A General Equilibrium Evaluation of Trade Liberalization in Canadian Agriculture

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Abstract

In this paper a general equilibrium model of the Canadian economy which has a high level of disaggregation in agricultural sector is developed in order to measure the impact of trade liberalization on agricultural trade. In the model a special attention has been given to the effects of sector specific agricultural policies especially in the grains and the supply managed sectors. Agricultural liberalization experiments included both unilateral and multilateral removal of agricultural policies.

The results of the experiments suggested that for the Canadian economy, efficiency gains from liberalization are quite substantial. However, it is also found that Canadian grain and dairy farmers are dependent upon subsidies in order to compete in the export markets and a unilateral removal of domestic farm policies may significantly reduce farm incomes in Canada. On the contrary, it is found that Canadian agriculture would fare well under the recent GATT agreement.

1. Introduction

Government intervention in agriculture has a long history. Canada is no
exception as grains, oilseeds, dairy and poultry are protected through subsidies, production controls, import restrictions and tariffs. Protective policies in Canadian agriculture have led to misallocation of resources by changing incentives in the domestic markets and as a result, any move toward a liberalization of agricultural trade could have a major impact on the Canadian economy. Consequently, liberalization of agricultural trade through removal/reduction of domestic support policies and border measures is an important economic policy issue.

Analyses of agricultural trade liberalization for the Canadian economy have traditionally been done in a partial equilibrium framework. These studies have several limitations. First, they concentrated on the effects of liberalization on sub-sectors of agriculture (e.g. grains and meat), but economy-wide effects of liberalization were completely ignored. General equilibrium analyses of world agricultural trade liberalization are fewer in number and conducted at a high level of aggregation with a small number of broadly defined commodity groups (Whalley, 1985; Cox and Harris, 1985). The impact of trade liberalization between the Canadian and United States economy has also been analyzed (Wigle, 1988). The aim of these models is to analyze the effects of trade liberalization on overall economy and as a result agriculture was treated as a broad aggregate and sector-specific agricultural policy and programs are not explicitly modelled in these analyses. Hence, effects of agricultural trade liberalization cannot be analyzed with these models. The economy-wide allocation and distribution effects of agricultural protection in the Canadian economy are complex and evaluating them requires a detailed analysis of the Canadian agriculture. As Buckwell and Medland (1991) pointed out, general equilibrium analyses should provide a more comprehensive set of results than those derived from partial equilibrium analyses, by incorporating the intersectoral linkages for products and factors and by inclusion of the income effects of price changes throughout the economy. A Canadian general equilibrium model that has a disaggregated agricultural sector has also been developed (Güzel and Kulshreshtha, 1995); however, it is not designed to analyze trade liberalization issues.

In this paper we use a general equilibrium model of the Canadian economy, which has a high level of disaggregation in agricultural and agriculture related sectors, to measure the impact of agricultural trade liberalization. This procedure enables us to assess the economy-wide effects of agricultural trade liberalization in the Canadian economy. Organization of the paper is as follows: In the next section, agricultural policy and programs that are currently in place in the Canadian agriculture are presented.
In the subsequent sections properties of the Canadian general equilibrium model are discussed and estimates of the effects of four liberalization experiments for the Canadian economy are presented. These are: first, the unilateral removal of direct payments for grains, second, unilateral removal of industrial milk subsidy, third, a simulation of the final GATT agreement, and fourth, a multilateral free trade in agricultural commodities.

2. Agricultural policy and programs in Canada

The grains industry is primarily located in two regions in Canada, the prairies which include Alberta, Saskatchewan and Manitoba, and Central Canada which includes Ontario and Quebec. The prairies is the larger grain producer of the two regions and exports approximately 75% of its grain production while most of the grain produced in Ontario and Quebec is consumed domestically.

There are a number of programs that support the grain sector in Canada. However, most support come from two programs: the Gross Revenue Insurance Program (GRIP), and the Western Grain Transportation Act (WGTA). GRIP is a safety net program that was introduced in the 1991-1992 crop year, and replaced the Western Grain Stabilization Act (WGSA) and Agricultural Stabilization Act (ASA) as the major support for grain farmers. GRIP provides producers with the option of insuring a target revenue per acre for any grain or oilseed crop planted. A crop-specific payout is made to a producer when actual production multiplied by the crop year average market price is less than the guaranteed revenue. For example the support price for wheat in the 1992-1993 crop year was 33% higher than the expected market price (Schmitz et al., 1994).

