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Title:

Impacts of Trade and Macroeconomic Linkages on Canadian Agriculture

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Abstract

Implications of trade and macroeconomic policies on the performance of the Canadian agricultural sector were analyzed using a structural econometric model. Results indicated that had Canada been more integrated with the world economy, its volume of trade would have been 3 percent higher and much greater price incentives for agriculture would have occurred.

Impacts of Trade and Macroeconomic Linkages on Canadian Agriculture

I. Introduction

Until recently, research on domestic agricultural policy focused largely on the impact of specific direct interventions in the market of agricultural products. Little was done to link agricultural performance to changing macroeconomic policies. However, with the move away from the Bretton Woods system of fixed exchange rates, it has become increasingly difficult to ignore the importance of the trade and macroeconomic dimensions to agricultural markets.

In his pioneering work, Schuh (1974) was without doubt the first to point out the importance of macroeconomic policy to agriculture through its impact on exchange rates. Later, Chambers and Just (1981), and Longmire and Morey (1983) presented evidence to ascertain the dominant effects of exchange rates on agricultural trade and prices. Other studies further suggested that, in the 1980's, macro-economic variables became even more important than the traditional sectoral variables as determinants of farm prices and incomes (Bautista and valdes, 1993; Valdes, 1986).

However, despite the recognition that exchange rates and macroeconomic policies have important effects on agricultural performance, economists still argue about the magnitude of these effects and the dominant effect of exchange rates. Indeed, Batten and Belongia, (1984) argue that, while exchange rates are important, variations in agricultural exports are dominated more by changes in real GNP in importing countries rather than changes in real exchange rates.

Answers to these conflicts as to the magnitude of these effects on agricultural markets are yet to come and more empirical work on this subject is needed. Indeed, the 1988 AAEA-sponsored pre-conference workshop on this subject manifests the profession's interest in quantifying the effects that macroeconomic factors have upon the economic performance and financial health of agriculture. This study is an effort in this direction. In particular, the implications of exchange rates and macroeconomic policies on the performance of the agricultural sector are analyzed within the framework of a structural econometric model. Further, an attempt to provide some orders of magnitude to these macroeconomic effects is made within the framework of the Canadian agricultural sector.

Background development of the Canadian agricultural economy

The importance of agriculture in Canada's international trade is proportionately greater than implied by its overall contribution to GDP. Canada is a major exporter of food and agricultural products and trade in these items is an important determinant of its overall balance of trade. The Canadian agricultural exports in the early seventies increased at a 13.2 percent per annum growth rate. Agricultural exports as a percentage of total exports averaged around 12 percent in 1970 through 1975, then drifted downward to reach a bottom low of 7.2 percent. Food imports while significant are lower than exports.

Though the overall net agricultural trade position is one of surplus, the drift in

agricultural exports in the 1980's can hardly go unnoticed. What caused this decline in Canadian agricultural exports? Answer to this question is yet to come. However, the development in the early 1970's, i.e., the move to a flexible exchange rates and the development of a well integrated international capital market, formed the basis of all the rhetoric about this problem. The main interest in this paper is to investigate the relative contribution of trade and macroeconomic policies to this problem.

The rest of the paper is organized as follows. Section 2 reviews the theoretical framework used to investigate the effects of commercial and macroeconomic policies on agricultural market performance. Section 3 outlines the analytical framework used to assess the extent of these effects on the performance of the Canadian agricultural sector. The impact of an alternative trade and macroeconomic policy scenario on the Canadian agricultural sector is the focus of section 4. Section 5 presents the general conclusions and summary of this study.

II. Trade and macroeconomic linkages: a RER approach.

To analyze the effects of trade and macroeconomic policies on the structure of incentives to a predominantly tradeable sector such as agriculture, economists often evaluated the effects of such policies on the real exchange rate (RER). The traded/ nontraded goods model, based on the concept of the RER, is often used to investigate these effects.

