Economic Development Policy for Canadian Agriculture

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Abstract: This study examines three alternative public policies to expand growth in Canadian agricultural production and trade: an approximately 50 percent increase in publicly-funded research and development, a 2 percent subsidy on exports for expanded market development, and a 25 percent reduction in the tariff equivalent of trade barriers. The study used a world food model developed at the International Institute for Applied Systems Analysis (IIASA) to evaluate the impacts of the alternative policies during 1980-2000. The results showed that the largest gains from trade liberalization would be for livestock products, where protection is currently highest Market development activities would also benefit livestock most, as demand is more responsive to market prices. Productivity increases would be most effective in expanding grain production and exports.

Introduction

The Canadian economy has emerged from the worst depression since the 1930s. The new government in Canada is confronted with an economic environment (for the remainder of the 1980s) of slow economic growth, high unemployment levels, and a large government deficit.[2] Policies and programmes to alleviate those problems are a high priority. The agricultural sector has been affected by low commodity prices and high costs, particularly those associated with debt repayments but also for energy and other purchased inputs arising from a depreciated Canadian dollar (relative to the US dollar). An increasing number of farm bankruptcies, low farm incomes, depreciated net worth of farmers, and increasing export competition with more restrictive import markets have created considerable pressure for wide ranging modifications in agricultural policies to provide more effective income support. The government has stated that, for agricultural productivity improvement and modernization to meet international competition, programmes must be designed and operated on a businesslike basis that rely on private sector initiatives. Any policy changes in the agricultural sector, therefore, need to be evaluated as to their impacts on the general economy.

The development of agricultural policy in Canada during the postwar period has generally been introduced on a single commodity or regional basis because problems emerge and political pressure groups are organized on that basis. Proposals to reduce government deficits have focussed on those areas with the largest government expenditures. Both approaches have inherent pressures to undertake policy making with a very narrow focus. The linkages among commodities within agriculture and between the agricultural and nonagricultural sectors must be fully recognized in any evaluation of agricultural policy.

As a consequence of the economic problems facing the government, pressure will be applied to increase agricultural programmes, to consider more frequently the tradeoffs with the nonagricultural sector, and to stimulate growth and development in agriculture. Such pressure will necessitate more comprehensive and analytical support for public expenditures and regulation in agriculture.

Canadian agriculture depends heavily on the export market, and agriculture accounts for about 10 percent of total Canadian exports. Export earnings are equivalent to over 50 percent of farm cash receipts. For commodities like wheat, barley, flaxseed, and rapeseed, exports can account for over 80 percent of production. The domestic market is small and demand is growing very slowly. Hence, export expansion holds the key to expanded agricultural growth. Increasing foreign government intervention in agricultural trade has made Canadian export expansion more difficult, as governments seek to protect the incomes of farmers through import restrictions and to expand exports through the use of subsidies, special trade arrangements, and promotion.

The intent of this paper is to illustrate that large differences exist in impacts among several strategies of fiscal or regulatory actions. We consider three types of public policies to improve the economic growth in the Canadian agricultural sector: expanded research and development activity to increase productivity and output, enhanced export markets with higher producer prices and export subsidies, and reduced levels of protection provided by tariffs, quotas, and other regulations through multilateral trade liberalization.

The three policies are examined through the use of the World Food Model developed by the International Institute for Applied Systems Analysis (IIASA). A dynamic simulation of the model was made for 1980-2000 to permit a phase-in period and to account for all the interrelationships and feedbacks. The model uses a general equilibrium framework to improve the consistency and completeness of the analysis.

Methodology

The structure and properties of the IIASA model have been described by Fischer and Frohberg (1982). The IIASA model includes 20 major countries explicitly modelled in a general equilibrium structure and linked through an international market exchange algorithm. The rest of the world (approximately 40 percent of agricultural production) is divided into 14 regions and represented by simple relationships. Two countries (USA and India) have very detailed representations, particularly for the production block, while another country and one region (China and the CMEA) have limited endogenous links within the global exchange mechanism. A description and analysis of the Canadian component are provided in Frohberg and Fischer (1984) and Robertson and Huff (1983). The level of disaggregation at the international level is 10 commodities (9 agricultural and 1 nonagricultural). Each country has 3 main blocks: consumer demand, commodity production, and public policy. For most countries, the consumer demand is structured in a linear expenditure system format. Production is predetermined, based on a production function of capital, labour, land, and fertilizer inputs. Inputs are allocated among commodities on the basis of a nonlinear programming model that maximizes producer expected net revenue. The IIASA model incorporates a reduced-form endogenous policy relationship, thereby permitting the evolution of policy according to economic conditions.

