ECONOMIC MODELS FOR POLICY DIALOGUE

for Conference of AID Economists

Yoon Joo Lee
Office of Development Planning
Bureau for Africa

November 6, 1984

The following is a brief description of two types of economic models which have been used widely with regard to policy dialogue in many developing countries: two models for studies of incentives and comparative advantage(INCA) and a computable general equilibrium model(CGE). The INCA models include a model for analysis at the product/company level and a model for sector-level studies using input-output tables. While the CGE model provides an overall picture of the economy, it is very difficult and time consuming to collect the data required for this type of model, especially in the developing countries. Accordingly, the number of sectors included in the analysis is usually small. While the INCA models produce results of partial equilibrium analysis, they provide information of the effects of traiff structure at a higher level of disaggregation: product level, company/firm level and/or at market level of the same type of products. The disaggregated information computed may also be aggregated at the subsector or sector level. This type of models are particularly useful for tariff reform.

The three models presented here are written in standard FORTRAN and would be utilized with limited computer skills.

1. AN INCA MODEL FOR MICROCOMPUTERS

The model calculates indicators of incentives (effective rates of protection and subsidy) and cost-benefit indicators (coefficients of domestic resource costs, economic rates of return on capital, net present value) at the firm level. Indicators of incentives are estimated under both the Balassa and Corden conventions for four distinct markets: domestic, preferrential exports, non-preferrential exports, and all markets. Cost-benefit ratios are estimated for four different modules: basic long-run, full-capacity, short-run, and incremental. The model has several built-in flexible features for purposes of sensitivity analysis and options for alternative methods for estimating capital costs, foregn factors of production, etc.

There are two categories of input data required for running the model: country specific and company specific. The country specific data include shadow exchange rate, social discount rate, shadow wage rate, and decomposition coefficients of non-traded goods and depreciation. The company specific data include values of products and direct tradable inputs at domestic and world market prices in each market; nominal protection coefficients for products and inputs in each market; values of non-traded inputs and depreciation allowances; values

and economic lives of fixed assets; decomposition coefficients of fixed assets and working capital, etc. The program, composed of about 700 statements, could be used both on micro and mainframe computers.

The model has been used mainly for empirical studies as a background to policy reform (Structural Adjustment Programs in particular) in a number of developing countries, including Ghana, Ivory Coast, Mali, Morocco, Senegal, Tunisia, and Turkey and its application to several other countries is being considered.

For details of the model, refer to "An INCA Model for Microcomputers," Yoon Joo Lee, Industrial Strategy and Policy Division, The World Bank, June, 1984.

2. AN ERP MODEL USING INPUT-OUTPUT TABLES

The model for estimating effective rates of protection (ERP) using input-output tables was prepared as a partial substitute and/or a complement to the INCA model described above. The INCA model, as indicated, requires detailed firm-level data, not readily available under most circumstances. To utilize such a model, therefore, an extensive firm-level survey should be undertaken. The survey normally involves large resources in terms of manpower, time and technical skills, not available for some research projects or countries. Though time and budget situation may allow for such a task, researchers may want to have some preliminary estimates at the sectoral level or to compare these results to those obtained from the firm-level study. In addition, given the input-output tables for a few different time periods, the model could provide a description of the evolution of effective protection. It also provides decomposition coefficients of non-traded goods and depreciation required for the INCA model. The model has been used in several developing countries including Ivory Coast, Senegal, Tunis, Philippines, Thailand and Turkey.

The model estimates ERP under both Balassa and Corden conventions for three distinct markets: domestic, exports, and total. The data required for running the model are nominal rates of protection (NRP) of each I/O sector. In the absence of non-tariff restrictions on foreign trade, this parameter can be computed from customs codes. With non-tariff restrictions such as quantitative restriction and price control, price comparisons between the domestic and the world prices should be undertaken, a time consuming task. The program was rewritten in GAMS in conjunction with tariff reforms in developing countries. The main question addressed in this policy reform was: To achieve uniform effective protection across subsectors,

what should be the nominal protection for each subsector or commodity? The program can be used both on micro and mainframe computers.

For details of the model, refer to "Estimation of Effective Rates of Protection," Yoon Joo Lee, Industrial Strategy and Policy Division, The World Bank, December 27, 1982.

