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Constructing a Social Accounting Matrix: Concepts and Use in Economic Policy Analysis

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تصميم مصفوفة حسابية اجتماعية: مبادئ واستعمالات في تحليل السياسات الاقتصادية

حسين بوغانمي و لقمان زعيبط وعمر الجابري وطالب الهنائي

خلاصة: تهدف هذه الورقة البحثية إلى تصميم "مصفوفة حسابية اجتماعية" وإبراز كيفية استعمالها لتحديد الآثار الكلية والقطاعية للتغييرات الخارجية والسياسات الاقتصادية مستعملين سلطنة عمان مثال لذلك. بدأنا أولا بتصميم مصفوفة كلية باعتماد الحسابات الوطنية للسلطنة التي تفيدنا في التحكم في مجا ميع المخطوطة المتعددة القطاعات والمؤسسات، ثم استعملنا المصفوفة لاستخراج "معامل المضاعفة" ومحاكاة آثار أربعة فرضيات سياسية وهي: ١) الزيادة في الصادرات الزراعية والتحويلة (فرضية التنويع الاقتصادي)، ٢) الزيادة في قيمة صادرات البترول، ٣) التخفيض من التحويلات الخارجية للوافدين، ٤) تحويلات مالية إلى العائلات الريفية (فرضية العدالة). أظهرت النتائج أن فرضية التنويع الاقتصادي لها اكبر مضاعف الإنتاج بينما كان لفرضية الزيادة في أسعار البترول اكبر الأثر على ميزانية الدولة وميزانية المدفوعات والادخار. أما فرضية التحكم في التحويلات المالية للأجانب فكان لها اكبر الأثر على دخل العائلات لكن معظم الزيادة في الدخل تحولت إلى العائلات القاطنة بالمدينة. واحتلت فرضية العدالة المرتبة الثانية من حيث الآثار على الدخل الفردي وخاصة دخل العائلات الريفية لكن آثارها على الدخل الوطني وميزانية المدفوعات كانت ضعيفة. عموما لم تكن نتائج هذه المحاكاة واضحة بصفة قاطعة. يجب على صانعي القرار عند معالجة مشاكل التنمية استعمال مجموعة من الآليات لتحقيق هدف معين.

ABSTRACT: The objective of this paper was to construct a social accounting matrix (SAM) and show how it can be used to determine the economy-wide and sectoral effects of external shocks and various policy options available using Oman as a model. We first constructed an aggregate SAM (macro SAM) based on the country's national accounts which provided the control totals for a multisectoral, multi-institutional SAM. Then, we used the SAM to derive the multiplier matrix coefficients and simulated the effects of four policy scenarios: 1) an increase in agricultural and manufacturing exports (diversification scenario), 2) an increase in oil export value, 3) a reduction in worker remittances, and 4) an income transfer to rural households (equity scenario). Results showed that the diversification scenario had the largest overall production multiplier, while the increase in oil export price scenario had the highest impact on government revenue, balance of trade and saving. The remittance control scenario had the highest impact on total household income but most of the income increase went to urban households. The equity scenario had the second largest increase on household income, mostly rural income, but the least effect on saving, and trade balance. The policy implications of these simulations are not clear-cut. In addressing development issues, policy makers would need to use a combination of policy instruments to achieve a specific objective.

Keywords: Social Accounting Matrix, Oman economy, multiplier, coefficient matrix.

Over the last two decades, Oman has recorded one of the highest growth rates in the middle Eastern region and in the world (Mansur, 1999). This growth has been accompanied by a structural transformation in which the role of agriculture measured in terms of its contribution to GDP declined from 70% in 1967 to 3% in year 2000. As in most rentier economies, however, the economic transformation has not been associated with the emergence of a strong industrial base but rather with a growing service sector triggered by a significant expansion of public spending (Beblaoui, 1987). This economic transformation is not in conformity with the structural transformation defined in the literature as a gradual sectoral shift over a long period of time from agriculture to manufacturing, then to services. Currently, the service sector makes up

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43% of GDP, that is six times as much as agriculture and manufacturing combined, while the oil and gas sector accounts for 49% of GDP.

Most of the economic growth achieved by Oman is explained by the changes in oil price and government expenditure (Martey, 1997). This pattern of growth is, however, highly vulnerable to external shocks, as the size of government revenue and the performance of the non-oil sector are closely linked to developments in the oil market. The analysis of such linkages requires the development of an economy-wide framework, which considers the interdependence among sectors but also is capable of identifying the policy options that best sustain economic growth and preserve the internal and external macro-balances of the country.

