The Effect of Exchange Rate Changes on the International Trade of Canadian Wheat

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To My Parents

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ABSTRACT

Although wheat today occupies a much smaller share of the national economy it still remains one of Canada's most significant foreign exchange earners and consistently offers a healthy contribution to Canada's balance of trade. Canada as a nation exports nearly three-quarters of it's total production and has become second, only to the United States, in supplying wheat to the world. As a result, Canada is now considered as the fourth largest agricultural exporting nation in the world.

Throughout the 1970's and 1980's the world wheat market has been characterized as being quite unstable and inherently unpredictable. During this period, it has undergone a transition from a producers' market to a "buyers" market. The importing nations are therefore in a position to be much more selective in regards to their purchase decisions and are consequently able to maximize their utility. Thus, the exchange rate has emerged as a very significant variable when considering the purchase of large quantities of wheat from any of the major wheat exporting nations.

This study has conclusively demonstrated, through the use of a simultaneous equation model and an accompanying econometric analysis, that a depreciation (appreciation) in the value of the Canadian dollar will produce an increase (decrease)

in the volume of Canadian wheat exports. The importance of this relationship is evidenced currently with the case of the soaring U.S. dollar and it's slumping Canadian counterpart and the fact that both of these countries represent the two largest wheat exporting nations in the world.

The potential for Canadian wheat exports appears limitless with the prevailing exchange rate of the Canadian dollar and the international reputation of Canadian wheat as being of consistently high quality. However, this is unfortunately not the case since there exists several obstacles and problems that prevent Canada from fully realizing the benefits of the current situation. Alternative strategies and policy directions to overcome these barriers range from the possible formation of a wheat exporter duopoly or triopoly to a complete revision of the Canadian agricultural trade strategy.

Finally, with the Canadian Wheat Board forecasting dramatic increases in the volume of annual Canadian wheat exports over the next decade - in excess of 20 million tonnes per year - the role of the exchange rate in attaining these goals will most certainly be a prominent one.

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CHAPTER I :

Introduction

> " It is customary to think of Canada as having a major comparative advantage in agricultural products, but if the structure of the nation's trade balance for this sector is any indication, that comparative advantage is based upon one product group - grains, and particularly unmilled Wheat. "
>
> (B.W. Wilkinson,1980,p.98)

Canada's dominant net export item in agricultural products continues to be wheat, with exports of other grains being of much lesser magnitude. In 1981-1982, wheat exports constituted roughly seventy-five per cent of the total disposition of Canadian wheat production which, in turn, represented approximately twenty per cent of total world wheat exports. More recently, the export of wheat in the crop year 1983-1984 proved to be the most successful in Canadian history when exports of wheat reached a record high of 18.7 million tonnes - an increase of 470,000 tonnes or slightly over three per cent from the previous year.(Agriculture Canada,1984) In consequence, the exports of wheat have become one of the major foreign exchange earners for Canada.

It is the purpose of this study to explore and verify the hypothesis that changes in the value of the Canadian dollar have very definite effects on the export trade of Canadian wheat. This endeavour will be accomplished largely with the aid of a simultaneous equation model of the Canadian wheat industry. Accompanying this

model will be an extensive empirical and econometric analysis involving a number of estimation proceedures.

In 1973, Canada followed suit with the rest of the internatioal community when it moved to adopt a system of flexible exchange rates. A decision of this magnitude had considerable and far reaching implications for both the economy and the nation, as a whole. According to economic theory, a system of floating exchange rates removes the balance-of-payments constraint, leaving domestic policy with more freedom to pursue the goals of high employment, growth and stable prices. (H.G. Johnson,1969), However, a flexible system also creates a tremendous impact on the foreign and trade related sectors of a nation's economy - which is precisely the focal point of this study (i.e. the case of Canadian wheat exports).

Canadian production and export of wheat is dominated by hard red spring wheat varieties which because of their relatively high protein levels have acquired an excellent international reputation and as a result command premium prices on world wheat markets. Recent trends have shown that higher yielding soft or medium hard wheats have been capturing a larger share of world trade in wheat. This development is primarily accounted for by the emergence of new milling technology. Nevertheless, the demand for the Canadian varieties of wheat has still remained high since price premiums for hard red spring wheat over other varieties has been constantly

narrowing. (Veemans,1984) Considering all of these facts, the Canadian Wheat Board still forecasts 1990 export levels of Canadian wheat to range between twenty and twenty-four million tonnes.

C H A P T E R II :

Literature Review, Theoretical Background and The Model

The purpose of this chapter is twofold. First, to present a brief but thorough cross-section of the literature relevant to this topic, and in doing so, highlighting the most recent related studies and second, to describe the economic theories that are to serve as the underlying basis for the hypotheses, model construction, economic analysis and policy formulation that will be extended in this thesis.

Literature Review

Related Studies

In a paper entitled " The Exchange Rate and U.S. Agriculture", G. Edward Schuh (1974) emphasized that the exchange rate has been an important omitted variable in past interpretations of U.S. agriculture development and trade problems. He also demonstrated that an overvaluation (devaluation) has very significant repercussions on both the foreign component as well as the domestic component of the agricultural sector. Schuh further proved that the movement to flexible exchange rates in the 1970's constituted important structural changes for both the U.S. agricultural sector and the U.S. economy. (Schuh,1974,p.3) Schuh's arguements tend to coincide with the major propositions of this thesis which revolve around the fact that exports of agricultural products (Canadian wheat) are indeed sensitive to fluctuations or changes in exchange rates, and that movements in the exchange rate will produce real adjustments in the

agricultural (wheat) trade balance.

In a related study, Paul Johnson, Thomas Grennes and Marie Thursby (1977) illustrated that the subsequent devaluation of the dollar was responsible for an important part of the increase in agricultural prices witnessed in 1973-1974. They concentrated specifically on wheat prices in their study because in value terms wheat is the most important agricultural product exported by the United States. Their analysis and results concluded that the dollar devaluation did have a significant effect on prices, however, it was not as dominant a factor as Schuh originally suggested. Furthermore, they implied that possibly due to the insulating policies adopted by all the major importers and exporters of wheat (except the United States) that the results may have been somewhat distorted.

The Economics of World Grain Trade (1978) a book written by the aforementioned authors deals more extensively with exchange rates and the international trade of wheat. As in their 1977 article, they focus on the devaluation of the U.S. dollar in 1973-1974 and the consequences it had upon the factor and product prices. The authors make considerable reference to an article by John Floyd (1965) in which he developed a model to explain the impact of overvaluation, trade controls and other monetary variables on factor prices. He predicted that a ten per cent devaluation would increase wheat prices by three per cent, which greatly contrasted the results from Johnson's,

Grennes' and Thursby's model that forecasted a much larger price increase of nearly seven per cent. In addition, it was argued that since the U.S. government enacted no insulating policies, trade effects resulting from the devaluation were much more pronounced than in other major wheat-trading countries which employed export taxes, quotas, embargoes, reduced tariffs, subsidized imports and other such protective actions. (Johnson,Grennes,Thursby 1978,p.115)

This topic of price and exchange rate transmission has been addressed by several economists. In the case of wheat, it has been empirically proven that Canada has exhibited nearly perfect price and exchange rate transmission and that all of the other major wheat exporting nations displayed similar results. (H. Collins,1980) It has also been determined that the elasticity of price transmission and the elasticity of the exchange rate transmission were respective responses of a given country's prices to changes in the world price and the country's currency dollar exchange rate. (H. Collins,1980,p.68)

In a dynamic analysis of the effects of exchange rate changes on U.S. agriculture (Chambers and Just,1981) the impact of devaluations in the U.S. dollar on the U.S. agricultural sector was studied. It was determined that the majority of the associated impact of exchange rate fluctuations came through an adjustment in the agricultural trade balance rather than a portfolio adjustment. In their study, Chambers and Just (1981) developed a somewhat simplistic model,

based on ten year quarterly data from 1967, which considered three agricultural commodities - soybeans, corn and wheat. Essentially, their results verified that monetary factors, such as exchange rates, do have a real impact on agricultural markets (both foreign and domestic) by altering the volume of exports and the relative split between exports and the domestic use of the three products. Finally, in their model Chambers and Just employed the exchange rate variable as a distinct and seperate regressor in the export equation. Although, the exchange rate variable proved to be insignificant for Wheat, this was still somewhat of a "revolutionary" treatment of this monetary factor since traditional modelling of grain exports usually deflated the own-price and the commodity index by the exchange rate.