3. A COMPUTABLE GENERAL EQUILIBRIUM MODEL(CGE)

The CGE model was developed jointly by Kemal Dervis, Jaime de Melo and Sherman Robinson of the World Bank. The model's particular applications are concerned with questions of growth and structural change, the choice of foreign exchange regime, and the impact of different development strategies on the distribution of income. The model, Walrasian in spirit, is in the tradition of economy-wide multisector models that have been used for development planning over the last two decades. It simulates the functioning of an economy by explicitly capturing the behavior of the various agents(households, firms, government, rest of the world), the institutional framework(fiscal system and transfer merchanisms), and the market clearing process. The model has been used for short term and medium term planning and policy analysis as well as for the evolution of the performance and prospects of develping countries including Turkey, Ivory Coast, Cameroon, Korea, and Yugoslavia.

The model is designed to provide a description of the evaluation of an economy over a number of periods, given the value of exogenous parameters and policy instruments. Within each period, it provides a set of equilibrium prices which leads to a balance of supply and demand on each market. Supply and demand for factors, commodities and foreign exchange are derived from each agent's optimal choice and from government's decisions.

There are two types of input data required for running the model: data needed for generating social accounting matrix and direct input data. Data for social accounting matrix include sectoral output, value added, exports and imports; foreign capital inflows; exchange rate, trade and export demand elasticities; prices of export and imports; consumption of the government and private sector; input-output flows, investment coefficient matrix; sectoral capital stocks, depreciation, investment, inventory investment; subsidies, tariff rates, tariff revenues by sector, wage bill and employment by sector; etc. The direct input data include various flags (i.e., options) and parameters such as export supply, tariff rate

adjustments, subsidy rate adjustments, income distribution, as well as sectoral total factor productivity growth rates; growth in world trade and exports; growth in world import prices and export prices; growth in labor force and real wages; etc. The program itself is composed of about 10,000 statements, or five boxes of computer cards. It is now executable on the mainframe computers only and the possibility of using on microcomputers is being considered.

For details of the model, refer to General Equilibrium Models for Development Policy, Kermal Dervis, Jaime de Melo and Sherman Robinson, The World Bank, 1982.

References

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6. Bulmer-Thomas, V., Input-Output Analysis in Developing Countries:Sources, Methods, and Application, John Wiley and Sons Ltd., 1982.

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COUNTRY INCENTIVE & COMPARATIVE ADVANTAGE ANAYLSIS

INDICATORS OF INCENTIVES : (COMPANY : ERG)

DOMESTIC MARKET PRICES

	TRADED PROCESS	N-TRADED	DEPREC	TOTAL
PRODUCT	12189.0	0.0	0.0	12189.0
TRADED INPUTS/FOREIGN EX	4811.0	595.2	338.4	5744.6
RETURN TO CAPITAL	829.1	487.1	111.0	1427.3
RETURN TO LABOR	3427.3	1129.5	204.1	4760.8
IMPORT DUTY/INDIRECT TAX	474.8	326.7	96.4	898.0

DOMESTIC RESOURCE COST

	CENTRAL				LOW				HIGH			
	TRADED PROCESS	N-TRADED	DEPREC	TOTAL	TRADED PROCESS	N-TRADED	DEPREC	TOTAL	TRADED PROCESS	N-TRADED	DEPREC	TOTAL
PRODUCT	8821.0	0.0	0.0	8821.0	9074.0	0.0	0.0	9074.0	8681.0	0.0	0.0	8681.0
TRADED INPUTS/FOREIGN EX	4538.0	595.2	338.4	5471.6	4732.0	595.2	338.4	5665.6	4432.0	595.2	338.4	5365.6
RETURN TO CAPITAL	2197.2	487.1	111.0	2795.4	1625.6	487.1	111.0	2223.8	3086.3	487.1	111.0	3684.5
RETURN TO LABOR	1882.8	903.6	163.2	2949.6	1728.6	847.1	153.0	2728.8	1996.5	1016.5	183.6	3196.7
IMPORT DUTY/INDIRECT TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

COUNTRY INCENTIVE & COMPARATIVE ADVANTAGE ANAYLSIS

INDICATORS OF INCENTIVES : (COMPANY : ERG)

EFFECTIVE RATES OF PROTECTION (ERP)

	CORDEN					BALASSA			
	MARKET 1	MARKET 2	MARKET 3	MARKET 4		MARKET 1	MARKET 2	MARKET 3	MARKET 4
CENTRAL	1.346	0.319	0.024	0.798	CENTRAL	2.517	0.476	-0.110	1.428
LOW	1.369	0.309	-0.102	0.767	LOW	2.411	0.401	-0.347	1.259
HIGH	1.373	0.325	0.028	0.816	HIGH	2.935	0.619	-0.024	1.696

EFFECTIVE RATES OF SUBSIDY (ERS)