The objective of this paper was to construct a Social Accounting Matrix for Oman and show how it can be used to determine the economy-wide and sectoral effects of external shocks and various policy options available to the government. In particular, four policy scenarios are considered and their multiplier effects are traced out. This paper is part of a larger project to build a fully flexible, agricultural-focused general equilibrium model. General equilibrium models require the availability of input-output and a detailed socio-economic data set. The paper will be structured as follows: Section 1 presents the general framework of the social accounting matrix as a comprehensive and consistent tool to capture income flows in the economy. Section 2 describes an aggregate macro SAM based on the country's national accounts statistics. Section 3 provides a detailed description of the 2000 multisectoral SAM and the data set required to construct it. In section 4 we give a brief description of the main characteristics of Oman economy based on SAM. In sections 5 and 6, we derive the multiplier matrix, present the various policy scenarios and discuss the results. The paper ends with conclusions and policy implications.

THE SAM FRAMEWORK: A Social Accounting Matrix represents a snapshot of the socio-economic system of a particular country for a given year. It provides a complete and consistent data set of all economic transactions taking place within that socio-economic system. The SAM is a square matrix which extends the input-output framework to incorporate information about sectoral linkages, balance of payments transactions, government budget, and investment. Generally, the SAM comprises six accounts: activities, factors, commodities, institutions (households, firms and government), rest of the world (ROW) and investment (Table 1). Each account is represented by both a row and a column of a table, where the rows represent incomes or receipts and the columns represent expenditure or outlays, reflecting the various transactions among sectors and institutions. Total expenditure should be equal to total receipts and therefore the corresponding row and column accounts in a SAM must balance.

The SAM is a relatively new tool of economic analysis compared to its Leontief Input-Output counterpart. Its modern use as a conceptual framework for policy and planning purposes started with Pyatt and Thorbecke (1976). More recently SAMs were constructed and used to address many development issues such as poverty, income distribution and structural adjustments and other policy issues (Thorbecke, 1985; Bautista and Thomas, 1998; Bautista *et al.*, 2001; Decaluwé *et al.*, 1999).

The underlying logic of the Social Accounting Matrix approach is the multiplier process. Assuming that some accounts are exogenous (usually, the

TABLE 1

Macro SAM, Oman 1999 (Millions Omani Rials).

	1 Activities	2 Commo-dities	3 Labor	4 Capital	5 House-holds	6 Firms	7 Govern-ment	8 Rest of the World	9 Accumu-lation	Total
1. Activities		5456.3						2790.0		8246.3
2. Commodities	2326.4				2954.3		1431.0		886.0	7597.7
3. Labor	1893.8									1893.8
4. Capital	3933.2									3933.2
5. Households			1893.8	1598.5				-538.0		2954.3
6. Firms				787.0			34.0	-227.0		594.0
7. Government	93.0	80.2		1547.7		75.0		57.0		1769.9
8. Rest of the World		2061.0					83.0			2061.0
9. Accumulation						519.0	305.0	62.0		886.0
Total	8246.4	7597.5	1893.8	3933.2	2954.3	594.0	1770.0	2061.0	886.0	

Source: Authors.

government, the ROW and the capital accounts), the SAM can be partitioned into endogenous accounts and exogenous accounts. Algebraically, the SAM is formulated as:

$$Y = AY + X \quad (1)$$

where Y is (n x 1) column vector of total incomes in the endogenous accounts (row sums in SAM); X is (n x 1) column vector of total exogenous incomes (each element of X is the sum of income from the government, ROW, and capital accounts); A is a (n x n) coefficient matrix of average expenditure on endogenous accounts; and n is the number of endogenous accounts. These coefficients are obtained by dividing each element in the endogenous accounts by the corresponding column totals.

Equation (1) states that total income in each endogenous account (row sum) can be obtained by summing the product of average expenditure by the corresponding income and the total exogenous incomes.

Equation (1) can be solved for endogenous incomes Y as:

$$Y = (I - A)^{-1} X$$
$$= MX \quad (2)$$

where M is the SAM multiplier matrix.

Equation (2) solves for the equilibrium level for all endogenous accounts which result from a shock, or "injection" given by changes in the elements of the exogenous accounts. Each element in the SAM multiplier Matrix indicates the direct and indirect effects on the row-account of an exogenous unit change in the column-account (Bautista *et al.,* 1998). The changes in case where the ROW, government, and capital accounts are exogenous could be related to exports, government current expenditure, or investment. The SAM multiplier coefficients are normally larger than their corresponding input-output multipliers because they capture both the production linkages and consumption linkages generated through valued added and household incomes (Bautista *et al.,* 2001).

Even though SAM-based analysis gives more insights into income linkages than input-output analysis it is still subject to the same limiting assumptions. SAM multiplier analysis assumes linearity and absence of substitution effects in production and demand relationships. It is a demand-driven analysis, assuming no supply constraints and fixed prices. These assumptions better reflect the case of spread unemployment/underemployment and the existence of excess capacity in the economy. They can be relaxed by extending SAM analysis to General Equilibrium Modeling in which non linearity and price endogeneity are fully considered.

