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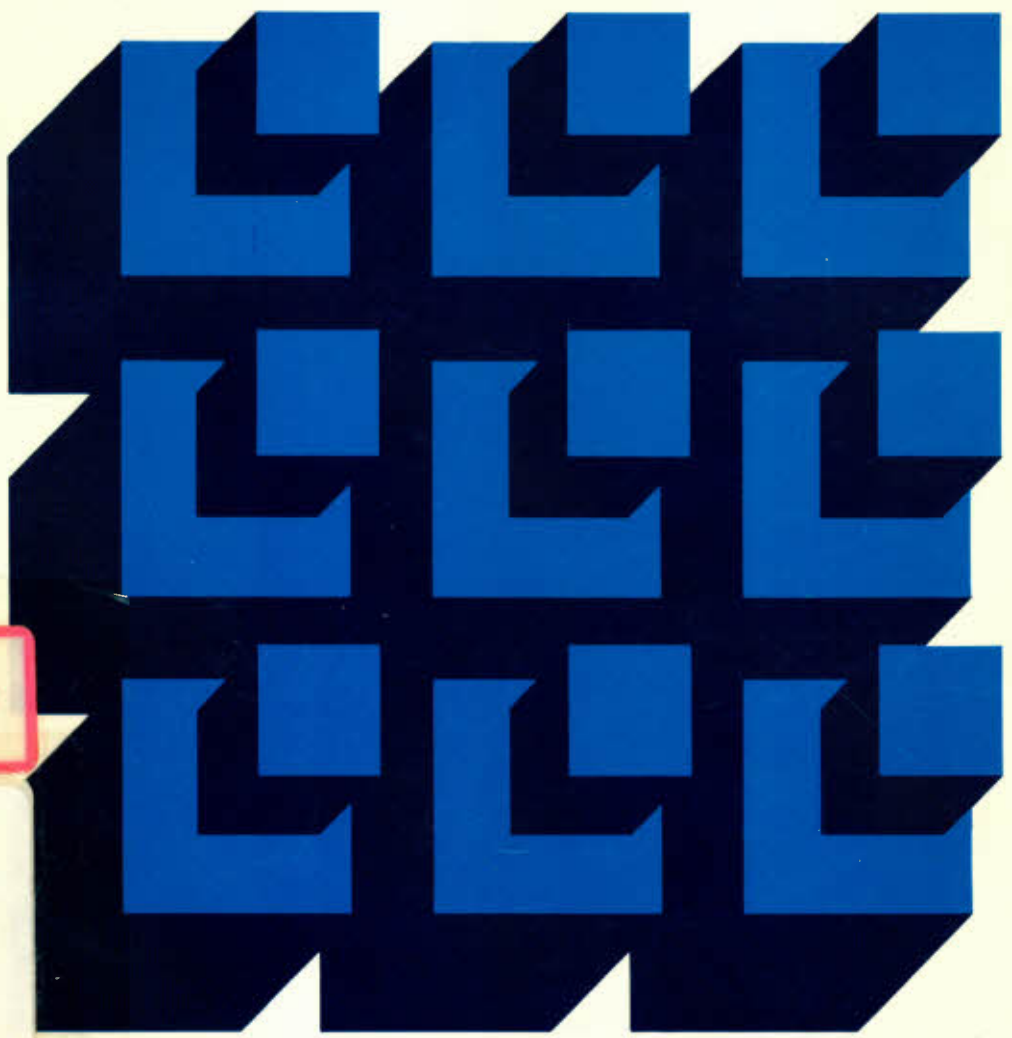

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DISCUSSION PAPER NO. 359

The Diversification of Prairie Agriculture: Opportunities Arising from Changes in the International Trading Environment

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by

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RÉSUMÉ

L'économie de la région des Prairies est en grande partie tributaire du marché des exportations. Quand les prix sont forts et les barrières commerciales peu élevées, elle est prospère; au contraire, quand les prix sont faibles et le marché entravé par des obstables au commerce, elle est en difficulté. Les fluctuations des prix et les mesures protectionnistes engendrent dans le secteur agricole une alternance de hauts et de bas.

L'auteur de l'étude analyse les conséquences économique de trois événements susceptibles de modifier notre environnement commercial, soit :

- l'accord canado-américain de libre-échange;
- une importante réduction éventuelle des barrières commerciales du secteur agricole, suite aux négociations qui se déroulent actuellement dans le cadre de l'Accord général sur les tarifs douaniers et le commerce (GATT); et
- un échec éventuel de ces négociations du GATT, avec les politiques plus protectionnistes qu'adopteraient alors les pays de la Communauté européenne.

L'étude met l'accent sur les effets que l'évolution du contexte commercial à l'échelle internationale pourrait avoir sur la diversification et la stabilité du revenu agricole dans les Prairies. Après avoir effectué une analyse de variance en vue de mesurer la stabilité du revenu agricole, l'auteur conclut que les diverses activités commerciales qui réduisent la variation du revenu favorisent la diversification, alors que celles qui augmentent la variation la retardent.

L'auteur a étudié vingt-sept produits de culture et d'élevage des Prairies. L'analyse statistique démontre qu'au cours de la dernière décennie, les prix affichaient une corrélation positive pour tous les produits importants des Prairies, et que ceux dont la corrélation positive était la plus marquée y avaient généré la plus grande partie du revenu agricole dans les Prairies. En conséquence, il ne serait pas vraiment avantageux de réduire, par exemple, la production céréalière d'exportation et d'augmenter d'autant l'élevage, étant donné la corrélation positive qui existe entre les prix de ces denrées.

L'auteur a élaboré un scénario de référence et sept autres scénarios possibles. Quatre de ces derniers incluent les changements auxquels l'accord canado-américain de libre-échange donnerait lieu et, dans tous ces cas, les effets prévus se sont révélés minimes (en deça de 1,5 % par rapport au scénario de référence). Dans la perspective des échanges multilatéraux, la libéralisation du commerce contribue à accentuer légèrement la variation prévue du revenu. Mais un échec des négociations du GATT et l'adoption de politiques de plus grande autosuffisance des pays de la CEE entraîneraient une augmentation de presque 5 %

de la variation du revenu et réduiraient la possibilité de diversification.

ABSTRACT

The Prairie economy depends to a large extent on export markets. Higher prices and lower trade barriers create greater prosperity, lower prices, and trade restrictions produce hardship. Fluctuations in market prices and protectionism have contributed to a "boom and bust" cycle in agriculture.

This study examines the economic ramifications of three potential changes in the trading environment:

- the effect of the Canada-U.S. Free-Trade Agreement (FTA);
- the effect of a significant reduction in agricultural trade barriers arising from the current round of the General Agreement on Tariffs and Trade (GATT) talks; and
- the effect of a failure at the GATT negotiations resulting in more intense protectionism by the European Community (EC).

The study concentrated on the impact the changes in the international trading environment could have on the diversification and stability of Prairie farm incomes. A variance analysis was applied to measure the stability of agricultural income. Trade alternatives which reduced the income variance were considered diversification-enhancing while those which increased the income variance were considered diversification-retarding.

Twenty-seven crop and livestock commodities were included in this investigation. The statistical analysis showed that over the last decade prices were positively correlated for all the important Prairie commodities, and that those that made the largest contribution to Prairie farm income exhibited the highest positive correlations. This implies that a shift from export grain production into livestock production, for example, would not yield significant gains as their prices are positively correlated.

A base case and seven additional cases were developed. The base case was the benchmark against which the other trade cases were judged. Four of the additional cases covered changes expected from the Canada-U.S. Free-Trade Agreement. The estimated trade effects were found to be very small, being within 1.5 per cent of the base case. Looking at the multilateral perspective, trade liberalization increased the estimated income variance slightly. A failure of the GATT talks, together with EC policies to raise its level of self-sufficiency, led to an almost 5 per cent increase in variance and a reduced potential for diversification.

CONTENTS

FOREWORD

This is one of several studies on diversification of the agricultural sector in the Prairies -- one of the themes in the Economic Council's project on the Future of Prairie Agriculture. The Council published its recommendations based on the research for this project in 1988 in Handling the Risks: A Report on the Prairie Grain Economy.

The present study deals with diversification within Prairie agriculture. It investigates the impact changes in the international trading environment would have on Prairie agriculture. The price correlations of some two dozen farm products are determined to see if diversification away from grains into other crops and livestock would stabilize Prairie farm income significantly. Several trade scenarios are explored, ranging from trade liberalization to a drive towards greater self-sufficiency and it is shown how each would affect the variability of Prairie farm incomes.

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Chairman

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The Diversification of Prairie Agriculture: Opportunities Arising from Changes in the International Trading Environment

1. Introduction

The economy of the Canadian prairies is characterized by resource based production which is surplus to regional requirements. As a result, prosperity is dependent to a considerable degree upon the ability to secure outlets for production and the prices received in external markets. These markets can either be international or in other regions of Canada. Given that resource based production, whether agricultural or non-agricultural, has large linkages to both the manufacturing and service sectors located in the prairies, changes in the external trading environment will generate significant "ripple effects". When prices are rising and trade barriers are receding, prosperity will increase. On the other hand, falling prices and protectionist trends create economic hardship. Over the long term, both prices and protectionism have exhibited sufficient fluctuation to characterize the prairie region as a "boom and bust" economy. In the agricultural sector these external forces may be exacerbated by the vicissitudes of weather. While the effects of such fluctuations are largely borne by the residents of the region, the federal government bears considerable responsibility for mitigating the impact of economic downturns. Of course, the central authority also benefits from additional revenues in times of economic expansion. Such fluctuations, however, lead to wasted investment and wasted human resources. Hence, all segments of Canadian society have an interest in the economic performance of the prairie region. While calls for reform are seldom

heard during periods of prosperity, in times of economic distress the search for alternatives to the existing system will be intensified. This examination will attempt to identify alternatives which may arise from changes originating in the international trading environment for food and agricultural products.

An economy which is dependent on international markets will always be less secure than one which largely serves a domestic market. The ability of governments to influence the international trading system will always be less than their ability to influence the performance of the domestic economy. The means available to a country to influence the international environment within which it trades are a function of its relative economic power, its ability to form cooperative alliances with other nations and the degree to which it can successfully apply moral suasion to induce trading partners to abide by existing and agreed to rules of international trade. The ability to influence the course of international events has two facets. First, securing access to external markets for products surplus to domestic requirements is a function of the degree to which protectionist forces in foreign markets can be countered. This has aspects pertaining to both the absolute quantities of products moving to foreign markets and the value added which they internalize. Second, little control can be exercised over prices received in external markets and, hence, it is difficult to counter the undesirable consequences arising from being a "price taker".

With respect to the long term economic performance of prairie agriculture, five options appear available: (1) no change to the current policy regime; (2) improvement and expansion of income stabilization programs; (3) reduced interaction with foreign markets; (4) broad based diversification out of agriculture; and (5) diversification within

agriculture. The current investigation will concentrate on the latter. This seems the logical point of departure. There are few, if any, possible changes in current policy that will reduce the historical dependence of the agriculture sector upon world markets unless there are identifiable changes in the international trading environment which would result in significant diversification within the agricultural sector itself. Of course, it is always possible to commit additional fiscal resources to income stabilization. Further, if major policy induced opportunities for this diversification within the agricultural sector exist, then such diversification is likely to be accomplished with less resources or economic costs than the remaining two alternatives. Diversification out of agriculture will mean major commitments of resources, both in terms of productive investment and social policies, to aid the transition. Reduced interaction with foreign markets without diversification out of agriculture would mean a major rationalization of the prairie economy, wasted resources and considerable population effects. While these issues will not be addressed directly, the prospects for diversification within agriculture will determine whether a choice will have to be made between long term continuation of the "boom and bust" cycle or increased budgetary expenditure on income stabilization, and serious consideration of either diversification out of agriculture or reduced foreign market interaction.

The study will commence with a discussion of diversification. The aim will be to provide a definition which has an economic interpretation and which is empirically measurable. This will provide a means by which the impacts of changes in the trading environment upon diversification can be assessed. A discussion of the economic ramifications of trade

liberalization or increased protectionism will then be presented. A historical base case which allows comparison with various alternatives involving changes to the international environment is developed at this point. This base case is also used to identify the direction in which the agricultural economy should evolve if diversification is to be enhanced. Thereafter, specific alternatives regarding changes to the trading environment are developed and compared to the base case to determine if they will lead to increased diversification. The specific cases investigated are: (1) the effect of the Canada-U.S. Free Trade Agreement (FTA); (2) the effect of a significant reduction in agricultural trade barriers arising from the current round of General Agreement on Tariffs and Trade (GATT) talks and; (3) the effect of a failure at the GATT resulting in increased European Community (EC) protectionism. Finally, a brief summary and conclusions are presented.

2. A Definition of Diversification

Before the ramifications resulting from changes to the international trading environment for the agricultural diversification of the prairie region can be assessed, an operational and quantifyable definition of regional diversification is required. To avoid confusion, it should be made clear from the outset that the level of income and diversification are two separate issues. Increases in the level of income for an exporting region will arise as a result of increased markets and improvements to the degree of value added accruing to the exporting region. Diversification is desired because it is preceived that it will reduce the negative effects associated with income variability. There is no reason to assume that a change in the economy

which increases the level of income will also provide additional stability. For example, increasing the level of value added which occurs to a region can increase the average level of income. If, however, the markets for those products which allow for increased value added are more volatile than the previous markets for low value added products then income variability will increase. Hence, there are four possible outcomes which can arise from any change in the economy: (1) the level of income increases and the variability of income decreases; (2) the level of income increases and the variability of income increases; (3) the level of income decreases and the variability of income decreases; (4) the level of income decreases and the variability of income increases. Clearly, the final result is undesireable. The second and third results involve trade offs and the value of stability must be weighed against income to determine if the change produced a desireable result. In the case of the first result, of course, the result is desireable. This paper attempts to determine whether changes in the international trading environment would be diversification enhancing or diversification retarding. As trade theory suggests that liberalization is likely to lead to increases incomes, identifying the effect on diversification becomes important because it can help to determine future policy priorities. If both income and diversification increase significantly then less policy intervention may be required in the future. On the other hand, if diversification is reduced or only marginally improved, future policy efforts to improve stabilization may be appropriate.

It is a common perception that the degree of diversification is a function of the number of products produced by a region. The larger the number of products the more diversified the economy. While this is one

possible definition of diversification it is not an operational one and its unidimensional character may actually be misleading. In a naive way, this definition of diversification relies on the "law of large numbers" in a global general equilibrium framework. The underlying assumption is that by producing a large number of products, the probability of having positively correlated inter-market variations in prices is reduced. In some sense, then, diversification is defined by its objective - reduction in the regional variability of income. Positively correlated inter-market variations in prices increase the variability of regional income. Negatively correlated variations will reduce it. For example, assume that a region produces two products. If the prices of the two products move together - i.e. when the price of the first good rises the price of the other good also rises and when the price of the first falls the price of the second also falls - then the entire economy's income increases or decreases at the same time. On the other hand, if prices move in an offsetting manner - i.e. when the price of the first good rises the price of the second tends to fall - then the regional income will exhibit more stability. Of course, some gains can be made from movements within the positively correlated range. If the mix of outputs moves from being concentrated in highly and positively correlated commodities to those with positive but lower degrees of correlation, then variation will be somewhat reduced.

In the absence of large numbers, adding to the number of products may increase the variability of regional returns. For example, this would happen if the price variations for the additional products are positively correlated with the price variations of the existing range of goods produced and if the variance in the price of new products is larger than the variance of the prices of existing products. Hence, the

perception that the production of a wider variety of goods is desirable because it will reduce the variation in regional income cannot be sustained. As a result, this definition of diversification would appear questionable. If more goods are not unequivocally better, then such a definition has no economic interpretation. Clearly, in terms of reducing the variability of income, a region might well be better off with a smaller number of negatively correlated outputs. Of course, the variability of regional income will also be affected by the share of income arising from negatively correlated outputs.

For the purpose of this study, agricultural diversification will be defined by its objective - reduction in the variability of income. Hence, a region will be considered more diversified if, as a result of a change in the economic contraints (in this case the international trading environment), the variability of income is reduced. This also provides an operational definition for quantitative comparison.

The quantitative measure which will be used is the total variance of gross revenues from major commodities for the prairie region. For a formal discussion of this measure see Appendix 1.

Changes in the international trading environment will, through price adjustments and subsequent resource responses, alter the share of total output contributed by any individual activity. Hence, it is possible to compare the expected variance of gross returns arising from a change in the international trading environment with that which existed prior to the change. The relative size of the variance would determine whether the change was diversification-enhancing or diversification-retarding. Of course, this relative measure abstracts from changes in levels of gross revenue which would arise from the change in the international trading environment. It could well be that a change in the trading

environment would lead to an increase in the level of gross returns and at the same time be diversification-retarding.

It should be made explicitly clear from the outset that the analysis developed here is based on gross revenues. While net revenue would be a more desired measure, it is not tractable or meaningful at this level of aggregation. Net revenue must account for costs and given the well known variation in cost structures among farms, a meaningful measure of net revenue would be very difficult to devise. This is better left to analysis of individual representative farms where models can be tested for alternative cost configurations. The major loss arising from the the use of the gross revenue approach is in the area of livestock production where feed grains are inputs to the production process. When livestock prices are increasing and feed prices are decreasing and, hence, profits are rising, the gross revenue aproach does not take account of the interactive effects of the two markets on the welfare of the sector. Given this limitation, the use of the gross revenue approach can still provide considerable insights into the problems of diversification as output prices remain a major source of agricultural instability.

The effect of changes to the trading environment on diversification may not be the only facets of trade liberalization which are of interest. The effects on the level of income and the value added accruing to the region may also be important. Examinations of the effects of changes to the trading environment concentrate on long run adjustments. Hence, information on levels of income are of limited use because any sustained increases tend to become capitalized into fixed resources. Thus, any results relating to the levels of income should be interpreted very carefully as the actual benefits to regional welfare

may be overestimated. The relative measures of levels of income presented should be viewed in this light.

Of more interest may be the change in the composition of output arising from new trading environments. Protectionist measures are often designed so as to maximize the value added accruing to the importing country. Trade liberalization will tend to reverse this process. An increase in value added will increase the impact of the sector on the regional economy. At the same time, however, adding to the value added may or may not reduce the variation in income. Again, this depends on the price correlations and the covariance terms.

The quantitative measure of diversification suggested may also provide considerable policy insights. For example, those combinations of activities whose expansion will contribute most to reducing the variance in gross revenues can be identified. Then, if the objective is indeed to reduce the variance of gross returns, expansion of these industries could be encouraged through policy initiatives. In a similar vein, commodities with positive covariances could be discouraged, or at least exempted from policy measures. Further, those commodities with volatile prices and a positive covariance coefficient might be targeted for coordinated price stabilization policies in aid of reducing fluctuations in regional revenues.

3. The Effect of Changes to the Trading Environment on Diversification

The "pure theory of international trade" provides few insights for the problem to be addressed in this paper. The abstract trade models would suggest that, under a limited set of assumptions, the movement from a world where no trade between countries exists to a world of

unfettered trade will lead to increased incomes. The means by which this is accomplished is the movement of resources out of the production of products which the nation produces relatively less efficiently and into the increased production of those goods which the national produces relatively more efficiently. In short, the gains from trade - increased incomes - arise from specialization. The other general result is price convergence. Price convergence, however, does not imply price stability.

Specialization also implies nothing about stability. While it is possible that specialization will lead to greater price or income stability it is also possible that it leads to greater instability. For example, a country could be moving its resources out of production of a commodity which had relatively stable prices and into a commodity which had highly unstable prices. Hence, with an expansion of total output, the variance of income would increase. There are numerous factors which affect the stability of commodity prices including their elasticities of supply and demand, the responsiveness of the output to changes in weather, e.g. drought, frost, heat units, perceptions of risk, etc. Hence, even at the most abstract level, the effect of trade liberalization on diversification is an empirical question. Certainly, particular border measures such as the European Communities variable levies lead to increased export price variability. This result cannot, however, be generalized to all border measures.

Of course in the multi-commodity, multi-factor world of the prairie economy the theoretical problem becomes intractable. One is clearly in a "second best" world and relegated to the use of piecemeal policy. It is well known that "the second best optimum is not attainable by decentralization"[1] - i.e. piecemeal policy. In addition, removal of

some or all of the trade restrictions in a multi-restriction world produces ambiguous results;

> The conclusion is that, in a world consisting of several countries, each with its own system of tariffs, the removal of some tariffs...may lead either toward or away from the optimal allocation of the world's productive resources. And this means that it is impossible to say on a priori grounds whether in the world of today the establishment of a free trade area in a part of it, for instance western Europe, or a general reduction of tariffs by one country, for instance, the United States, not followed by the complete removal of all tariffs and universal free trade, would lead to greater or smaller income...[2]

As the FTA is only a partial removal of trade barriers, as will be any progress arising from the GATT negotiations, it should be clear that conclusions regarding either income or diversification will arise from empirical analysis.

While the problem might best be approached using a computable general equilibrium model, no model exists which is sufficiently disaggregated both by commodity and region so that it would be useful in the context of the diversification of prairie agriculture. A standard comparative statics approach is followed in this investigation. This approach should provide considerable insights because most of the changes to the trading environment arising from the FTA are relatively small. The major weakness of the partial equilbrium approach is that the movement of resources between commodities cannot be tracked. As a result assumptions regarding these resource shifts will have to be made. These are documented in the various cases as they are developed. For the most part, the expansions or contractions in the production of individual commodities is so small that major alterations in resource use patterns are not expected. In addition, those major commidities whose trade is currently restrictted - supply management commodities and

Wheat Board grains - remain outside the FTA. Virtually all of the remaining commodities are currently traded and the existing barriers to trade do not sufficiently disrupt the movement of commodities that their removal will mean the disappearance of a prairie industry as a result of specialization. Hence, removal of trade barriers will lead to an alteration in the relative production of various commodities - some expanding, some contracting.

While border measures can take a large variety of forms, a tariff will be used to illustrate the effect of a trade barrier removal. This exposition is formally developed in Appendix 2. In the small country importer case a tariff can be seen as a means of increasing the price in the importing country. In other words, a nation such as Canada can be seen as a price taker when being supplied by the large U.S. market. The effect of the tariff is essentially adding the cost of the tariff to the landed U.S. price. Those who wish to buy the product in Canada must pay the landed U.S. price plus the amount of the tariff. This becomes the effective price against which Canadian producers must compete. Price fluctuations in the landed U.S. price are passed on through to Canadian producers but the price in Canada will be greater than the landed U.S. price by the amount of the tariff. It should be noted then that the price fluctuations in the Canadian market will be of the same magnitude as U.S. fluctuations but take place at a higher absolute level of price. Removal of a tariff means that the price in Canada will decrease and converge to the landed U.S. price. Canadian firms will respond to this effective decrease in price by decreasing output. Their response to this decline will be determined by their elasticity of supply.

