# Impact of the Crow Rate and Western Grain Transportation Act on Western Canadian Grain Production

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Changjing Xu
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# IMPACT OF THE CROW RATE AND WESTERN GRAIN TRANSPORTATION ACT ON WESTERN CANADIAN GRAIN PRODUCTION

BY

CHANJING XU

A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF SCIENCE

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# Abstract

The Crow's Nest Pass Agreement (introduced in 1897) and its successor , the Western Grain Transportation Act (WGTA) (introduced in 1984) [1] are the transport programs designed specifically for agriculture. These Acts are the major agricultural programs affecting western Canadian agriculture in terms of monetary transfers made to Prairie farmers over the period of 1950-87. The impact of the Crow/ WGTA and issue of changing method of payment has been widely studied. However previous studies on the grain production impact of Crow/WGTA either reached conclusions without any supporting empirical evidence or on the basis of inappropriate empirical studies in terms of methodologies. This thesis attempts to simulate the production effect of removal of Crow/WGTA through a better defined econometric model for the western grain sector.

The objectives of the thesis are to simulate the short-run and long-run possible economic impacts of Crow/WGTA on the western Canadian grain sector and to draw policy implications from the empirical findings. These

[1] will be abbreviated as Crow/WGTA

objectives are accomplished by simulating the econometric model for the grain sector.

The thesis begins with a brief review of historical and current major issues of Crow/WGTA and the current methodological problems with supply response models as used in related studies. This is followed by a theoretical discussion of the impact of Crow/WGTA subsidies and changing the method of payment. Subsequently, the econometric model and key econometric results used in simulation of the study are described. The study then focuses on simulating the possible production impact of complete removal of Crow/WGTA on western grain production during the period of 1960-87. Finally, the simulation results of the study are reported and discussed.

The main conclusion from the analysis is that the Crow/WGTA does cause resource misallocation in western Canadian grain production although the effect is relatively small. The impact of removal of Crow/WGTA on grain production differs by time frame. Wheat production would experience a decrease in all three time frame. Production of barley, rapeseed and other crops (flax, rye and oats) would increase in the long-run with rapeseed experiencing the largest increase. Increases in barley and rapeseed production would be relatively minor. Results also suggest that all crops could be adjusted to long run equilibrium levels in a relatively short time frame.

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# Chapter 1

# Introduction

In a large and sparsely populated country like Canada, transportation has historically played an important role in stimulating economic growth by faciliating trade both internally and internationally. The Crow's Nest Pass Agreement and Rates (introduced in 1897) and its successor,the Western Grain Tranportation Act (WGTA) [1] (introduced in 1984) are the transport programs designed specifically for agriculture. These Acts are the only significant national agricultural policies that have emphasized the development of the Prairie agricultural economy as a producer and exporter of grains and oilseeds. In essence, the Act allowed subsidized rail freight rates on grains and oilseeds shipped from Canadian Prairies for export and for domestic use in eastern Canada. The WGTA has been in place for many years, during which time western Canada has became quite developed. In the light of western Canadian development, it is necessary to re-examine the impacts of

[1] will be abbreviated as Crow/WGTA

transportation subsidies on western Canadian agriculture.

## 1.1 Background

The most important role of the Crow/WGTA was to encourage settlement in Western Canada and firmly establish a Canadian population base. The impetus for the construction of the Canadian Pacific Railway was largely political; many feared that without a railway linking East and West the Canadian west would fall into the orbit of the U.S., as the U.S. railways gradually expanded northward. [2]

An agreement between the Parliament of Canada and the Canadian Pacific Railroad in 1897 provided for a reduction of the price charged for moving grains from Prairie shipping points to Thunder Bay/Armstrong, Churchill and ports in British Columbia. The rates agreed upon at that time remained fixed (known as "the statutory rate" and grain transported under the rate is called "statutory grain") until 1984 when they were replaced by a new rate scale established by the Canadian Transportation Commission in accordance with the WGTA. The WGTA specified the rates to be paid by shippers and government in respect of grain moved over various mileages. Under the Act, the present annual government commitment currently is about $720 million. This payment is comprised of $658.6 million "Crow Benefit" and

[2]see Economic Council of Canada *Western Transition* 1984

the cumulative government share of inflation. [3]

The historical evolution of Crow/WGTA has been very well-documented. [4] The statutary rates have been popularly decribed as providing for the transport of grain at half a cent per ton-mile. While purists may quarrel concerning the precision of this definition, it is a useful summary of the statutory rate structure. [5] Over the years, especially after the inflationary years of the 1960's, the statutory rates were deemed to be too low for the railways to earn an adequate return from the transportion of grain. In 1959 the MacPherson Commission estimated that as early as 1948, the statutory rates were covering only two-thirds of the variable costs associated with moving grain and only one half of the fully allocated costs (these include an allowance for fixed costs borne by the railways.) [6] In 1976, the Snavely Commission reported that the railroads had lost approximatedly $105.5 million from shipping grains in 1974, even without a contribution to constant costs. The commission also found that costs covered by producers, federal government and railways were 32%, 18% and 50% respectively. [7] A calculation by J.C.Gilson showed that the loss suffered by railways in 1980 was

[3]see J.Heads *The WGTA: The Next Five Years Development in Canadian Grain Transportation Policy, Proceedings of a Conference*

[4]see for example Purdy,H.L. *Transport Competition and Public Policy in Canada*, UBC Press, Vancouver, 1972, PP.175-82 Harvey, D.R. *Christmas Turkey or Prairie Vulture?*, Heads, J *The Western Grain Transportation Act: The Next Five Years*

[5]see Heads, J. Ibid pp.42

[6]see Purdy,H.L. *Transport Competition and Public Policy in Canada* UBC Press, Vancouver, 1972, pp.175-82 cited from J.Heads Ibid.

[7]see Economic Council of Canada *Western Transition* 1984

$215 million, even after the inclusion of $170 million of revenue received from the federal government as branch line subsidies and rehabilitation payments. After the consideration of an appropriate contribution to constant costs, the loss increased further to $299 million. [8] These revenue shortfalls led the railways to defer branch line maintenance and capital expenditures and assign statutory grain deliveries a low priority.

Besides the discontent from the railways, there had been an increased demand for a policy change from the producers of other commodities. It is generally argued that the Crow subsidy raised the price of statutory grain and therefore encouraged greater production and marketing in its raw form. Consequently local grain prices were also increased. This is because nearly two-thirds of Prairie grain production is traditionally sold off the Prairies, and local markets tend to be residual or price-taking markets. Hence the prices of all statutory grain sold locally normally reflect that farmgate prices of grain sold for export. This results in higher statutary prices for grain sold for export as well as for grains sold locally. [9] This phenomena was bitterly criticized by livestock producers and processors, as their production was penalized due to higher costs for grain feed. The transport subsidy was criticized for discouraging regional diversification and making western agriculture more susceptible to cyclical variation in demand. This effect was also reported

[8]Ibid.

[9]see Kirk, B *Agricultural Impacts of Crow Change* final report, Feb.1983

by Gilson: " The opportunities in western Canada for expanding grain and livestock production, for crop diversification and for greater processing are being limited, in part, by the current freight rate structure".

Issues such as these encouraged the federal government to make changes to the Agreement. In February 1982, Dr.Gilson was commissioned to find a solution to these problems and to propose a new grain freight rate structure. Gilson's report published in June 1982 formed the basis of the Federal government transportation proposals of February 1983. In November 1983, the federal government passed the Western Grain Transportation Act (WGTA) to replace the Crow. The WGTA differed from the Gilson report recommendations, particularly in regards to method of payment. Gilson originally suggested that initially payment of all subsidy by the government should be paid to the railways with a gradual change towards payment to producers by 1989-90. Under the WGTA, the entire Crow Benefit was to be paid each year to the railways.

A major thrust of WGTA was to unfreeze the freight rate paid for the transportation of grain by the producer, and the greatest achievement of the WGTA is to have found a solution to the problem of inadequate freight rates for grain. [10] The old Crow involved a saving to farmers in terms of a lower freight rate (hence a transfer of income to farmers), and it did not

[10]see Heads, J. Ibid

involve any direct expenditure on the part of government. The present rate structure under the WGTA provides for the substantial payment of "Crow Benefit" from the government to the railway. As Heads indicated:" Without this infusion of funds, a continued requirement for the railways to carry grain at freight rates so far below variable cost would have inevitably led to the bankruptcy of the Canadian railways and/or to the collapse of the grain transportation system. Compensation provided by the WGTA has, in this way, averted a major disaster".

The current rate structure also discouraged the use of other transportation modes for grain, which consequently prevent the rail system from evoloving to a lower cost configuration. The subsidy has still been criticized for distorting resource allocation in western Canada since it encouraged the production of grains eligible for the subsidy at the expense of other crops. As a consequence, regional diversification is discouraged. Furthermore the $720 million grain export subsidy is in direct conflict with the $120 million being spent under the Western Economic Diversification Fund.

In the international arena, it has been argued that the payment is highly visible and is regarded as an export subsidy by many of Canada's trade partners. It is precisely this type of program that negotiators at General Agreement on Tariffs and Trade (GATT) meetings believe to be trade-distorting because farmers receive a higher price for exported grain and oilseed than in

the absense of the subsidy. Thus the federal government of Canada is under pressure to modify or eliminate the WGTA in current multilateral trade negotiations. [11]

## 1.2 Current Major Issues

A change in the method of payment has been considered for many years as a possible way to solve allocative problems caused by the existing subsidy. The following alternative methods of distributing the subsidy to producer have been considered:

1. a gradual phase out of the existing subsidy to railways with no compensation to producers; and

2. an immediate removal of the subsidy to railways and a corresponding adjustment in rail rates with compensation paid either

   (a) directly to producers in an annual or lump-sum form.

   (b) indirectly to producers through some income stabilization mechanism.