THE 1999 SOCIAL ACCOUNTING MATRIX FOR OMAN: A starting point for the construction of a Social Accounting Matrix is the existence of input-output tables. However, no such tables exist in Oman even though a lot of data is available in scattered forms with which to construct them. The Ministry of Economy issues a statistical yearbook which contains macro data of good quality providing sufficient information to construct a macro Social Accounting Matrix (Table 1). The Ministry of Economy also conducted a major household survey in 1999 which provides information on household incomes and expenditure shares, useful to construct a more disaggregated social accounting matrix. The macro SAM for Oman distinguishes the following accounts:

Activities. The activity entries indicate expenditure incurred during the production process by the various sectors in the economy (Table 1). Expenditure includes the purchase of intermediate inputs (2326.4 M.OR), payments to factors (labor and capital) as value added, or GDP at factor cost (5827.0 M.O.R), and production taxes (93 M.OR). The row entries for the activity represent the receipts going to the sectors from selling their output to the domestic market (5456.3 M.OR) and to export markets (2790 M.OR). The row total (8246.3 M.OR) represents the gross output in Oman, at producer prices.

Commodities. The commodity account, in the row, gives the aggregate demand for commodities (7597.7 M.OR) at market prices, which includes intermediate demand by production activities (2326.4 M.OR), final consumption expenditure by households (2954.3 M.OR), government expenditure (1431 M.OR), and investment expenditure (886 M.OR). The commodity column indicates the total supply of goods at market prices which includes the domestically-produced commodities, imported commodities (2061 M.OR), and import duties (80.2 M.OR). In the macro SAM of Oman, the value of domestically produced commodities (5456.3 M.OR), is derived as a residual representing the difference between gross production and exports.

Factors. Factor accounts in the Macro SAM include labor and capital. The row entry in the labor account represents the compensation of employees (wage and salaries) as given in the production account of the Statistical Yearbook 2000 (Ministry of Economy). Income payment received by the capital factor account (3933.2 M.OR) in the form of rents and profits is computed as a residual payment, given the value added at factor cost and the compensation of employees. In

the column, the labor account pays wage and salaries to households (1893.8 M.OR) whereas the capital account pays capital income to households, firms and the government. The Macro SAM shows that 41% of capital revenue (1598.5 M.OR) is distributed to households, 20% to firms as retained profits (787 M.OR) and 39% to the government (1547.7 M.OR). In Oman, the government receives most of its revenue as oil revenue from capital ownership in the oil and gas sector. The capital distribution figures above are approximated by examining the data on government revenue, households and firms revenue and by making adjustments to balance their receipts and expenditures.

Households. This account shows how households allocate their income on various expenditure categories. Income earned by households (Table 1, row 5) include labor and capital incomes described above and any remittances coming from abroad. In the Macro SAM, remittances are shown to be a negative figure (-538) which indicates rather an outflow as expatriate workers in Oman send their earnings to families abroad. The remittances value is taken from the Balance of Payments statistics. Total household income left for domestic spending is equal to 2954.3 Millions OR. This amount is usually allocated to three uses: consumption, savings and income taxes paid to the government (column 5). However, in Oman, data show no household savings and no income taxes, so total income is spent on commodity consumption.

Firms. Firms receives their income (row 6) from profits on capital ownership (787 M.OR) and from government transfers (34 M.OR). Their expenditure (column 6) consists of taxes on corporate profits paid to the government (75 M.OR) and transfers to the rest of the world, with the residual saving (519 M.OR) transferred to the capital account.

Government. The government account receives income from taxes, capital ownership in production activities and current transfers from abroad. In Oman, government receipts consists mainly of oil revenue generated from capital ownership in the major Oman oil company (PDO). Oil revenue and other revenue from public companies received by the government from the capital factor account amount for 1547.7 Million Rials. Tax revenues in Oman are insignificant and consist of production taxes (93 M.OR) from the activities account, tariffs on imports from the commodity account (80.2 M.OR), taxes on corporate profits (75 M.OR) and transfers from abroad (57 M.OR). Government revenue is spent (column 7) on public consumption from the commodity account (1431 M.OR), on government transfers to institutions, and on transfers to the capital account as savings (305 M.OR).

The Rest of the World (ROW). This account represents all the transactions between the domestic economy and foreign countries. Exports, net household remittances, net profit remittances, official interest payments to the government and the balance of trade deficit are given in the column (column 8), while imports and interest payments to foreign countries are given in the row account (row 8). The domestic economy receives income from the rest of the world as payments for exports (2790 M.OR), and pays the ROW for commodity imports (2061 M.OR). The current accounts deficit is covered by the capital account of the balance of payment, in the form of loans, and represents a foreign saving which adds up to the domestic public and private savings in the accumulation account. In 1999 the current deficit in Oman amounted to 62 million Rials. All information regarding the ROW account is derived from foreign trade statistics, section ten of the statistical yearbook 2000.