The complete IIASA model was simulated over the 1980-2000 period. The validation of that benchmark simulation included a review by a number of commodity and country specialists and thus incorporates some of their *a priori* expectations for critical commodity variables. The international prices from that simulation were the basis for the evaluation of the research and development and export enhancement results. Prices for the trade liberalization alternative were derived from a multilateral reduction of trade protection by all countries. In all simulations, the Canadian model incorporated those prices exogenously; the net export functions of other countries are thus not affected by Canada. To reflect current dairy policy in Canada, production was constrained to the previous period's domestic disappearance, except for the trade liberalization policy alternative.

The first policy—the expanded Canadian research and development (R&D) activities—was examined by adjusting the productivity trends incorporated in the IIASA model's production functions for the grains and oilseeds commodities by 17.5 percent.[3] The rate for yield increases was phased in between 1983 and 1990 to account for the lags between R&D activities and actual output increases. We assumed that an expenditure of C$66 million—about a 40 percent increase in the federal research budget for crops—would produce that level of research output.[4]

The second policy, enhanced export markets, could be introduced through a 2 percent increase for producer prices for export commodities (wheat, coarse grains, beef, other animals, and nonfood agriculture) and financed by consumers for the domestic consumption and government for export markets. For exports, government expenditures could be introduced through low cost credit, exporter services, or simply export subsidies. For that policy, the assumption of no reaction by other exporters may be questionable, particularly for commodities such as grains and oilseeds. The estimated cost of the programme to enhance export markets is about C$200 million.

The third alternative, trade liberalization, was evaluated by a multilateral reduction in all forms of protection. For the IIASA model simulations, the reduction was introduced by decreasing the world and domestic price differentials in all countries. The differentials or tariff equivalents of the border protection were reduced by 25 percent. The changes were instituted between 1982 and 1986 in a set of equal annual steps.

Results

The benchmark simulation for the 1980-2000 period indicates a moderate growth rate for Canadian agriculture, with GDP (agriculture) forecast to increase at 1.96 percent per year, one percentage point below the 1970s' rate of 2.98 (Table 1). Commodity prices for the agricultural sector are predicted to remain unchanged *vis-à-vis* nonagricultural prices.

Each policy (with respect to the benchmark simulation) provided a stimulus to the growth of the agricultural sector. The R&D improvement provided the largest growth in total production for agriculture and utilized the largest quantity of inputs (fertilizer, labour, and capital). For R&D improvement, as expected, the largest increases (compared to the benchmark) are shown for wheat (68 percent), coarse grains (52 percent), and protein feed (21 percent) (i.e., those commodities with

Table 1—Growth* of Canadian Agriculture, 1980-2000, Under Different Policies

	Benchmark	Expanded R&D	Export Enhancement	Trade Liberalization
Macro				
GDP (agriculture)	1.96	2.83	2.07	2.08
Capital investment	2.80	3.47	2.92	2.85
Fertilizer use	6.63	9.60	7.08	7.67
Labour in agriculture	0.18	1.06	0.30	0.12
Production				
Wheat	2.47	5.17	2.66	3.32
Coarse grains	2.94	5.12	3.09	2.99
Beef	2.17	2.48	2.31	1.80
Dairy	0.94	0.95	0.95	2.12
Other animals	2.11	2.26	2.23	2.20
Trade				
Wheat	3.00	6.01	3.20	3.73
Coarse grains	8.19	12.67	8.41	7.50
Beef	9.30	10.88	10.22	2.64
Other animals	2.79	3.14	3.08	3.09

[*Average annual percentage rates. Source: IIASA.]

increased research expenditures). Most of the fertilizer increase (as well as labour and capital) was allocated to wheat and coarse grains, substantially increasing their yields. However, livestock production also increased and did so at a faster rate than for the export subsidy policy, which is a likely result: as an expansion in resources (especially labour) devoted to crop production occurs, some of the resources within agriculture may be allocated to animal production to be fully utilized on a seasonal basis. Since domestic consumption is only marginally affected by the increased production, the main result is that exports expand as production expands. Dairy production was constrained to domestic demand levels.

