2. Social Accounting

1. Introduction

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, between firms and households, complicated by the presence of government and foreigners. The design of SAMs respects 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 in themselves are not present in the SAM but the payments made by firms to their owners are.

A SAM is not usually considered a model in itself but rather provides the *data* for macromodels in a convenient, one-stop, format.[1] SAMs are available for many countries and (for some countries) for several years, but are often elusive.[2]. They are sometimes published but then often are not considered to be of publishable quality because of the data problems encountered in their construction. One reason is that the combine information from many sources, the national accounts, balance of payments, fiscal balances as well as industrial surveys and a wide variety of "informal" data sources. When these data conflict, there may be no obvious way to say which should take priority. There will more to say on this issue below.

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 in the economy, they are easiest to understand when their rows and columns are ordered so that the first row-column pair corresponds to the first agent and so on. In this way, the *ith* row and *ith* column would correspond to the income and expenditure, respectively, of the *ith* agent. Unfortunately, not all authors follow this (or any other) convention and so SAMs 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 nominal income *flows* accounted for over some period of time, usually a year. If the year for which is the SAM is constructed is also consider the *base year* the SAM is also, by definition, in *real* terms.[3]

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[1]The definition of a model in Chapter 1 could be satisified by a SAM in that for each row-colum balance, one endogenous variable could be determined. This is a model, just not a very interesting or historically important one.

[2]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.

[3]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 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 firms, households, government and foreign.

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. Firm *income* derives from sales to *all* agents of the SAM (including other firms) and is shown in the rows corresponding to firms, usually the first. Firm *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. Household *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 derives most of its *income* from taxes. Government 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.

These are the principal agents in most SAMs but sometimes agents are broken down into "institutions" and "factors." This can be confusing, because while institutions are easily recognizeable and correspond to real entities in the economy, the category factors is more abstract. Strictly speaking, factors are not agents, but what agents own. In SAM accounting factors act is a fictional clearing house; factor income is gathered from firms and other sources and is then paid out to households or other recipients. Many SAMs include factors as separate categories, but the ones considered in this chapter will not and will therefore have at most four agents. It is a simplification, for sure, but also maintains a fairly strict correspondence between agents and the row-column pairs of the SAM.

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 1. *A Republican Paradise*

It is easiest to construct a SAM in Excel and the examples will assume basic navigational familiarity with spreadsheet mechanics. Let us begin with a SAM for a Republican Paradise Economy. Here, there is no government and no foreign trade; only firms and consumers. Although the

TABLE 2.1. A small SAM

	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	

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 by the factors of production; C = consumption by households, I = investment by both firms and households. 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 2.1.

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 $E2$ 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 $B5$ and $C5$. It is easiest to then define cell $B5$ as $= E2$ and $C5$ as $= E3$. This effectively insures that we have row-column equality for each agent but so far there is no guarantee that the column B or C actually adds up to the total as indicated in the SAM. To ensure that it does, the savings entry in $C4$ can be defined as a *residual,* that is as $= C5 - C2$. A simple numerical example is shown in Table 2.2 for an economy in which we know from other sources that consumption is equal to 80 and investment is 10.

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

TABLE 2.2. A numerical example of a small SAM

	A	*B*	*C*	*D*	*E*
1		Firms	Households	Investment	Total
2	Firms		80	10	$= sum(C2 : D2)$
3	HH	$= B5$			$= B3$
4	Savings		$= C5 - C2$		$= C4$
5	Total	$= E2$	$= E3$	$= D2$	

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 $C4$.

This first SAM serves more of a theoretical purpose rather than as data base for a real model. Simple SAMs need not be constructed for essentially theoretical arguments, of course, but it is often convenient, as we shall see, to represent the data of the theoretical model in such a compact way.

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 [4]:

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

that is *the sum of the row sums* is equal to the *sum of the column sums.* It is this principle that will guarantee that the sum of savings (for agents) is equal to investment.

[4]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.

EXAMPLE 2. *Example: Consider the* 2×2 *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 5×5 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 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.

