Chapter 6: Social Accounting Matrix and Computable General Equilibrium

6.1 Introduction

The Social Accounting Matrix (SAM) provides a framework for construction of the Computable General Equilibrium (CGE) model and is used as a database to be input in the CGE model. This chapter provides an overview of the developments in the application of SAM and CGE models with emphasis on Indonesia. Section 6.2 looks at the basic approaches to SAM as an equilibrium database. It also discusses briefly the recent developments in the applications of SAM models. In section 6.3, we discuss the basic form of the CGE model, the importance and advantage of CGE models, and the application of CGE modelling to the study of a variety of economic policies in developing countries. In this section, the earlier CGE models of the Indonesian economy are also reviewed in an effort to show how previous modellers have approached the specific features and problems of the economy.

6.2 Social Accounting Matrix

6.2.1 General Features of Social Accounting Matrices

The input-output model which was described in the previous chapter ignores the flows from producing sectors to factors of production (value added) and then to entities such as government and households and finally back to demand for goods. A SAM expands the input-output accounts to include a complete specification of the circular flow in the economy. In essence, this means that the SAM describes the full circular flow of income, establishing separate accounts for the activities of production, consumption and accumulation and transactions with the rest of the world (Stone and Croft-Murray 1959).

The SAM provides the initial conditions in terms of the structure of production, the factors of production and household income distribution by socio-economic groups, and the pattern of expenditures of the various institutions. It also provides the initial values of variables in other accounts, i.e., capital, rest of the world and government, and the base-year relationship among these accounts between them and the other accounts, factors, institutions and production activities which are usually considered endogenous (Thorbecke 1992). A SAM that shows the transactions that take place between all agents of an economy in a given year provide a typical database for a CGE model. The SAM

data which provide a snapshot picture of the economy are applied to the CGE model to be able to replicate that base year in the initial (benchmark) general equilibrium. The benchmark of a CGE model is actually a solution of the model that replicates the observed economic data in a given year. The calibration of a CGE model which replicates the benchmark year involves using the SAM data along with a limited amount of additional information to determine the values of all the parameters in the model. This makes CGE models different from macro-econometric models. The CGE models are always calibrated to replicate a particular benchmark year of the economy, whereas macro-econometric models are always estimated to fit a time series of observed historical data of the economy concerned.

Like input-output analysis, a SAM is a double-entry book-keeping system capable of tracing monetary flows through expenditures or payment and receipts. The square matrix format of a SAM allows the double-entry book-keeping to be displayed in a single-entry format. Each cell in the matrix represents a particular economic transaction which is recorded in value terms so that both the physical and financial flows can be captured. The row and column headings identify the various accounts. The payments (expenditures) are listed in columns and the receipts in rows. One important feature of a SAM is that each row and column reflects a separate account for which expenditures and receipts must balance to satisfy the fundamental equilibrium condition that demand equals supply or, in income terms, expenditures equal receipts.

The consolidated SAM is shown in Table 6.1. This table presents the main accounts of a typical SAM. There are six types of accounts in the SAM: the activities; commodities; factors of production (labour and capital) accounts; the current account of the domestic institution, divided into households, firms and the government; the capital account; and the rest of the world account. The first two accounts, 'Activities' and 'Commodities', represent the production and factor (labour and capital) markets. The 'Institutions' account deals with households, firms and government. The 'Capital' account reflects the saving-investment balance. The 'Rest of world' account reflects foreign expenditure and trade with the rest of the world.

The activities account represents the producing sectors or industries. This account describes the costs and revenues for domestic producers. In row (1), production activities receive money from the supply of different kinds of commodities to the domestic markets (Commodity account) and export markets (Rest of world account). Expenditures of the activity account are recorded in column 1. These consist of payments by the producers for intermediate goods (Commodity account), factor payments (Factor account), and value-added taxes (Government account).

Further substantial oil price decreases occurred in 1986 with the prices averaging about US $15.

In this study, a 50 per cent decrease in world oil prices in the medium term is simulated in isolation to examine its impact on the Indonesian economy.

(ii) EXP2: Decline in world prices for Indonesian agricultural export.

As presented in the literature review, the real commodity prices more than halved between 1980 and 1993. These unfavourable movements in world markets for major traded commodities hindered agricultural performance in Indonesia.