The WGTA is a rail transportation subsidy that provides the market payment of the 1981-1982 railway revenue shortfall from grain haulage of CD $659 million on annual basis to the railways, plus some share of cost increases. Schmitz et al. (1994) argue that the combined effect of GRIP and WGTA is to increase the expected farm returns by 65% in the 1992-1993 crop year.

The marketing boards for dairy, eggs, poultry, turkeys, and tobacco have an elaborate set of production quotas and import controls. The prices farmers receive for these farm commodities are set by a cost of production formula together with negotiations of industry officials. The impact of the marketing boards is to raise the price to domestic consumers and restricting imports with import quotas.
For table milk, eggs, poultry and turkey products production quotas are set such that consumer prices clear at a higher price than the free market price leading to quota rents.\textsuperscript{1} If production quota and import controls were removed, imports would increase and the overall effect on the domestic production would be ambiguous. Obviously, the net result of free trade depends upon where the free trade price is compared to the quota level and the autarky price.\textsuperscript{2}

3. The Canadian general equilibrium model

In this section, the Canadian computable general equilibrium (CANCGE) model that is developed for agricultural policy analysis is presented.\textsuperscript{3} The model, has an extensive commodity coverage in order to analyze the agricultural policies in detail. In total, twenty seven sectors that produce commodities for domestic use and export are included. These are: (1) wheat, (2) small grains and oilseeds, (3) other grains, (4) livestock, (5) dairy, (6) poultry, (7) other agriculture, (8) other primary, (9) meat, (10) poultry processing, (11) dairy processing, (12) feed, (13) sugar, (14) other food processing, (15) rubber, plastic and chemicals, (16) refined petroleum and coal, (17) other non-durable manufacturing, (18) other durable manufacturing, (19) metal, (20) machinery, (21) transportation equipment, (22) electric production, (23) construction, (24) transport, (25) trade, (26) financial and real estate, and, (27) other services.

On the production side the output is determined by a constant elasticity of substitution (CES) production function which can be specified as:

\begin{equation}
XS_i = A_i \left( \delta_{i1} L_i + \delta_{i2} T_i + \delta_{i3} K_i \right)^{-1/\rho} \quad (1)
\end{equation}

where, \(XS_i\) is the total output in sector \(i\), \(A_i\) is a shift parameter, \(K_i\) is the stock of the aggregate capital good, \(L_i\) is labor, and \(T_i\) is sectoral land use in agricultural sectors, \(\delta_i\) are the factor share parameters and \(\rho\) is the

\textsuperscript{1} The case of industrial milk is different from the table milk because taxpayers subsidize producers directly, as well as consumers through import controls, on products like cheese and yogurt.

\textsuperscript{2} Canadian processors have indicated that they can neither compete against imports without import quotas, nor able to export industrial milk products (in fact, all supply-managed products) without export subsidies, because of the artificially high prices of domestic farm commodities.

\textsuperscript{3} The theoretical foundations of the model can be found in Derviş et al. (1982), where many aspects of CGE modelling are analyzed.
substitution parameter.

Demands for intermediate inputs, \((V_i)\) are assumed to be determined by a fixed input-output coefficients technology as follows:

\[ V_i = a_i X_i \]  \hspace{1cm} (2)

Sectoral intermediate demands \((V_i)\) can then be aggregated to obtain total intermediate demand \((INT_i)\) by sector of origin.

\[ INT_i = \sum V_i = \sum a_i X_i \]  \hspace{1cm} (3)

Producers base their supply and input demand decisions on the value added or net price \((PVA_i)\) which is defined as:

\[ PVA_i = PX_i \left[ 1 - \text{ITAX}_i \right] + \text{SUBS}_i - \sum \text{PC}_j a_{ij} \]  \hspace{1cm} (4)

where \(PX_i\) is the average sectoral output price, \(\text{ITAX}_i\) is the indirect tax rate, \(\text{SUBS}_i\) is the subsidy rate, \(\text{PC}_i\) is the composite commodity price and \(a_{ij}\) gives the amount of intermediate input \(j\) needed to produce one unit of good \(i\). Hence \(\sum \text{PC}_j a_{ij}\) is the value of intermediate inputs that are used in the production of one unit of good \(i\). With this formulation, a sector whose relative value added price rises, will tend to pull resources away from other sectors.

The total supplies of factors of production are assumed to be fixed. Capital and labor are assumed to be mobile across all sectors and land is mobile in alternative uses among agricultural sectors. Labor, land and capital demands are determined through profit maximization under the assumption of competitive market which requires that the nominal input cost equals the value of its marginal product in each sector. However, in the dairy and poultry sectors the demand for factors of production are determined through minimizing the cost of the supply-managed output levels. By this specification, the difference between the value of the marginal product and nominal input cost is measured as rents accrued from output quotas in the supply-managed sectors. Factor market equilibrium is achieved when the total demand for factors is equal to total fixed supply of the factors in the economy. Hence, average factor prices adjust until the above conditions are satisfied.