3.2. Government. To include government, we need only to add a row and colum as done in Table 2.3. There, T_f in cell $B5$ is a sum of all taxes paid by firms, while T_h in $C5$ is that paid by households. These sum to total taxes in $F5$. Here there are no investment taxes, but there could be, and goverment does not tax itself.

In the expenditue column, cell $E2$ list government current consumption expenditure. Because this entry in the government column is also in the firm row, it must be government expenditure *satisfied by domestic firms.* When the government demands labor services from households, it pays W_g. Households also receive direct transfers from the government, T_r. Savings of the government is the residual difference between total tax income, T, and expenditure, $G + W_g + S_g$.

TABLE 2.3. A SAM with government

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

TABLE 2.4. A four-agent SAM

	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	
8							

To add foreign, we divide imports into competitive versus noncompetitive, as discussed above. Firms, households and government then consume a combination of locally produced goods provided by domestic firms and competitive imports. Direct, noncompetitive imports are then allocated to each of the agents, firms, households and government. Foreign savings, S^*, is defined as the difference between incomes (noncompetitive imports) and expenditure, exports net of competitive imports. Foreign savings is just the trade deficit.[5]. The following example includes both government and foreign.

EXAMPLE 3. *Show that the sum of savings is equal to investment in a one sector economy with four agents, firms, households, government and foreign. The SAM is shown in Table 2.4where* C = *consumption,* I_d =

[5]Note the subtle difference in how the terms are defined. Government savings is *the negative of* the deficit, while foreign savings *is* the trade deficit.

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

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

To show that Walras's law holds, sum the left-hand side of these four equations to obtain the row sums. The sum of the right-hand side is the column sums. Now cancel like terms on both sides. We are left with:

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

Investment is equal to the sum of savings if each individual agent is in income-expenditure balance. As noted above, this mathematical property of matrices is interpreted in economics as 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.

TABLE 2.5. Example SAM

	A	B	C	D	E	F	G	H	I	J
1			Firms		Households					
2		Cocos	Corn	Fish	Wilson	Hanks	Investment	Government	Foreign	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	
12										

EXAMPLE 4. *A Simple Hanks-Wilson 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 several important reasons: first there is no money in Hank's economy. This means that the government cannot run a deficit (it can run a surplus). Second, what Hanks saves, Hanks invests. Savings and investment are not undertaken by different individuals. Although Wilson is never actually seen doing any work in the film, we quite liberally assume the following social structure: 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). Households goods, fish, cocos and corn, have utility for Hanks and Wilson. Hanks owns the firms; he hires Wilson, pays him a wage. 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 1 coco, 2 corn and 2 fish. Foreign: firms trade goods with neighboring island. Fish is exchanged for salt. The SAM for this is island economy is shown in Table 2.5 and is differs from Table 2.4 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 think of the quantities in Table 2.5 as in either physical or value terms. Note first that there are seven agents in this model: three firms, two households, government and foreign. 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 is in income-expenditure balance. A few special 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 will only worsen over time, since as just noted, Wilson does not save and therefore cannot not accumulate assets. We will have to see if this is really true in the next chapter. We have the following national income and product accounts (NIPA) 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:* $Y = C + I + G + X - M = 32 + 10 + 5 + 3 - 3 = 47$*. (2) Gross Domestic Product by Industry is broken down as follows: Gross domestic product is equal to gross value added, the sum of wages, profits, taxes and noncompetitive imports. It might be easier just to take the gross value of production and subtract intermediate goods. In either case, we have: 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.* $GNP = 47 - 17 = 30$.

As has been noted, 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 with behavioral equations. Without a more detailed 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 that is covered in more detail in the next chapters.

