More recently estimates of compensation of employees in the industrial sector have become available. These estimates and the recent labor force surveys should allow prediction of employee compensation by each sector.

The equations for predicting income from nonagricultural properties and enterprises will be refitted to the disaggregated data. Presently the variables relating to corporate taxes, corporate savings, income from government enterprises, and interest on public and consumer debt are exogenous. Again, recent work by Ramangkura [19] indicated that at least part of these variables could be endogenized. Ramankura's work also indicated that government revenues, total government expense and hence the government budget deficit could be made endogenous.

As the model is tentatively structured it will be possible to calculate the trade balance of net goods and services with only two items (service exports and other imports) being exogenous. Future plans call for a balance of payments sector to be incorporated into the system.

The influence of changes in agriculture on the consumer price index are partly determined. Currently price determination is limited to the agricultural sector. The price levels in the nonagricultural sector are fixed. The consumption price deflator is endogenous but depends in part on an exogenous GDP price deflator.

SUMMARY AND EXTENSION OF RESULTS

The recursive modeling system described above is designed for analysis of economic development over a relatively short (3-5 years)

time horizon. The emphasis is on the analysis of development plans in the agricultural sector and on the measure of what effect these policies have on the nonagricultural sector. It is envisioned that a static analysis in which unlikely policy combinations were eliminated would precede the more extensive recursive annual analysis of a few selected policy sets.

The macro-econometric approach has an advantage in that it allows for nonlinearities and substitution between primary inputs in production. The main disadvantage is that production functions or, in this case, value-added functions represent a high level of aggregation. Planners are still faced with questions of more precisely what, when, where, and how much.

In Thailand, the regional accounts are not complete enough to support regional econometric models of the type estimated at the Kingdom level. For this reason the regional group in the DAE has been constructing input-output models which emphasize the agricultural related sectors of the economy in each region. The information is being gathered by cross-sectional survey. The National Economic and Social Development Board is cooperating to estimate the nonagricultural part of the I/O matrix. This work is not completed, but it is useful to indicate how the I/O effort can be used with the macro econometric work.

Both the model by Johansen and the Brookings have incorporated aspects of an I/O matrix in an econometric modeling process.[1] The

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[1] A short review of these models was made by Fox et al. [20].

researchers with the Brookings model used known levels of gross output (X_t) to estimate levels of final demand (F_t);

$$F_t = (I-A)\, X_t$$

The model by Johansen used a production function (Cobb Douglas) to predict gross output (Xi) or supply in each sector as a function of labor, (L) capital, (K) and technology ($e^{E_{it}}$).

$$X_i = A_i L^{b_i} K^{c_i} e^{E_{it}}$$

Total demand was divided into intermediate and final parts. The intermediate component of total demand for each was estimated by using I/O relationships. Total demand and total supply are related by:

$$X_i = \sum_j a_{ij} X_j + E_{di}$$

In the current research, the incorporation of I/O relationships would lead directly to estimates of gross sector outputs which are not provided directly by the macro model nor readily available in published sources in Thailand. Then, by equating supply and demand for each sector output, the gross output for each sector could be estimated.

$$X(i, t) = (I-A_t^*)^{-1}\, FD(i, t)$$

where: FD(i, t) is a vector of final demands

$(I-A_t^*)$ is a flow matrix modified to reflect commodity flows as determined by the ASM.

If the estimates of gross output are to be consistent with assumed changes in methods of production, the $(I-A_t^*)$ matrix must be restructured.

Researchers with the KASS project in Korea follow this procedure when linking a national I/O model with a recursive linear programming model [9].

A more powerful result can be obtained if the Johansen formulation is used to estimate gross output for the nonagricultural sectors. Gross outputs from the agricultural related sectors would still be determined in the ASM. The estimation of total supply by a production function process followed by or simultaneous with intermediate demand via an I/O process would allow the output prices for the nonagricultural sectors to be determined endogenously. In this manner the I/O approach will complement and extend the current effort.