

Chapter 2

Social accounting matrices (SAM)

The data necessary to calibrate a computable general equilibrium model (CEG) are gathered in a SAM.

I will use a part of Chapter 10 of the excellent book by Elisabeth Sadoulet and Alain de Janvry *Quantitative Development Policy Analysis*, The John Hopkins University Press, 1995.

Definitions

The general structure of a SAM is represented in Table 10.1. A SAM is a square matrix in which each transactor or account has its own row and column. The payments (expenditures) are listed in columns and the receipts in rows. As each account must balance, the corresponding row and column totals are equal. There are six types of accounts in the SAM: the activities, commodities, and factors (labor and capital) accounts; the current accounts of the domestic institutions, divided into households, firms, and the government; the capital account; and the rest of the world account.

Activity or production accounts are used to buy raw materials and intermediate goods and hire factor services to produce commodities. Their expenditures (column 1) hence include the purchase of intermediate commodities. The remainder is, by definition, value-added, of which a part may be payable to the government as a tax on the activity, (e.g., a value-added tax). Value added is then distributed to factors of production in the form of wage payments and of rent to fixed factors. The receipts (row 1) of the activities derive from sales on the domestic market, exports, and export subsidies received from the government. Export taxes to the government are noted as negative export subsidies.

Commodity accounts can best be seen as representing domestic product markets. Note that because commodity accounts are defined separately from activities, they need not have the same sectoral definitions. Commodity accounts (column 2) purchase imports and domestically produced commodities, including services from the trade sector, and pay indirect taxes, including tariffs levied on imports net of subsidies, on commodities. Their receipts (row 2) proceed from sales on the domestic market of intermediate products to activities, of final goods to households and government for consumption, and of investment goods to the capital account.

Factor accounts include labor and capital accounts. They receive payments (row 3) from the sale of their services to activities in the form of wages and rent and income from abroad as remittances and capital income. These revenues are distributed (column 3) to households as labor incomes and distributed corporate and unincorporated profits, and to firms as non-distributed profits after the corresponding taxes have been paid to government.

Institutions include households, firms, and government, with households usually disaggregated in different socioeconomic groups. Distinction is made between current and capital accounts, accounts 4 and 5, respectively. Households' incomes include the factor incomes described above and various transfers coming from other households, from government, from firms (mostly from insurance), or from abroad. Remittances are sometimes introduced here rather than in the labor accounts if information is available at this level. Households' expenditures consist of consumption and income taxes, with residual savings transferred to their capital account. Firms receive profits and transfers and spend on taxes and transfers. Their residual savings go into their capital account. The government account is distinct from administrative activities included in the activity accounts, which buy intermediate goods, pay wages, and deliver "administrative services." This government account spends its current expenditures on directly buying the services provided by the activity account. The other items in the current budget are transfers to households and firms, and the remaining savings are transferred to the capital account. On the income side, the government receives tax revenues and current transfers from abroad.

In principle, a separate *capital account* could be identified for each of the institutions described above. In practice, however, adequate data are seldom available, and only the government capital account is separated from a consolidated capital account of the domestic private institutions. These capital accounts collect savings together with net foreign capital transfers (also called foreign savings) from the rest of the world. This provides the necessary finance for domestic fixed capital formation and changes in stocks.

Transactions between the domestic economy and the *rest of the world* are recorded in the last account. The economy receives income from the rest of the world as payment for exports and pays for imports to the rest of the world. Similarly, some factor payments are received from abroad, offsetting factor payments to the rest of the world, and current transfers to and from abroad are made by the current institutions' account. The current accounts deficit is covered by net foreign capital transfers, which appear as foreign savings. SAMs do not usually contain assets accounts. Thus, if the foreign exchange used by the economy results in a decrease in reserves, the latter should be aggregated to the net foreign capital transfers. The fact that the foreign account deficit exactly matches the deficit in the savings-investment account is a standard result of national accounting. In the SAM framework, it is a mathematical necessity that if all other accounts are balanced, then the last one will also be in equilibrium.

There is no unique way of disaggregating and organizing the data in a SAM. The number of accounts in each category depends on the objectives of the study. We have already mentioned the possibility of disaggregating the household account to show separate socioeconomic classes. Similarly, the government account could be disaggregated into several entities. A SAM which emphasizes agriculture may have several agricultural subsectors rather than only one or two, as is typical in most general-purpose SAMs. SAMs also vary in the way transactions are recorded. We have mentioned the case of remittances, which are received either by the labor factor or by the household. Imports are sometimes also split between intermediate and final goods imports directly bought by the activities and institutions accounts. Also, returns to family labor may be aggregated with the return to fixed factors rather than with labor income. SAMs can also be built for different economic entities. The most common use of SAMs is at the national level, as presented here. However, SAMs have also been built for regional economies and for villages, with an example of the latter presented later in this chapter. The disaggregation scheme and the density of transactions among domestic accounts will clearly differ in these cases. Finally, accounts could be arranged in any order, a feature which is largely a matter of taste and tradition. However, all SAMs must respect the same logic of complete and consistent accounting.