   (c) into programs and projects of benefit to the western economy.

[12]

[11] see Agriculture Canada *Growing Together* 1989

[12] see Agricultural Diversification Alliance *Transform the Crow* Dec. 1989

Unless the WGTA payment is decoupled in some fashion , that is, the payment of the Crow/WGTA to producers is not linked to the level of output, then transportation subsidies are unlikely to influence production. If the amount of transfer producers received was dependent upon the amount of output they produced, then the WGTA would still be considered trade-distorting.

## 1.3 Problem Statement

### 1.3.1 Introduction

The first step in any systematic analysis of agricultural policies is therefore to describe as accurately as possible the consequences of each policy. This requires a model of the economy. Descriptive and empirical work are essential before it is possible to make useful normative judgements. [13] As noted by Tyrchniewicz (1984), basic to any assessment of the impact of changes in freight rates is an understanding of agricultural supply response.

However, previous studies on the production impact of Crow/WGTA either reached conclusions without any supporting empirical evidence or on the basis of inappropriate empirical studies. Most of these studies have ignored cross price effects in supply, but such cross price effects must be considered in evaluating the production impacts of subsidies to multiple crops.

[13]Stiglitz, J.E. *Some Theoretical Aspects of Agricultural Policies* World Bank Research Observer Vol.2 No.1 Jan. 1987

### 1.3.2 Current Methodological Problems with Supply Response Models and in Related Studies

Empirical analyses of the impact of the Crow/WGTA on agricultural production have employed both normative approaches and positive approaches. Mathematical programming, which considers how resources should be allocated in order to achieve certain goals, has been the most common approach adopted. Econometric models have been employed to a lesser extent. On the choice of techniques, Nerlove *et al* expressed the view that linear programming and econometric approaches are complementary rather than competitive.

In supply analysis, mathematical programming assumes a specific production function and objective function, and then calculates an optimal production pattern corresponding to resource limitations. One major problem with linear programming is that the optimal solution typically is extremely sensitive to the available levels of fixed resources and specified constraints on rate of adjustment. Since these constraints on adjustment (flexibility coefficients) are essentially arbitrary, mathematical programming appears to have little value in modeling supply response.

In contrast, this thesis calculates production impacts of Crow/WGTA using an econometric model. The strength of this approach, as stated by H.G.Coffin (1984), lies in its ability to accommodate and integrate a large

number of economic variables and relationships in a simultaneous adjustment format. On the other hand, Coffin also points out this approach requires a substantial amount of reliable data and assumptions are likely to be over-simplified, "The complexity of the Crow issue and the impact of prescribed changes render it difficult to have a thorough grasp of all aspects, so the limitations of such analysis must be recognized."

Furthermore, it can be argued that it is difficult to provide any economic interpretation of many previous estimates of supply functions for Canadian agriculture and to incorporate estimates in a consistent manner into a comprehesive model. Therefore it is advisable to estimate econometrically the relevant parameters of a comprehensive model. [14] The inappropriatness of the earlier literature on Western Canada supply response is illustrated by the recent study by Fulton *et al* (1989) assessing the impacts of Canadian agricultural policies, including the Crow/WGTA from estimates of supply elasticities in various Canadian and U.S studies. In spite of the critical need for knowledge of long-run impacts on production, only short-run estimates were available so that long-run elasticities were defined in an essentially arbitrary manner (all cross effects as zero, all own price effects as three times short run elasticities). In interpreting the results Fulton *et al* also recognized that omitting the cross-price elasticities will result in greater production responses than if they were included.

[14] see B.Coyle, *An assessment of trade-distorting effect of stabilization program*, 1991

There are no major reports or studies on the impact of Crow/WGTA in recent years. The most complete survey is by Harvey, who presents and compares the assumptions and results of various studies of the Crow rate impact. [15] Econometric studies on the impact of Crow/WGTA include Harvey( Agricultural Canada) and Alberta Agriculture, which have methodological problems as discussed above. Harvey applied an econometric model (the Food and Agriculture Regional Model (FARM)) developed by Agricultural Canada to the grain sector. [16] Harvey estimated supply response in western Canada using acreage demand equations for grains. The equations were estimated separately by ordinary least square (OLS). While no constraint that the sum total of individual grain acreages will not exceed the total available acreage imposed during estimation, he recognized the estimates of individual parameters will be subject to simultaneous equation bias. Since the model does not include any partial adjustment or adaptive-expectation mechanism, the resulting elasticities are short-run. Exclusion of cross elasticites of supply leads to misleading results.(e.g. Paddock 1984)

Alberta Agriculture in a recent study analysed the impact of changing the method of payment on the different areas in Alberta. The study assumed that grain producers will be fully compensated for the increase in transporta-

[15]Harvey, D.R. *Christmas Turkey or Prairie Vulture? An economic analysis o the Crow's Nest Pass Grain Rates*

[16]It is a large-scale, quarterly forecasting model of Canadian markets for agricultural commodities, food and inputs.

tion costs as the Crow Benefit payment is diverted from the railway to the producer. The grain farmer will after completion of the sale, receive his Crow Benefit directly from the government. The hypothesis accepted for the study was that with a change in the method of payment, farmers will change their crop and livestock production patterns and will face changes in their revenue and welfare. An econometric model was used for the grain sector. It consisted of supply functions of each grain as a function of the farm gate price and various exogenous supply shifters. One exogenous supply shifter was a so-called subsidy variable which represented the level of government contribution towards grain shipments to export position in Alberta. This variable was explained as an attempt to measure forces which are similar to those measured by the price variable. Each supply equation was estimated separately by OLS. The authors concluded that results suggest different reactions towards price and subsidy since different coefficients are found.

The Alberta Agriculture study assumed that farmers are fully compensated for the increase in freight rate, but this effect was not incorporated into the model. The study did not indicate in which way the payment is made. The model did not carefully consider problems in formulating appropriate price-expectations , which is perhaps the most important determinant of agricutural supply. Thus the estimated changes from the simulation results on the production of the affected grain due to the increase of freight rate are overestimated since it ignores the offsetting impact of the annuity

payment on producer decisions. Simulation results over the data period obtained by means of reducing the CWB net initial payment for grains and the market price for Canola actually only suggest the impact of increasing freight rate, but not with compensation. Also, supply equations include the level of government contribution towards grain shipments as a subsidy variable explaining grain supply. This does not make much intuitive sense since produers do not have the information on this variable when making their production plan.

The argument presented above indicates the need for a better specified supply response model in re-assessing the impact of Crow/WGTA. This thesis attempts to simulate consequences of policy changes based on such a model.

## 1.4 Objectives

This study will focus on the following objectives:

1. **to simulate the short-run and long-run possible economic impacts of Crow/WGTA on the western Canadian grain sector.**

2. **to draw policy implications from the empirical findings.**

To fulfill these objectives, the study will simulate the effect of removal of Crow/WGTA through an econometric model for western grain sector. The model which will be used here was developed by Coyle in a study of the

trade distortion effects of stabilization programs in Western Canada. The model is adapted here to assess the impact of Crow/WGTA. In contrast to earlier models, this model includes cross price effects, and the acreage equations are specified as conditional on total acreage in a manner that reduces multicollinearity problems.

The question asked in this study is similar to the question asked in Fulton *et al*'s study (1989) and by Alberta Agriculture (1989): what would have been the impact on Prairie Agriculture had Crow/WGTA not been in effect over the period 1960-87? In order to answer this question, simulation results will be obtained under the assumption of complete removal of Crow/WGTA and then compared to the baseline (actual data).

## 1.5 Scope and Organization of the Thesis

The common view is that the Crow/WGTA has very important implications for the rural and general economy of western Canada. Impacts on eastern Canada have been considered relatively minor or non-existent by most researchers; so few studies have analyzed impacts in eastern Canada. [17] The basis for eastern interest centered around the livestock and poultry industries and the implications of policy changes which would alter the competitive position of those industries.

[17] H.G. Coffin, *Western Grain Transportation Initiatives and Agriculture in Eastern Canada 1984*

For similar reasons this study will focus on the impact of Crow/WGTA within western Canadian agriculture. Off-board grains, including barley, oats, feed wheat and oilseeds, moving into eastern Canada through Thunder Bay are also eligible for the freight rate subsidy. But the selling prices of Prairie feed grain are quoted in store Thunder Bay. The domestic price for western Canadian feed grains at Thunder Bay is not the same as the CWB export price at this point. The former is based on the Montreal corn equivalent price less transportation and handling costs. The latter is, to a large extent, a hypothetical price quoted by the CWB. [18] To the purchaser of grain it makes little difference who paid the tranportation costs from the country elevator to Thunder Bay. U.S and world market conditions are the principal determinants of farm gate prices of grains produced in central and eastern Canada. And due to the dominance of corn in the east market, the changing of feed grain prices in west wouldn't affect eastern grain prices. That is to say there will be only very minor effects on eastern Canada from changes in Crow/WGTA.

This study is organized as follows. Chapter II reviews the theoretical

[18]This price, it is assumed, takes into account such factors as the prevailing and expected international prices for feed grains, the volume of export already committed, the availability of feed grains for domestic consumption in eastern Canada, and the ability of the grain transportation and handling system to handle additional quantities of grain for export.
see Meilke, K.D. and Corter, de.H. *A Quarterly Econometric Model of the North American Feed Grain Industry* Commodity Forecasting Models for Canadian Agriculture, Vol.1 Agriculture Canada, Pub.No.78/2 Oct.1987

framework underlying the study. The structural econometric model and simulation procedure and data for grain sectors are presented in Chapter III. Chapter IV presents simulation results and dicussion. Chapter V will summarize the conclusion of the study.

# Chapter 2

# Theoretical Considerations

## 2.1 Introduction

Agricultural policies are usually examined in order to see that they are not causing resources to be used in an inefficient manner. Resource misallocation will occur when price or output deviates from what it would otherwise be if all markets in the economy were competitive and free of externalities. Two main criteria for evaluating agriculture policy ,as stated in Fulton's study, are

1. the effectiveness of agricultural policy in reducing farm income variation.