In the small country exporter case a tariff can be seen as reducing

the price in the exporting country. A country like Canada can be seen as a price taker when supplying the large U.S. market. The effect of the tariff then is to drive a wedge between the given U.S. price and the Canadian price. Price fluctuations in the U.S. price are passed back through to Canadian producers but the price in Canada will be less than in the U.S. by the amount of the tariff. It should be noted then that the price fluctuations in the Canadian market will be of the same magnitude as U.S. fluctuations but take place at a lower absolute level of price. Removal of a tariff means that the price in Canada will increase to converge to the U.S. price. Canadian firms will respond to this effective increase in price by increasing output. The response to the incentive will be determined by their elasticity of supply. Thus, removal of trade barriers will alter the share of aggregate production in each sector through the magnitude of the supply response.

The information requirements for these cases appear quite manageable. Information is required on the size of the tariff reduction, the current quantity, current price level and the domestic elasticity of supply for each commodity. In the case of the Canada-U.S. trade agreement, the tariff reductions are available from the supplementary tariff schedules of the FTA. In the optimistic and pessimistic GATT cases the future trading environment is less clear and assumptions regarding future levels of trade restrictions must be made. Quantities of output and prices are generally available for tradeables. Domestic supply elasticities are available for a number of commodities, while for others, some assumptions will have to be made regarding supply elasticties. These elasticities can be varied, however, to determine the sensitivity of the variance in regional income to these assumptions. It should be noted that, as the prices of tradeables are assumed to be

exogenous in both cases, removal of the tariffs will have no effect on the variability of prices. The expected supply responses are a result of the reduction in tariffs. This allows the before and after variance in regional gross revenues to be compared. It should also be noted that variations in quantities supplied in response to such short run price changes remain. Hence, the measure developed does not account for lagged short run supply responses to price variations. It should be pointed out that as the actual variation in prices remains unchanged, the contribution of these short run supply responses will also remain unchanged. They will simply take place around the level of output represented by the new total share of output. As almost all agricultural commodities exhibit a lag between changes in price and the supply response, the direct variation in annual returns attributable to exogenous price changes can be calculated at the new share level. Of course, the imposition of, or increases in, tariff levels will have the opposite effect. Changes in levels of quantitative restrictions such as import quotas can be treated in a similar fashion.

4. Income Variability in the Current Trading Environment

This section presents the case to be used as a basis of comparison of the impacts on gross income variability for the various trade alternatives developed in later sections. The base case itself can provide considerable insights into the problems of income variability manifest in prairie agriculture.

4.1 Commodities and Data

A total of twenty-seven commodities or commodity groupings were selected for examination based on their importance to the international

trade of the prairie region. In a few cases, such as fresh and processed fruit, where imports are significant but production in the prairies is insignificant, the products have been excluded. The analysis is done on a final product basis so inputs to other agricultural activities are not included. For example, forage is almost entirely consumed by domestic livestock. Therefore it is not included as a separate category in order to prevent double counting. While not heavily traded, the major supply management commodities - dairy, chicken, turkeys and eggs - are included because they do represent significant components of prairie farm income (approximately nine percent of farm cash receipts). To ignore these commodities would considerably bias the variability in regional income and reduce the policy information available. Finally, other minor non-tradeables, including new specialty crops, are excluded largely due to problems of acquiring complete data series. Speculation regarding exports of new products was not undertaken as prices, and hence price variations, in such products do not exist. Other studies in the series examined such opportunities. Given these exclusions, the estimates of income variabilty will be biased to the extent that such excluded commodities would contribute to the variability. The list of commodites examined does, however, include the major part of prairie agricultural production. The product divisions generally conform to the classifications of Canadian international trade statistics. This facilitates the matching of tariff rates to commodities for the various trade cases. A complete list of the commodites included is presented in Table 4.1.(1).

Table 4.1.(1)

Selected Commodities

Feeder Cattle (F CATTLE)	Rye
Slaughter Hogs (S HOGS)	Wheat
High Quality Beef (HQ BEEF)	Hard Spring Wheat Flour (HSW FLOUR)
Manufacturing Beef (LQ BEEF)	Durum, Semolina Flour (DS FLOUR)
Pork	Fresh Tomatoes (FR TOMATO)
Processed Pork (PROC PORK)	Other Fresh Vegetables (FRESH VEG)
Chicken	Processed Vegetables (PROC VEG)
Turkey	Sugar Beets (S BEETS)
Dairy	Linseed Oil-Cake-Meal (PROC LIN)
Eggs	Canola Oil-Cake-Meal (PROC CANO)
Honey	Certified Seed (SEEDS)
Barley	Flaxseed
Oats	Canola
	Wool

The price data required to calculate the gross variance of income were collected for each of the selected commodities. In some cases the trade classifications represent aggregates of product groups for which only the prices for the individual components of the aggregate were available. In these cases a weighted average of the individual component prices was used in the calculation of income variance. The prices were collected on an annual basis for the years 1977 to 1986. In those years where prices were reported on a crop year basis, the price was applied to the year that the crop was grown - e.g. the 1986-87 crop year price was considered to be the 1986 price. All prices were converted to 1986 dollars using the Price Index for Gross Domestic Product. This provides for the calculation of income variance with inflationary trends removed. The year 1986 was chosen so that the real dollar value of the price variation could be standardized to the quantity data. The latest year for which there was a complete set of production data available was 1986.

As far as possible, all quantities are adjusted for further value added to prevent double counting. For example, as the analysis is conducted on a final product basis, actual production quantities of pork have been adjusted at the appropriate rate to reflect that portion of production which is further processed. In a similar fashion, barley is adjusted to reflect that portion which is used for animal feed within the prairie region; wheat for flour production; canola for the proportion crushed, etc. Hence, the variance of income calculated represents the gross income of the agricultural sector rather than farm level incomes. This method would seem more appropriate to the study of changes to the trading environment as they will have effects on the degree of value added internalized in traded goods as well as on the mix

of farm level commodities produced.

4.2 The Variance of Income

It should be remembered that variance is only important as a relative measure. The absolute values tend to be very large. This is particularly true when large aggregates such as prairie agricultural production are being used. What is important is the relative contribution of the elements of the variance-covariance matrix to the total variance. For simplicity, all values reported in the text will be standardized to the 18th decimal - e.g. 9.356 would be 9.356E+18. Of course, positive covariances add to the total variance while negative covariances reduce it. What determines whether the covariance is positive or negative is the relationship between the two commodity prices. If the prices are positively correlated over time the covariance will be additive. The opposite is true when prices are negatively correlated. Hence, the price correlation matrix can provide considerable information regarding the likely ability of an economy to diversify. The price correlation matrix is reported in Table 4.2.(1).

TABLE 4.2.(1)

CORRELATION MATRIX - PRICES OF PRAIRIE AGRICULTURAL COMMODITIES, 1977-1986

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE
F CATTLE	1.000													
S HOGS	0.383	1.000												
HQ BEEF	0.891	0.394	1.000											
LQ BEEF	0.889	0.210	0.967	1.000										
PORK	0.288	0.961	0.249	0.072	1.000									
PROC PORK	0.517	0.539	0.264	0.166	0.602	1.000								
CHICKEN	0.366	0.795	0.544	0.409	0.751	0.191	1.000							
TURKEY	0.526	0.877	0.649	0.497	0.826	0.409	0.954	1.000						
DAIRY	0.455	0.294	0.694	0.630	0.190	-0.119	0.745	0.660	1.000					
EGGS	0.165	0.563	0.456	0.352	0.527	-0.005	0.893	0.829	0.732	1.000				
HONEY	0.687	0.767	0.811	0.695	0.687	0.359	0.786	0.891	0.583	0.689	1.000			
BARLEY	0.662	0.169	0.885	0.881	0.073	-0.053	0.551	0.550	0.818	0.557	0.684	1.000		
OATS	0.420	0.426	0.689	0.589	0.348	-0.061	0.710	0.656	0.800	0.643	0.728	0.821	1.000	
RYE	0.683	0.393	0.860	0.839	0.331	0.044	0.717	0.713	0.794	0.668	0.825	0.943	0.850	1.000
WHEAT	0.691	0.534	0.902	0.835	0.393	0.035	0.768	0.777	0.814	0.666	0.869	0.892	0.869	0.935
HSW FLOUR	-0.267	-0.708	-0.176	-0.080	-0.704	-0.314	-0.709	-0.637	-0.390	-0.379	-0.355	-0.077	-0.295	-0.277
DS FLOUR	-0.223	-0.678	-0.127	-0.048	-0.653	-0.155	-0.610	-0.531	-0.272	-0.244	-0.333	-0.025	-0.275	-0.242
FR TOMATO	-0.381	-0.476	-0.487	-0.369	-0.496	-0.399	-0.681	-0.721	-0.667	-0.744	-0.643	-0.489	-0.575	-0.571
FRESH VEG	-0.143	-0.704	-0.215	-0.099	-0.733	-0.211	-0.505	-0.595	-0.006	-0.457	-0.704	-0.137	-0.333	-0.374
PROC VEG	-0.653	-0.525	-0.446	-0.443	-0.612	-0.586	-0.526	-0.593	-0.296	-0.327	-0.591	-0.337	-0.301	-0.561
S BEETS	0.804	0.557	0.866	0.837	0.506	0.286	0.696	0.760	0.603	0.542	0.875	0.823	0.704	0.930
PROC LINS	0.556	0.662	0.741	0.676	0.599	0.110	0.896	0.876	0.724	0.816	0.891	0.762	0.804	0.914
PROC CANO	0.619	0.659	0.787	0.729	0.569	0.130	0.874	0.865	0.734	0.784	0.896	0.765	0.792	0.908
SEEDS	0.593	0.632	0.428	0.353	0.700	0.725	0.488	0.603	0.208	0.301	0.652	0.252	0.393	0.465
FLAXSEED	0.678	0.589	0.840	0.756	0.473	0.105	0.822	0.813	0.862	0.687	0.858	0.822	0.888	0.905
CANOLA	0.301	0.735	0.345	0.246	0.713	0.070	0.858	0.767	0.599	0.632	0.629	0.343	0.605	0.579
WOOL	0.809	0.603	0.943	0.865	0.501	0.350	0.760	0.837	0.737	0.643	0.904	0.862	0.783	0.908

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL
WHEAT	1.000												
HSW FLOUR	-0.368	1.000											
DS FLOUR	-0.364	0.944	1.000										
FR TOMATO	-0.500	0.280	0.054	1.000									
FRESH VEG	-0.386	0.182	0.285	0.267	1.000								
PROC VEG	-0.414	0.556	0.469	0.553	0.374	1.000							
S BEETS	0.889	-0.387	-0.378	-0.454	-0.498	-0.688	1.000						
PROC LINS	0.910	-0.501	-0.467	-0.592	-0.566	-0.597	0.895	1.000					
PROC CANO	0.928	-0.505	-0.472	-0.589	-0.513	-0.602	0.892	0.990	1.000				
SEEDS	0.382	-0.452	-0.356	-0.653	-0.460	-0.884	0.581	0.535	0.551	1.000			
FLAXSEED	0.958	-0.499	-0.462	-0.641	-0.353	-0.536	0.838	0.902	0.927	0.528	1.000		
CANOLA	0.630	-0.842	-0.847	-0.473	-0.477	-0.607	0.584	0.767	0.758	0.524	0.756	1.000	
WOOL	0.937	-0.377	-0.295	-0.615	-0.378	-0.559	0.927	0.881	0.899	0.557	0.903	0.536	1.000

The values on the diagonal are all 1.000 reflecting the perfect correlation of own prices. It is immediately obvious that the positively correlated prices outweigh, to a considerable degree, those which are negatively correlated. Leaving aside the own price correlations which are all positive, the total number of negatively correlated combinations is 115 while there are 236 positively correlated pairs. It is also clear that the negatively correlated prices are concentrated in a few commodities. This would suggest that a broadly based diversification strategy will be of only limited success. In addition, the only export commodities which have been consistently negatively correlated are the relatively minor flour commodities. The other goods with consistently negative correlations are vegetables. As vegetables are generally imported and receive tariff protection, any move toward trade liberalization will lead to a contraction of output and thus a decrease in the contribution the commodity can make to the reduction in the variance in gross income.

The correlation coefficients can, however, cover up considerable short term advantages. For example, while the correlation between feeder cattle and barley is .662 over the decade, between 1984 and 1986 they have moved in opposite directions. Feeder cattle were strengthening while barley prices fell. Of course, the strong feeder cattle prices reflect the opportunities in cattle feeding arising from poor barley prices. Furthermore, strong feeder cattle prices translate into increased incomes for cow-calf operations as feedlot operators bid up the price of feeders to take advantage of low barley prices. When such windows of opportunity arise they can be capitalized upon by farmers and on-farm diversification, e.g. combining grain and cow-calf operations, can help reduce the variability of the operation's income.

Other such opportunities may also present themselves.

Given that the major export commodities are all positively correlated and imported commodities negatively correlated, the likelihood that significant reductions in variance will arise from trade liberalization seems remote. This is because changes in the mix of outputs arising from trade liberalization will only change the distribution among positively related prices rather than moving the region into a mix of outputs which contain a greater proportion of negatively correlated prices. Given the existing pattern of price correlations, no opportunities for such diversification appear to be available. Still, this does not mean that the variance of income cannot be reduced considerably by expanding away from commodities which have a heavy weighting and are highly positively correlated into those which are important but less positively correlated. These opportunities are explored below.

To facilitate this examination the variance-covariance matrix for the base case is presented in Table 4.2.(2)

TABLE 4.2.(2)

VARIANCE/COVARIANCE MATRIX OF GROSS REVENUES FOR PRAIRIE AGRICULTURAL COMMODITIES, 1977-1986 - BASE CASE

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE
F CATTLE	8.821													
S HOGS	1.206	0.281												
HQ BEEF	138.338	10.929	683.681											
LQ BEEF	23.443	0.990	224.545	19.712										
PORK	16.056	9.551	121.872	5.995	87.866									
PROC PORK	3.128	0.582	14.040	1.500	11.492	1.037								
CHICKEN	3.533	1.369	46.228	5.903	22.883	0.632	2.643							
TURKEY	1.752	0.521	19.049	2.474	8.688	0.467	1.741	0.315						
DAIRY	2.693	0.310	36.120	5.570	3.545	-0.242	2.411	0.738	0.992					
EGGS	0.914	0.557	22.228	2.913	9.211	-0.010	2.708	0.868	1.360	0.870				
HONEY	2.896	0.577	30.081	4.376	9.146	0.519	1.813	0.710	0.824	0.912	0.504			
BARLEY	186.770	8.485	2197.018	371.554	65.410	-5.128	85.099	29.300	77.387	49.371	46.098	2255.913		
OATS	20.477	3.708	295.948	42.919	53.550	-1.021	18.948	6.043	13.079	9.841	8.486	639.903	67.385	
RYE	16.357	1.681	181.335	30.047	24.996	0.362	9.400	3.227	6.380	5.024	4.720	361.190	56.297	16.256
WHEAT	734.268	101.205	8435.846	1326.963	1319.195	12.680	446.631	155.901	289.997	222.184	220.569	15150.118	2551.578	1348.691
HSW FLOUR	-6.163	-2.912	-35.656	-2.759	-51.198	-2.479	-8.945	-2.771	-3.016	-2.741	-1.952	-28.338	-18.808	-8.656
DS FLOUR	-0.162	-0.088	-0.810	-0.052	-1.495	-0.039	-0.242	-0.073	-0.066	-0.055	-0.058	-0.295	-0.551	-0.238
FR TOMATO	-0.018	-0.004	-0.200	-0.026	-0.073	-0.006	-0.017	-0.006	-0.010	-0.011	-0.007	-0.364	-0.074	-0.036
FRESH VEG	-0.666	-0.585	-8.812	-0.691	-10.770	-0.337	-1.288	-0.523	-0.009	-0.668	-0.784	-10.227	-4.290	-2.361
PROC VEG	-0.512	-0.073	-3.081	-0.519	-1.514	-0.158	-0.226	-0.088	-0.078	-0.080	-0.111	-4.221	-0.653	-0.597
S BEETS	14.963	1.850	141.887	23.303	29.729	1.826	7.094	2.673	3.763	3.170	3.891	244.959	36.237	23.510
PROC LINS	1.975	0.420	23.167	3.589	6.718	0.134	1.741	0.588	0.862	0.911	0.756	43.298	7.898	4.407
PROC CANO	27.346	5.193	306.222	48.188	79.321	1.963	21.138	7.217	10.875	10.880	9.458	540.426	96.707	54.447
SEEDS	36.842	7.016	234.476	32.852	137.392	15.450	16.597	7.088	4.339	5.873	9.693	250.703	67.536	39.272
FLAXSEED	42.452	6.578	463.090	70.747	93.481	2.250	28.157	9.617	18.103	13.516	12.837	823.365	153.669	76.918
CANOLA	43.453	18.951	439.100	53.133	325.321	3.479	67.929	20.951	29.028	28.696	21.734	793.482	241.689	113.576
WOOL	0.096	0.013	0.990	0.154	0.189	0.014	0.050	0.019	0.029	0.024	0.026	1.643	0.258	0.147

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL
WHEAT	32000.805												
HSW FLOUR	-510.070	15.043											
DS FLOUR	-15.885	0.894	0.015										
FR TOMATO	-1.400	0.017	0.0001	0.00006									
FRESH VEG	-108.330	1.107	0.055	0.003	0.614								
PROC VEG	-19.568	0.570	0.015	0.001	0.077	0.017							
S BEETS	997.111	-9.418	-0.289	-0.022	-2.447	-0.570	9.826						
PROC LINS	194.822	-2.322	-0.068	-0.006	-0.531	-0.094	3.356	0.358					
PROC CANO	2470.045	-29.172	-0.857	-0.069	-5.980	-1.182	41.619	8.810	55.355				
SEEDS	1428.882	-36.736	-0.910	-0.107	-7.542	-2.443	38.141	6.699	85.764	109.564			
FLAXSEED	3612.530	-40.785	-1.189	-0.106	-5.824	-1.491	55.378	11.377	145.351	116.511	111.082		
CANOLA	5483.335	-159.012	-5.035	-0.180	-18.212	-3.901	89.060	22.333	274.685	267.226	387.621	592.408	
WOOL	6.727	-0.059	-0.001	-0.0002	-0.012	-0.003	0.117	0.021	0.268	0.234	0.382	0.524	0.0004

NOTE: All figures shown have been converted to a basis of (1.0×10^{14})

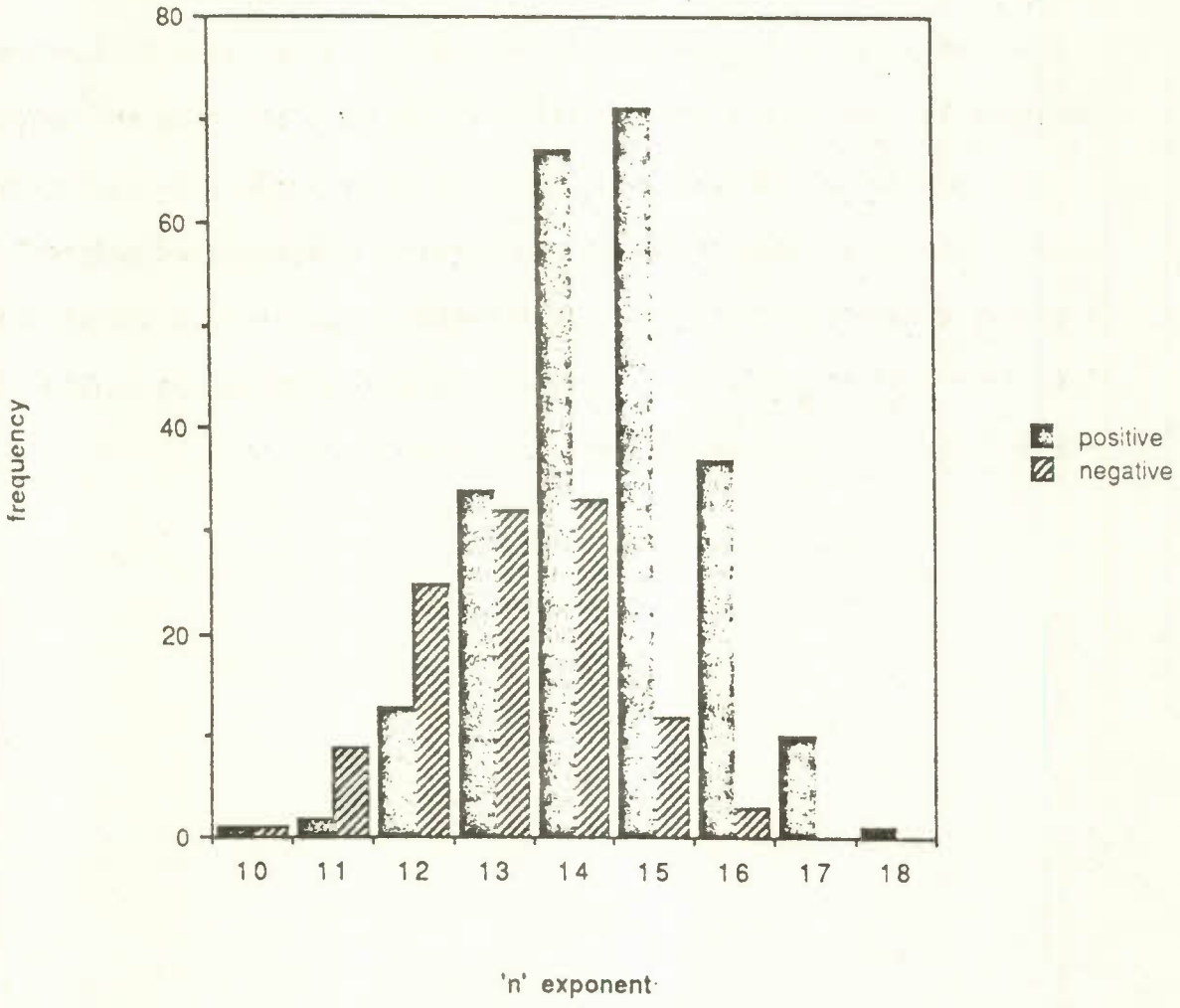
The variance and covariance values tend to be very large but, as suggested above, it is their relative size which is important. They indicate the relative contribution of the various components to the variability of income. Those on the diagonal represent the own variance and indicate the contribution of the variation in own prices to income instability. The other terms represent the interactive impacts of the twenty-seven commodities.

