Chapter 2: The Social Accounting Matrix

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Abstract

This chapter explains what Social Accounting Matrices (SAM) are and how they are constructed using National Income and Product Accounts, information on the government budget and the balance of payments. The chapter provides a step-by-step discussion using of a sequence of simple toward increasingly complex examples of one-sector SAMs.

1. Social Accounting

The ideas of the first chapters can be put to use immediately in the construction of a social accounting matrix or SAM. A SAM is itself a data base and not a model. As will be seen, many models can be fitted to the same data base with very different inherent analysis and policy implications.

Definition 1. *A SAM is a matrix in which rows and columns correspond to the income and expenditure respectively of each of the agents of the economy.*

A SAM dates back to Quesnay's *Tableau Economique* of the late 18th century, the essential insight of which is that each transaction in an economy during the course of a year can be seen as both a *purchase* and a *sale.* The two-sided nature of this interaction suggests that a matrix might be useful in keeping track of the economic activity. Modern SAMs were reconciled to *National Income and Product Accounts* (NIPA) by Sir Richard Stone [3] who was a principle architect of the United Nations System of National Accounts. A more advanced introduction to SAMs is available in King [4] in Pyatt and Round [5]. Still, SAMs are not

system of national accounts and should rather be thought of as a mechanism by which the national account can be reconciled with the government accounts from the ministry of finance, the balance of payments and other sources of information. The main problem is that these sources do not always agree, indeed they are not even necessarily expressed in the same time frame or currency; a SAM is a way of forcing consistency on these different sources.

A SAM is a matrix representation of the circular flow of income. SAMs respect the difference between goods and factors. Goods provide their consumers with utility, while factors are used to produce goods and are not in themselves useful. *Intermediate* goods are somewhere on the spectrum between goods and factors; they could be consumed directly, or they could be used as inputs into the production of other goods. Intermediate goods are produced by firms and then sold to other firms rather than to households, government or foreigners who only consume goods. Factors are not present in the SAM but the payments made by firms to their owners are.

A SAM is not a model itself but rather provides the *data* for macromodels in a convenient, one-stop, format. SAMs are available for many countries and (for some countries) for several years, but are often elusive.[1]. They are sometimes published but then often are not considered to be of publishable quality because of the data problems encountered in their construction.

SAMs are in principle *square matrices,* that is, with the same number of rows as columns. Some SAMs have intermediate rows or columns which serve only to sum up the more disaggregated data they contain. Since SAMs rows and columns correspond to income and expenditure of agents or players in the economy, they are easiest to understand when their rows and columns are ordered so that the first row corresponds to the first column, second row to the second column and so on. In this way, the *ith* row and *ith* column might correspond to the income and expenditure, respectively, of the *ith* agent. Unfortunately, not all authors follow this or any other convention and SAM can vary widely in their architecture. Some SAMs appear rectangular, but in fact their rows and respective columns are just disaggregated in different ways, giving rise to the appearance of a rectangular matrix.

Real SAMs describe income *flows* accounted for over some period of time, usually a year. But there is certainly nothing wrong with including some financial data in a SAM, and it is often done. Indeed, it is possible to construct financial

[1]The worldwide web can be a place to start looking, but there are no guarantees that a SAM for the appropriate country and year exists or can be found.

SAMs based on *stocks* rather than flows; hence the central organizing principle is not income and expenditure but rather *assets* and *liabilities.* There will be more to say on this issue in Chapter XX.

2. Agents of the SAM

Our working definition of a SAM is an income-expenditure balance for economic agents. Agents are broad categories of economic actors, including:

1. *Firms* combine *factors of production,* labor, land and capital, with *intermediate goods* to produce final *goods.* There may be many firms or they may all be aggregated into one depending on how detailed the SAM is. Their *income* derives from sales to *all* agents of the SAM (including other firms) and is shown in the rows corresponding to firms. Their *expenditure* is all purchases made from other agents of the SAM, *including savings,* and is shown in the columns corresponding to firms. The sum of factor payments is *value added,* and includes wages, profits and rents. Firms also pay taxes and import intermediate goods from abroad.

2. *Households* own the factors of production and receive income from firms in exchange for their use. Households spend this income on the same goods produced by the firms, establishing a circular flow of income. There may be many households or they may all be aggregated into one depending on the detail of the SAM. Their *incomes* are derived from payments to households by all other agents (sometimes including other households) and their *expenditure* is all purchases made from other agents of the SAM, *including savings,* and is shown in the columns corresponding to households.

3. *Government* federal, state and local, taxes households, firms and foreigners, buys goods and services and makes transfers to firms (subsidies) and households and foreigners (transfers). Like households and firms there may be many levels of government represented in the SAM or they may all be aggregated into one. The government *income* row records tax payments for all agents (including government itself). The corresponding column is government *expenditure* and, as for firms and households, includes savings. The goods government buys are from firms but the services they buy are from households, payment for the factors of production are recorded in the government column and household row. Transfers are often mixed in with

these factor payments, but may be disaggregated and shown separately, or not. Government savings is the negative of the government deficit.

