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Contents

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General Equilibrium Impacts of Technological Change under Different Market Structures: A Comparison of Supply Managed and Other Primary Agricultural Markets in Canada

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ABSTRACT

Market impacts of technological change in Canadian agriculture are measured within a CGE framework using 2001 input-output data with agriculture disaggregated to six sectors and thirteen commodities. Technological change is modelled as productivity rises in the use of intermediate inputs and of primary factors. Impacts on output, intermediate use of output, foreign trade, final consumption, returns to primary factors and relative price are calculated for primary and processed food products. Impacts of technological change can be summarised into two general outcomes. First, supply managed sectors respond to technological change differently than other agricultural sectors. In the former, economic rents generated from quotas increase while in the latter, outputs, exports, and final consumption increase along with declines of relative supply prices. Second, large relative price declines for other commodities lead to consumer gains.

Introduction

Economic assessments of impacts of new technologies can use several approaches. Many studies have used the partial-equilibrium model of Alston *et al*., (1995) which examines market consequences of new technologies and calculates changes in producer and consumer welfare. Partial equilibrium multi-stage production models after Martin and Alston (1994) have also been used in number of occasions to capture the impacts of research induced technological change in agriculture systems. An alternative approach is available in applied general equilibrium models, which provide economy-wide estimates of impacts consistent with microeconomic theory Several CGE applications have modeled impacts of biotechnological innovations using Global Trade Analysis Project (GTAP) CGE model of global trade analysis (Huang *et al*., 2003; Stone *et al*., 2003). CGE models usually focus on cost reduction (input saving) and output expansion from the new technology and derive general equilibrium price, production, trade, and

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welfare impacts resulting from total factor productivity or factor-biased technical change (Elbehri and MacDonald, 2003).

An extensive collection of partial equilibrium analyses of the impacts of 'research and development' investments for various commodities exists for Canada (Alston *et al*., 2000). They report the impacts of research and development as marginal or average rates of return values in the approximate range of 30-100%. Multi-sectoral linear programming models have predicted estimates of rate of returns of comparatively lower (by about 10%) magnitude (Klein *et al.*, 1994). To our knowledge, there has been no computable general equilibrium analysis of the impacts of technological change in Canadian agriculture to date (we are certain of the absence of such performed using data after year 2000).

This paper reports general equilibrium results of a modeling exercise evaluating technological change in Canadian agriculture. The focus is on primary agricultural production taking into account supply management restrictions in dairy and poultry production. Technological change is modeled as input savings in the use of purchased inputs (intermediate inputs as per Statistics Canada sectoral input classification) and of primary factors.

A computable general equilibrium (CGE) model evaluates the impacts of technological change modeled independently in supply managed sector and other primary agricultural sector on the primary agricultural commodity markets. Output, intermediate demand for commodities, exports/imports and relative supply prices are the considered market impacts. The returns to primary factors in the two sectors are also evaluated.

The objective is to measure the general equilibrium impacts of technological change in the primary agricultural commodity markets. Input-output and final demand data for 2001 published by Statistics Canada is used. Simulations provide impacts at the individual commodity market level. I believe that evaluation of returns to primary factors in the two sectors under technological change provides a comparable general equilibrium estimate for the producer surplus measure in the partial equilibrium literature.

Results of the simulations show important effects of technological change. Productivity improvement in the primary agricultural production has a number of impacts for primary products that are not supply-controlled via quotas. The lower supply prices make primary products cheap inputs for processing sectors, spilling over the impact of technological change in primary production to the processing industries which in turn will produce final goods at lower prices. When primary products are exported the lower domestic supply prices make the Canadian exporters competitive in world

trade. However, supply managed commodity markets show an accumulation of quota rents to the farmers as the only significant impact.

Study Context

Canadian Agriculture

Agriculture in Canada has been an important sector throughout the history of the country as a source of food and exports. The agriculture and agri-food system accounted for 8.1% of total Gross Domestic Product (GDP) in 2004 (primary production and processing together making 3.4%). The overall system has been growing in size at 2.4% per annum (Agriculture and Agri-Food Canada, 2006).

Agriculture performs several inter-sectoral functions which are important for the overall economic growth. Primary agriculture is a large user of energy products and repair and maintenance services. For example in 2002, it purchased 7.4% of all industrial diesel oil used, accounting for 5.8% of the total value of diesel production in Canada (Agriculture and Agri-Food Canada, 2006). At the same time the agriculture and agri-food sector is a key supplier to other industries.