Example: A Social Accounting Matrix for Ecuador, 1980

SAMs provide a great deal of information about the structure of an economy. An example is given in Table 10.2 with a SAM for Ecuador in 1980. Recall that, by convention, the cell ij is a payment from account j to account i . The reading of this SAM shows the following features of the Ecuadorian economy:

a. *Sectoral structure of domestic production and value added.* Agriculture represents 9% of domestic production $[(t1 + t2)/ta]$, and 12.6% of GDP $[(t1 - c1 + t2 - c2)/(ta - ca)]$. The oil sector is of about the same size, with figures at 8.8% and 12.7%, respectively. Manufacturing production, noted as activities 4 and 5, is larger but nevertheless shows a low level of industrialization accounting for only 18.4% of GDP.

b. *Sectoral contrasts in the generation of income.* Sharp contrasts are seen between sectors whose production mostly generates value added and sectors with high intermediate demand.

	Activities									Commodities							Factors			
	Ag. exports 1	Other ag. 2	Oil 3	Ind. consum. 4	Prod. goods 5	Util. transp. 6	Trade-services 7	Govt. services 8	Total activ. a	Ag. exports 9	Other ag. 10	Oil 11	Ind. consum. 12	Prod. goods 13	Util. transp. 14	Trade-services 15	Govt. services 16	Total commod. c	Skilled 17	Unskilled 18
Current accounts																				
1 Ag. exports									7,719									7,719		
2 Other ag.										27,489								27,489		
3 Oil											779							779		
4 Ind. cons. goods												67,213						67,213		
5 Prod. goods													45,727					45,727		
6 Util. constr. transp.														77,023				77,023		
7 Trade-services									5,545	7,612	1,682	12,624	30,719		67,369			125,551		
8 Govt. services																43,081		43,081		
c Total activities									13,264	35,101	2,461	79,837	76,446	77,023	67,369	43,081	394,582			
9 Ag. exports	18		26	8,174	2,292	80	148	46	10,784											
10 Other ag.		758		18,246	139		1,278	416	20,837											
11 Oil	177	52	176	307	1,322	3,410	149	322	5,915											
12 Ind. cons. goods	128	1,324	48	15,207	636	55	3,082	933	21,425											
13 Prod. goods	1,392	1,846	2,825	4,552	23,022	21,245	8,860	9,519	73,261											
14 Util. constr. transp.	152	243	1,725	1,355	1,443	2,943	12,125	3,315	23,303											
15 Trade-services	359	240	626	782	653	7,078	19,859	1,940	31,537											
16 Govt. services																				
c Total commodities	2,226	4,477	5,426	48,623	29,507	34,811	45,501	16,491	187,062											
17 Skilled	95	259	1,295	1,934	2,067	6,448	18,600	21,343	52,041											
18 Unskilled	124	197	443	7,429	5,829	23,711	32,872	5,149	75,754											
19 Ag. labor	2,559	12,670	6	214	146	27	300	98	16,020											
f Total labor	2,778	13,126	1,744	9,577	8,042	30,186	51,772	26,590	143,815											
20 Corporate capital	453	1,316	2,112	7,086	5,384	4,382	4,421		25,154											
21 Urb. low educ.	1,478	423		7,204	1,070	5,585	8,491		24,251									6,275	31,578	
22 Urb. med. educ.	148	299		2,493	1,076	2,224	6,044		12,254									16,537	18,188	
23 Urb. high educ.	214	101		157	165	657	3,624		4,918									25,249	1,802	
24 Rural own ag.	1,719	40		1,405	275	1,319	3,460		8,218									1,870	7,641	
25 Small farms	1,674	1,495		1,980	437	1,287	2,737		9,610									1,294	13,522	
26 Medium farms	1,337	2,508		363	73	289	900		5,470									297	1,848	
27 Large farms	2,166	3,884		241	56	554	1,213		8,114									519	1,175	
h Total households	8,736	8,720		13,843	3,152	11,915	26,469		72,835									52,041	75,754	
28 Firms																				
29 Income tax																				
30 Value-added tax	263	179	31,830	3,215	1,501	845	1,680		39,513											
31 Import tariff										3	-606	88	1,477	11,062					12,024	
32 Government																				
33 Rest of world										10	2,485	5,805	3,794	51,418	3,128	7,887			74,527	
Capital accounts																				
34 Government																				
35 Total private																				
r Total	14,456	27,818	41,112	82,344	47,586	82,139	129,843	43,081	468,379	13,277	36,980	8,355	85,108	138,926	80,151	75,256	43,081	481,133	52,041	75,754

