Economic Policy Research Center

Computable General Equilibrium Model of Georgian Economy

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Abstract:

Computable General Equilibrium (CGE) model developed below provides a comprehensive macro-economic framework to describe market-oriented economy of Georgia. With CGE model, quantities and prices in various equilibria can be computed and simulation analysis can be performed to infer what will happen if different policies, i.e. fiscal regulations, sectoral policies, international trade regulation or environmental policies are introduced. Quantities of consumption, output, imports, exports, savings, investments and other macro variables, in each commodity sector can be computed to analyze economic structure in detail.

For Georgia, CGE model have one strong advantage in data requirements. Usually, what is needed for econometric estimation is time series data for a long period. In contrast, CGE models require input-output (I/O) tables and basic national accounts for a single year. In the situation, when we don't have so long time series, CGE models can be a powerful tool in empirical analyses.

CGE models are utilized in estimating real side of an economy focusing on efficiency of resource allocation. That is, effects of distortion caused/removed by economic policies in terms of sectoral output, consumption, international trade, prices, utility e.t.c. can be quantified.

The short list of issues that well fall within the range CGE models analyze include:

- ✓ Effects of tax policies or public expenditure modifications in Georgia
- ✓ Income distributional aspects of economy
- ✓ Possible scenario for introducing consumption taxes in Georgia
- ✓ International trade aspects and effects of trade liberalization
- ✓ Environmental policy analysis

Nevertheless, as mentioned above, CGE modeling relies on Input/Output tables and Social Accounting Matrices, which require disaggregated data for the key sectors in Georgia (the sectors we intend to analyze). That is, we need disaggregation in factor inputs, intermediate inputs from other sectors in each sector; also how much of each sectoral output is used for final consumption, intermediate inputs for other sectors, exports, e.t.c. For building the SAM we rely on the data provided by Supply and Use table (Year 1999, source: Department of Statistics of Georgia). One major deficiency in the data is that we do not possess required level of disaggregation of value added into the production factors and another is that for

large sectors, like manufacturing, energy, mining and others, there is no disaggregated data in SUT. Instead, some of these sectors are combined into a single sector. This poses a limitation on our model in two ways: first, at this stage we are not able to incorporate factor prices into the model and second, we are limited in performing policy simulations on sectors mentioned above. As for model building, we shall fit our CGE analysis to the level data is available on Georgian economy.

With detailed sectoral disaggregation, CGE model tends to be large-scaled and for quantitatively measuring general equilibrium of an economy, computational techniques (GAMS non-linear programming software techniques in particular) shall be utilized.

As for model building structure, first overall economy structure is systemized and each agent behavior is mathematically formulated by simultaneous equations derived with Lagrange method and respective utility/profit maximizing behaviors. The system includes domestic production, domestic output transformation into domestic good and exports, Armington's aggregation of domestic good and imports into final domestic product, also government behavior, investment behavior, household behavior, trade and BoP conditions, subsidies and various market clearing conditions.

After the system of simultaneous equations for each agent behavior is formulated, we build Social Accounting Matrix from I/O table and perform process of calibrating share/scale/other parameters from existing data on base run equilibrium. And then GAMS program is built to solve the system and to quantitatively perform simulations in various policy variables.

I. Model Formulation:

In our analysis 14 sectors of Georgian economy along with the different economic agents form the model suitable for quantifying various equilibria and effects brought about by changes in policy variables. Activities of various production stage firms with their demand and supply of intermediate inputs, factor demand and dis/aggregation into domestic/composite goods are derived from firms' profit maximizing behavior. Households are assumed to follow utility maximizing behavior. International trade, along with Government behavior, subsidies and saving behavior are incorporated into the model as well.

In the analysis Georgian economy is assumed to follow small open economy model with perfectly competitive markets.

Behavior of each economic agent is formulated into the simultaneous equations in following paragraphs.

Domestic Production

By the assumptions at this point we utilize Cobb-Douglas type production function for composite factor formation at the bottom stage and Leontief function for gross output combining value added and intermediate inputs at the top level of production. The simultaneous equations describing domestic production are derived from profit maximizing behavior of each production level agent and zero profit conditions.