2. the effectiveness of agricultural policy in promoting efficient resource allocation.

It is clear that the nature of policy determines the trade-off relationship, that is resource efficiency and income distribution.

Thus in making policy changes, there will be no 'optimal' alternative which can meet various objectives, but a 'better' alternative. For example, "decoupling", which is the view that income transfers can be made without incurring any costs, is a popular concept in policy analysis. Fulton *et al* conclude that there is reason to believe that decoupled programs are not possible and all distributive programs involve some degree of resoure misallocation.

## 2.2 Freight Rate Subsidies and Output Price

From an economic perspective, transportation is a factor of production, conceptually no different than land, labor and capital. [1] Therefore transportation cost should be deducted as other input costs from the producer's revenue, and the freight rate subsidy under the Crow/WGTA should be viewed as an input subsidy since it lowers production cost.

However, given the pricing and handling mechanism on the Prairies, i.e marketing controls on grain, the freight rate subsidies under the Crow/WGTA can be viewed as output price subsidy and the Crow/WGTA as a market price support program. The reason behind this argument is that Prairie farmers do not themselves transport their grain from the Prairies. Instead subsidies

[1] see Tychniewicz, *Western Grain Transportation Initiatives: where do we go from here?* Canadian Journal of Agricultural Economics 32(July 1984)

have influenced producer's production decisions through the higher market price for selling export grains and oilseeds. These subsidies have raised the market prices for non-Board crops like rapeseed and the Board price from Canadian Wheat Board(C.W.B) for grains under the Board like wheat, barley and oats through a higher net initial payment. [2] The farm-gate grain prices in Western Canada differed from the prices at export position by the cost of shipping from the point of production. This price relationship would show that farm-gate grain prices would be increased by raising the transport cost subsidy and the spread between the two prices would be reduced by the amount of subsidies. Thus, to a first order of approximation, changes in Crow/WGTA subsidies will only affect farmers' behavior through changes in grain prices at the producer level.

## 2.3 Economic Impacts of Crow/WGTA on Western Canada Grain Production

As early as the 19th century, Ricardo's principle of comparative advantage had explained how trading partners could mutually benefit from specialization in production and trade. If the relative cost of producing products differ

[2]The pricing and handling for wheat, barley and oats is under the control of Canadian Wheat Board(CWB), which is a Crown Corporation with monopoly control over the marketing of above grains produced in the Prairie provinces and Peace River area of British Columbia. When selling to the C.W.B, the freight cost and primary elevator handling charges are deducted from the initial payment at the time of delivery; the other costs are later charged against the pool. Thus given the export price at export position, the price received by producer for exported grain is higher than it would be in the absence of the freight rate subsidy on moving grain from farm to port.

in two locations, then both regions can in principle gain by trade. Accordingly trade occurs because nations or regions can exploit their comparative advantage to obtain higher income.

Theoretical models typically assume there are no transport costs between two locations. In reality, international trade entails transport and other handling charges. The proportion of transport cost can be a significant factor affecting relative prices and therefore affecting the term of trade. Transport cost was introduced into a two-country, two-commodity model by Samuelson in 1954. The model assumes the countries exchange their imports and exports at some midway international market. An international exchange ratio is set at this midpoint. The transportation costs involved in trade are represented by a fraction of the commodities being used up in the process of trade. The fraction of each commodity "lost" is equivalent to the amount paid for its transportation cost. Thus more commodities leave the exporting point than arrive at the midway exchange point. [3] The model has shown that higher trade costs reduce the volume of trade.

"Traditionally, one of the most important sources of economic growth is specialization and the division of labour, and the degree of division of labour depends on the size of the market, which in turn expands as transportation costs decline." [4] This clearly states the relationship among transportation,

[3]see Colman, D., Young, T. *Principles of Agricultural Economics*
[4]Adam Smith, *Wealth of Nations* Book 1, chapter 1-3

specialization and economic growth. In a study on the role of transportation in the development of western Canada, Wilson and Tychniewicz conclude that "It is true that in a developing economy, the inexpensive transportation would encourage regional specialization and division of labor, thereby increasing productivity. Further in slow growth areas, transportation subsidies can be used to stimulate development if smallness of the market is the problem. However, in a developed economy, transport charges are a relatively small portion of the value of commodities. Therefore intentional transport subsidies for growth purpose may be exceedingly costly in direct financial terms, as well as in terms of resource misallocation ." [5]

To accelerate the development and growth of the Prairie region was one of the initial objectives of the Crow, and the Crow presumably has succeeded in this regard. Now that the Pairie region is developed, transportation subsidies are less appropriate as indicated above. Given the landlocked location of the Prairies, which is serviced by the two railways, the Crow/WGTA might be justified on the grounds of preventing the reduction of potential for trade caused by high transport cost and exploiting the Prairie's comparative advatages. Even so the WGTA is subject to criticism since the current priority is not to stimulate regional development but rather to remove distortions caused by the Crow/WGTA.

[5]see Wilson,W.W. Tychniewicz, E.W. *The role of transportation in the development of western Canadian agriculture, Western Transition*

Previous studies on the impact of Crow/WGTA have led to the following conclusions. The Crow/WGTA has led to a misallocation of resources within the Prairie since it encouraged production of grains for export at the expense of other crops. These programs subsidized the prices of eligible grains. . Due to the subsidy the prices of grain eligible for the subsidy were raised higher. Fulton et al found that Crow/WGTA has increased the average price of wheat and barley in the Prairies by approximately 10 per cent since 1975. The Crow/WGTA has increased net farm incomes across the Prairies by between 20-25% over the period of 1980-1987. [6] On the other hand, the induced increases in local grain prices raise input costs and reduce profits for local firms processing grain for export and for livestock industries using these grains as feed.

Fulton *et al* and other studies concluded that Crow/WGTA has increased the average annual wheat and barley production by approximately 7 and 6 per cent respectively in long-run since 1975. As a result the Crow/WGTA has increased specialization of western agriculture on production of grain for export. Due to the unstable world grain market, this greater specialization has translated into a higher level of risk and uncertainty for Prairie farm incomes.

Based on the discussion of the role of transportation in regional develop-

[6]see Agricultural Diversification Alliance *Transform the Crow* Dec. 1989

ment, the removal of Crow/WGTA would lead to a more diversified regional economy. Beyond this, various previous studies (e.g Kirk, Alberta Agriculture) have concluded that an increase in freight rates and decrease in farmgate prices will lead to a shift in production towards higher-valued crops (wheat, rapeseed, flax) from lower-valued crops (barley, oats).

The error in this argument can be seen as follows. First, in equilibrium crops with higher market prices or revenue per acre also entail a higher marginal cost of production or cost per acre. Thus the changes in production depend upon changes in relative product prices rather than the initial levels of product prices. Second, changes in production are not easily predicted from changes in multiple product prices. Production will shift along the production possibility frontier in a manner that depends on the multidimensional curvature of this frontier. In other words, due to the importance of cross price effects on supply, a reduction in one commodity's price does not necessarily imply reduction in supply of this commodity when other prices are changing. To ignore cross price effects will generate misleading results. Thus qualitative as well as quantitative impacts on crop production of Crow/WGTA can only be derived from an empirical analysis.

# Chapter 3

# Model, Simulation Procedure and Data

## 3.1 Description of the Model

Econometric models for western agriculture were formulated by Coyle for the purpose of estimating production effect of three stabilization policies. Models were formulated using both duality theory and more ad hoc methods (in particular acreage demand equations). Although duality approaches are superior to the extent that underlying behavioral hypotheses are reasonably approximated, acreage demand models may be more appropriate than seriously mis-specified output supply models. Here only the acreage demand model of Western agriculture and key econometric results are summarized.

The system of acreage response equations for the purpose of estimating impacts of Canadian Wheat Board(CWB) and market price was specified as

follows:

$$L_t^i = a_i + \sum_{j=1}^{4} a_{ij} P^j/w^1 + a_{i5} w^2/w^1 + a_{i6} K_t + a_{i7} L_t + a_{i8} L_{t-1} + a_{i9} t + e^i; i = 1, .., 4 \quad (3.1)$$

$$L_t = b_0 + b_1 p^C/w^1 + b_2 P^L/w^1 + b_3 w^2/w^1 + b_4 w^3/w^1 + b_5 Z + b_6 L_{t-1} \quad (3.2)$$

$L_t^i$ is acreage in crop i during year t. $L_t = \sum_{i=1}^{4} L^i$ is total crop acreage, and p is the vector of expected prices for crops. K is the stock of farm machinary and equipment, and t denotes a time trend used as a proxy for technical change. Acreage demands are homogeneous of degree zero in prices. In equations (3.1), $K_t$ and $L_t$ are treated as quasi-fixed inputs. Since variable input decisions are made jointly with investment decisions, lagged cropland $L_{t-1}$ is also included in (3.1) ($K_{t-1}$ was insignificant).

Equation (3.2) is a standard Nerlove supply response equation for total crop acreage except that the rate of adjustment, i.e. $b_6 = 1 - \lambda_1 - \lambda_2 r$ is expressed as a function of a real interest rate r).

The four crops were defined as wheat, barely, rapeseed, and an aggregate of other crops (oats, rye, flax). $p^C$ is an aggregate Divisia output price index for the four crops. $w^1$ is an aggregate price for crop inputs, $w^2$ is a wage rate for hired farm labor. $w^3$ is an aggregate price index for livestock inputs, and $p^L$ is a Divisia price index for livestock. Z is a weather index related to conditions for crop growth in western Canada (GRODEX)..