4. *Foreigners* earn *income* in our country by selling goods to firms, households and government in the form of imports and buying goods from firms (our exports). Imports are divided conceptually into *competitive* and *noncompetitive* imports. The former is used to construct *net exports* and the latter is treated as a factor of production, akin to labor, land or capital. Our agents import intermediate and final goods as well as factor services from all foreigners and this purchases are recorded in the foreign income row. When agents purchase either foreign factor services or intermediate and final goods that *are not produced by domestic firms,* they are called *noncompetitive imports* and are registered in the foreign row. Sales to foreigners by firms are *net of their imports of similar goods*, that is, *competitive imports*. These sales are shown in the firm's row and foreign column. The foreign column includes *foreign savings,* which is also known as the *trade deficit* or the *current account deficit* in the balance of payments.

3. Balancing a SAM

Definition 2. *A SAM is balanced when investment is equal to the sum of savings for each agent. This is known as* Walras law.

If total savings is not equal to investment, then there is an error in one of the income-expenditure balances for the four agents. This serves as a check on the consistency of the SAM. We use this idea to help build the SAM and make sure that it is correctly constructed. We proceed by way of a simple examples.

Example 3. *A Republican Paradise*

Let us construct a SAM for a Republican Paradise Economy. Here, there is no government and no foreign trade; only firms and consumers. Although the circular flow of income is preserved, the assumptions simplify economic life considerably and the SAM is correspondingly straightforward.

The income-expenditure balance for firms is

$$V_A = C + I$$

where V_A = value added; C = consumption, I = investment. Value added is paid to households who in turn consume C and save S.

$$V_A = C + S$$

Income is in this economy is Y and the same is shown in Table 3.

Table

	A	B	C	D	E
1		Firms	Households	Investment	**Total**
2	Firms		C	I	Y
3	HH	VA			Y
4	Savings		S		S
5	**Total**	Y	Y	I	

Observe that the table is constructed as if it were an Excel spread sheet with row and column identifiers. Excel is the natural tool for SAMs since its workspace is already organized as if it were a matrix. The entry in cell $E1$ for example, Y, would be the expression $[= sum(C2 : D2)]$. Since income is equal to expenditure for both firms and households, the row sums in $E2$ and $E3$ must be the same as the column sums in B and C. It is easiest to then define cell $B5$ as $= E2$ and $C5$ as $= E3$. This effective ly insures that we have row-column equality for each agent. The savings entry in $C4$ can then be defined as a *residual,* that is as $= C5 - C2$. A simple numerical example is shown in Table 3 for an economy in which consumption is equal to 80 and investment is 10.

Table

	A	B	C	D	E
1		Firms	Households	Investment	**Total**
2	Firms		80	10	$= sum(C2 : D2)$
3	HH	$= B5$			$= B3$
4	Savings		$= C5 - C2$		$= B4$
5	**Total**	$= E2$	$Y = E3$	$= D2$	

Because of the way this SAM is constructed, it is guaranteed to balance; that is savings will have to be equal to investment. By the way, note that firms undertake no savings of their own in this economy. This assumption is made for simplification only. Had data been available for firm savings, we could have entered it directly into cell $B4$ and calculated value added in $B3$ as a *residual* as we did for household savings in $C4$.

3.1. Why Savings is Equal to Investment for the Economy as a Whole

The result of the previous discussion, that savings is equal to investment for the economy as a whole, is not an essentially economic conclusion. It rather turns out to be a mathematical property of matrices. To see this let us review some basics: The *Commutative Property for Addition* implies that when we add two numbers, order does not matter.

$$a + b = b + a$$

Example: $7 + 3 = 3 + 7$.This works for a matrix as well. Let the matrix have n rows and m columns. Define the *ith row sum,* R_i, and the jth column sum C_j. We have [2]:

$$\sum_{i=1}^{n} R_i = \sum_{j=1}^{m} C_j$$

- that is *the sum of the row sums* is equal to the *sum of the column sums.*

Example 4. *Example: Consider the* $2x2$ *matrix.*

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

The first row sum is $R_1 = a+b$*; the second row sum is* $R_2 = c+d$*. The sum of the row sums* $\sum_{i=1}^{n} R_i = a + b + c + d$*. The first column sum is* $C_1 = a + c$ *the second is* $C_2 = b + d$*. The sum of the column sums is* $\sum_{j=1}^{m} C_j = a + c + b + d$*. Thus from the commutative property for addition above we have:* $\sum_{i=1}^{2} R_i = \sum_{j=1}^{2} C_j$.