(i) From the condition to $\underset{Y_j, F_{hj}}{\max imize}\ \pi_j^y = p_j^y Y_j - \sum_h r_h F_{hj} \quad s.t.\ Y_j = b_j \prod_h F_{hj}^{\beta_{hj}}$

and taking derivatives from Lagrangian $L_j(Y_j, F_{hj}, \eta_j) = (p_j^y Y_j - \sum_h r_h F_{hj}) + \eta_j (Y_j - b_j \prod_h F_{hj}^{\beta_{hj}})$

we obtain the following equations:

$$Y_j = b_j \prod_h F_{hj}^{\beta_{hj}}, \quad \forall j \quad (1)$$

$$F_{hj} = \frac{\beta_{hj} p_j^y}{r_h} Y_j, \ \forall h, j \ \ (2)$$

The notations are as follow:

π_j^y Profit of $j-th$ sector at the bottom stage production

Y_j Value added produced by $j-th$ sector

F_{hj} Input of the $h-th$ factor by $j-th$ sector

p_j^y Price of the value added of the $j-th$ sector

r_h Factor price

(ii) At the top production stage optimization problem can be expressed in following:

$$\underset{Z_j,Y_j,X_{ij}}{\max imize}\ \pi_j = p_j^s Z_j - (p_j^y Y_j + \sum_i p_i^q X_{ij}) \quad s.t.\ Z_j = \min\left\{\frac{X_{ij}}{ax_{ij}};\frac{Y_j}{ay_j}\right\}$$

Which yield following two equations:

$X_{ij} = ax_{ij} Z_j, \quad \forall i, j$ (3)

$Y_j = ay_j Z_j, \quad \forall j$ (4)

Finally, zero profit condition for gross output firm is added to the above equations finalizing simultaneous equations for domestic production:

$$\pi_j = p_j^s Z_j + G_j - (ay_j p_j^y Z_j + \sum_i ax_{ij} p_i^q Z_j) = 0 \Leftrightarrow \quad p_j^s = ay_j p_j^y + \sum_i ax_{ij} p_j^q - G_j / Z_j \quad \forall j \ (5)$$

Where:

π_j Profit of $j-th$ sector at the top stage production

Z_j Gross output of $j-th$ sector

X_{ij} Intermediate input of the $i-th$ sector demanded by $j-th$ sector

ax_{ij} Coefficient of minimum requirement of the $i-th$ intermediate input for unit of gross output

ay_j Coefficient of minimum requirement of value added for unit of gross output

p_j^s Supply price of the $j-th$ sector

p_i^q Price of $i-th$ intermediate good

Government Behavior

In the model Georgian economy government collects ad valorem taxes on production and imports, as well as direct taxes on households. No consumption taxes are yet introduced. Revenues are spent on consumption of various commodities, government savings and subsidies on sectors.

We assume constant average propensity for government to save and subsidize different industries. Also, government consumption expenditure of commodities is assumed to have constant average propensity.

Government behavior can be formulated in following model equations:

$$T_j = \tau_j p_j^s Z_j, \quad \forall j \quad (6)$$

$$T^d = \tau d \sum_h r_h FF_h, \quad (7)$$

$$T_i^m = \tau m_i p_i^m M_i, \quad \forall i \quad (8)$$

$$G_i = \omega_i \left(\sum_j T_j^m + \sum_j T_j + T^d \right), \ \forall i \quad 0 \le \omega_i \prec 1 \quad (9)$$

$$X_i^g = \frac{\mu_i}{p_i^q} \left(T^d + \sum_j T_j + \sum_j T_j^m - S^g - \sum_j G_j \right), \quad \forall i \quad (10)$$

T_j $j-th$ *commodity production tax revenue*

τ_j *Production tax rate*

T^d *Taxes on household*

τd *Direcxt tax rate*

FF_h $h-th$ *factor endowment*

T_i^m *Import tariff revenue from importing* $i-th$ *commodity*

τm_i *Import tariff rate*

M_i *Import of* $i-th$ *commodity*

G_i *Supply of funds for government subsidizing*

X_i^g *Public consumption of* $j-th$ *commodity*

μ_i *Share for consuming* $j-th$ *commodity*, $(0 \le \mu_i \le 1, \sum_i \mu_i = 1)$