	CORDEN					BALASSA			
	MARKET 1	MARKET 2	MARKET 3	MARKET 4		MARKET 1	MARKET 2	MARKET 3	MARKET 4
CENTRAL	1.232	0.205	-0.089	0.684	CENTRAL	2.291	0.249	-0.336	1.201
LOW	1.256	0.195	-0.207	0.655	LOW	2.197	0.183	-0.536	1.049
HIGH	1.257	0.210	-0.084	0.701	HIGH	2.680	0.370	-0.261	1.444

NET EFFECTIVE RATES OF PROTECTION (NEP)

	CORDEN					BALASSA			
	MARKET 1	MARKET 2	MARKET 3	MARKET 4		MARKET 1	MARKET 2	MARKET 3	MARKET 4
CENTRAL	1.213	0.244	-0.034	0.696	CENTRAL	3.404	1.428	0.862	2.350
LOW	1.369	0.309	-0.102	0.767	LOW	3.411	1.401	0.653	2.259
HIGH	1.082	0.162	0.098	0.593	HIGH	3.618	1.492	0.903	2.482

NET EFFECTIVE RATES OF SUBSIDY (NES)

	CORDEN					BALASSA			
	MARKET 1	MARKET 2	MARKET 3	MARKET 4		MARKET 1	MARKET 2	MARKET 3	MARKET 4
CENTRAL	1.105	0.137	-0.141	0.589	CENTRAL	3.185	1.209	0.643	2.131
LOW	1.256	0.195	-0.207	0.655	LOW	3.197	1.183	0.464	2.049
HIGH	0.980	0.062	-0.196	0.492	HIGH	3.384	1.263	0.684	2.250

COUNTRY INCENTIVE & COMPARATIVE ADVANTAGE ANAYLSIS ----------

INDICATORS OF DOMESTIC RESOURCE COSTS, ECONOMIC RETURN ON CAPITAL AND NET PRESENT VALUES

***BASIC MODULE *** COMPANY : ERG SECTOR : TET

SHD MATRIX

	CENTRAL				LOW				HIGH			
	TRADED PROCESS	N-TRADED	DEPREC	TOTAL	TRADED PROCESS	N-TRADED	DEPREC	TOTAL	TRADED PROCESS	N-TRADED	DEPREC	TOTAL
PRODUCT	9350.3	0.0	0.0	9350.3	9074.0	0.0	0.0	9074.0	9896.3	0.0	0.0	9896.3
TRADED INPUTS/FOREIGN EX	4810.3	630.9	358.7	5799.9	4732.0	595.2	338.4	5665.6	5052.5	678.5	385.8	6116.8
RETURN TO CAPITAL	2329.1	516.3	117.7	2963.1	1625.6	487.1	111.0	2223.8	3518.4	555.3	126.6	4200.3
RETURN TO LABOR	1995.8	957.8	173.0	3126.6	1728.6	847.1	153.0	2728.8	2276.0	1158.8	209.4	3644.2
IMPORT DUTY/INDIRECT TAX	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOMESTIC FACTORS MODEL

	CENTRAL	LOW	HIGH
DRC(1)	1.618	1.453	1.821
DRC(2)	1.471	1.356	1.613

FOREIGN LABOR MODEL

	CENTRAL	LOW	HIGH
DRC(3)	1.829	1.673	2.019
DRC(4)	1.636	1.528	1.768

FOREIGN CAPITAL MODEL-ADJUSTED WITH NORMAL FOREIGN PROFIT

	CENTRAL	LOW	HIGH
DRC(5)	1.861	1.602	2.219
DRC(6)	1.673	1.473	1.951

FOREIGN CAPITAL MODEL-ADJUSTED WITH OBSERVED FOREIGN PROFIT

	CENTRAL	LOW	HIGH
DRC(7)	1.794	1.549	2.131
DRC(8)	1.621	1.431	1.883

ERC UNADJUSTED

	CENTRAL	LOW	HIGH
ERC(1)	-0.002	0.006	-0.006

NPV UNADJUSTED

	CENTRAL	LOW	HIGH
NPV(1)	-2230.491	-1544.109	-3185.323

ERC ADJUSTED (WITH NORMAL FOREIGN PROFIT)

	CENTRAL	LOW	HIGH
ERC(2)	-0.035	-0.029	-0.037

NPV ADJUSTED (WITH NORMAL FOREIGN PROFIT)

	CENTRAL	LOW	HIGH
NPV(2)	-2748.495	-2051.922	-3728.734

ERC ADJUSTED (WITH OBSERVED FOREIGN PROFIT)

	CENTRAL	LOW	HIGH
ERC(3)	-0.020	-0.017	-0.018

NPV ADJUSTED (WITH OBSERVED FOREIGN PROFIT)

	CENTRAL	LOW	HIGH
NPV(3)	-2509.285	-1871.307	-3396.178

BEST AVAILABLE