2.1 The traded /nontraded goods model

Consider an economy that consumes and produces both exportables (x) and importables (m) as well as nontraded (home) goods (h). Further, assume this economy is a price taker in world markets and income equals consumption. Let P_x, P_m, and P_h be the prices of exportable, importable, and home goods, respectively. Within this framework, while domestic supply and demand of both traded goods need not be equal because the gap is closed by trade, the same is not true for nontraded goods. Nontraded goods market have to clear through the adjustment of P_h. The formal model may then be reduced to the equilibrium condition in the home goods market (Dornbusch, 1974; corden, 1971). In equilibrium, the excess demand for nontraded goods will be zero:

$$N(P_x/P_h,\ P_m/P_h,\ Y) = 0 \qquad (1)$$

Note also that the domestic relative price of importable in terms of exportable, P_m/P_x, is determined by the given world terms of trade, P^*, and the tariff wedge, $T = (1+t)$.

$$P_m/P_x = P^* T \qquad (2)$$

A framework for evaluating the effects of a tariff on trade is obtained by totally differentiating the market equilibrium condition in (1) and noting that the redistribution of tariff proceeds implies a zero net income effect (constant real income).

$$\frac{\partial N}{\partial (P_m/P_h)} \frac{d(P_m/P_h)}{dt} + \frac{\partial N}{\partial (P_x/P_h)} \frac{d(P_x/P_h)}{dt} = 0 \qquad (3)$$

Define the compensated excess demand elasticities of home goods w.r.t relative prices

of importable and exportable as $\Delta_m \equiv \frac{\partial N}{\partial (P_m/P_h)} \frac{P_m/P_h}{(P_m/P_h)M}$ and $\Delta_x \equiv \frac{\partial N}{\partial (P_x/P_h)} \frac{P_x/P_h}{(P_x/P_h)X}$,

respectively. One can write the above as $$\Delta_m (\hat{P}_m - \hat{P}_h) + \Delta_x (\hat{P}_x - \hat{P}_h) = 0 \quad (4)$$

Where a hat denotes the proportional change in a variable. Since terms of trade are given, a change in the domestic relative price of importables in terms of exportables is identically equal to the tariff change. That is: $(\hat{P}_m - \hat{P}_h) - (\hat{P}_x - \hat{P}_h) = \hat{T}$. Substituting this result into (4) above, one can solve for the change in the equilibrium relative prices of traded goods in terms of nontraded goods triggered by a change in the tariff.

$$\begin{aligned} \hat{P}_x - \hat{P}_h &= -\frac{\Delta_m}{\Delta_m + \Delta_x} \hat{T} \\ \hat{P}_m - \hat{P}_h &= \left[1 - \frac{\Delta_m}{\Delta_m + \Delta_x}\right] \hat{T} = \frac{\Delta_x}{\Delta_m + \Delta_x} \hat{T} \end{aligned} \quad (5)$$

Integrating (5) and substituting $\hat{T} = (\hat{P}_m - \hat{P}_x)$ in the above system yields a framework for evaluating the consequences of trade policies on relative agricultural prices.

$$\begin{aligned} Ln\,(P_x/P_h) &= a + \omega\, Ln\,(P_x/P_m) \\ Ln\,(P_m/P_h) &= a - (1-\omega)\, Ln\,(P_x/P_m) \end{aligned} \quad (6)$$

These effects of trade policies on relative agricultural prices through the real rate

of exchange, though clear in the literature, should not obscure the fact that accompanying macroeconomic policies such as fiscal and monetary policies can offset the changes in the RER caused by trade policies. Indeed, macroeconomic policies designed originally to generate employment and expand output may lead to incentive bias against agriculture.

2.2. Macroeconomic policies and agricultural incentives

To illustrate, consider an economy with continuous budget deficit. Expansionary government spending causes an increase in the demand for home goods which raises their price and causes the RER to decline. The reduction in the RER will work against the entire tradeable component of agriculture, both exportable and import competing. This effect would occur regardless of whether the additional expenditure is financed by borrowing or expansion of money supply.

Increased government spending through domestic borrowing will raise interest rates and crowd out the private sector. Reduction in private spending causes a change in composition of expenditure in favor of government and leads to a decline in the RER. Similarly, foreign borrowing to finance increased expenditures will lead to a decline in the RER. Capital inflow increases the demand for home goods through the income effect of a larger consumption. Therefore, the price of home goods increases, implying a decline in the RER.

When the deficit is financed by an expansion of the money supply, Snape (1989) argues that monetary expansion will bring about domestic inflation. Production of

tradeable goods is discouraged since, at fixed nominal exchange rate, their prices are anchored by world prices. Production of non-tradeable goods, on the other hand, is encouraged since their prices can rise. The end result is a decline in the RER.