International Trade and BOP Equations

By employing model of small open economy, world import and export prices for commodities are exogenously fixed in our model. Relationships between import and export prices in local and foreign currency terms, as well as balance of payment condition are summarized in simultaneous equations;

$$p_i^e = \varepsilon p_i^{We}, \quad \forall i \quad (11)$$

$$p_i^m = \varepsilon p_i^{Wm}, \quad \forall i \quad (12)$$

$$\sum_i p_i^{We} E_i + S^f = \sum_i p_i^{Wm} M_i, \quad (13)$$

Notations :

p_i^m, p_i^e *Import and export prices in local currency*

p_i^{We}, p_i^{Wm} *World prices in foreign currency terms (exogenous)*

ε *Exchange rate*

S^f *Current account deficit in foreign cuirrency*

E_i *Export volume of* $i-th$ *commodity*

Domestic Output Transformation

We assume that domestic good and exports are imperfectly substitutable and employ constant elasticity of transformation function to describe the disaggregation of domestic output into domestic good and exports.

The behavior of transformation firm is optimized in following manner:

$$\max_{Z_j, D_j, E_{ij}} imize \ \pi_j^z = (p_j^d D_j + p_j^e E_j) - (1 + \tau_j) p_j^s Z_j$$

Subject to: $Z_i = \theta_i (\xi e_i E_i^{\phi_i} + \xi d_i D_i^{\phi_i})^{\frac{1}{\phi_i}}, \quad \forall i \quad (14)$

Lagrangian for this profit maximization problem is defined as follow:

$$L(Z_i, E_i, D_i, \lambda) = (p_i^e E_i + p_i^d D_i) - (1+\tau_i) p_i^s Z_i + \lambda[Z_i - \theta_i(\xi e_i E_i^{\phi_i} + \xi d_i D_i^{\phi_i})^{\frac{1}{\phi_i}}]$$

From which first order conditions are obtained:

$$\frac{\partial L}{\partial \lambda} = 0 \qquad \Leftrightarrow \; CET\ production\ \ function\ constraint,$$

$$\frac{\partial L}{\partial Z_i} = -(1+\tau_i) p_i^s + \lambda = 0, \ \forall i$$

$$\frac{\partial L}{\partial E_i} = p_i^e - \lambda \frac{\theta_i(\xi e_i E_i^{\phi_i} + \xi d_i D_i^{\phi_i})^{\frac{1}{\phi_i}} \xi e_i \phi_i E_i^{\phi_i - 1}}{\phi_i(\xi e_i E_i^{\phi_i} + \xi d_i D_i^{\phi_i})} = 0, \ \forall i,$$

$$\frac{\partial L}{\partial D_i} = 0 \quad \forall i,$$

After substituting Lagrange multiplier, taking into consideration form of CET function and deleting ϕ_i in both denominator and numerator, third equation can be rewritten in following:

$$p_i^e = \frac{(1+\tau_i) p_i^s Z_i \xi e_i E_i^{\phi_i - 1}}{(\frac{Z_i}{\theta_i})^{\phi_i}}$$

Next, after solving for $E_i^{\phi_i - 1}$, we get:

$$E_i^{\phi_i - 1} = \frac{p_i^e Z_i^{\phi_i - 1}}{(1+\tau_i) p_i^s \xi e_i \theta_i^{\phi_i}} \quad \Rightarrow \quad E_i = \{\frac{(1+\tau_i) p_i^s \xi e_i \theta_i^{\phi_i}}{p_i^e}\}^{1/1-\phi_i} Z_i \qquad (15)$$

Similarly, $D_i = \{\frac{(1+\tau_i) p_i^s \xi d_i \theta_i^{\phi_i}}{p_i^d}\}^{1/1-\phi_i} Z_i, \ \forall i$ (16)

Notations :

π^z Pr*ofit of the transformation firm*

θ Pr*oductivity parameter of transformation function*

$\xi e, \xi d$ *Share parameters of transformation function*, $\xi e + \xi d = 1, \quad \xi e, \xi d \geq 0$

ϕ *Parameter related to elasticity of transformation*, $\phi \geq 1$

D_i *I – th domestic good*

p_i^d Pr*ice of i – th domestic god*

Armington's Aggregation

We are employing CET function to represent aggregation of domestic good and imports into the Armington's composite good. Again, assumption is that imported commodity and domestic good are imperfectly substitutable.