The enhanced export markets programme increased production in the year 2000 by 2.7-3.6 percent for the export commodities and 1.7-2.3 percent for net import commodities (compared with the benchmark scenario). The differences largely reflect supply elasticities, with the largest response for wheat.

The liberalized trade policy had significantly different impacts on commodity production levels. The largest increases for the 1980-2000 period were for wheat (19 percent) and dairy (26 percent); a small increase occurred for coarse grains, and a decline occurred for beef (6 percent). No production constraints were imposed on dairy as in the case of the two other policies, so production expanded despite a 2.5 percent price decline. Trade liberalization caused an 11 percent decline in Canadian beef prices; wheat prices increased 6 percent and coarse grain prices increased 3 percent.

Implications

The intent of this paper is to illustrate the impacts of different agricultural policies designed to accelerate growth of the total agricultural sector, taking into account linkages among commodities and countries and dynamic effects. The three types of policies analyzed have markedly different impacts on the agricultural sector and on individual commodities. The differences among commodities depend on their productivity growth, international competitiveness, and supply elasticities.

The overall impact of the multilateral reduction in agricultural trade protection indicates the apparent comparative advantage of Canadian agriculture, and the reduction in protection may be one of the most effective (and cost-effective) policies to achieve growth in the agricultural sector. For

that policy, the largest gains would be achieved for grains, despite generally lower protection and inelastic world demand. The dairy export increases for Canada suggest a dramatic rise in world prices as markets are liberalized. Given such large adjustments, the results need to be interpreted carefully, as the model structure may not fully reflect existing market restraints.

The enhanced export markets programme provided the lowest growth for the agricultural sector. Moreover, its impact could be overstated if other countries react to a Canadian programme of export promotion. The largest impact was for those commodities with the increased prices, particularly wheat. Nevertheless, significant increases occurred for all other commodities, illustrating the strong links among commodities that should be considered in any export market expansion programme.

R&D expansion contributed to the largest increase in GDP (agriculture) and hence has a significantly higher expenditure multiplier than export market development (assuming cost estimates for both policies are realistic). R&D expansion contributes an additional C$924 million (14 percent) to GDP (agriculture). The results, however, assume that Canada is able to capture the exclusive benefits of the research. Sizeable international leakage of research results could occur, causing expanded global production with lower prices that would reduce the projected benefits.

The multicommodity, multicountry IIASA model used in a dynamic multiperiod simulation demonstrates the model's effectiveness for a planning tool to evaluate alternative public policies using a range of economic and social indicators.

Notes

[1]Agriculture Canada and International Institute for Applied Systems Analysis, respectively.

[2]The May 22, 1985, Federal Government Budget Papers indicated that, for the mid-range international policy environment case for 1987-90, the real GDP growth rate would be 3.1 percent, the unemployment rate would be 8.5 percent, and the government deficit would be C$32.7 billion or 6.8 percent of GNP (in 1986/87).

[3]Yields per acre were increased for wheat, coarse grains, protein feed, other food, and nonfood agriculture. Emphasis was given to export commodities (traditionally grains, oilseeds, and oilseed products).

[4]Little work has been undertaken to estimate the relationship between research and output. Zentner and Peterson (1984) estimate elasticities of 0.8 to 0.9 for wheat research expenditures in Canada on wheat production (after a 6- to 8-year lag).

References

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Discussion Opening – *Terrence S. Veeman*

The three papers in this session illustrate the wide variety of agricultural policy problems faced by the industrialized nations: the impact of the CAP and protective price régimes on the evolution of the agricultural sectors of the EC; the problems of rural poverty and inadequate nutrition that can be found in virtually all rich nations but that are exacerbated in the case of southern Africa; and the desire of most developed nations, including Canada, to attempt to use the agricultural sector, despite its declining relative role in the overall economy, as a possible catalyst for national development.