Now complete SAMs have *four agents:* firms, households, government and foreign. To each agent there corresponds a *row* for income and *column* for expenditure. The *fifth* row and column of the SAM is for savings and investment respectively. Since for each agent, *income* is balanced with *expenditure*, the row and column sums are the same; that is: $R_i = C_i$ for i = 1,2,3,4. Now consider the SAM as a $5x5$ matrix with $R_i = C_i$ for i = 1,2,3,4. Since from the commutative property, we have $\sum_{i=1}^{5} R_i = \sum_{j=1}^{5} C_j$. The first four rows sums plus the sum

[2]Summation notation is defined by the $\sum_{i=1}^{n}$which just says "sum what follows" according to the *index* i as it runs from 1 to n. The choice of letters for the index is usually i, j or k and has no significance other than if one letter has already been used in the expression, and we want to use a second $\sum$ then we choose a different index.

of the savings row S is equal to the first four columns I, plus the sum of the investment column, I. We then have:

$$\sum_{i=1}^{4} R_i + S = \sum_{j=1}^{4} C_j + I$$

Since the sum of the first four rows must be the sum of the first four columns, we have:

$$S = I$$

The row sum of savings equals the column sum of investment. Note that inventories are the adjusting factor, or residual, in the rows of the SAM. Savings are is the residual in the columns.

Example 5. *Show that savings is equal to investment in a one sector economy with four agents, firms, households, government and foreign. The SAM is*

Table

	A	B	C	D	E	F	G
1		Firms	Households	Invest	Govt	Foreign	**Total**
2	Firms		C	I_d	G	E	X
3	Households	V_A			$W_g + T_r$		Y_h
4	Savings	S_f	S_h		S_g	S^*	S
5	Govt	T_f	T_h				T
6	Foreign	M_f	M_h	M_I	M_g		M
7	**Total**	X	Y_h	I	T	M	

where C = consumption, I_d = investment satisfied by domestic firms, G is government expenditure and E is *net exports,* that is exports less *competitive imports.* Y_h = income of households; V_A = value added; government wages are W_g and transfers including domestic interest payments are T_r. Taxes on firms, S_f = savings of firms; S_h = savings of households, S^* = foreign savings, S = total savings. Noncompetitive imports of firms are M_f for household M_h for investment M_I. Total noncompetitive imports are M.

Write the row and column sums (income equals expenditure) for firms

$$C + I^d + G + E = V_A + S_f + T_f + M_f$$

and households :

$$V_A + W_G + T_r = C + S_h + T_h + M_h$$

The income expenditure balance for government is

$$T_f + T_h = G + W_g + S_g + T_r + M_g$$

and finally for foreign

$$M_f + M_h + M_I + M_g = E + S^*$$

Now take the sum of these four equations row sums on the left and the sum of the column sums on the right and cancel like terms on both sides.

$$I^d + M_I = S_f + S_h + S_g + S^*$$

Investment is equal to the sum of savings if each individual agent is in income-expenditure balance. This matrix property is often called *Walras' Law*. Investment equals the sum of savings for all agents. We next consider a more complex numerical example in which there is more than one sector in the economy.

Example 6. *A Simple Hanks Economy.*

Let us think about an island economy, something like what Tom Hanks encountered in the movie *Castaway.* There are only a few raw materials available on this island, but there are fish in the ocean and coconuts waiting to be felled from trees. Neither are free for the taking however, with some effort is required to convert raw materials into final goods for consumption. Taking some poetic license with the film, we observe that Hanks does indeed have some help, an imaginary but useful sidekick called Wilson. The island economy simplifies our task of analyzing economic life for two important reasons: first, there is no money in Hank's economy and second, *what Hanks saves, Hanks invests.* Savings and investment are not undertaken by different individuals. Although Wilson is never actually seen doing any work, we quite liberally assume the following social structure:

1. *Firms:* Hanks and Wilson form three firms to produce cocos, corn and fish. The factors are labor and a fish hook (capital owned by Hanks). There are intermediate goods: fish is used to fertilize corn. Corn is used as fish bait. Corn can be consumed or saved in the form of seed for future production (investment).

2. *Households* goods, fish, cocos and corn, have utility for Hanks and Wilson. Hanks owns the firms; he hires Wilson, pays him a wage.

3. *Government:* A gun, retrieved from the plane wreckage, is the basis of government defense expenditure. Current costs include only labor which is used to patrol the island, one day per week. Wilson's military labor is remunerated by government wages of 2 cocos, 5 corn and 5 fish..

4. *Foreign:* firm trades goods with neighboring island. Fish is exchanged for salt.

Table

	A	B	C	D	E	F	G	H	I	J
1			Firms			Households	Invest-			
2		Cocos	Corn	Fish	Wilson	Hanks	ment	Govt	For	**Total**
3	Cocos				3	3			1	7
4	Corn			1	7	8	10			26
5	Fish		2		5	3			2	12
6	Wage	2	5	5				5		17
7	Profit	4	17	4						25
8	Savings					10		0	0	10
9	Taxes	1	2	2						5
10	Imports				2	1				3
11	**Total**	7	26	12	17	25	10	5	3	

First note that this SAM differs from Table 3.1 above in that it is multisectoral. In order to intelligently discuss the macroeconomy we will need to aggregate the three sectors using some price system. It usually convenient to assume that prices and wages in the base SAM are equal to *one.* This is by no means realistic but the *normalization* of prices and wages does allow changes from the base to be measured even though we never identify the physical units of the base SAM. With all prices equal to one, we can interpret the quantities in Table 3.1 as in either physical or value terms.