Canada is assumed to be a small country in international trade. On the import side, this specification means that Canada can import any quantity without affecting the exogenous world prices. A common treatment of imports in CGE models is the Armington specification (Armington, 1969). In an Armington commodity system, goods are assumed to be differentiated by the country of origin of supply and they are treated as imperfect substitutes. In previous applied models, imports are combined with domestic
goods according to a CES aggregation function. This specification restricts
the elasticity of import demand to one, which has been shown to be
statistically inappropriate (Alston et al., 1990). In order to solve this problem
Hanson et al. (1989) specified an Almost Ideal Demand System (AIDS).
AIDS is a flexible functional form and has advantages over the CES import
aggregation function (Kilkenny and Robinson, 1990). The AIDS formulation
of the Armington assumption gives an import demand function of the
following form:

\[ S_{im} = A_{im} + \gamma_i \ln(\text{PD}/\text{PM}) + \beta_i \ln \left( \frac{\text{CC}}{\text{CCO}} \right) \]  

where \( S_{im} \) is the sectoral value share of imports in total expenditure on
the composite commodity, \( A_{im} \) is the intercept term and represents the base
year share, \( \gamma_i \ln(\text{PD}/\text{PM}) \) gives the effect of changes of relative prices on the
import share, and \( \beta_i \ln \left( \frac{\text{CC}}{\text{CCO}} \right) \) gives the income effect.

World prices of imports are assumed to be exogenous, therefore the
domestic price of the imported good is:

\[ \text{PM}_i = \text{PWM}_i (1 + t_m) \text{ER} \]  

where \( \text{PWM}_i \) is the world price of imports in U.S. dollars, \( t_m \) is the tariff
rate and \( \text{ER} \) is the exchange rate between the U.S. and Canadian dollars.

On the export side of the model, product differentiation is also assumed
through a Constant Elasticity of Transformation (CET) function (Powell et
al., 1968). Thus, the producers are assumed to maximize revenue

\[ \text{PX}, \text{XS}_i = \text{PD}_j, \text{DC}_i + \text{PE}_j \text{E}_i \]  

where \( \text{PD}_j \) is the domestic price, \( \text{DC}_i \) is the domestic commodity, \( \text{PE}_j \) is the
domestic price of exports and \( \text{E}_i \) is the sectoral exports,
subject to a given level of output:

\[ \text{XS}_i = \text{AT}_i \left( \tau_i, \text{E}_i, \frac{\rho_i}{1}, (1-\tau_i) \text{DC}_i, \frac{\rho_i}{1-\rho_i} \right) \]  

where \( \text{AT}_i, \tau_i, \) and \( \rho_i \) are parameters with \( \tau_i \) giving the share of exported good
in total output, and \( \rho_i \) is related to elasticity of transformation (\( \mu_i \)) by the
expression:

\[ \mu_i = \frac{1}{(\rho_i - 1)}. \]  

The solution to this problem gives the optimal allocation between
domestic goods and exports, where the marginal rate of transformation
between the two are equalized to the given relative prices. Hence, the
proportion of the output destined for the export market is directly related to
the price of the good in the world market relative to price in the domestic
market.

\[ \frac{\text{E}_i}{\text{DC}_i} = \left[ \frac{(\text{PE}_i/\text{PD}_j)}{(1-\tau_i)/\tau_i} \right]^{\mu_i} \]
The domestic price of exported good (PE) is determined by:

\[ PE = PWE \cdot (1 + te) \cdot ER \]  

where PWE is the exogenous world price of exports, and te is the export subsidy rate.

In the model the exchange rate is flexible, and the balance of payments condition gives the excess demand equation for foreign exchange and the solution to this determines the nominal exchange rate.

In the model the decision making units that determine the demand for commodities are households and government which demand consumer goods, and firms which demand intermediate and capital goods. There are two representative households, agricultural and the other. Agricultural households receive income from factors such as wage earnings, return to agricultural capital and land earnings. The second source of agricultural household income is the transfers such as transfers from government, from businesses and the rest of the world. Households are assumed to save a fraction of their disposable income according to their marginal propensity to save parameters. Net savings are allocated entirely to investment in the sense that the model is "savings-driven". Savings come from four different sources in the model:

i) Private saving, which is determined by household behavior,
ii) Enterprise saving that corresponds to undistributed profits of the firms,
iii) Public saving which shows the net budget surplus of the government,
iv) Foreign saving which arises from the current account deficit.