Some immediate insights are gained from the examination of the matrix. As suggested in the discussion of the price correlation matrix, the positively correlated pairs exceed the number of negatively correlated pairs by a considerable margin. This, in itself, does not necessarily lead to a large variation in income. The relative weighting of the commodities is also important. In other words, if the important commodities were concentrated in the negatively correlated commodities, they could counterbalance the larger number of positively correlated but less important commodities. Figure 1 provides a histogram of the distribution of positive and negative covariances.

FIGURE 1

PRAIRIE AGRICULTURAL COMMODITIES, 1977-1986

Covariance Frequencies



As can be seen, the distribution of the covariances is skewed in a fashion which tends to increase the variance in income rather than reduce it. Not only are there a greater number of positive covariances but they also tend to be the important commodities. The negative covariances, on the other hand, tend to be the less important commodities. As a result, the prospect of significant enhancement of diversification due to changes in the trading environment does not appear to be strong.

The essence of the problem can probably be best illustrated by Figure 2.

FIGURE 2 — PRAIRIE COMMODITIES, 1977–86

PRICE CORRELATION VERSUS COVARIANCE

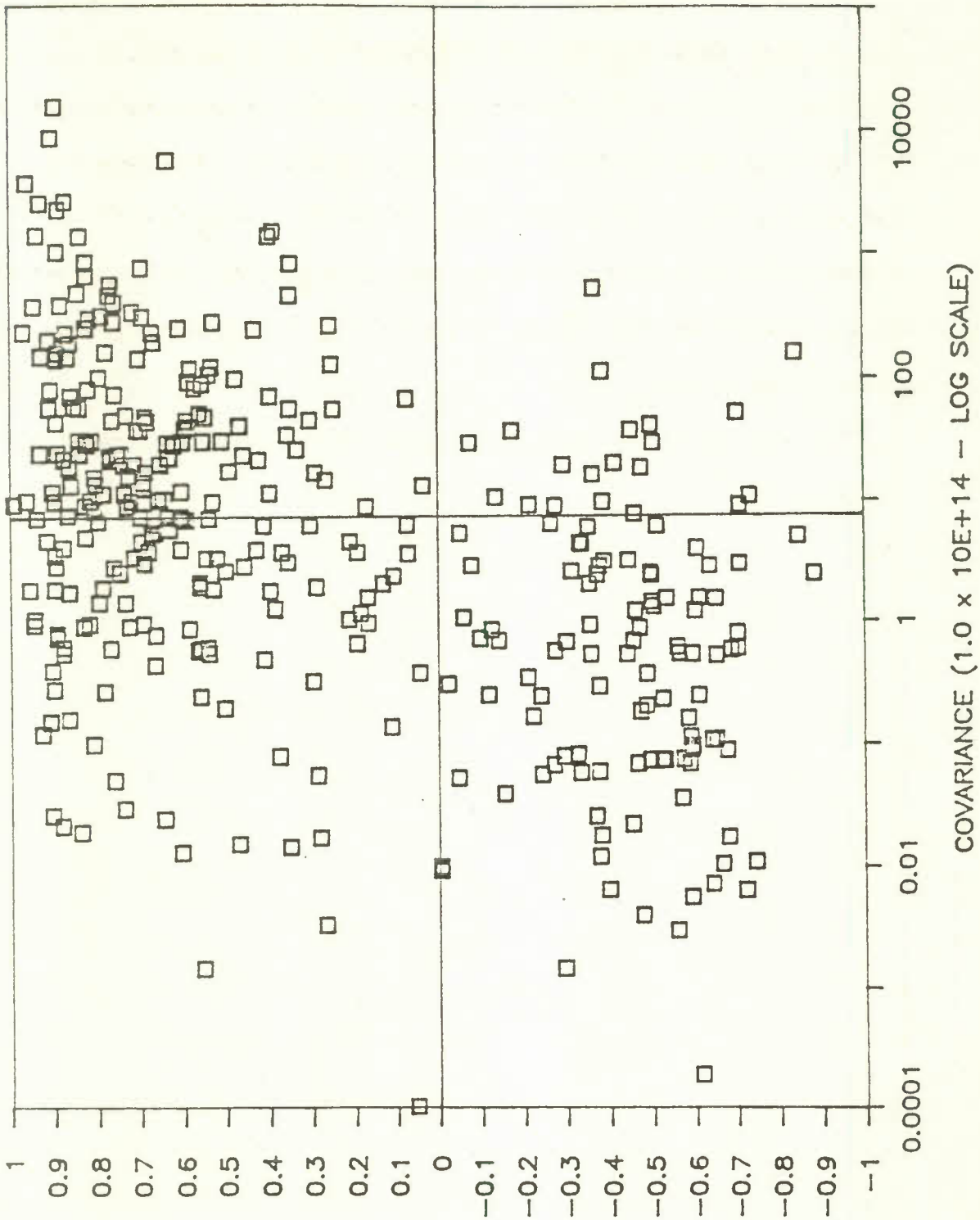


Figure 2 displays a scatter diagram of the price correlations against the covariance values where the latter is plotted on a logarithmic scale. In general, the plot runs from the bottom left to the top right hand corner; that is, it has a positive slope. Furthermore, the log scale, which is used for ease of illustration, distorts the actual configuration as the very large (and mostly positive) covariances are de-emphasised. As can be clearly seen, those commodities with large covariances also tend to be highly positively correlated. A well-diversified economy would have the opposite configuration. In other words, the distribution would slope downward from left to right. This implies that those commodities with large covariances would also be those with prices that are strongly negatively correlated. Positively correlated prices would be concentrated in the commodities with small covariances. The top left and bottom right quadrants are very sparse for prairie agriculture as presently constituted. This means there are no obvious avenues for resource shifting which will lead to significant diversification. Of course, any shift in the mix of outputs which moves the orientation of the distribution closer to one which slopes downward from left to right is likely to reduce the total variance of gross income in the prairie region.

The total variance of gross income in the prairie region (as defined by the twenty-seven selected commodities) is 9.539. It is this figure which will be used to evaluate the impact of all subsequent cases.

4.3 An Extension of the Base Case

Before developing the trade alternatives, some additional information may be gleaned from the base case. While there may not be

any obvious alteration to the mix of outputs which will lead to a reduction in the variance in income for the prairie region, this does not mean that such alterations do not exist. In essence, what is required is that resources be moved from outputs whose prices are highly correlated and which have a large covariance into a mix of products whose prices are less highly correlated and which have a smaller covariance. This will mean some increase in the covariance of the latter products but also a decrease in the former's. The net effect will be to decrease the variance of income. If diversification is the objective of policy, identifying the changes in the mix of outputs which are diversification-enhancing could provide information to policy makers as to where resources might be targeted - e.g. incentives for additional meat processing or increased production of irrigated crops. Of course, this abstracts from any trade offs which might have to be made if the change were to reduce the average level of income. One such diversification enhancing case will be developed in this section. This exercise could indicate the gains in diversification which may be possible. It can also provide a benchmark against which the various trade cases can be judged. Basically, a counterfactual argument will be developed. This argument will ask the question: What would have been the effect on the variance of income if the mix of outputs had been constituted differently in the past? Rather than attempting to strictly minimize the total variance of income, this scenario must be somewhat subjective to allow for realism in resource movements and marketing opportunities. The process will, however, be largely objective as the selection of the change in product mix will be made with information derived from the price correlation matrix and the variance-covariance matrix.

The case developed allows a movement of resources out of wheat production into the production of additional processed pork, fresh pork, canola and processed canola products. This alteration of the configuration of prairie agriculture arises from the price correlations and covariances observable in the base case. It also provides a feasible combination of outputs given Canadian resources.

If the objective is to enhance diversification the movement out of wheat production is logical given its contribution to the total variance of returns. As the most important prairie agricultural commodity, it will have a heavy weighting in the covariance calculation. Unfortunately for diversification, wheat prices are also highly positively correlated with the prices of most other major prairie commodities. Of the positively correlated pairs, only feeder cattle, the three pork industry classifications, eggs, canola and certified seeds have a coefficient of less than .700. Table 4.3.(1) presents the distribution of price correlations for wheat prices.

Table 4.3.(1)

Distribution of Price Correlations and Covariances - Selected Commodities, 1977-1986

Price Correlations

Correlation	Wheat	Processed Pork	Canola	Pork	Processed Canola
.90 to 1.00	6	0	0	1	4
.80 to .89	6	0	1	1	5
.70 to .79	2	1	6	3	7
.60 to .69	3	1	4	2	2
.50 to .59	1	2	5	5	2
.40 to .49	0	1	0	1	0
.30 to .39	2	2	3	3	0
.20 to .29	0	2	1	2	0
.10 to .19	0	5	0	1	1
.00 to .09	1	3	1	2	0
-.10 to -.01	0	3	0	0	0
-.20 to -.11	0	2	0	0	0
-.30 to -.21	0	1	0	0	0
-.40 to -.31	3	2	0	0	0
-.50 to -.41	2	0	2	1	1
-.60 to -.51	0	0	0	0	3
-.70 to -.61	0	0	1	2	1
-.80 to -.71	0	0	0	2	0
-.90 to -.81	0	0	2	0	0
-1.00 to -.91	0	0	0	0	0

Covariance

Covariance Size	Wheat		Processed Pork		Canola		Pork		Processed Canola	
	+	-	+	-	+	-	+	-	+	-
10^{18}										
10^{17}	1									
10^{16}	9				1		1		1	
10^{15}	9	2			8	1	3		4	
10^{14}	1	1	4		10	1	9	2	10	1
10^{13}	1	1	6	3	1	2	7	2	5	2
10^{12}			6	3	1	1	1		1	1
10^{11}			1	1				1		1
				2						

The correlation with wheat price exceeds .70 for over half of the remaining twenty six commodities. Further, the covariance values for wheat tend to be very large. The distribution of covariance terms is also presented in Table 4.3.(1). Hence, moving resources out of wheat production will tend to have a considerable effect on the total variance of income. Processed pork products, on the other hand, tend not to be as highly correlated with other commodity prices, although the tendency to positive correlation remains. The covariances for this commodity grouping are also more evenly distributed between fairly equal positive and negative values. Again, however, the weighting remains skewed to positive covariances. Relative to wheat, the other commodities selected for expansion also exhibit a lower degree of price correlation. As these are all relatively important, an expansion of these commodities will likely lead to a decline in the total variance of prairie agricultural income.

The actual case devised provides for a 20 percent increase in the output of processed pork and a 40 percent increase in the production of fresh pork over current levels produced in the prairie region. As, for example, a 20 percent increase in prairie pork production (approximately 65,000 tons) is less than 1 percent of total North American pork production (7,325,000 tons) the effects on price are not likely to be discernible. The increase in processed pork is assumed to arise from additional animals so that the total herd expansion is the sum of the animal equivalents of the expansion of the two products. The number of slaughter hogs utilized in these calculations remains constant because the cases are constructed on a final product basis and, hence, intermediate products are not included in the total variance calculation.

The extra feed required to produce these animals is expected to come from land diverted from wheat production to the production of additional barley. Thus, the quantity of wheat produced will decline. The movement of resources takes account of the appropriate differences in yields between commodities.

The case also allows for a 25 percent increase in the quantity of canola produced. This may represent an upper bound for increased canola production. All of this increase is also assumed to arise from acreage diverted from wheat production. Two-thirds of this additional canola production is further processed.

The new variance-covariance matrix for this case can be found in Appendix 3 and is denoted "base case extension". The total variance of gross income for this case is 9.353. This represents a 2 percent decline relative to the base case. While the decline suggests this scenario would represent some progress toward diversification, the variance in income remains very large. This simply indicates the difficulties associated with diversification within the agricultural sector alone. As prices are so interrelated, targeting sectors for diversification programs may not yield significant improvements. It also suggests that the effects on diversification rising from trade liberalization are not likely to be large. The changes expected from the Canada-U.S. Free Trade Agreement are developed in the next section.

5. The Canada-U.S. Free Trade Agreement

The most significant trade policy issue in recent Canadian history is the Free Trade Agreement signed by the U.S. and Canada. While the volume of trade between Canada and the U.S. is the largest between any

two countries in the world, many irritants to trade still exist. In particular, it is claimed that limited access to U.S. markets has prevented Canadian firms from achieving economies of scale. While this may be the case for the agricultural processing industry, restrictions on access to the U.S. market has not been the reason why some prairie farmers have not realized all of the economies of scale available. If trade liberalization leads to economies of scale in the processing sector, it is likely to change both the mix of products produced in the prairies as well as the degree of value added which will accrue in the prairies. To the extent that these changes reduce total income variance, they will be diversification-enhancing. Ex ante, however, it is not possible to determine whether the changes brought by the FTA will be diversification-enhancing or diversification-retarding. In addition, even if no significant economies of scale can be realized, enhanced and more secure market access to the U.S. may alter trade patterns and provide a stimulus to alter resource commitments in the prairies. In any case, before alternatives based on the changes brought to the trading environment by the FTA can be developed, a brief outline of the Agreement's agricultural provisions is required.

5.1 The Agricultural Provisions in the FTA

From the outset of the discussions between the U.S. and Canada, agriculture was recognised as being a "sensitive" sector. Just as the trade in farm and food products has, in general, become a major GATT issue as well as the most critical issue at the current Uruguay round, trade negotiations between the U.S. and Canada in this area were expected to be difficult. The high degree of subsidization and regulation, on both sides of the border, lies at the heart of the problem. In the absence of a major commitment by both federal

governments (plus state and provincial governments) to considerably reduce or eliminate their farm income support policies, little real progress could be made. Such a commitment was not forthcoming. As a result, those commodities whose bilateral trade was heavily restricted before the Agreement will remain, for the most part, heavily restraicted once the Agreement is implemented. Hence, the possibilities which could arise from gains to trade are restricted to a subset of prairie agriculture.

Segments of the Canadian agricultural industry, particularly the red meat industries, were becoming increasingly concerned over maintaining existing levels of market access in the face of rising U.S. protectionism. In addition, the deterioration of the international trading environment meant a general increase in reliance on U.S. markets as Canadian products were increasingly shut out of existing markets. This was most evident in the heavily subsidized EC which was rapidly expanding its agricultural output. As a result, more secure access was desired by Canadians to ensure a continuation of trade flows to the U.S. The only major exception was Western Canadian grains where the Canadian Wheat Board limited exports to the U.S. Hence, while the agreement has a positive, trade enhancing element, it also has as a major concern the maintenance of market access. Consequently, the Canadian approach to agricultural issues in the negotiations was characterized by a mixed set of goals. These are illustrated by the three objectives for the agricultural sector - "to improve access for farm products; to make access more secure and to preserve Canada's agricultural policy instruments"[3] - announced by the federal government. The first two goals refer to expanding or retaining markets for Canadian products in the U.S. The final goal is concerned with restricting the access of

U.S. products in the Canadian market. The FTA sections which address agricultural concerns should be viewed with these stated objectives in mind.

As with products from other sectors of the economy, the FTA provides for the elimination of all tariffs over a period of ten years. The only exception is fresh vegetables and fruits. For these commodities, Canada can reimpose existing seasonal tariffs for a period of twenty years. These "snapback" provisions can only be activated under a limiting set of circumstances and thus will have little impact except under very adverse market conditions. In general, however, the tariff levels are small and not perceived to be the major restricting influences on agricultural trade.

Both countries currently utilize countercyclical meat import policies which allow the restriction of beef imports if traded quantities exceed formula-established trigger levels. Of course, the law simply backs up a system of negotiated "voluntary" export restraints which are the actual means used to constrain imports. While these provisions are aimed primarily at offshore imports, they have meant that in the past Canadian exports to the U.S. have, at times, been cut off in November or December. The value of trade lost when these restrictions are imposed can be considerable but more worrisome are the security of supply concerns which have been created for U.S. customers. Therefore, Canadian beef exporters have found it difficult to develop and maintain consistent market channels by which to move product to the U.S. The provisions of the FTA now exempts both countries from their respective meat import acts which should result in Canadian processors having more secure access to U.S. markets.

The FTA also contains provisions by which the two countries will

undertake to harmonize technical regulations. These are particularly sensitive in the area of health regulations. In the past, there have been instances, on both sides, when differences in health regulations have been used to restrict trade, particularly in meat and livestock. Further, border inspections have been used as short term inhibitors to trade. The frequency of such inspections will now be reduced. Other non-tariff barriers will also be eliminated. The success of all such reductions to these barriers will depend on the effectiveness of the dispute settlement mechanism. This can only be assessed once it begins operation.

The Canadian Wheat Board (in conjunction with the Department of External Affairs) has restricted the import of grains from the U.S. through an import license requirement. This allows the Board to better carry out its responsibilities relating to Canada's international grain trade because it removes any instability which would arise from grain moving into the Wheat Board Area. To prevent retaliation by the U.S. for this trade barrier, exports to the U.S. have been voluntarily restricted. Under the FTA these licenses are to be eliminated.

The activation of these provisions is contingent upon the alignment of Canadian and U.S. subsidy levels. These provisions are not likely to come into effect in the near future. This is because U.S. subsidies on wheat are approximately $50 per tonne higher than those in Canada. Subsidies on barley and oats are also higher. A working group on grains and oilseeds will continue negotiation in this area. Given the current confrontational attitude of the U.S. toward the subsidy policies of the EC, any significant reduction in U.S. subsidies seems unlikely in the near future. In fact, unless there is significant progress at the current round of the multilateral trade talks, U.S. subsidy levels may

well increase over time.

The FTA sets out the methodology for determining equivalent subsidies in great detail. A long list of U.S. programs is included for purposes of calculation, including all aspects of the 1985 U.S. Food Security Act and related export subsidies. In addition, some less direct forms of subsidization are included such as the Corps of Engineers Inland Waterways Program, research expenditures, and state agricultural budgetary allocations which are specific to particular grains. Canadian programs included are Western Grain Stabilization payments, Canadian Wheat Board pool deficits, the Special Canadian Grains program, provincial stabilization schemes, research expenditures, branch line rehabilitation, crop insurance, and cash advance programs, to name a few. Many of the subsidies are tied to market prices so that, for example, in times of drought, the level of the subsidy declines. In years of high yields the subsidies increase. Given the complexity of the subsidies involved and their year to year volatility, any consistent alignment would seem problematic at best, making the opening of cross border trade a relatively remote possibility.

In addition, the agreement allows each party to introduce contingency protection measures or to reintroduce import resrictions on wheat, oats, and barley and their products (such as flour) if imports increase significantly as a result of a change to agricultural programs. This would seem to considerably restrict the ability of governments to introduce policies aimed at encouraging exports as a means of increasing the degree of diversification.

While not directly a result of the FTA, low erucic acid rapeseed (canola in Canada) oil was recently granted "generally regarded as safe" (GRAS) status by the U.S. By the terms of the FTA, the label "canola"

can now be substituted for the term rapeseed when the product is marketed in the U.S. This should greatly improve Canadian opportunities to expand into U.S. markets for canola and its processed derivatives. The major U.S. import restriction policies for sugar and sugar products remain in force, effectively eliminating most Canadian products from the U.S. market. The only concessions relate to food products which have a sugar content of less than 10 percent.

Clearly, the provisions on grain allow for the maintenance of the major Canadian policy instruments in this area and, hence, have more to do with the third objective of the federal government than they do with improving market access. The other area where the retention of policy instruments took precedence over trade considerations was in the commodities where supply management marketing boards are in place. Canadian poultry and egg producers, in particular, perceived that they had a great deal to lose from trade liberalization. In addition, one of the major pillars upon which the last twenty years of Canadian agricultural policy had been built would have had to be abandoned. Neither the federal nor provincial governments were willing to take that step. Of course, abandonment of the supply management system would have, after the long run adjustment, a destabilizing effect on the prices of poultry commodities. To the extent that supply management isolates the Canadian market, it reduces price variability. As Canadian prices for these commodites are now considerably higher than in the U.S., import quotas are required to prevent large quantities of U.S. product from flowing into Canada and reducing the market share of domestic producers. Under the terms of the FTA, imports will be held at levels equal to the average of the previous five years. Little emphasis is placed on the dairy sector in the FTA, suggesting that there was

little pressure for change on either side of the border. As a result, the ability of the Boards to restrict supply is maintained. Furthermore, if required, new supply management boards can be implemented.

The elimination of tariffs on supply managed products has the potential to affect processors and food manufacturers who produce derivative products. This is because the price of raw product input into TV dinners, chicken pies etc. are higher in Canada as a result of supply management. Some of these products are not on the import control list - chicken or turkey cordon bleu, chicken or turkey TV dinners, chicken or turkey Kiev. There are provisions in the FTA which will allow the Canadian government to add these products to the import control list if the industry is being damaged by large increases in U.S. exports. Already in the dairy industry, a considerable number of products have been added to the import control list. Hence, it would appear that there is little likelihood of any significant change from the status quo for the supply management commodities or their derivatives as a result of the FTA. While this has meant that the Canadian government has been able to achieve the objective of maintaining the main elements of Canadian agricultural policy intact, it also means that major changes will not likely arise as a result of the FTA.

Given this brief overview of the FTA's agricultural provisions, the impact on the diversification of prairie agriculture will now be assessed. As with any ex ante examination of a change to the rules by which commodities trade, the projections will be somewhat speculative. This is because of the general equilibrium nature of trade liberalization:

> As is well known, international trade is a topic which can only be assessed within a general equilibrium framework from which quantitative results cannot be expected. Trade theory suggests that benefits from trade will only be assured under an extremely limited set of conditions. Given the complexities of modern industrial economies there can be no reasonable expectations that such conditions will be manifest as a result of any agreement which would liberalize trade. ... The move toward free trade is for the most part a political "leap of faith." Partial equilibrium approaches to quantification are not likely to be particularly insightful.[4]

The major problem with attempting to use pre-liberalization parameters to estimate the effects of a changing trade environment is the fact that the majority of the gains expected from liberalization arise from the transfer of resources from inefficient to efficient industries. This means that the supply functions upon which existing information on production relationships are based no longer exist. As it is not possible to estimate the reapportioning of resources among production activities - a general equilibrium problem - quantitative estimates of the new equilibrium can only relate general trends. It is possible, however, to provide a range of probable outcomes within which the actual equilibrium can be expected to fall. In aid of this, two cases will be developed concerning the possible impact of the FTA on prairie agriculture. The first is a conservative or pessimistic scenario. The second can be considered an aggressive or optimistic scenario. It should be noted that the terms optimistic and pessimistic refer to the degree to which those involved in prairie agriculture are willing and able to exploit the opportunities arising from the FTA and does not refer to the effect the scenarios have on the prospects for agricultural diversification. The conservative or pessimistic case is developed first.