TABLE 2.6. National accounts

By Expenditure		By Product		Value Added	
Consumption	32	Cocos	7	Wages	17
Investment	10	Fish	24	Profits	25
Government	5	Corn	11	Government	5
Exports	32	Govt	5		
Imports	−3				
TotalGDP	47		47		47
GNP	30				

TABLE 2.7. SAM for Hanks-Wilson

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
1			Firms		Households					
2		Cocos	Corn	Fish	Wilson	Hanks	Investment	Government	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	
12										

EXAMPLE 5. *Assume that the SAM above is for a given base year. In the following year, exports double with no change in prices. The SAM for the second year is shown in Table 2.7. 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*, 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. 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 this component of 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 up and up 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 and evidently this would have achieved the same effect in slowing down income growth. As exports grow and with it demand and production, firms do not pay out the full increase in value added to the households.*

TABLE 2.8. GDP accounts

GDP	520
Consumption	384
Investment	90
Goverenment expenditure	46

Source: NIPA

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 simple story, a rising tide does indeed lift all boats. But this cannot be a complete story of the how the SAM adjusts since we still lack a full model of the process. But no matter what that model is, it should be roughly consistent with the observations in this second SAM. If not policymakers will justifiably be concerned. Are they getting advice from a model that makes sense? There must be more to the story.

4. Constructing a basic SAM for a Closed Economy

In this and the following sections, we transition from imaginary economies to real ones and address the problem of how to construct a SAM from actual data. 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

We take 2000 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 2.9. Government accounts

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)	25

Source: Ministry of Finance.

The first step in constructing the SAM is put these data from the NIPA in Table 2.8 and the government accounts 2.9 into the matrix of Table 2.10. 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. Interest payments are not included. From Table 2.9 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 2.9 in cell $F37$

TABLE 2.10. A SAM, closed economy

	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	
7						

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 $F5$. Government savings is the residual, that is 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 2.9 also shows government transfers to households as 8 and thus savings would be -13 as shown in the SAM in Table 2.10, cell $E4$. This negative government savings is, as noted, 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.

With government income set to match the level in Table 2.9 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. If the national accounts shows government investment, the PSBR will not agree with the number published by the Ministry of Finance. From a finance perspective, the national accounts PSBR will be incorrect, since it does not measure the impact the government will have on financial market, which is the reason the PSBR is of interest in the first place. But consider a capital transfer from the Ministry of Finance to an NGO. This has to be covered by the borrowing by the government in the capital market but on behalf of the NGO. From a national accounts perspective, it is clearly incorrect to count the project twice, once for NGO and second from the government. The double counting is usually caught and eliminated by those responsible for the national accounts. If NGOs are counted in the private sector investment total, the fault is really with the way in which the national accounts are compiled. Since the ultimately liability for the loan resides with the government, the investment is in fact public sector investment in all but name. 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 investment does indeed include some double-counting is still an important concern, but PSBR will nonetheless agree with the published number. Note that it is preciesely this potential for double counting that required that we use the figure of 46 for G instead of 48 as reported by the Ministry of Finance.

With the government accounts now integrated into the national income and product accounts, we can complete the SAM in Table 2.11. Total value added must be equal to GDP, here 511. From this we subtract firm savings at a "guesstimated" 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

TABLE 2.11. A SAM for 2000

	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	90	52	
7						

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 2.11), 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 boldface.

To get total household income of 447 we 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.

Can we check our work so far? Note that the calculation of household saving produces 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 outside 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 add to both income and expenditure of firms leaving firm savings and therefore value added by households untouched. In the final SAM of this chapter, we estimate that intermediate goods are 25% of GDP and so 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, as we have seen. 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. In order to keep the SAM consistent with that NIPA, we take the *control magnitudes* for *total* imports and exports from the national accounts, rather than the balance of payments data. This avoids the problem of having to convert balance of payments data from U.S. dollars to local currency units, especially when the national accounts office has already done it.

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, as income for firms. Imports are more difficult to handle. We begin by splitting imports into competitive and noncompetitive. 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 to get final demand satisified by domestic producers.

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 authors 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 *noncompetitive*. 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 2.12 below:

We will use the percentage shown in the final column on the left to distribute total imports between competitive and noncompetitive.