Accumulation. Accumulation represents the investment-saving account. The column gives the investment expenditure as shown in the national accounts statistics of Oman. In 1999, investment, as a component of aggregate demand, amounted to a total of 886 Million Rials. The accumulation account collects, in the row, domestic and foreign savings to provide the necessary finance for capital formation. Firms and government savings amount respectively to 513 and 306 Millions Rials while foreign saving, as mentioned above, amounts to 62 Millions Rials.

THE 1999 MULTI-SECTORAL SOCIAL ACCOUNTING MATRIX: The Macro SAM described above will constitute a basis to construct a more disaggregated one. The various entries of each account in the macro SAM will serve as a control total in the disaggregation process which requires data from various sources. Given some assumptions, the control total in the macro SAM will reconcile data and bring mutual consistencies of these sources within a balanced SAM framework. The following paragraphs will briefly discuss the most important features of the 1999 multisectoral-SAM of Oman.

Sectoral Classification. The 1999 multisectoral SAM for Oman (Table 2) can distinguish nine activities, eight commodities and two household accounts. The rest of the accounts are similar to the ones in the Macro SAM described above. Activities and commodities are chosen according to the classification used in the national account aggregates including the oil and gas sector, mining, agriculture, fishery, manufacturing, construction, water and electricity, government services and private services. In the commodity account, government and

TABLE 2

1999 Multisectoral Social Accounting Matrix, Oman, Units: Millions of Omani Rials (M.OR).

	Activities										Commodities									Factors			Institutions							
	Crude Oil & Gaz	Mining	Agriculture	Fisheries	Manufacture	Elect & Water	Construction	Government Services	Private Services	Total Activities	Crude Oil & Gaz	Mining	Agriculture	Fisheries	Manufacture	Elect & Water	Construction	Services	Total Commodities	Labor	Capital	Total Factors	Rural Household	Urban Household	Total Household	Firms	Government	Rest of the World	Accumulation	Total
Crude Oil & Gaz											511																	2127		2638
Mining												8																24		32
Agriculture													107															46		153
Fisheries														44														16		60
Manufacture															753													115		868
Elect &Water																212												0		212
Construction																	358											0		358
Govt Services																		850										0		850
Private Services																		2614										462		3076
Total Activities																			5457									2790		8247
Crude Oil & Gaz	34	0	26	4	91	21	7	19	93	296													0	0	0				215	510
Mining	3	3	0	0	5	0	33	0	13	58													0	0	0				3	61
Agriculture	0	0	11	0	0	0	0	0	0	11													136	174	310				12	333
Fisheries	0	0	0	2	0	0	0	0	0	2													15	26	41				3	46
Manufacture	142	12	8	1	367	80	121	85	385	1202													194	628	822				313	2337
Elect & Water	3	0	1	0	14	2	3	3	10	37													24	135	158				17	212
Construction			5	1	0	0	5	1	4	5	14	35											0	0	0					
Services			85	0	3	0	132	35	50	56	326	687											222	1401						
Total Commodities	273	17	48	7	614	140	218	168	842	2326																				5826
Labor	133	9	22	14	71	15	85	600	946	1894																				
Capital	2195	7	82	38	179	55	53	72	1251	3933																				
Total Factor	2328	16	104	51	250	70	138	672	2198	5826																				
Rural Household																				568	131							-108		591
Urban Household																				1326	1468							-430		2363
Total Household																				1894	1599							-538		2954
Firms																					788						34	-227		595
Government	37	0	2	1	4	1	2	11	35	93	0	2	8	10	57	0	0	13	80		1548					75		57		1853
Rest of the World												51	217	2	1526			264	2061								83			2144
Accumulation																										519	305	62		886
Total	2638	33	153	59	868	211	358	850	3075	8245	511	61	332	46	2336	212	358	3741	7598	1894	3934		591	2363	2954	594	1853	2144	886	

Source: Authors.

TABLE 3

Oman economic structure based on SAM.

	Value Added	%	Value Added/ Total Production (%)	Value Added/ Labor (%)	Imports	%	Imports/ Domestic Suuply (%)	Exports	%	Exports/ Total Production (%)
Oil and Gas	2365	40	90	6	0	0	0	2127	76	81
Mining	16	0	48	57	51	2	84	24	1	75
Agriculture	105	2	69	21	217	11	65	46	2	30
Fishery	52	1	88	27	2	0	4	16	1	26
Manufacturing	254	4	29	28	1526	74	65	115	4	13
Electricity and Water	71	1	34	21	0	0	0	0	0	0
Construction	140	2	39	60	0	0	0	0	0	0
Government Service	682	12	80	88	0	0	0	0	0	0
Private Service	2233	38	73	42	265	13	7	462	17	15
Total	5918	100	-	-	2061	100	-	2790	100	-

Source: Authors; based on SAM, Table 2.

private services are combined into a single commodity designated as "service". As an activity, "government service" is distinct from government as an institution in account 8, Table 1. The government, as an activity, buys intermediate goods, pays wage and deliver administrative services.