A quick check shows that the Hanks SAM is in balance since the sum of savings equals investment. Thus, we are assured that each agent (of which there are *seven)* is in income-expenditure balance.

A few odd features of this SAM are worth noting:

1. There is no *government savings* (no surplus or deficit). Taxes paid by the firms are immediately and completely respent on government defense purchases.

2. There is no *foreign savings* (no trade surplus or deficit); trade is balanced with exports equal to imports.

3. There are no direct taxes since all taxes paid by firms.

4. Firms do not save; neither does Wilson. It follows that the only agent that accumulates capital in this economy is Hanks.

5. All imports are *noncompetitive.* There are no imports of corn, fish or coconuts to the island.

Note that Hanks is richer than Wilson since all firms are profitable and Hanks appropriates the profits; this is presumably for reasons outside this SAM based analysis and is taken as given. Moreover, the distribution of income does not seem like it will change over time, since as we noted above, Wilson does not save and therefore cannot not accumulate assets. We will have to see if this is really true later in the chapter.

We have the following national income and product accounts in this SAM

1. *Gross Domestic Product by Expenditure.* Private consumption is 32 since it includes noncompetitive salt imports, investment is 10, government consumption of goods and services is 5. Net exports is zero since exports and imports are both 3. Hence: $Y = C + I + G + X - M = 32 + 10 + 5 = 47$

2. *Gross Domestic Product by Industry* is broken down as follows: Coconut output is 7, corn is 24, fish is 11, and government wages are 5 so, again, $Y = 47$ (recall that these components can be added up since prices and wages are equal to one.)

3. GDP is also equal to *value added* wages 17, profits 25 (including firm saving and taxes) and value added by government, 5, again $Y = 47$.

4. *GNP*–now say that Wilson is a "resident" of the island but not a citizen. Hanks is the only citizen and doesn't work abroad. GDP is still 47 but GNP = *GDP + net factor payments.* $GNP = 47 - 17 = 30$.

It is also worth noting that we have no theory of how the various cells in the SAM change with respect to one another. For this we need some kind of economic *model.* We will return to this issue in the next chapter. Without an economic model, the best we can do is make a some guesses as to how the economy with change in the years following the base. The SAM insures only that the guesses will be *consistent* with one another in the sense that they could add up to a feasible set of national accounts. But beyond this, we are on our own. Consider now a second example, our first foray into dynamics:

Example 7. *Assume that the SAM above is for a given base year. In the following year, exports double. The SAM for the second year looks like:*

Table for Example

	A	B	C	D	E	F	G	H	I	J
1			Firms			Households	Invest-			
2		Cocos	Corn	Fish	Wilson	Hanks	ment	Govt	Foreign	**Total**
3	Cocos	0	0	0	4	4	0	0	2	**10**
4	Corn	0	0	3	10	11	11	0	0	**35**
5	Fish	0	2	0	8	4	0	0	4	**18**
6	Wage	3	10	7				5		**25**
7	Profit	6	21	6						**33**
8	Savings				1	13		0	-3	**11**
9	Taxes	1	2	2						**5**
10	Imports				2	1				**3**
11	**Total**	**10**	**35**	**18**	**25**	**33**	**11**	**5**	**3**	

Some interesting changes have taken place here as a result of the increase in exports. First the economy is clearly richer: GDP is risen from 47 to 63, some 34, assuming there has been no change in the price level. Both Hanks and Wilson benefit from the export led growth. Consumption rises as do wages and profits, all by assumption.

In the export-led growth example above, total investment increased from 10 to 11. This means that total savings had to increase by one as well. Did it? Since the SAM is in balance savings must have adjusted but how did it do so? It is often instructive to ask this question. Note first that foreign savings went *down* from zero to -3. The new number corresponds to a trade *surplus* on the current account in the balance of payments. Since savings and investment are

moving in opposite ways, either household or government savings must rise to compensate. Government savings is fixed since income is 5 and expenditure is 5 (under the assumption that prices have not changed) so the government budget remains in balance. The rise in export has apparently had no bearing on security needs. Thus, the adjustment must take place in savings by households and indeed it does show an increase of 4. Wilson's savings increases by 1 and Hanks's by 3. Evidently, a rise in exports must lead to an increase in domestic savings.

How does this happen? First, note that all the extra income earned by the rise in exports was paid directly to the households in the form of higher wages and profits and this explains how the income of both Hanks and Wilson increased. Would it be possible for their consumption to rise by the same amount so that their savings would remain constant? In other words, why must their consumption necessarily go up by a smaller amount than their income to achieve a savings-investment balance.

The principal reason is that had consumption risen by the full increase in income that would have doubled the impact on demand from an increase in exports. As firms increased output to respond to that demand, income would have grown again and so too would have demand. Apparently without some form of *leakage*, the growth in income due to the export boom would have become explosive, driving income to infinity. Since this did not occur, that is income "only" increased by 34%, it is apparent that the marginal propensity to consume out of income must have been less than one for both households in this small economy.