5.2 The Conservative Scenario for the Canada-U.S. Free Trade Agreement

The basic assumptions of this case are that the only response to

the FTA from prairie agriculture results from the incentive provided by the removal of the tariffs. In other words, all changes to quantities produced take place from movements along existing supply functions. This implies no market development is undertaken. This may be due to other barriers to trade, such as technical barriers, which are not removed in the future because of an inability to agree to their form or it may be the result of an inability or unwillingness by Canadians to exploit opportunities as they arise. It is further assumed that there is no alignment of subsidies meaning the institutional status quo of the grains sector remains in force. Trade in canola and canola products is expected to increase. The supply management commodites, in conformance with the FTA provisions, also experience no change. The trade regime for sugar is assumed to remain unchanged.

The commodities included from the group of twenty-seven selected above can be divided into two groups: net export commodities and net import commodities. These classifications were determined from the Statistics Canada trade figures. The commodities on the net export list include Feeder Cattle, Slaughter Hogs, High Quality Beef, Low Quality Beef, Fresh Pork, Processed Pork, Honey, Processed Linseed Products, Processed Canola Products, Certified Seed, Flax and Canola. The net import list includes Fresh Tomatoes, Fresh Vegetables, Processed Vegetables and Wool.

To determine the effect of the removal of tariffs, the elasticity of supply estimates were combined with the published tariff removal schedules included in the FTA. An attempt was made to utilize the most up to date supply elasticities available. To this end, individuals in Agriculture Canada were contacted and their current estimates requested. Where no estimates were available from Agriculture Canada, a search of

the relevant literature was conducted and the most recent estimates were utilized. In a few cases, no published estimates could be found and an elasticity of 1.00 was assumed. As new trade equilibriums should reflect long run adjustments, long run elasticities were used wherever possible. A complete listing of the elasticities used, and their sources, can be found in Appendix 4.

The tariff rates used in the calculations are found in the volumes included with the FTA. Of course, the applicable rates for the net export commodities were the U.S. import tariffs. These were converted to Canadian dollar equivalents to reflect the true price effect for Canadian exporters. For net import commodities, the Canadian tariffs were utilized. In those cases where there were commodities with different tariff rates subsumed within one of the twenty-seven commodity groupings, a weighted average of the applicable rates was adopted. All tariffs were then converted so that they conform to the calculation units of the twenty-seven commodities. A listing of the tariff rates can be found in Appendix 5. The tariffs are scheduled to be reduced according to various timetables. As the intent of this study is to approximate the new long run adjustment position, interim positions were not considered. All adjustments are assumed to have taken place at the point when all tariffs are removed.

To be consistent with the base case, the changes in tariffs and elasticities were applied to 1986 prices and quantities. Where ad valorem tariffs are in place they were calculated as a percent of the 1986 price. In the cases of live hogs, unprocessed pork and wool, no tariff exists. Regarding live hogs, however, the current U.S. countervailing duty was assumed to remain in force. This assumption is made because the Canadian subsidies which have been found

countervailable are still in effect and no motions have been made to remove them. Some additional assumptions regarding the movement of resources between commodities were also required. The production of canola and flax is increased due to the reduction of the U.S. tariffs. The estimates will have a somewhat upward bias because no account can be taken of the increased cost of transportation for westward movements which will arise from provisions in the FTA which restrict rail subsidies. Tariff removal has two components, the direct increase due to the reduction of the tariff on the raw product and the indirect increase due to the reduction of the tariff on the processed derivatives. It is assumed that the total increase in production arises from the transfer of resources out of wheat production. Wheat production is reduced by the appropriate adjustment factor for each crop. While the validity of this "one off" transfer of resources out of wheat may be questioned, the assumption is made so that the maximum diversification benefit can be examined. Given the importance and high degree of price correlation exhibited by wheat, spreading the resource shifts among the other grains would tend to reduce the effect on income variance. The additional production of animals will require feed. All additional feed requirements are assumed to come from the diversion of barley which would have been sold out of the prairie region. In other words, it is moved into higher value added production and the direct contribution of barley to income variance is reduced.

The detailed results of the changes to the variance-covariance matrix arising from the conservative free trade case can be found in Appendix 3 under the title Conservative Canada-U.S. FTA Scenario 1. This can be compared to the base case in Table 4.2.(2) above. The total variance of income for the prairie region which arises from this

scenario is 9.550. This represents a 0.12 percent increase in variance relative to the base case.

An almost unchanged variance should not have been unexpected. As the tariff rates are generally small relative to the price of the products the changes in quantities generated from the elasticity estimates tended to be modest. In some cases the tariffs are already zero. Further, as the major grain crops and supply management commodities remain untouched by the FTA, much of the production mix remains as it was before the agreement. In the case of grains, only indirect trade effects arise from the movement of resources between commodities. Any reductions in the variance of income which arise from the increase in exports are partially offset by the reduction in the production of imported commodities. As noted above, the prices of these commodities tend to be negatively correlated. Thus, any reduction in their production will tend to increase the total variance of gross income. This case further highlights the problems associated with the diversification of prairie agriculture. When one compares these results with those of the "base case extension", it is apparent that trade liberalization, in the absence of additional measures which actively channel resources in a diversification-enhancing direction, will not lead to a significant reduction in the variance in regional income. To determine the sensitivity of the analysis to the methodology employed further cases were developed.

Analyses were conducted to determine the importance of the values of the elasticities to the results. Two additional cases were calculated. The first, denoted Conservative Canada-U.S. FTA Scenario 2, utilized elasticities which were inflated 20 percent above those of

Conservative Canada-U.S. FTA Scenario 1. The second - denoted Conservative Canada-U.S. FTA Scenario 3 - was produced through the use of elasticities reduced 20 percent from that initial FTA scenario. The detailed results for the variance-covariance matrix can be found in Appendix 3.

The total value of the gross variance in income in the case of increased elasticities is 9.548. This is a 0.02 percent reduction in total variability relative to the first conservative scenario but it still represents a 0.1 percent increase in the total variance when compared to the base case. The case where the elasticities were reduced 20 percent gave a value of 9.432. This represents a reduction of 1.24 percent when compared to the initial conservative case. This suggests that the results are not particularly sensitive to the elasticities assumed. This conclusion should not have been unexpected given the offsetting interactions between the commodities indicated by the price correlation matrix. Further, as the elasticities increase or decrease, the supply response of the imported commodities will move to offset, to some extent, any changes in exports.

The assumptions embodied in these cases are, of course, very conservative since they do not allow any market expansion and only allow limited movement of resources among sectors. A less restrictive case will now be developed.

5.3 The Optimistic Scenario for the Canada-U.S. Free Trade Agreement

Due to general equilibrium problems relating to the ex ante estimation of the effects of trade liberalization, few quantitative estimates have been made of the expected impacts of the trade liberalization process resulting from the FTA. The liberalization process concerns not only the removal of tariffs and quotas but also the

removal of non-tariff barriers and other less formal impediments to market development. Such trade inhibiting practices can span the range of actions from restrictions on business travel to the abuse of health standards. While the effect of the removal of such impediments is difficult to quantify, the trade reducing impacts of such practices have received considerable attention in the period prior to and during the negotiations. Consequently, provisions exist in the FTA to address such trade irritants once the agreement comes into force or at least to promote a negotiated solution to contentious issues in the period after implementation.

The red meat sector has received the greatest attention in terms of these issues for two primary reasons. First, given the perishability and potential health risks associated with meat, the myriad of existing health regulations provide considerable scope for abuse in aid of market protection:

> Health and sanitation regulations are accepted by both countries as necessary to prevent the spread of diseases of plants or animals. There are suspicions and some evidence, however, that these regulations have been used to control movements beyond the legitimate levels.[5]

The second reason that the red meat industry has received attention is that considerable perceived market potential is available in California[6]. The ability to tap this market has, in part, been limited by the application of non-tariff barriers by the U.S.[7] If the FTA can bring about a significant reduction in the use of such non-tariff barriers then:

> ... exports of red meat from the prairies to the United States will continue to grow, and the physical flows of pork and beef seem to support this opinion. ... The geographic location of the provinces relative to California certainly suggests a potential for Canadian product. The potential consumer and human population in California is greater than the total

> we have in Canada; and, considering that the west normally is in a surplus position (particularly for beef), suggests that Canadian trade should be north to south.[8]

If all of the changes in the FTA are implemented and the further negotiations are successful in aligning technical standards and removing other trade irritants, considerable opportunities should present themselves for the exports of red meat out of the prairie region.[9] This, of course, also depends upon whether or not Canadian producers and processors are willing to exploit the opportunities which arise.[10]

The other major area where opportunities are likely to be present is in canola and canola products. As mentioned above, the combination of the changes brought by the FTA and the granting of GRAS status for this oilseed should provide considerable market potential for Canadian product.

One major study which examined the expected effects of trade liberalization on the Canadian prairies was done for the three prairie grain handling pools by Deloitte, Haskins + Sells.[11] This study developed a number of alternative cases for the year 1995, of the changes in prairie agriculture which would result from trade liberalization. The most optimistic of these cases will be used here as the basis for the Optimistic Canada-U.S. FTA Scenario. The Deloitte study's optimistic scenario would likely represent the maximum change which could be expected from the FTA and therefore provides an upper bound to the range of outcomes which could arise from the FTA. Further, the Deloitte study's assumptions matched the actual FTA provisions fairly closely. The Deloitte study assumed no major changes to the grain economy but assumed maximum access for red meat and canola products. This would appear to conform fairly closely to the provisions of the actual FTA where grains remain restricted. Hence, it should

provide a reasonable case for the purpose of this study.

The results of the Deloitte study also took account of the changes in west-east trade which were expected to arise out of trade liberalization with the U.S. In particular, while there was to be considerable expansion of beef exports into the California and Pacific Northwest markets of the U.S., there was also to be some reduction in the movement of beef to markets in Central Canada. Thus, the results for beef are net of these west-east changes. In addition, barley production was expected to decline as a result of imports of U.S. corn and other feeds into Central Canada. This was partially offset by an increase in the export of malting barley to the U.S.[12]

The net changes in prairie output derived in the Deloitte study were: Beef, 12 percent increase; Pork, 2 percent increase; Barley, 6 percent decrease; Canola, 3 percent increase; Flax, 1 percent increase; and Rye, 1 percent increase. In our case, all of the increase in canola production is assumed to be in processed form for export to the U.S. The pork increase is divided between fresh and frozen pork in the ratio of base case production. All additional beef production is assumed to be in the form of high quality beef. The additional feed required is assumed to be reallocated from existing barley marketings outside of the prairie region. All other commodities enter at the values used in the Conservative Canada-U.S. FTA Scenario 1 and, hence, are assumed to realize only the gains or reductions arising from the removal of the tariffs.

The variance-covariance matrix for this case is located in Appendix 3 under the title Optimistic Canada-U.S. FTA Scenario. The total value of the variance in total gross revenue is 9.630. This represents an almost one percent increase compared to the base case. The positive

effect on total variance in this case is greater than in any of the Conservative cases. The major reason for this increase is the expansion of high quality beef production. Certainly, such an expansion would have a positive effect on the value added accruing in the prairie region and, hence, lead to an increase in the absolute level of income. However, the effect on diversification will not be significant because beef prices are relatively highly correlated with the prices of other commodities. As is well known, beef prices are also highly variable. Hence, the increased contribution of high quality beef to the total value of output also tends to add considerably to the variance of income.

The effect of Canada-U.S. trade liberalization on the diversification of prairie agriculture is somewhat disappointing. While the income effects of the FTA are likely to be of considerable benefit on average, it would seem that the post-FTA era will leave the prairie agricultural sector as vulnerable to large swings in income as it was in the past. Of course, if the FTA provides opportunities for expansion into entirely new export lines, the variance of income could be reduced. This will depend upon the absolute size of the price variance and how the price movements of any new goods are correlated with the prices of existing comodities.

6. The Multilateral Agricultural Trade Environment

The terms of reference for this study were to examine the diversification opportunities which would arise from the Canada-U.S. Free Trade Agreement and which were available from trade with the EC. Other markets such as Japan were explicitly excluded. Any discussion of

changing trade relations with the EC, however, can only be undertaken within the context of the multilateral trading system for agricultural commodities. As the EC has developed and expanded over time, Canadian agricultural products have been increasingly shut out of the Community market. Over the period 1965 to 1985 the total value of Canadian exports to the current twelve EC countries decreased by approximately 45 percent in real terms.[13] The reduction in trade with the EC, however, is part of a wider deterioration in the international trading system for agricultural commodities. While total Canadian agricultural exports have been rising, increased protectionism and export subsidization have meant considerable opportunities foregone for Canadian products.

This deterioration has a number of causes. The most significant individual event, however, has been the evolution of the EC from a major importer of many agricultural commodities to an important and heavily subsidized exporter. The reasons why the EC has followed this direction with its agricultural policies are complex. The food shortages during the Second World War and the immediate post-war period meant that European policy makers have consistently given a high priority to food security. This concern has been manifested in policies which promote self-sufficiency in food production. In addition, farm lobby groups within the Community are very powerful. As with all industrialized nations, rapid technological change in agriculture combined with inelastic demand for food commodities has meant that increases in supply have put downward pressure on prices, resulting in a movement of resources out of agriculture. This process of technologically induced exit of farmers has been resisted by farm groups in the EC. Thus, the large subsidies of the Community's Common Agricultural Policy (CAP) have allowed the satisfaction of two major goals of EC agricultural policy -

increased levels of self-sufficiency and greater resources retained in farm level production than market prices would suggest. Of course, the costs of the EC realizing these objectives has been borne by those, including Canada, who traditionally exported to Community countries as well as consumers and taxpayers in the Community itself. This problem has been exacerbated by the expansion of the EC from the original six to the current twelve members. The movement of the Community from a position of net importer to net exporter of many commodities, however, would appear to be largely the result of an underestimation of the response of farmers to the high prices produced by the CAP subsidies. The prices have induced investment in modern technology and provided an incentive to farm intensively. This caused a rapid shift in the supply schedule, resulting in surpluses for many commodities. Significant price reductions have proved impossible because of the high expenditures EC farmers made to acquire the new technology and the capitalization of CAP benefits into fixed assets. As an alternative, the Community turned first to a storage policy and, when that proved only a "stop gap" measure, subsequently to export subsidies. As considerable excess resources are now employed in agriculture, even a reduction to self-sufficiency levels is likely to prove very difficult for CAP policy makers.

The CAP export subsidies can mean that EC product moves into Canadian markets. While there has not been significant movement of subsidized EC product into the West, Community beef has moved into Central Canada. This may have displaced beef originating in the prairies to some extent. Countervailing duties imposed by Canada have effectively shut out imports from the EC. The issue is now before the GATT and if a ruling is made against Canada, then the problem may

return. Other products - e.g. pasta - are also exported under subsidy and may be affecting the viability of western industries.

The second major factor which has led to the deteriorating international trading system for agricultural commodities has been the reaction of the U.S. to its shrinking share of international export markets. The U.S. perceives that its loss of market share is, to a considerable degree, the result of EC export subsidies although U.S. macroeconomic policies may have been the significant factor in poor export performance. The need to finance the large U.S. deficit resulted in a strong U.S. dollar which made U.S. agricultural commodities less competitive in world markets. The 1985 Food Security Act (the Farm Bill) provided the means for the U.S. to win back lost markets. The Act changed the emphasis of U.S. policy from storage as a means of supporting international prices to export subsidies. The subsequent increase in product moving into world markets as a result of the Farm Bill has meant severely depressed commodity prices and a virtual trade war between the U.S. and the EC.

Consistent and increasing protection for agricultural commodities has been a mainstay of Japanese policy. The deteriorating U.S. trade balance with Japan has lead to intense pressure by the U.S. for better access to Japanese food markets and considerable strain on U.S.-Japanese relations. Other exporting nations have also been seeking a reduction in Japanese protectionism against agricultural imports.

Currently, the major protagonists in the international agricultural dispute appear ready to stand their ground and allow a further deterioration in the trade environment. The Japanese remain adamant that they should not unilaterally open their markets:

> It is unfair for the U.S. to ask for agricultural trade liberalization of any country to which it does not

> apply agricultural free status. The U.S. stated that the (GATT) Waiver item was recognized by the members of GATT upon its establishment. ... The reasons why EC countries and others don't make a complaint about this are considered to be that they want to retain the export subsidy system and import levy system. Also, while the U.S. criticizes the EC's export subsidy system, it adopts a similar system. Furthermore, the U.S. is unfair in its imposition of restrictions on the import of beef from Australia, wheat from South American Countries, oranges from Japan, and sugar, while at the same time, demanding Japan liberalize trade in 2 to 3 years ...[14]

The mood in the U.S. remains aggressive and:

> As of mid-1987, the political pressures are toward increasing rather than decreasing export subsidies, despite mounting protests from abroad.[15]

The Europeans appear to remain equally intransigent. In April, 1988, Francois Guillaume, the French Agriculture Minister stated:

> If it is necessary, we regret to say, we will do as the Americans, subsidize our exports as much as the Americans, to at least maintain our share of the world market.[16]

It should be clear that any unilateral abandonment of agricultural trade policies by the EC is extremely unlikely. Hence, any changes to the trading arrangements between Canada and the EC must be developed within a multilateral context. Basically, liberalization will have to involve not only the EC, but Japan, the U.S., other developed economies and the developing countries. It is not possible for any one of these economic units to abandon their agricultural trade policies without reciprocation from other major producers. Hence, it is only meaningful to talk about trade liberalization between Canada and the EC within a framework of mutual multilateral reductions in levels of farm support. This requires a multicountry model which can account for the interactive impacts of a general reduction in protectionism.

Of course, the next major opportunity for reform of the international trading system for agricultural commodities is at the

current Uruguay Round of the GATT negotiations. The confrontations and recriminations which the problems in agricultural trade have caused led to a high priority being given to agriculture at the talks. However, the outcome of the negotiations is far from clear. While there are considerable pressures for reform, little real progress has apparently been made to date. The proposals of the major protagonists remain far apart and much effort is still being expended in attempts to reach a concensus concerning exactly what the parties agree to negotiate. Given that the total amount of resources committed to agricultural production considerably exceeds those required to supply needs at undistorted prices, complete abandonment of all trade-distorting agriculture policies would mean massive, and politically unacceptable, alterations to the patterns of resource use in agriculture. Hence, even if the Uruguay Round could be considered a success at its conclusion, only modest changes in agricultural policies should be expected. They will also be multinational in nature. Of course, the multilateral talks could fail and the agricultural trading environment could continue to deteriorate. As the Canada-U.S. FTA will, if ratified, be in effect, no major disruptions to market access in the U.S. would arise. On the other hand, the EC market could be further closed to Canadian exports. These considerations will form the basis of multilateral alternatives developed below.

6.1 The Optimistic Multilateral Scenario

Concern over the deteriorating international trading environment has not only been manifest at the GATT. Other international organizations have also been cognizant of its disruptive effect. For example, the member nations of the OECD expressed concerns about:

> the economic and welfare situation of the farm sector, within which income disparities persist; the degree of

> indebtedness which for many farmers is high; the increasing instability and depression of world markets of basic agricultural products with their impacts on trade balances; rising budgetary outlays; and about tensions created in international economic relations because of increased competition for export markets.[17]

In response to these concerns, the Council of Ministers of the OECD requested a major study of these problems in May 1982. This endeavour took almost five years to complete, being submitted in late April 1987. The study provides a comprehensive multinational examination of agricultural policies and includes, as an important element, an examination of "the market impacts and economic consequences of a gradual and balanced reduction in assistance to producers ..."[18] The basis of this analysis is a:

> near linear, medium-term partial equilibrium comparative static model of agricultural production, demand and trade. ... The model system is built around individual country models which are linked through trade between countries.[19]

This model was chosen for a number of reasons. First, it provides the framework for a multilateral reduction in agricultural trade and farm support policies which realism requires. Second, it has a Canadian submodel from which quantitative estimates are available. Third, it is one of the most disaggregated models available. This is important as it allows for commodity interactions in its estimates. In all, fourteen tradeable commodities and eleven economic blocks are explicitly modeled. Further, the model allows for changes to both border measures such as tariffs and quotas and domestic policies affecting prices and quantity of output.

A number of other models of world agricultural trade, of course, exist. A cross section of these models was review for another paper in this series (Carter, McCalla and Schmitz)[20]. A subset of these models had the capability to provide estimates of the changes arising from

trade liberilization. These included: The International Institute for Applied Systems Analysis model (7 industrialized regions, 9 commodities); the Whalley, Wigle and Trela model (4 industrialized regions, 2 grains); the FAPRI model based at Iowa State (5 industrialized regions, 3 commodities); the model developed by Tyers and Anderson (7 industrialized regions, 7 commodities); The Michigan State University model (5 industrialized regions, 8 crop commodities); the SWOPSIM model of USDA (4 industrialized regions, 13 commodities) and the World Wheat Trade Model (7 industrialized regions, wheat)[21]. The scenarios developed by these models are attempts to estimate the cost of trade restrictions and the extent of the distortions they cause. To accomplish this task, the models, within their individual limitations, assume that all trade restrictions are removed. While such an exercise may be informative about the cost of trade distortions and provide an incentive for efforts which would encourage trade liberalization, their estimates should not be used as inputs for estimates of the gains from trade liberalization. This is because it is unrealistic to expect that the MTN will lead to removal of all agricultural subsidies. Even those who perceive that progress is possible at the multilateral trade negotiations realize "domestic political realities...appear to preclude true trade liberalization in agriculture by phasing out most or all domestic agricultural program."[22] As the reviewers of the trade model themselves conclude that

> "How things will turn out is not know, but it would seem that one prudent strategy would be to assume that there will not be radical changes in policy regimes in the near future. This would suggest policy approaches which seek incremental liberalization and preparation for a window of opportunity should it arise." (Carter, McCalla and Schmitz)[23]

The OECD approach is consistent with this conclusion.