Commodity Input-output Submatrix. One crucial block in the SAM is the input-output (IO) sub-matrix (intersection between activities and commodities) which shows intermediate raw material demand for each sector. The national account statistics provide information only on total intermediate consumption of each sector but not on its sectoral sources. In the absence of IO tables in Oman, we assume that the economy of Oman is quite similar in its structure to that of Saudi Arabia for which input-output coefficients are available (Al-Khalfani and Schreiner, 1993). We, thus, apply these coefficients to approximate the input-output production process for Oman. This assumption is quite realistic since both economies are considered to be " rentier economies" where the oil and the service sectors make up almost 90%of GDP, and the technology employed in producing commodities in both countries is similar.

Export and Import Sub-matrices. Exports by commodity are shown in the SAM (Table 2) by the intersection of the activity rows with the rest of the world column, while imports are given by the intersection of Rest of the World row account and the commodity columns. Control totals for exports and imports are given by the macro-SAM. Commodity exports and imports are available, in standard international trade classification form and harmonized form, from the section on foreign trade of the Statistical Yearbook 2000. We aggregated the two-digit commodity classification of the harmonized system to conform with the sectoral classification in the activity and commodity accounts of the SAM. For example the export commodities originating from the agricultural sector are considered to consist of live animal and animal products, vegetable products, animal and vegetable oil and fat. All other processed agricultural based commodities are included in the manufacturing sector (prepared foodstuff, tobacco, beverages ...). A particular feature of the export structure of Oman is the high level of re-exports which represent an almost 70% of total non-oil exports. Given that no significant value added is incorporated in the production of these-exports, they are considered to be a service activity, and therefore originate from the private service account in the SAM. Re-exports consist mainly of machinery and transport equipments which make up 70% of the total.

Final Demand Submatrix. Final demand includes household consumption, government consumption and investment expenditure (intersection of commodity rows with household, government and accumulation columns). In the sectoral SAM, we distinguish two types of households, urban households, and rural households. This distinction is useful to highlight possible differences in consumption patterns and income distribution. The information on commodity consumption for each category of household is taken from the preliminary results of a recent household survey, the first conducted in Oman. The survey provides information on expenditure shares of various food and non-food items by household categories. We applied these shares to the total consumption expenditure given in the macro SAM. We also applied investment shares, taken from the macro data on gross fixed capital formation, to the total in the accumulation account to derive investment by commodities. Finally, government consumption is assumed to consist only of services.

FEATURES OF OMAN ECONOMIC STRUCTURE BASED ON SAM: Many economic indicators can be derived from the SAM as shown in Table 3. In terms of value added,

oil is the single most important sector in Oman economy accounting for 40% of GDP, followed by the private service sector (38%) and the government sector (12%). The country shows little industrialization as indicated by the 4% contribution of manufacturing sector to GDP. Agriculture and fishery contribute only 3% to GDP.

Comparisons between sectors can also be made in terms of the share of value added in the production and the proportion of labor income in the value added generated in each sector. The oil, agriculture, fishery, and service sectors generate a high proportion of their production as value added, whereas the manufacturing, electricity and construction, given their high intermediate consumption, generate a lesser proportion of value added (column 4).

The latter sectors are expected to have higher backward linkages than the former ones. Within the value added, income distributed to labor is highest in the government and construction sectors with respectively 88% and 60%, whereas it is lowest in the oil sector with only 6% (column 5). As expected, the production of oil and gas is highly capital intensive with most income distributed to capital.

Imports in Oman are dominated by the manufacturing sector, followed by the service and agricultural sectors with respectively 74%, 13%, and 11% of the value of total imported goods and services. Imported goods in mining, manufacturing and agriculture represent a high proportion of the total domestic supply of these goods (column 8). On the export side, the oil sector accounts for 76% of total foreign exchange earnings and exports 81% of its production. Services represent 17% of total exports, while manufacturing and agriculture represent 4 and 2%, respectively. Even though the share of agriculture in total exports is low, shadowed by the dominance of oil, agricultural exports represent 30% of the sectoral production (Table 3). The external sector shows a 60 million Rials deficit representing 1% of GDP.

The present SAM is not sufficiently disaggregated to derive information on income distribution. Nevertheless, the SAM shows that 80% of generated household income is accounted for by urban households (not shown in the table above). Rural households derive 90% of their income from labor wages compared to 60% for urban households. Also, note the high level of household remittances flowing out of the country which represent approximately 25% of total foreign exchange payments.