Similarly to the developments of the previous paragraph, the following equations can be easily derived:

$$Q_i = \gamma_i(\delta m_i M_i^{\eta_i} + \delta d_i D_i^{\eta_i})^{\frac{1}{\eta_i}}, \quad \forall i \quad (17)$$

$$M_i = \{\frac{p_i^q \delta m_i \gamma_i^{\eta_i}}{(1+\tau m_i) p_i^m}\}^{1/1-\eta_i} Q_i, \forall i \quad (18)$$

$$D_i = \{\frac{p_i^q \delta d_i \gamma_i^{\eta_i}}{p_i^d}\}^{1/1-\eta_i} Q_i, \quad \forall i \quad (19)$$

Notations :

Q_i *Output of i – th composite good*

p_i^q *Price of i – th composite good*

$\gamma, \delta m, \delta d$ *Productivity and share parameters of CES function*

η *Parameter related to elasticity of substitution*

Household Behavior

In the model households own all factor endowments, which are inelastically supplied to sectors for production. We assume households to arrange their consumption bundle to maximize utility subject to income constraint. Cobb-Douglas type utility function is being employed.

$$\max_{X_i^p} \; UU = \prod_i (X_i^p)^{\alpha_i} \quad s.t. \; \sum_i p_i^q X_i^p = \sum_h r_h FF_h - S - T^d$$

From the optimization problem we obtain household demand function for each commodity:

$$X_i^p = \frac{\alpha_i}{p_i^q}(\sum_h r_h FF_h - S - T^d) \quad \forall i, \qquad (20)$$

X_i^p *Household consumption of i – th commodity*

α *Share parameters in household utility function*, $(0 \le \alpha_i \le 1, \sum_i \alpha_i = 1)$

S *Household saving*

Savings and Investments

We assume constant average propensity for savings and constant share parameters for investment demand functions.

Household and Government Savings

$$S = ss \sum_h r_h FF_h \,, \qquad (21)$$

$$S^g = ss^g (\sum_j T_j^m + \sum_j T_j + T^d) \,, \qquad (22)$$

Investments

$$X_i^v = \frac{\lambda_i}{p_i^q}(S + S^g + \varepsilon S^f), \quad \forall i \quad (0 \le \lambda_i \le 1, \sum_i \lambda_i = 1) \qquad (23)$$

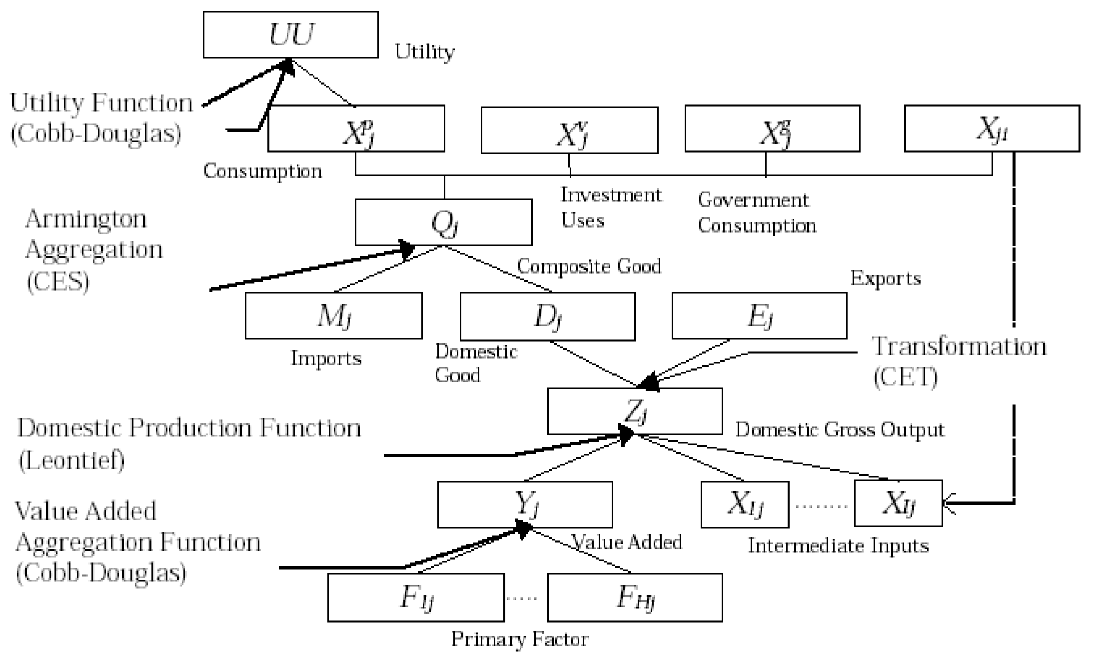
Equilibrium Conditions

In conclusion, we need to finalize our model with market clearing conditions in commodity markets and factor markets to arrive at general equilibrium of economy.