Supply management in dairy and poultry has been a distinct feature of Canadian agriculture since 1970s. Supply management refers to the systematic use of production and border controls to manage national supplies to satisfy projected demand at a target price. The goal of controlling supply so the market clears at the target price is to stabilize and enhance dairy farm incomes. In Canada, the federal government sets the price of industrial milk at a level determined by cost of production formulae. To maintain the predetermined price, the level of industrial milk production and imports of industrial milk products must be restricted. The National Milk Marketing Plan sets out the framework to calculate the quantity of industrial milk needed to meet domestic requirements and any planned exports. The quantity supplied of industrial milk in each province is restricted using a Market Share Quota. Each province's Market Share Quota is determined using its historical share of national industrial milk production. Quota holdings in the supply managed industries have grown significantly over time. In 2004, the average dairy farm had around 1.2 million dollars worth of quota compared to an approximate value of 300 thousand dollars in 1994 and the average poultry farm around 1.5 million dollars compared to an approximate value of 400 thousand dollars in 1994. In each case, on average, value of quota accounted for 50% and 53% of total farm assets respectively (Agriculture and Agri-Food Canada, 2006).

The large strides in technology in recent years have brought about considerable transformation in agricultural production activity in Canada. Average farm size has been continuously increasing while the number of farms has been decreasing (Schmitz *et al.*, 2002). Labor has been freed from agriculture while the production processes have been more material using. Factor productivity indicators in agriculture have been improving regularly and for the six years from 1997 to 2003 multifactor productivity has been growing at 3% per annum (Agriculture and Agri-Food Canada, 2006). Over the last 20 years, cattle carcass weights have increased by 33%. Larger litter sizes, more litters per year, and heavier carcass weights have resulted in a 49% increase in pork production per sow since 1990. Crop yields also have risen steadily. Average annual corn yield has risen from 5 tons per hectare to more than 7.5 tons per hectare over the 30 years from 1970 to 2000, according to agricultural census.

Data and Model

Data is from the L (link) level classification of 2001 input–output data and final demand tables for Canada published by Statistics Canada[1] (Statistics Canada, 2006). For the computable general equilibrium (CGE) analysis reported here, above data was aggregated to 25 commodities, 20 sectors. Representative agent's final demand is four-fold: final consumption, government consumption, investment and net exports. 3 Primary factors are endowed to the agent.

Agricultural detail in the model includes 13 commodities representing total Canadian agriculture: 9 primary commodities and 4 processed commodities. Primary commodities include cattle and calves, swine, other livestock, grains, oilseeds, fruits and vegetables as non supply managed goods and poultry (chicken and turkey combined), eggs, and raw milk as supply managed goods. This paper looks at the general equilibrium response of the commodity markets of these two groups to technological change.

The CGE model is a single country version of the Basic Model of Regional Trade (BMRT) by Wigle and Snoddon (2004). Each production activity is modeled by a nested (hierarchical) production function, which enable the special functional forms as, for instance, constant elasticity of substitution (CES), Cobb-Douglas or Leontief functions to be contained within CES functions, and many layers of hierarchy can be utilized (Shoven and Whalley, 1992). Further, this structure allows a flexible representation of the degree of substitution between inputs to the production process

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[1]   The detailed input output data is available from Statistics Canada at <http://www.statcan.gc.ca/pub/15-201-x/2008000/5005546-eng.htm>

(Rutherford, 1994). Domestic and imported goods in production and consumption aggregate under Armington assumption (Armington, 1969) with constant elasticities of substitution. Domestic output and exports are transformed with constant elasticity. Consumer Preferences are Cobb-Douglas. Appendix 1 contains the detailed equation system used in the model. The model was implemented in GAMS and MPSGE software systems. Appendix 2 contains the input, output and final demand tables after the aggregation of the L level data by the author.

Supply management regime in dairy and poultry is modeled as an endogenous tax (Benjamin *et al.*, 1999; van Meijl and van Tongeren, 2002) facilitating a switch from a binding to a non-binding status. Thus, the model adjusts endogenously both the quantity and the quota rent.

Simulations

As mentioned previously, technological change is modeled as productivity increases in inputs. It is implemented in the model as 10% savings of inputs in the counterfactual simulations. Two groups of inputs are considered: intermediate goods and primary factors (see table 1 for detailed allocation of each input category into supply managed, non supply managed and processing agriculture). Any input other than a primary factor used in the production is considered as an intermediate input. Thus, any of the 25 commodities could be an intermediate input in a given production activity. Primary factors are capital, labour (wages, salaries and supplementary labour income) and mixed income (i.e income of unincorporated businesses).