TABLE 2.12. Imports, Paraguay (1995)

	1995 (USD $\times 10^{-6}$)	%
Consumer Goods	1,317.6	47.1
Non-Durable	968.8	34.6
Food	156.9	5.6
Other	811.9	29.0
Durable	348.7	29.0
Automobiles	123.2	4.4
Other	225.6	8.1
Intermediate Goods	504.4	18.0
Fuel	191.6	6.9
Other	312.7	11.2
Capital Goods	975.0	34.9
Machinery	629.4	22.5
Transportation	235.0	8.4
Other	110.6	4.0
Total	2,796.9	100.0

Source: [**1**], p. 81.

TABLE 2.13. GDP Accounts, Paraguay (2000)

	Current LCU $\times 10^{-9}$
Gross domesitic product	17,699
Consumption	15,089
Investment	4,235
Public	838
Private	3,397
Government	1,276
Exports	6,164
Imports	9,065

Source: [**2**], p. 11

The GDP accounts are given in Table **??**

TABLE 2.14. Government Accounts, Paraguay (2000)

	Current LCU $\times 10^{-9}$
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.

Finally the government accounts are shown in Table 2.14 below:

The first step in constructing the SAM is to enter consumption from the national accounts in cell $C4$ in the preliminary Table 2.15 , 15,089 from 2.8. This "hard number" is shown in the table in normal font to distinquish it from the results of a calculation, shown in the table in italics. This amount includes imports, both competitive and thus must be corrected if it is to show the amount of consumption 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 data is not sufficiently detailed to support the distinction. We then take the proportion of consumer to total imports from Table 2.12, 47.1%, and apply it the level of imports 9,065 in Table **??** to find 4,270, which is then inserted into the SAM at $H4$. The remainder of total imports, 4,795, is shown in cell $J14$ as the sum of *noncompetitive imports.* 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 $H4$. In the SAM of Table 2.15 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 for investment 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 2.14 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 2.15 shows that no noncompetitive imports are allocated to government; this is unlikely since at a minimum, foreign interest payments made by any agency of the government should be included here. In Table 2.15 government expenditure in the national income accounts includes purchases of domestically produced goods and services, shown in $F4$, as well as government wage payments in $F6$, domestic interest and transfers, shown in $F7$ and $F8$ respectively. Imports of intermediate goods are determined as a residual of the row total, $4,795$ and list as 1,635 in cell $B14$. This guarantees that the sum of noncompetitive imports shown in $J14$ is respected.

The total *gross value of production* in cell $J4$ is then entered in $B16$, simply using the expression $= J4$. To ensure the column sum is in fact 18,599, we take Value added in cell $B6$ as a residual, determined by the expression shown to the immediate right, [B16-B9-B10-B14]. This implies that firm savings, 1,766 must either be given as a hard number from the data or determined by as a row residual. The same is true for the government and foreign entries in column B since, at most, there can only be one residual for each colum and one for each row. As jus noted, in column B the foreign entry is determined as a residual The government row is shown as the result of a calculatation (in italics)

TABLE 2.15. SAM, Paraguay (2000)

	A	B	C	D	E	F	G	H	I	J	K
1		Firms	HH	Investment		Govt	Gross	Comp	Net	Total	
2				Public	Private		Exports	Import	Exports		
3											
4	Firms		15,089	213	862	501	6,164	4,270	*1,894*	*18,599*	
5	Households					*1,360*		[=G4–H4] ↗	158	*14,712*	
6	Value added	*13,194*	⟵[=B16-B9-B10-B14]			775	↖ [=F6+F7+F8]		[=sum(B5:I5)] ↗	*775*	
7	Interest					15				*15*	
8	Transfers					571			158	*729*	
9	Savings	1,766	*-775*	⟵[=C16-C4-C9-C10]		*502*	⟵[=F16-F4-F5]		[=sum(B8:I8)] ↗		
10	Govt	*1,964*	*399*	⟵[=C11+C12-C13]						*2,363*	
11	Direct tax	438	399								
12	Indirect tax	1,527									
13	Subsidies	1									
14	Foreign	*1,635*	0	625	2,535	0				*4,795*	
15											
16	Total	*18,559*	*14,712*			*2,363*					
17			↖ [=J4]	↖ [=J5]			↖ [=J10]				

The next step is to calculate government savings and see if it is consistent with Table 2.14. The first step is to force the government column total in $G16$ to equal the government row total by writing $= J10$ in cell $F16$. Row 10 is the sum of all government payments, direct and indirect taxes less subsidies, import tariffs and government revenue from parastatal operations. The entries in the government column include government consumption of goods and services in cell $F4$ government wages in cell $F6$ interest payments in cell $F7$ and transfers in $F8$. Government savings is then the difference between government income in cell $F16$ and the rest of government expenditure in column F. Total government income is $2,363$,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, $= F16 - F4 - F5$. We would also have subtracted noncompetitive imports in cell $F14$, had there been any.