$$Q_i = \sum_j X_{ij} + X_i^p + X_i^g + X_i^v, \quad \forall i \qquad (24)$$

$$\sum_j F_{hj} = FF_{h}, \quad \forall h \qquad (25)$$

The structure of CGE model can be illustrated by the chart given below.



There are $(i+h+18)j+h+4$ simultaneous equations in our system and the same number of endogenous variables: $Y_{j,} F_{hj,} X_{ij,} Z_{j,} X^g_j, X^v_j, E_i, M_i, Q_i, D_i, r_h, X^p_i, p^y_j, p^s_j, p^e_j, p^q_j, p^m_j, p^d_j, \varepsilon, S^g, S, T_j, T^m_j, G_j$ *and* T^d

Taking into account, that one of the equations is redundant due to the Walras' law, we shall set the numeraire and solve the model in relative terms.

Next we build social accounting matrix from the original data on Georgian economy to calibrate the model, quantify its equilibrium and run counter-factual analysis simulating changes with various policy variables.

II. The Input-Output Table and Social Accounting Matrix for Georgia:

The I-O table and SAM for Georgia are derived from Supply and Use table for year 1999 (Given in Appendix II, source: Department of Statistics of Georgia). As mentioned above, we incorporate 14 sectors of Georgian economy into the model, they are: Agriculture, Forestry & Fishing; Manufacturing, Mining and Energy; Household Processed Goods; Construction; Trade Services; Hotel and Restaurant Services; Transportation and Storage Services; Communications; Financial Services; Real Estate; Public Administration; Education; Healthcare; Other Communal, Social and Personal Services; Domestic Services.

One deficiency in data provision is the lack of data on value added decomposition into labor and capital factors. This poses a need to combine factors in our model into a single composite factor.

III. Calibrating the Model:

Taking into the account scale of the model, it's advantageous not to econometrically evaluate model parameters, but to calibrate them from the base run equilibrium. Estimation is easily performed from the model equations written for initial equilibrium:

Equations (20), (1) and (2) respectively yield:

$$\alpha_i = \frac{p^{q0}_i X^{p0}_i}{\sum_j p^{q0}_j X^{p0}_j}$$

$$\beta_{hj} = \frac{r_h^0 F_{hj}^0}{\sum_k r_k^0 F_{kj}^0}$$

$$b_j = \frac{Y_j^0}{\prod_h (F_{hj}^0)^{\beta_{hj}}}$$

Where all the values at the right –hand side of equations are given in SAM.
Next, from intermediate input demand functions, we obtain:

$ax_{ij} = \frac{X_{ij}^0}{Z_j^0}$, $ay_j = \frac{Y_j^0}{Z_j^0}$ and from investment demand and government purchases demand functions follow: $\mu_i = X_i^{g0} \Big/ \sum_j X_j^{g0}$, $\lambda_i = X_i^{v0} \Big/ \sum_j X_j^{v0}$

From CET and CES functions, we get:

$$\delta m_i = \frac{(1+\tau m_i) p_i^{m0} M_i^{0^{(1-\eta_i)}}}{(1+\tau m_i) p_i^{m0} M_i^{0^{(1-\eta_i)}} + p_i^{d0} D_i^{0^{(1-\eta_i)}}}, \quad \delta d_i = \frac{p_i^{d0} D_i^{0^{(1-\eta_i)}}}{(1+\tau m_i) p_i^{m0} M_i^{0^{(1-\eta_i)}} + p_i^{d0} D_i^{0^{(1-\eta_i)}}}$$