The acreage response equations were estimated as a system conditional on

total crop acreage,

$$L = \sum_{i=1}^{M} L^i \tag{3.3}$$

Thus equations (1) satisfy the following adding-up restrictions

$$\begin{aligned} \sum_{i=1}^{M} \partial L^i(p,q,L)/\partial P^j &= 0, j = 1,.,M \\ \sum_{i=1}^{M} \partial L^i(p,q,L)/\partial q^k &= 0, allk \\ \sum_{i=1}^{\infty} \partial L^i(p,q,L)/\partial L &= 1 \end{aligned} \tag{3.4}$$

Since total crop acreage L is stochastic, the disturbances $e^1,.,e^4$ for equation (3.1) are in general linear independent. Thus all M conditional acreage response equations (3.1) were estimated jointly by 3SLS subject to the restriction (3.4) on coefficients of (3.1). These restrictions facilitate estimation of (3.1) in the presence of multicollinearity between prices. The total acreage equation (3.2) for cropland was estimated separately.

It is well known that one of the most important determinant of agricultural supply is producer expectations of prices. Various alternatives were considered in Coyle's study for expected market price including current prices, a one year lag in prices, and forecasts from an ARIMA model for these prices. The most satisfactory results were obtained using the following definition of expected prices for CWB crops (wheat, barley, oats) :

$$P_t = \text{initial payment}_t + \text{adjustment payment}_{t-1}$$

$$+\text{interim payment}_{t-1} + \text{final payment}_{t-2} \qquad (3.5)$$

Here the farmers expectations at time of planting for the total CWB price are regressive in the sense that the expectation for each component of the total price is equal to the most recently observed value for that component. Expected prices for other crops were defined as market prices for the previous year.

The system of equations was estimated by iterative three stage least squares (I3SLS) subject to the adding up restriction (3.4). The key econometric results of crop acreage demand equation for wheat, barley and rapeseed from Coyle's study [1] are presented in Table 3.1 (coefficients for "other crops" were substituted out of the model whenever the adding up restrictions were employed). All variable (except for the time trend t) were normalized to 1.0 for 1984, so that coefficients can be interpreted as elasticities circa 1984. Table 3.1 reports estimates of system equations when five insignificant coefficients are deleted based on the Gallant and Jorgenson joint test statistic. [2] All own price effects (A11, A22, A33) have a positive sign and are significant at the 99 per cent level. With one exception (A14, which is the least significant) all cross price effects have negative signs.

[1] For details of methodology and explanation of results reference Coyle, B.T. *On Modeling Systems of Crop Acreage Demands* Department of Agricultural Economics, University of Manitoba, 1991

[2] which is approximately a chi-square under the null hypothesis

Table 3.1: I3SLS Estimates of Linear Model with insignificant coefficients deleted

| | Estimate | T -ratio |
|---|---|---|
| A1 | -1.192 | 6.08 |
| A11 | 0.139 | 2.89 |
| A12 | -0.072 | 2.63 |
| A13 | — | — |
| A14 | 0.06 | 1.73 |
| A15 | -0.109 | 2.06 |
| A16 | 0.316 | 4.31 |
| A17 | 2.168 | 9.4 |
| A18 | 0.588 | 5.36 |
| A19 | -0.025 | 6.91 |
| A2 | 1.608 | 4.2 |
| A21 | — | — |
| A22 | 0.272 | 3.51 |
| A23 | -0.261 | 1.93 |
| A24 | -0.236 | 2.37 |
| A25 | 0.281 | 1.88 |
| A26 | -0.662 | 3.18 |
| A27 | — | — |
| A28 | -1.656 | 5.31 |
| A29 | 0.048 | 5.64 |
| A3 | 1.179 | 2.23 |
| A31 | -0.558 | 3.69 |
| A32 | — | — |
| A33 | 0.432 | 2.90 |
| A34 | — | — |
| A35 | — | — |
| A36 | — | — |
| A37 | -1.805 | 2.49 |
| A38 | — | — |
| A39 | 0.047 | 5.96 |

| Equation | Dubine-Watson |
|---|---|
| Wheat | 2.299 |
| Barley | 1.94 |
| Rapeseed | 1.855 |
| Other Crops | 1.942 |

Ordinary Least Squares (OLS) results for further modification of the Nerlove response model are presented in Table 3.2.

The modified total crop acreage demand model is specified as follows:

$$L_t = (1-\lambda(r))L_{t-1}+a_0+a_1p^C/w^1+a_2p^L/w^1+a_3w^2/w^1+a_4Z+a_5t+a_6r \quad (3.6)$$

[3] where $\lambda(r)$ is specified as a linear function

$$\lambda = \lambda_0 + \lambda_1 r \quad (3.7)$$

The coefficients $\lambda_1$ and $a_6$ are insignificant (with wrong signs). When the term $a_6r$ is exluded from the equation, the coefficient $\lambda_1$ of r is significant with the correct sign, which reported in Table 3.12. The key price variables for crops and livestock $p^C$ and $p^L$ are significant with correct sign.

[3]for details of methodology and results reference Coyle, B.T. Ibid

Table 3.2: OLS Estimates of Total Crop Acreage Demand Equations

| Approximation (3.6), $a_6 = 0$, to Modified Nerlove model $\lambda$ linear(3.7) | | |
|---|---|---|
| | Estimate | T-ratio |
| A0 | 0.49 | 2.93 |
| A1 | 0.2 | 2.77 |
| A2 | -0.318 | 3.74 |
| A3 | 0.214 | 1.91 |
| A4 | 0.051 | 1.89 |
| A5 | 0.007 | 2.98 |
| A6 | — | — |
| $\lambda_0$ | 1.067 | 6.36 |
| $\lambda_1$ | -0.174 | 4.61 |

## 3.2 Description of Data for Simulation Excercise

The model described above is used to simulate the production effects of removal of the Crow/WGTA. Based on the previous discussion, the Crow/WGTA can be approximated as a output price support program since the subsidies are implicit in the farm output prices. Therefore effects of removal of the Crow/WGTA subsidies could simply be incorporated into the model through the output prices.

A set of "real" prices was calculated under the assumption of totally eliminating Crow/WGTA by using the methodology described in Fulton et al's study. The simulation data period is from 1960 to 1987 and the calculated

"real " and actual prices for wheat, barely, rapeseed, rye, oats and flax, are presented in Table 3.2 and Table 3.3.

The procedures as described in Fulton *et al*'s study [4] are as follows. It was necessay first to obtain an estimate of the monetary transfer made to Prairie farmers under that program. This was done by determining the shortfall in railway revenues that resulted from the Crow Rate being in effect prior to 1984 and the actual government expenditures to the railway under WGTA since 1984. The second step involved determining the proportion of the Crow/WGTA transfer that was attributable to each of the major grains. This was done by calculating the proportion that each of the major commodities (wheat, oats, barley, flax, rye, and canola) constituted of the total volume of all six commodities shipped out of western Canada. These percentages were then used to allocate the transfer under Crow/WGTA to the commodities. The Crow/WGTA transfer allocated to each commodity was then substracted from the total value of production of that commodity, to arrive at the total revenue that farmers could have expected to receive had Crow/WGTA not been in place. Dividing the revised total revenue figure by the production of each of the commodities resulted in an estimate of the price that would have been obtained had Crow/WGTA been removed.

Data for the Crow Benefit was obtained from Fulton, and data on the pro-

[4]Ibid., pp.43-pp.44

Table 3.3: Real Prices of Wheat and Barley With and Without Crow/WGTA, Western Canada, 1960-87

| | Price Without Crow/WGTA | | Price With Crow/WGTA | |
|---|---|---|---|---|
| Year | Wheat | Barley | Wheat | Barley |
| 1960 | 41.703 | 28.015 | 51.20 | 35.03 |
| 1961 | 39.779 | 30.823 | 59.73 | 42.60 |
| 1962 | 52.607 | 41.795 | 62.44 | 48.91 |
| 1963 | 53.271 | 37.732 | 62.06 | 43.55 |
| 1964 | 50.400 | 38.383 | 61.80 | 45.74 |
| 1965 | 49.377 | 42.673 | 59.81 | 49.27 |
| 1966 | 54.482 | 45.022 | 63.13 | 50.54 |
| 1967 | 49.023 | 40.498 | 62.32 | 46.66 |
| 1968 | 42.800 | 35.059 | 55.20 | 40.02 |
| 1969 | 37.988 | 24.291 | 48.75 | 32.52 |
| 1970 | 31.258 | 22.375 | 50.13 | 31.84 |
| 1971 | 37.174 | 26.063 | 49.88 | 32.55 |
| 1972 | 46.661 | 34.970 | 61.17 | 40.63 |
| 1973 | 100.968 | 78.396 | 113.26 | 85.35 |
| 1974 | 148.947 | 106.841 | 162.80 | 115.20 |
| 1975 | 129.935 | 96.571 | 140.99 | 103.15 |
| 1976 | 112.381 | 90.231 | 120.08 | 97.02 |
| 1977 | 91.922 | 77.812 | 104.94 | 83.68 |
| 1978 | 105.444 | 76.253 | 117.50 | 85.42 |
| 1979 | 140.839 | 77.174 | 158.14 | 87.54 |
| 1980 | 171.326 | 109.890 | 187.29 | 119.38 |
| 1981 | 191.617 | 126.613 | 203.81 | 135.26 |
| 1982 | 163.994 | 110.068 | 176.57 | 117.09 |
| 1983 | 157.337 | 99.423 | 170.60 | 109.50 |
| 1984 | 156.968 | 110.527 | 174.27 | 120.57 |
| 1985 | 141.946 | 109.241 | 151.73 | 115.42 |
| 1986 | 108.114 | 75.401 | 123.70 | 87.00 |
| 1987 | 76.826 | 58.901 | 97.08 | 69.00 |
| Average Annual Changes | | | -10% | -10% |

Note: dollars per ton.