Once the saving decisions are made, sectoral household consumption demand (CD) is determined by a Linear Expenditure System (without subsistence minima) as follows:

\[ CD = \sum Q_i \cdot (1-s_i) \cdot Y_i \cdot (1-t_i) / P_i \]  

where Q_i is the average consumption share of sector i's product in total private consumption demand.

In the model productive investment and inventory investment are differentiated. Producers are assumed to make their sectoral inventory investment (DST_i) decisions based on a fixed inventory/total output ratio:

\[ DST_i = \Phi \cdot XS \]  

The general equilibrium solution for the model can be summarized as follows: On the demand side, relative prices and incomes determine the total demands for each composite commodity. Part of this demand is for imports and the rest of it is for domestic production. Product market equilibrium requires that the supply of goods for each sector be equal to total domestic demand (absorption).
\[ \text{CC}_t = \text{INT}_t + \text{CD}_t + \text{GD}_t + \text{ID}_t + \text{DST}_t \]  

(14)

where, \( \text{INT}_t \) are the intermediate demands, \( \text{CD}_t \) are the consumption demands, \( \text{GD}_t \) are the government consumption demands, \( \text{ID}_t \) are the investment demands, and \( \text{DST}_t \) are the sectoral inventory investment demands. Each component of the demand depends on domestic prices, exchange rate and exogenous values of world prices.

Given the balance of payments condition which clears the foreign exchange market, there are as many excess demand equations as the number of prices and the exchange rate. By the Walras' Law, the excess demand equations are not independent and some price normalization rule is required to complete the system. Since only the relative prices are determined in the model, one of the prices must be chosen as the \textit{numéraire}. In fact, in a Walrasian model, the choice of the \textit{numéraire} is arbitrary since all the excess demand equations are homogeneous of degree zero in all prices. In the model GDP deflator is chosen as the \textit{numéraire}.

4. Data

The basic data for 1986 was gathered from various publications of Statistics Canada. For input-output accounts Statistics Canada (1990) was used. However, for the purposes of the present model, further adjustments to this data were necessary. First, agricultural sector is disaggregated into wheat, small grains, other grains, livestock, dairy, poultry, and other agriculture by using the related coefficients from Thomassin and Andison (1987). Second, "other operating surplus" has been disaggregated into capital and land by using corresponding ratios of land and other depletable assets to total fixed assets in agriculture. Third, "net income of unincorporated business" account has been allocated between labor and capital using respective shares of wages, salaries, and supplementary labor income and other operating surplus in the total of these two items. Finally, input-output data have been compiled with the base year macroeconomic data and a micro-consistent general equilibrium data set has been constructed (for details of this procedure see Derviş et al., 1982, and Shoven and Whalley, 1984). The model is solved with a program that is written in the General Algebraic Modelling System (GAMS) Language\(^4\).

In 1986 direct transfer payments to Canadian agriculture include a subsidy on grain transportation of CD $745.7 million, a price subsidy under WGSA of CD $855 million, and industrial milk payments of CD $416

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\(^4\) The complete model and the base year data set are available from the authors upon request.
Table 1
Agricultural Policy and Program Payments in Canada
(1986 million Canadian dollars)

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Direct Payments for Grains</th>
<th>Industrial Milk Subsidy</th>
<th>Quota Reuts a</th>
<th>World Price Response in the GATT scenario b</th>
<th>World Price Response in the Liberalization scenario c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>1008.5</td>
<td></td>
<td>7</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Small Grains</td>
<td>256.1</td>
<td></td>
<td>8</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Other Grains</td>
<td>336.1</td>
<td></td>
<td>5</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Dairy</td>
<td>416</td>
<td>949.6</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
<td>570.6</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Agriculture</td>
<td></td>
<td></td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Base year model solution.

million (Table 1). These direct subsidies were modelled as price wedges between the domestic output price and the price received by the producers, and were included in the analysis of the GATT and multilateral trade liberalization.