A second option would been to have firm savings increase. This would achieve the same effect. As exports grow and with it demand and production, firms simply do not pay out the full increase in value added to the households. They *retain* some of their *earnings* in the form of business savings, or indeed retained earnings. This did not occur in the SAM above, but it could have!

The growth is equalizing with regard to the distribution of income since Wilson, the poor, gets the same absolute increase in income as does Hanks, the rich; hence Wilson's percentage increase is greater. The share of wages in total income also increases. In this model, a rising tide does indeed lift all boats.

In the following sections, we leave behind imaginary economies and address the problems of how to construct a SAM from actual data.

4. Constructing a basic SAM for a Closed Economy

We start small with a closed economy, no imports or exports, and work up to more complex examples. From an initial data search we have found in the national income accounts

Table Gross Domestic Product by Expenditure (LCU) 1990

Y	C	I	G
520	384	90	46

Source: National Income and Product Accounts

We take 1990 as the base year and thus real and nominal magnitudes are the same; the base SAM will then agree with nominal terms with the national accounts. There are no intermediate goods GVP (gross value of production) is equal to GDP. This need not be the case; had we started from input-output data, for example, intermediate sales and purchases would have been available. From the government accounts at the Ministry of Finance or Central Statistical Office, we find:

Table : Income and Expenditure of General Government, 1990

Income from all sources, taxes, etc.	52
Direct taxes on households	20
Indirect taxes	16
Taxes on corporate profits	12
Other revenue	4
Investment (including capital transfers)	10
Consumption	67
Goods and services	48
Transfers	8
Wages	9
Interest	2
Public Sector Borrowing Requirement (PSBR)	

Source: Ministry of Finance

The first step in constructing the SAM is put these data from the NIPA in Table 4 and the government accounts 4 into the matrix of Table 4. The SAM is

shown there as it would look in an Excel spreadsheet. Consumption, for example is in cell $C2$.

But here we encounter our first problem. The information from the Ministry of finance is not consistent with national accounts. What can be done? Without interviewing the individuals responsible for collecting and distributing the data, we are forced to choose between the conflicting data sets. This always involves some judgment, but since the SAM will rely more heavily on the NIPA accounts for information in might be better to put 46 for government consumption than 48. A second reason for preferring the national accounts is that policymakers who use the information will expect that the SAM "looks like" the economy with which they are familiar. This is best achieved by forcing the SAM to be consistent with the published GDP and its components.

In the national accounts, government spending G includes spending on goods and services as well as the factor service, labor. From Table 4 we see that government wage payments are 9. It follows that firms must supply the rest of government demand on the current account, which is here $46 - 9 = 37$. This shown in the SAM of Table 4 in cell $F37$

Government income from all sources is equal to 52, shown as the row sum. Taxes on households are entered as 20 while the remaining sources of revenue, indirect taxes, 16 direct corporate tax, 12 and other sources 4 are charged to firms. The latter might raise a question but "other sources" are likely to be profits earned by parastatal enterprises, sometimes called state-owned enterprises (SOEs) or other profitable ventures. Indeed, the tax may be net of losses incurred by subsidized public sector operations. In any event, it is a probably a better guess to put the residual in the firms account than even to split it proportionately between firms and households. The risk in the latter strategy is that household savings may well go unrealistically negative as we shall see below.

Since income equals expenditure, we also enter 52 in as the column sum in cell $F52$. Later we will define government savings as a residual that is we will determine government savings as the difference between total expenditure and the rest of the government expenditure column. This way we will be certain income and expenditure do in fact balance for the government by making savings the residual as we did above

Table 4 also shows government transfers to households as 8 and thus savings would be -13 as shown in the SAM in Table 4, cell $E4$. This *negative government savings* is just a deficit on the government's current account. It does not take into account government investment, which is counted in the investment column,

along with all other sources of investment *demand* satisfied by domestic firms.

Table 1990 SAM

	A	B	C	D	E	F
1		Firms	HH	Invest	Govt	**Total**
2	Firms		384	90	37	511
3	Households				$8+9+2$	
4	Savings				-13	
5	Govt	$16+12+4$	20			52
6	**Total**	511			52	

With government income set to match the level in Table 4 but expenditure taken from the national accounts, *current government savings* will not agree with that published by the Ministry of Finance. In order to make government savings match, we could conceivably scale down the government income row but this is not advisable. For one, government savings is not as visible as the PSBR, defined as:

$$PSBR = I_g - S_g$$

where I_g is government *investment* and S_g is current government savings. So only if the national income accounts shows government investment *and it is consistent with* that shown in the government accounts will the PSBR of the SAM conflict with figure offered by the Ministry of Finance. This is unlikely however, since the Ministry of Finance will also record investment *transfers* in total investment. If the government finance the development of some capital project that is undertaken by an NGO or private sector firm, both the government and the NGO or are recording the transaction. But from the perspective of the national accounts, of course, this is double counting and must be netted out. If the national accounts include government investment, capital transfers provides a simple explanation for why the published PSBR does not agree with the SAM. If, on the other hand, government investment is not broken out of the total, then the government accounts will have to be used to determine the PSBR. Whether the figure does indeed include some double-counting is still an important concern, but it will nonetheless agree with the published number. This same opposability for double counting is why we used the figure of 46 for G instead of 48 as reported by the Ministry of Finance. The double counting is usually caught and eliminated by those responsible for the national accounts.