Relevant Literature: The Canadian Situation

Wheat has and continues to be Canada's dominant net export item and hence, it's position of importance in this country's international trade. Canada in a Changing World Economy (B.W. Wilkinson, 1980) states that the perceived comparative advantage Canada has in the trade of agricultural products is based solely upon one group - grains, and in particular unmilled wheat. Additional reference is made by the author in regards to the significance of the exchange rate;

> "...there is scope for an improved international competitive position provided that the Canadian dollar remains at or below it's current level of about $0.85 U.S. However, a restoration of the Canadian dollar to something near parity with the U.S. $ would effectively prevent much, if any improvement from occuring in the trade balance in this sector."
>
> (B.W. Wilkinson,1980,p.98)

The notion of the exchange rate as an integral component of a comparative advantage in the world wheat market is a concept that has been alluded to in several articles in agricultural economics. " Oligopoly Pricing in the World Wheat Market" (Alouze,Watson and Sturgess,1978) pointed out that the world wheat market, which had previously been dominated by a co-operative duopoly comprised of the United States and Canada, has since the early 1970's been characterized by high, unstable prices and low carry over stocks. This, they stressed, indicated the existence of a competitive market environment. Thus, it was extende that the importing nation of wheat, ceterius paribus, would likely act in an economic and rational manner endeavouring to maximize their utility and henceforth, regard the exchange rate and purchasing power as key elements in their purchase decision process. This theme is endorsed in a related article which concludes that the demand for exports of a country depends primarily on two factors - economic activity abroad and the export price of the country relative to the price of it's competitors on export markets. (Spitaller,1980,pp.328-348)

H. Bruce Huff (1969) appraised Canada's position and future role in the world wheat market. He proclaimed that in the remainder of the twentieth century the world wheat market would be characterized by persistent surpluses which he attributed to increased production by less developed countries and non-North American producers, increased

effects of restrictive trade policies and technological improvements in the baking industry. Huff forecasted the implications for Canada as including a decrease in the quantity of Canadian wheat exported, a reduction in acreage required to adjust to the anticipated foreign and domestic wheat demand, and a significant impact on Canada's balance of trade.

In contrast to Huff's analysis, Loyns and Carter(1984) took a somewhat more optimistic view of Canada's future in the world wheat market. These economists predict a greater potential in the international grain market as opposed to the domestic market in the 1990's and a significant growth in the demand for feed grains. They also promote the idea that the incentive for increasing production in Canada, and for that matter the other major exporting countries, will be retarded by price pressures and uncertainty regarding future prospects. (Loyns and Carter,1984,p.128) The uncertainty they attribute primarily to the growing dependence on centrally planned markets (i.e. the Eastern Bloc,USSR and China).

The Canadian Wheat Board

Acknowledgement of the existence and function of the Canadian Wheat Board must be made when considering any topic related to wheat in Canada. Fundamentally, this board offers a viable alternative to the open market although, it still remains committed to make full and consistent use of the shipping and exporting segments of

the private sector. Under the authority of the Canadian Wheat Board Act, the board is the sole marketing agency for wheat, oats and barley produced in Western Canada and in addition, has extensive powers to control the movements of other grains. Moreover, the Canadian Wheat Board is not only obliged to market grain in inter-provincial and export trade but, in doing so, it must meet world wide competition and make every effort to maintain and expand the markets for Canadian grain. (C. Wilson,1979,pp.64-89) Therefore, as a "state trading (selling) agency", the Board must compete with grain sellers of other wheat producing and exporting nations but, to it's advantage not with other sellers in Canada.

Theoretical Background & the Model

Single and Simultaneous Equation Approach

In this thesis, an aggregate demand and supply model (consult Ch. 3) for Canadian wheat has been developed. In respect to the demand function estimation, it has been assumed that the demand function can be regarded as a member of a series of interdependent relationships - specifically, domestic disappearance,export demand and inventory demand. Consequently, a simultaneous equation approach has been applied to this model. In order to employ a single equation approach, the demand function for Canadian wheat would have had to be viewed as a single independent relationship however, based on econometric theory the modelling of such a relationship of an interdependent nature would ultimately require a multi-equation format.

Furthermore, if a single equation method was in fact utilized in the estimation of this particular function, it would inevitably produce biased and inconsistent parameter estimates.[1]

Formulation of the Equations

The equations that comprise the econometric model, to be presented in the next chapter, are based upon specific economic theories. In the domestic disappearance equation, the price of oats and barley have been included as seperate regressors with the purpose of testing for the presence of substitutes. However, a staple good such as wheat, can be considered as an inferior good and thus, according to demand theory no real substitutes exist and the income effect will not reinforce the substitution effect.(Samuelson and Scott,1975,p.404) The substitution effect can best be described by the Slutsky equation, which in it's final form appears as follows;

$$\frac{\partial X_i}{\partial P_j} = \frac{\partial X_i}{\partial P_j} - X_j \frac{\partial X_i}{\partial M} \qquad 2$$

in terms of elasticities; $E_{ij} = E_{ij}^{*} - V_j N_{im}$

where;

$E_{ij} \equiv$ the price elasticity of X_i with respect to P_i
$N_{im} \equiv$ the income elasticity of X_i with respect to M
$V_i \equiv$ the relative share of good j in total expenditure

$M \equiv \Sigma P_i X_i$

$^{*} \equiv$ the compensated effect

Consequently, an inferior good such as wheat would have an income elasticity (N_{im}) of less than zero an therefore, to prove the existence of substitutes, the empirical results will have to provide positive parameter estimates for the price of oats and price of barley variables respectively.

In the inventory equation, the cost of capital has been introduced as an explanatory variable in an attempt to account for the costs of storing wheat - which in the Canadian system is extremely significant. This can be verified by the actuality that Canada exports a greater percentage of its total production (almost three-quarters)than any other major wheat producer. (The Winnipeg Grain Exchange, 1973) Again, the empirical results should optimally produce a negative parameter estimate to illustrate the inverse relationship between the amount of inventory or wheat stocks and the cost of capital.

The export demand equation is the most complex of the four equations that make-up the model. In addition to the own price of wheat and the (t-1) lag of export demand, the equation consists of the real internal transportation cost of wheat, foreign aid shipments of wheat and the exchange rate variable. The internal transportation cost variable appears for two reasons. First, the integralness of transportation, which is reflected in the fact that in 1981-82 the grain handling system took delivery of some

thirty-one million tonnes of the major grains and oilseeds. (Canadian Wheat Board, 1983,pp.4-26) Second, that with the recent reforms and transition of the Crow rate, the future potential implications upon the costs, volumes and routing of transportation should prove to be quite significant and also, provide ample reason for further empirical analysis of this model. Expanding on this thought, the recently legislated changes in the crow's rate have concentrated primarily on the method of payment of the annual subsidy. The new method provides for payment of the subsidy entirely to the railways, so that rail rates will continue to be much lower than the costs of rail shipments of grain. However, grain shippers will pay a share of future railway cost increases and it is anticipated that there could be doubling of grain rates by 1986 and as much as a five-fold increase by the year 1991. (Veemans, 1984,pp.94-97)

The foreign aid variable is a combination of the United States Public Law 480 shipments of wheat for humanitarian purposes and the Canadian contribution (which until 1969 averaged 10% of total exports) for World-wide hunger and disaster relief. The primary reason for the inclusion of this government policy variable centers around the supposition that the effect upon the demand for wheat on world markets is

significantly effected by such moral actions.