5. Effects of agricultural trade liberalization

Analysis of trade liberalization was carried out in three scenarios. First, a unilateral removal of the direct domestic transfer payments to the grains sector and the industrial milk subsidy was examined. Second, a possible outcome of the Uruguay Round of GATT agreement was simulated, finally, a multilateral agricultural liberalization scenario in which all direct transfers, import restrictions and production quotas for supply management were removed, i.e. a complete agricultural trade liberalization in Canada was simulated. The results of these three scenarios are presented in Table 2 and Table 3, respectively.
Table 2
Percentage Changes in Producer Prices Over 1986 Prices in Response to Liberalization in Canadian Agriculture

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Direct Payments</th>
<th>Industrial Milk Subsidy</th>
<th>GATT</th>
<th>Multilateral Trade Liberalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>-12.4</td>
<td>-0.5</td>
<td>0.8</td>
<td>-9.9</td>
</tr>
<tr>
<td>Small Grains</td>
<td>-7.9</td>
<td>-0.3</td>
<td>0.4</td>
<td>-6.5</td>
</tr>
<tr>
<td>Other Grains</td>
<td>-8.6</td>
<td>-0.3</td>
<td>0.5</td>
<td>-7.1</td>
</tr>
<tr>
<td>Livestock</td>
<td>-12.6</td>
<td>-0.5</td>
<td>0.8</td>
<td>-10.1</td>
</tr>
<tr>
<td>Dairy</td>
<td>-7.4</td>
<td>-2.6</td>
<td>0.6</td>
<td>-40.9</td>
</tr>
<tr>
<td>Poultry</td>
<td>-2.4</td>
<td>-5.4</td>
<td>0.8</td>
<td>-52.5</td>
</tr>
<tr>
<td>Other Agriculture</td>
<td>-3.5</td>
<td>-0.2</td>
<td>0.1</td>
<td>-3.1</td>
</tr>
<tr>
<td>Meat Processing</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.2</td>
<td>-0.4</td>
</tr>
<tr>
<td>Poultry Processing</td>
<td>0.0</td>
<td>0.0</td>
<td>-0.2</td>
<td>-0.4</td>
</tr>
<tr>
<td>Dairy Processing</td>
<td>-0.1</td>
<td>0.0</td>
<td>-0.2</td>
<td>-0.4</td>
</tr>
<tr>
<td>Feed</td>
<td>-0.1</td>
<td>0.0</td>
<td>-0.2</td>
<td>-0.4</td>
</tr>
</tbody>
</table>

Source: Authors' estimates.

6. Effects of removing direct transfer payments

The impact of unilaterally removing the direct domestic supports was analyzed in two simulations. First, we removed the grain and oilseeds supports (i.e. WGTA and GRIP) and second we removed the industrial milk subsidy. The removal of the direct payments to grain producers resulted in a decline in the price received by the farmers by 12.4% for wheat, 7.9% for small grains, and 8.6% for other grains (see Column 1 of Table 2). Wheat production decreased by 35% compared to the 1986 base year level and wheat exports declined around 57%. While the direction of change in prices and production was not surprising, the magnitude of change was more than expected. The drop in exports suggests that Canada's export position, at the current world price, is highly influenced by domestic subsidies. The drop in revenue that would occur from the removal of subsidies would be reflected in lower land values. The results also suggested that, the price received by producers in the livestock sector would decline by 12.6% compared to 1986 level due in part to the increase in output of the livestock sector by 1.8%. This is mainly because of the change in the relative prices among agricultural commodities. After the removal of grain price supports, livestock would be a relatively more profitable alternative for the producers.

The removal of the industrial milk subsidy was estimated to have a major impact on the dairy sector. The price received by dairy farmers would decline...
Table 3
Effects of Liberalization in Canadian Agriculture on Sectoral Production, Exports and Imports

<table>
<thead>
<tr>
<th>Base Solution (1986 million Canadian Dollar)</th>
<th>Direct Payments for Grains(^{1})</th>
<th>Industrial Milk Subsidies(^{1})</th>
<th>GATT(^{1})</th>
<th>Multilateral Trade Liberalization(^{1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output (O)</td>
<td>Export (X)</td>
<td>Import (M)</td>
<td>Output (O)</td>
<td>Export (X)</td>
</tr>
<tr>
<td>Wheat</td>
<td>4580.3</td>
<td>2215.5</td>
<td>99.8</td>
<td>-34.6</td>
</tr>
<tr>
<td>Small Grains</td>
<td>3388.3</td>
<td>815.9</td>
<td>276.6</td>
<td>-11.9</td>
</tr>
<tr>
<td>Other Grains</td>
<td>2561.7</td>
<td>274.9</td>
<td>420.5</td>
<td>-8.2</td>
</tr>
<tr>
<td>Livestock</td>
<td>5666.6</td>
<td>535.2</td>
<td>233.3</td>
<td>1.8</td>
</tr>
<tr>
<td>Dairy</td>
<td>2882.4</td>
<td>185.2</td>
<td>274.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Poultry</td>
<td>1383.3</td>
<td>55.5</td>
<td>81.3</td>
<td>0.0</td>
</tr>
<tr>
<td>Other Agriculture</td>
<td>2256.6</td>
<td>249.5</td>
<td>339.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Food Processing</td>
<td>39307.9</td>
<td>5136.6</td>
<td>4613.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Manufacture</td>
<td>335048.1</td>
<td>103327.2</td>
<td>108430.3</td>
<td>1.6</td>
</tr>
<tr>
<td>Services</td>
<td>497085.2</td>
<td>25320.8</td>
<td>22896.7</td>
<td>0.3</td>
</tr>
</tbody>
</table>

\(^{1}\) Percentage change over the base year solution.