Loseby and Pieraccini ingeniously use the principal components technique to address the question of possible convergence of selected aggregate variables of the agricultural sector of the EC. The apparent greater growth in real agricultural value-added in nations such as Italy and Ireland, where real incomes were initially low, is not an entirely unsuspected result of a customs union with a common agricultural price policy. It is not at all clear, however, that the movement of several of the macro variables is closely related to the CAP.

One wishes that the authors might have justified their choice of the selected aggregate variables. Furthermore, the principal components technique is rather mechanistic and does not rest on any specific theoretical models that would give a stronger justification to the possible direction and magnitude of impacts between the sectoral macro variables. Our profession faces the considerable challenge of postulating more explicit theoretical models in which income variables, terms of trade, inflation, and productivity are causally interrelated. Finally, is "convergence" really that useful a measure of an achievement of the CAP? I would prefer to judge the economic performance of the CAP in terms of allocative and technical efficiency, equity (including the personal, functional, and regional distributions of income), and stability.

Behrmann describes the incidence of rural poverty and malnutrition in southern Africa and gives us a useful list of three major causes and several remedial policy measures. Even recognizing that estimates of food availability are often biased downwards and those of nutritional requirements upwards, we can agree with Behrmann that serious undernutrition can exist in nations where per capita food supplies are increasing. In discussing the causes of poverty and inadequate nutrition, the author might have used the entitlements approach of A.K. Sen to lend more analytical rigour to his paper. In addressing policy measures, Behrmann discusses the costs but not the possible benefits of the migrant labour system and gives too abbreviated a treatment of the property rights and institutional questions with respect to tribal land. Finally, as in most nations, the predominant cause of rural poverty in the RSA rests with the highly unequal access to assets, especially land and skills. Poverty and hunger in that nation will not be eradicated without substantial redistribution of political and economic power.

Huff and Frohberg correctly emphasize that agricultural policy must be formulated in a more comprehensive way. Whether an IIASA-style systems analytical model necessarily provides a more synoptic and rational approach to policy making is a more open question. The strength of such simulation modelling is its general equilibrium framework, which permits better study of interdependencies and feedback mechanisms. On the other hand, the policy insights from global modelling are only as good as the assumptions upon which the model is based. Much of the Forester-style global modelling efforts of the past 15 years has been seriously flawed with improper assumptions (typically coloured by the popular thinking of the moment) and debatable, if not wrong, conclusions. The IIASA model, fortunately, appears to be more credible.

The policy of expanded R&D has the greatest impact on agricultural GDP, although the authors must do further analysis to put the three options on a comparable basis in terms of respective social benefits and costs. Furthermore, are the gains from expanded research permanent or merely transitory? I would have anticipated, *a priori*, that the trade liberalization option might have had stronger impacts. Moreover, I am uneasy with the conclusion that Canadian dairy production and trade would be considerably stimulated under trade liberalization. In any event, Canadian agricultural policy makers would be well advised to pursue both expanded research and multilateral trade liberalization.

Discussion Opening – *Ewa Rabinowicz*

Is convergence good or bad? Loseby and Pieraccini claim that "convergence" might be a measure of the CAP's achievements. "Convergence" is defined as a similarity in growth rates (or better still a similarity after a period of catching up by less developed nations). Convergence of that type is, however, not a measure of success from the maximization of welfare point of view. Why has a customs union been created? One would have expected exploration of *comparative advantages* to be an important issue. Then, if comparative advantages are allowed to affect resource allocation, everything should not be growing at the same rate but a specialization should emerge.

What were the criteria for choosing the variables? Why use both a real and a nominal version of the same variable (X_4 and X_2) and the rate of inflation (X_1)? If X_4 is deflated by the GDP deflator (X_1), then $X_4 = X_2 - X_1$. Even if another deflator is used, a strong correlation between the variables must exist.

The analysis shows that (for the EC) the strongest upward trend of all the variables is for inflation. Why? If value added grows in real terms ($X_4 > 0$), then $X_2 > X_1$. If one used simple, naive comparisons, that would be the result (or perhaps the difference between the agricultural deflator and the general deflator is greater than real growth in value added).