In the econometric model, the exchange rate regressor has been expressed in terms of Canadian dollars per SDR. Historically, Special Drawing Rights (SDR's) arose out of a decision by the International Monetary Fund, to create a new asset and reserve medium, after the troubles with the gold exchange standard in the 1960's. Essentially, the SDR is a "currency basket" valued as a weighted sum of certain widely traded national currencies. (Caves and Jones 1981,pp. 454-455) Since, the SDR reflects a more international monetary flavour, it has been selected as the basis for the exchange rate in this thesis, as opposed to a more customary Canadian/U.S. dollar based exchange rate. Empirically, a positive parameter estimate for the exchange rate variable will be required to verify the hypothesis that a depreciation (devaluation) of the Canadian dollar will create an increase in the volume of exports of Canadian wheat, and vice-versa.

Briefly, the production equation, which along with the (t-1) lag of inventory constitutes the supply section of this model, consists of three independent variables - the own-price of wheat, the real farm wage rate and the cost of capital. The presence of the farm wage rate and cost of capital are really self explanatory as inputs in the production of wheat. It would

certainly prove interesting to include the price/cost of fertilizers and pesticides as additional regressors in the production equation but, due to the restrictions imposed by the degrees of freedom it is not possible at this time.

Where applicable, the appropriate independent variables have been deflated by the consumer price index and the wholesale price index. They have been equated into real terms in an effort to eliminate any distortions and/or "noise" in the data that was produced by the presence of inflation and other monetary disturbances during the time in question.

Exchange Rate and the Balance of Payments

Canada, along with many other countries, after 1971 moved to a system of floating exchange rates or freely flexible rates. Under a regime of floating exchange rates, government no longer endeavoured to maintain fixed parities or neither did they undertake direct intervention in the foreign exchange markets. Thus, authorities seldom exchanged national money for international reserves, so that each country's balance of payments would never be in a deficit or a surplus (Frenkel and Johnson,1978,p.47). Essentially then, with a flexible system, exchange rates were allowed to freely adjust in free markets in order to equilibriate suppplies and demands of national monies. In the 1970's, Canada, the United States and West Germany

displayed the best examples of countries operating under an almost purely flexible exchange rate system. However, towards the end of the decade and throughout the early 1980's, Canada's international financial position weakened and domestic monetary authorities unoffically adopted an exchange rate regime known as a managed float. As with floating exchange rates, the authorities do not fix a price for national currency, but they may nevertheless buy and sell it to influence their exchange rate. Evidence of the existence of this system can be witnessed as recently as the summer of 1984, when the Bank of Canada authorities interceded heavily by selling off huge reserves of U.S. dollars in an effort to bolster a slumping Canadian dollar.

The balance of payments is simply the net receipt of money from abroad. With the aid of Walras' Law, the true essence of the Balance of Payments can be described by a simple equation:

$$B = (P_x X - P_m M + E) + C \qquad 3$$

where: B = balance of payments surplus
C = capital account surplus (money value of the net supply of assets)
X = exports
M = imports
E = net interest income from abroad in terms of money
P_x, P_m = money prices of exports and imports, respectively

$(P_x X - P_m M + E)$ = currency account surplus

The relationship between the exchange rate system and the Balance of Payments is really quite apparent, Purchasing Power parity theory assumes that the terms of trade are fixed so that exchange rate variations are accompanied by offsetting changes in price levels. To the extent that this is not true there will be changes in relative prices such as the terms of trade. Therefore, if there was a depreciation in the domestic currency the exports from foreign nations would become more expensive relative to domestic exports and thus, individual nations would be inclined to purchase more goods from the country which had experienced the depreciation. Consequently, the balance of trade of this country should witness a marked improvement. Obviously, then, depreciation means that foreign currency costs more in terms of domestic currency, and equivalently domestic money costs less than foreign money, so that domestic goods should appear more economical in comparison with identical foreign produced goods.

In reference to the situation of Canadian wheat, a depreciation of the Canadian dollar should theoretically make the Canadian produced wheat more attractive to foreign buyers. The international reputation of Canadian wheat is one that has been traditionally founded upon hard, high quality Red Spring wheat. Historically, in comparison to other major

exporters Canadian wheat has remained just slightly more expensive, however, a depreciation should allow foreign importers (maximizing their profit/utility) to purhcase this high quality wheat at a similar or better price than offered by the competing wheat exporting nations.

Chapter 2: Footnotes

[1]For an indepth discussion of the simultaneous equation approach, estimation procedurers, etc. - consult Chapter 3.

[2]For a complete mathematical derivation of the Slutsky equation, see: (Layard and Walters, 1978, pp.130-144)

[3]If a detailed account of this equation is required, consult - (Either, 1983, pp.286-287)

C H A P T E R III :

The Model

Simultaneous Equation Models

The econometrics approach in this study is based upon a single commodity simultaneous equation model comprised of four equations and an identity. Econometric theory relates that the simultaneous equation system is introduced where there exists a two-way causation or joint dependence among one or more of the explanatory variables. That is, if $Y = f(X)$ but also $X = f(Y)$, a single equation model is both inappropriate and unjustifiable due to the simultaneous bias. Thus, a multi-equation model must be employed which would include a series of interrelated yet, separate equations in which Y and X would appear as endogenous variables even though they may assume the form of explanatory variables elsewhere within the model. It also becomes apparent, that a model in which the behaviour of the variables are jointly determined violates one of the major assumptions, $E(uX) = 0$, of Ordinary Least Squares (OLSQ) and consequently rules out the utilization of this procedure on the grounds that it will yield parameter estimates that are both biased and inconsistent. A system of simultaneous equations is generally accepted as being more expedient where complex models (i.e. Industry, Regional and National Economic Models) are involved. (Pindyck and Rubinfeld,1981,pp.324-328) Given the nature of economic phenomena and specifically, the introduction of

international economic phenomena (i.e. commodity markets, the incorporation of monetary factors - inflation and exchange rates, foreign aid, etc.) necessitates for this model a simultaneous equation approach and further eliminates a single equation on the basis of the presence of simultaneity.

Therefore, for these reasons and given the essence of my problem (the effects of exchange rates on the international trade of Canadian grain) the simultaneous equation format is not only the logical alternative but the optimal means of attaining the most statistically consistent and efficient parameter estimates. However, there does exist very strict identification requirements for specifying a system of simultaneous equations, but undoubtedly, there is really no better econometric technique for gaining an understanding of the interdependence of market forces.

Three Stage Least Squares Estimation

As mentioned, the Ordinary Least Squares (OLSQ) estimation procedure becomes most inapropos in a simultaneous equation context, due primarily to the biased and inconsistent estimates that result. The rational alternative is the application of other methods of estimation that will proffer better estimates of the parameters. Hence, the Three Stages Least Squares (3SLS) method rises to prominence on the premise that it is a true

"systems" approach because it is a technique applied to all the equations of the model at the same time and provides estimates of all the parameters simultaneously. In consequence, this thesis will concentrate upon and employ Three Stage Least Squares (3SLS) results as the basis for the economic analysis of the topic in question.

Elaborating on the Three Stage Least Squares procedure, it is a systems method that has evolved as a natural and logical extension of both the Zellner estimation and Theil's Two Stage Least Squares (Zellner and Theil,1962). Simply stated, the method developed by these two econometricians involves the application of least squares estimation in three successive stages with generalized least squares parameter estimates being obtained in the third and final stage. The first two stages are identical to those in a two stage least squares estimation which incidentally will be discussed later on in this chapter.

Perhaps, the most prominent attribute of the Three Stage Least Squares procedure is that it utilizes more information than any of the single equation techniques (i.e. OLSQ, ILS - Indirect Least Squares,2SLS) In particular, it takes into account the entire structure of the model with all the restrictions that this structure imposes on the values of the parameters (Koutsoyiannis,1976,pp.456-466).

Through considerable econometric analysis, it has been determined that the simultaneous equation model, which is the crux of this thesis, is properly specified, it is overidentified and there exists no autocorrelation across time. However, the author is convinced that the error terms (u's) of the model are contemporaneously dependent or correlated. Therefore, the choice of 3SLS, as the estimation procedure for this model, is well founded in the basic assumptions of the method itself. Furthermore, it should be noted that even though the parameter estimates will still be biased they are more asymptotically efficient (because 3SLS accounts for the cross-equation correlation) than any estimates that could be attained through some single equation estimation method.