SAM MULTIPLIER ANALYSIS: In this section, we derive the multiplier matrix, as given by equation 2, and show how it is interpreted in the specific case of Oman economy (Table 4.). Each element in Table 4 represents the impact of a unit exogenous change of the corresponding account on the various endogenous accounts of the system. As discussed above, the exogenous accounts assumed in this study are the rest of the world, the government, and the capital accounts. So if one is interested, for example, in the impact of a change in agricultural exports (the exogenous element of the agricultural activity account) on the whole economy, the results can be read along column corresponding to the agricultural sector. The diagonal elements represent the own sector effect and the off-diagonal elements represent the linkage to other sectors effect (Sadoulet and De Janvry, 1997). Reading down the columns, Table 4 shows that the agricultural activity has a total production effect of 1.94 of which 1.05 is own production effect and 0.89 linkage to others sectors effect. This means that if agricultural exports increase by 1 million Rials, that would induce an increase of 1.05 million Rials in agricultural production and 0.87 million Rials in the production of other sectors.

Our calculation shows also that the industrial and the service sectors (manufacturing, electricity and water, government and private services) have higher multiplier effects (total production effect) than the primary sectors (agriculture, fishery, oil and mining). This is due mainly to the fact that the primary sectors use less intermediate inputs and have smaller demand elasticities than manufacturing and services.

Based on the multiplier matrix we conduct four experiments to trace out the effects of a change in one or more exogenous variables. Each experiment represents a policy option available to the government or an external shock beyond government control. The experiments consist of 1) an increase in agricultural and manufacturing export (diversification scenario); 2) a change in oil export value, 3) a reduction in the remittances of foreign workers and, 4) a direct income transfer to rural households (equity scenario). In order to make inter-scenario comparison, we assume an arbitrary change of 100 million Rials in the exogenous variable of each scenario and simulate the effects on the sector's own production, linkages to other sectors, overall production, households incomes, induced government revenues, Imports, and savings. The following paragraphs will describe the rationale behind each scenario.

SCENARIO 1: *Sectoral diversification.* Economic diversification has always been an important development objective. That is, the induction of a shift in the production structure of the economy away from oil and gas toward agriculture and manufacturing (tradable goods). However, sectoral diversification has shown little progress as indicated by the still very low shares of manufacturing and agriculture in GDP, and the rapid

TABLE 4

SAM Multipliers Coefficients Matrix, Oman, 1999.

	Crude Oil & Gaz	Mining	Agriculture	Fisheries	Manufacture	Electricity & Water	Construction	Government Services	Rural Household	Urban Household	Firms
Crude Oil & Gaz	1.05	0.05	0.22	0.11	0.16	0.15	0.07	0.09	0.07	0.07	0
Mining	0	1.01	0	0	0	0	0.01	0	0	0	0
Agriculture	0.02	0.03	1.05	0.03	0.02	0.02	0.03	0.05	0.09	0.05	0
Fisheries	0.01	0.01	0.01	1.05	0.01	0.01	0.01	0.02	0.03	0.02	0
Manufacturing	0.12	0.25	0.13	0.13	1.25	0.24	0.24	0.23	0.22	0.23	0
Electricity & Water	0.04	0.05	0.05	0.05	0.05	1.05	0.05	0.08	0.08	0.10	0
Construction	0.01	0.04	0	0	0.01	0.01	1.02	0.01	0.01	0.01	0
Government Services	0.11	0.11	0.12	0.13	0.13	0.14	0.14	1.20	0.18	0.25	0
Private Services	0.34	0.34	0.36	0.40	0.40	0.42	0.44	0.63	0.54	0.78	0
Rural Household	0.11	0.17	0.14	0.18	0.12	0.12	0.17	0.34	1.12	0.16	0
Urban Household	0.58	0.53	0.61	0.71	0.46	0.48	0.54	0.96	0.40	1.51	0
Firms	0.22	0.10	0.19	0.20	0.12	0.13	0.10	0.11	0.09	0.10	1
Total Production	1.70	1.88	1.94	1.90	2.04	2.03	2.02	2.31	1.22	1.51	0
Own Multiplier	1.05	1.01	1.05	1.05	1.25	1.05	1.02	1.20			
Linkage (other sectors)	0.65	0.87	0.89	0.85	0.79	0.98	1.00	1.11			
Induced Income	0.69	0.70	0.75	0.88	0.58	0.60	0.71	1.30	1.52	1.67	0

Source: Authors.

growth of the non tradable service sector (Development Council, 1996). The theoretical explanation of the tendency of a natural resource rich economy to diversify into the non-tradable sector is related to various macroeconomic policies (level of government spending and the real exchange rate), the explanation of which is beyond the scope of this paper. The main policy recommendation (World Bank) to overcome this tendency is to limit government spending and avoid the appreciation of the real exchange rate in order to create favorable competitive conditions for agricultural and manufacturing exports. In the SAM framework, the exchange rate is not a policy variable but we can gain some insights into this scenario by allowing agricultural and manufacturing export demand to change exogenously and trace out the economy-wide and sectoral impact of this change.