How does the method used compare with "eyeballing" or simple calculations that are easily interpreted and easily compared with other studies?

Behrmann quotes several studies on the incidence of malnutrition in southern Africa that compare average requirements with average availabilities or report on the number of children too small for their age. Scholars such as T.N. Srinivasan are questioning the whole idea of that type of comparison. To quote Srinivasan, "Less than 10 percent of [children in Sri Lanka] were normal when U.S. height-weight charts [were used] to assess growth. Yet life expectancy at birth in Sri Lanka is over 65 years."

According to Table 1, enough food exists (on average) in the countries analyzed; still, the author concentrates on obstacles to production, while obstacles to redistribution should be more interesting as far as malnutrition is concerned.

An efficient programme for alleviation of malnutrition requires careful assessment of consumption, income, and employment of the most vulnerable groups. Are such studies available for the countries that are studied in the paper?

Huff and Frohberg's paper contains too little *specific* information about the Canadian model and Canadian agriculture (production and consumption, elasticities, and policy modelling) to make it possible for others to evaluate the scenarios presented.

The authors pinpoint the need to "consider the tradeoffs with the nonagricultural sector," but do not give any indicators for the rest of the economy in the presentation of the results. To compare, for instance, overall GDP growth rates among the scenarios would be interesting; the high growth rate of agriculture at the expense of the overall growth rate is not much of an achievement.

The authors state that "large differences exist in impacts among several strategies," but the differences are small, at least as far as general indicators are concerned, particularly if one rounds up the figures, as one should. Using figures to 2 decimal places gives a feeling of false precision that is not and cannot be present in this type of analysis.

Why do grains and livestock products respond differently to the enhanced export markets programme versus trade liberalization? More information on prices would be interesting for the free trade scenario. Fertilizer use appears to be growing too fast in the simulations.

General Discussion – *Cathy L. Jabara*, Rapporteur

How can convergence really be attributed to the consequences of the CAP? What is needed is a reference system without the CAP. Even without institutions such as the CAP, factor prices will tend to converge due to international trade. If the analysis were carried out after 1981 (when turbulence within the CAP started), one would observe the indicators in the paper diverge again.

How were the parameters that reflect the Canadian policies in the final results obtained? The framework used by Huff and Frohberg was not useful for policy evaluation, especially in the case of research, because it did not analyze the costs and benefits of the expenditures on the various programmes.

Loseby stated that she agreed with all the observations on her paper. However, she pointed out that the study of convergence within the CAP was interesting because lack of convergence is used by member countries to postpone other harmonization policies. A study of convergence is not of interest for evaluation of the CAP on efficiency criteria. In regard to the question of whether or not the CAP has contributed to convergence, Loseby observed that the null hypothesis could be accepted; i.e., the CAP has not increased divergence. Loseby stated that she experimented with the use of the principal components method, and to separate out the effects of real and monetary variables would be interesting. She observed that in the EC context, the terms of trade will not necessarily move in the same direction. Under high rates of inflation, relative prices will change. However, under EC policy, the rate of change in product prices is determined sectorally. One could, therefore, expect that the terms of trade may not have moved in the same direction over the period under study.

Behrmann stated that he did not collect the data in his paper first hand. He used the data as collected, but the information does confirm that children in the sample areas are underweight and that life expectancy is not 65 years old. Behrmann stated he has observed from his own field experience that the extent of poverty is great. He also stated that studies on production, consumption, and income are available.

Huff agreed that more information is required to study the impacts of the policies in his paper. However, with regard to Canadian dairy policy, be asserted that his premise is true; that is, if prices drop 10 percent, farmers would still be eager to increase dairy production. Fertilizer use per acre in Canada is quite small and thus the results in the paper with respect to its use are reasonable. Huff stated that the selection of the level of the policies in his paper was *ad hoc* but made with the idea of keeping a reasonable balance of expenditures on each option. The interest of the paper is to only measure the impacts of the policies. He agreed that a cost-benefit framework would be appropriate for analyzing the returns to research and other expenditures but stressed that the purpose of his paper was to measure production, consumption, and trade impacts only.

Participants in the discussion included U. Koester, G. Schmitt, and W.B. Sundquist.