Two Stage Least Squares Estimation

In an effort to produce a legitimate and arrant econometric analysis of this topic, a Two Stage Least Squares method has additionally been applied to the model. Two Stage Least Squares contrasts 3SLS because it is a single equation method and makes use only of the variables appearing in the entire model. At this point, it is important to emphasize that 2SLS fails to recongnize the contemporaneous dependence of the random terms of the equations and this fact alone serves as one of the prime reasons for employing 3SLS as the basis for the thesis.

Essentially, Two Stage Least Squares estimation uses the information available from the specification of an equation system to obtain unique estimates for each of the structural parameters. The first stage involves the creation of an instrument through the estimation by Ordinary Least Squares of the reduced form equations, while the second stage of 2SLS involves a variant of instrumental - variables estimation (Kalejian and Oates,1981). Since, the thesis model is definitely over-identified the 2SLS approach is indeed vindicated and even though the author believes that the specification of the model is accurate, Two Stage Least Squares is less sensitive to specification error as compared with the "systems" methods (i.e. 3SLS, FIML - Full Information Maximum Likelihood) and thus, is quite appropriate .

Description of the Model

The model itself (see Tables I and II) is comprised of four equations - domestic disappearance, export, inventory and production - and one identity. The structural model has been formulated in such a fashion as to accurately depict the structure of the economic relationships of the variables represented by this complete system of equations. The coefficents of the structural parameters or the results of the 3SLS and 2SLS estimation procedures can be found in the following chapter.

TABLE I

The Model:

Domestic Disappearance Equation

$$PDW = a_0 + a_1 PDWL + a_2 RPW + a_3 RPDI + a_4 RPOT + a_5 RPBV + u_1$$

Export Equation

$$PEW = b_0 + b_1 PEWL + b_2 RPW + b_3 XRSDR + b_4 PLAID + b_5 RITW + u_2$$

Inventory Equation

$$PSW = c_0 + c_1 PSWL + c_2 RPW + c_3 KPL + u_3$$

Production Equation

$$PPW = d_0 + d_1 RPW + d_2 KPLR + d_3 RFWR + u_4$$

Identity

$$PDW + PEW + PSW = PPW + PSWL$$

TABLE II

The Variables:

Jointly Dependent Variables

PDW = per capita domestic disappearance of Wheat, metric tons per person
PEW = per capita export of Canadian Wheat, metric tons per person
PSW = per capita inventory of Wheat, metric tons per person
PPW = per capita production of wheat, metric tons per person
RPW = real wholesale market price of Canadian Wheat, deflated by the wholesale price index (WPI)
KPL = cost of capital, based on Canadian chartered banks Prime lending rate

Predetermined Variables

RPDI = real personal disposable income, deflated by the Consumer Price Index
RPOT = real wholesale price of Canadian Oats, deflated by the Wholesale price Index
RPBY = real wholesale price of Canadian Barley, deflated by the Wholesale Price Index
XRSDR = exchange rate, Canadian dollars per SDR
PLAID = foriegn aid shipments of wheat in metric tons, based on USDA P.L.480 Stats. and 10% of Canadian exports
RITW =real internal transportation cost of Canadian Wheat, deflated by the Consumer Price Index
RFWR = real farm wage rate (annual figure), deflated by the Consumer Price Index
L = lag, indicates a t-1 lag of the variable in question
u = error term
a,b, c,d = applicable coefficents

The functional relationships expressed by the four equations and the identity are assumed to be linear in their parameters. To preserve and ensure the linearity of the system two additional statistical techniques have been applied. First, all four of the dependent variables have been converted into (Canadian) per capita terms and secondly, the entire array of variables in the structural model have undergone a transformation into a natural logarithmic form.

Placing considerable emphasis on proper specification, this econometric model has endeavoured to incorporate both the demand and the supply functions on an equal basis. Obviously, this is a vital responsibility of any model building process because as Gordon A. King implies - it is too often the case, that many models reflect only the authors' interests thus, focusing on one aspect and ignoring the true problem formulation. (King, 1975,p.165) It is based on this line of reasoning, that the credability of this thesis model is enhanced and verified. The model has attempted to include all those variables that would be realistically associated with an aggregate model of this nature. If one consults the model (Table I and II), an examination of the variables provides evidence of the inclusion of monetary factors, government policy variables, transportation costs. substitutes, etc. The incorporation of these variables

have certainly contributed to the complexity of this single commodity agricultural model but, an examination of the more macroaspects of the economy such as the effects of exchange rate fluctuations is now more plausible and theoretically just.

C H A P T E R IV :

Empirical Results, Analysis and Policy Implications

The empirical analysis and results are based upon annual data taken from the years 1950 to 1982, for a total number of observations equaling thirty-three.[1] The empirical results are presented in two sections - first, the reduced-form estimates of the model and second, the structural estimates which consist of single equation, two stage and three stage estimates of the model

The T-Statistic & the Signs of the Parameters

The regression analysis has two major concerns which are the signs of the parameter estimates and the t-statistics of each of the regressors or explanatory variables. The signs of the parameter estimates are carefully considered because they display the type of relationship the regressor has with the dependent variable. On the other hand, the t-statistic indicates the statistical significance of the explanatory variable. The statistical test for rejecting the null hypothesis $(B=0)$ associated with a regression coefficent is usually based upon the t-distribution - "the T distribution is relevant because for statistical testing we need to utilize a sample estimate of the error variance rather than it's true value." (R. Pindyck and D. Rubinfeld,1981, p.57) The choice of the significance level is, of course, arbitrary and depends in practice on the type of conclusions to be reached from the model.

Table 1 : Ordinary Least Squares (OLSQ) Estimates - Structural Model

Export Equation

$$PEW = \underset{(-0.469)}{-0.406615} + \underset{(1.7935)}{0.332739}\ PEWL - \underset{(-0.588)}{0.088712}\ RPW + \underset{(1.8093)}{0.717993}\ XRSDR$$
$$- \underset{(-0.492)}{0.029796}\ PLAID + \underset{(0.7839)}{0.135789}\ RITW$$

Simplified Export Equation

$$PEW = \underset{(-16.90)}{-0.649528} + \underset{(3.4373)}{0.753060}\ XRSDR$$

Table 2 : Ordinary Least Squares (OLSQ) Estimates - Reduced-Form Model

Domestic Disappearance Equation

$$PDW = \underset{(-1.574)}{-12.3334} + \underset{(0.0939)}{0.018748}\ PDWL - \underset{(-0.339)}{0.115998}\ RPDI - \underset{(-1.474)}{0.758956}\ RPOT$$
$$+ \underset{(0.8066)}{0.366372}\ RPBV - \underset{(-0.878)}{0.090629}\ PSWL - \underset{(-0.526)}{0.107109}\ PEWL$$
$$- \underset{(-1.602)}{0.719042}\ XRSDR - \underset{(-1.031)}{0.083291}\ PLAID + \underset{(1.893)}{1.22458}\ RITW$$
$$+ \underset{(1.630)}{1.32227}\ RFWR$$

Export Equation

$$PEW = \underset{(0.8732)}{7.65350} + \underset{(0.0759)}{0.016853}\ PDWL + \underset{(0.8029)}{0.305125}\ RPDI - \underset{(-2.714)}{1.55308}\ RPOT$$
$$+ \underset{(2.343)}{1.18324}\ RPBV - \underset{(-0.359)}{0.041287}\ PSWL + \underset{(0.1589)}{0.035963}\ PEWL$$

... equation contd.