	Factors			Institutions																	
	Ag. labor	Total labor	Capital	Urban low ed.	Urban med. ed.	Urban high ed.	Rural nonag.	Small farms	Medium farms	Large farms	Total households	Firms	Income tax	Indir. tax	Import tariff	Govt.	Rest of world	Govt. invest.	Private invest.	Total	
	19	1	20	21	22	23	24	25	26	27	28	28	29	30	31	32	33	34	35	1	
Current accounts																					
1 Ag. exports																	6,737				14,456
2 Other ag.																	329				27,818
3 Oil																	40,333				41,112
4 Ind. cons. goods																	15,131				82,344
5 Prod. goods																	1,859				47,586
6 Util. constr. transp																	5,116				82,139
7 Trade-services																	4,292				129,843
8 Govt. services																					43,081
a Total activities																	73,797				468,379
9 Ag. exports				812	433	203	159	307	110	119	2,143								350		13,277
10 Other ag.				4,570	2,404	1,153	1,007	3,736	1,153	1,075	15,098								1,045		36,980
11 Oil				529	295	165	123	195	51	49	1,407								1,033		8,355
12 Ind. cons. goods				20,413	12,282	6,323	4,895	11,584	3,639	3,253	62,389								1,294		85,108
13 Prod. goods				8,957	6,943	4,490	3,074	4,780	1,487	1,678	31,409							2,778	31,478		138,926
14 Util. constr. transp				5,358	4,190	3,019	1,708	3,405	591	925	18,196							15,868	22,784		80,151
15 Trade-services				13,101	10,692	7,006	3,770	5,947	1,555	1,647	43,718										75,256
16 Govt. services				141	129	101	37	62	19	30	519					42,562					43,081
c Total commodities				53,881	37,968	22,460	14,773	29,016	8,605	8,776	174,879					42,562		18,646	57,984		481,133
17 Skilled																					52,041
18 Unskilled																					75,754
19 Ag. labor																					16,020
f Total labor																					143,815
20 Corporate capital																					25,154
21 Urb. low educ.	968	38,821		1,041	1,151	918	6	12	4	9	3,141	2,000				2,666	33			70,912	
22 Urb. med. educ.	291	35,016		986	1,099	920	5	8	3	5	3,026	2,263				2,920	22			55,501	
23 Urb. high educ.	130	27,181		774	921	756	1	1		1	2,434	2,213				1,875	10			38,631	
24 Rural non ag.	612	10,123					145	246	79	156	629	156				125				19,251	
25 Small farms	7,652	22,468					333	554	182	349	1,418	35				437				33,968	
26 Medium farms	3,417	5,562					60	102	32	63	257	18				18				11,325	
27 Large farms	2,950	4,644					39	64	21	40	164	111				58				13,094	
h Total households	16,020	143,815		2,801	3,171	2,574	592	987	321	623	11,069	6,799				8,059	65			242,682	
28 Firms			25,154	1,561	1,788	1,819	422	560	327	407	6,974	6,373				26	2,088				40,615
29 Income tax				2,389	4,041	4,213	444	372	42	29	11,530	5,329									16,859
30 Value-added tax																					39,513
31 Import tariff																					12,024
32 Government													16,859	39,513	12,024						69,327
33 Rest of world						776					776	7,975					8,026			931	57,327
Capital accounts																					
34 Government																	10,614	14,423			25,037
35 Total private				10,280	9,103	6,789	3,020	3,023	2,030	3,169	37,454	14,139						6,391			57,984
i Total	16,020	143,815	25,154	70,912	55,501	38,631	19,251	33,968	11,325	13,094	242,682	40,615	16,859	39,513	12,024	69,327	91,304	25,037	57,984		

Source: de Larrey, Sadoulet, and Farcoux, 1991.