The two types of technological change (i.e. rise in productivity of intermediate input use and of primary factor use) constitute modeling scenario (1) and (2) respectively. Scenarios (1) and (2) are independently implemented in supply managed production and other primary production. When Supply managed sector is subjected to technological change, the situation is identified as 'case A' and when rest of primary agricultural sector undergoes technological change, the situation is identified as 'case B'. This separation and independent treatment of supply managed and other sectors is motivated by the strategic importance of the supply managed sector (dairy and poultry) in Canadian agriculture. Further, the statistics indicate that the interlinkages between the supply managed sector and other agricultural sectors are very few.

Table 1:   Intermediate input and primary factor use (Million dollars)

	Sectors		
	Supply managed	**Other agriculture**	**Processing**
Intermediate Inputs			
Cattle and calves	35	1,317	4,804
Swine		42	3,086
Poultry	217	173	1,334
Other animals			100
Raw milk			4,144
Eggs	1		286
Red meat			2,446
Poultry meat			1,450
Processed dairy			1,860
Grains	387	1,406	1,899
Fruits and vegetables	74	267	906
Oil seeds	35	127	1,258
Other primary agricultural goods	465	1,862	2,324
Other processed food	894	3,272	8,604
Agricultural support services	611	1,976	
Forestry products		27	
Mining products		11	53
Utilities	125	817	899
Fuel	99	1,088	507
Secondary manufacturing goods	181	3,506	6,070
Machinery, equipment, vehicles	27	339	37
Construction goods	143	725	98
Transport services	179	692	1,775
Commercial services	994	4,084	11,870
Social services	20	72	1
Primary Factors			
Labour	494	3,023	10,201
Capital	1,953	6,988	12,155
Other (mixed returns)	366	1,311	78

Source: Authors' aggregation using data by Statistics Canada (2006)

Results and Discussion

Table 2 reports the results from the benchmark solution of the model prior to the incorporation of technological change scenarios. It lists the market variables for each primary commodity market in the model.

Table 2:   Benchmark results (Millions of dollars)

Commodity	Output	Intermediate Use	Exports	Imports	Final Consumption
Cattle and calves	7,791	6,164	1,388	-	-
Swine	3,843	3,133	525	-	-
Other live animals	386	121	86	-	-
Grains	6,092	3,700	2,383	-	-
Oilseeds	2,028	1,425	1,028	-	-
Fruits and vegetables	3,542	1,786	-	1,424	3,199
Raw milk	4,155	4,146	-	-	9
Poultry	1,761	1,727	-	7	-
Eggs	551	286	-	38	303

Individual Market Results from Counterfactual Simulations

This section documents the results of the simulations for each commodity market. The logic of presentation is summarised in the figure 1. The two types of inputs (intermediate goods and primary factors) contribute to the production of any commodity. Technological change is modeled via these two input types. Output of each commodity is end-used as intermediate input or net export. Relative change of each variable (output, intermediate use, export/import and relative price) is evaluated by comparing the benchmark equilibrium and counterfactual equilibrium. Percentage changes of each variable from the benchmark solution is calculated and reported.

Impacts of technological change in supply managed sector on non supply managed commodities are insignificant. Similarly, impacts of technological change in non supply managed sector on supply managed commodities are insignificant as well. These results are not reported.

Figure 1: An illustration of the logic behind modeling market effects using cattle and calves market as an example
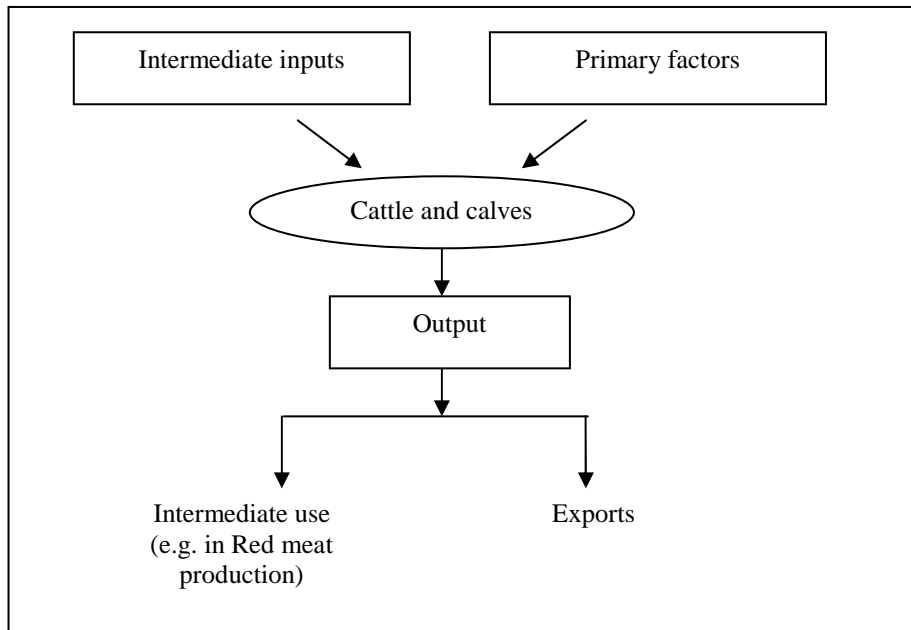
Non Supply Managed Commodities