Table 3.4: Real Price of Rapeseed and Other Crops(flax, rye and oats), With and Without Crow/WGTA, Western Canada, 1960-87

| | Price Without Crow/WGTA | | Price With Crow/WGTA | |
|---|---|---|---|---|
| Year | Rapeseed | Other Crops | Rapeseed | Other Crops |
| 1960 | 60.575 | 0.36870 | 72.42 | 0.41602 |
| 1961 | 61.919 | 0.35299 | 79.68 | 0.43064 |
| 1962 | 73.256 | 0.36282 | 85.42 | 0.42836 |
| 1963 | 97.611 | 0.36719 | 108.20 | 0.41275 |
| 1964 | 105.980 | 0.36129 | 118.05 | 0.42030 |
| 1965 | 95.916 | 0.39726 | 106.35 | 0.45529 |
| 1966 | 101.434 | 0.42138 | 110.69 | 0.47336 |
| 1967 | 90.715 | 0.42173 | 102.13 | 0.47381 |
| 1968 | 68.765 | 0.38876 | 80.47 | 0.43974 |
| 1969 | 76.925 | 0.32629 | 88.38 | 0.36491 |
| 1970 | 89.102 | 0.30278 | 100.33 | 0.35729 |
| 1971 | 96.982 | 0.30453 | 104.44 | 0.35075 |
| 1972 | 88.771 | 0.50112 | 98.23 | 0.54696 |
| 1973 | 174.630 | 0.94525 | 182.23 | 0.94906 |
| 1974 | 303.060 | 1.23319 | 312.79 | 1.19817 |
| 1975 | 232.586 | 1.00000 | 240.01 | 1.00000 |
| 1976 | 207.441 | 0.89843 | 216.69 | 0.90289 |
| 1977 | 261.638 | 0.74174 | 269.42 | 0.75914 |
| 1978 | 262.389 | 0.73552 | 273.20 | 0.75443 |
| 1979 | 275.416 | 0.91970 | 285.31 | 0.90404 |
| 1980 | 259.63 | 1.15611 | 266.62 | 1.11538 |
| 1981 | 262.232 | 1.28229 | 271.34 | 1.18578 |
| 1982 | 269.882 | 1.06769 | 276.46 | 1.03071 |
| 1983 | 312.746 | 0.93595 | 320.50 | 0.94578 |
| 1984 | 358.248 | 1.12228 | 369.53 | 1.10912 |
| 1985 | 313.077 | 1.09171 | 318.66 | 1.06969 |
| 1986 | 210.088 | 0.83309 | 222.13 | 0.87266 |
| 1987 | 192.533 | 0.73244 | 206.57 | 0.80454 |
| Average Annual Changes | | | -5% | -2% |

Note: dollars per ton.

Table 3.5: The Total Volume of Shipments out of Western Canada, 1960-87

| Year | Wheat | Durum Wheat | Oats | Barley | Rye | Flaxseed | Rapeseed | Total |
|---|---|---|---|---|---|---|---|---|
| 1960 | 392003 | 0 | 36944 | 87581 | 5805 | 17776 | 9047 | 549159 |
| 1961 | 302554 | 0 | 27661 | 58985 | 3410 | 11792 | 9577 | 413982 |
| 1962 | 470850 | 0 | 88126 | 80013 | 9361 | 13376 | 5129 | 666858 |
| 1963 | 521158 | 43424 | 49128 | 91409 | 7953 | 17055 | 6676 | 736803 |
| 1964 | 490394 | 30489 | 40440 | 74411 | 7313 | 16557 | 10436 | 670040 |
| 1965 | 545509 | 19290 | 51117 | 93380 | 12007 | 23299 | 16756 | 761358 |
| 1966 | 604375 | 23220 | 37727 | 111991 | 10917 | 19799 | 17820 | 825849 |
| 1967 | 11835 | 489 | 467 | 1886 | 176 | 198 | 378 | 15429 |
| 1968 | 10746 | 670 | 636 | 1772 | 97 | 382 | 275 | 14578 |
| 1969 | 10038 | 1090 | 314 | 3659 | 193 | 550 | 503 | 16347 |
| 1970 | 8717 | 1621 | 882 | 5127 | 294 | 840 | 1179 | 8660 |
| 1971 | 11838 | 2136 | 486 | 6420 | 388 | 534 | 1265 | 23067 |
| 1972 | 15254 | 1872 | 499 | 5148 | 227 | 444 | 1034 | 24478 |
| 1973 | 13163 | 1299 | 611 | 5105 | 180 | 383 | 687 | 21428 |
| 1974 | 10097 | 1314 | 619 | 4547 | 257 | 272 | 721 | 17827 |
| 1975 | 11883 | 2305 | 787 | 4668 | 315 | 389 | 1056 | 21403 |
| 1976 | 13306 | 1530 | 837 | 5785 | 294 | 241 | 645 | 22638 |
| 1977 | 17139 | 1834 | 747 | 5150 | 252 | 478 | 1161 | 26761 |
| 1978 | 12820 | 1484 | 336 | 5193 | 239 | 399 | 2137 | 22608 |
| 1979 | 16600 | 1907 | 316 | 5355 | 431 | 600 | 2128 | 27337 |
| 1980 | 15707 | 2716 | 379 | 6337 | 341 | 396 | 1150 | 27026 |
| 1981 | 16868 | 2601 | 492 | 7397 | 588 | 339 | 1111 | 29396 |
| 1982 | 22224 | 2861 | 351 | 6824 | 505 | 461 | 1085 | 34311 |
| 1983 | 20472 | 2268 | 380 | 6280 | 671 | 357 | 1316 | 31744 |
| 1984 | 16247 | 1777 | 290 | 4756 | 305 | 485 | 1941 | 25801 |
| 1985 | 19086 | 1675 | 291 | 6283 | 235 | 588 | 1760 | 29918 |
| 1986 | 19226 | 2866 | 403 | 7208 | 252 | 687 | 2074 | 32681 |
| 1987 | 19169 | 3174 | 530 | 5581 | 257 | 525 | 2374 | 31613 |

Note: From Table, "Primary Net Receipts of Canadian Grain at Western Country Elevators."
Note: Thousands of bushels before 1967, Thousands of tons after 1967.

Table 3.6: Crow Benefit and Proportions of Crow/WGTA transfer to Each Crop, 1960-87

| YEAR | Crow Benefit | Wheat | Barley | Oats | Rye | Flax | Rapeseed |
|---|---|---|---|---|---|---|---|
| 1960 | 181 | 129 | 28 | 12 | 1 | 5 | 2 |
| 1961 | 195 | 142 | 27 | 13 | 1 | 5 | 4 |
| 1962 | 208 | 146 | 24 | 27 | 2 | 4 | 1 |
| 1963 | 220 | 168 | 27 | 14 | 2 | 5 | 1 |
| 1964 | 232 | 180 | 25 | 14 | 2 | 5 | 3 |
| 1965 | 243 | 180 | 29 | 16 | 3 | 7 | 5 |
| 1966 | 251 | 190 | 34 | 11 | 3 | 6 | 5 |
| 1967 | 261 | 208 | 31 | 7 | 2 | 3 | 6 |
| 1968 | 273 | 213 | 33 | 11 | 1 | 7 | 5 |
| 1969 | 282 | 191 | 63 | 5 | 3 | 9 | 8 |
| 1970 | 291 | 161 | 79 | 13 | 4 | 13 | 18 |
| 1971 | 293 | 177 | 81 | 6 | 4 | 6 | 16 |
| 1972 | 291 | 203 | 61 | 5 | 2 | 5 | 12 |
| 1973 | 286 | 193 | 68 | 8 | 2 | 5 | 9 |
| 1974 | 275 | 176 | 70 | 9 | 3 | 4 | 11 |
| 1975 | 273 | 180 | 59 | 10 | 4 | 4 | 13 |
| 1976 | 268 | 175 | 68 | 9 | 3 | 2 | 7 |
| 1977 | 347 | 246 | 66 | 9 | 3 | 6 | 15 |
| 1978 | 393 | 248 | 90 | 5 | 4 | 6 | 37 |
| 1979 | 418 | 282 | 81 | 4 | 6 | 9 | 32 |
| 1980 | 431 | 293 | 101 | 6 | 5 | 6 | 18 |
| 1981 | 440 | 291 | 110 | 7 | 8 | 5 | 16 |
| 1982 | 451 | 329 | 896 | 4 | 6 | 6 | 14 |
| 1983 | 473 | 338 | 935 | 5 | 9 | 5 | 19 |
| 1984 | 500 | 349 | 921 | 5 | 5 | 9 | 37 |
| 1985 | 325 | 225 | 682 | 3 | 2 | 6 | 19 |
| 1986 | 695 | 469 | 153 | 8 | 5 | 14 | 44 |
| 1987 | 719 | 508 | 126 | 12 | 5 | 11 | 53 |

Note: Millions of Dollar

portion of each of the major commodities shipped out of western Canada was obtained from "Grain Trade of Canada", and "Grain Statistic Handbook" (see Table 3.4). The proportions of monetary transfer to each crop are calculated from this data and presented in Table 3.4. Other data on crop acreage, production and price for grain for Western Canada was obtained from Coyle (1991).

## 3.3 Short and Long-run Production Effects

In simulating the impacts of price subsidy changes on the production of crops (as proxied by acreage demands), both direct effects and indirect effects need to be considered. The total effects in the short-run and long-run were defined as follows.