With the government accounts now integrated into the national income and product accounts, we can complete the SAM in Table 4. The assumption of a

closed economy simplifies matters significantly; total *value added* must be equal to GDP, here 511. From this we subtract firm savings. Firms savings is often difficult to come by and may well have to be guesstimated as a rate. It is possible that there exists a published savings-investment balance that might provide an estimate, but absent this, we are on our own. We do know that most likely, the savings rate is not zero, may start with a guess of say 10%. We can then adjust this rate to make household savings come out to be a reasonable fit to the (often scanty) data on household savings rates. Here we have arbitrarily inserted a 51 as a reasonable estimate.

Value added by households must now be total firm income 511 less savings and taxes. Since it is the firms that pay indirect taxes, whether a value added tax (VAT) or a sales tax, the latter must be added to total government income in the firm column. The calculation is shown in the SAM below (Table 4), with firm payments to households of determined as the residual difference between the row sum and the other entries in the firm column. The residuals in this SAM are shown in italics.

Table 1990 SAM

	A	B	C	D	E	F
1		Firms	HH	Invest	Govt	**Total**
2	Firms		384	90	37	511
3	Households	428			19	447
4	Savings	51	43		−4	90
5	Govt	32	20			52
6	**Total**	511	447		52	

To get total household income of 447we must add transfers, wage payments and interest from government of 19. With the latter as the column total, we are assured that household income is equal to expenditure, so long as household savings adjusts as the residual. With direct taxes taken from the government accounts at 20, savings must be 43 to balance. This gives a savings rate out of after-tax income of $43/(447-20)$ or about 10%. This might seem low, but note that total investment is only 90/511 or 17.6% and is supplemented by the assumed savings rate of firms of 10% as noted above. Were there some evidence to contradict this distribution of savings, it could easily be integrated to get an improved estimate of the SAM.

This SAM for a closed economy is now complete. Had it been built from an input-output framework, there would have been intermediate goods included.

Note that in a one-sector SAM, intermediate goods do not disturb the balance, since they are on the diagonal of the SAM matrix. This means they add to both income and expenditure of firms leaving firm savings and therefore value added by households untouched. In the final SAM of this section, we estimate that intermediate goods are 25% of GDP. GDP is no longer equal to GVP. This is important to note, but of no consequence to the remaining entries in the matrix.

4.1. A SAM for an Open Economy

When there are imports and exports in an economy, the SAM must be augmented by a new row and column for the income and expenditure of the rest of the world or foreigners. This is not conceptually difficult, but because imports are priced in units of foreign currency, there are in effect *two goods* and some exchange rate must be introduced to equate the two. Again we let the national income and product accounts, rather than the balance of payments data, to determine the *control magnitudes* for *total* imports and exports.

Exports are the easiest to take into account in the SAM. Exports from the national accounts are already denominated in units of local currency and thus can be inserted into the first row of the SAM that shows the income of firms. But first note that in an open economy, the entries for consumption, investment and government represent a mix of domestically produced goods and imports competing with those goods. Often consumers of goods are unaware of the origin of their goods and for this reason imports are *subtracted* in the GDP expression.

Knowing which imports are competitive, that is, which are close substitutes for domestically produced goods, is tricky and often boils down to a matter of judgement. Some cases are clear; poor African, Latin American or Asian countries import computers but produce none domestically and thus computers are clearly *noncompetitive* imports. But what about a food crop like wheat that competes with domestic rice but lacks complete substitutability? This is, obviously, less clear and depends ultimately upon the judgement of the author of the SAM.

One convenient, but ultimately arbitrary, way to proceed is to assume all consumer imports are *competitive*, while intermediate and capital goods are *non-competitive*. This breakdown is often provided by the Central Bank or Ministry of the Exterior as they seek to classify imports for the balance of payments. A typical data set drawn from the *Central Bank of Paraguay* is given in the Table 4.1 below:

Table Imports by Economic Classification for Paraguay, 1995 (USD x 10^{-3})

Consumer Goods	1,317,560
Non-Durable	968,820
Food	156,893
Other	811,927
Durable	348,740
Automobiles	123,178
Other	225,562
Intermediate Goods	504,347
Fuel	191,612
Other	312,735
Capital Goods	974,997
Machinery	629,365
Transportation	235,039
Other	110,593
Total	2,796,904

Source: [1], p. 81.

The GDP accounts for Paraguay in 1995 are

National Income and Product Accounts (1995)

Y	C	I	G	E	M
17,699	15,089	4,235	1,276	6,164	9,065

Source: [2], p. 11.