Table 3 lists the percentage changes of market effects for non supply managed commodities due to the two technological change scenarios. Outputs of all the six commodities increase for both scenarios. The increased output is largely exported. Intermediate demand for the commodities from other sectors increase slightly. In the case of fruits & vegetables, where a significant portion of output is consumed as final goods, final consumption rises by 7.6% and 3.2% for scenarios 1 and 2 respectively. Relative supply prices decrease making exports more competitive. Lower supply prices of the primary products make them cheap inputs for processing sectors, spilling over the impact of technological progress to secondary markets. Technological change in the use of intermediate inputs has a greater impact than that of primary factors, in terms of output, exports and relative price.

Counterfactual results for the 6 non supply managed commodities show significant total gains from technological change. Productivity increase by 10% in the use of purchased inputs (intermediate inputs) results in growth of non supply managed primary agriculture by 1616 million dollars via output expansion. For corresponding productivity increase in the use of primary factors, growth is 782 million dollars. The primary commodity export

increases in either case of technological change contribute by 1034 and 409 million dollars respectively to Canadian agricultural trade surplus.

Table 3: Market effects for non supply managed commodities
(Percentage changes from benchmark)

	Output		Intermediate use		Exports		Imports		Relative price	
	(1)*	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Cattle & calves	5.5	2.8	1.2	1.4	20.8	8.4	-	-	-13.3	-5.6
Swine	5.7	2.2	2.1	0.6	21.3	9.3	-	-	-13.5	-6.9
Other livestock	9.4	4.1	2.0	0.6	17.3	7.4	-	-	-7.4	-3.6
Grains	7.6	4.1	0.1	2.1	18.4	7.1	-	-	-9.7	-3.2
Oilseeds	9.0	4.1	1.4	1.3	15.3	6.3	-	-	-7.5	-3.1
Fruits & vegetables	8.1	3.7	0.8	1.3	-	-	-1.6	-0.2	-9.5	-4.2

*Scenario number

Supply Managed Commodities

The supply managed commodity markets fail to show significant general equilibrium impacts in output and intermediate use. The endogenous tax in the model captures the quota rents due to technological change in factor use for the two scenarios (Table 4). Significant increments in quota rents are observed for the three commodities. Technological change in the use of intermediate inputs appears to have a larger impact on the quota rents than that of primary factors. Under output controls and price controls (and accompanying trade restrictions), quota rents capture the impact of productivity increases in factor use. Value of quota rents accruing as a result of technological change are in fact comparable to value of output gains in unregulated commodity markets measured as a percentage of the sector's size (nearly 5% in either case).

Table 4: Quota rent increases resulting from productivity change
(Millions of Dollars)

Commodity	Quota rent increase	
	(1)*	(2)
Raw milk	273.783	203.617
Poultry	0	65.749
Eggs	39.783	19.654

*Scenario number

Impact on the Total Agricultural Sector

Percentage changes in market impacts for all agricultural markets in the model were aggregated by weighted averaging (weights reflecting the relative output share in the total sector) to reflect the total impact for each 'case' and each 'scenario' of technological change. Results appear in table 5. Technological change in supply managed sector has insignificant impact on the overall agricultural sector while the same in other primary agriculture has a larger impact in increasing agricultural output, increasing exports, reducing imports and driving down the relative supply prices. Again, the intermediate input scenario has a higher impact in output, exports/imports and relative price compared to primary factor scenario.

Table 5:   Percentage changes of impacts on the total agricultural sector

	Output		Intermediate use		Exports		Imports		Relative price	
	(1)*	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Case A	0.1	0	-0.1	0	0.5	-0.1	-0.1	0.1	-0.2	0
Case B	2.5	1.3	0.8	1.0	12.9	5.0	-1.2	-0.1	-3.6	-1.4

*Scenario number

Returns to Primary Factors

Returns to primary factors in agricultural sectors produce an estimate of producer welfare in those sectors (table 6). Cross effects (i.e. change of returns to primary factors in supply managed sector due to technological change in other primary sector etc.) are insignificant and not reported. The lower returns to primary factors in supply managed sector (case A) are compensated by the higher rents accruing on quota which act as an endowment to the farmers in this sector. However, increase of factor returns by 9% for a given endowment of primary factors in the unregulated sector show the beneficial impacts to owners of capital and labour even though the conventional wisdom anticipates a release of capital and labour from agriculture as the technology advances.