Since econometric results suggestd that capital stock $K_t$ adjusts much more slowly than total crop acreage $L_t$, the following calculations treat $K_t$ as fixed. If the system of acreage response equations is expressed as

$$x_i = f_i(p^j, q_t, L_t), i = 1...4, j = 1...4 \tag{3.8}$$

$$L_t = g(P_t, q_t, L_{t-1}) \tag{3.9}$$

then the short-run effect of Crow/WGTA on crop acreages, conditional on

total crop acreage, is defined as

$$\partial x_i^{SR}/\partial WGTA = \sum_{j=1}^{4} \partial f_i/\partial p^j dP^j \tag{3.10}$$

Allowing for annual adjustment in total cropland, the short-run total effect of a change in price $P^j$ on acreage demand $x_i$ will be the following:

$$\partial x_i/\partial p^j = \partial f_i/\partial p^j + \partial f_i/\partial L * \partial g/\partial P * \partial P/\partial p^j \tag{3.11}$$

where $\partial P/\partial p^j$ is the impact of $p^j$ on aggregrate crop price P. Using estimates of the conditional acreage response model, the short-run total effects are calculated as

$$\partial x_i/\partial WGTA = \sum_{j=1}^{4} \partial x_i/\partial p^j dP^j \tag{3.12}$$

In the long-run, there will be complete adjustment in total crop acreage, that is $L_t$ will be equal to $L_{t-1}$. Thus the change in total acreage demand due to a change in price P will be

$$\partial L_t/\partial P = b_1/(1 - b_6) \tag{3.13}$$

[5] then the long-run total effect of a change in prices on acreage demand for each crop is obtained as

$$\partial x_i^{LR}/\partial p^j = \partial f_i/\partial p^j + \partial f_i/\partial L * b_1/(1 - b_6) * \partial P/\partial p^j \tag{3.14}$$

and in turn the long-run impact of WGTA is defined as

$$\partial x_i^{LR}/\partial WGTA = \sum_{j=1}^{4} \partial x_i^{LR}/\partial p^j dP^j \tag{3.15}$$

[5] see equation 3.2

# Chapter 4

# Simulation Results and Discussion

## 4.1 Introduction

Complete removal of Crow/WGTA would be expected to affect crop production patterns through induced changes in farm prices and in turn lead to a more diversified pattern of production. The production effect, which would have occured in the past if the Crow/WGTA was removed, was simulated through an econometric model. The estimates from the econometric model were utilized to calculate direct and indirect effects, that is own price and cross price effects on production, in both a short- and long-run framework. In order to simulate the policy changes, the "real" prices, which are the prices that would have been obtained had Crow/WGTA been removed were employed with the calculated total effect to result in a new production level. The changes in acreages seeded into wheat, barley, rapeseed and other crops (flax, rye and oats) resulting from the removal of Crow/WGTA. are

presented in the following section.

## 4.2 Simulation Results

### 4.2.1 Wheat

The actual and the simulated changes in wheat acres due to the elimination of Crow/WGTA are presented in Table 4.1. The percent changes in wheat acres for each year are presented in Table 4.2.

The above estimates suggest that complete removal of Crow/WGTA would decrease average annual wheat production (if we assume a constant yield) by 1.55% in short-run assuming no adjustment in total crop acreage. 6.56% in short-run with annual adjustment in total crop acreage and 7.81% in the long-run.

### 4.2.2 Barley

The actual and simulated barley acres are presented in Table 4.3. The percent changes of barley acres in each year are presented in Table 4.4.

It is estimated that barley production (assuming a constant yield) would have decreased by 4.69% in both short run and the long run. These responses are identical because the coefficient of current total crop acreage ($L_t$) is insignificant in the acreage demand equation for barley.

Table 4.1: Wheat Acres With and Without Crow/WGTA, Western Canada,1960-87

| | Acres With Crow/WGTA | Acres Without Crow/WGTA | | |
|---|---|---|---|---|
| Year | Actual | Short Run* | Short Run** | Long Run |
| 1960 | 23976 | 23540.1 | 21933.5 | 21531.9 |
| 1961 | 24716 | 23794.9 | 21009.1 | 20312.6 |
| 1962 | 26330 | 25788.8 | 24336.7 | 23973.6 |
| 1963 | 27090 | 26638.6 | 25293.2 | 24956.8 |
| 1964 | 29200 | 28544.8 | 26686.8 | 26222.3 |
| 1965 | 27892 | 27272.9 | 25642.2 | 25234.5 |
| 1966 | 29293 | 28773.8 | 27420.4 | 27082.1 |
| 1967 | 29671 | 28879.9 | 26865.0 | 26361.3 |
| 1968 | 29018 | 28171.9 | 26154.9 | 25650.6 |
| 1969 | 24550 | 24087.8 | 22102.6 | 21606.3 |
| 1970 | 12075 | 11592.0 | 10231.2 | 9891.0 |
| 1971 | 18994 | 18445.1 | 16982.3 | 16616.6 |
| 1972 | 20915 | 20331.8 | 18921.8 | 18569.3 |
| 1973 | 23215 | 22995.7 | 22207.6 | 22010.5 |
| 1974 | 21570 | 21465.3 | 20871.0 | 20722.5 |
| 1975 | 22855 | 22711.0 | 22139.6 | 21996.7 |
| 1976 | 27165 | 27051.5 | 26420.8 | 26263.1 |
| 1977 | 24275 | 23946.6 | 23090.2 | 22876.1 |
| 1978 | 25670 | 25463.5 | 24573.3 | 24350.7 |
| 1979 | 25380 | 25236.3 | 24307.1 | 24074.8 |
| 1980 | 27060 | 26953.2 | 26194.7 | 26005.0 |
| 1981 | 30056 | 30090.2 | 29450.6 | 29290.7 |
| 1982 | 30520 | 30415.1 | 29708.0 | 29531.2 |
| 1983 | 33120 | 32960.4 | 32046.1 | 31817.6 |
| 1984 | 31870 | 31644.1 | 30650.0 | 30401.4 |
| 1985 | 33230 | 33101.2 | 32428.6 | 32260.4 |
| 1986 | 34310 | 33945.0 | 32451.5 | 32078.1 |
| 1987 | 33014 | 32229.0 | 30154.8 | 29636.2 |

Note:
1.*:Changes in wheat acres in short run assuming the total land is fixed.
2.**:Changes in wheat acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.2: % Changes of Wheat With Completely Removing Crow/WGTA, Western Canada,1960-87

| Year | Short Run* | Short Run** | Long Run |
|---|---|---|---|
| 1960 | -1.8182% | -8.519% | -10.194% |
| 1961 | -3.7269% | -14.998% | -17.816% |
| 1962 | -2.0553% | -7.571% | -8.949% |
| 1963 | -1.6661% | -6.633% | -7.874% |
| 1964 | -2.2438% | -8.607% | -10.198% |
| 1965 | -2.2196% | -8.066% | -9.528% |
| 1966 | -1.7724% | -6.393% | -7.548% |
| 1967 | -2.6663% | -9.457% | -11.155% |
| 1968 | -2.9157% | -9.867% | -11.605% |
| 1969 | -1.8828% | -9.969% | -11.991% |
| 1970 | -3.9999% | -15.270% | -18.087% |
| 1971 | -2.8901% | -10.591% | -12.517% |
| 1972 | -2.7883% | -9.530% | -11.215% |
| 1973 | -0.9446% | -4.340% | -5.188% |
| 1974 | -0.4855% | -3.240% | -3.929% |
| 1975 | -0.6301% | -3.130% | -3.755% |
| 1976 | -0.4179% | -2.740% | -3.320% |
| 1977 | -1.3529% | -4.881% | -5.763% |
| 1978 | -0.8044% | -4.272% | -5.139% |
| 1979 | -0.5663% | -4.227% | -5.143% |
| 1980 | -0.3946% | -3.198% | -3.899% |
| 1981 | 0.1138% | -2.014% | -2.546% |
| 1982 | -0.3437% | -2.661% | -3.240% |
| 1983 | -0.4819% | -3.242% | -3.932% |
| 1984 | -0.7090% | -3.828% | -4.608% |
| 1985 | -0.3876% | -2.412% | -2.918% |
| 1986 | -1.0638% | -5.417% | -6.505% |
| 1987 | -2.3778% | -8.661% | -10.231% |
| Average Annual Decrease | -1.55% | -6.56% | -7.81% |

Note:
1.*:Changes in wheat acres in short run assuming the total land is fixed.
2.**:Changes in wheat acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.3: Barley Acres With and Without Crow/WGTA, Western Canada,1960-87

| | Acres With Crow/WGTA | Acres Without Crow/WGTA | |
|---|---|---|---|
| YEAR | Actual | Short Run* | Short Run** |
| 1960 | 6743 | 6845.8 | 6845.8 |
| 1961 | 5424 | 5563.6 | 5563.6 |
| 1962 | 5176 | 5350.5 | 5350.5 |
| 1963 | 6042 | 6134.5 | 6134.5 |
| 1964 | 5325 | 5410.8 | 5410.8 |
| 1965 | 5893 | 6006.6 | 6006.6 |
| 1966 | 7160 | 7289.2 | 7289.2 |
| 1967 | 7780 | 7929.7 | 7929.7 |
| 1968 | 8500 | 8769.0 | 8769.0 |
| 1969 | 8970 | 8882.6 | 8882.6 |
| 1970 | 9480 | 9334.0 | 9334.0 |
| 1971 | 13408 | 13349.4 | 13349.4 |
| 1972 | 12050 | 12135.9 | 12135.9 |
| 1973 | 11520 | 11402.7 | 11402.7 |
| 1974 | 11370 | 11161.7 | 11161.7 |
| 1975 | 10590 | 10493.1 | 10493.1 |
| 1976 | 10302 | 10234.0 | 10234.0 |
| 1977 | 11330 | 11261.6 | 11261.6 |
| 1978 | 10060 | 9931.3 | 9931.3 |
| 1979 | 8730 | 8494.3 | 8494.3 |
| 1980 | 10950 | 10702.3 | 10702.3 |
| 1981 | 12730 | 12379.3 | 12379.3 |
| 1982 | 11775 | 11558.5 | 11558.5 |
| 1983 | 9780 | 9622.4 | 9622.4 |
| 1984 | 10370 | 10190.5 | 10190.5 |
| 1985 | 10775 | 10616.5 | 10616.5 |
| 1986 | 10810 | 10688.3 | 10688.3 |
| 1987 | 11372 | 11362.6 | 11362.6 |