Assuming an average medium period of 5 years, the actual rate of decline in world prices for Indonesian agricultural primary commodity exports amounted to 20 per cent per period between 1980 and 1993.

In this study, a 20 per cent decline in world prices for the export agriculture in the medium term is simulated in isolation to examine its impact on the Indonesian economy.

(b) Changes in domestic policies

(iii) EXP3: Agricultural demand-led industrialisation.

As presented in the literature review, a policy of export-led industrialisation may run into trouble due to an inadequate agricultural support base. In the 1990s significant changes have occurred in public policies, which have viewed agriculture more positively and advocated agricultural demand-led industrialisation (ADLI).

Under ADLI, investment would be channelled into agriculture to increase the agricultural productivity. Improvements in irrigation systems, access to credit, dissemination of new seeds and fertilisers, better roads to markets, and fair prices for agricultural produce would not only energise a major sector in the economy, but would enhance industrialisation. The primary mechanisms through which the ADLI strategy works is the generation of induced demand for industrial output through increased demand for industrial inputs and through increased consumption of manufacturers by farmers. With ADLI strategy, agriculture is developed as a leading sector in the industrialisation process.

The essence of the ADLI strategy consists of improving the productivity of agriculture. It is assumed that by shifting the investment structure towards

agriculture (Farm food crops, farm nonfood crops, livestock, forestry, and fishery) will allow the factor productivity of agriculture to grow. Since agricultural yields in Indonesia are low because farming practices in many parts of the country utilise outdated technology, there are many opportunities to improve agricultural productivity.

In the GEMINA model, the efficiency parameter A in equation (10) captures the productivity change affected by the labour and capital utilisation. In order to isolate the effects of ADLI strategy, the experiment assumes that agricultural productivity increased by 10 per cent from the base value.

It should be noted that agricultural productivity change under consideration in this study is Hicks neutral. The agricultural productivity change results in alteration of production function but does not require gross investment to bring it about. The productivity of both old and new investment goods just increases. This is generally referred to as dis-embodied technical change.

It may be argued that, in reality, some technical change would only be possible through greater investment, for example in agricultural research and development. In this study, there are difficulties in relating technical change to investment or in making it embodied particularly when investment is endogenous. For similar reasons we have not attempted to model the effects of combining changes in both investment and agricultural productivity.

(iv) EXP4: Reducing agricultural export and indirect taxes.

Other means of maintaining international competitiveness for agricultural produce might be a reduction of agricultural exports and indirect taxes. A reduction of these taxes is a rational policy response to the decline in agricultural world prices caused by the substantial subsidies used by developed countries.

In order to isolate the effects of a reduction of agricultural exports and indirect taxes, the experiment assumes that the export tax rate and indirect tax rate are both decreased by 50 per cent from the base value.

(v) EXP5: Combination of EXP1 and EXP3.

This experiment is carried out to determine whether the ADLI experiment (EXP3) can mitigate the adverse effects of decline in oil prices (EXP1).

(vi) EXP6: Combination of EXP2 and EXP3.

This experiment is carried out to determine whether the ADLI experiment (EXP3) can mitigate the adverse effects of decline in agricultural export prices (EXP2).

7.9 Summary

This chapter has presented the technical specification of GEMINA (General Equilibrium Model for INdonesian with emphasis on Agriculture). It began with an overview of the main features of the GEMINA model. The main part of this chapter was devoted to developing a multi-sector CGE model that can be used to analyse macroeconomic agricultural linkages and evaluate sectoral effects of changes in macroeconomic policies on agricultural development performance in Indonesia.

The parameters of the model have been calibrated so that the base-year data for 1985 represent an equilibrium solution. Most of the parameters were computed using base-year shares from the 1985 Indonesian SAM. The various elasticities were "guesstimates" based on a literature survey. The GEMINA model is used to analyse the economy-wide effects of changes in two types of agricultural policies, a program to improve agricultural productivity and a cut in export and other indirect taxes imposed on the agricultural sector. The effects of the first of these policies are simulated both in isolation and in conjunction with each of the adverse external shocks. The results of several simulations run with the GEMINA model are presented in Chapter 8.