$$\xi e_i = \frac{p_i^{e0} E_i^{0^{(1-\phi_i)}}}{p_i^{e0} E_i^{0^{(1-\phi_i)}} + p_i^{d0} D_i^{0^{(1-\phi_i)}}}, \quad \xi d_i = \frac{p_i^{d0} D_i^{0^{(1-\phi_i)}}}{p_i^{e0} E_i^{0^{(1-\phi_i)}} + p_i^{d0} D_i^{0^{(1-\phi_i)}}}$$

$$\gamma_i = Q_i^0 \Big/ (\delta m_i M_i^{0\eta_i} + \delta d_i D_i^{0\eta_i})^{\frac{1}{\eta_i}}, \quad \theta_i = Z_i^0 \Big/ (\xi e_i E_i^{0\phi_i} + \xi d_i D_i^{0\phi_i})^{\frac{1}{\phi_i}}$$

For savings functions, we have $ss = S^0 \Big/ \sum_h r_h^0 FF_h$, $ss^g = S_0^g \Big/ (\sum_j T_j^{0m} + \sum_j T_j^0 + T^{0d})$

And for direct tax rate and government subsidies $\tau d = T^{d0} \Big/ \sum_h r_h^0 FF_h$ and

$$\omega_i = G_i^0 \Big/ (\sum_j T_j^{0m} + \sum_j T_j^0 + T^{0d})$$

<u>*Derivation of expenditure function for measuring Hicksian equivalent variations*</u>

$$\sum_i p_i^{q0} X_i^{p0} = \frac{UU0}{\prod_i (\frac{\alpha_i}{p_i^{q0}})^{\alpha_i}} \quad :$$

We can define Lagrangian for household expenditure minimization problem as follows:

$L = \sum_i p_i^{q0} X_i^{p0} + \lambda(UU0 - \prod_i X_i^{p0^{\alpha_i}})$. First order conditions for problem are:

$$\frac{\partial L}{\partial X_i^{p0}} = 0 \quad \Rightarrow \quad p_i^{q0} = \frac{\lambda \alpha_i \prod_i X_i^{p0^{\alpha_i}}}{X_i^{p0}} \quad (i)$$

$$\frac{\partial L}{\partial \lambda} = 0 \quad \Rightarrow \quad UU0 = \prod_i X_i^{p0^{\alpha_i}} \quad (ii)$$

From equations (i) we have: $X_i^{p0^{\alpha_i}} = (\frac{\lambda \alpha_i}{p_i^{q0}})^{\alpha_i} (\prod_i X_i^{p0^{\alpha_i}})^{\alpha_i}$

After multiplying all these equations we get: $UU0 = \lambda^{\sum_i \alpha_i} \prod_i (\frac{\alpha_i}{p_i^{q0}})^{\alpha_i} \times (UU0^{\sum_i \alpha_i})$

Next, taking into account that $\sum_i \alpha_i = 1$, we obtain $\lambda \prod_i (\frac{\alpha_i}{p_i^{q0}})^{\alpha_i} = 1$.

From equations (i), we proceed:

$$p_i^{q0} = \frac{\lambda \alpha_i \prod_i X_i^{p0^{\alpha_i}}}{X_i^{p0}} = \frac{\lambda \alpha_i UU0}{X_i^{p0}} \quad \Rightarrow \quad \sum_i p_i^{q0} X_i^{p0} = \lambda UU0 \sum_i \alpha_i = \lambda UU0 = \frac{UU0}{\prod_i (\frac{\alpha_i}{p_i^{q0}})^{\alpha_i}}$$

IV. Illustrative Analysis of Policy Simulations:

From the I-O table it can be easily inferred that the two basic commodities consumed by household are agricultural goods and manufacture sector products as their share parameters in consumption function are greater than those of other sectors. This can be employed in taxation policies of domestic production and we should expect increase in household utility if government is supposed to liberalize domestic manufactured goods production. The details of quantitative analysis is obtained in GAMS.

Suppose that indirect interference in manufactured goods sector is reduced from 14.7% to 9%.

