL_i GM_i / WAGEG_i$ $i=1,\ldots,12$

(9.5) $KG_i = SGK_i GM_i / KAPG_i$ $i=1,\ldots,12$

10. Resource constraints

(10.1) $EEL_i = LP_i - BL_i$ $i=1,\ldots,12$

(10.2) $EEK_i = LK_i - BK_i$ $i=1,\ldots,12$

(10.3) $EET = \sum_{i=1}^{4} LT_i - \sum_{i=1}^{4} BT_i$

TABLE 2

Endogenous Variables

B_i = price of output of i-th sector

DST - value of inventory investment

EEK_i - excess demand for capital in i-th sector

EEL_i - excess demand for labor in i-th sector

EET_i - excess demand for land

G1R - revenues of public sector enterprise and net receipts from social security system

G2E - total expenditures of conventional government sector

G2R - total revenues of conventional government sector

G3E - total expenditures of government trading sector

G3R - total revenues of government trading sector

GM_j - factor cost of government value added in sector j

HG_j - factor cost of government value added per physical unit of output of sector j

HM_j - factor cost of private household value added in sector j

HP_j - factor cost of household value added per physical unit of output of sector j

INV - value of total fixed investment

INVT - value of total investment

KG_i - government demand for capital in i-th sector

KP_i - private demand for capital in i-th sector

LG_i - government demand for labor in i-th sector

LP_i - private demand for labor in i-th sector

QH_{ik} - consumption of i-th sector output by k-th income class

Endogenous Variables (continued)

S_k — total consumption expenditure by k-th income class = YE_k

$\hat{S}_k$ — value of subsistence consumption expenditure by k-th income class

SF — foreign savings

SG1 — savings of first government sector

SG2 — savings of second government sector

SG3 — savings of third government sector

SP — private savings

SSS — total savings

TP_i — private demand for land in i-th sector

VHG_j — factor cost of a unit of government value added

VHP_j — factor cost of a unit of private value added

YD_k — gross income of k-th income class adjusted for subsidies, transfers and taxes

YE_k — YET_k adjusted for purchases from government trade sector and its imports and indirect taxes

YET_k — YD_k minus private saving of k-th income class = S_k

YH_k — gross income of k-th income class

X_i — gross output of sector i

X_q — shadow prices on constraints

TABLE 3

Exogenous Variables and Parameters

a_{ij} — input-output coefficient in i-th row and j-th column

a_{mn} — all coefficients written in this form in these equations are exogenously specified ratios of the entry in n-th row and n-th column to the sum of the n-th column of the SAM matrix

α_{ik} — marginal expenditure on sector i goods by income class k

BE_i — export prices of output of i-th sector

BE_{21} — price of foreign exchange earned through remittances

BI_i — import prices of goods of type i

BK_i — supply of capital in i-th sector

BL_i — supply of labor in i-th sector

BT_i — supply of land in i-th sectors

CG_j — amount of government value added per unit of output of sector j

CH_j — amount of private value added accruing to households per unit of output of sector j

DST_i — deliveries of goods for inventory accumulation by the i-th sector

E_i — exports of the i-th sector

INV_i — deliveries of fixed investment goods by the i-th sector

$KAPG_j$ — returns to capital in government activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

KAP_j — returns to capital in private activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

PD_i — price differentials on exports imposed by the government trading sector

$QG1_i$ — exogenously specified use of i-th sector output by the first government sector which are the public enterprises

$QG2_i$ — exogenously specified use of i-th sector output by the second government sector, which is conventional government

$QG3_i$ — exogenously specified use of i-th sector output by the third government sector, which is government trading

Exogenous Variables and Parameters (continued)

$RENT_j$ — returns to land in private activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

RM — remittances by migrants

Θ_{ik} — quantity of the i-th sector goods consumed by cla-s k at subsistence income, $\hat{S}_k$

SGL_j — share of labor in government value-added in j-th sector

$WAGEG_j$ — returns to labor in government activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

SBK_j — share of capital in government value-added in j-th sector

SPL_j — share of labor in private value added in j-th sector

SPK_j — share of capital in private value-added in j-th sector

SPT_j — share of land in private value-added in j-th sector

SRM_k — share of k-th income class in remittances by migrants

$SSGL_j$ — share of k-th income class in value-added by labor in j-th government sector

$SSPL_{jk}$ — share of k-th income class in private value-added by labor in j-th sector

$SSPK_{jk}$ — share of k-th income class in private value-added by capital in j-th sector

$SSPT_{jk}$ — share of k-th income class in private value-added by land in j-th sector

$WAGE_j$ — wages in private activity in sector j, exogenously specified in GEM-1 and GEM-2 and endogenous in GEM-3

Z_{i23} — expenditure by conventional government sector in outputs of various producing sectors

Z_{i24} — government trade sector purchases for domestic use

$Z_{i24'}$ — government trade sector imports

Z_{i39} — deliveries by i-th producing sector for inventory accumulation

$Z_{26,36}$ — imports of investment goods