III. Analytical framework

The framework used to assess the effects of trade and macroeconomic policies on the performance of the agricultural sector embraces the idea that changes in agricultural performance occur as a response to changes in the economic environment. This latter is defined by relevant indicators of the state of the economy such as trade and fiscal and monetary policies. Impacts of these policies are transmitted to agriculture through specific linkage mechanisms. Explicit introduction of these policy indicators makes it possible to analyze the channels by which the economic environment affects incentive structures for agricultural production.

The model comprises two blocks. The first, examines how trade and general macroeconomic policies affect price incentives in agriculture. The price block comprises three equations: one to explain the real exchange rate, another one to explain the degree of commercial openness of the economy, and a third one to explain the relative agricultural price.

Relative agricultural price estimates obtained from the first block of equations are fed into a second output and factor prices block. Variations in relative agricultural prices, among other "state variables", allow for a choice of a technique to be implemented.

Thus, affecting sectoral output and resource productivity. The theoretical basis for this approach was developed by Mundlak (1988).

Thus, unlike most economic analyses, this study assumes that at any point in time the economy has a large collection of techniques for production. Each technique is identified with a production function. The subset of techniques that are actually implemented is referred to as the "implemented technology". The latter is determined by the available technology, constraints (e.g., capital) and prices. These variables, referred to as "state variables", reflect the economic environment and allow for a choice of a technique to be implemented.

The production technology is approximated by a Cobb-Douglas function in which the intercept and the slope are functions of the state variables. Sectoral output is expressed as a function of sectoral labor, capital, and the state variables. Further, along with the factor shares, the production block includes an equation for Canadian farmland values.

3.3 Data and model estimation

It is now possible to assemble the different structural equations and build the price and the production systems of equations. Estimation of these block requires the use of different sets of data. In particular, annual data on commodity flows; prices, wages and rates of returns; resources; fiscal and monetary variables; and other derived ratios were used. Data were collected for the above categories for the period 1960-1992. When necessary constant price data are used at the price level of 1985.

Given the simultaneous nature of the model, two stages least squares procedure was used. Parameter estimates from the simultaneous system of equation are not significantly different from those obtained in a preliminary analysis of each structural equation estimated individually. Further, validation of the model comparing a static simulation of the endogenous variables with the actual values for the period of investigation, 1960-1992 indicated the model's good fit. Summary results of the simultaneous system of equations estimation is reported in table 1 and 2 below.

Now that an empirical model has been estimated and validated, it can be used to investigate the effects of a program of trade liberalization and macroeconomic policy management of the economy. The next section focusses on such a program to determine its effects on price incentives in the Canadian agriculture.

Table 1. Simultaneous estimation of the price system of equations, 1960-1992.

Equations (1)-(3).

$$\underset{}{\text{Ln DCO}} = \underset{(-1.52)}{-0.084} + \underset{(1.57)}{0.386}\,\text{Ln}(1-t_x/1+t_m) \underset{(-1.95)}{-0.259}\,\text{Ln g} + \underset{(2.33)}{0.118}\,\text{D74} + \underset{(11.19)}{0.812}\,\text{LnDCO}_{t-1}$$

$R^2 = 0.88$

$$\text{Ln}(P_x/P_h) = \underset{(-2.34)}{-0.505} + \underset{(2.90)}{0.609}\,\text{Ln}(P_x/P_m) \underset{(-1.74)}{-0.405}\,\text{Ln g} \underset{(-7.44)}{-0.606}\,\text{Ln u} \underset{(-3.21)}{-0.058}\,\text{Ln Y}$$

$R^2 = 0.79$

$$\text{Ln}(P_i/P_h) = \underset{(7.00)}{0.501} + \underset{(2.31)}{0.140}\,\text{Ln}(P_x/P_h) \underset{(-1.27)}{-0.058}\,\text{Ln u} \underset{(-3.57)}{-0.029}\,\text{Ln Y} \underset{(6.23)}{-0.304}\,\text{Ln DCO}$$

$R^2 = 0.87$

Notes: t-statistics are in parenthesis.

Table 2. Simultaneous estimation of the production system of equations, 1960-1992.

