SAM for the standard CGE model is used as an example. Section 4.3 demonstrates the actual construction of a SAM for Japan based on the IO tables for 2000.

Section 4.4 deals with the problems often encountered in the construction of a SAM. There are two problems. The first problem is caused by missing data because of statistical imperfection or statistical discrepancy. The second problem is related to the timing of construction of the IO tables, which are the main components of a SAM. As the IO tables are constructed, at most, once every several years, we often have to use IO tables that are several years old. To fix statistical discrepancies in old SAMs or to update them, it is necessary sometimes to conduct matrix adjustments for SAMs, whose methods are explained in Section 4.4.

4.1 Structure of social accounting matrix

As discussed above, CGE models are used to analyse economic activities, which are transactions involving goods and factors, and the concurrent flows of funds between agents in an economy. The latter can be considered as a mirror image of the former (or, vice versa).

The knots of the transactions, or their starting points and ending points, can be categorized as 'Activity', 'Factor', 'Indirect Tax', 'Final Demand' and 'External'. These knots are termed agents in the following explanation.[1] A SAM describes transactions by these agents. In this categorization, 'External' (i.e., exports and imports) is conveniently treated as separated from the domestic final users in 'Final Demand', although the former is part of the latter. Depending on the needs of the analysis, these agents can be merged into broader ones or divided into narrower ones.

The SAM is written in a matrix-form table. The agents specified above are used as both row labels and column labels. (Thus, the matrix is square.) The entries in a SAM indicate flows of goods and services from the agents listed in the rows to the counterpart agents listed in the columns. The corresponding payments (or the flows of funds) are made in the opposite direction. Hereinafter, the names of each entry in the table are referred to as 'row label'–'column label' in this order.

4.1.1 Social accounting matrix for the simple CGE model

As the simple CGE model shown in Chapter 2 consists of one household and two firms with two goods and two factors, its SAM has only 'Activity', 'Factor' and 'Final Demand'.[2] The SAM of the simple CGE model is shown in Table 4.1.[3] In this SAM, 'Activity' is subdivided into the bread sector

Table 4.1 SAM for the simple CGE model

		Activity		Factor		Final Demand	Total
		BRD	MLK	CAP	LAB	HOH	
Activity	BRD					15	15
	MLK					35	35
Factor	CAP	5	20				25
	LAB	10	15				25
Final Demand	HOH			25	25		50
Total		15	35	25	25	50	

Unit: yen

and the milk sector; 'Factor' is subdivided into capital and labour. In this simple model, we do not include a government, investment, indirect taxes and foreign trade; thus, only household consumption constitutes 'Final Demand'.

Activity and final demand (household)

The cell labelled 'BRD'–'HOH' in Table 4.1 shows that the bread producer receives 15 yen from the household. In return, the bread producer supplies bread worth 15 yen to the household. The other side of the coin is that the household spends 15 yen to purchase bread worth 15 yen. Similarly, the cell 'MLK'–'HOH' implies that there is a transaction involving the exchange of 35 yen and milk worth 35 yen between the milk producer and the household.

Factors and activity

'Factor' consists of capital and labour, which are used for 'Activity'. These transactions are shown in the cells in the 'Factor' row and the 'Activity' column. For example, the cell 'CAP'–'BRD' shows that the capital holder earns five yen in exchange for capital services provided to the bread sector. The 'LAB'–'BRD' cell shows a similar exchange of labour services for 10 yen between the labour holder and the bread sector.

Final demand (by the household) and factors

It will be easy to understand if we interpret the 'Factor' rows/columns as a virtual management agent of factors. This factor management agent is commissioned by other agents (in this case, the household) to provide their factors to 'Activity' (in this case, bread and milk) and to receive the factor income on behalf of the household (in this case). The former part

of the factor payment process is shown, for example, in the 'CAP'–'BRD' cell, which has already been explained. The latter part of the commission process is represented by the 'HOH'–'CAP' and 'HOH'–'LAB' cells. These cells mean that the household receives 25 yen for capital and 25 yen for labour from the virtual factor management agent (i.e., 'Factor'). In return, the 'Final Demand' sector provides those factors to the management agent. (This example shows that the capital payments are equal to the labour payments; however, this is coincidental.)

Row sums and column sums

The row sums and the column sums in the SAM show the total receipts and the total payments of funds respectively, and each row sum must match its corresponding column sum. For example, the row sum of 'HOH' is the total amount of funds received from the factor management agent by the household; the column sum of 'HOH' is the total amount of funds paid by the household for its purchase of goods. Both totals sum to 50 yen.

Returning to the 'Activity' block, the row sum of 'BRD', i.e., 15 yen, is the money the bread producer receives from the household to the bread producer. Conversely, the column sum of 'BRD', i.e., 15 yen, is the total production cost of the bread producer. This is also the case for the milk producer. The equality between each row sum and its corresponding column sum suggests that all the goods produced and all the factors endowed in this economy are used up.