Table 6:   Percentage changes in returns to primary factors due to technological change

	Returns to primary factors	
	(1)*	(2)
Case A	1	-10
Case B	9	-6

*Scenario number

Conclusion

Results of the counterfactual experiments highlight the distinct differential market impacts that result from the presence and absence of supply management. The overall general equilibrium response in any single commodity market appears to be comparable as a ratio to its size, but the way in which the impact manifests differs. In supply managed commodities, the impacts of technological change (whether in the use of intermediate inputs or of primary factors) are captured in the quota rents while in rest of primary agriculture, outputs and exports expand considerably, and relative supply prices decline. The general equilibrium outcome that quota rents freezes the spillovers of technological change and retain the gains to the producers is also in conformity with several early partial equilibrium analyses on the Canadian dairy and poultry sector, i.e. Arcus (1981); Barichello (1981); Veeman (1982) (These were some of the first studies carried out to assess the economic impact of supply management). Returns to primary factors are also higher for non supply managed commodity production. However, the fact that quota rents act as an asset to supply managed farmers, offsets this disparity to a certain extent. From the general equilibrium results, it can be concluded that supply management limits the spill-over effects of technological change significantly, thus reducing the social welfare gains. In other commodities, the overall impact can be considered socially beneficial. The results obtained here extend the understanding about the economic outcomes of supply control program in Canada and elsewhere. In addition to the already known negative impacts of supply control, i.e. efficiency losses, we display the potential freezing effect production quotas can have on the incidence of technological change.

Acknowledgements

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Appendix 1
Model Equation Structure

1. Representative Agent and Final Demand

1.1 Utility Function

$$U = U(\Gamma, \Lambda_L)$$

U = utility function

Γ = composite good

Λ_L = leisure

1.2 Composites of final demands

$$\Gamma = \Gamma(X_1,.......,X_N)$$

$X_i(i = 1,......,N)$ = consumer demands for final goods

1.3 Consumer income

$$Y = \sum_{f=1}^{F} \omega_f(E_f - \Lambda_f) + Z + T)$$

Y = consumer income Y comes from 3 sources, namely, factor endowment income (net of leisure)

Z = foreign exchange endowment (in domestic currency)

T = government tax transfer

ω_f = factor prices

$E_f - \Lambda_f$ = factor endowments (net of leisure)

1.4 Budget Constraint

$$\sum_{i=1}^{N} \Pi_{iF} Xi \leq Y$$

Π_{iF} = consumer prices of final goods Xi

1.5 Ad-valorem taxes on final demands

$$\Pi_{iF} = \Pi_i(1 + t_i)$$

Π_i = producer prices

t_i = ad-valorem taxes

2. Firms and Production

2.1 Multi-output production function

$$Q_k(y_{1k}.....y_{Nk}) = F_k(\overline{A}_k, \gamma_k)$$

$\overline{A}_k$ = composite intermediate goods

γ_k = value-added

2.2 Composites of intermediate inputs

$$\overline{A}_k = \overline{A}_k(A_{1k},....A_{Nk})$$

$A_{1k},....A_{Nk}$ = Intermediate inputs

2.3 Composites of primary factors

$$\gamma_k = \gamma_k(b_{1k},....b_{Fk})$$

$b_{1k},....b_{Fk}$ = primary factor inputs

2.4 Domestic-export transformation

$$y_{ik} = y_{ik}(\overline{q}_{ik}, q_{ik})$$

y_{ik} = unfinished output goods

$\overline{q}_{ik}$ = finished goods for the domestic market

q_{ik} = finished goods for the export market

2.5 Ad-valorem taxes on primary factors

$$\omega_f = \omega_f (1 + \lambda_f)$$

ω_f = producer factor price

λ_f = ad-valorem factor tax

2.6 Ad-valorem taxes on intermediate inputs

$$\Pi_{ik} = \Pi_i(1+\sigma_k)$$

Π_{ik} = producer intermediate price

Π_i = market price for intermediate inputs

σ_k = ad-valorem intermediate tax

2.7 Zero profit conditions

$$\sum_{i=1}^{N} P_i \overline{q}_{ik} + \sum_{i=1}^{N} \overline{P}_i q_{ik} = \sum_{i=1}^{N} \Pi_{ik} A_{ik} + \sum_{i=1}^{F} \omega_f b_{fk})$$