The projections of the OECD model are used as the basis for our Optimistic Multilateral Scenario. The OECD study assumed:

> ... assistance on all commodities in all countries is reduced by 10 per cent. Policies measured on a volume basis (United States grains Farmer Owned Reserve and Set Aside, Japanese Paddy Field Reorientation Programme, USA and EEC dairy stock changes) were also reduced by 10 per cent.[24]

The reductions in trade restrictions and subsidies in the multilateral model produced a number of effects on international prices. Reference prices for livestock products increased while prices for products used for feeding livestock tended to decline. Prices of beef rose 1.5 percent. Prices of wheat and coarse grains fell slightly. Pork and poultry prices rose slightly.

While comparisons of the estimates of models is always difficult, it should be clear that the changes arising from a 10 percent reduction of border measures will be considerably less than those that would arise from a 100 percent reduction. Of course a 10 percent reduction does not mean a 10 percent change in price as

> "it should be remembered that a cut in assistance of 10 percent may itself be rather modest. A cut of 10 percent in assistance on a commodity where assistance makes up, say 20 percent of producer price is, after all, only a cut of two percent in producer price."[25]

Further, as the incentives for resource reallocation and increasing efficiency for a small change in trade barriers is far less than when a dramatic change in barriers is implemented, the proportional response will be less. For example, the price changes for wheat reported in the models review by Carter, McCalla and Schmitz[26] ranged from +3.7 percent to +25 percent for a 100 percent reduction in barriers. One would expect that the changes arising from a 10 percent reduction would, at best be proportionately less. As the OECD itself suggests,

> "the declines for cereals are small; it could be safely said that these changes are not significantly different from zero"[27]

The OECD model also assumed reductions in the support levels of policies such as the U.S. Set Aside and Farmer Owned Reserve programmes which tent to restict supply and support price. If the 10 percent reduction in those programs was not assumed the OECD model would have predicted a 0.23 percent increase in cereal prices.

As the published OECD reports did not include estimates of the changes in trade volumes, the research section of the OECD in Paris was contacted and the actual quantities secured. The OECD model indicated that Canadian exports of milk products would increase by 56 percent (on a relatively small base), beef by 46 percent, Canola by 0.59 percent and Pork by 0.11 percent. Wheat and barley exports declined by 1.05 percent and 1.95 percent respectively. Imports of chicken increased 11 percent while imports of wool decreased 2.08 percent. The OECD study used the years 1979-1981 as the basis for its estimates. Given that the level of farm support internationally has increased considerably since then, these changes represent conservative values. To be consistent with the base case in this study the percentage changes are applied to 1986 Canadian exports. As surplus milk production in the prairie provinces pertains more to the management of seasonal milk supply than a structural problem, all of the increase in milk product exports was assumed to come from surplus production in Central Canada. All changes in beef, pork, wheat, barley and canola exports were credited to prairie production.[28] In the cases of poultry and wool the new quantities were apportioned across the country according to the current share of national production. The changes in animal feed requirements were assumed to be the result of the diversion of production surplus to the

prairie region.

The variance-covariance matrix for this case can be found in Appendix 3 under the title Optimistic Multilateral Scenario. The value of the total gross variance in prairie agricultural income is 9.565. This represents a 0.27 percent increase relative to the base case. This slight rise results from the movement of resources into beef production with its highly variable prices. While the small size of the total change may be surprising, it is more a comment on the limited possiblities available for multinational trade liberalization than the possibilities for diversification as:

> A reduction in assistance of 10 per cent means that PSE/CSEs[29] are reduced by 10%. The decline in effective prices will generally be less. If, for example, the PSE is 50 per cent of the effective price, a 10 per cent reduction in PSE will mean a 5 per cent initial[30] reduction in the effective producer prices.

The adjustments which would result from the multinational alterations in national agricultural policies could have a significant effect on the interrelationships between prices of various commodities. Hence, more than for any other alternative developed, the assumption that the inter-price movements remain the same as in the past can be questioned and the results interpreted with increased caution. This is particularly true because trade liberalization is likely to reduce the variability of world prices. Export subsidies, especially those of the EC, and variable levies, are responsible for increasing the variability of world prices. Stable international prices may induce increased resource commitments in exporting countries which could lead to larger trade effects than are accounted for in the OECD model. Still, the total effect on world prices for the commodities utilized in this scenario, as predicted by the OECD model, ranged between +1.46 percent

for beef to -0.35 percent for barley.[31]

6.2 The Pessimistic Multilateral Scenario

The reduction in levels of domestic agricultural support and the subsequent trade effects assumed above are based on the premise that significant progress will be made at the current GATT negotiations. As the results of these disussions are far from clear at this point, failure remains a distinct possiblity. This could lead to a further deterioration in the international trading system for agricutural commodities. In this case it will be assumed that the Canada-U.S. FTA has been ratified and access to the U.S. market is assured. Levels of Japanese protectionism remain as presently constituted. It is assumed, however, that the EC increases its protectionist measures in aid of self-sufficiency. However, no increase in the level of commodities moving out of the EC under the various export subsidy programs is assumed. These would seem to be reasonable assumptions given the current direction of CAP policies. Attempts are being made in Brussels to stabilize or reduce output through reduced prices or quantitative controls. These policies are having some limited success. Hence, the quantities of EC commodities moving into world markets will likely stabilize. The implied reduction in output, however, will free up European agricultural resources. Currently, CAP policies are being initiated to encourage the movement of these freed-up resources into the production of commodities for which the Community is less than self-sufficient. This is particularly true in the case of animal feeds and edible oils. As these commodities now comprise most of Canada's exports to the Community, in a deteriorating trade environment such exports would likely be at risk.

It will be assumed for this "worst case" scenario that imports of

major Canadian commodities into the EC are eliminated. While this assumption is unrealistic, particularly in the case of high quality Canadian hard wheat which serves special culinary needs, it does represent the worst possible case. The quantity and value of exports to the EC twelve for major Canadian commodities in 1986 are presented in Table 6.2.(1).

TABLE 6.2.(1)

CANADIAN EXPORTS TO THE EUROPEAN COMMUNITY, 1986

COMMODITY	CLASSIFICATION	QUANTITY (tonnes)	VALUE ($000)
Barley	06119	143,673	12,541
Oats	06131, 06133, 06139	41,314	3,777
Wheat	06164, 06165, 06167, 06168, 06169	1,495,060	296,961
Rapeseed oil, cake and meal	15351	22,973	3,394
Rapeseed	21240	60,418	12,612

Source: Statistics Canada, Catalogue No. 65-202

It is further assumed that 50 percent of these exports find alternative markets offshore. For the other 50 percent it is assumed that prices decline sufficiently so that there is an incentive to transfer the resources used to produce these exports into the production of barley for animal feed. This lower priced barley allows for an expansion of red meat and livestock output. The additional available feed is apportioned among the various livestock commodities - high quality beef, pork and processed pork - according to the current ratios of production. As market access to the U.S. is assured through the FTA, the additional production is assumed to be exported to U.S. markets.

The variance-covariance matrix for this case is located in Appendix 3 under the title Pessimistic Multilateral Scenario. The total value of the variance of gross income is 10.010. This represents a 4.94 percent increase relative to the base case. Such a change is clearly diversification-retarding. The major reason for this is the movement of resources into beef production with its relatively high price correlations and variable prices. This case represents the largest deviation from the base case of all the cases developed in this study. Despite this, the change in the total variance of gross income is still less than 5 percent. Thus, it would appear that no matter what changes in the international trading environment come about, the effects on the diversification of prairie agriculture are not likely to be significant.

7. Summary and Conclusions

This study investigated the impacts of changes to the international trading environment on the diversification of prairie agriculture. The measure of diversification used was the total variance of gross

agricultural income. This measure was chosen because it provides an operational method of evaluating diversification by its objective. The reason diversification is desirable, in an economic sense, is that it will reduce the variation in income. Hence, alternatives which reduce the variance of income can be considered diversification-enhancing while those which lead to increases in income variance are diversification-retarding. Of course, other goals such as increasing the level of income are also important. Clearly the best of all worlds would be one where a change in policy led to increased income, additional value added and an economy which was becoming more diversified. It is, however, possible that income could increase while the variance in income was also increasing. The policy desires for increased incomes must be then balanced against the desire for stability. To this point in this study the exclusive focus has been on the variation in income so that the work retained its primary objective - the study of the effects of the changing trading environment on diversification. The results will now be discussed in the context of the other goals.

The total variance of income is determined by the way in which the movement in prices of various commodities are interrelated and by the contribution the commodity makes to total income. Prices which tend to move together - those which are positively correlated - add to the variance of income. To the extent that prices move in opposite directions (negative correlation), the total variance in income will be reduced.

This study selected twenty-seven commodities for its investigation. From the outset the limitations to the diversification of prairie agriculture were apparent. Prices over the last decade tended to be

positively correlated for all of the important prairie commodities. In addition, those commodities whose contribution to total prairie income is large tended to exhibit the highest levels of positive correlation. This indicated that feasible resource substitution possibilities would not be particularly diversification-enhancing. For example, movements out of export grain production into livestock would not yield significant gains because both sets of prices were generally highly positively correlated with the prices of most other commodities.

In all, a base case and seven additional cases were developed. These other alternatives were all compared to the base case. The first case was constructed using information from the base case price correlation matrix and variance-covariance matrix. The purpose of this scenario was to identify commodities with weakly positively correlated prices which also made large contributions to total income. Once these commodities were identified, it was assumed that policies were implemented to encourage the transfer of resources into the production of these commodities and out of the production of those commodities with high positive price correlations. This was the benchmark against which the trade cases could be judged. This scenario yielded only a 2 percent reduction in the total gross income variance. The limited success from this direct targeting suggested that changes in the trading environment would also have only a limited effect on diversification-enhancement. This is borne out by the fact that none of the trade cases was as diversification-enhancing as the "base case extension" scenario.

Four alternatives based on the changes expected from the Canada-U.S. Free Trade Agreement were developed. Three of these could be considered conservative cases because they assume that the only response to the FTA arises from reactions to changes in the tariff

levels. The first of these three used estimates of supply elasticities and reductions in tariff values to determine the new mix of outputs. Two further cases were developed to test the sensitivity of the results to the assumed elasticities. It was determined that the results were not materially affected by changes to the elasticities. Two of these three scenarios were found to be diversification-retarding and one diversification-enhancing. The effects were very small, however, being within 1.5 percent of the base case.

An optimistic FTA scenario was also developed. It assumed that non-tariff barriers are removed and that Canadians aggressively seek to exploit market opportunities in the U.S. The results of a previous study were used to provide information on the expected changes. Major expansions were expected in the areas of red meat and canola. This alternative proved to be somewhat diversification-retarding. This was due largely to the fact that beef prices are highly variable and positively correlated with most other prices. Still, the increase in variance was less than 1 percent greater than the base case.

Two cases relating to changes in multinational trade were also developed. The first assumes that the Uruguay Round of GATT discussions is successful and reductions in agricultual support programs and trade restrictions are manifest in the future. The results of a major OECD study on trade liberalization were adapted for our purposes. This alternative was found to increase the total gross variance of income slightly. The second alternative assumed that the GATT talks fail and, as a consequence, the EC continues to follow policies to increase its level of self-sufficiency. Canadian exports are reduced commensurate with these policies. This scenario led to an almost 5 percent increase in the total gross variance in income and, hence, a reduced degree of

diversification. A summary of the results is provided in Table 7.(1).

Table 7.(1)

Comparison of Scenarios

Scenario	Total Variance of Gross Income*	% Change from Base Case
Base Case	9.539	--
Base Case Extension	9.353	-1.95
Conservative Canada-U.S. FTA Scenario 1	9.550	+.12
Conservative Canada-U.S. FTA Scenario 2	9.548	+.09
Conservative Canada-U.S. FTA Scenario 3	9.432	-1.12
Optimistic Canada-U.S. FTA Scenario	9.630	+.95
Optimistic Multilateral Scenario	9.565	+.27
Pessimistic Multilateral Scenario	10.010	+4.94

* all values are 10^{18}

Of course, all projections regarding the future are subject to the validity of the assumptions and the accuracy of the data. The assumption that the interrelationship of prices over the last decade is typical and will continue is somewhat limiting. However, unless there is a major shift in fundamental relationships in the future, the general trends (although not the actual level of variation) are likely to be representative. As a price taker for most tradeables, changes in domestic conditions will not significantly effect price levels. Any deficiencies in the price data would only have a minor impact on the results as they would not affect the general direction of price movements. While none of the trade cases is likely to represent the actual evolution of events, they would seem to provide a reasonable range within which the future may unfold. The changes which the trade cases suggest seem well within the range where substitution among outputs can be easily accomplished within the constraints of prairie resources. If the resulting changes had been larger, substitution among outputs would take place less easily, thereby complicating the analysis.

The results of this study would appear to indicate that little alteration in the diversification of prairie agriculture can be expected from changes in the trading environment investigated. Of course, other markets such as Japan, China, or Russia might provide more diversification enhancing markets but investigations of these markets was beyond the terms of reference of this study. This result stems from the relationship between the movement of prices among commodities and the constraints imposed by the existing resource base on substitution possibilities. These are forces largely beyond the control of policy makers. This means that if stability of income is a goal it will not arise as a result of trade induced diversification. Reduction of income

instability will still require stabilization policies.

While changes in the trading environment will not lead to a significant decrease in the variability of regional income, trade liberalization is likely to have other desireable effects. Although there is a tendency for increases in income to be capitalized over the long run, all of the trade liberalization cases resulted in increases in gross regional income - see Table 7(2). This is the expected result from trade theory. Hence, trade liberalization would seem to provide for improvements in income while having little effect on diversification and, thus, can be viewed as a positive step. If the changes in variance of income are adjusted for the increase in income then all but the Pessimistic Multilateral Case can be seen as diversification enhancing.

TABLE 7.(2)

CHANGES IN GROSS INCOME ARISING FROM CHANGES IN THE TRADING ENVIRONMENT

Scenario	Change in Gross Income Relative to the Base Case (Percent)
Base Case Extention	+1.60
Conservative Canada-U.S. FTA Scenario 1	+1.29
Conservative Canada-U.S. FTA Scenario 2	+1.38
Conservative Canada-U.S. FTA Scenario 3	+1.23
Optimistic Canada-U.S. FTA Scenario	+3.37
Optimistic Multilateral Scenario	+0.44
Pessimistic Multilateral Scenario	-0.10

It is also important to note that all of the trade alternatives will lead to an increase in the percentage of value added production in the prairie region - see Table 7(3). This increase is largely the result of movements out of primary grain sales and into more livestock and red meat production as well as oilseed processing. Given that trade restrictions tend to be devised so as to maximize the ability of the importing country to capture value added, this may be the major benefit to prairie agriculture arising from trade liberalization.

TABLE 7.(3)

THE PROPORTION OF GROSS INCOME ARISING FROM VALUE ADDED PRODUCTION

Scenario	Percent of Gross Revenue From Value Added Production
Base Case	27.4
Base Case Extension	29.5
Conservative Canada-U.S. FTA Scenario 1	28.1
Conservative Canada-U.S. FTA Scenario 2	28.2
Conservative Canada-U.S. FTA Scenario 3	28.0
Optimistic Canada-U.S. Scenario	31.1
Optimistic Multilateral Scenario	27.9
Pessimistic Multilateral Scenario	32.8

These results do not mean trading opportunities will not arise in the future for new products. Such opportunities may arise from more inventive methods of processing and presenting the traditional products of the prairie region. This would also increase the value added accruing to the prairies. It should be remembered, however, that a simple expansion in the number of products produced in a region will not necessarily lead to a reduction in the variance of income for the region. That will depend upon the way in which the prices of the new products are correlated with each other and with existing products.

Trade liberalization is likely to increase incomes and value added. Still, given the configuration of the prices of major commodities and that trade liberalization is not likely to alter them significantly, the variation in agricultural income is likely to remain a fact of life for prairie producers. As any effects of trade liberalization on diversification are likely to be marginal at best, the income and value added opportunities from trade induced specialization should be pursued. As a result incomes should rise. Policy effort could then be channeled into designing and refining non trade distorting - decoupled - stabilization programs.

The results also do not mean that individual farmers could not reduce the variability of their operation's incomes through alterations to their mix of outputs. Considerable opportunities would seem to present themselves. These opportunities have been examined directly in another study in this series.

While the results of this examination may appear disappointing, they do suggest that if increased diversification is desired, it will not be sufficient to trust changes in the trading environment to bring it about. Other policy avenues will have to be actively explored.

FOOTNOTES

1. See Allingham and Archibald, p.172.

2. See Ozga, p.499.

3. See Government of Canada, Preliminary Transcript - Canada-U.S. Free Trade Agreement - Elements of the Agreement (Ottawa, 1987), p. 55.

4. See Kerr (1986a) p.1.

5. See Menzie and Prentice (1987) p.947.

6. See Kerr (1986b).

7. See Gillis et al (1985).

8. See Schmitz (1984), p.160.

9. See Bruce and Kerr (1986).

10. For a discussion of the perceived attitudes and aptitudes of Canadians, see Schmitz (1984).

11. See Deloitte, Haskins + Sells Associates (1985) for details of the study.

12. The Deloitte study also predicted an 80 percent decline in the poultry industries. The study assumed that the poultry commodities would be included in the FTA. As this did not come to pass, it will be excluded from this analysis.

13. See Kerr and Farney (1988) for a more detailed discussion of historical Canada-EC trade trends.

14. See Kuroyanagi (1988) p.7.

15. See Hathaway (1987) p.89.

16. As cited in "Europeans Vow to Continue Trade War".

17. See National Policies and Agricultural Trade, p.7.

18. See National Policies and Agricultural Trade, p.3.

19. See National Policies and Agricultural Trade, p.137.

20. See Carter, McCalla and Schmitz.

21. See Carter, McCalla and Schmitz for full documentation.

22. See Hathaway (1987) p.142.

23. See Carter, McCalla and Schmitz,p.63.

24. See National Policies and Agricultural Trade, p.144. The OECD actually considered a number of cases with different assumptions regarding the composition of the 10 percent cut. This particular scenario was chosen because the implied equity in reduction might be considered politically tractable.

25. See National Policies and Agricultural Trade, p.153.

26. See Carter, McCalla and Schmitz, Table 5, p.96.

27. See National Policies and Agricultural Trade, p.151.

28. Hence, this represents the maximum benefits that would accrue to the prairie region from this multilateral liberalization. This is probably not unrealistic if domestic livestock subsidies are expected to be reduced.

29. The Producer Subsidy Equivalent (PSE) and Consumer Subsidy Equivalent (CSE) were used as the means to standardize the value of agricultural support across countries and across programs. The Producer Subsidy Equivalent is defined as the payment that would be required to compensate farmers for the loss of income resulting from the removal of a given policy measure. The Consumer Subsidy Equivalent corresponds to the implicit tax on consumption resulting from a given policy measure and to any susidies to consumption.

30. See National Policies and Agricultural Trade, p. 144.

31. See National Policies and Agricultural Trade, Table 3, p. 32.

APPENDIX 1

If the c_i's are random and normally distributed variables and the x_i's are constants, then, in the n variable case, the total variance of gross revenues from tradeable commodities can be formulated as:

$$Var(cx) = x'Dx$$

where x = a column vector of activity levels
x' = x transpose
c = a row vector of expected prices
D = the variance-covariance matrix of expected prices

or

$$Var_{i=1}^{n} c_i x_i = \sum_{i=1}^{n}\sum_{j=1}^{n} x_i vc_i c_j x_j$$

where $vc_i c_j = vc_i^2$ when i=j

e.g., vc_i^2 = variance(c_i)

and

$vc_i c_j$ = covariance($c_i c_j$)

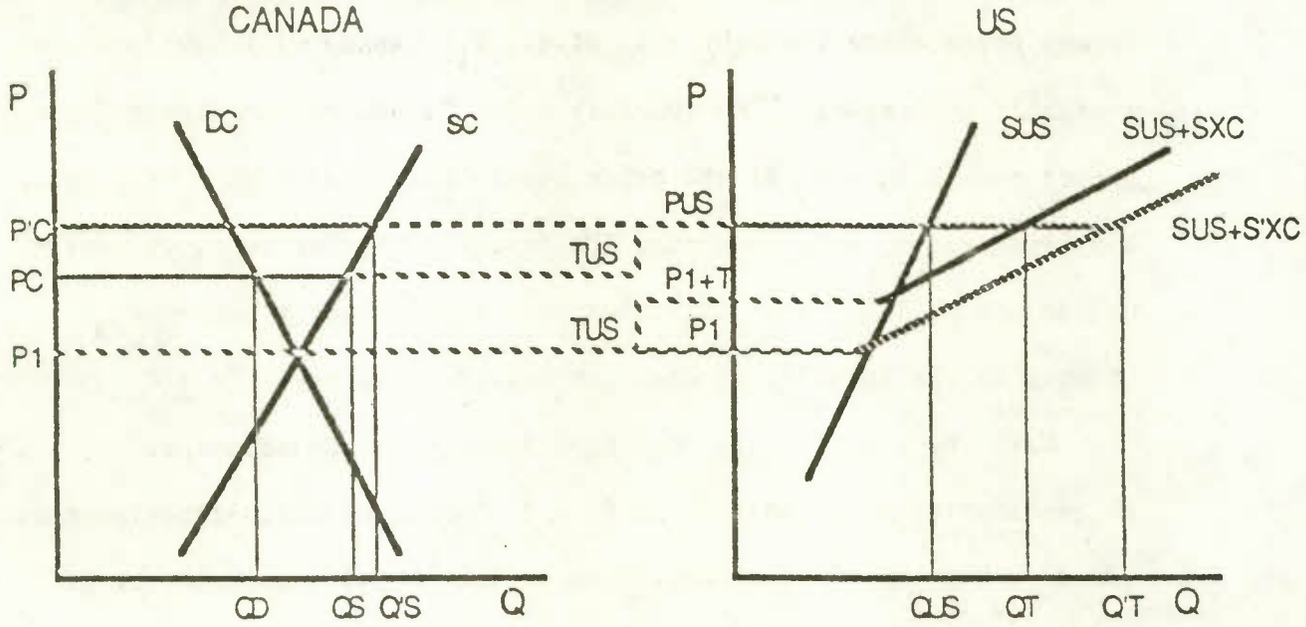
If $vc_i c_j$ is negative, it acts to reduce the variance of gross returns according to its contribution to total output. If it is positive it will add to the total variance of gross returns.