Equations (1)-(3)

$$\text{Intercept } (\Gamma) = \underset{(6.15)}{13.479} - \underset{(-1.01)}{2.780}\ \text{Ln}(P_l/P_h) - \underset{(-7.54)}{1.684}\ \text{Ln}(K/N) - \underset{(-9.92)}{2.496}\ \text{Lnrl} + \underset{(2.28)}{0.392}\ \Gamma_{t-1}$$

$R^2 = 0.90$

$$\text{K. Share } (B) = \underset{(-4.02)}{-0.736} - \underset{(1.33)}{0.305}\ \text{Ln}(P_l/P_h) - \underset{(8.72)}{0.164}\ \text{Ln}(K/N) - \underset{(11.62)}{0.246}\ \text{Lnrl} + \underset{(1.95)}{0.325}\ B_{t-1}$$

$R^2 = 0.91$

$$\text{Ln}(P_L/P) = \underset{(-2.28)}{-1.234} + \underset{(4.24)}{1.175}\ \text{Ln}(P_l/P_h) + \underset{(2.22)}{0.110}\ \text{Ln}(K/N) + \underset{(4.85)}{0.542}\ KG^e + \underset{(23.75)}{0.844}\ \text{Ln}(PL/P)_{t-1}$$

$R^2 = 0.98$

Notes: t-statistics are in parenthesis.

IV. Simulating the effects of policy changes

The price system of equations is used to simulate the effects of a trade liberalization program implemented together with consistent macroeconomic policies. Changes in trade policies are introduced in the year 1970. These changes consisted of completely eliminating taxes on exports and setting a uniform tariff of 5 percent on imports. Changes in government expenditures are assumed only in periods when drastic increases in the variable took place. The reasoning behind the imposed values is to bring the fiscal deficit financed by borrowing to a manageable level. Finally, money supply as a proportion of income which reached a record high in 1966-70 and could not be sustained for later years is assumed to grow smoothly during that period and remain constant after 1982.

4.1 Simulation run results

Results from the simulation run indicated that relative prices respond to policy changes. Indeed, the trade liberalization and macroeconomic policy program caused an increase of the degree of commercial openness, real rate of exchange, and relative price of agriculture by 2.3 percent, 9.8 percent, and 7.7 percent, respectively. This implies that had Canada been more integrated with the world economy, its volume of trade would have been almost 3 percent higher, and the price incentives for agriculture would have been, on average, 8 percent higher.

4.2 Aggregate supply and farmland values response to trade liberalization

The output and factor prices block is used in this section to provide estimates of the supply elasticity for Canadian agricultural output. This parameter is particularly important for public policy given that it measures the ability of the agricultural sector to adjust production to changing economic conditions confronting it in a dynamic economy. To achieve this end, we simulate the production block with the new relative agricultural prices that result from the alternative trade and macroeconomic policy scenario.

Results from the simulation run indicate that aggregate supply of Canadian agricultural products from the sector as a whole is quite responsive to incentives. This finding lends support to the growing body of evidence that the supply of agricultural products may not be as inelastic as had often been assumed. Indeed, over a 20 year time span aggregate supply elasticity moved from 1.53 to 2.01 with an average value of 1.76. These results are consistent with the estimates of the aggregate long-run supply elasticities for agriculture found in the literature (Tweeten and Quance, 1969; Pandey et

al., 1982; Colman and Rayner, 1971). Land prices, on the other hand, were not very responsive to price increases. Results indicate a long-run price elasticity of 0.34.

V. Summary and conclusions

The implications of trade and macroeconomic policies on the Canadian agricultural sector performance are investigated within a structural econometric model. After validation, the model was used to investigate the impact of a trade liberalization and macroeconomic policy management of the economy. Results from this program indicated an increase of the degree of commercial openness, the RER, and the relative agricultural price by 2.3 %, 9.8 %, and 7.7 %, respectively. This implies that had Canada been more integrated with the world economy, the volume of trade would have been almost 3 percent higher; and much greater price incentives for agriculture would have occurred. Indeed, relative agricultural prices would have been, on average, 8 percent higher for the period of investigation.

Relative agricultural price estimates resulting from this scenario were used to simulate the production block and assess the price responsiveness of Canadian agricultural supply. Results indicated that aggregate supply of Canadian agriculture is quite responsive to price incentives. Indeed, over the period of investigation, aggregate supply elasticity averaged a value of 1.76. This result is consistent with the estimates of the aggregate long-run supply elasticities for agriculture reported in the literature. Land prices, on the other hand, were not very responsive to price increases.

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