( ) - applicable t-statistics

$n = 33$ - total number of observations

Table 2 : (continued)

Export Equation (contd)

$$+ \underset{(1.7483)}{0.872373}\ XRSDR + \underset{(0.5780)}{0.051912}\ PLAID - \underset{(-0.376)}{0.270431}\ RITW$$

$$- \underset{(-1.190)}{1.07310}\ RFWR$$

Inventory Equation

$$PSW = \underset{(1.1145)}{12.2536} + \underset{(0.0796)}{0.022173}\ PDWL - \underset{(-1.966)}{0.93722}\ RPDI + \underset{(0.99105)}{0.711479}\ RPOT$$

$$- \underset{(-1.5507)}{0.982197}\ RPBY + \underset{(4.6501)}{0.66944}\ PSWL - \underset{(-0.1445)}{0.041038}\ PEWL$$

$$- \underset{(-0.5697)}{0.356622}\ XRSDR + \underset{(0.57778)}{0.065099}\ PLAID - \underset{(-1.1412)}{1.02985}\ RITW$$

$$- \underset{(0.1626)}{0.183929}\ RFWR$$

Production Equation

$$PPW = \underset{(0.9737)}{11.0650} + \underset{(0.7483)}{0.215314}\ PDWL + \underset{(1.5803)}{0.778619}\ RPDI - \underset{(-1.7121)}{1.27033}\ RPOT$$

$$+ \underset{(1.13886)}{0.745527}\ RPBY - \underset{(-2.6519)}{0.394581}\ PSWL - \underset{(-0.4444)}{0.130440}\ PEWL$$

$$+ \underset{(0.04583)}{0.029647}\ XRSDR + \underset{(1.47629)}{0.171915}\ PLAID - \underset{(-0.56237)}{0.524508}\ RITW$$

$$- \underset{(-1.4795)}{1.72949}\ RFWR$$

Price Equation

$$RPW = \underset{(2.3881)}{13.0590} + \underset{(1.01046)}{0.139909}\ PDWL + \underset{(1.1017)}{0.261206}\ RPDI + \underset{(0.22842)}{0.081555}\ RPOT$$

.... equation cont'd

( ) - applicable t-statistics

$n = 33$ - number of observations

Table 2 : (continued)

Price Equation (cont'd)

$$+ \underset{(2.57783)}{0.812054}\ RPBV - \underset{(-1.60022)}{0.114575}\ PSWL - \underset{(-0.37973)}{0.053632}\ PEWL$$

$$+ \underset{(2.15579)}{0.671110}\ XRSDR + \underset{(0.979759)}{0.054903}\ PLAID - \underset{(-2.4554)}{1.10200}\ RITW$$

$$- \underset{(-2.62962)}{1.47917}\ RFWR$$

Capital Equation

$$KPL = \underset{(-1.488)}{-10.8551} - \underset{(-1.6728)}{0.308800}\ PDWL + \underset{(3.5429)}{1.11995}\ RPDI + \underset{(1.1742)}{0.558951}\ RPOT$$

$$- \underset{(-1.0139)}{0.425846}\ RPBV - \underset{(-0.74853)}{0.071456}\ PSWL + \underset{(0.37252)}{0.070149}\ PEWL$$

$$+ \underset{(1.61133)}{0.668794}\ XRSDR - \underset{(-1.22155)}{0.091266}\ PLAID + \underset{(0.146834)}{0.087863}\ RITW$$

$$+ \underset{(0.437156)}{0.327856}\ RFWR$$

( ) - applicable t-statistics

$n = 33$ - total number of observations

Table 3 : Two Stage Least Squares (2SLS) Estimates - Structural Model

Domestic Disappearance Equation

$$PDW = \underset{(1.707)}{3.52514} + \underset{(1.5913)}{0.274176}\ PDWL - \underset{(-0.121)}{0.085292}\ RPW - \underset{(-1.364)}{0.377827}\ RPDI$$
$$- \underset{(-1.925)}{0.932878}\ RPOT + \underset{(0.9463)}{0.627777}\ RPBY$$

Export Equation

$$PEW = - \underset{(-0.406)}{0.378634} + \underset{(1.7848)}{0.333479}\ PEWL - \underset{(-0.594)}{0.099437}\ RPW + \underset{(1.8059)}{0.722996}\ XRSDR$$
$$- \underset{(-.053)}{0.03202}\ PLAID + \underset{(0.8232)}{0.142843}\ RITW$$

Inventory Equation

$$PSW = \underset{(2.456)}{1.91988} + \underset{(8.7184)}{0.756435}\ PSWL - \underset{(-2.278)}{0.403975}\ RPW - \underset{(-2.100)}{0.147354}\ KPL$$

Production Equation

$$PPW = \underset{(2.072)}{9.40704} - \underset{(-1.684)}{0.378818}\ RPW + \underset{(1.7595)}{0.521160}\ KPL - \underset{(-1.905)}{1.11094}\ RFWR$$

Identity

$$PDW + PEW + PSW = PPW + PSWL$$

( ) - applicable t-statistics

$n = 33$ - total number of observations

Table 4 : Three Stage Least Squares (3SLS) Estimates - Structural Model

Domestic Disappearance Equation

$$PDW = \underset{(1.483)}{2.06731} + \underset{(1.9316)}{0.269752}\ PDWL - \underset{(-1.974)}{0.733327}\ RPW - \underset{(-0.903)}{0.146366}\ RPDI - \underset{(-1.975)}{0.762513}\ RPOT + \underset{(2.391)}{1.05902}\ RPBV$$

Export Equation

$$PEW = \underset{(-0.321)}{-0.254340} + \underset{(1.6644)}{0.244157}\ PEWL - \underset{(-0.389)}{0.057195}\ RPW + \underset{(1.9599)}{0.623674}\ XRSDR + \underset{(0.1324)}{0.006428}\ PLAID + \underset{(0.0626)}{0.008970}\ RITW$$

Inventory Equation

$$PSW = \underset{(2.536)}{1.84371} + \underset{(9.5110)}{0.687136}\ PSWL - \underset{(-2.338)}{0.384774}\ RPW - \underset{(-2.626)}{0.170425}\ KPL$$

Production Equation

$$PPW = \underset{(1.692)}{6.73202} - \underset{(-1.507)}{0.312262}\ RPW + \underset{(1.3455)}{0.349784}\ KPL - \underset{(-1.520)}{0.774527}\ RFWR$$

Identity

$$PDW + PEW + PSW = PPW + PSWL$$

( ) - applicable t-statistic

$n = 33$ - total number of observations

It is generally a rule of thumb that for a large sample size and a five per cent level of significance, that if the value of the t-statistic is greater than two (in absolute value) the null hypothesis can indeed be rejected. Subsequently, due to the large sample size of this model and the degrees of freedom (n-k = 33-16 = 17), that a parameter estimate with a t-statistic that exceeds 1.9 shall be considered significant a five per cent level of significance and similarly, a coefficent estimate with a t-statistic greater than 1.6 will be deemed statistically significant at a ten per cent level of significance.

Interpretations of the Results for the Model's Reduced-Form

In Table 2, the Ordinary Least Squares regression results for the reduced-form of the thesis model are presented. Unlike the structural model, the equations are not formulated and based directly upon economic theory but rather the reduced-form equations are simply the endogenous variables expressed in terms of the predetermined variables and the disturbance terms. These are the equations that describe how each endogenous variable is causally determined by the predetermined variables and the disturbance terms. (H. Kalejian and W. Oates,1981,p.254)

The exchange rate variable emerges as being statistically significant in three of the six reduced-form equations. In the domestic disappearance equation, the exchange rate is significant

at ten per cent but, interestingly enough, has a negative coefficent estimate. However, logic dictates that the sign of the exchange rate regressor is in fact correct, for theoretically a devaluation in the exchange rate of the Canadian dollar would decrease internal consumption due to an offsetting incremental increase in export demand for Canadian wheat. As expected, the exchange rate variable was significant in the reduced-form export equation but it's presence in the price equation was also statistically significant and at a level even greater than a 95 per cent confidence interval. These results needless to say surpassed all a priori expectations. The price equation results also confirmed a presupposed economic relationship - one that was just recently experienced in the U.S. agricultural economy:

> ".... during the same period the value of the dollar rose some 25%. That rise in effect translated U.S. agricultural prices to foreign buyers at levels that were on the average 25% higher than they otherwise would have been. That rise in export prices choked off demand from foreign importers and made the U.S. less competitive in relation to other exporters."
> (Schuh,1984,p.244)

Interpretation of the Results for the Model's Structural Form

On the whole, the empirical results do indicate that the model appears to fit very well and the signs of the parameter estimates more than reasonably demonstrate the a priori

expectations cited earlier in this thesis. The empirical work undertaken has been fashioned in such a manner as to yield the most comprehensible results possible. These results progress in complexity from a single equation estimation (Table 1) employing Ordinary Least Squares, through to a Two Stage (Table 3) and Three Stage Least Squares (Table 4) estimation of the structural form of the entire simultaneous equation model.