APPENDIX 2

Changes to the international trading environment can take many forms. They can, however, be loosely divided into two categories: those measures which alter the price at which goods cross the border and those which directly affect the quantity of commodity traded. Tariffs, variable levies, export subsidies, transportation subsidies and input subsidies are examples of the former. Import quotas, licensing requirements, voluntary export restraints (VER's) and most non-tariff barriers such as health regulations, inspection procedures and consumer protection legislation affect the quantities traded directly. The effect of changes to price distorting policies can be illustrated by the removal of a tariff. The removal of tariffs will lead to changes in the relative prices of tradeable goods and through supply responses, alter the regional output mix. This can be illustrated for the case of Canada-U.S. trade by Figure A.2.1.

FIGURE A.2.1

(a)



(b)

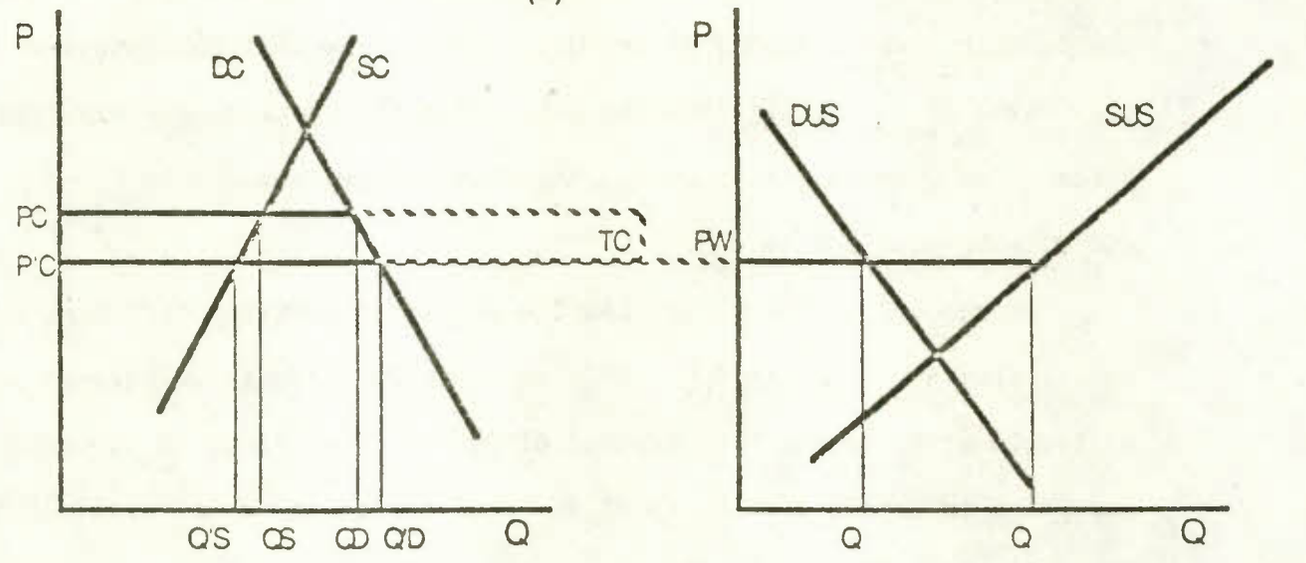


Figure 1(a) illustrates the case where Canada is an exporter of the commodity. Canadian demand and supply curves are depicted as D_C and S_C. At any price above where $D_C = S_C$ (i.e., P_1) Canada will have product available for export. The quantity which Canada has available for export equals $S_C - D_C$ at any price level; for example at P_C the export supply equals $Q_S - Q_D$. Assuming the "small exporting country" model, Canada can sell all that it wishes at the U.S. import price, P_{US}. Changes in the quantity of Canadian exports will not affect P_{US}.

With the tariff (T_{US}) in place, supplies of Canadian product will become available in the U.S. at $P_1 + T$. Hence, Canadian supplies must be added to U.S. supplies at any price so that total supply in the U.S. equals $S_{US} + S_{XC}$ where S_{XC} is the Canadian export supply. To determine the Canadian export supply at any U.S. price, one must subtract the unit value of the tariff from the U.S. price to determine the Canadian price. For example, at price P_{US} the Canadian price would be P_C and $Q_S - Q_D$ equals $Q_T - Q_{US}$.

The removal of the tariff has the effect of shifting the total U.S. supply from $S_{US} + S_{XC}$ to $S_{US} + S'_{XC}$ as Canadian product now becomes available at P_1 in the U.S. instead of $P_1 + T$. The effect is to raise the price in Canada from P_C to P'_C. Total change in Canadian output is $Q'_S - Q_S$. This represents the increase in the contribution to total regional output of the product as a result of trade liberalization. The removal of a foreign export subsidy simply increases the external price, causing a movement along the domestic supply curve. The removal of an input subsidy in a market into which Canada exports also has the effect of increasing the border price. The share of the commodity in the domestic production mix will be reflected in a movement along the domestic supply curve.

The case of imports is presented in Figure 1(b). Again, domestic Canadian demand and supply are represented by D_C and S_C. At any external price below that where $D_C = S_C$, Canada will import. It is assumed that the U.S. is in a net export position at P_W. With the Canadian tariff in place the effective import price for Canada becomes $P_W + T_C = P_C$ where T_C is the Canadian tariff. Again, given the usual assumptions of the small country case, Canada can purchase all that it wants at P_W. In other words, the level of Canadian imports has no discernible effect on P_W.

At P_C, Canada is willing to import $Q_D - Q_S$. If the tariff is removed the price in Canada falls to $P'_C = P_W$ and Canada imports $Q'_D - Q'_S$. The decrease in the contribution to regional output of this commodity becomes $Q_S - Q'_S$ as a result of trade liberalization. Of course, this discussion abstracts from transportation costs and the costs imposed by other border measures. The effects of trade liberalization are also partial equilibrium in nature and general equilibrium aspects are ignored. In other words, the shifts in resources between inefficient and efficient industries which one would expect from trade liberalization have not been included. Modeling these general equilibrium aspects is normally perceived as intractable <u>ex ante</u>. To the extent that these adjustments are ignored, the analysis will provide biased estimates.

APPENDIX 3

Contains the Variance-Covariance Matricies for the Following Cases:

1. Base Case Extension
2. Conservative Canada-U.S. FTA Scenario 1
3. Conservative Canada-U.S. FTA Scenario 2
4. Conservative Canada-U.S. FTA Scenario 3
5. Optimistic Canada-U.S. FTA Scenario
6. Optimistic Multilateral Scenario
7. Pessimistic Multilateral Scenario

VARIANCE/COVARIANCE MATRIX - BASE CASE EXTENSION

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
F CATTLE	8.82E+14														8.821E+14
S HOGS	1.21E+14	2.81E+13													1.487E+14
HQ BEEF	1.38E+16	1.09E+15	6.84E+16												8.329E+16
LQ BEEF	2.34E+15	9.90E+13	2.25E+16	1.97E+15											2.687E+16
PORK	2.25E+15	1.34E+15	1.71E+16	8.39E+14	1.72E+16										3.871E+16
PROC PORK	3.75E+14	6.98E+13	1.68E+15	1.80E+14	1.93E+15	1.49E+14									4.390E+15
CHICKEN	3.53E+14	1.37E+14	4.62E+15	5.90E+14	3.20E+15	7.58E+13	2.64E+14								9.247E+15
TURKEY	1.75E+14	5.21E+13	1.90E+15	2.47E+14	1.22E+15	5.61E+13	1.74E+14	3.15E+13							3.858E+15
DAIRY	2.69E+14	3.10E+13	3.61E+15	5.57E+14	4.96E+14	-2.91E+13	2.41E+14	7.38E+13	9.92E+13						5.351E+15
EGGS	9.14E+13	5.57E+13	2.22E+15	2.91E+14	1.29E+15	-1.18E+12	2.71E+14	8.68E+13	1.36E+14	8.70E+13					4.530E+15
HONEY	2.90E+14	5.77E+13	3.01E+15	4.38E+14	1.28E+15	6.23E+13	1.81E+14	7.10E+13	8.24E+13	9.12E+13	5.04E+13				5.612E+15
BARLEY	1.87E+16	8.48E+14	2.20E+17	3.72E+16	9.16E+15	-6.15E+14	8.51E+15	2.93E+15	7.74E+15	4.94E+15	4.61E+15	2.26E+17			5.392E+17
OATS	2.05E+15	3.71E+14	2.96E+16	4.29E+15	7.50E+15	-1.23E+14	1.89E+15	6.04E+14	1.31E+15	9.84E+14	8.49E+14	6.40E+16	6.74E+15		1.200E+17
RYE	1.64E+15	1.68E+14	1.81E+16	3.00E+15	3.50E+15	4.34E+13	9.40E+14	3.23E+14	6.38E+14	5.02E+14	4.72E+14	3.61E+16	5.63E+15	1.63E+15	7.273E+16
WHEAT	7.04E+16	9.70E+15	8.09E+17	1.27E+17	1.77E+17	1.46E+15	4.28E+16	1.49E+16	2.78E+16	2.13E+16	2.12E+16	1.45E+18	2.45E+17	1.29E+17	3.150E+18
HSW FLOUR	-6.16E+14	-2.91E+14	-3.57E+15	-2.76E+14	-7.17E+15	-2.97E+14	-8.95E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.95E+14	-2.83E+15	-1.88E+15	-8.66E+14	-1.974E+16
DS FLOUR	-1.62E+13	-8.77E+12	-8.10E+13	-5.21E+12	-2.09E+14	-4.64E+12	-2.42E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.76E+12	-2.95E+13	-5.51E+13	-2.38E+13	-4.828E+14
FR TOMATO	-1.77E+12	-3.95E+11	-2.00E+13	-2.56E+12	-1.02E+13	-7.63E+11	-1.73E+12	-6.33E+11	-1.04E+12	-1.09E+12	-7.15E+11	-3.64E+13	-7.39E+12	-3.61E+12	-8.822E+13
FRESH VEG	-6.66E+13	-5.85E+13	-8.81E+14	-6.91E+13	-1.51E+15	-4.05E+13	-1.29E+14	-5.23E+13	-9.19E+11	-6.68E+13	-7.84E+13	-1.02E+15	-4.29E+14	-2.36E+14	-4.639E+15
PROC VEG	-5.12E+13	-7.34E+12	-3.08E+14	-5.19E+13	-2.12E+14	-1.89E+13	-2.26E+13	-8.78E+12	-7.78E+12	-8.04E+12	-1.11E+13	-4.22E+14	-6.53E+13	-5.97E+13	-1.255E+15
S BEETS	1.50E+15	1.85E+14	1.42E+16	2.33E+15	4.16E+15	2.19E+14	7.09E+14	2.67E+14	3.76E+14	3.17E+14	3.89E+14	2.45E+16	3.62E+15	2.35E+15	5.511E+16
PROC LINS	1.97E+14	4.20E+13	2.32E+15	3.59E+14	9.41E+14	1.61E+13	1.74E+14	5.88E+13	8.62E+13	9.11E+13	7.56E+13	4.33E+15	7.90E+14	4.41E+14	9.918E+15
PROC CANO	3.14E+15	5.97E+14	3.52E+16	5.54E+15	1.28E+16	2.71E+14	2.43E+15	8.30E+14	1.25E+15	1.25E+15	1.09E+15	6.21E+16	1.11E+16	6.26E+15	1.439E+17
SEEDS	3.68E+15	7.02E+14	2.34E+16	3.29E+15	1.92E+16	1.85E+15	1.66E+15	7.09E+14	4.34E+14	5.87E+14	9.69E+14	2.51E+16	6.75E+15	3.93E+15	9.232E+16
FLAXSEED	4.25E+15	6.58E+14	4.63E+16	7.07E+15	1.31E+16	2.70E+14	2.82E+15	9.62E+14	1.81E+15	1.35E+15	1.28E+15	8.23E+16	1.54E+16	7.69E+15	1.853E+17
CANOLA	4.78E+15	2.08E+15	4.83E+16	5.84E+15	5.01E+16	4.59E+14	7.47E+15	2.30E+15	3.19E+15	3.16E+15	2.39E+15	8.73E+16	2.66E+16	1.25E+16	2.564E+17
WOOL	9.64E+12	1.28E+12	9.90E+13	1.54E+13	2.64E+13	1.72E+12	4.96E+12	1.88E+12	2.94E+12	2.41E+12	2.57E+12	1.64E+14	2.58E+13	1.47E+13	3.730E+14

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
WHEAT	2.94E+18													2.942E+18
HSW FLOUR	-4.89E+16	1.50E+15												-4.741E+16
DS FLOUR	-1.52E+15	8.94E+13	1.49E+12											-1.432E+15
FR TOMATO	-1.34E+14	1.70E+12	1.03E+10	6.13E+09										-1.325E+14
FRESH VEG	-1.04E+16	1.11E+14	5.45E+12	3.28E+11	6.14E+13									-1.021E+16
PROC VEG	-1.88E+15	5.70E+13	1.51E+12	1.14E+11	7.75E+12	1.74E+12								-1.808E+15
S BEETS	9.56E+16	-9.42E+14	-2.89E+13	-2.23E+12	-2.45E+14	-5.70E+13	9.83E+14							9.532E+16
PROC LINS	1.87E+16	-2.32E+14	-6.82E+12	-5.54E+11	-5.31E+13	-9.43E+12	3.36E+14	3.58E+13						1.875E+16
PROC CANO	2.72E+17	-3.35E+15	-9.86E+13	-7.89E+12	-6.88E+14	-1.36E+14	4.79E+15	1.01E+15	7.32E+15					2.812E+17
SEEDS	1.37E+17	-3.67E+15	-9.10E+13	-1.07E+13	-7.54E+14	-2.44E+14	3.81E+15	6.70E+14	9.86E+15	1.10E+16				1.575E+17
FLAXSEED	3.46E+17	-4.08E+15	-1.19E+14	-1.06E+13	-5.82E+14	-1.49E+14	5.54E+15	1.14E+15	1.67E+16	1.17E+16	1.11E+16			3.876E+17
CANOLA	5.78E+17	-1.75E+16	-5.54E+14	-1.98E+13	-2.00E+15	-4.29E+14	9.80E+15	2.46E+15	3.47E+16	2.94E+16	4.26E+16	7.17E+16		7.486E+17
WOOL	6.45E+14	-5.87E+12	-1.45E+11	-1.93E+10	-1.19E+12	-2.96E+11	1.17E+13	2.12E+12	3.09E+13	2.34E+13	3.82E+13	5.76E+13	4.03E+10		8.014E+14
															9.353E+18

VARIANCE/COVARIANCE MATRIX - CONSERVATIVE CANADA-U.S. FTA SCENARIO 1

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
F CATTLE	8.37E+14														8.3682223E+14
S HOGS	1.18E+14	2.81E+13													1.4558306E+14
HQ BEEF	1.38E+16	1.12E+15	7.17E+16												8.6564041E+16
LQ BEEF	2.34E+15	1.01E+14	2.35E+16	2.07E+15											2.8059488E+16
PORK	1.54E+15	9.40E+14	1.23E+16	6.05E+14	8.51E+15										2.3879732E+16
PROC PORK	3.12E+14	5.97E+13	1.47E+15	1.58E+14	1.16E+15	1.09E+14									3.2735239E+15
CHICKEN	3.44E+14	1.37E+14	4.73E+15	6.05E+14	2.25E+15	6.48E+13	2.64E+14								8.3998620E+15
TURKEY	1.71E+14	5.21E+13	1.95E+15	2.53E+14	8.55E+14	4.79E+13	1.74E+14	3.15E+13							3.5351017E+15
DAIRY	2.62E+14	3.10E+13	3.70E+15	5.71E+14	3.49E+14	-2.49E+13	2.41E+14	7.38E+13	9.92E+13						5.2998343E+15
EGGS	8.90E+13	5.57E+13	2.28E+15	2.98E+14	9.07E+14	-1.01E+12	2.71E+14	8.68E+13	1.36E+14	8.70E+13					4.2051228E+15
HONEY	2.83E+14	5.78E+13	3.09E+15	4.49E+14	9.02E+14	5.34E+13	1.82E+14	7.11E+13	8.26E+13	9.14E+13	5.06E+13				5.3085424E+15
BARLEY	1.81E+16	8.45E+14	2.24E+17	3.79E+16	6.41E+15	-5.24E+14	8.47E+15	2.92E+15	7.70E+15	4.91E+15	4.60E+15	2.24E+17			5.3878754E+17
OATS	1.99E+15	3.71E+14	3.03E+16	4.40E+15	5.27E+15	-1.05E+14	1.89E+15	6.04E+14	1.31E+15	9.84E+14	8.50E+14	6.37E+16	6.74E+15		1.1830636E+17
RYE	1.59E+15	1.68E+14	1.86E+16	3.08E+15	2.46E+15	3.71E+13	9.40E+14	3.23E+14	6.38E+14	5.02E+14	4.73E+14	3.60E+16	5.63E+15	1.63E+15	7.1987829E+16
WHEAT	7.04E+16	9.96E+15	8.50E+17	1.34E+17	1.28E+17	1.28E+15	4.40E+16	1.53E+16	2.85E+16	2.19E+16	2.18E+16	1.48E+18	2.51E+17	1.33E+17	3.1933824E+18
HSW FLOUR	-6.00E+14	-2.91E+14	-3.65E+15	-2.83E+14	-5.04E+15	-2.54E+14	-8.95E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.96E+14	-2.82E+15	-1.88E+15	-8.66E+14	-1.7628790E+16
DS FLOUR	-1.57E+13	-8.77E+12	-8.29E+13	-5.33E+12	-1.47E+14	-3.96E+12	-2.42E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.77E+12	-2.94E+13	-5.51E+13	-2.38E+13	-4.2156123E+14
FR TOMATO	-1.69E+12	-3.88E+11	-2.00E+13	-2.57E+12	-7.03E+12	-6.40E+11	-1.70E+12	-6.21E+11	-1.02E+12	-1.07E+12	-7.02E+11	-3.55E+13	-7.25E+12	-3.54E+12	-8.3758305E+13
FRESH VEG	-6.17E+13	-5.57E+13	-8.59E+14	-6.73E+13	-1.01E+15	-3.29E+13	-1.23E+14	-4.98E+13	-8.75E+11	-6.36E+13	-7.47E+13	-9.69E+14	-4.08E+14	-2.25E+14	-3.9989019E+15
PROC VEG	-4.09E+13	-6.02E+12	-2.59E+14	-4.36E+13	-1.22E+14	-1.33E+13	-1.85E+13	-7.20E+12	-6.38E+12	-6.60E+12	-9.10E+12	-3.45E+14	-5.35E+13	-4.90E+13	-9.7946653E+14
S BEETS	1.46E+15	1.85E+14	1.45E+16	2.39E+15	2.93E+15	1.87E+14	7.09E+14	2.67E+14	3.76E+14	3.17E+14	3.90E+14	2.44E+16	3.62E+15	2.35E+15	5.4088307E+16
PROC LINS	3.06E+14	6.68E+13	3.77E+15	5.85E+14	1.05E+15	2.19E+13	2.77E+14	9.35E+13	1.37E+14	1.45E+14	1.21E+14	6.86E+15	1.26E+15	7.01E+14	1.5399659E+16
PROC CANO	2.86E+15	5.58E+14	3.37E+16	5.31E+15	8.39E+15	2.16E+14	2.27E+15	7.76E+14	1.17E+15	1.17E+15	1.02E+15	5.78E+16	1.04E+16	5.85E+15	1.3152619E+17
SEEDS	3.82E+15	7.47E+14	2.56E+16	3.58E+15	1.44E+16	1.69E+15	1.77E+15	7.54E+14	4.62E+14	6.25E+14	1.03E+15	2.66E+16	7.19E+15	4.18E+15	9.2356202E+16
FLAXSEED	4.36E+15	6.94E+14	5.00E+16	7.65E+15	9.71E+15	2.43E+14	2.97E+15	1.01E+15	1.91E+15	1.43E+15	1.36E+15	8.65E+16	1.62E+16	8.12E+15	1.9216089E+17
CANOLA	4.46E+15	2.00E+15	4.74E+16	5.74E+15	3.38E+16	3.76E+14	7.16E+15	2.21E+15	3.06E+15	3.02E+15	2.30E+15	8.33E+16	2.55E+16	1.20E+16	2.3217561E+17
WOOL	9.39E+12	1.28E+12	1.01E+14	1.58E+13	1.86E+13	1.47E+12	4.96E+12	1.88E+12	2.94E+12	2.41E+12	2.58E+12	1.64E+14	2.58E+13	1.47E+13	3.6661835E+14

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
WHEAT	3.10E+18													3.1008073E+18
HSW FLOUR	-5.02E+16	1.50E+15												-4.8705284E+16
DS FLOUR	-1.56E+15	8.94E+13	1.49E+12											-1.4727984E+15
FR TOMATO	1.35E+14	1.66E+12	1.01E+10	5.89E+09										-1.3344475E+14
FRESH VEG	-1.01E+16	1.05E+14	5.19E+12	3.06E+11	5.56E+13									-9.9830554E+15
PROC VEG	-1.58E+15	4.67E+13	1.24E+12	9.20E+10	6.05E+12	1.17E+12								-1.5242072E+15
S BEETS	9.82E+16	-9.42E+14	-2.89E+13	-2.19E+12	-2.33E+14	-4.67E+13	9.83E+14							9.7882335E+16
PROC LINS	3.05E+16	-3.70E+14	-1.09E+13	-8.65E+11	-8.04E+13	-1.23E+13	5.34E+14	9.06E+13						3.0674054E+16
PROC CANO	2.61E+17	-3.14E+15	-9.21E+13	-7.23E+12	-6.12E+14	-1.04E+14	4.47E+15	1.51E+15	6.40E+15					2.6980564E+17
SEEDS	1.50E+17	-3.91E+15	-9.69E+13	-1.12E+13	-7.64E+14	-2.13E+14	4.06E+15	1.13E+15	9.81E+15	1.24E+16				1.7213978E+17
FLAXSEED	3.75E+17	-4.30E+15	-1.25E+14	-1.09E+13	-5.85E+14	-1.29E+14	5.84E+15	1.91E+15	1.65E+16	1.31E+16	1.24E+16			4.1972774E+17
CANOLA	5.69E+17	-1.68E+16	-5.31E+14	-1.86E+13	-1.83E+15	-3.37E+14	9.39E+15	3.75E+15	3.11E+16	3.00E+16	4.31E+16	6.58E+16		7.3267341E+17
WOOL	6.62E+14	-5.87E+12	-1.45E+11	-1.89E+10	-1.13E+12	-2.43E+11	1.17E+13	3.37E+12	2.89E+13	2.49E+13	4.03E+13	5.52E+13	4.03E+10	8.1909119E+14
														9.5496433E+18