Source: Authors' estimates.
around 2.6% and the dairy output would decline around 3.5%. In this scenario, the domestic market was still protected by the import controls, and supply management in the fluid milk market was still in effect. That is, table milk, which is the bulk of milk production, still received a price support from consumers through production quotas and import restrictions. Hence the reduction in farm revenues was mitigated. What is not shown in Table 3 is the distribution of lower returns across provinces. Since, the province of Quebec produces approximately 50% of the industrial milk in Canada any reduction would effect that province the most.

The conclusion to be drawn from this analysis is that Canadian grain and dairy farmers are dependent upon subsidies to compete in current export markets. Without some changes in other countries towards a more liberal world trade in agriculture, a removal of domestic farm programs would significantly reduce farm incomes in Canada.

7. World agricultural trade liberalization

We now turn to the second question and analyze the effects a more liberalized world agricultural trade would have on the Canadian economy. This was carried out in two steps. First we simulated the current GATT agreement. In this simulation all direct payments from the government to agricultural sectors were decreased by 20%. The GATT require a replacement of import quotas with a tariff structure plus a guaranteed access to imports of up to 5% of current Canadian consumption levels. It is also suggested that these tariff equivalents to be decreased by 36% in the next five years. In the supply managed sectors this was simulated by, first, replacing the import restrictions with a tariff equivalent structure for the base year and, second, decreasing the tariff equivalents by 36%. The domestic output controls were still in effect in this simulation; however, the world prices of grains and oilseeds were adjusted upward to reflect the expected increase as a result of the GATT outcome (see Table 1).

The results of this simulation show that, the prices received by farmers in all the agricultural production activities would improve (see Column 3 of Table 2). Output of wheat and small grains (including oilseeds) would increase by 1.7 and 5.6%, respectively. Canada would be more competitive especially in small grains and oilseeds where exports would increase by 20.3% over the 1986 level. The imports of dairy and poultry sectors would increase by 31 and 35%, respectively as a result of removal of import restrictions and changes in the tariff structure (this is still within the 5%
The aggregate results of the GATT for Canadian agriculture are positive. Household income and land returns both increase over the current levels. The government deficit is decreased as well, because of the drop in transfer payments.

The second trade liberalization simulation was a complete multilateral agricultural trade liberalization. The expected increase in world price for agricultural commodities in response to a world-wide trade liberalization were those estimated in the world agricultural liberalization model by Burniaux et al. (1990). When all direct government transfers to agriculture, the import restrictions, and domestic production quotas in supply-managed sectors were removed, there were large changes in the agricultural sectors. First, grain and livestock (beef and pork) producers had a net decrease in price of about 6.5 to 10.1 % (Table 2). The dairy and poultry sectors experienced a sharp decline in price, due mainly to removal of quotas. Price received by the producers in the supply managed sectors declined by 40.9 % in dairy products and 52.5 % in poultry. Finally, the general equilibrium price effect was observed in the food processing sectors in which domestic prices of meat, poultry and dairy processing sectors also declined.

The first important result suggested that the poultry sector would have a better chance of surviving complete trade liberalization than the dairy sector. The second conclusion that grain and oilseed producers would not fare so well under complete trade liberalization is also an important result. The basic reasons for this result can be summarized as follows: First, Canadian cereal yields have not increased as fast as those in Europe. This lack of growth in yields per acre has directly reduced the comparative advantage of grains in the prairies. Second, rising cost of transportation and handling of prairie grains has also eroded the traditional comparative advantage of prairie grains. Canada’s major competitors in the grain export markets, Europe, United States, Australia and Argentina do not have long distances over which grain must be transported. All these changes have made Canadian grain farmers less competitive in the international marketplace.