In the single-equation estimations, the Ordinary Least Squares (OLSQ) procedure has been applied separately to the original export equation and also, to a simplified export equation - consisting only of the per capita exports of Canadian wheat, a constant term and the exchange rate variable. As anticipated, the results confirmed and illustrated the genuine significance of the exchange rate variable. This is corroborated by the appearance of t-statistic values, for the exchange rate variable, well in excess of two.

The Two Stage Least Squares results (Table 3) were somewhat disenchanting, with only two of the four equations displaying truly wortwhile results. The inventory equation was quite acceptable and also, the production equation exhibited very good parameter estimates and t-statistics. In the production equation, the own-price of wheat and the cost of capital

variables were significant at 10% and the real farm wage rate, which was even better, appeared significant at a 5% level. As suspected, the farm wage rate possessed a negative parameter estimate thus, reflecting the theory that a decrease in the cost of inputs will create an increase in the amount of production of Canadian wheat.

The poor results of the Two Stage Least Squares estimation technique can be primarily attributed to the type of model being employed and the very nature of the method itself. On the other hand, the Three Stage Least Squares (3SLS) procedure which utilizes more information and consequently, takes into account the entire structure of the model is then really much more appropiate. Furtermore, in addition to the simultaneity of the system of equations, the 3SLS is further justified as the optimal procedure because of the suspected autocorrelation which exists in the model. Therefore, it is the essence and quality of the 3SLS results (Table 4) that has determined their use as the basis for the econometric and policy analysis in this thesis.

In the domestic disappearance equation, one can observe that with the exception of the real personal disposable income variable, all of the other regressors are statistically significant at a 5% level. The own-price of wheat possesses a

negative sign illustrating the fact that as the price decreases the quantity of wheat consumed domestically increases. The real personal disposable income regressor, as mentioned proved to be statistically insignificant but, it also had a negative parameter estimate which corroborates the inferior nature of the wheat commodity. In regards to the presence of substitutes, interestingly enough both the price of oats and barley variables were statistically significant yet, only the price of barley variable had the correct (positive) sign to signify a substitute relationship. Since, as discussed in Chapter 2 wheat has no real substitutes, these empirical results can best be explained by the fact that the data used in the domestic disappearance of wheat is comprised of a total figure consisting of human, animal and other uses. Therefore, the substitute relationship of barley may be explained in terms of non-human consumption.

The Three Stage Least Squares procedure provided both some very substantial and disappointing results for the export equation. Consider for example, the parameter estimate for the exchange rate variable which emerged as being both statistically significant at 5% and holding a positive sign. These results conclusively demonstrate the principal arguement of this thesis which is that a depreciation (appreciation) in the value of the Canadian dollar will yield an increase (decrease) in the volume of Canadian wheat exports. Although the other independent

variables in the export equation all possessed the proper signs and thereby, confirmed the economic relationships presented in the second chapter, none of these regressors proved to be statistically significant. [2]

In contrast, far better 3SLS results were derived for the Inventory equation. All three of the explanatory variables were significant at the 5% level with t-statistics greater than two and furthermore, each variable had the correct sign. The negative parameter that was forecasted in Chapter 2 for the cost of capital variable, did in fact appear and thus, supported the postulate that an increase in the cost of capital will reduce the amount of wheat inventory or carry-over stocks.

Exchange Rate Policy and the Agricultural Trade Balance

As previously discussed, in 1973 almost all of the developed nations converted to a system of flexible exchange rates. This system which has been described as "bloc" floating, is comprised of a number of major currencies to which other nations have fixed their national currencies. The omnipresence of this system can be witnessed in the fact that it is now estimated that approximately 85% of world trade takes place across flexible exchange rates (Schuh,1984,p.243).

One of the most pronounced effects of the shift to flexible exchange rates, by the international community, has been

experienced in the manner that monetary and fiscal policy have impacted upon the economy. For example, under the new system and international monetary conditions which prevail, changes that occur in the U.S. monetary policy, induce changes in international capital flows which in turn, prompt changes in the value of the dollar and subsequently, influence both exports and imports (Schuh,1984,pp.243-244). It becomes most apparent then, that the net result of a flexible exchange rate system is that agriculture, and for that matter, all export and import competing industries, ultimately must bear the brunt of the burden of changes in the monetary and fiscal policies enacted by domestic authorities.

Essentially, governments use intervention in exchange markets because they do not believe that the markets will proceed smoothly and quickly to equilibrium. They also utilize monetary and fiscal policies to promote internal and external balance in the belief that the unaided market processes will produce worse outcomes in the short run. One of the prime advantages of employing monetary and fiscal policies in combination with exchange rate policies is that it creates the ability to alter the relative prices of traded goods.

> " ... monetary and fiscal policies in conjunction with exchange rate policies can be used to induce short-term capital inflow or outflow to

> allow consumption of traded goods to exceed or fall short of production of traded goods via a deficit or surplus in the current account."
>
> (Black,1977,p.25)

The increased monetary instability that has prevailed during the 1970's and 1980's has been one of the major contributing factors to the instability of international commodity markets. Where the instability in international commodity markets has been generally attributed to climatic and political factors, in Canada and the U.S. it has largely been the result of a purely monetary phenomenon.[3]

In the decade of the 1970's, the United States experienced an unprecedented export boom, exemplified by their agricultural trade volume almost doubling during this period. This dramatic increase has been very closely tied to the fall in the value of the U.S. dollar on international money markets in the 1970's. Similarly, in the same period Canada also experienced significant increases in export demand of agricultural products due largely to the nature of the close linkage of the Canadian dollar with it's American counterpart. However, since the latter part of the 1970's, the Canadian dollar has fallen dramatically relative to the U.S. dollar which has steadily increased in value during the Reagan administration. Although, the Canadian dollar has lost ground relative to the U.S. dollar,

it has maintained parity or has been strengthened against most other major currencies. Since the U.S. is Canada's biggest competitor in the world wheat market, more importance is placed upon the value of the U.S. dollar. Consequently, Canada's agricultural trade balance and specifically, the exports of wheat and grains have shown outstanding improvement with this recent performance of the U.S. dollar. Additionally, the United States embargo on the sale of wheat and grain to the Soviet Union in 1980 coupled with the continual poor harvests of the Soviet bloc and an increased trade with China, have produced significant dividends for Canadian agricultural (wheat) exports. In 1981/1982 the exports of Canadian wheat to countries with centrally planned economies totaled approximately 10,164,000 tonnes or 54.5% of Canadian wheat exports.(Canadian Wheat Board,1981/82, pp.9-10) From this one can observe the increased importance of exports as a source of income for Canadian farmers and the substanial role grain exports from the Prairies has as a vital source of foreign exchange for Canada. Thus, in the 1970's, without the large volume of grain exports, the Canadian dollar most certainly would have been weaker and as a result, the repercussions of a devalued dollar would have been felt throughout the entire domestic economy.