As stated previously, the IO tables are the main components of a SAM. The shadowed cells of the SAM in Table 4.1 can be found in the corresponding IO tables. How to derive data for the cells other than the shadowed ones is explained in detail in Section 4.2.

Concerning the composition of a SAM, the order of row and column entries can be freely arranged, and row/column entries can be added depending on the purpose of analysis and data availability. We often develop a SAM and consequently a CGE model with 10 or more sectors in 'Activity' and several household types in 'Final Demand'. We can also incorporate a government and taxes, and international trade with import tariffs and export subsidies. In the next subsection, the SAM for the standard CGE model is explained.

4.1.2 SAM for the standard CGE model

Here we present the SAM for the standard CGE model, which is an extension of the simple CGE model. The standard CGE model, into which a government, investment and savings, international trade and

Table 4.2 SAM for the standard CGE model

		Activity		Factor		Indirect Tax		Final Demand			External	Total
		BRD	MLK	CAP	LAB	IDT	TRF	HOH	GOV	INV	EXT	
Activity	BRD	21	8					20	19	16	8	92
	MLK	17	9					30	14	15	4	89
Factor	CAP	20	30									50
	LAB	15	25									40
Indirect Tax	IDT	5	4									9
	TRF	1	2									3
Final Demand	HOH			50	40							90
	GOV					9	3	23				35
	INV							17	2		12	31
External	EXT	13	11									24
Total		92	89	50	40	9	3	90	35	31	24	

Unit: yen

intermediate inputs are incorporated, will be developed fully in Chapter 6; however, its SAM is discussed here in advance for convenience of explanation. This SAM is shown in Table 4.2.

To accommodate a government, and investment and savings, we create two more virtual agents, similar to the virtual factor management agent, explained in Subsection 4.1.1. The first virtual agent, similar to tax and customs offices, is termed a virtual tax and customs agent, which is separate from the government itself. This virtual agent collects indirect taxes (production taxes in this section) and import tariffs, and transfers the tax revenue to the government. The second virtual agent is similar to an investment agent, which accepts savings from the household, the government and the external sector to purchase goods for domestic investment. In the following part, we explain Table 4.2, focusing on these new entries in the SAM of the standard CGE model.

Activity

'Activity' includes intermediate inputs in addition to the capital and labour input originally considered in Table 4.1. The intermediate input of bread and milk production appears in the 'Activity'–'Activity' cells. This example shows that bread worth 21 yen and milk worth 17 yen are used as intermediate inputs for the bread production. The intermediate inputs for the milk production can be interpreted in the same manner.

Table 4.3.A SAM for the standard CGE model – using data from IO tables

		Activity		Factor		Indirect Tax		Final Demand			External	Total
		BRD	MLK	CAP	LAB	IDT	TRF	HOH	GOV	INV	EXT	
Activity	BRD	21	8					20	19	16	8	92
	MLK	17	9					30	14	15	4	89
Factor	CAP	20	30									50
	LAB	15	25									40
Indirect	IDT	5	4									9
Tax	TRF	1	2									3
Final	HOH											0
Demand	GOV											0
	INV											0
External	EXT	13	11									24
Total		92	89	0	0	0	0	50	33	31	12	

Unit: yen

SAM are empty, the row-sum and column-sum equality rule does not hold for the rows and the columns other than those located in the 'Activity' block.

Let us consider the cells that can be filled immediately by applying the row-sum and column-sum equality rule. First, as the row sums of capital and labour are 50 yen and 40 yen, the corresponding blank cells of 'HOH'–'CAP' and 'HOH'–'LAB' indicating factor income must be 50 yen and 40 yen (Table 4.3.B).[7] In the same way, we can determine the total production tax and import tariff revenues transferred from the tax and customs agent to the government. Total production tax revenues appear in the row sum of 'IDT' (nine yen), which is transferred only to the government; thus, this receipt of production tax revenues of nine yen should be put in the 'GOV'–'IDT' cell. Similarly, total import tariff revenues appear in the row sum of 'TRF' (three yen), which is transferred only to the government; thus, three yen should be put in the 'GOV'–'TRF' cell. By following this procedure we obtain Table 4.3.B.

In the same manner, we can compute the current account deficit by subtracting total exports shown in Table 4.3.A (12 yen, shown by the sum of the shadowed cells in the 'EXT' column) from total imports (24 yen, shown by the sum of the shadowed cells in the 'EXT' rows). The current account deficit equals foreign savings, which are put in the 'INV'–'EXT' cell. Then, Table 4.3.C is attained.