Note:
1.*:Changes in barley acres in short run assuming the total land is fixed.
2.**:Changes in barley acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.4: % Changes of Barley With Completely Removing Crow/WGTA, Western Canada,1960-87

| Year | Short Run* | Short Run** |
|---|---|---|
| 1960 | 1.5249% | 1.5249% |
| 1961 | 2.5745% | 2.5745% |
| 1962 | 3.3712% | 3.3712% |
| 1963 | 1.5304% | 1.5304% |
| 1964 | 1.6107% | 1.6107% |
| 1965 | 1.9282% | 1.9282% |
| 1966 | 1.8046% | 1.8046% |
| 1967 | 1.9246% | 1.9246% |
| 1968 | 3.1652% | 3.1652% |
| 1969 | -0.9749% | -0.9749% |
| 1970 | -1.5399% | -1.5399% |
| 1971 | -0.4369% | -0.4369% |
| 1972 | 0.7132% | 0.7132% |
| 1973 | -1.0180% | -1.0180% |
| 1974 | -1.8320% | -1.8320% |
| 1975 | -0.9153% | -0.9153% |
| 1976 | -0.6599% | -0.6599% |
| 1977 | -0.6040% | -0.6040% |
| 1978 | -1.2798% | -1.2798% |
| 1979 | -2.6996% | -2.6996% |
| 1980 | -2.2622% | -2.2622% |
| 1981 | -2.7548% | -2.7548% |
| 1982 | -1.8385% | -1.8385% |
| 1983 | -1.6119% | -1.6119% |
| 1984 | -1.7310% | -1.7310% |
| 1985 | -1.4707% | -1.4707% |
| 1986 | -1.1255% | -1.1255% |
| 1987 | -0.0828% | -0.0828% |
| Average Annual Changes | -4.69% | -4.69% |

Note:
1.*:Changes in barley acres in short run assuming the total land is fixed.
2.**:Changes in barley acres in short run assuming the total land makes a short run (annual) adjustment.

### 4.2.3 Rapeseed

Estimated changes in the acres of rapeseed and the actual acres are presented in Table 4.5. The annual percent changes are presented in Table 4.6.

As a result of eliminating the Crow/WGTA, rapeseed production (assuming yield constant) increased in all three time frames, that is short run without annual adjustment in total land, short run with an annual adjustment in total land and long run equilibrium. The average annual increases in the three time frames are 5.27%, 9.45% and 10.49% respectively

### 4.2.4 Other Crops: Flax, Oats and Rye

Estimated acreage changes for other crops (flax, oats and rye) and the actual acres are presented in Table 4.7. The annual percent changes are presented in Table 4.8. The actual and estimated changes in total acreages in long run are presented in Table 4.9.

According to simulations, production of these other crops (assuming contant yield) would increase in all three time frames. The average annual increase is 2.12% in short run (with no adjustment in total land), 2.21%, in short run (with annual adjustment) and 2.23% in long run.

Table 4.5: Rapeseed Acres With and Without Crow/WGTA, Western Canada, 1960-87

| | Acres With Crow/WGTA | Acres Without Crow/WGTA | | |
|---|---|---|---|---|
| Year | Actual | Short Run* | Short Run** | Long Run |
| 1960 | 763 | 787.46 | 830.07 | 840.72 |
| 1961 | 710 | 773.02 | 839.70 | 856.37 |
| 1962 | 371 | 380.53 | 397.58 | 401.84 |
| 1963 | 478 | 495.29 | 515.08 | 520.02 |
| 1964 | 791 | 836.92 | 878.86 | 889.34 |
| 1965 | 1435 | 1512.88 | 1582.79 | 1600.27 |
| 1966 | 1525 | 1585.66 | 1644.37 | 1659.05 |
| 1967 | 1635 | 1749.37 | 1841.90 | 1865.03 |
| 1968 | 1056 | 1121.07 | 1182.24 | 1197.53 |
| 1969 | 2022 | 2156.12 | 2292.36 | 2326.43 |
| 1970 | 4074 | 4727.31 | 5109.90 | 5205.55 |
| 1971 | 5341 | 5930.51 | 6273.27 | 6358.96 |
| 1972 | 3318 | 3616.19 | 3802.59 | 3849.19 |
| 1973 | 3205 | 3340.06 | 3430.73 | 3453.40 |
| 1974 | 3160 | 3266.59 | 3339.13 | 3357.27 |
| 1975 | 4520 | 4656.05 | 4750.22 | 4773.76 |
| 1976 | 1778 | 1808.37 | 1842.77 | 1851.37 |
| 1977 | 3590 | 3792.13 | 3897.67 | 3924.05 |
| 1978 | 6980 | 7257.65 | 7459.37 | 7509.80 |
| 1979 | 8420 | 8804.53 | 9061.41 | 9125.62 |
| 1980 | 5140 | 5319.93 | 5440.00 | 5470.02 |
| 1981 | 3463 | 3527.58 | 3589.00 | 3604.35 |
| 1982 | 4370 | 4497.62 | 4582.00 | 4603.09 |
| 1983 | 5717 | 5903.64 | 6035.15 | 6068.03 |
| 1984 | 7588 | 7905.56 | 8102.79 | 8152.10 |
| 1985 | 6875 | 7068.75 | 7184.71 | 7213.70 |
| 1986 | 6523 | 6825.77 | 7062.38 | 7121.54 |
| 1987 | 6677 | 7253.23 | 7602.81 | 7690.20 |

Note:
1.*:Changes in rapeseed acres in short run assuming the total land is fixed.
2.**:Changes in rapeseed acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.6: % Changes of Rapeseed With Completely Removing Crow/WGTA, Western Canada,1960-87

| Year | Short Run* | Short Run** | Long Run |
|---|---|---|---|
| 1960 | 3.206% | 8.790% | 10.186% |
| 1961 | 8.876% | 18.268% | 20.616% |
| 1962 | 2.569% | 7.165% | 8.314% |
| 1963 | 3.618% | 7.757% | 8.791% |
| 1964 | 5.805% | 11.107% | 12.433% |
| 1965 | 5.427% | 10.299% | 11.517% |
| 1966 | 3.978% | 7.828% | 8.790% |
| 1967 | 6.995% | 12.654% | 14.069% |
| 1968 | 6.162% | 11.954% | 13.402% |
| 1969 | 6.633% | 13.371% | 15.056% |
| 1970 | 16.036% | 25.427% | 27.775% |
| 1971 | 11.038% | 17.455% | 19.059% |
| 1972 | 8.987% | 14.605% | 16.009% |
| 1973 | 4.214% | 7.043% | 7.750% |
| 1974 | 3.373% | 5.669% | 6.243% |
| 1975 | 3.010% | 5.093% | 5.614% |
| 1976 | 1.708% | 3.643% | 4.127% |
| 1977 | 5.630% | 8.570% | 9.305% |
| 1978 | 3.978% | 6.868% | 7.590% |
| 1979 | 4.567% | 7.618% | 8.380% |
| 1980 | 3.501% | 5.837% | 6.421% |
| 1981 | 1.865% | 3.638% | 4.082% |
| 1982 | 2.920% | 4.851% | 5.334% |
| 1983 | 3.265% | 5.565% | 6.140% |
| 1984 | 4.185% | 6.784% | 7.434% |
| 1985 | 2.818% | 4.505% | 4.927% |
| 1986 | 4.642% | 8.269% | 9.176% |
| 1987 | 8.630% | 13.866% | 15.175% |
| Average Annual Changes | 5.27% | 9.45% | 10.49% |

1.*:Changes in rapeseed acres in short run assuming the total land is fixed.
2.**:Changes in rapeseed acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.7: Other Crops Acres With and Without Crow/WGTA, Western Canada, 1960-87

| | Acres With Crow/WGTA | Acres Without Crow/WGTA | | |
|---|---|---|---|---|
| Year | Actual | Short Run* | Short Run** | Long Run |
| 1960 | 9413 | 9728.64 | 9739.54 | 9742.27 |
| 1961 | 7762 | 8123.75 | 8138.87 | 8142.66 |
| 1962 | 9211 | 9401.76 | 9410.55 | 9412.74 |
| 1963 | 8603 | 8761.31 | 8768.70 | 8770.55 |
| 1964 | 7694 | 7849.97 | 7858.44 | 7860.56 |
| 1965 | 8721 | 8877.94 | 8886.75 | 8888.95 |
| 1966 | 8049 | 8163.90 | 8170.33 | 8171.93 |
| 1967 | 6792 | 6944.73 | 6952.71 | 6954.70 |
| 1968 | 7543 | 7732.18 | 7741.25 | 7743.52 |
| 1969 | 8614 | 8936.31 | 8948.35 | 8951.36 |
| 1970 | 9390 | 9777.44 | 9795.73 | 9800.31 |
| 1971 | 8081 | 8278.35 | 8289.11 | 8291.80 |
| 1972 | 6638 | 6804.49 | 6812.23 | 6814.16 |
| 1973 | 7419 | 7541.12 | 7545.48 | 7546.56 |
| 1974 | 7124 | 7244.06 | 7247.45 | 7248.30 |
| 1975 | 6868 | 6955.70 | 6958.66 | 6959.41 |
| 1976 | 6105 | 6188.16 | 6190.61 | 6191.22 |
| 1977 | 6285 | 6364.41 | 6368.24 | 6369.20 |
| 1978 | 5581 | 5673.33 | 5676.68 | 5677.51 |
| 1979 | 5929 | 6057.31 | 6061.06 | 6062.00 |
| 1980 | 4907 | 4995.32 | 4997.69 | 4998.29 |
| 1981 | 5453 | 5564.71 | 5566.71 | 5567.22 |
| 1982 | 5918 | 6006.34 | 6008.71 | 6009.31 |
| 1983 | 4838 | 4905.09 | 4907.40 | 4907.98 |
| 1984 | 5300 | 5388.45 | 5391.31 | 5392.03 |
| 1985 | 5137 | 5197.72 | 5199.52 | 5199.97 |
| 1986 | 5236 | 5338.72 | 5342.66 | 5343.65 |
| 1987 | 4821 | 4922.81 | 4928.05 | 4929.36 |