Canada's increasing dependence upon trade with centrally planned economies has been questioned by many agricultural economists and policy makers. The trend towards greater trade with the Communist Bloc countries has many authorities concerned since, the result has been a noticeable decline in Canada's customers for wheat. It is often forgotten that although, the U.S.S.R. is one of the major wheat importers, it is also the world's largest wheat producer. Since, the beginning of the 1980's the U.S.S.R. has assumed the position as Canada's leading grain export market followed by China and Japan. The concerns about the medium-run strength of export demand by the Soviet Union hinge on the fact that future grain sales to the U.S.S.R. are heavily conditional on the degree to which meat production and consumption are increased, which are both very problematic areas. (Veemans,1984,p.40) A 1983 report by the OECD echos this thought when it suggests that U.S.S.R. grain import requirements could fall to about 15 million tonnes by 1985 and possibly drop below 10 million tonnes by 1990 (Canada in 1983 supplied in excess of 8 million tonnes to the Soviet Union) and that the forecasted potential for wheat demand from China may not be evidenced until the early 1990's. (OECD, 1983,pp.5-36) This then signifies the economic costs associated with the dependence on centrally planned economies, which all

revolve around the traditional instability of the import demand of these countries. The same OECD report confirms this statement when it indicates that the Soviet Union is believed to possess the resources, technology and ability to substantially improve agricultural output. Therefore, it appears that Canada has replaced a relatively stable market demand associated with the traditional markets and in its place substituted unstable market demand through an increased percentage of export volume aimed at centrally planned economies.

Alternative Solutions and Policy Directions

The Canadian Wheat Board's long term goal is to achieve a projected export target of 36 million tonnes of wheat by the year 1990, which is an increase of slightly over 25% of the current export volume of Canadian wheat. In order to accomplish this aim Canada must permanently maintain, if not increase, its traditional twenty percent market share of world wheat exports. Many individuals and groups, such as the Canada Grains Council, have suggested that this export goal of 36 million tonnes is overly optimistic and that an export target of approximately 34 million tonnes is by far a much more realistic ambition. (Veemans,1984,p.2) However, as this study has demonstrated, with a sub 80¢ (U.S.) dollar

and provided it stays at or near this level, this may in fact be a very conceivable outcome.

The empirical analysis of this study has indeed realized it's objective in verifying the hypothesis that decreases in the value of the Canadian dollar spawn increases in the export volume of domestically produced wheat. This then leads one to the conjecture that the manipulation of the nation's exchange rate policy may be exploited, by governments and policy makers, to achieve gains in export trade. However, the regulation of such a variable is extremely difficult under a system of flexible exchange rates and is an action that cannot be justified solely on the premise of aggrandizing the commodity (wheat) export sector. Intelligbly, the impact of a depreciated dollar has pronounced effects on all of the major elements of the balance of payments situation (i.e. the higher cost of imports) and is an event that has repercussions upon the entire economy. Further complications include the risk of competitive devaluations or of the stimulation of overproduction of commodities, by competitive countries and primary producers respectively.

> "...the analysis required is more complex than can be made from the ordinary treatment of an exchange rate change initiated by a single country, since the exporter must appraise both the differentiated changes likely in importing countries and the probable exchange rate reactions of other producers."
>
> (Ridler and Yandle,1972,p.559)

Therefore, the recognition of the interdependence with other suppliers of Canada's main exports and of the national components of world trade is an integral factor when contemplating any changes in the country's exchange rate policy. The ramifications of exchange rate changes and related policy decisions are thus, witnessed throughout the general economies of the importing and exporting countries, as well as on the international commodities market.

Currently, two of the most important characteristics of the world grain market are its dynamic nature and the fact that it is characterized by an instability in volumes traded and in price levels. Both of these aspects contribute to the growing opinion that in the 1980's, the balance of the market power in grain has apparently shifted from the major exporters to the major importers of grains. (Veemans,1984) This recent transition to a buyer's market further establishes the gravity of the role of the exchange rate in the international trade of primary commodities.

As previously mentioned, the appreciation of the U.S. dollar has been one of the leading factors in Canada regaining its traditional share of the world wheat export market. Any further declines in the value of the Canadian dollar and increases in value of its U.S. counterpart, should only lead to additional increases in the export volume of Canadian wheat. For the major

importers of wheat, this exchange rate trend means that higher quality Canadian wheat can now be secured at an equal or lower price than "made in America" wheat. However, any attempts by monetary authorities to "fix" or maintain a specific value for the Canadian dollar is not recommended. Simply, because in most cases, the institution of a "dirty" float is usually easily suspected, widely publicized and often may create retalitory actions by other nations and producers. Such reprisals can be attributed to the possibility of a decline in economic activity of other producing nations and secondary effects, experienced by importing countries, felt through the impact of inflationary and deflationary tendencies on cost levels, and conceivably on the distribution of consumption expenditure. (Ridler and Yandle,1972)

It would be expected, that with both the depreciation of the Canadian dollar and the high quality of Canadian wheat, that export sales of this commodity would be even higher than their current levels. Unfortunately, there are several prominent obstacles that prevent the maximum realization of the benefits of a depreciated dollar. Probably, the most significant of these hindrances is the presence of restrictive trade barriers that have been erected by many of the developed

countries, and in particular the members of the European Economic Community. Specifically, through the operation of the Common Agriculture Policy, the EEC has been able to insulate themselves from external market relationships and in this way have considerably effected prices, volumes and the destinations of internationally traded wheat.

> "...importing countries like the EEC have successfully kept downward pressure on exporter prices and volumes to the benefit of their own treasuries and producers."
>
> (Loyns and Carter,1984,p.5)

Such protective measures (i.e. import tariffs,high support prices, etc.) by the EEC have resulted in increased production, decreased grain prices outside the EEC, and increased exports from the community (i.e. France).

Consequently, if Canada hopes to capitalize on the incremental comparative advantage created by the exchange rate then, it must press for freer trade or trade liberalization in the world grain market. Logically, Canada and other wheat exporting nations have to initiate and encourage some nominal form of co-operation to offset these detrimental trade barriers. Along similar lines, many individuals have hypothesized the creation of a grain exporting cartel or triopoly in an effort to combat the tariffs, quotas and non-tariff barriers, that exist for grains and indeed, most agricultural commodities. However, this form of

hard-line approach would most certainly lead to undesirable counteractions by the entities involved. But, without any trade liberalization Canada is committed to it's current trend of increased export (wheat) trade with the Communist Bloc nations.

Although, the Canadian dollar has depreciated, it along with the currencies of the other major industrialized countries are still much stronger than those of the developing and third world nations. Yet, these countries represent the greatest potential market for Canadian wheat exports with their large populations and their capacity for economic development. Unfortunately, these nations face monumentous exchange constraints that must be eliminated if their full import potential is to be realized. Several solutions exist to alleviate this situation, and of these there are many in which Canada can assume a principal role. Enhancing export fiancing (i.e. through the use of credits) for major wheat purchases is just one alternative, others includeimproved bilateral trade relations and assistance programs aimed at increasing their stock of human capital. It becomes apparent then, that improving these nation's balance of trade and balance of payments is the prime objective and optimal means of securing stable markets for Canadian wheat exports and in fact, all exports of agricultural and non-agricultural products. All this serves to reinforce Edward G. Schuh's belief that industrialized

nations must recognize that trade is a two-way street.

> "...in the case of less developed nations of which the majority of them will not be able to import agricultural products unless industrialized countries are willing to accept labour-intensive manufactured goods."
> (Schuh,1984,p.245)

Finally, there are some other policy directions which are not directly related to the exchange rate but, nevertheless, should be adopted or at least considered in order to improve the volume of Canadian wheat exports. First of all, it seems that the Canadian government has assumed an agricultural trade policy of protecting the production of commodities for which this country does not possess a comparative advantage (i.e. fruits, vegetables,dairy,etc,), while advocating reduced trade restrictions on those commodities for which there is pronounced comparative advantage (i.e. wheat). Whether this policy persists or is abolished with a new government in Ottawa remains to be seen. Second, with the technological innovations in the baking industry there is a growing trend and demand for lower quality wheat. Hence, the transition from the production of high quality wheats may be a new direction for Canadian farmers and agrologists to consider.