Table 4.3.B SAM for the standard CGE model – filling the cells for household factor income and indirect tax revenues

		Activity		Factor		Indirect Tax		Final Demand			External	Total
		BRD	MLK	CAP	LAB	IDT	TRF	HOH	GOV	INV	EXT	
Activity	BRD	21	8					20	19	16	8	92
	MLK	17	9					30	14	15	4	89
Factor	CAP	20	30									50
	LAB	15	25									40
Indirect	IDT	5	4									9
Tax	TRF	1	2									3
Final	HOH			50	40							90
Demand	GOV					9	3					12
	INV											0
External	EXT	13	11									24
Total		92	89	50	40	9	3	50	33	31	12	

Unit: yen

Table 4.3.C SAM for the standard CGE model – filling the cells for the current account deficits

		Activity		Factor		Indirect Tax		Final Demand			External	Total
		BRD	MLK	CAP	LAB	IDT	TRF	HOH	GOV	INV	EXT	
Activity	BRD	21	8					20	19	16	8	92
	MLK	17	9					30	14	15	4	89
Factor	CAP	20	30									50
	LAB	15	25									40
Indirect	IDT	5	4									9
Tax	TRF	1	2									3
Final	HOH			50	40							90
Demand	GOV					9	3					12
	INV										12	12
External	EXT	13	11									24
Total		92	89	50	40	9	3	50	33	31	24	

Unit: yen

There are three accounts that show imbalances between their receipts and payments of funds in Table 4.3.C: the household, the government and the investment. The flows of funds involving these agents are typically supposed to appear in the following three cells: direct tax payments by the household to the government ('GOV'–'HOH') and

Table 4.3.D SAM for the standard CGE model – three cells left unfilled

		Activity		Factor		Indirect Tax		Final Demand			External	Total
		BRD	MLK	CAP	LAB	IDT	TRF	HOH	GOV	INV	EXT	
Activity	BRD	21	8					20	19	16	8	92
	MLK	17	9					30	14	15	4	89
Factor	CAP	20	30									50
	LAB	15	25									40
Indirect	IDT	5	4									9
Tax	TRF	1	2									3
Final	HOH			50	40							90
Demand	GOV					9	3					12
	INV										12	12
External	EXT	13	11									24
Total		92	89	50	40	9	3	50	33	31	24	

Unit: yen

transfers of funds by the household and the government to the investment ('INV'–'HOH' and 'INV'–'GOV'). (These cells are shadowed in Table 4.3.D). However, these cells cannot be filled using only the row-sum and column-sum equality rule. We need an additional technique.

If one of these three unknown cells can be filled by some means, the other two cells are filled by applying the same technique employed so far. Here, by seeking data sources other than the IO tables (for example, the national account tables), we may be able to determine direct tax revenues. If that value can be determined, it is entered into the 'GOV'–'HOH' cell. (In addition to the value of direct taxes, values for one of the other two cells may be available. In such a case, the selection of the first datum to be filled should be made in consideration of the reliability of the data sources.) Assuming that direct tax revenue is 23 yen, the SAM is shown in Table 4.3.E. The other two cells are mechanically filled as previously demonstrated. Finally, we complete the compilation of our SAM as shown in Table 4.2.

4.3 Example: Social accounting matrix for Japan

To demonstrate how the above-mentioned process can be applied to construction of a SAM with actual data, we construct a SAM for Japan.[8] In empirical studies, the objective of the study is usually decided first and then the specification of the most suitable model is determined,

Table 4.3.E SAM for the standard CGE model – filling a cell using external data sources

		Activity		Factor		Indirect Tax		Final Demand			External	Total
		BRD	MLK	CAP	LAB	IDT	TRF	HOH	GOV	INV	EXT	
Activity	BRD	21	8					20	19	16	8	92
	MLK	17	9					30	14	15	4	89
Factor	CAP	20	30									50
	LAB	15	25									40
Indirect	IDT	5	4									9
Tax	TRF	1	2									3
Final	HOH			50	40							90
Demand	GOV					9	3	23				35
	INV										12	12
External	EXT	13	11									24
Total		92	89	50	40	9	3	73	33	31	24	

Unit: yen

encompassing sectoral aggregation, agents, policy devices and so on. However, just for demonstration purposes, we skip these processes and simply concentrate upon the construction of a SAM.

To simplify the model, we distinguish between three production activities: agriculture, manufacturing and services (hereinafter, they are abbreviated as AGR, MAN and SRV in the SAM); and two production factors: capital and labour. There is only one representative household as well as the government, the investment and the external sector. The base year is set at 2000.[9] In addition to the IO tables, the national account tables for 2000 are also available.[10] Among the IO tables with various sectoral aggregation levels – 517 × 405-sector tables and consolidated square tables with 13, 32, 104 and 188 sectors – we use the 13-sector table in this example.

The first task is to aggregate the 13-sector table into a 3-sector table for simplicity (Table 4.4). The IO table consists of the square part indicating intermediate inputs and outputs by agriculture (AGR), manufacturing (MAN) and service (SRV) sectors and the so-called overhangs; i.e., the entries outside of the square part. The lower overhang shows payments for factor uses (i.e., generation of value added), while the right-side overhang indicates final demand. While the aggregation of the square part is straightforward, special care is needed for the overhang parts. The