Note:
1.*:Changes in other crops (flax, oats and rye) acres in short run assuming the total land is fixed.
2.**:Changes in other crops acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.8: % Changes of Other Crops With Completely Removing Crow/WGTA, Western Canada,1960-87

| Year | Short Run* | Short Run** | Long Run |
|---|---|---|---|
| 1960 | 3.35321% | 3.46907% | 3.49803% |
| 1961 | 4.66048% | 4.85537% | 4.90409% |
| 1962 | 2.07105% | 2.16641% | 2.19025% |
| 1963 | 1.84022% | 1.92609% | 1.94756% |
| 1964 | 2.02722% | 2.13725% | 2.16475% |
| 1965 | 1.79951% | 1.90060% | 1.92587% |
| 1966 | 1.42745% | 1.50733% | 1.52730% |
| 1967 | 2.24872% | 2.36614% | 2.39549% |
| 1968 | 2.50808% | 2.62826% | 2.65831% |
| 1969 | 3.74171% | 3.88152% | 3.91647% |
| 1970 | 4.12604% | 4.32090% | 4.36962% |
| 1971 | 2.44210% | 2.57525% | 2.60854% |
| 1972 | 2.50815% | 2.62472% | 2.65386% |
| 1973 | 1.64606% | 1.70476% | 1.71943% |
| 1974 | 1.68525% | 1.73288% | 1.74479% |
| 1975 | 1.27687% | 1.32010% | 1.33091% |
| 1976 | 1.36208% | 1.40222% | 1.41226% |
| 1977 | 1.26347% | 1.32447% | 1.33972% |
| 1978 | 1.65436% | 1.71433% | 1.72932% |
| 1979 | 2.16409% | 2.22739% | 2.24322% |
| 1980 | 1.79978% | 1.84825% | 1.86036% |
| 1981 | 2.04854% | 2.08534% | 2.09454% |
| 1982 | 1.49278% | 1.53284% | 1.54285% |
| 1983 | 1.38683% | 1.43456% | 1.44649% |
| 1984 | 1.66894% | 1.72287% | 1.73636% |
| 1985 | 1.18210% | 1.21710% | 1.22585% |
| 1986 | 1.96181% | 2.03707% | 2.05589% |
| 1987 | 2.11187% | 2.22050% | 2.24766% |
| Average Annual Changes | 2.12% | 2.21% | 2.23% |

Note:
1.*:Changes in other crops (flax, oats and rye) acres in short run assuming the total land is fixed.
2.**:Changes in other crops acres in short run assuming the total land makes a short run (annual) adjustment.

Table 4.9: Total Acres With and Without Crow/WGTA, Western Canada,1960-87

| Year | Actual Acres | Acres Without Crow/WGTA | |
|---|---|---|---|
| | | Short Run* | Long Run |
| 1960 | 40895 | 36484 | 35380.6 |
| 1961 | 38612 | 34361 | 33298.6 |
| 1962 | 41088 | 37009 | 35989.8 |
| 1963 | 42213 | 38049 | 37007.5 |
| 1964 | 43010 | 38890 | 37860.3 |
| 1965 | 43941 | 39606 | 38522.1 |
| 1966 | 46027 | 42017 | 41014.6 |
| 1967 | 45878 | 41294 | 40147.9 |
| 1968 | 46117 | 41109 | 39857.3 |
| 1969 | 44156 | 39588 | 38445.9 |
| 1970 | 35019 | 30883 | 29849.3 |
| 1971 | 45824 | 41590 | 40532.0 |
| 1972 | 42921 | 38958 | 37967.6 |
| 1973 | 45359 | 42213 | 41426.8 |
| 1974 | 43224 | 39801 | 38944.9 |
| 1975 | 44833 | 41139 | 40215.4 |
| 1976 | 45350 | 40953 | 39853.7 |
| 1977 | 45480 | 41846 | 40937.5 |
| 1978 | 48291 | 45792 | 45167.0 |
| 1979 | 48459 | 46107 | 45518.6 |
| 1980 | 48057 | 44703 | 43865.0 |
| 1981 | 51702 | 48185 | 47305.4 |
| 1982 | 52583 | 49533 | 48770.6 |
| 1983 | 53455 | 50960 | 50336.1 |
| 1984 | 55128 | 52931 | 52381.3 |
| 1985 | 56017 | 53102 | 52373.3 |
| 1986 | 56879 | 53952 | 53220.2 |
| 1987 | 55884 | 52852 | 52093.8 |
| Average Annual Changes | | -7.8% | -9.8% |

1.*:Changes in total acres in short run

## 4.3 Discussion

Simulation results suggest that complete removal of Crow/WGTA would affect the pattern of grain production via the induced changes in the farm prices. The prices of wheat and barley decreased by about 10%. The prices of rapeseed and other crops (flax, rye and oats) decreased by about 5% and 2% respectively. Simulation results do not completely support conclusions of previous studies, due to the increase in freight rate, producers will switch to higher valued crops, (wheat and rapeseed) from lower-valued crops, (barley and oats) (e.g Kirk , Alberta Agriculture.), or the conclusion drawn by Agriculture Canada's elasticity analysis that wheat and barley will experience the largest decline.

When there is no adjustment in total crop acres, changes in production are approximated by substitution of land among crops. When there is adjustment in total land, the changes in production will not only depend on the changes of prices but changes in the total crop land. The simulation results suggest that complete removal of Crow/WGTA would decrease total crop land by 7.8% in short run and 9.8% in long run. Wheat production would increase and barley, rapeseed and other crops production would increase in the long run. In both the short run with an annual adjustment in total crop land and in the long run, wheat production would decrease and barley, rapeseed and other crops production would increase. Wheat produc-

tion would decrease by 9.8% in the long run compared to the 7% decrease in Fulton's study. Barley production would increase by 4.69% in long run compared to a 6% decrease in Fulton's study. It is estimated rapeseed production would experience the largest increase in the long run by 10.49% and other crops would experience relatively minor increase by 2.23%. The total acreage seeded to grain would decrease by 9.8% in the long run with the elimination of transport subsidy.

The analysis suggests that compelete removal of Crow/WGTA would encourage regional diversification in terms of crop mix. That is the production of other crop except wheat would increase. A more diversified production pattern should increase stability of income. From economic logic the increased production of barley and other crops in the long run and their lower prices might induce expansion of livestock and processing industries. If this secondary effect does occur, the estimates from this thesis might underestimate the degree of diversification in terms of both crop and livestock production.

These simulation results assume complete removal of the Crow/WGTA. It is also assumed that there is either no compensation for removal of Crow/WGTA or that compensation is non-distorting. Results show that estimated impacts in the short run when there is adjustment in total land is close to estimated impacts in the long run. This suggests that the new production level in the short run, when there is adjustment in total crop land to the removal of

Crow/WGTA, is close to long run equilibrium. This also suggests that production can be adjusted to a long run equilibrium level in a relatively short time frame.

# Chapter 5

# Summary and Conclusion

This thesis reports simulation results concerning the impacts of removal of Crow/WGTA on acreage demands for the western Canadian grain sector from 1960-87. These simulations were based on parameter estimates of an econometric model of the grains sector in western Canada.

In order to fulfill the specific objectives of this thesis, the first step involved calculating the short-run and long-run production effects based on the parameter estimates of supply response in the western grain sector. The second step involved simulating the model with a new set of "real prices" under the secenario of complete removal of Crow/WGTA. The prices of the major commodities represents the major policy variables in this thesis.

The results suggest that the Crow/WGTA does cause resource misallocation in western Canadian grain production although the effect is relatively small. These programs lead to a small increase in regional specialization

and dependence on exports, which in turn increase the instability of farm income. Simulation results show that farmgate prices would fall due to the elimination of Crow/WGTA. The magnitude of decrease would differ among crops, i.e wheat and barley prices decreased relatively more than rapeseed and other crops. The impact of removal of Crow/WGTA on grain production are differed in the three time frames, ( i.e short-run when there is no adjustment in total crop acres, short-run when there is an annual adjustment in total crop acres, and long-run when there is complete adjustment in total crop acres). In the long-run, wheat production would decrease and barley, rapeseed and other crops production would increase. Rapeseed production would experience the largest increase by 10.49% in long run. The new production level in short-run when there is adjustment in total crop acres is close to the long-run equilibrium level. This suggests that production can be adjusted to a long run equilibrium level in a relatively short time frame.

In conclusion, resource distortion caused by Crow/WGTA at farm level is relatively small. This implies that these programs do not have much negative impact on efficient allocation of resources in grain production. However, it is still not a good program in terms of income distribution due to the relatively larger resource misallocation caused in railway sector, as reported by previous studies. The intentional transport subidies for growth purposes may be exceedingly costly in direct financial term, as well as in terms of resource misallocation. The current WGTA costs government around $658.6 million

annually. "Without the infusion of this funds, a continued requirement for the railways to carry grain at freight rates so far below variable cost would have inevitably led to the bankcruptcy of the Canadian railways/or to the collapse of the grain transportation system. Thus compensation provided by WGTA has averted a major disaster", as stated by Heads previously.

Thus it seems the major distortion caused by Crow/WGTA is at railway level. It is commonly argued in economics that efficient use of nation's economic resources generally require that price for goods and services be equal to the marginal cost of production. Removal of the programs would permit the railway to set the prices of transport services to approximate the marginal cost of supplying the services.

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