SCENARIO 2*: Change in oil export revenue.* In the last three decades oil prices have known many swings reflecting mainly changes in world demand for oil. Due to the dominance of the oil sector, the effect of oil price movements will not be felt only in the oil sector but will also trickle down to the non-oil sectors. Oil price shocks could have serious macroeconomic implications since government revenue, public spending, balance of payments and saving are also affected. The measures needed to respond to cyclical price behavior shocks are within the domain of fiscal and monetary policies and require the use of a macro economic model. However, using a SAM framework we can determine the static effects of an external shock on the main macroeconomic aggregates.

SCENARIO 3*: Foreign workers remittances.* Remittances of profit and earnings of expatriate workers constitute a large proportion of foreign exchange and affect negatively the trade balance. The government perceives workers remittances as a drain of resources, the reduction of which would conserve foreign exchange and increase national savings. A reduction in workers' remittances could reflect a long-term government policy which induces more participation of Omani nationals in the labor market and an increase in labor productivity.

SCENARIO 4*: Equity scenario.* Heavy public spending in the region of Muscat and other large cities, during oil boom periods, had created disparities between these cities and rural areas. The government is trying to redress this problem by promoting an equitable distribution of income through regional balances and transfer policies. The Fifth Five-Year Plan (1996-2000) has, for example, made provision in its regional development strategy for significant investment funds to be allocated outside large cities. In the analysis of this scenario, we simply assume the existence of interpersonal income disparities and allow for an income transfer to rural households.

SIMULATION RESULTS: Results of the four policy scenarios are presented in Table 5. The diversification scenario (Scenario 1) assumed an increase of exports in both agriculture and manufacturing, proportional to their initial level of exports. This exogenous increase in demand generated an economy-wide total production increase of 200 millions (2.43%). This overall production growth was the result of the initial direct increase in agricultural and manufacturing production to satisfy the increased demand, and the production increase of the latters and all other sectors due the multiplier effect (own production and linkage effects). Note that the production increase in agriculture, fishery and manufacturing (own production effect) totaled 125 M.OR which includes the initial 100 M. OR stimulus to satisfy the export demand and 25 M.OR as a second round effect due the production and income multipliers. The linkage to others sectors generated 75 M.OR production increase. This scenario also induced a 65 million increase (2.21%) in household incomes, of which 13 millions (2.23% increase) rural and 52 millions (2.20%) urban incomes. As a result of the overall production growth, imports increased by 53 M.OR (2.49%) but not enough to compensate for the 100 M. OR export increase, which had a positive impact on trade balance (+47 M.OR). Government revenue and saving also increased by 34 M.OR (1.84%) and 12 M.OR (1.43%), respectively. The increase in saving is mainly due to the growth in firms' prof it (2.43%) and government revenue.

The injection of 100 M.OR oil export earnings in the domestic economy (Scenario 2), due to an exogenous increase in the final demand, generated an overall production growth of 2.06% (170 M.OR), little less than the growth generated by the diversification scenario. This can be explained by the relatively smaller production linkages the oil sector has, given its enclave nature and its capital-intensive production process based mostly on imported capital goods. This scenario also induced a 2.35% (69 M.OR) increase in household incomes, an almost equal percentage increase as in the previous scenario, but most of this income growth goes to urban households (85%). As expected, however, the increase in oil revenue and savings, respectively 2.61% and 2.12%, are higher than that of the diversification scenario, particularly due to higher profit incomes for both the government and oil companies.

The reduction in foreign remittances outflow (Scenario 3) had a positive effect on the whole economy as overall production increased by 1.84% (170 M.OR). The significant increase in the production of all sectors particularly, water and electricity (4.78%), fishing (3.38), agriculture (3.17%), and manufacturing (2.69%), is due to the

TABLE 5

Policy simulation.