In a related issue, other wheat producing nations (i.e. France) employ a vastly different approach to the production of this staple. These countries strive for high productivity per acre and the

production of high yielding, lower quality varieties of wheat. Whereas, the Canadian and U.S. methods are associated with land-intensive production techniques oriented towards the growing of high-quality, high-protein, rust resistent wheats. Despite Canada's recent advances, significant productivity improvements are vital and necessary if Canadian producers are to retain their comparative advantage in wheat and other grains, on international markets. In order to accomplish these productivity gains, agricultural research must act as the catalyst. Unfortunately, this type of research in Canada is severely underfunded and underemployed. This statement is verified when considering the fact that the United States has devoted to research about twice the staff per million acres of wheat production as has Canada. (Auer,1970,pp.50-51) Adequate manpower and financial support is essential especially, for grain research when one considers the importance of wheat and other grains to the Prairie and Canadian economies. Obviously, there is an immediate need for a re-evaluation of government policy in this area and also an initiative to increase the involvement of the private sector in agricultural research. After all, consumers and producers benefit equally from agricultural research, not to mention the position of Canadian wheat in domestic and international markets.

This study and its model has endeavoured to account for the internal transportation cost of wheat and the role of transportation in the export of Canadian wheat. Although, the empirical analysis proved that the variable was insignicant this result can be largely attributed to the unrealistic nature of these costs. But with the recent revisions in the Crows Nest Pass Rates and other developments in the transportation industry (i.e. double tracking of rail lines to the West Coast) this variable should in the near future become considerably more important. Even though, internal transportation costs are expected to increase from these actions the effects upon wheat shipments should be more than off set by improvements in the physical plant and efficiency of operations and services available to shippers. Stemming from all of this, is the recommendation of two basic policies - first, the modification or elimination of Crow - related restrictions, as the grain industry emerges from the traditional Crow environment and secondly, improvements in port and terminal capacity accompanied by upgrading of the entire handling and transportation system to accommodate the forecasted increases in export volumes of wheat and other grains.

Chapter 4 : Footnotes

[1] For a full description of the data sources and the tranformation of the data, consult the appendix.

[2] As in similar models, a variable representing the exports of other major wheat producers was utilized in the 3SLS procedure. However, this proved to be fruitless and created even worse results.

[3] With respect to the nature of a monetary phenomenon logically, proper emphasis must be directed to the importance of interest rate policy and its impact on the value of the Canadian dollar.

CHAPTER V :

Summary and Conclusions

The main objective of this study was to establish the validity of it's principal postulate. Corroborated by extensive empirical analysis, based upon a simultaneous equation model, it has been conclusively proven that significant export effects for Canadian wheat occur as a result of changes in the country's exchange rate. For the most part, the resulting effects have been associated with shifts in the import demand and export supply schedules of this commodity. That is, the exchange rate changes have been primarily considered as enhancing (diminishing) the attractiveness of Canadian wheat on international markets.

The significance of the exchange rate and the role of wheat exports are confirmed by the fact that Canada exports almost three-quarters of it's total production which, in turn, constitutes approximately 20% of world wheat exports. In the 1950's and 1960's under a system of fixed exchange rates, governments and policy makers were able to employ the exchange rate as an instrument or policy tool. However, in 1973 the international community converted to a system of flexible exchange rates. In consequence, Canada could at best only marginally influence its exchange rate through a managed-float and was no longer able to fully utilize the exchange rate as regulatory device.

In the previous chapter, three very important characteristics of the world wheat market were emphasized. Specifically, they were; 1)the instability of the global wheat market, 2)the volatile nature of world wheat prices and 3)the recent transition or trend towards a "buyers" market. The relevance of these three characteristics are that they all serve to illustrate the competitive nature of the world wheat market. Thus, the exchange rate differential between the importer and exporter of wheat has now come to play a more prominent role in the purchase decision process. This is particularly germane when considering the sub-80¢ (U.S.) Canadian dollar and the fact, that the United States is Canada's largest competitor in the world wheat export market.

The empirical results of this study along with the theoretical and policy analysis have produced some very interesting conclusions regarding the export effects of exchange rate changes. Briefly stated, they can be summarized as follows:

1) A depreciation (appreciation) in the Canadian dollar creates an increase (decrease) in the volume of Canadian wheat exports.

2) In light of #1 , it is not recommended that governments and/or policy makers institute any adjustments or new policy orientations for the exchange rate with the purpose of enhancing the Balance of Trade or achieving some desired export level of Canadian wheat. This is so advised

because of the possibilities of provoking retaliatory actions, which may include; competitive devaluations, altered motives in bilateral trade arrangements, and the appearance of protectionism (i.e. tariff and non-tariff barriers) in the countries affected.

3) Even though national economic and monetary policies may be employed to insulate the general level of economic activity from changes in the exchange rate, there is a good chance that very strong repercussions may be experienced. For instance; significant sectoral shifts, high import costs, inflationary and deflationary tendencies and any number of other secondary effects.

4) If Canada is to fully realize the export advantages of a lower valued dollar, certain policy changes or directions should be adopted. They are:

i) some form of nominal co-operation with other major wheat exporters to re-establish, to a certain degree, a "sellers" market.

ii) lobby and press for trade liberalization in order that the world wheat market regain some measure of stability and Canada can reduce its dependence on important demand from countries with centrally planned economies.

iii) strive for increased trade with developing nations since their large populations and capacity for economic development represent the greatest potential markets for Canadian wheat exports. Additionally, it would be a means of reducing, in the long run, the volumes of wheat designated and freely given as foreign aid.

5) There are other non-exchange rate related methods which exist to improve the export volumes of Canadian wheat. Among them are;

i) a transition to the production of lower quality, high yielding wheat - re: revolutionary changes in the Baking industry plus forecasted growth potential.

ii) larger financial committments to agricultural research in wheat and other grains.

iii) improvements in the internal transportation and export oriented facilities in Canada.

iv) protection of agricultural products, such as wheat, for which Canada has a comparative advantage.

Countless possibilities exist in regards to suggestions for further efforts and empirical work concerning the topic of this study. One of the most interesting options would be to construct a more comprehensive and complete model for Canadian wheat. Incorporated in this revised model could be a more intricate representation of the domestic disappearance relationship, inclusion of the full money market and a new production equation which accounts for inputs such as fertilizers, agricultural chemicals and machinery. Finally, if the model and its empirical analysis could be repeated five to ten years in the future (with additional updated data) the new results would certainly be exciting to consider, especially, since observations under a system of flexible exchange rates would exceed fifteen in total and Canada would now be exporting wheat in the +20 million tonne range projected by the Canadian Wheat Board.

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Sources of Data

No. of Observations = 33 Years 1950-1982

Statistics Canada:
- i) Grain Trade in Canada 22-201,22-207
- ii) Canadian Statistical Review 11-003E
- iii) Historical Statistics of Canada 2nd Edition,M228-M230,M301-M309
- iv) Industry Price Indexes 62-011
- v) The Wheat Index 22-006

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Data Transformation

Metric Conversion:
- Wheat 1 Metric Ton = 36.743711 Bushels
- Oats 1 Metric Ton = 64.842000 Bushels
- Barley 1 Metric Ton = 45.930000 Bushels

Pounds to Metric Tons (Wheat):
- 59.0 Pounds = 1 Bushel
- 36.743711 Bushels = 1 Metric Ton

Conversion Factors:
Consumer Price Index (CPI)

1981 = 2.369	1949 = 1.724
1961 = 1.334	1939 = 2.725

Variables:
- Domestic Disapperance of Wheat = (Human Food + Animal Food + Other Uses)
- Exchange Rate = Canadian $ per SDR (end of period)
- PLAID = Wheat freely given as Foreign Aid, the variable consists of P.L.480(USDA Stats.) and 10% of Canadian Exports.
- FWR = Farm Wage Rate, Annual Wage of Farm Help per Year(without board)
- TRANSPORTATION COST = total domestic transportation cost of 1 metric ton of wheat - placed in dollars per Metric Ton. Figure is comprised of Rail Cost(Regina to Thunder Bay) and Water Cost (Thunder Bay to Montreal)

Time Series Processor (TSP)

TSP or Time Series Processor is a computer package designed specifically for the purpose of regression analysis. The package developed at Harvard is capable of being programmed for OLSQ, ILS, 2SLS, 3SLS, and FIML estimation proceedures. At Lakehead University the TSP programs are run on a VAX-11/780 Computer System.