8. Macroeconomic effects

Macroeconomic effects of the above scenarios are summarized in Table 4. The results obtained in all the scenarios suggested that, the overall effect on the exchange rates were not important, being less than 1 % in all simulations. The real income gains from a unilateral liberalization in agriculture were CD $ 1.8 billion in the case of the removal of direct


Table 4
Macroeconomic Effects of Liberalization in Agriculture*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Base Solution</th>
<th>Direct Payments for Grains</th>
<th>Industrial Milk Subsidy</th>
<th>GATT</th>
<th>Multilateral Liberalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange Rate*</td>
<td>1.387</td>
<td>1.389</td>
<td>1.386</td>
<td>1.364</td>
<td>1.385</td>
</tr>
<tr>
<td>GDP</td>
<td>506107.9</td>
<td>507972.1</td>
<td>506402.3</td>
<td>506285.6</td>
<td>508549.2</td>
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<tr>
<td>Investment</td>
<td>103381.2</td>
<td>105124.9</td>
<td>103774.2</td>
<td>103971.1</td>
<td>106923.6</td>
</tr>
<tr>
<td>Fixed Investment</td>
<td>101634.2</td>
<td>103466.5</td>
<td>102021.3</td>
<td>102439.3</td>
<td>105047.2</td>
</tr>
<tr>
<td>Household Savings</td>
<td>42048.6</td>
<td>41915.1</td>
<td>42026.8</td>
<td>42000.5</td>
<td>41719.4</td>
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<tr>
<td>Enterprise Savings</td>
<td>78173.6</td>
<td>78565.9</td>
<td>78173.9</td>
<td>78066.1</td>
<td>78073.7</td>
</tr>
<tr>
<td>Agricultural Savings</td>
<td>4358.9</td>
<td>3430.8</td>
<td>4271.4</td>
<td>4315.6</td>
<td>2859.9</td>
</tr>
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<td>Government Deficit</td>
<td>13767.1</td>
<td>11337.3</td>
<td>12677.7</td>
<td>12989.2</td>
<td>5840.7</td>
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<td>Government Revenue</td>
<td>187669.4</td>
<td>190051.9</td>
<td>188142.0</td>
<td>188325.1</td>
<td>192570.9</td>
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<tr>
<td>Total Subsidies</td>
<td>10642.6</td>
<td>8871.7</td>
<td>10241.8</td>
<td>9860.0</td>
<td>5989.4</td>
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<tr>
<td>Indirect Taxes</td>
<td>60191.9</td>
<td>60351.4</td>
<td>60220.5</td>
<td>60208.8</td>
<td>60400.3</td>
</tr>
<tr>
<td>Tariff Revenue</td>
<td>4170.6</td>
<td>4223.4</td>
<td>4177.5</td>
<td>4175.6</td>
<td>4236.1</td>
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<td>Household Taxes</td>
<td>4926.6</td>
<td>4844.6</td>
<td>4926.2</td>
<td>4917.5</td>
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<td>Agr. Household Income</td>
<td>15096.5</td>
<td>13906.1</td>
<td>15541.5</td>
<td>15621.7</td>
<td>13312.8</td>
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<td>Other Household Income</td>
<td>413770.1</td>
<td>415750.6</td>
<td>413851.3</td>
<td>413403.8</td>
<td>414810.5</td>
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<td>Labor Earnings</td>
<td>274343.8</td>
<td>275213.6</td>
<td>274755.5</td>
<td>274076.1</td>
<td>274660.0</td>
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<td>Capital Earnings</td>
<td>173244.2</td>
<td>173400.8</td>
<td>173197.9</td>
<td>172922.5</td>
<td>172895.2</td>
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<tr>
<td>Land Rentals</td>
<td>3278.3</td>
<td>2095.7</td>
<td>3223.7</td>
<td>3308.2</td>
<td>2346.8</td>
</tr>
<tr>
<td>Agricultural Employment*</td>
<td>497085.4</td>
<td>451601.0</td>
<td>489952.9</td>
<td>488953.4</td>
<td>441061.4</td>
</tr>
</tbody>
</table>

* Magnitudes are millions of 1986 dollars unless otherwise indicated.

Source: Authors' estimates.