3. Trade and Import Aggregation

3.1 Domestic-import Armington aggregation

$$\Phi_i = \Phi_i(\, x_i, M_i^{\omega}\,)$$

$\Phi_i =$ domestic-import Armington aggregation

$M_i^{\omega} =$ world imports

$x_i =$ domestic goods

3.2 Prices of exports (with trade taxes)

$$p_i^{c\omega} = p_i^c (\, 1 + \tau_x^{c\omega}\,)(\, 1 + \overline{\tau}_m^{c\omega}\,)$$

$\tau_x^{c\omega} =$ export tax imposed by CAN on goods originating from CAN to ROW

$\overline{\tau}_m^{c\omega} =$ import tax imposed by ROW on that same goods from CAN to ROW

$$p_{x_i} = p_i (\, 1 + \tau_x\,)(\, 1 + \overline{\tau}_m\,)$$

3.3 Prices of imports (with trade taxes)

$$p_i^{\omega c} = \overline{p}_i^{\omega} (\, 1 + \overline{\tau}_x^{\omega c}\,)(\, 1 + \tau_m^{\omega c}\,)$$

$$p_{m_i} = \overline{p}_i (\, 1 + \overline{\tau}_x\,)(\, 1 + \tau_m\,)$$

4. Rest of World

4.1 Import production technology

$$\nu_i = \alpha_i m_i$$

$\nu_i =$ total foreign exchange required to import the amount $m_i^{\omega c} = m_i$ from ROW to CAN.

$\alpha_i =$ constant foreign exchange price of importing goods i from ROW (source w) to
CAN (destination c)

4.2 Export production technology

$$\mu_i = \gamma_i M_i^{\omega}$$

$\mu_i =$ total foreign exchange earned from exporting the amount M_i^{ω} from CAN to ROW.

$\gamma_i =$ price (in foreign currency) of exporting goods i from CAN (source c) to ROW (destination w)

4.3 Foreign exchange rate

$$\overline{p}_i = \alpha_i \Omega$$

α_i = price of imports (in foreign currency)

Ω = foreign exchange rate

4.4 Zero profit condition of import production technology

$$\Omega v_i = \overline{p}_i m_i$$

5. Accounting Identities

5.1 Balance of payments

$$Z = \Omega \xi$$

Z= amount of foreign exchange endowment (in domestic currency)

ξ = domestic currency equivalence of the amount of foreign exchange

5.2 Government tax revenue

$$T = \sum_{i=1}^{N} \Pi_i X_i t_i + \sum_{k=1}^{K}\sum_{f=1}^{F} \omega_f b_{fk} \lambda_f + \sum_{k=1}^{K}\sum_{i=1}^{N} \Pi_i A_{ik} \sigma_k + \sum_{i=1}^{N} \overline{p}_i (1 + \overline{\tau}_x) m_i \tau_m + \sum_{i=1}^{N} p_i M_i^{\omega} \tau_x$$

T= amount of government tax transfer

6. Market Clearing

6.1 Market clearing for Armington composites

$$\sum_{k=1}^{K} A_{ik} + X_i = \Phi_i$$

6.2 Market clearing for finished goods (domestic)

$$x_i = \sum_{i=1}^{K} \overline{q}_{ik}$$

6.3 Market clearing for finished goods (export)

$$M_i^{\omega} = \sum_{i=1}^{K} q_{ik}$$

6.4 Market clearing for primary factors

$$\sum_{k=1}^{K} b_{fk} = E_f + \Lambda_f$$

6.5 Market clearing for foreign exchange

$$\xi + \sum_{i=1}^{N} \mu_i = \sum_{i=1}^{N} v_i$$

Appendix 2:
A2.1 Key to Acronyms:

GOODS

CTG	"Cattle and calves",
PGG	"Hogs",
PLG	"Poultry",
ANG	"Other live animals",
MKG	"Fluid milk, unprocessed",
OVG	"Eggs in the shell",
MPG	"Beef, pork, other meat, fresh, chilled, frozen",
MRG	"Prepared meat products",
FLG	"Animal fat and lard",
PPG	"Poultry, fresh, chilled, frozen",
AFF	Agriculture forestry and fishing",
MIN	"Mining",
FUE	"Mineral fuels (No Petroleum)"
MFT	"Meat, Fish, Vegetable, food tobacco",
OSM	"Other Secondary MFG",
MEV	"Machinery equipment and Vehicles"
CON	"Construction"
TRS	"Transportation and storage"
UTL	"Utilities (includes ELY)"
CSV	"Commercial Services"
SSV	"Social and Govt services"
ITX	"Indirect taxes (all)",
SUB	"Subsidies (all)",