The first step is to enter consumption from the national accounts in cell $C4$, 15,089 from 4. This amount includes imports, both competitive and thus must be corrected if it is to show the amount of consumption that is satisfied by domestic firms. The same is true of the other components of aggregate demand, at least investment and government expenditure. As a first approximation, the amount we allocate to noncompetitive imports for households is simply zero; that is, we assume all imports are competitive. For most countries this assumption is simply inaccurate since at least *foreign tourism* should be counted as noncompetitive imports. Here, the Paraguayan data is not sufficiently detailed to support the distinction. In the SAM of Table **??** shows that consumption satisfied by domestic firms is the same 15,089 less consumption's share of competitive imports 4,270 that are mixed in with investment and government expenditure as well.

Our reference data does allow us to split investment into private and public in this SAM with the totals shown in cells $D16$ and $E16$. Total noncompetitive imports is split between public and private investment in proportion to their totals and are shown in cells $D13$ and $E14$. Now the sum of private and public investment together with the imported component of investment should agree with the national accounts, $4,235$.

Table 4.1 presents a breakdown of public sector spending with purchase of goods and services, separated from transfers, interest payments and remuneration of labor. In the particular of case of the data from Paraguay, the government and national income accounts are consistent, that is, we have $G = 1,276$ which just the sum of goods and services of 501 and government wages of 775. This is fortunate as noted above.

Table Government Accounts for Paraguay, 1995[1]

Income from all sources, taxes, etc.	$2,364$
Direct taxes on households	328
Indirect taxes	$1,527$
Taxes on corporate profits	438
Expenditure (current account)	$2,363$
Consumption of goods and services	501
Government employment	775
Subsidies to firms	309
Transfers to households	571
Primary surplus	516
Interest payments	14.6
Government savings	502
Investment	838
Public Sector Borrowing Requirement (PSBR)	336

Source: [2], p. 21,23. Note: 1. Current LCU (Guaranies) $x10^9$

In Table **??** government expenditure in the national income accounts includes purchases of domestically produced goods, shown in $F4$, and services, imports of goods and services as well as government wage payments in $F6$, interest and transfers, shown in $F7$ and $F8$ respectively. Noncompetitive imports in cell $F14$ are set to zero in this SAM simply because our data source does not distinguish between imported and domestically produced items in the consumption bundle of the government.

As noted above, exports can be inserted directly from the national accounts in cell $G4$ To calculate net exports in $I4$ we must now subtract competitive imports in $H4$. Using the rule suggested above, that as a first approximation, all consumer imports be considered competitive, we take the proportion of consumer to total imports from Table 4.1 and apply it the level of imports in the national accounts, The result is shown in cell $I4$ The balance of imports less competitive imports is noncompetitive and is placed in cell $J14$ as the sum of *noncompetitive imports.*

Imports of intermediate goods are shown in cell $B14$ and sum with noncompetitive imports of investment goods to the total shown in $J14$. Since noncompetitive imports less foreign transfers shown in $I8$ as 159, the *residual item,* foreign savings of $2,742$ is shown in $I9$, in the savings row and net export column.

<<Insert Excel SAM here>>

The next step is to calculate government savings consistent with Table 4.1. It is the difference between government income in cell $J10$ and government expenditure in column F. The entries in this column include government consumption of goods and services in cell $F4$ government wages in cell $F6$ interest payments in cell $F7$ and transfers in $F8$. Row 10 is the sum of all government payments, direct and indirect taxes less subsidies, import tariffs and government revenue from parastatal operations, in this case equal to zero. Total government income is $2,363$, seen in $J10$, while total expenditure is $501 + 1,360 = 1,861$. Government savings is then equal to 502, shown in cell $F9$, and determined residually by the expression shown, $I16 - I4 - I5$. We would also have subtracted noncompetitive imports in cell $F14$, had there been any.

Next we consider the income and expenditure balance of households. Household consumption is the largest item of expenditure given in cell $C4$, as noted above, while direct taxes are in cell $F11$. Household income is shown in row 5, which simply sums payments in rows 6,7 and 8. *Value added,* payment for factor services of labor and capital, is shown in $B6$. Household income is thus the sum of this value added, government payments to households in the form of wages, interest and transfers as well as *foreign transfers* of 158, shown in cell $I8$ Total household income appears in $J5$ and is $14,712$.