Subsidies for grains, CD $ 294 million in the removal of the industrial milk subsidy. In the multilateral liberalization simulations, the real income gain was CD $ 177 million in the GATT scenario and 2.4 CD $ billion in the multilateral liberalization scenario. Overall income gains constitute less than 1% of the real income in Canadian economy. This is consistent with the fact that agriculture makes up about 3% of the GDP in Canada. Government revenues increased by CD $ 2.4 billion in the removal of grain subsidies, CD $ 472 million in the case of industrial milk subsidy, CD $ 655 million in the GATT, and CD $ 4.9 billion in the multilateral liberalization scenario. Consequently, the government deficit declined sharply. The government deficit decreased around CD $ 2.5 billion after the removal of grain price supports, CD $ 500 million in the industrial milk scenario, CD $ 777 million in the GATT scenario and CD $ 5.2 billion in the multilateral liberalization scenario. Main sources of the improvement in the government budget were...
higher government revenues and the declining program pay-outs. Given that
the agricultural supply changed very little with trade liberalization, it can be
argued that most of these transfer payments were simply economic rent to
production. Another way to express the same result is to examine how return
to land would decrease as a result of more liberal agricultural policies. As a
result of declining prices in agricultural sectors, return to land decreased by
CD $ 1.2 billion (36.1 %) in the case where only grain subsidies were
removed. The decrease in the returns to land reached CD $ 931.5 million
(28.4 %) in the multilateral liberalization scenario.

Declining prices and outputs lead to movement of labor and capital out
of agriculture into relatively higher marginal value product sectors. In fact
the largest efficiency gain in the economy obtained from reducing the output
of highly subsidized agricultural sectors such as grains and oilseeds. As a
result, agricultural employment decreased around 9.2 % in grain price
supports, 1.4 % in industrial milk, 1.6 % in the GATT and 11.3 % in the
multilateral liberalization scenarios compared to the 1986 levels.

Consequently, agricultural household incomes and agricultural savings also
decreased because of liberalization. Agricultural savings declined by CD $ 928.1 million (20.3 %) after the removal of grain price supports and CD $ 87.5 million (2.4 %) with the removal of industrial milk subsidy. In the
liberalization scenarios, agricultural savings declined by CD $ 43.3 million
(1 %) in the GATT and CD $ 329.2 million (34.4 %) in the multilateral
liberalization scenario. One can argue that there are substantial economy-
wide efficiency gains from agricultural trade liberalization for the Canadian
economy. However, these gains would be achieved at the expense of lower
returns to factors of production that are employed in agriculture and hence
lower agricultural incomes. This also shows that the adjustment to a more
liberalized agricultural trade would be difficult in these sectors.

9. Conclusion

Previous analyses of trade liberalization for Canadian agriculture have
been done either in a partial equilibrium framework for various industries or
in a general equilibrium framework in which the structure of the agriculture
industry is overlooked. In this paper, we developed a general equilibrium
model of the Canadian economy which has a high level of disaggregation for
agriculture and hence allowed us to incorporate all specific agricultural policy

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5 This would convert to 45484 jobs in grain price supports, 7133 jobs in industrial milk
subsidy, 8132 jobs in the GATT and 56023 jobs in the multilateral liberalization scenarios.
instruments including price supports, supply management and import restrictions. The model produced similar results to that of partial equilibrium estimates at the sectoral level and at the same time allowed us to analyze the economy-wide effects of agricultural liberalization.

The results obtained under different simulations showed that, in the long run agricultural and agriculture-related food processing sectors may contract as result of a move towards more liberal agricultural policy and programs. At the micro level, adjustment would occur through decreasing employment in the agricultural sectors. At the macro level, there would be an improvement in the government budget, through declining program pay-outs. However, the results of the study suggest that these improvements in the real income and the government budget would be achieved at the expense of declining agricultural employment and incomes.

The drop in price for supply managed products resulted in a modest cut back in dairy production and a small increase in poultry production. While there are general equilibrium effects of resources moving between sectors, these results support the argument that most of the transfer payments to farmers result in increased rents rather than increases in output.

There are at least two strong conclusions that can be drawn from this study. First, multilateral free trade leads to the highest GDP for the Canadian economy. However, Canadian agriculture does not fare well given the world price responses, and the cost structure for the industry. One can conclude that, the cost of producing and marketing agricultural commodities in Canada must decline if the industry is to be competitive in world markets. It is interesting to note that some other agricultural exporters have already made this adjustment, notably New Zealand and Australia.

A second strong conclusion is that Canadian agriculture would do quite well under the GATT agreement. The grains and oilseeds prices would rise, and farm exports would also increase. The supply-managed commodities would experience a drop in production, mainly due to the increased guaranteed access, but the prices received by dairy and poultry farmers would not decrease.
References


Özet

Kanada Tarımında Ticaret Liberalizasyonunun Bir Genel Denge Değerlendirmesi

Bu çalışmada Kanada ekonomisi için tarım ve tarıma dayalı sektörlerin ayrıntılı olarak yer aldığı bir genel denge modeli geliştirilmiş ve bu model tarım ürünlerini ticaretinde liberalizasyonun Kanada ekonomisine olası etkilerinin araştırılmasında kullanılmıştır.