FACTORS

LAB	"Labour",
MIX	"Mixed Income",
CAP	"Profits and Other returns"

SECTORS

OAS	"Other animals and crops-NON SUPPLY MGD",
ACS	"Pesticides, fertilizer and other agricultural chemical manufacturing",
DMS	"Dairy product manufacturing",
MMS	"Meat product manufacturing",
SMS	"Supply mgd sector-mlk,chk,tur,egg",
PRI	"Primary (agr, for, fish)",
MIN	"Mining",
UTL	"Utilities",
CON	"Construction",
FFM	"Food and Feed Manufacturing",
PMF	"Primary Manufacturing"
MEV	"Machinery Equipment Vehicles"
WRT	"Wholesale, retail trade",
TRN	"Transportation and storage",
CIA	"Cul, Inf, Adv, Ent., Trav.",
CSV	"Other Commercial services",
SSV	"Soc, educ and gov services"

A2.2-Input Table

INPUT	UTL	MIN	MEV	CON	CSV	SSV	OAS	ACS	DMS	MMS	SMS	PRI	FFM	PMF	WRT	TRN	CIA
UTL	109.0	1651.2	1353.3	490.2	16250.7	9305.8	816.9	187.6	78.8	181.5	125.0	103.7	638.2	8367.8	8487.4	2027.6	3668.7
MIX	12.0	180.0	96.9	6019.0	41289.0	12297.0	1310.8	1.0	12.0	3.9	366.2	1088.9	62.0	300.9	4392.0	2344.0	755.0
CTG			0.8	0.1	0.2	0.2	1316.8	0.1	0.1	4803.9	35.2		0.4	1.0	4.9	0.2	
PGG			0.8		0.1	0.1	41.6	0.1	0.1	3085.9	0.4		0.3	1.1	1.9	0.1	
PLG			0.7		0.1	0.1	172.8	0.1		1333.9	217.2		0.5	1.0		0.1	0.1
ANG			0.7		18.2	0.1		0.1	0.1	99.9			0.4	0.9		0.1	
MKG			0.6		0.1	0.1			4144.1				0.1	0.6			
OVG			0.9		191.1	0.1	0.4		0.1		0.5		92.0	0.9		0.1	
MPG			0.3		2643.0					2228.9			122.0		5.9	0.1	
MRG			0.4		729.0					11.9			71.8			0.1	
FLG			0.3		19.0					24.9			95.9		12.9	1.1	0.1
PPG			0.4		676.0					1388.9			60.9			0.1	
AFF	14.1	0.4	418.0	712.6	809.3	442.8	5666.0	1.0	0.2	10.1	1570.9	1858.0	6376.9	10156.1	74.1	6.5	3.9
MIN	160.2	3935.2	229.5	6734.6	14.1	169.9	11.1	13.1	0.1	12.9		6.2	40.3	8492.2	4.2	33.9	1.9
FUE	4450.0	1790.4	604.7	1234.6	3535.2	2066.1	1088.3	589.0	48.8	81.6	98.7	542.5	376.1	28093.0	3003.7	6399.9	303.3
MFT	0.3	1.0	3973.5	9.5	8949.0	29.2	3272.0	0.5	1754.4	259.7	894.2	58.3	8340.3	486.5	246.0	108.8	116.3
OSM	48.5	1621.7	21065.5	29255.0	34314.0	7887.9	3505.7	806.2	614.5	606.2	181.1	418.3	4849.1	85096.5	3393.3	703.9	3681.5
MEV	785.9	2262.0	84125.8	9012.6	27606.9	4775.3	339.0	39.8	0.2	0.2	27.4	462.9	36.9	5014.7	261.4	2330.4	2664.3
CON	855.0	797.2	385.9	71.0	8235.0	5008.0	724.8	6.0	9.9	14.0	143.2	103.0	74.0	3255.2	539.0	1486.0	460.7
TRS	341.0	581.1	2147.4	1856.6	11499.9	3076.2	692.4	141.0	431.6	213.8	178.6	401.7	1129.4	7218.7	2049.8	40437.7	341.4
CSV	3604.0	17589.3	31168.5	26277.1	163021.4	54421.2	4084.1	379.4	1045.0	1572.2	993.9	4014.5	9252.7	44340.6	53298.3	15112.5	24563.5
SSV	469.0	37.0	42.8	407.0	414.0	26237.5	71.9				20.1	15.9	1.1	7.0	9.0	204.0	147.0
ITX	1735.0	1386.0	1381.8	5270.0	36528.0	6465.8	1244.3	24.0	47.0	81.8	347.7	410.8	449.8	3316.6	6844.0	4276.0	2268.0
SUB	-3031.0	-132.0	-204.2	-85.0	-1903.0	-1972.2	-3218.6		-41.0	-8.2	-297.4	-79.2	-48.2	-267.4	-362.0	-2271.0	-1216.0
LAB	6313.0	11564.0	30776.8	38848.0	129383.0	151954.8	3022.8	274.0	978.0	2407.8	494.2	3956.8	6814.8	55784.6	75617.0	29051.0	22776.0
CAP	19137.0	46702.0	21910.9	6767.0	99155.0	24556.9	6988.4	402.0	1487.0	1061.9	1952.6	2054.9	9605.9	44037.8	23259.0	13088.0	16819.0