As with government, savings is the residual balancing item for the household row-column equality. Total income less consumption $15,089$ and direct taxes of 399 gives household savings of -774. The fact that household savings is *negative* is certainly a warning flag and must be investigated further. It would typically suggest that the figure for firm savings is inaccurate and indeed more savings

	Firms	HH	Investment public	Investment private	Govt	Exports	Comp Import	Net Exports	Total
Firms		**15,089**	**213**	**862**	**501**	**6,164**	**4,270**	**1,894**	**18,559**
Households	**13,194**				**1,360**			**158**	**14,712**
Value added	13,194				775		[G4-H4]		**13,969**
Interest		[C16-C9-C10-C14]			15	[I16-I4-I5]			**15**
Transfers					571			158	**729**
Savings	**1,766**	**-776**			**502**			**2,743**	**4,235**
Govt	**1,964**	**399**							**2,363**
Direct	438	399	[C16-C4-C10-C14]			[F16-F4-F5]			**837**
Indirect	1,527								**1,527**
Subsidies	1								**1**
Foreign	**1,635**		**625**	**2,535**					**4,795**
Total	**18,559**	**14,712**	**838**	**3,397**	**2,363**			**4,795**	

[J4] J[5] [J10] [J14]

sum of investment = savings

should be allocated to households. Similarly, there could be a problem with tax revenues, recorded incorrectly. Tax revenues may well be reported on a fiscal year basis or may even be projected and therefore fail to accurately account for taxes actually paid. Foreign transfers may also be incorrectly stated because of problems with the exchange rates, or coverage or other errors.

In this case, there is nothing evidently wrong with the savings as reported by the Central Bank of Paraguay. Negative savings was a topic of intense discussion in the country when it occurred and remains a problem in other countries which rapidly liberalize their current and capital accounts. As access to foreign goods and the borrowing with which to acquire them opens up, the urge to increase consumption is irresistible. Consequently, consumption turns negative. One interesting simulation, to be discussed in greater detail below, is to consider the track of the economy as savings rates recover and households must repay the accumulated debt.

We have left the income and expenditure balance for firms, the most complex, to the last. Gross firms savings is shown in $B9$ is part of *gross operating surplus* which includes profits, depreciation on capital equipment as well as retained earnings and is sometimes a published figure. Profits in our SAM are not split out of value added, and depreciation is subsumed in gross savings. Depreciation is usually accumulated in a sinking fund until new equipment must be purchased. In the published data, it is often the case that firm savings is combined with household savings to arrive a total figure for gross private savings. In the case of Paraguay, we are lucky enough to have information on undistributed profits from the published savings-investment balance as seen in Table 4.1.

Table Savings and Investment, Paraguay 1995[1]

Total investment	4,235
Change in inventories	152
Gross fixed investment	4,083
Firm savings	1,766
Undistributed profits	388
Depreciation	1,378
Household savings	−776
General government savings	502
Foreign savings	2,743
Total savings	4,235

Source: [2], p. .Note: 1. Current LCU (Guaranies) $x10^9$

Note that foreign savings in this table, $2,743$ is not the same as the difference between imports and exports in Table 4, 2901. This discrepancy raises an interesting question. Foreign savings is typically reported as the *current account deficit* in the balance of payments (i.e., the negative of the current account surplus). Usually the balance of payments are presented in U.S. dollar terms, and this can cause a discrepancy in reported values.

The difference, 158, is taken as foreign transfers and added to household income in cell $I5$. This insures that the savings-investment balance of the SAM matches, term by term, that of Table 4.1. We know this to be true since total investment in Table 4.1 does agree with the national accounts; hence, if foreign savings in the SAM is adjusted to Table 4.1, domestic savings must *per force* agree. Since government savings in the SAM matches Table 4.1 and we take firms savings as the sum of undistributed profits and depreciation from Table 4.1, the SAM residual is household savings and it must therefore agree with the savings-investment balance. If we believe the data for government savings, it is only necessary to split the balance of savings between households and firms. Capital consumption allowance might be a first approximation, if available, for *total* firms savings. Certainly aggregate depilation as captured in the capital consumption allowance number might well overstate *economic* depreciation, but the difference can just be although of as an admittedly crude estimate of undistributed profits.

Table 4.1 is an example of ancillary material that can often be used to refine a SAM. But what if we did not have the savings-investment balance of Table 4.1? In that case, our best option would have been to use foreign *transfers* from the balance of payments data (in U.S. dollars) converted at the official or some more appropriate exchange rate, so that the foreign savings came into line with the current account deficit, or at least approximately so. The official exchange rate was 1.973 in 1995 [2]. Using the balance of payments as published by the IMF, this gives foreign transfers of much more, some 385.3. Perhaps the difference goes to explain the negative households savings, at least in part.

Balance of Payments 1995[1]			
Exports	4,218.6		
Imports	4,489		
Services	−126.9		
Balance on goods and services		−387.3	
Factor Income		109.7	
Transfers		195.3	
	Current account		−92.3
Financial account		243.1	
Errors and omissions		−106.1	
	Capital account		137.1
	Change in reserves		44.8

Source: [6]. Note: 1. Current FCU (USD) $x10^6$

The rest of this table certainly does *not* agree with the foregoing analysis and we choose the savings-investment data over the balance of payments largely as a matter of judgement. The negative savings of households suggests that this may not be the right course. The SAM underestimates exports significantly *vis-a-vis* the balance of payments. This would generate higher GDP, more value added and greater savings for households. The discrepancy in the data is generally attributed to smuggling of contraband from Paraguay under the protective tariff walls of Brazil.

5. References

References

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