This, as indicated by counter-factual GAMS analysis (summary is given on the next page) brings about 132 mln. GEL increase in household income measured by Hicksian equivalent variations. The effects on the functioning of economy can be understood by systemizing domestic production process, intermediate inputs and external sector. In detail:

First, more competitive domestic manufacture production attracts more production factors from other sectors and production possibility frontier for decomposition of domestic output expands. This is represented by 5.6% and 4.4% inflow of labor and capital in manufactured goods sector and roughly 4.8 % increase in its output. Next, there is around 5.4 % decrease in domestic good price compared to 3.9 % decrease in manufacturing export price, which makes iso-profit curve less steeper and expands exports by 7.5 % and domestic output by around 4 %. In external sector, slope of BOP constraint is unchanged, but, on the other hand, it is relaxed and shifts downward while net imports decrease and manufacturing imports rise by around 0.6 %.

In conclusion, with both imports and domestic good increased, consumption possibility frontier expands and output of composite good is increased by around 2.4 % to bring more consumption and improvement in welfare. These changes in manufacturing sector are transferred to other sectors through intermediate inputs. Factor outflow from Public administration would be the highest and it would suffer most from policy modification. Also, Trade sector becomes more profitable to attract factors, expand and benefits from policies introduced.

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PARAMETER dXp
AGR  1.302,   MAN  5.623,   CTR  1.204,   HTL  0.531,   TRN -0.195
PRO  0.642,   SOC  1.326

PARAMETER dF
        AGR       MAN       CTR       TRD       HTL       TRN

LAB      0.949      5.678     -0.874     4.662     1.181     -0.709
CAP     -0.222      4.453     -2.023     3.449     0.008     -1.861
 +      PRO        PA       SOC

LAB     -1.355    -12.213     -2.163
CAP     -2.499    -13.231     -3.298

PARAMETER dZ
AGR  0.497,   MAN  4.860,   CTR  -1.641,   TRD  3.852,   HTL  0.401
TRN  -1.479,   PRO  -1.970,   PA  -12.554,   SOC  -2.536


PARAMETER dXg
CTR -17.470,   PRO -17.928,   PA  -17.554,   SOC -17.370

PARAMETER dXv
AGR -6.277,   MAN -2.279,   CTR -6.368

PARAMETER dE
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AGR -6.734, MAN 7.597, TRN -8.257, PRO -9.152

PARAMETER dM
AGR 8.795, MAN 0.667

PARAMETER dQ
AGR 0.980, MAN 2.428, CTR -1.641, TRD 3.852, HTL 0.401
TRN 0.651, PRO -1.901, PA -12.554, SOC -2.536

PARAMETER dD
AGR 0.732, MAN 4.074, CTR -1.641, TRD 3.852, HTL 0.401
TRN 0.651, PRO -1.901, PA -12.554, SOC -2.536

PARAMETER dpd
AGR -0.571, MAN -5.432, CTR -0.585, TRD 0.386, HTL 0.079
TRN 0.808, PRO -0.031, PA -0.484, SOC -0.705

PARAMETER dps
AGR -0.676, MAN 0.007, CTR -0.585, TRD 0.386, HTL 0.079
TRN -0.320, PRO -0.067, PA -0.484, SOC -0.705

PARAMETER dpq
AGR -0.682, MAN -4.745, CTR -0.585, TRD 0.386, HTL 0.079
TRN 0.808, PRO -0.031, PA -0.484, SOC -0.705

PARAMETER dpy
AGR 0.449, MAN 0.781, CTR 0.780, TRD 0.781, HTL 0.777, TRN 0.781
PRO 0.627, PA 0.391, SOC 0.382

PARAMETER dpm
AGR -3.991, MAN -3.991, CTR -3.991, TRD -3.991, HTL -3.991
TRN -3.991, PRO -3.991, PA -3.991, SOC -3.991

PARAMETER dpe
AGR -3.991, MAN -3.991, CTR -3.991, TRD -3.991, HTL -3.991
TRN -3.991, PRO -3.991, PA -3.991, SOC -3.991

PARAMETER dr
CAP 1.173

PARAMETER depsilon = -3.991
PARAMETER dTd = 0.611

PARAMETER dT
AGR -0.182, MAN -37.080, CTR -2.216, HTL 0.481, TRN -1.794
PRO -2.036, SOC -3.223

PARAMETER dTm (ALL 0.000)
PARAMETER dS = 0.611
PARAMETER dSg = -17.953
PARAMETER dG
MAN -17.953

PARAMETER EV = 131.919 Hicksian equivalent v
ariations
PARAMETER WW = 26.484 total welfare change
VARIABLE UU.L = 1097.225 utility