A2.3- Output Table

OUTPUT	UTL	MIN	MEV	CON	CSV	SSV	OAS	ACS	DMS	MMS	SMS	PRI	FFM	PMF	WRT	TRN	CIA
UTL	33667.0	64.3	0.7	46.1	2906.2	6052.3		61.0	0.1			0.2	0.5	285.1	0.1	9031.5	32129.2
CTG						3.8	7505.6				281.4			0.1			
PGG							3788.3				54.7			0.2			
PLG			0.1				64.4				1696.6		0.1		0.1		
ANG						1.1	381.1				3.9	0.1	0.1	0.1			
MKG			0.3	0.1	0.1	0.2	90.2		0.1		4062.8		0.2	0.4		0.1	0.1
OVG		0.1					20.1				530.9						
MPG						0.2	233.0			10278.9				0.1	15.0		
MRG		0.1	0.2			0.1				2451.9			215.0	0.2	9.0		
FLG			0.3	0.1	0.1	0.1				233.9		0.1	0.1	6.4		0.1	
PPG			0.3			0.1	2.6			3904.9	68.4		0.1				
AFF	29.0	0.8	704.4	0.5	1525.3	21.9	17712.8		0.7		640.2	14489.2	96.6	336.1	55.5		
MIN		20700.1	2.8	132.4	1.0	12.1	0.1	14.0	0.4			0.6	1.1	431.7	13.5	1.6	0.6
FUE		61449.2	0.8	0.1	6.2	33.0			0.2			0.2	0.5	29951.2	156.1	0.5	0.3
MFT		1.6	457.8	9.3	7174.6	109.0	604.5		9818.5	2108.9	10.5	27.1	42684.2	4350.1	983.9	55.2	624.9
OSM	1.0	5891.6	6898.0	2.9	334.1	387.1	438.0	2587.0	113.0	10.9		311.3	2117.9	226800.4	2096.5	16.1	10396.2
MEV		915.6	181772.1	1.2	37.0	11.5		13.0	3.7	4.9		7.3	100.9	24968.6	1477.1	825.3	447.6
CON		0.1	0.1	131783.0		0.1			0.1				0.2	0.2		0.1	
TRS		0.7	1.7	0.3	6713.9	1740.3	287.1		0.1			249.4	1.2	3.6	52.2	101518.2	7.5
CSV	1306.0	942.0	9642.7	903.8	564679.8	26052.4	23.7	190.0	674.0	483.3	0.3	331.7	3224.1	16583.3	176270.9	3891.4	33748.2
SSV		0.3	0.7	0.2	0.1	272297.6			0.1				0.8	1.2	0.1	0.1	0.1

A2.4- Final Demand Table

Final Demand	PEX	GOV	INV	NETX
UTL	27895.9			2505.0
CTG	237.0		2.0	1388.0
PGG	95.7		90.0	525.0
PLG	34.7		7.0	-7.0
ANG	121.9		58.0	86.0
MKG	9.0			
OVG	303.0			-38.0
MPG	2750.0		-90.0	2867.0
MRG	1986.3		1.0	-124.0
FLG			-1.0	88.0
PPG	1944.1		30.0	-124.0
AFF	6952.5		-394.4	934.0
MIN	419.1		-1349.5	2383.0
FUE	12213.6		-1109.2	26188.0
MFT	40416.7		-236.1	340.0
OSM	35839.1	712.0	2262.9	21539.0
MEV	42086.7	4650.0	51007.4	-26904.0
CON		17680.0	91936.0	
TRS	19445.9	56.0	620.0	17716.0
CSV	340511.4	3475.0	28566.0	11657.0
SSV	32537.0	211708.0		-27.0
ITX	59548.0	682.0	8301.0	3050.0