	Base Y	Scenario 1			Scenario 2			Scenario 3			Scenario 4		
		X	Y	%	X	Y	%	X	Y	%	X	Y	%
	M.OR	M.OR	M.OR	DY/Y	M.OR	M.OR	DY/Y	M.OR	M.OR	DY/Y	M.OR	M.OR	DY/Y
Oil and Gas	2638.0	0	16.9	0.6	100	104.8	4.0	0	7.4	0.3	0	7.1	0.3
Mining	2.4	0	0.1	0.3	0	0.1	0.2	0	0.1	0.2	0	0.1	0.9
Agriculture	153.0	26	28.9	18.9	0	2.3	1.5	0	4.9	3.2	0	9.4	6.7
Fishing	59.6	9	10.2	17.1	0	1.0	1.5	0	2.0	3.4	0	3.2	5.4
Manufacturing	868.3	65	86.2	9.9	0	12.0	1.4	0	23.3	2.7	0	22.3	2.6
Electricity and Water	212.0	0	5.4	2.5	0	4.3	2.0	0	10.1	4.8	0	7.5	3.5
Construction	358.0	0	0.8	0.2	0	0.5	0.1	0	0.7	0.2	0	0.5	0.2
Government Service	850.0	0	12.7	1.5	0	11.2	1.3	0	25.3	3.0	0	17.6	2.1
Private Service	3075.6	0	39.1	1.3	0	34.3	1.1	0	77.7	2.5	0	54.3	1.8
Rural Households	591.0	0	13.2	2.2	0	11.3	2.0	0	15.5	2.6	100	111.7	18.9
Urban Households	2363.1	0	52.1	2.2	0	58.1	2.5	100	151.4	6.4	0	40.0	1.7
Firms	594.5	0	14.5	2.4	0	21.5	3.6	0	10.3	1.7	0	8.6	1.5
Total Production	8246.9	100	200.1	2.4	100	170.3	2.1		151.4	1.8		122.0	1.5
Household Income	2954.1		65.3	2.2		69.4	2.4	100	166.9	5.7	100	151.6	5.1
Government Revenue	1853.0		34.0	1.8		48.4	2.6		25.6	1.4		8.6	0.5
Imports	2144.0		53.3	2.5		32.8	1.5		65.4	3.1		70.4	3.3
Saving	886.0		12.6	1.4		18.8	2.1		9.0	1.0		7.6	0.9

Scenario 1: 100 M.OR increase in agricultural and manufacturing exports.
Scenario 2: 100 M.OR injection in the oil sector.
Scenario 3: 100 M.OR reduction in workers remittances.
Scenario 4: 100 M.OR transfer to rural households.

higher domestic spending power since part of the remittances is now spent at home. This scenario induced the highest increase in household income (5.65%) as a result of the initial direct injection of income (100 M.OR) and the higher value added generated by the multiplier effects. Government revenue, imports and national saving increased respectively by 1.49%, 3.28% and 1.09%.

The equity scenario, in which 100 M.OR was transferred directly to rural households, generated 122 M.OR (1.48%) increase in total production and 152 M.OR (5.13%) in household incomes. Rural households who benefited from the transfer had their income increased by a significant 18.89% (111.65 M.OR including the initial transfer of 100 M.OR). Even though urban households had no income transfer, their income increased by 1.69% (39 M.OR) due to the induced increase in the production of all sectors. Agriculture and fishery benefited the most from this scenario (production increase of 6.16% and 5.35% respectively) as rural households spend most of their income on the production of these sectors. Government revenue, imports and saving increased by 0.47, 3.28, and 0.85%, respectively.

Conclusions

The purpose of this paper was to build a Social Accounting Matrix and apply it to analyze various policy scenarios reflecting development issues that the Sultanate of Oman as a case study. We started first with the construction of a macro SAM and then disaggregated it into a multi-sectoral, multi-institutional SAM in which seven major sectoral activities and two types of households were identified. The bulk of information to construct the Macroeconomic SAM is available from the Statistical Yearbook of Oman published by the Ministry of National Economy (2000). The Ministry also provided unpublished data on sectoral intermediate-consumption, which served as a basis on which to construct the input-output component of the multisectoral SAM.

The multisectoral SAM was used to derive the multiplier coefficients matrix and then simulate the sectoral and economy-wide effects of four policy scenarios that are of relevance to a predominately-oil economy. Among these, the diversification scenario, promoting agricultural and manufacturing exports, yielded the highest increase in overall production. The second scenario (increase in world oil prices) had the highest impact on government revenue, balance of trade and saving. The remittance control scenario had the highest impact on total household income but most of the income increase went to urban households. The equity scenario had the second largest increase on household income, mostly rural income, but the least effect on saving, and trade balance.

The policy implications of these results are not clear-cut. In addressing development issues, policy makers would certainly use a combination of policies to achieve a specific objective. For example, economic diversification, a long-term strategic objective of the Sultanate, can be achieved by adopting export-oriented policies through promotion of agricultural and manufacturing exports. But this needs to be complemented by other policies, if higher rural household incomes and more saving are also important considerations. According to our results, the equity issue is best dealt with by direct income transfer to households but this policy had the least effect on saving and therefore on long term economic growth. Another set of policies is therefore required to address the long-term economic growth issue.

Finally, when interpreting the results of our SAM-based analysis, one needs to keep in mind the limiting assumptions of the SAM approach. In particular, assumptions of fixed prices, perfectly elastic supply and linearity impose unrealistic restrictions to the behavior of some economic variables and limit the choices of relevant policy scenarios. The relaxation of these assumptions and resulting effects of changes in economic variables on the economy will be undertaken in a future paper.

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