TABLE 2.16. SAM, Paraguay (2000), con't

	A	B	C	D	E	F	G	H	I	J	K
1		Firms	HH	Investment		Govt	Gross	Comp	Net	Total	
2				Public	Private		Exports	Import	Exports		
3											
4	Firms		15,089	213	862	501	6,164	4,270	*1,894*	*18,559*	
5	Households	*13,194*				*1,360*			*158*	*14,713*	
6	Value added	*13,194*				775				*13,969*	
7	Interest					15				*15*	
8	Transfers					571			158	*730*	
9	Savings	1,766	*-775*			*502*			*2,743*	*4,235*	
10	Govt	*1,964*	*399*							*2,363*	
11	Direct	438	399							*837*	
12	Indirect	1,527								*1,527*	
13	Subsidies	1								*1*	
14	Foreign	*1,635*	0	625	2,535	0				*4,795*	
15											
16	Total	*18,559*	*14,713*	*838*	*3,397*	*2,363*			*4,795*		
17											

Next we consider the income and expenditure balance of households in the the final version of the SAM shown in Table 2.16 Household consumption is in cell $C4$, as noted above, while direct taxes are in cell $C11$. Household income is shown in row 5, which simply sums *value added,* or payment for factor services of labor and capital, as 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 $14,713$.

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 will be investigated further. It would typically suggest that the figure for firm savings is inaccurate and indeed more 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. 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.

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, 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

TABLE 2.17. Savings and Investment, Paraguay (1995)

	Current LCU $\times 10^{-9}$
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. ??

of Paraguay, we are lucky enough to have information on undistributed profits, of 388, from the published savings-investment balance as seen in Table 2.17. This is added to depreciation to give total firms savings of 1,766, shown in $B9$ of Table 2.15.

Note that foreign savings in this table, 2,743 is not the same as the difference between imports and exports in Table 2.8, 2,901. 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, $2,901 - 2,743 = 158$, is taken as foreign transfers and added to household income in cell $I5$, treated as a hard number. This insures that the savings-investment balance of the SAM matches, term by term, that of Table 2.17. We know this to be true since total investment in Table 2.17 does agree with the national accounts; hence, if foreign savings in the SAM is adjusted to Table 2.17, domestic savings must *per force* agree. Since government savings in the SAM matches Table 2.17 and we take firms savings as the sum of undistributed profits and depreciation from Table 2.17, 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

TABLE 2.18. Balance of Payments, Paraguay (1995)

		USD $\times 10^{-6}$
Exports	4,218.6	
Imports	4,489.0	
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**].

balance of savings between households and firms. Capital consumption allowance might be a first approximation, if available, for *total* firms savings. Certainly aggregate depreciation 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 2.17 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 2.17? 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, shown in 2.18,this gives foreign transfers of more, 385.3. Perhaps the difference goes to explain the negative households savings, at least in part.

The rest of Table 2.18 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. Conclusion

We now have a SAM to work with in the following chapters. The going has been rough in places and it is certainly necessary to remind the reader that the methods described here are only one way of putting the SAM together. We have traced through the procedure, using a combination of common sense and the basic idea that there is one residual for every agent's row-column balance. The methodololgy described in this chapter produces a consistent, but not unique estimate of the social accounting matrix. But internal consistency, as we have seen, is far from the only goal of the exercise. Above all the SAM must reproduce familiar data faithfully, so that policymakers can "see" their economies in the data. If this goal is not met, the excerise will be useless and the recommendations based on it will fall on deaf ears.

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