VARIANCE/COVARIANCE MATRIX - CONSERVATIVE CANADA-U.S. FTA SCENARIO 2

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
F CATTLE	8.45E+14														8.4521593E+14
S HOGS	1.18E+14	2.81E+13													1.4617089E+14
HQ BEEF	1.38E+16	1.11E+15	7.10E+16												8.5900711E+16
LQ BEEF	2.34E+15	1.01E+14	2.33E+16	2.05E+15											2.7817121E+16
PORK	1.56E+15	9.48E+14	1.23E+16	6.07E+14	8.66E+15										2.4095925E+16
PROC PORK	3.12E+14	5.92E+13	1.46E+15	1.56E+14	1.16E+15	1.07E+14									3.2505912E+15
CHICKEN	3.46E+14	1.37E+14	4.71E+15	6.02E+14	2.27E+15	6.43E+13	2.64E+14								8.3948656E+15
TURKEY	1.72E+14	5.21E+13	1.94E+15	2.52E+14	8.62E+14	4.76E+13	1.74E+14	3.15E+13							3.5323964E+15
DAIRY	2.64E+14	3.10E+13	3.68E+15	5.68E+14	3.52E+14	-2.47E+13	2.41E+14	7.38E+13	9.92E+13						5.2843320E+15
EGGS	8.94E+13	5.57E+13	2.26E+15	2.97E+14	9.14E+14	-1.00E+12	2.71E+14	8.68E+13	1.36E+14	8.70E+13					4.2010924E+15
HONEY	2.84E+14	5.78E+13	3.07E+15	4.47E+14	9.09E+14	5.29E+13	1.82E+14	7.11E+13	8.25E+13	9.13E+13	5.05E+13				5.2983088E+15
BARLEY	1.82E+16	8.46E+14	2.23E+17	3.78E+16	6.47E+15	-5.20E+14	8.48E+15	2.92E+15	7.71E+15	4.92E+15	4.60E+15	2.24E+17			5.3857101E+17
OATS	2.00E+15	3.71E+14	3.02E+16	4.38E+15	5.31E+15	-1.04E+14	1.89E+15	6.04E+14	1.31E+15	9.84E+14	8.50E+14	6.38E+16	6.74E+15		1.1827058E+17
RYE	1.60E+15	1.68E+14	1.85E+16	3.06E+15	2.48E+15	3.68E+13	9.40E+14	3.23E+14	6.38E+14	5.02E+14	4.73E+14	3.60E+16	5.63E+15	1.63E+15	7.1955296E+16
WHEAT	7.10E+16	9.99E+15	8.49E+17	1.34E+17	1.29E+17	1.27E+15	4.41E+16	1.54E+16	2.86E+16	2.19E+16	2.18E+16	1.49E+18	2.52E+17	1.33E+17	3.2019987E+18
HSW FLOUR	-6.03E+14	-2.91E+14	-3.63E+15	-2.81E+14	-5.08E+15	-2.52E+14	-8.95E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.96E+14	-2.82E+15	-1.88E+15	-8.66E+14	-1.7656340E+16
DS FLOUR	-1.58E+13	-8.77E+12	-8.25E+13	-5.31E+12	-1.48E+14	-3.93E+12	-2.42E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.77E+12	-2.94E+13	-5.51E+13	-2.38E+13	-4.2244766E+14
FR TOMATO	1.71E+12	-3.89E+11	-2.00E+13	-2.57E+12	-7.11E+12	-6.37E+11	-1.71E+12	-6.23E+11	-1.02E+12	-1.07E+12	-7.04E+11	-3.57E+13	-7.27E+12	-3.55E+12	-8.4029012E+13
FRESH VEG	-6.27E+13	-5.62E+13	-8.63E+14	-6.77E+13	-1.03E+15	-3.30E+13	-1.24E+14	-5.03E+13	-8.83E+11	-6.42E+13	-7.55E+13	-9.80E+14	-4.12E+14	-2.27E+14	-4.0446144E+15
PROC VEG	-4.29E+13	-6.28E+12	-2.69E+14	-4.53E+13	-1.29E+14	-1.37E+13	-1.93E+13	-7.51E+12	-6.66E+12	-6.89E+12	-9.49E+12	-3.60E+14	-5.59E+13	-5.11E+13	-1.0225591E+15
S BEETS	1.46E+15	1.85E+14	1.45E+16	2.38E+15	2.95E+15	1.86E+14	7.09E+14	2.67E+14	3.76E+14	3.17E+14	3.90E+14	2.44E+16	3.62E+15	2.35E+15	5.4066823E+16
PROC LINS	2.85E+14	6.19E+13	3.48E+15	5.39E+14	9.82E+14	2.01E+13	2.57E+14	8.66E+13	1.27E+14	1.34E+14	1.12E+14	6.36E+15	1.16E+15	6.49E+14	1.4252515E+16
PROC CANO	2.84E+15	5.50E+14	3.31E+16	5.21E+15	8.35E+15	2.12E+14	2.24E+15	7.65E+14	1.15E+15	1.15E+15	1.00E+15	5.71E+16	1.03E+16	5.77E+15	1.2965651E+17
SEEDS	3.79E+15	7.38E+14	2.51E+16	3.52E+15	1.43E+16	1.65E+15	1.75E+15	7.45E+14	4.56E+14	6.18E+14	1.02E+15	2.63E+16	7.10E+15	4.13E+15	9.1257092E+16
FLAXSEED	4.33E+15	6.85E+14	4.92E+16	7.51E+15	9.67E+15	2.39E+14	2.93E+15	1.00E+15	1.89E+15	1.41E+15	1.34E+15	8.55E+16	1.60E+16	8.01E+15	1.8967770E+17
CANOLA	4.44E+15	1.98E+15	4.67E+16	5.65E+15	3.37E+16	3.69E+14	7.09E+15	2.19E+15	3.03E+15	2.99E+15	2.27E+15	8.25E+16	2.52E+16	1.18E+16	2.2993479E+17
WOOL	9.44E+12	1.28E+12	1.01E+14	1.57E+13	1.87E+13	1.45E+12	4.96E+12	1.88E+12	2.94E+12	2.41E+12	2.58E+12	1.64E+14	2.58E+13	1.47E+13	3.6644483E+14

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
WHEAT	3.12E+18													3.1205367E+18
HSW FLOUR	-5.04E+16	1.50E+15												-4.8864765E+16
DS FLOUR	-1.57E+15	8.94E+13	1.49E+12											-1.4777652E+15
FR TOMATO	-1.36E+14	1.67E+12	1.01E+10	5.93E+09										-1.3431286E+14
FRESH VEG	-1.03E+16	1.06E+14	5.24E+12	3.10E+11	5.68E+13									-1.0116154E+16
PROC VEG	-1.65E+15	4.88E+13	1.29E+12	9.63E+10	6.38E+12	1.28E+12								-1.5962427E+15
S BEETS	9.85E+16	-9.42E+14	-2.89E+13	-2.19E+12	-2.35E+14	-4.88E+13	9.83E+14							9.8189679E+16
PROC LINS	2.83E+16	-3.42E+14	-1.01E+13	-8.03E+11	-7.52E+13	-1.19E+13	4.94E+14	7.76E+13						2.8476081E+16
PROC CANO	2.59E+17	-3.09E+15	-9.08E+13	-7.15E+12	-6.09E+14	-1.07E+14	4.41E+15	1.38E+15	6.22E+15					2.6665045E+17
SEEDS	1.48E+17	-3.86E+15	-9.57E+13	-1.11E+13	-7.62E+14	-2.20E+14	4.01E+15	1.04E+15	9.56E+15	1.21E+16				1.7014229E+17
FLAXSEED	3.72E+17	-4.25E+15	-1.24E+14	-1.08E+13	-5.83E+14	-1.33E+14	5.77E+15	1.75E+15	1.61E+16	1.28E+16	1.21E+16			4.1494643E+17
CANOLA	5.65E+17	-1.66E+16	-5.25E+14	-1.85E+13	-1.83E+15	-3.48E+14	9.29E+15	3.43E+15	3.04E+16	2.93E+16	4.21E+16	6.45E+16		7.2463751E+17
WOOL	6.64E+14	-5.87E+12	-1.45E+11	-1.90E+10	-1.14E+12	-2.54E+11	1.17E+13	3.12E+12	2.85E+13	2.46E+13	3.98E+13	5.46E+13	4.03E+10	8.1914535E+14
														9.5477532E+18

VARIANCE/COVARIANCE MATRIX -CONSERVATIVE CANADA-U.S. FTA SCENARIO 3

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
F CATTLE	8.27E+14														8.2705461E+14
S HOGS	1.17E+14	2.81E+13													1.4489529E+14
HQ BEEF	1.38E+16	1.12E+15	7.23E+16												8.7218024E+16
LQ BEEF	2.34E+15	1.02E+14	2.38E+16	2.09E+15											2.8291712E+16
PORK	7.47E+14	4.59E+14	6.02E+15	2.97E+14	2.03E+15										9.5572152E+15
PROC PORK	3.08E+14	5.92E+13	1.47E+15	1.57E+14	5.62E+14	1.07E+14									2.6635900E+15
CHICKEN	3.42E+14	1.37E+14	4.75E+15	6.07E+14	1.10E+15	6.43E+13	2.64E+14								7.2693327E+15
TURKEY	1.70E+14	5.21E+13	1.96E+15	2.55E+14	4.18E+14	4.76E+13	1.74E+14	3.15E+13							3.1062594E+15
DAIRY	2.61E+14	3.10E+13	3.71E+15	5.73E+14	1.70E+14	-2.47E+13	2.41E+14	7.38E+13	9.92E+13						5.1396482E+15
EGGS	8.85E+13	5.57E+13	2.29E+15	3.00E+14	4.43E+14	-1.00E+12	2.71E+14	8.68E+13	1.36E+14	8.70E+13					3.7525004E+15
HONEY	2.81E+14	5.79E+13	3.10E+15	4.51E+14	4.41E+14	5.30E+13	1.82E+14	7.11E+13	8.26E+13	9.14E+13	5.06E+13				4.8631750E+15
BARLEY	1.80E+16	8.45E+14	2.25E+17	3.81E+16	3.13E+15	-5.20E+14	8.47E+15	2.92E+15	7.70E+15	4.91E+15	4.60E+15	2.24E+17			5.3660057E+17
OATS	1.98E+15	3.71E+14	3.04E+16	4.42E+15	2.57E+15	-1.04E+14	1.89E+15	6.04E+14	1.31E+15	9.84E+14	8.51E+14	6.37E+16	6.74E+15		1.1575736E+17
RYE	1.58E+15	1.68E+14	1.86E+16	3.09E+15	1.20E+15	3.68E+13	9.40E+14	3.23E+14	6.38E+14	5.02E+14	4.73E+14	3.60E+16	5.63E+15	1.63E+15	7.0818481E+16
WHEAT	6.98E+16	9.93E+15	8.52E+17	1.34E+17	6.22E+16	1.27E+15	4.38E+16	1.53E+16	2.85E+16	2.18E+16	2.17E+16	1.48E+18	2.50E+17	1.32E+17	3.1230817E+18
HSW FLOUR	-5.97E+14	-2.91E+14	-3.67E+15	-2.84E+14	-2.46E+15	-2.52E+14	-8.95E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.96E+14	-2.82E+15	-1.88E+15	-8.66E+14	-1.5062493E+16
DS FLOUR	-1.57E+13	-8.77E+12	-8.33E+13	-5.36E+12	-7.18E+13	-3.93E+12	-2.42E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.78E+12	-2.94E+13	-5.51E+13	-2.38E+13	-3.4656492E+14
FR TOMATO	-1.68E+12	-3.86E+11	-2.01E+13	-2.58E+12	-3.42E+12	-6.32E+11	-1.70E+12	-6.19E+11	-1.02E+12	-1.06E+12	-7.00E+11	-3.54E+13	-7.22E+12	-3.53E+12	-7.9988402E+13
FRESH VEG	-6.07E+13	-5.51E+13	-8.54E+14	-6.70E+13	-4.88E+14	-3.23E+13	-1.21E+14	-4.93E+13	-8.66E+11	-6.29E+13	-7.40E+13	-9.59E+14	-4.04E+14	-2.22E+14	-3.4509080E+15
PROC VEG	-3.89E+13	-5.75E+12	-2.48E+14	-4.19E+13	-5.70E+13	-1.26E+13	-1.77E+13	-6.88E+12	-6.10E+12	-6.31E+12	-8.70E+12	-3.29E+14	-5.12E+13	-4.68E+13	-8.7767869E+14
S BEETS	1.45E+15	1.85E+14	1.46E+16	2.40E+15	1.43E+15	1.86E+14	7.09E+14	2.67E+14	3.76E+14	3.17E+14	3.90E+14	2.44E+16	3.62E+15	2.35E+15	5.2658563E+16
PROC LINS	3.27E+14	7.18E+13	4.07E+15	6.32E+14	5.52E+14	2.34E+13	2.98E+14	1.00E+14	1.47E+14	1.56E+14	1.30E+14	7.37E+15	1.35E+15	7.54E+14	1.5985297E+16
PROC CANO	2.89E+15	5.66E+14	3.43E+16	5.41E+15	4.16E+15	2.18E+14	2.30E+15	7.87E+14	1.19E+15	1.19E+15	1.03E+15	5.86E+16	1.05E+16	5.93E+15	1.2916936E+17
SEEDS	3.84E+15	7.56E+14	2.60E+16	3.64E+15	7.11E+15	1.69E+15	1.79E+15	7.64E+14	4.67E+14	6.33E+14	1.05E+15	2.69E+16	7.28E+15	4.23E+15	8.6118299E+16
FLAXSEED	4.37E+15	6.99E+14	5.06E+16	7.73E+15	4.77E+15	2.43E+14	2.99E+15	1.02E+15	1.92E+15	1.44E+15	1.37E+15	8.70E+16	1.63E+16	8.17E+15	1.8864895E+17
CANOLA	4.48E+15	2.02E+15	4.81E+16	5.82E+15	1.67E+16	3.77E+14	7.23E+15	2.23E+15	3.09E+15	3.06E+15	2.32E+15	8.41E+16	2.57E+16	1.21E+16	2.1732578E+17
WOOL	9.33E+12	1.28E+12	1.02E+14	1.59E+13	9.07E+12	1.45E+12	4.96E+12	1.88E+12	2.94E+12	2.41E+12	2.58E+12	1.64E+14	2.58E+13	1.47E+13	3.5758895E+14

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
WHEAT	3.08E+18													3.0830337E+18
HSW FLOUR	-5.01E+16	1.50E+15												-4.8561179E+16
DS FLOUR	-1.56E+15	8.94E+13	1.49E+12											-1.4683105E+15
FR TOMATO	-1.34E+14	1.66E+12	1.00E+10	5.85E+09										-1.3262070E+14
FRESH VEG	-1.00E+16	1.04E+14	5.14E+12	3.02E+11	5.45E+13									-9.8536744E+15
PROC VEG	-1.51E+15	4.47E+13	1.18E+12	8.77E+10	5.72E+12	1.07E+12								-1.4530646E+15
SUG BEETS	9.79E+16	-9.42E+14	-2.89E+13	-2.18E+12	-2.31E+14	-4.47E+13	9.83E+14							9.7605048E+16
LIN OIL	3.27E+16	-3.97E+14	-1.17E+13	-9.26E+11	-8.56E+13	-1.26E+13	5.74E+14	1.05E+14						3.2869097E+16
RAPE OIL	2.64E+17	-3.18E+15	-9.34E+13	-7.31E+12	-6.14E+14	-1.01E+14	4.54E+15	1.64E+15	6.58E+15					2.7302474E+17
SEEDS	1.51E+17	-3.96E+15	-9.80E+13	-1.13E+13	-7.65E+14	-2.06E+14	4.11E+15	1.23E+15	1.01E+16	1.27E+16				1.7418158E+17
FLAXSEED	3.77E+17	-4.33E+15	-1.26E+14	-1.10E+13	-5.83E+14	-1.24E+14	5.88E+15	2.07E+15	1.68E+16	1.33E+16	1.25E+16			4.2199933E+17
RAPESEED	5.73E+17	-1.69E+16	-5.36E+14	-1.88E+13	-1.83E+15	-3.26E+14	9.48E+15	4.07E+15	3.19E+16	3.07E+16	4.38E+16	6.72E+16		7.4063238E+17
WOOL	6.60E+14	-5.87E+12	-1.45E+11	-1.89E+10	-1.12E+12	-2.32E+11	1.17E+13	3.62E+12	2.93E+13	2.52E+13	4.05E+13	5.58E+13	4.03E+10		8.1899599E+14
															9.4322337E+18

VARIANCE/COVARIANCE MATRIX - OPTIMISTIC CANADA-U.S. FTA SCENARIO

F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
8.37E+14														8.368E+14
1.18E+14	2.81E+13													1.456E+14
1.51E+16	1.22E+15	8.58E+16												1.021E+17
2.34E+15	1.01E+14	2.58E+16	2.07E+15											3.027E+16
1.58E+15	9.67E+14	1.38E+16	6.22E+14	9.01E+15										2.600E+16
3.07E+14	5.86E+13	1.58E+15	1.55E+14	1.17E+15	1.05E+14									3.382E+15
3.44E+14	1.37E+14	5.18E+15	6.05E+14	2.32E+15	6.36E+13	2.64E+14								8.908E+15
1.71E+14	5.21E+13	2.13E+15	2.53E+14	8.80E+14	4.71E+13	1.74E+14	3.15E+13							3.742E+15
2.62E+14	3.10E+13	4.05E+15	5.71E+14	3.59E+14	-2.44E+13	2.41E+14	7.38E+13	9.92E+13						5.658E+15
8.90E+13	5.57E+13	2.49E+15	2.98E+14	9.33E+14	-9.90E+11	2.71E+14	8.68E+13	1.36E+14	8.70E+13					4.445E+15
2.83E+14	5.78E+13	3.38E+15	4.49E+14	9.28E+14	5.24E+13	1.82E+14	7.11E+13	8.26E+13	9.14E+13	5.06E+13				5.624E+15
1.66E+16	7.73E+14	2.24E+17	3.47E+16	6.04E+15	-4.71E+14	7.76E+15	2.67E+15	7.05E+15	4.50E+15	4.21E+15	1.87E+17			4.955E+17
1.99E+15	3.71E+14	3.31E+16	4.40E+15	5.42E+15	-1.03E+14	1.89E+15	6.04E+14	1.31E+15	9.84E+14	8.50E+14	5.83E+16	6.74E+15		1.159E+17
1.61E+15	1.70E+14	2.05E+16	3.11E+15	2.56E+15	3.68E+13	9.49E+14	3.26E+14	6.44E+14	5.07E+14	4.78E+14	3.32E+16	5.69E+15	1.66E+15	7.149E+16
7.15E+16	1.01E+16	9.45E+17	1.36E+17	1.34E+17	1.28E+15	4.47E+16	1.56E+16	2.90E+16	2.22E+16	2.21E+16	1.38E+18	2.55E+17	1.36E+17	3.203E+18
-6.00E+14	-2.91E+14	-3.99E+15	-2.83E+14	-5.18E+15	-2.50E+14	-8.95E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.96E+14	-2.58E+15	-1.88E+15	-8.74E+14	-1.788E+16
-1.57E+13	-8.77E+12	-9.07E+13	-5.33E+12	-1.51E+14	-3.89E+12	-2.42E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.77E+12	-2.69E+13	-5.51E+13	-2.40E+13	-4.312E+14
-1.69E+12	-3.88E+11	-2.19E+13	-2.57E+12	-7.23E+12	-6.28E+11	-1.70E+12	-6.21E+11	-1.02E+12	-1.07E+12	-7.02E+11	-3.25E+13	-7.25E+12	-3.57E+12	-8.287E+13
-6.17E+13	-5.57E+13	-9.39E+14	-6.73E+13	-1.04E+15	-3.23E+13	-1.23E+14	-4.98E+13	-8.75E+11	-6.36E+13	-7.47E+13	-8.87E+14	-4.08E+14	-2.27E+14	-4.028E+15
-4.09E+13	-6.02E+12	-2.83E+14	-4.36E+13	-1.26E+14	-1.30E+13	-1.85E+13	-7.20E+12	-6.38E+12	-6.60E+12	-9.10E+12	-3.15E+14	-5.35E+13	-4.95E+13	-9.784E+14
1.46E+15	1.85E+14	1.59E+16	2.39E+15	3.01E+15	1.84E+14	7.09E+14	2.67E+14	3.76E+14	3.17E+14	3.90E+14	2.23E+16	3.62E+15	2.37E+15	5.350E+16
3.06E+14	6.68E+13	4.13E+15	5.85E+14	1.08E+15	2.15E+13	2.77E+14	9.35E+13	1.37E+14	1.45E+14	1.21E+14	6.28E+15	1.26E+15	7.08E+14	1.521E+16
2.91E+15	5.68E+14	3.75E+16	5.40E+15	8.78E+15	2.16E+14	2.31E+15	7.89E+14	1.19E+15	1.19E+15	1.04E+15	5.39E+16	1.06E+16	6.01E+15	1.323E+17
3.82E+15	7.47E+14	2.80E+16	3.58E+15	1.48E+16	1.66E+15	1.77E+15	7.54E+14	4.62E+14	6.25E+14	1.03E+15	2.43E+16	7.19E+15	4.22E+15	9.294E+16
4.18E+15	6.64E+14	5.24E+16	7.32E+15	9.56E+15	2.29E+14	2.84E+15	9.71E+14	1.83E+15	1.37E+15	1.30E+15	7.58E+16	1.55E+16	7.85E+15	1.818E+17
4.46E+15	2.00E+15	5.18E+16	5.74E+15	3.47E+16	3.69E+14	7.16E+15	2.21E+15	3.06E+15	3.02E+15	2.30E+15	7.62E+16	2.55E+16	1.21E+16	2.307E+17
9.39E+12	1.28E+12	1.11E+14	1.58E+13	1.91E+13	1.44E+12	4.96E+12	1.88E+12	2.94E+12	2.41E+12	2.58E+12	1.50E+14	2.58E+13	1.48E+13	3.630E+14

WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
3.20E+18													3.200E+18
-5.10E+16	1.50E+15												-4.950E+16
-1.59E+15	8.94E+13	1.49E+12											-1.498E+15
-1.37E+14	1.66E+12	1.01E+10	5.89E+09										-1.356E+14
-1.03E+16	1.05E+14	5.19E+12	3.06E+11	5.56E+13									-1.014E+16
-1.60E+15	4.67E+13	1.24E+12	9.20E+10	6.05E+12	1.17E+12								-1.549E+15
9.97E+16	-9.42E+14	-2.89E+13	-2.19E+12	-2.33E+14	-4.67E+13	9.83E+14							9.944E+16
3.10E+16	-3.70E+14	-1.09E+13	-8.65E+11	-8.04E+13	-1.23E+13	5.34E+14	9.06E+13						3.116E+16
2.70E+17	-3.19E+15	-9.37E+13	-7.35E+12	-6.22E+14	-1.06E+14	4.55E+15	1.53E+15	6.62E+15					2.788E+17
1.52E+17	-3.91E+15	-9.69E+13	-1.12E+13	-7.64E+14	-2.13E+14	4.06E+15	1.13E+15	9.98E+15	1.24E+16				1.747E+17
3.65E+17	-4.12E+15	-1.20E+14	-1.05E+13	-5.60E+14	-1.23E+14	5.59E+15	1.83E+15	1.61E+16	1.25E+16	1.13E+16			4.073E+17
5.78E+17	-1.68E+16	-5.31E+14	-1.86E+13	-1.83E+15	-3.37E+14	9.39E+15	3.75E+15	3.17E+16	3.00E+16	4.13E+16	6.58E+16		7.404E+17
6.73E+14	-5.87E+12	-1.45E+11	-1.89E+10	-1.13E+12	-2.43E+11	1.17E+13	3.37E+12	2.93E+13	2.49E+13	3.86E+13	5.52E+13	4.03E+10	8.284E+14
													9.630E+18

VARIANCE/COVARIANCE MATRIX - OPTIMISTIC MULTILATERAL SCENARIO

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
F CATTLE	8.82E+14														8.821E+14
S HOGS	1.21E+14	2.81E+13													1.487E+14
HQ BEEF	1.43E+16	1.13E+15	7.25E+16												8.792E+16
LQ BEEF	2.34E+15	9.90E+13	2.31E+16	1.97E+15											2.754E+16
PORK	1.61E+15	9.57E+14	1.26E+16	6.01E+14	8.82E+15										2.457E+16
PROC PORK	3.13E+14	5.82E+13	1.45E+15	1.50E+14	1.15E+15	1.04E+14									3.223E+15
CHICKEN	3.51E+14	1.36E+14	4.74E+15	5.87E+14	2.28E+15	6.28E+13	2.62E+14								8.417E+15
TURKEY	1.75E+14	5.21E+13	1.96E+15	2.47E+14	8.71E+14	4.67E+13	1.73E+14	3.15E+13							3.559E+15
DAIRY	2.69E+14	3.10E+13	3.72E+15	5.57E+14	3.55E+14	-2.42E+13	2.40E+14	7.38E+13	9.92E+13						5.322E+15
EGGS	9.14E+13	5.57E+13	2.29E+15	2.91E+14	9.23E+14	-9.83E+11	2.69E+14	8.68E+13	1.36E+14	8.70E+13					4.229E+15
HONEY	2.90E+14	5.77E+13	3.10E+15	4.38E+14	9.17E+14	5.19E+13	1.80E+14	7.10E+13	8.24E+13	9.12E+13	5.04E+13				5.327E+15
BARLEY	1.86E+16	8.43E+14	2.25E+17	3.69E+16	6.52E+15	-5.10E+14	8.42E+15	2.91E+15	7.69E+15	4.91E+15	4.58E+15	2.23E+17			5.388E+17
OATS	2.05E+15	3.71E+14	3.05E+16	4.29E+15	5.37E+15	-1.02E+14	1.88E+15	6.04E+14	1.31E+15	9.84E+14	8.49E+14	6.36E+16	6.74E+15		1.184E+17
RYE	1.64E+15	1.68E+14	1.87E+16	3.00E+15	2.50E+15	3.62E+13	9.35E+14	3.23E+14	6.38E+14	5.02E+14	4.72E+14	3.59E+16	5.63E+15	1.63E+15	7.206E+16
WHEAT	7.34E+16	1.01E+16	8.68E+17	1.33E+17	1.32E+17	1.27E+15	4.44E+16	1.56E+16	2.90E+16	2.22E+16	2.20E+16	1.51E+18	2.55E+17	1.35E+17	3.246E+18
HSW FLOUR	-6.16E+14	-2.91E+14	-3.67E+15	-2.76E+14	-5.13E+15	-2.48E+14	-8.90E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.95E+14	-2.82E+15	-1.88E+15	-8.66E+14	-1.774E+16
DS FLOUR	-1.62E+13	-8.77E+12	-8.34E+13	-5.21E+12	-1.50E+14	-3.86E+12	-2.41E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.76E+12	-2.94E+13	-5.51E+13	-2.38E+13	-4.247E+14
FR TOMATO	-1.77E+12	-3.95E+11	-2.06E+13	-2.56E+12	-7.29E+12	-6.36E+11	-1.73E+12	-6.33E+11	-1.04E+12	-1.09E+12	-7.15E+11	-3.62E+13	-7.39E+12	-3.61E+12	-8.557E+13
FRESH VEG	-6.66E+13	-5.85E+13	-9.08E+14	-6.91E+13	-1.08E+15	-3.37E+13	-1.28E+14	-5.23E+13	-9.19E+11	-6.68E+13	-7.84E+13	-1.02E+15	-4.29E+14	-2.36E+14	-4.223E+15
PROC VEG	-5.12E+13	-7.34E+12	-3.17E+14	-5.19E+13	-1.52E+14	-1.58E+13	-2.24E+13	-8.78E+12	-7.78E+12	-8.04E+12	-1.11E+13	-4.20E+14	-6.53E+13	-5.97E+13	-1.198E+15
S BEETS	1.50E+15	1.85E+14	1.46E+16	2.33E+15	2.98E+15	1.83E+14	7.06E+14	2.67E+14	3.76E+14	3.17E+14	3.89E+14	2.44E+16	3.62E+15	2.35E+15	5.417E+16
PROC LINS	1.97E+14	4.20E+13	2.39E+15	3.59E+14	6.73E+14	1.34E+13	1.73E+14	5.88E+13	8.62E+13	9.11E+13	7.56E+13	4.30E+15	7.90E+14	4.41E+14	9.691E+15
PROC CANO	2.73E+15	5.19E+14	3.15E+16	4.82E+15	7.95E+15	1.96E+14	2.10E+15	7.22E+14	1.09E+15	1.09E+15	9.46E+14	5.37E+16	9.67E+15	5.44E+15	1.225E+17
SEEDS	3.68E+15	7.02E+14	2.42E+16	3.29E+15	1.38E+16	1.55E+15	1.65E+15	7.09E+14	4.34E+14	5.87E+14	9.69E+14	2.49E+16	6.75E+15	3.93E+15	8.709E+16
FLAXSEED	4.25E+15	6.58E+14	4.77E+16	7.07E+15	9.37E+15	2.25E+14	2.80E+15	9.62E+14	1.81E+15	1.35E+15	1.28E+15	8.19E+16	1.54E+16	7.69E+15	1.824E+17
CANOLA	4.36E+15	1.90E+15	4.54E+16	5.33E+15	3.27E+16	3.49E+14	6.78E+15	2.10E+15	2.91E+15	2.88E+15	2.18E+15	7.92E+16	2.43E+16	1.14E+16	2.218E+17
WOOL	9.66E+12	1.29E+12	1.02E+14	1.54E+13	1.89E+13	1.43E+12	4.94E+12	1.89E+12	2.95E+12	2.41E+12	2.58E+12	1.64E+14	2.59E+13	1.47E+13	3.679E+14

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
WHEAT	3.20E+18													3.196E+18
HSW FLOUR	-5.10E+16	1.50E+15												-4.947E+16
DS FLOUR	-1.59E+15	8.94E+13	1.49E+12											-1.497E+15
FR TOMATO	-1.40E+14	1.70E+12	1.03E+10	6.13E+09										-1.382E+14
FRESH VEG	-1.08E+16	1.11E+14	5.45E+12	3.28E+11	6.14E+13									-1.065E+16
PROC VEG	-1.96E+15	5.70E+13	1.51E+12	1.14E+11	7.75E+12	1.74E+12								-1.888E+15
S BEETS	9.97E+16	-9.42E+14	-2.89E+13	-2.23E+12	-2.45E+14	-5.70E+13	9.83E+14							9.936E+16
PROC LINS	1.95E+16	-2.32E+14	-6.82E+12	-5.54E+11	-5.31E+13	-9.43E+12	3.36E+14	3.58E+13						1.954E+16
PROC CANO	2.47E+17	-2.92E+15	-8.57E+13	-6.86E+12	-5.98E+14	-1.18E+14	4.16E+15	8.81E+14	5.54E+15					2.537E+17
SEEDS	1.43E+17	-3.67E+15	-9.10E+13	-1.07E+13	-7.54E+14	-2.44E+14	3.81E+15	6.70E+14	8.58E+15	1.10E+16				1.621E+17
FLAXSEED	3.61E+17	-4.08E+15	-1.19E+14	-1.06E+13	-5.82E+14	-1.49E+14	5.54E+15	1.14E+15	1.45E+16	1.17E+16	1.11E+16			4.001E+17
CANOLA	5.50E+17	-1.60E+16	-5.05E+14	-1.81E+13	-1.83E+15	-3.92E+14	8.94E+15	2.24E+15	2.76E+16	2.68E+16	3.89E+16	5.97E+16		6.955E+17
WOOL	6.74E+14	-5.88E+12	-1.45E+11	-1.94E+10	-1.19E+12	-2.97E+11	1.17E+13	2.12E+12	2.69E+13	2.34E+13	3.83E+13	5.27E+13	4.04E+10	8.213E+14
														9.565E+18

VARIANCE/COVARIANCE MATRIX - PESSIMISTIC BILATERAL SCENARIO

	F CATTLE	S HOGS	HQ BEEF	LQ BEEF	PORK	PROC PORK	CHICKEN	TURKEY	DAIRY	EGGS	HONEY	BARLEY	OATS	RYE	SUM
F CATTLE	8.82E+14														8.821E+14
S HOGS	1.21E+14	2.81E+13													1.487E+14
HQ BEEF	1.94E+16	1.53E+15	1.34E+17												1.549E+17
LQ BEEF	2.34E+15	9.90E+13	3.14E+16	1.97E+15											3.585E+16
PORK	2.27E+15	1.35E+15	2.42E+16	8.49E+14	1.76E+16										4.628E+16
PROC PORK	4.44E+14	8.26E+13	2.79E+15	2.13E+14	2.31E+15	2.09E+14									6.052E+15
CHICKEN	3.53E+14	1.37E+14	6.47E+15	5.90E+14	3.24E+15	8.97E+13	2.64E+14								1.115E+16
TURKEY	1.75E+14	5.21E+13	2.67E+15	2.47E+14	1.23E+15	6.64E+13	1.74E+14	3.15E+13							4.644E+15
DAIRY	2.69E+14	3.10E+13	5.06E+15	5.57E+14	5.02E+14	-3.44E+13	2.41E+14	7.38E+13	9.92E+13						6.796E+15
EGGS	9.14E+13	5.57E+13	3.11E+15	2.91E+14	1.30E+15	-1.40E+12	2.71E+14	8.68E+13	1.36E+14	8.70E+13					5.434E+15
HONEY	2.90E+14	5.77E+13	4.21E+15	4.38E+14	1.30E+15	7.37E+13	1.81E+14	7.10E+13	8.24E+13	9.12E+13	5.04E+13				6.842E+15
BARLEY	1.87E+16	8.48E+14	3.08E+17	3.72E+16	9.27E+15	-7.28E+14	8.51E+15	2.93E+15	7.74E+15	4.94E+15	4.61E+15	2.26E+17			6.271E+17
OATS	2.03E+15	3.68E+14	4.12E+16	4.26E+15	7.54E+15	-1.44E+14	1.88E+15	6.00E+14	1.30E+15	9.78E+14	8.43E+14	6.36E+16	6.65E+15		1.311E+17
RYE	1.64E+15	1.68E+14	2.54E+16	3.00E+15	3.54E+15	5.14E+13	9.40E+14	3.23E+14	6.38E+14	5.02E+14	4.72E+14	3.61E+16	5.59E+15	1.63E+15	8.000E+16
WHEAT	7.31E+16	1.01E+16	1.18E+18	1.32E+17	1.86E+17	1.79E+15	4.44E+16	1.55E+16	2.89E+16	2.21E+16	2.19E+16	1.51E+18	2.52E+17	1.34E+17	3.605E+18
HSW FLOUR	-6.16E+14	-2.91E+14	-4.99E+15	-2.76E+14	-7.25E+15	-3.52E+14	-8.95E+14	-2.77E+14	-3.02E+14	-2.74E+14	-1.95E+14	-2.83E+15	-1.87E+15	-8.66E+14	-2.129E+16
DS FLOUR	-1.62E+13	-8.77E+12	-1.13E+14	-5.21E+12	-2.12E+14	-5.49E+12	-2.42E+13	-7.27E+12	-6.61E+12	-5.55E+12	-5.76E+12	-2.95E+13	-5.48E+13	-2.38E+13	-5.182E+14
FR TOMATO	-1.77E+12	-3.95E+11	-2.79E+13	-2.56E+12	-1.03E+13	-9.03E+11	-1.73E+12	-6.33E+11	-1.04E+12	-1.09E+12	-7.15E+11	-3.64E+13	-7.34E+12	-3.61E+12	-9.641E+13
FRESH VEG	-6.66E+13	-5.85E+13	-1.23E+15	-6.91E+13	-1.53E+15	-4.79E+13	-1.29E+14	-5.23E+13	-9.19E+11	-6.68E+13	-7.84E+13	-1.02E+15	-4.26E+14	-2.36E+14	-5.014E+15
PROC VEG	-5.12E+13	-7.34E+12	-4.31E+14	-5.19E+13	-2.14E+14	-2.24E+13	-2.26E+13	-8.78E+12	-7.78E+12	-8.04E+12	-1.11E+13	-4.22E+14	-6.49E+13	-5.97E+13	-1.384E+15
S BEETS	1.50E+15	1.85E+14	1.99E+16	2.33E+15	4.21E+15	2.59E+14	7.09E+14	2.67E+14	3.76E+14	3.17E+14	3.89E+14	2.45E+16	3.60E+15	2.35E+15	6.085E+16
PROC LINS	1.97E+14	4.20E+13	3.24E+15	3.59E+14	9.52E+14	1.91E+13	1.74E+14	5.88E+13	8.62E+13	9.11E+13	7.56E+13	4.33E+15	7.85E+14	4.41E+14	1.085E+16
PROC CANO	2.71E+15	5.14E+14	4.25E+16	4.77E+15	1.11E+16	2.76E+14	2.09E+15	7.15E+14	1.08E+15	1.08E+15	9.37E+14	5.35E+16	9.52E+15	5.39E+15	1.362E+17
SEEDS	3.68E+15	7.02E+14	3.28E+16	3.29E+15	1.95E+16	2.19E+15	1.66E+15	7.09E+14	4.34E+14	5.87E+14	9.69E+14	2.51E+16	6.71E+15	3.93E+15	1.022E+17
FLAXSEED	3.22E+15	4.99E+14	4.92E+16	5.37E+15	1.00E+16	2.42E+14	2.14E+15	7.29E+14	1.37E+15	1.03E+15	9.74E+14	6.24E+16	1.16E+16	5.83E+15	1.546E+17
CANOLA	4.29E+15	1.87E+15	6.07E+16	5.25E+15	4.55E+16	4.88E+14	6.71E+15	2.07E+15	2.87E+15	2.83E+15	2.15E+15	7.84E+16	2.37E+16	1.12E+16	2.481E+17
WOOL	9.64E+12	1.28E+12	1.39E+14	1.54E+13	2.67E+13	2.03E+12	4.96E+12	1.88E+12	2.94E+12	2.41E+12	2.57E+12	1.64E+14	2.56E+13	1.47E+13	4.130E+14

	WHEAT	HSW FLOUR	DS FLOUR	FR TOMATO	FRESH VEG	PROC VEG	S BEETS	PROC LINS	PROC CANO	SEEDS	FLAXSEED	CANOLA	WOOL	
WHEAT	3.17E+18													3.168E+18
HSW FLOUR	-5.08E+16	1.50E+15												-4.925E+16
DS FLOUR	-1.58E+15	8.94E+13	1.49E+12											-1.490E+15
FR TOMATO	-1.39E+14	1.70E+12	1.03E+10	6.13E+09										-1.376E+14
FRESH VEG	-1.08E+16	1.11E+14	5.45E+12	3.28E+11	6.14E+13									-1.060E+16
PROC VEG	-1.95E+15	5.70E+13	1.51E+12	1.14E+11	7.75E+12	1.74E+12								-1.879E+15
S BEETS	9.92E+16	-9.42E+14	-2.89E+13	-2.23E+12	-2.45E+14	-5.70E+13	9.83E+14							9.892E+16
PROC LINS	1.94E+16	-2.32E+14	-6.82E+12	-5.54E+11	-5.31E+13	-9.43E+12	3.36E+14	3.58E+13						1.945E+16
PROC CANO	2.43E+17	-2.89E+15	-8.49E+13	-6.79E+12	-5.92E+14	-1.17E+14	4.12E+15	8.73E+14	5.43E+15					2.501E+17
SEEDS	1.42E+17	-3.67E+15	-9.10E+13	-1.07E+13	-7.54E+14	-2.44E+14	3.81E+15	6.70E+14	8.49E+15	1.10E+16				1.613E+17
FLAXSEED	2.73E+17	-3.09E+15	-9.01E+13	-8.02E+12	-4.42E+14	-1.13E+14	4.20E+15	8.63E+14	1.09E+16	8.84E+15	6.39E+15			3.001E+17
CANOLA	5.39E+17	-1.57E+16	-4.97E+14	-1.78E+13	-1.80E+15	-3.85E+14	8.80E+15	2.21E+15	2.69E+16	2.64E+16	2.90E+16	5.78E+16		6.717E+17
WOOL	6.69E+14	-5.87E+12	-1.45E+11	-1.93E+10	-1.19E+12	-2.96E+11	1.17E+13	2.12E+12	2.66E+13	2.34E+13	2.90E+13	5.17E+13	4.03E+10	8.063E+14
														1.001E+19

APPENDIX 4

SUPPLY ELASTICITIES FOR THE FREE TRADE AGREEMENT SCENARIOS

COMMODITY	ELASTICITY	+20%	-20%	SOURCE
Bread Wheat (1972-1987)	0.86 (LR)	1.032	0.688	Agriculture Canada, Eric Johansen
Duram Wheat (1972-1987)	1.37 (LR)	1.644	1.096	Agriculture Canada, Eric Johansen
Barley (1972-1987)	0.24 (LR)	0.288	0.192	Agriculture Canada, Eric Johansen
Oats (1972-1987)	2.05 (LR)	2.46	1.64	Agriculture Canada, Eric Johansen
Rye (1972-1987)	0.90 (LR)	1.08	0.72	Agriculture Canada, Eric Johansen
Rapeseed (1972-1987)	2.21 (LR)	2.652	1.768	Agriculture Canada, Eric Johansen
Flaxseed (1972-1987)	2.31 (LR)	2.772	1.848	Agriculture Canada, Eric Johansen
Pork (W. Canada) (1972-1982)	1.06 (LR)	1.272	0.848	Coleman, J.R. (1986)
Feeder Cattle (1972-1981)	1.221	1.4652	0.9768	Shonkwiler, J.S. and S. Hinkley, (1985)
Hogs (W. Canada) (1972-1987)	0.6 (LR)	0.72	0.48	Agriculture Canada, Pierre Charlebois
Fed Cattle (1972-1987)	0.3 (LR)	0.36	0.24	Agriculture Canada, Pierre Charlebois
Tomatoes (Fresh) (1960-1978)	0.552	0.6624	0.4416	Hammig, M.D. and R.C. Mittelhammer, (1982)
Honey	1.00	1.20	0.80	Assumed
Vegetables (Fresh)	1.00	1.20	0.80	Assumed

Vegetables (Processed)	1.00	1.20	0.80	Assumed
Linseed Products	1.00	1.20	0.80	Assumed
Canola Products	1.00	1.20	0.80	Assumed
Seeds	1.00	1.20	0.80	Assumed

APPENDIX 5

TARIFF RATES FOR THE FREE TRADE AGREEMENT SCENARIOS

COMMODITY	CLASSIFICATION(S)	NET TRADE	TARIFF RATE
Cattle	00190	Export	$1.27/cwt.
Swine	00349	Export	free
Beef (high quality)	01101	Export	$2.54/cwt.
Beef (low quality)	01103	Export	$56/tonne
Pork (unprocessed)	01122, 01124, 01128, 01129	Export	free
Pork (processed)	01152, 01323, 01324, 01329, 01524, 01729	Export	$28/tonne
Honey	05509	Export	$0.00127/lb.
Tomatoes (fresh)	09190	Import	$55.10/tonne
Vegetables (fresh)	09103, 09105, 09110, 09120, 09125, 09130, 09135, 09140, 09145, 09150, 09155, 09160, 09165, 09168, 09170, 09175, 09178, 09181, 09182, 09185, 09199	Import	$27.60/tonne
Vegetables (processed)	09210, 09211, 09235, 09282, 09288, 09299, 09455, 09491, 09499, 09505, 09512, 09513, 09535, 09565, 09577, 09582, 09591, 09593, 09599, 09925, 09940, 09960, 09970, 09999	Import	18%
Linseed Oil	15330	Export	$125/tonne

Rapeseed Oil, Cake and Meal	15351	Export	7.5%
Seeds (for sowing)	21101, 21103, 21104, 21105, 21107, 21109, 21115, 21118, 21125, 21127, 21129, 21199	Export	$0.038/kg
Flaxseed	21230	Export	$11/tonne
Rapeseed	21240	Export	$11/tonne
Wool	24209, 24219, 24229	Import	free

Source: Government of Canada, The Canada-U.S. Free Trade Agreement (Copy 10-12-87, Ottawa, 1987).

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