Agriculture and trade services count 84% and 65% of their production as value added, respectively, computed as $(ti - ci)/ti$ for activity i . This is in contrast to the production goods sector, with high intermediate demand and only 38% of its production distributed in value added. Within value added, further contrast can be made between labor income and profit. In this particular SAM, profits from informal sector firms have been directly attributed to the households that operate them. This is an efficient way of keeping track of the social distribution of asset ownership and of dealing with the lack of separation between the return to labor and the return to the fixed factors that often occurs in these firms. However, this allocation blurs the concepts of factors of production. Labor income accounts for less than 5% of value added in the oil sector and more than 60% in the utilities-construction-transportation sector. Finally, tax rates, which are net of subsidies in this SAM, are significant only for the manufacturing sectors, constituting 8.3% and 9.5% of value added, and for the oil sector. In the latter case, taxes, direct government participation in oil extraction, and subsidies to the refineries are all lumped together, and government captures 89% of value added. This aggregation is acceptable only if the structure of government revenues is not the focus of the analysis.

c. *Import dependency and import tariff rates*, as measured in the columns of the commodity accounts. Imported industrial production goods represent 37% of domestic supply and are taxed at an average rate of 21%.

d. *The structure of external trade*. Imports (row 33, columns 9–16) are dominated by industrial production goods (69% of all imports) and exports (column 33, rows 1–8) by oil (55% of the value of exports). The balance of trade is roughly in equilibrium, as noted by comparing total imports in 33c to total exports in a33. The traditional agricultural exports sector only generates 9% of total exports even though 47% of its production is exported.

e. *The sources of household incomes*, in rows 21 to 27. Interestingly, the households which receive the highest share of their income from wages are the urban households with high education and the small farmers: 70% of urban household income is wage income, with almost all income received by skilled labor. Similarly, 66% of small farmer income is wage income, albeit from unskilled labor. Savings rates average 15% of income, varying from 8.9% in small farms to 15.4% in large farms.

f. *Important macroeconomic features of the economy.* The investment rate in the economy is 27%, with public investment representing 24% of all investment. The balance-of-payments deficit (row 34, column 33) amounts to 5% of GDP. Since the balance of trade is almost in equilibrium, this current deficit is mostly due to transfers abroad, as debt service and capital flight, by urban households, firms, and government. The foreign capital transfer that covers this deficit is shown as a transfer to the government account, corresponding to the institutional arrangement in Ecuador at that time. Total government expenditures (current expenditures, in 32t, less savings [row 34, column 33], plus capital expenditures in c34) account for 27% of GDP. Of the government budget, 55% is spent on consumption (administration), 24% on investment, and 10% on transfers abroad (interest payment on debt). The government deficit amounts to 12% of its revenues (in 32t).

A weakness of this SAM, also common to most SAMs, is in the definition of the activities and the confusion that exists with the commodity disaggregation. Activities are intended to each stand for a representative productive agent. Firms that are aggregated under each heading should thus have the same production function, with a unique technology and a similar distribution of factor income. In agriculture, therefore, activities should correspond not to commodity aggregates, but rather to alternative production systems, which each produce a variety of commodities with a given technology.

Construction of a SAM: Data Requirements

ments. In all cases, the starting point should be the building of a highly aggregated SAM based on the country's national accounts statistics. Then, disaggregation of the different accounts is based on three sets of data:

- a. *Activity and commodity balances*, which are usually easily derived from input-output tables.
- b. *Disaggregation of value added* into income by labor categories and profits, which is usually based on employment surveys and sectoral censuses. It is, however, often difficult to properly account for informal sector activities, which are seldom represented in industrial surveys.
- c. *Determining incomes and outlays of the private institutions*, and of households in particular, is the most difficult part in the construction of a SAM. On the expenditure side, consumption surveys are often available, and taxes are found in the government budget. On the

income side, a multipurpose household survey is needed. If this is not available, some compromises are necessary, using data from family expenditure surveys, or from rural and urban income distribution surveys, or from labor force surveys. If the household survey contains labor force characteristics of household members, then this greatly improves the mapping of factor incomes to households. Incomes and outlays of all firms aggregated together are sometimes available in the national accounts documents. Transfers between government and private institutions are usually available from government statistics. Transfers among private institutions are rarely directly available at the level of disaggregation required and thus need to be estimated on the basis of indirect indicators. A complete balance of payments is necessary to provide information on property income flows and transfers between the domestic economy and the rest of the world. When direct information is not available, household savings may be derived as residuals.

In conclusion, the construction of a disaggregated SAM is very demanding in terms of data. And, even when the statistical material is available, the reconciliation of information from various sources and surveys requires considerable effort. Nevertheless, this cannot be avoided, as a consistent characterization of the interdependencies of the economic and social system is necessary to analyze the implications of policies.